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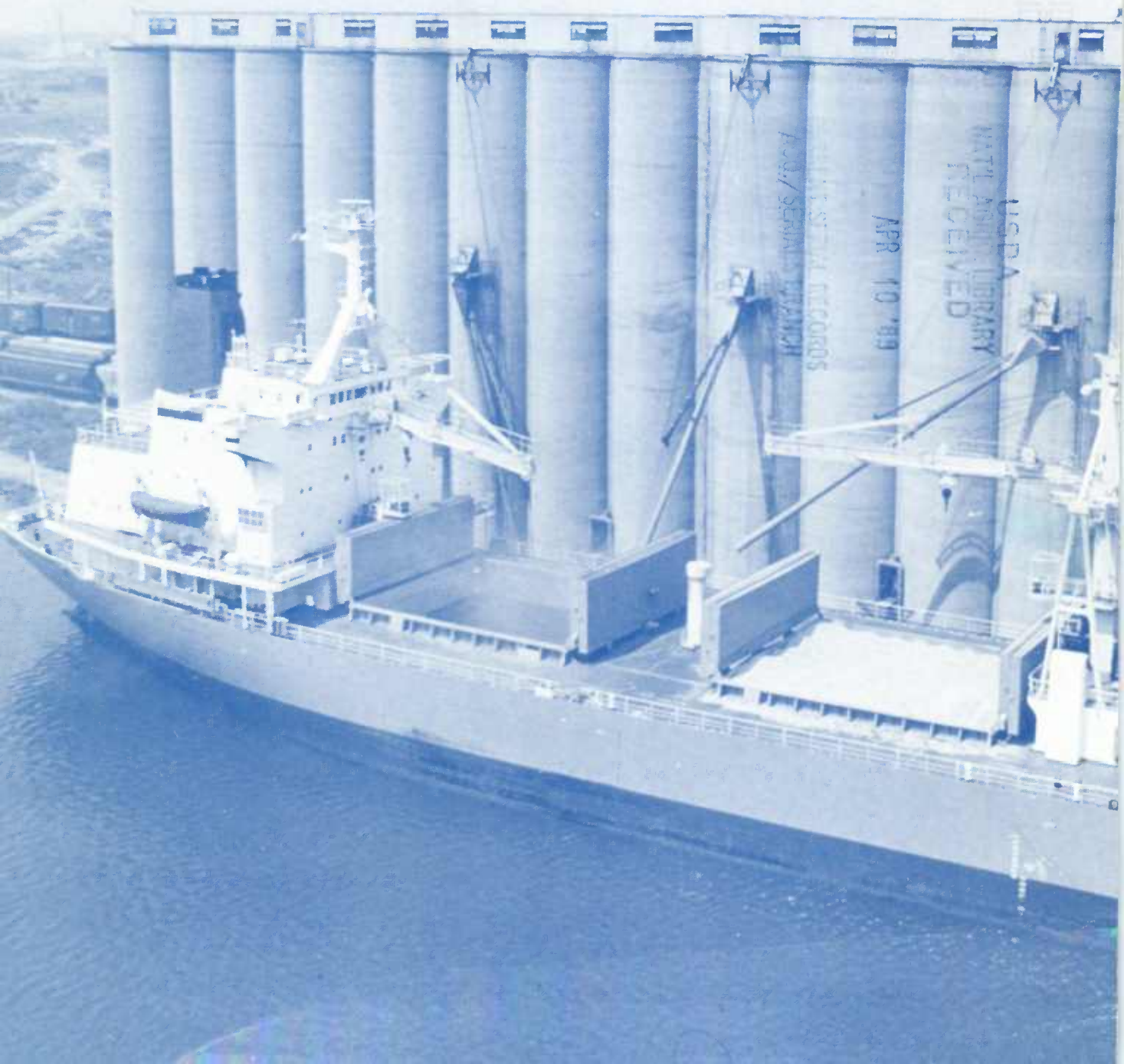
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United States Department of Agriculture

Economic Research Service

Agricultural Economic Report Number 564

Embargoes, Surplus Disposal, and U.S. Agriculture



EMBARGOES, SURPLUS DISPOSAL, AND U.S. AGRICULTURE.
Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report Number 564. December 1986.

ABSTRACT

Embargoes did not cause the farm crisis of the 1980's and an aggressive export subsidy program to reduce surplus commodity stocks would not have prevented it. The cause more likely rests with radical changes in such worldwide economic conditions as recession, high interest rates, and the value of the dollar. The short-term embargoes of the 1970's, implemented to correct short supplies and high prices, stabilized markets and had little lasting effect on trade, prices, and farm income. The longer term 1980 USSR embargo, implemented for foreign policy reasons, barely changed U.S. and world trade levels, but did alter trade flows as the USSR replaced lost U.S. exports from other sources. U.S. policies to protect farmers from the cost of embargo more than offset any immediate damage. A general export subsidy to dispose of stocks would be more expensive than existing programs although farm income would remain basically unchanged and world price variability would increase. If the subsidy's goal was to maximize income minus subsidy costs, targeted subsidies could do so at lower costs than current programs but would be difficult to implement and would not eliminate stocks. If the goal was to eliminate stocks, then targeted subsidies could not improve income sufficiently to offset Government costs.

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EMBARGOES, SURPLUS DISPOSAL, AND U.S. AGRICULTURE



Economic Research Service
U.S. Department of Agriculture

PREFACE

This study fulfills a congressional mandate contained in the 1985 Supplemental Appropriations Bill. The bill directed the Economic Research Service (ERS) to conduct:

> ...a study to determine the losses suffered by U.S. farm producers during the last decade as a result of embargoes and the failure to offer for sale on world markets commodities surplus to domestic needs at competitive prices.

ERS enlisted the best academic authorities in a joint research effort to produce this study. The International Agricultural Trade Research Consortium, of which ERS is a member and sponsor, was used to identify and solicit participation of university faculty who are experts in international trade. This study, then, is the product of a team of agricultural economists from ERS, 14 universities, and one private research institution.

This report uses metric units throughout. Metric tons are referred to as tons. 1 metric ton = 2,204.6 pounds

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FOREWORD

What effect have export embargoes had on U.S. agriculture? The many answers available to us demonstrate the great divergence of perceptions of policymakers, the general public, and agricultural economists. The popular perception is that embargoes, especially the 1980 embargo against the USSR, have been a major cause of declining exports, low prices, and the farm financial crisis. On the other hand, some economists have argued that, given the nature of world agricultural markets, embargoes are ineffective and that they have been a minor contributor to the problems faced by U.S. agriculture.

A second issue over which there is serious difference of opinion is whether the Commodity Credit Corporation, by not using available authority to sell surplus commodities on world markets at subsidized prices rather than accumulating stocks, has economically harmed the agricultural sector and increased the costs of price support programs. The argument is that CCC and farmer-owned reserve stocks have a price-suppressing effect on markets and reduce farm income and that this effect would be removed if surpluses were instead sold on world markets even at subsidized prices. Another argument is that it costs Government more to hold stocks than it would to subsidize disposal on world markets.

These debates must be correctly resolved, not to resolve an academic debate but because these issues underlie an important part of the debate on future U.S. farm and agricultural trade policy. Policies based on incorrect assumptions about the causes of current farm sector problems or about the effects of a new direction in management of surplus production can introduce new distortions in both domestic and international markets and create new and even more serious problems.

In 1985, Congress mandated that the Economic Research Service conduct analysis to resolve these two issues. Recognizing the importance of the issues and the necessity that the analysis be as comprehensive and objective as possible, ERS solicited participation of the best academic authorities in a joint research effort. The International Agricultural Trade Research Consortium (IATRC), of which ERS is a member and sponsor, was used to identify and solicit participation of university faculty who are experts in international agricultural trade. The findings presented here represent the most comprehensive, indepth analysis of these issues that the agricultural economics profession could provide, given constraints imposed by time, data, and analytical methods. The consistency and robustness of results derived from alternative analytical approaches lend a degree of confidence to the conclusions that could not have been achieved with any single approach.

This analysis places export embargoes in perspective as one (and a relatively minor one) of several factors that converged to make the first half of the decade of the 1980's so disappointing and painful for U.S. agriculture. It also shows that subsidized export disposal of surpluses causes very different distortions in world markets, will not necessarily increase domestic prices, and under many conditions would have been more expensive to operate than the existing stocks program.

The process employed in this research may well be as important a contribution as the research findings themselves. A large team of agricultural economists from more than a dozen universities, one private research institution, and the Economic Research Service successfully defined and executed a research plan resulting in a comprehensive and, we hope, credible, published report on an important current problem on schedule and within about 9 months. It demonstrates what a cooperative effort among agricultural economists can accomplish given a defined goal, resources, and leadership. It should be used as a model for future efforts.

Many individuals contributed to this endeavor. Names, institutional affiliations, and role of contributors to the project follow. Three individuals deserve to be singled out for their contributions to the project. Alex McCalla was one of the three co-principal investigators and executive director of the project steering committee. In these roles, Alex provided the intellectual spark and the field generalship that kept the team moving toward the objective of a high-quality, useful research report. Without this kind of leadership, the process would not have worked. William Kost and Alan Webb, serving on the project steering committee, were also the principal advisors to the editorial staff. They helped perform the difficult task of transforming a set of papers into an integrated report.

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CHAPTER 1

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CHAPTER 1

EMBARGOES, SURPLUS DISPOSAL, AND U.S. AGRICULTURE: A SUMMARY

PRINCIPAL FINDINGS

This study presents results of comprehensive analyses of four U.S. export embargoes and possible programs of general and targeted export subsidies for 1970-84. It focuses on wheat, feed grains, oilseeds, and dairy products. Principal findings are:

- ***Embargoes of the 1970's.*** The general oilseed embargo of 1973 and the targeted sales suspensions of 1974 and 1975 did not last long and had predictable, short-term results. That is, they moderated high futures prices but generally had little effect on trade volumes, world prices, U.S. exports, and U.S. farm income. Foreign country response was limited. In fact, the embargoes were viewed as positive, market stabilizing forces by other countries.

- ***The 1980 Embargo Against the USSR.*** The 1980 embargo was a foreign policy action to punish the USSR. It was not meant to reduce high prices. Its longer duration (16 months) meant that success depended on cooperation of grain companies and competitive exporters. Early cooperation waned, and the effect on USSR meat consumption was minimal. The embargo did not significantly reduce USSR imports (at most, 3 million tons) or world trade. The USSR altered trade flows by replacing lost U.S. exports with the same or substitute commodities from other sources. Therefore, world prices and trade volumes changed little. Because of changed USSR behavior, the United States lost USSR market shares after the embargo. The United States also lost market shares throughout the 1980's, but likely more as a result of world economic conditions and foreign country response rather than the embargo. Policies implemented during the embargo to prevent U.S. farmers from bearing the cost of the embargo were more than successful.

- ***General Export Subsidies.*** The Commodity Credit Corporation (CCC) is authorized to sell surplus commodities on world markets at competitive prices. This would require export subsidies. The United States has chosen not to go this route, relying instead on land set asides, commodity storage, and support prices. A dynamic analysis of the period beginning in 1973 was conducted on potential effects of a general subsidy program for wheat and feed grains which disposed of farmer-owned reserves (FOR) and/or CCC stocks. U.S. disposal of stocks would have cost more than existing programs, and farm income would have been basically unchanged. World prices would have been much more variable. A static analysis of dairy stock disposal reaches similar conclusions; disposal could be done, but it would be more expensive than current programs and would have little effect on dairy farmers' incomes.

- ***Targeted Export Subsidies.*** General subsidies apply equally to all destinations. The alternative is to determine if different subsidies targeted at particular destinations are preferable. It pays to subsidize price-responsive markets when other countries do not change their behavior. If the subsidy goal is to maximize farm income, minus subsidy costs, then targeted subsidies could do so at lower cost than general subsidies. If, however, the goal is to eliminate all stocks, then targeted subsidies do not raise farm income enough to offset government costs.

  In both cases, effectiveness and cost of subsidy programs depend critically on two responses: How much importers respond to changing prices and whether competitive exporters retaliate. If the former is unresponsive and exporters retaliate, export subsidy programs are very expensive and move limited quantities. A range of assumptions is analyzed to illustrate the importance of these issues.

- ***Macroeconomic Effects.*** Embargoes did not cause the farm crisis of the 1980's and an aggressive export subsidy program to reduce surplus commodity stocks would not have prevented it. The cause more likely rests with radically altered macroeconomic conditions: The rising U.S. dollar, global recession, and

high real interest rates. Our analysis suggests that if world economic conditions of 1979/80 had prevailed throughout the 1980's, U.S. exports, world prices, U.S. farm prices, and U.S. farm incomes would have been much higher and program costs would have been significantly lower. U.S. farm income depends heavily on national and global developments far removed from the U.S. farm sector.

BACKGROUND

U.S. agriculture faces its worst economic crisis since the Great Depression. The rapid growth and relative prosperity of the 1970's have faded to widespread stagnation and financial stress in the 1980's. Depressed international markets for U.S. farm products have replaced the strong export-led growth of the 1970's. Despite large increases in Government payments, many farmers face severe financial problems. The deteriorating economic position of U.S. agriculture is reflected in substantially reduced agricultural asset values.

Many factors have contributed to the change in U.S. agriculture's economic fortunes, and many remedies for agriculture's problems have been suggested. We have not attempted to analyze all factors leading to the present agricultural situation. This study analyzes one of the possible causes of agriculture's distress: U.S. agricultural export embargoes since the early 1970's. The study also analyzes a suggested solution: Disposal of surplus U.S. agricultural commodities by subsidizing exports in foreign markets. Given the operational methods of U.S. domestic agricultural price support programs, such price-competitive disposal would require some type of export subsidy. We also evaluate the effects of the changing macroeconomic conditions facing agriculture.

The study concentrates on the effects of export embargoes and surplus disposal on exports, farm prices, farm income, and Government program costs. It describes the four embargoes implemented since 1970 and determines their international and domestic effects in the short and long terms. In assessing implications of surplus disposal, the study evaluates the national and international effects, including costs, of major disposal options available to or through the CCC.

We focus on the commodities primarily affected by the embargoes (wheat, feed grains, and soybeans) in the embargo part of the study. We consider wheat, feed grains, and dairy products in the surplus disposal analysis because of their importance in CCC stocks.

The study covers 1970 to 1983/84 or 1984/85, depending on data availability. This period includes all four embargoes and is long enough to permit detailed assessment of the effects of alternative surplus disposal policies.

We used widely different methods of analysis to provide a comprehensive assessment of effects of U.S. export embargoes and surplus disposal. Such diversity is necessary because no single methodology can determine the short-, medium-, and long-term effects of embargo or disposal actions. A range of analytical methods allowed us to compare results and determine whether they provide a consistent assessment of the embargoes' effects. Such consistency adds weight to the conclusions drawn about effects of embargo or disposal actions. Finally, the limited time we had to conduct the study forced us to draw primarily upon existing economic models.

Numbers cited here need to be interpreted within the context of the model used to derive them. As in all quantitative economic analyses, results depend on the structure of the model employed, its assumptions, statistical validity of estimated parameters, and ultimately on data quality. Although this does not mean that selection of the model predetermines conclusions, it does imply that interpretation of results should be conditioned by how they were derived.

Estimates should be interpreted not as precise point projections but rather as indicators of general tendencies and orders of magnitude. Changes in prices, trade volumes, or farm income were derived from models that capture how economic actors respond to the changes in market conditions created by embargoes or surplus disposal. But these are all models in which a substantial number of other variables are assumed to be constant. Conditionality of the results must be recognized. Nevertheless, our results indicate the direction of the changes produced by embargoes and surplus disposal, and the general order of magnitude of these changes.

THE ECONOMIC SETTING

The effects of changes in world agricultural structure and policy and in the general economic environment must be isolated from effects of embargoes and the potential for surplus disposal. During the embargoes, other changes also influenced agricultural trade, prices, and U.S. farm incomes. Disentangling effects of the embargoes from effects of other forces is difficult, but vitally important. These other forces may have either compounded the embargoes' effects or offset them. Changes in market conditions also complicate historical analysis of the potential for surplus disposal. We place effects of embargoes and surplus disposal in perspective by simultaneously considering effects of the changing economic environment upon U.S. agriculture.

Changes in the economic environment facing U.S. agriculture fall into four general areas: (1) Structure of the agricultural sector, (2) world markets, (3) relevance and importance of macroeconomic conditions, and (4) farm policy.

Structural Changes in the U.S. Farm Sector

Increased specialization, growing reliance on purchased inputs, and greater dependence on foreign markets since the early 1970's have made farm income much more subject to influences from outside the agricultural sector. In the 1970's, agriculture became more productive, and incomes rose through the growth of larger, more specialized farms relying increasingly on capital-intensive production methods. Greater specialization means that farmers no longer have the diversity of onfarm enterprises to cushion a fall in prices of one commodity. Greater reliance on purchased capital inputs and debt accumulation has increased interest costs as a proportion of total production expenses, thereby linking farming more closely to factors affecting the entire economy. At the same time, exports in the past 10 years have accounted for 25-30 percent of farm cash receipts, compared with 10-15 percent in the 1950's and 1960's.

Changes in World Markets

U.S. agriculture benefited from rapidly expanding agricultural trade in the 1970's. This expansion was driven by income growth in developing countries and Eastern Europe and by changes in Soviet and Chinese policies that put greater reliance on imports to meet domestic food needs. The relative importance of traditional U.S. agricultural trading partners, such as Japan and Western Europe, declined as exports to developing and centrally planned countries increased. Variations in economic conditions or import policies of these countries are now vitally important to U.S. grain and oilseed producers.

Domestic and trade policies of importing and exporting countries increasingly influence world grain prices. Some policies attempt to protect domestic producers from foreign competition; others attempt to achieve "food security." The trend toward greater public intervention has especially affected the international wheat market. Because of some policies, domestic prices of many importing and exporting countries are largely disconnected from world prices. For example, a fall in world wheat prices is not passed to Japan's consumers because government border policies prevent it. Such policies can greatly inhibit effectiveness of an export subsidy policy. Public intervention also has increasingly affected coarse grain markets, but soybean markets have remained relatively open.

Despite the importance of government policies and intervention, international grain marketing is a highly flexible, fluid, and technologically sophisticated system dominated by efficient transnational firms. Ability of private firms to use futures and forward markets for commodities, transportation services, and currencies permit the market to manage natural instability and to adapt to impediments of national governments. International markets are able to adjust quickly to changes from domestic economic conditions and government policies, such as an embargo affecting trade flows between two or more countries.

Changes in Macroeconomic Conditions

Two major factors affecting U.S. agricultural exports have been the rate of economic growth in importing countries and the value of the U.S. dollar. The dollar's value has varied substantially since the move from fixed to floating exchange rates during the early

1970's. Shifts in domestic macroeconomic policies have influenced exchange rates. The two oil price shocks of 1973/74 and 1979 were important factors in the domestic and global economies and in international trade.

During the 1980's, U.S. fiscal and monetary policies have affected the economic well-being of the U.S. farm sector. A combination of restrictive monetary policy and expansionary fiscal policy resulted in high real interest rates and an appreciation of the international value of the dollar. The restrictive monetary policy helped reduce the rate of inflation but contributed to domestic and global recession. Lower economic growth and high real interest rates precipitated a debt crisis in developing countries. Reduced economic growth and world liquidity problems depressed demand for imports of agricultural and other products. High value of the dollar depressed demand for U.S. exports. Weak demand and higher production expenses generated by increased interest costs squeezed agricultural earnings. High real interest rates made land a less attractive investment and contributed to a decline in the value of agriculture's most basic asset. U.S. agriculture was caught in economic circumstances resulting in major financial stress.

Changes in Farm Policy

Although U.S. farm policy legislation has changed in the past 15 years, the basic thrust of commodity programs has been constant. Effect of these programs has varied with the changing economic environment. In the early 1970's, flexibility of U.S. price support programs allowed U.S. farmers to respond rapidly to expanding world demand for grain and livestock feed. During the early 1980's, reduced international demand, a strong dollar, and relatively high U.S. loan rates contributed substantially to reduced U.S. agricultural exports. The Government acquired grain stocks to support domestic prices. But, because of the importance of the United States in international markets, this Government stock accumulation effectively meant supporting world prices. The appreciating U.S. dollar and high and rigid loan rates provided an incentive for importers and competing exporters to produce more grain and oilseeds. Mechanisms for providing price and income support for the U.S. farm sector ultimately contributed to the loss of the very markets responsible for the sector's prosperity.

Changes in the setting within which agriculture operates significantly influenced effects of export embargoes and potential effects of surplus disposal. The four embargoes happened in different market contexts. Feasibility of the subsidized disposal of grain surpluses depends upon the prevailing market environment. Hence, economic setting is of paramount importance to this study.

TRADE EMBARGOES

The United States has used both general and targeted export embargoes for agricultural products. The 1973 general embargo on oilseeds and oilseed products restricted shipments to all foreign markets. The remaining embargoes were all targeted; that is, restricted to specific importers. The 1974, 1975, and 1980 actions were targeted against the USSR. The 1975 action also covered Poland.

A wide variety of analytical approaches was used to determine effects of the embargoes. We used economic theory to determine effects expected from the restriction of U.S. exports. For the analysis of the embargoes of the 1970's, which were of relatively short duration, we examined trade and price patterns to determine what trends were already underway and how these changed following the embargo. Public policy statements, embassy cables, and press reports during each action were analyzed. We interviewed individuals in key positions of authority at the time to determine how countries responded to the embargoes. We used the same methods for the 1980 embargo, but its longer duration permitted us also to use quantitative economic models based on annual or quarterly data to predict economic effects. These predictions were then evaluated in the light of actual events. We obtained estimates of the effect of the embargoes upon U.S. exports, prices, and farm income. To provide the fullest possible evaluation of likely effects, we employed models using alternative assumptions about price formation and the determination of trade flows and compared their results.

By drawing upon a range of methods using different economic assumptions, we determined whether alternative models lead to similar conclusions about implications of U.S. embargoes. Study results are broadly consistent. While each method provides a slightly different quantitative estimate of embargo effects, the general picture is the same. We are, therefore, confident in our qualitative conclusions.

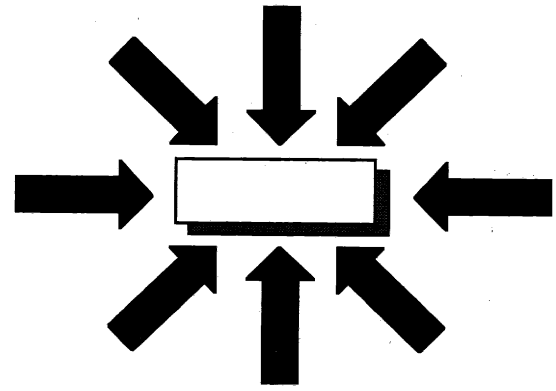
The 1973 Oilseed Sales Restriction

The 1973 embargo of high-protein feedstuffs resulted from several global economic and policy changes that significantly altered the environment in which U.S. agriculture operated. The sector changed from one characterized by excess productive capacity and low, stable prices to one engaged in full production with high, unstable prices.

Despite record-high world soybean production in 1972/73, strong foreign demand and a sharp decline in world fishmeal production tightened protein meal supplies and caused soybean prices to rise rapidly. In June 1973, the domestic price of soybean meal was more than three times its year-earlier level. The rapid rise in prices threatened to disrupt domestic livestock production and to thwart the President's anti-inflation efforts. Political pressure to limit agricultural exports to control prices was considerable.

The sales restraint was announced on June 27, 1973, after months of rising soybean prices and increasing concern about the adequacy of domestic supplies. The embargo prohibited all U.S. exports of soybeans, soybean meal and cake, soybean oil, cottonseed, cottonseed meal and cake, and cottonseed oil. The embargo was replaced 5 days after the announcement with an export licensing procedure that lasted until October 1, 1973. Licenses were initially issued for 50 percent of the unfilled balance for verified soybean export contracts and for 40 percent of the unfilled balance for soybean cake and meal contracts. However, licenses for 100 percent of the volume called for in soybean meal contracts were issued from August 1, and licenses were issued for 100 percent of the volume called for in soybean contracts from September 1, 1973. Hence, export restrictions were in place for about 1 month for soybean meal and 2 months for soybeans.

Many Approaches, Same Result



The U.S. decision to embargo apparently was not influenced by possible foreign repercussions to the action, and U.S. foreign policy advisors were not consulted before sales were restricted.

Short-Term Effects

The immediate results of a total sales restriction by a major exporter are to raise prices on the world market where supplies are reduced and to lower prices in the domestic market where supplies are increased. Following the 1973 sales restriction, prices for soybeans and meal in such major international centers as Rotterdam rose and domestic U.S. prices fell sharply. The divergence between U.S. and Rotterdam prices was short-lived, however. After July, Rotterdam soybean and soybean meal prices declined. The persistent decline in both U.S. and Rotterdam prices implies that the market was already weak before imposition of U.S. export restraints. Uncertainty and speculative pressures fueled rapidly increasing prices before the embargo. The embargo broke the cycle of panic buying and speculation in the spring 1973.

Although overseas sales were restricted for several weeks, the restriction had little effect on U.S. soybean and soybean meal exports for the 1972/73 marketing year. Export sales in 1972/73 were smaller than in 1971/72, largely due to limited supplies and high prices rather

than to restricted exports. Short-term effect of the embargo on U.S. trading partners was minimal. Japan, the largest U.S. customer, changed the seasonal pattern and product composition of its oilseed imports, but the overall volume of Japan's trade was unaffected. Possibly anticipating shortages, Japan purchased above-normal quantities of soybeans in the 6 months preceding the embargo. The restrictions also minimally affected other U.S. customers. Foreign buyers benefited from the lower prices resulting from the embargo.

If we assume that the decline in world soybean prices was entirely due to the embargo, the export restriction reduced cash receipts to U.S. soybean producers less than 1 percent. The sustained decline in prices after the embargo suggests that income would have dropped anyway; the embargo was merely the catalyst. Onfarm soybean stocks were so low that, even if prices had remained high until the September harvest, few farmers would have been able to take advantage of them. Cash receipts to U.S. soybean producers would have been less than $52 million, less than 1 percent, greater if they had been able to sell the soybeans they had on hand between July 1 and September 1 at pre-embargo prices. Livestock producers and consumers gained from the embargo to the extent that prices for protein feedstuffs and food were lower as a result.

Long-Term Effects

The 1973 embargo had little effect on U.S. agriculture and no detectable effect beyond the start of the 1974/75 crop year. Its short duration occurred under such tight market conditions that it precluded a long-term response by other countries. Even Brazil, the other major supplier, protected its domestic market by restricting soybean exports rather than taking advantage of the situation to increase its market share.

The embargo possibly altered importers' attitudes toward the reliability of the United States as a supplier, but probably did not significantly alter long-term import behavior of foreign purchasers. Japan's response, the most visible and vigorous, was mostly symbolic. A small Japanese Government stock of soybeans was established, but this stock has remained only large enough to satisfy demand for about 8 days. Japan's Government also financially supported trading companies' investments in overseas soybean production, but the amount of this investment and its results have been insignificant. Japan still relies heavily on the United States for soybean imports. But, Japan has used the embargo as a food security justification for continuing protective domestic agricultural policies.

Some members of the European Community (EC) have used the embargo to lobby for increased domestic production of oilseeds and the imposition of restrictions on soybean imports. However, the principal impetus for the EC measures is the problem created by soybean imports for the EC's high-priced grain policies rather than concerns about food security.

There is little evidence that U.S. competitors in the soybean market significantly altered their domestic or export policies to take advantage of the embargo. Prices were so favorable to exporters, even without the embargo, that the embargo could have added very little extra incentive to increase exports. Even with this incentive, Brazil's agricultural trade policies focused more on maintaining adequate domestic supplies and low domestic prices than on consistently encouraging exports of soybeans or meal. Brazilian export policy apparently did not change to take advantage of the 1973 embargo. On the contrary, Brazil imposed its own restrictions on exports during the period and was an even less reliable supplier than the United States. Argentina's emergence as a soybean exporter in the mid-1970's also appears unrelated to the 1973 embargo. High prices, favorable growing conditions for soybeans, and Argentina's more liberal export policies were responsible for the increase in its exports.

Long-term effect of the 1973 soybean embargo on the competitive U.S. position in world markets and on U.S. exports was negligible. Supply and demand responses to the embargo were small. No significant policy response by a major soybean or soymeal trading country can be traced to the U.S. action. Main factors affecting international trade in soybeans and soybean products during the mid-1970's were strong demand in the face of reduced supplies

of protein feeds and the consequent responses to high prices. The U.S. soybean embargo was only a minor disturbance in a highly volatile market.

The 1974 and 1975 Grain Moratoria

The USSR was a major source of the variability in grain market prices in the early 1970's. The 1974 and 1975 moratoria were targeted at this perceived source of the market disruptions. In this sense, the grain moratoria were surgical attempts to deal with the uncertainty of grain supplies without undermining confidence in the United States as a reliable supplier in the eyes of longstanding trading partners.

The 1974 sales moratorium was linked directly to deteriorating crop prospects in the United States and several other large grain trading countries and to extremely low U.S. stocks. Unfavorable weather in the United States reduced corn production and placed upward pressure on prices. Major U.S. trading partners were consulted extensively; they voluntarily agreed to restrain their purchases from the United States. The 1974 sales moratorium went into effect in October, when as a result of an attempted major purchase by the USSR, the President requested U.S. grain exporters to suspend contracts for delivery of 2.3 million tons of corn and 900,000 tons of wheat to the USSR.

Less than a year later, on July 24, 1975, a second sales moratorium was instituted to reduce effects on the grain market of the uncertainty generated by deteriorating grain production prospects in the USSR. The poor 1974/75 crop had resulted in low carryover stocks and left the U.S. and world grain markets highly vulnerable to supply shocks in 1975/76. Markets reacted strongly to reports in the summer that the USSR grain crop was deteriorating. Continued inflationary fears and disclosure of significant purchases by the USSR prompted the Secretary of Agriculture to call on the major grain companies to withhold sales first from the USSR and then from Poland. The 1975 moratorium was lifted after the United States signed separate 5-year, long-term trade agreements with both countries in the fall 1975.

Short-Term Effects

The 1974 and 1975 grain moratoria combined with several other developments to calm the cash and futures markets for grain. The 1974 suspension lowered Kansas City average monthly prices of wheat 11 cents per bushel between October and November. As the 1974/75 marketing year progressed, the supply situation eased with the weakening of feed demand in the United States and abroad. This was reflected in wheat prices declining from their presuspension level of $5.47 per bushel to $3.81 in June 1975.

The 1975 moratorium and a proposed U.S.-USSR long-term sales agreement in September 1975 also reduced pressure on prices. September 1975 wheat and corn prices at the farm level averaged $4.11 and $2.76 per bushel, but fell to $3.58 and $2.33 per bushel by November.

The effect of the moratoria on total U.S. exports was negligible. Although only 2.2 million of the 3.2 million tons of corn and wheat contracted for shipment to the USSR before the 1974 action were shipped in the 1974/75 crop year, the United States increased its sales to third-country markets. The 1975 moratorium did not hinder U.S. exports of wheat and coarse grains in 1975/76. Rather, sales reached an all-time high.

The effect of the moratoria on U.S. farm cash receipts also was negligible. The higher prices at the time the moratoria were announced would probably not have persisted in any case.

Long-Term Effects

Long-term effects of the 1974 and 1975 moratoria are difficult to measure precisely but appear to be limited. The USSR imported large volumes of U.S. products after the moratoria until the 1980 embargo. From 1976/77 to 1978/79, the United States supplied an annual average of 71 percent of USSR grain imports. USSR grain purchases averaged over 10 million tons, well in excess of the 6-million-ton minimum specified in the long-term grain agreement.

The most obvious policy change resulting from the 1974 and 1975 moratoria was the signing

of the U.S.-USSR long-term grain agreement in October 1975. This began an era of greater U.S. Government management of export quantities, at least with Eastern Bloc countries, which had become substantial sources of uncertainty and instability in Western grain markets in the early 1970's. This agreement provided greater information about production and import demand in the USSR, key areas of uncertainty in the international grain market. The agreement helped importers and exporters make long-term production, consumption, and trade plans.

The moratoria raised questions about long-term reliability of the United States as a supplier, as did the 1973 embargo. But, because the moratoria were imposed after substantial consultation with other countries, U.S. trading partners generally saw the actions as part of a set of positive initiatives to stabilize markets. By stabilizing its domestic market, the United States really stabilized the world market by restoring world confidence in the United States as a reliable supplier. Moreover, in signing the USSR and Poland to long-term agreements, the United States helped reduce market uncertainty.

The 1980 Embargo to the USSR

Circumstances surrounding the 1980 U.S. embargo differed greatly from the earlier three actions. The 1980 embargo was a foreign policy action motivated by the USSR invasion of Afghanistan. Unlike the trade actions of the 1970's, concern about adequate domestic supplies was not a factor in the decision. Because it was a foreign policy action, conditions needed to lift the embargo, short of a USSR withdrawal from Afghanistan, were unclear.

The embargo, lasting nearly 16 months from January 4, 1980, to April 24, 1981, included a wider range of products (wheat, feed grains, soybeans, meat, dairy products, poultry, animal fats, and agrichemicals) than preceding embargoes. Grain was most important, accounting for almost 80 percent of the value of U.S. agricultural exports to the USSR in 1979. Yet, the embargo was only partial for grains because the United States honored the 1975 U.S.-USSR agreement. The USSR was allowed to import the 8-million-ton obligation specified in the fourth (1979/80) and fifth (1980/81) years of the accord.

President Carter wanted to make a strong statement that the United States would not allow USSR aggression to go unanswered, according to our interviews with key officials of the period. Military responses were considered inappropriate, and diplomatic protests were considered inadequate. An agricultural embargo emerged as the most plausible alternative when a report by the Central Intelligence Agency (CIA) showed that a grain embargo would reduce USSR meat consumption 20 percent. The report assumed full cooperation from other exporters in not filling the void left from the withdrawal of U.S. grain from the USSR market and that USSR port capacity constraints and low domestic grain harvests would contribute to reduced livestock production. In contrast, a U.S. Department of Agriculture (USDA) analysis done at the time, but which, according to our interviews, probably did not enter into the decision to embargo, predicted only a 2- to 4-percent decline in USSR meat consumption assuming full cooperation from other exporters.

The embargo decision was based on two important conclusions from the analysis at that time. First, cooperation of other exporters and grain companies was essential. Second, grain companies and U.S. farmers would have to be compensated. If the embargo effect on the USSR was to be as large as estimated by the CIA report, the decline in world grain trade would be significant and compensation to the U.S. farm sector would need to be large.

All but two trading firms agreed to cease shipping grain to the USSR in exchange for financial compensation. After a meeting with officials from other major exporting countries, only Argentina announced it would not cooperate. Australia, Canada, and the EC agreed to ship no more than "normal and traditional" amounts to the USSR during the embargo. In practice, "normal and traditional" provided considerable latitude for interpretation. For example, Canadian officials interviewed indicated that they thought Canada's commitment was for only the remainder of the 1979/80 crop year.

U.S. actions to compensate U.S. farmers for losses caused by the embargo included

increased loan rates for wheat and corn. Call and release prices for grain in the FOR were also raised. First-year interest payments on corn entering the reserve were waived, and reserve storage payments were increased. The Government agreed to purchase 4 million tons of wheat, including 3.7 million tons withheld from the USSR, and to assume contractual obligation for up to 10 million tons of corn. In March, noneligible 1979 crop corn was allowed into the FOR, and the emergency loan program was extended to September 1981, making farmers eligible for $2 billion in loan assistance. In July, loan rates were increased again, an additional $300 million of emergency funds were made available to farmers, minimum prices on FOR-held grain were made mandatory, and interest payments on FOR loans were waived.

The embargo's effect is difficult to assess even 6 years after its announcement. The United States clearly received less than full cooperation from other exporters, and USSR meat consumption did not decline by the amount the CIA predicted. Demand for U.S. agricultural exports also weakened in the years after the embargo, placing pressure on farm incomes. A number of simultaneous events and policy changes also affected world agriculture and U.S. trade. Assigning precise weights to causes of changes in trade or farm income is difficult, even after the fact. We used a variety of methods to examine effects of the 1980 embargo in order to gather as complete a picture as possible.

Short-Term Effects

We approached short-term effects of the 1980 embargo in two ways. First, from data, we examined changes after the embargo went into effect. We emphasized what happened to international trade, prices, and USSR agriculture during the early 1980's rather than the importance of the embargo as a source of the changes. Then, we presented what the embargo effects would have been if all other unrelated changes, such as crop shortfalls, policy shifts, and exchange rate changes, were held constant. This approach allowed us to isolate embargo-related trade and price effects from other factors.

The 1980 embargo denied the USSR 10-17 million tons of U.S. grain during the first year, representing the amount the USSR needed to obtain from other sources to prevent a decline in domestic consumption. The ultimate effect on the world market and the United States depends on the extent to which the USSR made up for the reduction in U.S. imports.

Two alternative responses were open to the USSR to reduce the effect of the embargo. Both would have had major implications for world grain trade and U.S. farmers. One alternative was to internally absorb the loss by reducing stocks as much as possible, slaughtering livestock in the short run, and cutting meat consumption in the longer run. These actions would have reduced the demand for grain in the world market and, without a compensating reduction in U.S. exports, would have depressed world prices. The other alternative was to replace embargoed U.S. grain with imports of grains and substitute commodities from other exporters. If the USSR could replace all the grain simply by switching suppliers, world trade volume would not be affected and world grain prices would remain unchanged, except for some increase in transport costs. To the extent that the USSR substituted livestock products for grains, world grain prices would fall and livestock product prices would rise. The USSR primarily pursued the option of replacing U.S. grain with that from other suppliers and increasing imports of substitute commodities.

The embargo had little effect on USSR grain use. USSR wheat and coarse grain imports in the first year of the embargo were consistent with levels that might have been expected given previous import trends and estimated USSR grain stocks at the time. USSR feed use declined marginally, partly because of a policy initiated before the embargo to promote use of forage and nongrain feeds in livestock rations. Hence, reduced U.S. supplies were met largely by increased imports from other sources and reduced stocks.

The embargo did not significantly affect the volume of world grain trade. An examination of actual trade, and that predicted on the basis of trends before the embargo, does not reveal a strong embargo effect. At most, world grain trade fell 3 million tons, or less than 2 percent. Subsequent changes in volume of world grain trade appear to be due more to the supply/demand balances of major grain-trading

countries and to economic factors unrelated to the embargo.

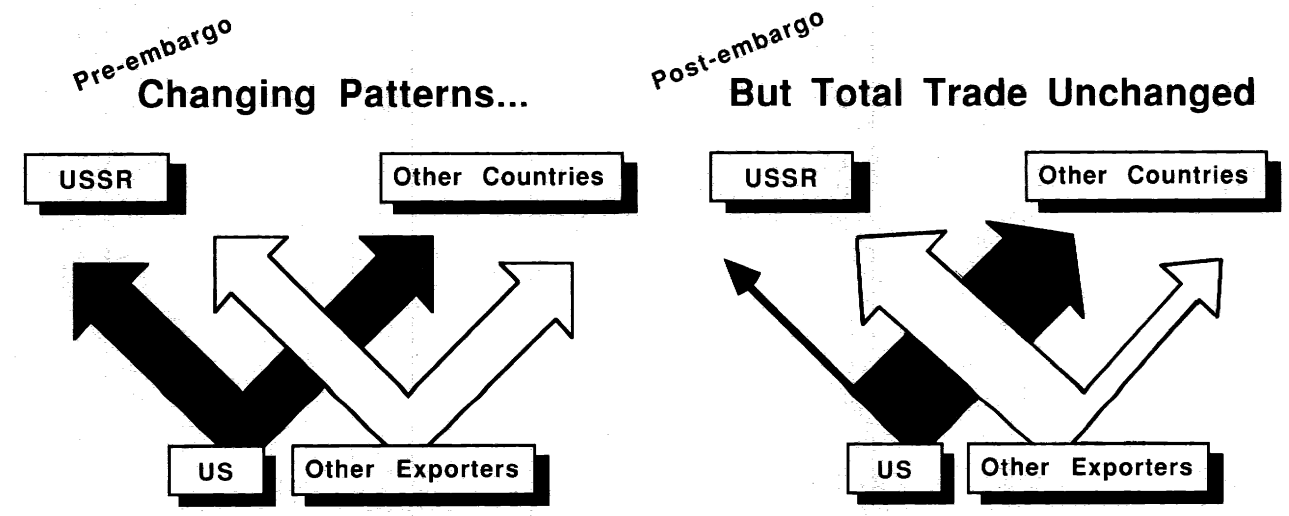
Grain-trading patterns realigned in 1980. The magnitude of this realignment for the wheat and corn markets is estimated in table 1.1, which shows the difference between actual 1980 trade flows and those that would have been expected if trends from the 1970's had continued. All major U.S. competitors sold more-than-expected quantities to the USSR. Argentina and Australia did this by diverting exports from other markets. Canada and the EC also increased their export volume to provide the additional supplies to the USSR.

The EC continued to ship some grain to the USSR after the embargo was imposed because previously issued export licenses could not be revoked. With this exception, the EC apparently complied during the embargo with its commitment made to the United States. Canada also complied with the embargo but only until the 1979/80 crop year ended in June. In the following crop year, Canadian exports to the USSR increased sharply. The Canadian Government officially announced its withdrawal from participation in the embargo at the end of November 1980. Australia substantially increased its exports to the USSR in 1979/80, but this increase was already

Table 1.1--Estimated change in exports between 1970-79 and 1980

Exporter	Wheat			Corn		
	USSR	Others	Total	USSR	Others	Total
			Million tons			
Argentina	1.7	-1.6	0.1	1.7	-4.2	-2.5
Australia	2.2	-1.9	.3	NA	NA	NA
Canada	2.2	-.8	1.4	NA	NA	NA
EC	.6	.3	.9	NA	NA	NA
United States	-3.2	0	-3.2	-7.1	11.5	4.4
Other exporters	.9	-.6	.3	1.8	-3.7	-1.9
Total	4.4	-4.3	NA	-3.6	3.6	NA

NA = Not applicable.



specified in an existing long-term supply agreement between the two countries.

The United States reduced wheat sales to the USSR by 3.2 million tons and corn sales by 7.1 million tons. The United States was unable to make up its loss in the wheat market with larger sales to other markets. Increased U.S. corn exports to other markets helped to offset the decline in corn exports to the USSR. The reverse was true for the USSR; that is, the USSR made up the loss of U.S. wheat but could not replace U.S. corn.

The embargo changed the commodity composition of imports in the USSR and its sources of supply, trade data suggest. USSR imports of wheat, barley, and livestock products (grain-equivalent) sharply increased in 1980 (table 1.2). USSR corn imports dropped 4.4 million tons from 1979. The increase in livestock product imports was equivalent to an estimated 3.4 million tons of feed grains.

U.S. market prices dropped immediately after the embargo was announced but returned to pre-embargo levels in less than 2 weeks. Prices declined again when harvests in the Southern Hemisphere hit records but rebounded as the weather worsened in the Northern Hemisphere that summer. Nevertheless, some farmers suffered a loss because they had to sell at temporarily depressed prices in order to get needed planting funds.

The embargo did not cause major short-term changes in world grain prices. The export prices of the two most affected exporters, the United States and Argentina, were remarkably stable during the embargo. However, comparison of quarterly wheat and corn export prices for the two countries reveals that Argentina obtained a price premium for its wheat and corn during 1980.

The USSR succeeded in replacing most of the embargoed U.S. grain, according to data on trade, supply, and use in the USSR. However, the USSR had to change its commodity mix of imports and had to pay a premium for Argentine grain to replace embargoed grain. World wheat and barley trade to the USSR increased at the expense of corn trade, and world livestock trade to the USSR increased at the expense of all grain trade. Our best estimate is that the embargo reduced USSR grain imports by no more than 3 million tons during 1980, after adjusting for the grain equivalent of higher imports of livestock products.

1980 Embargo Changes Soviet Import Mix

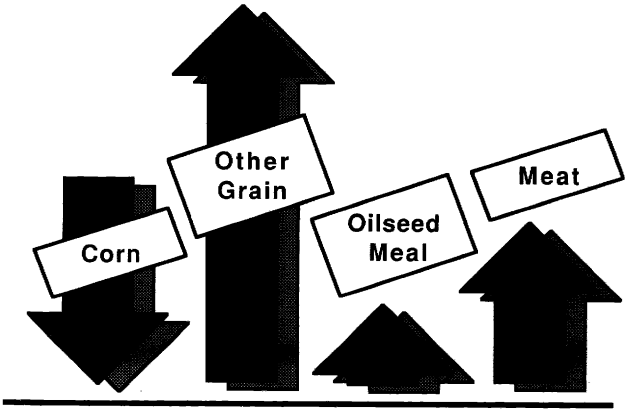


Table 1.2--USSR grain and livestock product imports

Commodity	1977	1978	1979	1980	1981	1982	1983	1984
				Million tons				
Wheat	6.4	9.0	9.6	14.9	17.3	21.1	23.0	28.0
Barley	.1	.6	1.3	2.4	4.8	2.7	1.6	1.4
Corn	4.0	13.3	14.6	10.2	16.5	11.5	6.4	12.4
Other grains and livestock	.1	0	3.5	3.5	7.8	3.1	2.1	4.0
Livestock products 1/	8.0	2.5	8.8	12.2	13.2	12.0	13.6	11.9

1/ Livestock products in grain equivalents.

Although the most likely effect of the embargo was a 3-million-ton reduction in USSR grain imports in 1980, we also estimated minimum and maximum effects. We chose two extremes which bracket the most likely case: zero and 11-million-ton reductions in USSR imports.

A key determinant of the magnitude of the embargo's effect upon world trade and prices was the ease with which importers could shift their sources of supply of grains in the world market. Quality differences, political ties, contractual arrangements, and long-term agreements can inhibit trade adjustments to the shock of an embargo. Hence, two sets of computations were made: One assumes that wheat or coarse grains from one exporter substituted perfectly for wheat or coarse grains from another exporter, and the second assumes that wheat or coarse grains from different exporters were less than perfect substitutes. Table 1.3 shows simulated effects of the 1980 embargo on U.S. prices, exports, and export earnings under both these assumptions and for the three assumed levels of USSR import reductions.

Estimates derived from models of world grain trade suggest that, even under the most pessimistic assumptions about the embargo's effects on U.S. exports, export prices of U.S. wheat fell no more than $11-$12 per ton, or 7 percent, in 1980. The embargo lowered coarse grain prices $8 per ton, or 6 percent, in the same year. U.S. wheat exports declined 2.4 million tons, and U.S: coarse grain exports fell 6.3 million tons. These reductions would have generated a loss of export earnings of $2.2 billion. These estimates were derived using two extreme assumptions: USSR grain imports fell 11 million tons as a result of the U.S. action, and grain available from alternative suppliers was an imperfect substitute for U.S. grain.

Under the most plausible assumption, that the USSR was deprived of 3 million tons of grain imports, the embargo lowered U.S. export prices of wheat 2-4 percent and export prices of coarse grains 1-3 percent. U.S. wheat exports fell 0.6-1.3 million tons, or 1.5-4 percent. Coarse grain exports dropped 1.4-2.9 million tons, or 2-4.5 percent. U.S. export earnings declined 3-8 percent, depending upon assumptions made about the degree of substitution between U.S. wheat and coarse grains and those of competitors.

The gross cost of the embargo to the U.S. Government was $2.2 billion, but the net cost was lower due primarily to the subsequent resale of contracts purchased from grain companies. Immediately following the embargo, the Government spent $500 million on buying and retendering sales contracts from exporting firms, $1 billion on directly purchasing grain, and $700 million on moving commodities into the grain reserve.

We used a model of the U.S. agricultural sector to estimate the effects of the embargo on U.S. farm prices, incomes, and Government

Table 1.3--Effects of 1980 embargo on U.S. prices, exports, and export earnings under alternative assumptions

Assumptions		Wheat change in--		Corn change in--		Trade value
Market structure	Effect on USSR imports	U.S. prices	U.S. exports	U.S. prices	U.S. exports	
	Million tons	*$/ton*	*Million tons*	*$/ton*	*Million tons*	*Mil. $*
Perfect substitute:						
	0	-0.94	-0.19	-0.19	-0.14	-98
	-3	-2.70	-.56	-1.85	-1.40	-498
	-11	-7.90	-1.64	-6.24	-4.71	-1,621
Imperfect substitute:						
	0	-4.98	-1.03	-2.44	-1.89	-756
	-3	-6.48	-1.34	-3.82	-2.89	-1,096
	-11	-11.45	-2.37	-8.31	-6.28	-2,232

program costs. The advantage of this model was that it could incorporate changes in farm policy and U.S. export levels in the wake of the embargo.

Changes in domestic farm programs as a result of the embargo put upward pressure on prices. The CCC expanded U.S. grain demand by purchasing and isolating 154.8 million bushels of wheat and 159.7 million bushels of corn from the market. The release price for wheat in the FOR was increased, and the loan rates for both wheat and corn were raised. Both these actions increased grain prices at the farm level in the years after the embargo.

When we incorporated these policies along with the trade effects of the embargo into the model of the U.S. agricultural sector, domestic policy changes dominated the trade effects. Even when we assumed the most extreme embargo-induced reduction in world trade (11 million tons), farm prices for wheat and corn were still 12 and 1 percent higher than with no embargo and no compensating change in farm programs in the 1979/80 crop year. A 3-million-ton reduction in world trade, with no compensating policy changes, did not affect wheat prices and it reduced corn prices by less than 3 percent in 1979/80.

Long-Term Effects

Procedures used to compute the short-term embargo effects are appropriate for comparing one state of the world with another, but they do not capture the possible long-term embargo effects. To analyze long-term effects, we used several procedures to trace effects of the embargo on trade, stocks, and farm income over time.

In 1981, the year following the embargo, increased sales to other markets offset effects on U.S. exports of reduced grain sales to the USSR. Higher wheat sales to China helped compensate for loss of the USSR market. Argentina and other exporters increased corn shipments to the USSR, resulting in greater U.S. exports to Mexico and others. The U.S. share of the USSR market would probably have contracted even without the embargo as the period of detente faded and production capacity of competing exporters expanded.

The embargo has been at least partially responsible for a long-term change in the mix of USSR grain and feed imports. Wheat is substituted for corn as a feed grain because wheat can be obtained easily from other suppliers. The United States is the world's largest corn exporter, and a USSR return to the pre-embargo expansion of corn use would mean a return to U.S. sources of supply. The quarterly pattern of USSR wheat imports has changed to take advantage of greater Argentine grain availability in the first quarter. Oilseed imports have increased steadily, probably reflecting an attempt to improve livestock feed rations rather than the embargo's effects. USSR feeding practices now rely less on grain, with a 27-percent increase in use of nongrain feed supplies between 1979/80 and 1985/86. Given USSR grain production problems, this may have been the trend even without the embargo.

The USSR's shift away from U.S. supplies weakened after the embargo was lifted in 1981, although imports from the United States have not recovered to levels that could have been expected based on trends during the 1970's. The USSR is a price-conscious buyer. Statistical analysis suggests that the embargo increased USSR responsiveness to changes in the prices of corn and wheat. The embargo probably made the USSR more aware of the possibility of diversifying its supply sources and the cost savings this might produce. However, high U.S. grain prices in recent years have been as much a factor in the failure of the USSR to purchase U.S. grain as any residual effect of the embargo.

U.S. farmers were overcompensated for the shortrun embargo effects, which is not surprising since the offsetting policy measures were enacted in early 1980 when estimates of the embargo's effects were large. Depending on the economic assumptions made, net farm income increased between $0.2-$2.2 billion over 1979-84 as a result of U.S. policies to compensate producers.

Despite its immediate cost to the Government, the embargo reduced long-term costs of price support operations. Higher loan rates lowered the amount of deficiency payments to farmers. Higher feed costs reduced dairy production and costs of price support operations for dairy products. Although Government storage costs

increased as a result of changes in the reserve program, the net effect of policy changes due to the embargo was to reduce long-term Government outlays an estimated $0.3-$1.5 billion.

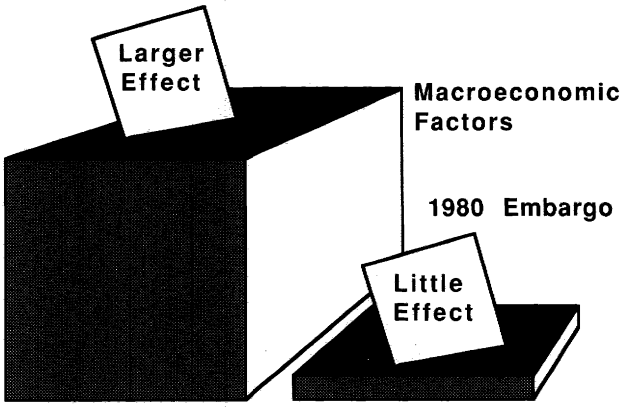
Changes in domestic and international economic conditions had a far greater long-term effect on the costs of Government support for agriculture and the financial health of the farm sector than did the 1980 embargo. Appreciation of the dollar against other major currencies and the reduced rate of world income growth during the early 1980's dramatically lowered U.S. grain and soybean exports. In the unlikely event that macroeconomic conditions existing at the end of the 1970's, such as higher income growth, higher inflation, and lower exchange rates, had continued, U.S. wheat exports would have averaged an estimated 18 percent higher between 1982 and 1984. U.S. soybean exports would have risen 20 percent, and corn exports would have risen 35 percent. As a result, export prices would have increased an estimated 16-20 percent over actual prices. Despite an average reduction in Government payments of $7 billion per year, annual net farm income would have risen by an estimated $1 billion. Effects of export embargoes on the U.S. agricultural economy have been minor compared with effects of changes in the global economic environment.

SURPLUS DISPOSAL

One suggested solution for the U.S. agricultural crisis is the disposal of Government-held stocks into the world market at competitive prices. In other words, subsidize U.S. exports from Government-owned or controlled inventories. Legal authority exists to sell stocks at competitive prices by using either general export subsidies or targeted export subsidies. General subsidies directly or indirectly reduce costs of U.S. exports to all importers. Targeted subsidies reduce costs to one or more selected importers.

The second part of this study, exploring whether using export subsidies during the 1980's could have increased farm income and reduced farm program costs, concludes that such subsidies would not have effectively accomplished these tasks. The study particularly assesses the potential for expanding disposal of stocks acquired or controlled by the CCC as the result of U.S. price support programs. Two major issues are addressed: The CCC's legal authority to increase its stock disposals over the past decade, and the consequences of such a policy. Effects on farm income reported here refer to the effect due to the disposal program only. Since it is a disposal of public stocks overseas, the effect on farm income is not great. The major farm income effect comes from the domestic price support program, not the export surplus disposal program.

Effect on Grain Prices



As in the embargo analysis, a variety of theoretical and empirical models were used to determine the domestic and international implications of U.S. subsidy programs. Estimates of the potential effects of surplus disposal on exports, prices, farm income, and Government program costs were derived. Based on these estimates, qualitative conclusions are drawn about the implications of increased use of U.S. agricultural export subsidies.

CCC Operations and Legislative Authority

The CCC has the primary role of supporting and stabilizing prices of a number of key commodities, including grain and dairy products. The CCC stabilizes and supports

grain prices by making loans to farmers against their crops. When market prices fall below the loan rate plus the interest owed on the loan, farmers can pay their loans off to the CCC with the commodities instead of cash. The CCC also stabilizes and supports dairy prices by purchasing dairy products at announced prices to place a floor under the milk price.

When market prices remain below legislated loan rates for long, the CCC accumulates stocks of wheat, corn, and dairy products. When prices are low, inventories also accumulate in the FOR, a Government program to ensure greater stability of domestic and international supply. Combined CCC and FOR wheat stocks have exceeded a billion bushels several times in recent years. Corn stocks reached 2.5 billion bushels in 1982/83, and are much larger now. At times in the past 15 years, CCC butter purchases have reached 30 percent of production, 10 percent of cheese production, and 50 percent of nonfat dry milk production.

Stocks buffer price swings created by crop failures at home or abroad. But, when market prices remain low relative to support prices, inventories become large. Government inventory costs rise as storage costs rise. Furthermore, excessive Government stocks can overhang the market, depressing farm prices.

The CCC is authorized but not obligated to reduce its commodity stocks with a variety of programs, including domestic and international food aid, emergency relief programs, barter arrangements, and subsidized exports or export credits. The CCC operates many export subsidy programs that fall under two general categories:

- General subsidy payments, in cash or in-kind, on overseas sales to lower the cost to foreign buyers.

- Targeted subsidies in particular markets to offset subsidies offered by other suppliers or to satisfy some other need.

The CCC had the legal authority to implement a more aggressive program of stock disposal, particularly of CCC-owned stocks, during the late 1970's or early 1980's. Congress limited the CCC's ability to dispose of surplus stocks between 1982 and 1984. During those years, Congress removed the CCC's longstanding authority to competitively price inventories in foreign markets. This change did not affect export volume, however, because the authority was not being used at the time of its removal and was not used when reinstated. The CCC had other alternatives (including direct credit, loan guarantees, donations, export subsidies, and payment-in-kind (PIK) export enhancements) that permitted more aggressive use of Government aid for exports.

Options Considered

This study evaluates general and targeted subsidies to dispose of Government stocks of wheat, coarse grains, and dairy products in export markets. The period 1977/78 to 1984/85 was analyzed and, therefore, includes the recent years of substantial accumulation of Government stocks. The following disposal options were considered:

- An across-the-board, uniform export subsidy on all wheat, coarse grains, and dairy products that would lower the costs of U.S. exports to all foreign buyers, increase demand, and eliminate Government stocks.

- A set of targeted subsidies on wheat and coarse grains to increase farm income the largest possible amount using the smallest subsidy cost (hereafter, referred to as the option to maximize farm income).

- A set of targeted subsidies on wheat and coarse grains to dispose of all publicly-held stocks.

We considered four critical factors in analyzing export disposal options: Importer response, competitor response, surplus size, and farm program constraints. Importer response embodies how consumers and producers in importing countries react to lower prices and the extent to which trade policies permit transmission of lower world prices to the domestic market. If a small price decline substantially increases the quantity of U.S. products imported, then a small subsidy would be extremely effective in eliminating U.S. surpluses. However, if a large price decline is needed to increase U.S. exports, then very large subsidies would be required to be very effective. Increased export quantities resulting from subsidies must at least compensate for

reduced prices to make the policy cost-effective for the United States.

This study assumes that grain importing countries are moderately responsive to reduced import prices. This is a middle-ground assumption made by the study group after extensive discussion, since some economists argue that relatively rigid trade policies make these markets highly unresponsive to price changes, particularly in the short run. Others, however, argue that these importers are very responsive to price changes.

The second critical factor in the analysis is the response of competing exporters to U.S. subsidies. Exporters could respond in one of two ways, each with different implications for the United States. First, other exporters could allow their domestic and export prices to fall along with the decline in world prices resulting from the U.S. subsidy. In this case, subsidies would improve the competitive U.S. position and increase U.S. market shares at the expense of other exporters. The extent to which this happens will depend on how much producers in other countries reduce production in response to lower prices. Second, competitors could retaliate with subsidies of their own. If they merely choose to match U.S. subsidies in order to maintain their own export volume, the result would be a smaller expansion in U.S. exports because the United States would not displace shipments from other countries in foreign markets. To the extent that subsidized prices expand world imports, U.S. exports would increase. If, however, competitors retaliate against U.S. subsidies by offering larger subsidies of their own, a trade war could break out. The outcome of such an action is uncertain, but we do know it would be costly. U.S. exports could fall, and market share could be lost.

Our research led us to assume that most competitors would pursue the first option: They would do nothing and allow their exports to decline. However, we assumed that the EC would maintain fixed internal prices and increase its export restitutions (subsidies) throughout the study period in order to allow its export prices to follow the world price decline. We assumed that other competitors would not retaliate by changing their policies.

A third factor is the size of the surplus to be sold relative to the size of the world market. The larger the U.S. volume for disposal on the world market, the larger the subsidies needed to induce importers to purchase the quantity available. This has a number of implications for the disposal options considered. First, the year in which a surplus disposal policy begins can affect the operation and results of the program. A disposal program initiated in a year when surplus stocks are not large could prevent further surplus accumulation. It would avoid the need to dispose of large quantities in a short period of time. Program costs are likely to be lower because the level of subsidy required will be less.

The final factor is the effect of farm program constraints on surplus disposal options. Government stocks are a function of legislated loan rates, release prices, and target prices. Relationship of these prices to the market price determines the size of the surplus and the rate at which it accumulates.

This study assumes that there would have been no PIK program in 1983/84 and 1984/85, but that other elements of U.S. farm programs would have been unchanged. Surplus disposal programs in the mid-1970's would have prevented stock buildup in the early 1980's. PIK, a stock reduction program, would not have been required had there been no stocks. Because stocks held by the CCC and in the FOR are considered public stocks, we analyzed the disposal of both CCC and FOR stocks.

General Export Subsidies

We examined effects of a general subsidy program for grains by evaluating a stock disposal program which did not allow surplus stocks to accumulate. Crop years 1977/78 through 1984/85 were examined. We present results for disposal of CCC stocks alone and for CCC and FOR stocks combined.

We examined effects of a general subsidy program for dairy stocks by considering two alternatives: The disposal program beginning in a year of low surplus stocks and the program beginning in a year of large stocks.

U.S. export subsidies to all markets would have raised U.S. export volume and market shares,

but would have lowered world market prices and made U.S. exports more price competitive. In the short run, increased U.S. export volume would have increased the volume of the commodity moving into world markets. Because the United States is a significant supplier of grains and dairy products, world prices would have declined. As a result, the United States would need to pay a subsidy on all exports, commercial and Government. Without the subsidy payment on all exports, exporting companies would be unable to profitably acquire grain for export at the loan rate and compete with subsidized U.S. Government grain exports.

The general subsidy needed to eliminate all CCC wheat stocks over 1977/78 to 1984/85 would, in effect, cut world prices from $0-$38 per ton each year, an average of almost $10 per ton (table 1.4). The subsidy needed for corn would have ranged from $0-$22 per ton, an average of $6.30 per ton. The average annual cost of the subsidy program would have been $418 million for wheat and $376 million for corn. Note that 1977/78 was a year in which public stocks were low relative to recent years. Therefore, cost estimates are lower than if the program began in a year with high stocks.

Average subsidy costs per ton of exports in a disposal program is important in judging effectiveness of that program. Even more important to subsidy decisions is the mounting subsidy cost of each additional ton exported. A disposal program shipping 3.56 million tons of additional wheat per year from CCC surplus stocks would have cost an average of $160 per ton annually (table 1.4). Additional corn exports of 7.61 million tons would have cost $49 per ton. At a 1977-84 average price of $124 per ton, wheat surpluses cost more to subsidize for export than they are worth. It would have been cheaper to give the surplus away or destroy it.

If both CCC and FOR stocks were included in the program, the average subsidy required would have increased to $17 per ton for wheat and $11 per ton for corn (table 1.4). When we assume that importers are more responsive to

Table 1.4--Average annual exports, subsidies, and net subsidy costs for the 1977/78-1984/85 crop years for the disposal of CCC and combined CCC and FOR stocks

Item	Units	Response of importers to lower prices: Medium response: CCC stocks only	Medium response: CCC and FOR stocks 1/	High response: CCC stocks only	High response: CCC and FOR stocks 1/
Wheat:					
Increase in exports	*Mil. tons*	3.56	5.99	3.66	6.02
Total exports	*do.*	42.14	44.57	42.24	44.60
Subsidy rate	*Dol./ton*	9.92	16.53	5.88	10.66
Net subsidy cost 2/	*Mil. dol.*	571.00	715.00	365.00	405.00
Cost per additional ton of exports	*Dol./ton*	160.30	119.36	99.70	67.35
Percent of annual price ($124.52)	*Percent*	129	97	80	54
Corn:					
Increase in exports	*Mil. tons*	7.61	10.06	7.77	10.03
Total exports	*do.*	59.71	62.16	59.87	62.13
Subsidy rate	*Dol./ton*	6.30	10.63	4.72	8.66
Net subsidy cost 2/	*Mil. dol.*	371.00	554.00	278.00	414.00
Cost per additional ton of exports	*Dol./ton*	48.76	55.03	35.81	41.27
Percent of annual price ($103.19)	*Percent*	47	53	35	40

1/ This case is not currently feasible since, under current law, farmers retain marketing rights for their FOR stocks.
2/ Gross subsidy costs net of storage costs and sales losses of the CCC if the sales price is less than the loan rate, adjusted for the value of inventories at the end of the period. Costs do not take into account any savings due to the elimination of the PIK program.

lower export prices, the subsidy required to dispose of CCC stocks would have been smaller, averaging $5.90 per ton for wheat and $4.70 for corn.

Assuming importers are only moderately responsive to price changes, we found that CCC stock disposal would have increased the export volume of wheat and corn approximately 9 and 15 percent compared with the export volume without the subsidy. The disposal would have reduced CCC stocks to zero, lowering total U.S. stocks 10 percent for wheat and 15 percent for corn. CCC stock disposal would have increased the U.S. share of the world wheat market 2.4 percent and the U.S. share of the world corn market 3 percent. Disposal of both CCC and FOR stocks would have increased U.S. wheat exports 15 percent and corn exports 20 percent. Wheat stocks would have fallen 50 percent, and corn stocks would have fallen 52 percent. U.S. share of the world wheat and corn markets would have increased 4 percent.

CCC stock disposal under the moderate price response assumption would have reduced the annual average value of U.S. wheat exports over the 8-year period $44 million, but increased the value of corn exports $341 million. The net effect of the changes would have been an increase in annual average export earnings of $297 million. World wheat demand is only moderately responsive to a fall in price. In many countries, policy measures such as import quotas restrict trade and block the fall in world prices from consumers. As a result, a general subsidy program would probably lead to a greater decline in wheat export prices than an increase in export volume. Only if importers are highly responsive to price change would the value of U.S. wheat exports increase. Because world corn demand is more price responsive, both the volume and value of U.S. exports would increase with a general subsidy program.

A general export subsidy program would have reduced Government-owned stocks. But the program would not have significantly raised producer incomes because the assumed reduction in Government stocks through surplus disposal was simulated in such a way as to not significantly affect farm prices. Domestic market prices would have remained close to actual levels over the 8-year period, but export prices would have been lower and more volatile under the subsidy program. Loss of payments from the PIK program would have lowered net farm income $3.5 billion over the period with the alternative disposal program in effect.

Additional net cost to the Government of disposing of all CCC stocks, after including savings from reduced storage costs, would have averaged $571 million per year for wheat and $371 million for corn. If FOR stocks were included, average cost to the Government would have increased to $715 million for wheat and $554 million for corn. Expenditures would have been as high as $2.9 billion for wheat and $2 billion for corn in some years.

The nature of the world dairy market severely limits the extent to which export subsidies could be used for dairy products. Unlike wheat and coarse grains, only a small proportion of dairy production enters world trade. The number of regular importing regions is small, and many countries have highly restrictive dairy-import policies, such as high price supports and nontariff trade barriers. In this market, the irregular disposal of surplus stocks presents particular problems. Disposing of surplus dairy stocks on the export market at whatever price they would bring would be more costly than accumulating stocks when world prices are low and expanding exports when prices are high.

A dairy surplus disposal program was evaluated for two periods: One beginning in 1974, a year of low surplus stocks, and one beginning in 1980, a year of high stocks. Table 1.5 compares annual average exports and budget outlays for 1980/81 to 1984/85 for the actual program and the two disposal alternatives. Dairy disposals increased under both simulated programs. Disposal of all dairy products in the 1974 program increased 123,000 tons, nearly 20 percent over the combined domestic and export disposals of the actual dairy program. Disposals in the 1980 program increased 234 million tons, or 33 percent. These programs cost more than the actual program, however. The 1974 program cost 9 percent more than the actual program, and the 1980 program cost 19 percent more. Only if Government stocks were valued at zero

would disposal be cheaper than the existing program.

We probably underestimated costs of the two alternatives, particularly for the program started in the high stock year of 1980. For nonfat dry milk disposals in 1980, the United States needed to expand its share of the world market, excluding intra-EC trade, from 31 percent to 84 percent to dispose of the accumulated surplus. The United States probably could not have found buyers for this great an increase in export quantities without substantially lowering prices below those used in the computation of subsidy costs. Program costs could be reduced if surplus disposal is managed so that stocks are released if market conditions are favorable, not necessarily in the year stocks are accumulated.

Retaliation by other exporters probably would increase U.S. costs of a general export subsidy program and reduce its effectiveness. Figures given above are low estimates because they assume that competing suppliers do not retaliate to maintain their market shares and because the surplus disposal program began in a year of low surplus stocks. Competitors would be likely to respond to a more aggressive U.S. export policy. Competitive subsidization would reduce the gain in U.S. market shares and reduce effectiveness of a general export subsidy in disposing of surplus U.S. stocks. Similarly, disposal of surpluses would be considerably more expensive if the program were initiated in a year after there had been substantial stocks accumulation.

Targeted Export Subsidies

Targeted subsidies to increase U.S. export volume likely cost less than general subsidies because a targeted approach captures the more price-responsive importers. Consumer demand in some countries is more sensitive to price changes. In other countries, government policies reduce import responsiveness to price changes. Markets also differ in the amount of U.S. competition from other exporters. Orienting the subsidy program toward those markets more responsive to price changes increases U.S. export volume more per dollar of subsidy than does a general subsidy.

A targeted export subsidy program can be used for different objectives. By exploiting differences in price responsiveness of importers, targeted export subsidies can increase U.S. exports to price-responsive countries. Such subsidies can also force the United States to subsidize its exports in other markets to defend its market shares. If the United States subsidized wheat sales to Egypt, for example, Egypt would buy more wheat from the United States and less wheat from other countries. Other exporters would be forced to find other markets for their wheat. Export supplies available to these markets would rise and prices would fall. The United States consequently would be forced to subsidize sales to importers in the rest of the world to protect its market shares from the displaced grain of other exporters.

Table 1.5--Average annual disposal and budget cost of actual and simulated dairy disposal alternatives, 1980/81-1984/85

Commodity	Disposal programs					
	Actual		Initiated in 1974		Initiated in 1980	
	Disposal 1/	Budget cost	Disposal	Budget cost	Disposal	Budget cost
	1,000 tons	*Mil. dol.*	*1,000 tons*	*Mil. dol.*	*1,000 tons*	*Mil. dol.*
Butter	138	266	137	275	165	315
Cheese	236	545	292	595	312	616
Nonfat dry milk	287	362	355	410	418	464
Total	661	1,173	784	1,280	895	1,395

1/ Includes domestic as well as export disposals.
Note: Budget outlays are in 1977 dollars and assume inventories are valued at the world price and surplus disposal occurs at the price the residual importer is willing to pay.
Source: Computed from appendix tables, Chapter 22.

Two targeted subsidy cases were examined: One to dispose of all publicly held stocks and another to maximize farm income, or gross sales, minus subsidy cost whether stocks are depleted or not. These alternatives were analyzed using a reference year of 1980 and were compared with a global, uniform subsidy (table 1.6).

The amount of a targeted subsidy varies by destination. For wheat, subsidies to maximize U.S. producer incomes are not very effective because the demand for wheat is relatively unresponsive to price. Therefore, wheat subsidies are small because using large subsidies, even when they are targeted to particular markets, barely increases imports. In 1980, subsidies of $8.70 per ton would be needed for shipments to centrally planned countries, where our analysis shows demand was the most responsive and markets were shared with competitors. The largest subsidies to major importers were given to North Africa and the Middle East, $13.60 per ton, because these markets were price sensitive and shared with the EC. Virtually every purchaser would receive some subsidy, but these would be small on average. Because of the higher demand responsiveness, export subsidies needed for coarse grains would exceed $50 per ton, considerably larger than for wheat. The most price-responsive markets, where a shortage of foreign exchange limits imports or where the United States faces stiff competition, would receive subsidies of as much as $70 per ton.

A targeted subsidy program to maximize income of U.S. grain producers would increase wheat exports 1 million tons, from 36 to 37 million tons, in 1980, and coarse grain exports 20 million tons, from 64 to 84 million tons. The larger increase in coarse grain exports reflects the greater price responsiveness of the coarse grain market. Most increased wheat and coarse grain exports would go to developing countries.

The targeted subsidies required to eliminate all public stocks would be large for wheat, considerably larger than those needed to maximize income of U.S. grain producers. The amount of stocks available for disposal exceeds the export volume that would maximize farm incomes. Disposal of the additional quantity would require large subsidies. The smallest subsidy required to eliminate Government wheat stocks in 1980 would be $59 per ton, and the largest subsidy would be $79 per ton. In the coarse grain market, the subsidies required to eliminate Government stocks would

Table 1.6--Subsidy rate and cost comparisons using higher elasticity and spatial equilibrium price discrimination model, 1980/81

Item	Unit	Global subsidy	Targeted subsidy for income	Targeted subsidy for disposal
Wheat:				
Increase in exports	*Mil. tons*	12.10	0.87	13.00
Total exports	*Mil. tons*	48.00	36.77	48.90
Subsidy rate	*Dol./ton*	59.22	1/5.17	2/63.40
Total subsidy cost	*Mil. dol.*	2,840.00	190.00	3,100.00
Cost per additional ton of exports	*Dol./ton*	234.71	218.39	238.46
Corn:				
Increase in exports	*Mil. tons*	19.96	21.23	25.80
Total exports	*Mil. tons*	83.50	84.77	89.34
Subsidy rate	*Dol./ton*	32.55	3/52.85	4/44.10
Total subsidy cost	*Mil. dol.*	2,720.00	4,480.00	3,940.00
Cost per additional ton of exports	*Dol./ton*	136.27	211.02	152.71

1/ Average subsidy, with a range of $0-$49.61.
2/ Average subsidy, with a range of $0-$79.38.
3/ Average subsidy, with a range of $0-$71.50.
4/ Average subsidy, with a range of $0-$78.85.

range from $35-$79 per ton. Cost per additional ton of exports would be $238 for wheat and $152 for corn.

If the objective is to eliminate public stocks, U.S. wheat exports would increase 13 million tons, from 36 to 49 million tons, in 1980, while coarse grain exports would increase 25 million tons, from 64 to 89 million tons. The disposal program would allow the United States access to wheat markets in the developing countries and coarse grain markets in the Middle East. Coarse grain exports also would expand to Western Europe and other developed countries. In terms of reduced wheat stocks, this program would be more effective than the income-maximizing alternative. But the increase in coarse grain exports of the disposal scenario would be only slightly greater than the income-maximizing scenario because of the more price-sensitive behavior of importers and competitors.

Targeted export subsidies would increase U.S. export earnings from wheat and coarse grains. If targeted subsidies were used to maximize income of grain producers, export earnings for wheat would rise $200 million, from $6.2 billion to $6.4 billion. Coarse grain earnings would rise from $8 billion to almost $9 billion. If subsidies were used to eliminate public stocks, export earnings for wheat and corn would increase $8.5 billion for wheat and $10.8 billion for coarse grains because exports would be larger.

Stock disposal under a targeted subsidy program would increase farm prices and producer income. A policy to maximize producer income would increase producer receipts for wheat and coarse grains almost $7 billion in 1980. However, if targeted subsidies were used to dispose of all Government stocks, income would increase much less, just over $2 billion. Increased grain prices from a targeted disposal would reduce income of livestock producers, and the net effect on farm income, therefore, would be lower than these figures suggest.

Export subsidies would involve substantial Government expenditures. Thus, export subsidies are an expensive way to reduce surpluses. In 1980, the subsidies to maximize producer income would require Government expenditures of roughly $4.7 billion. If the stock disposal objective were pursued, the expenditures in 1980 would total $7 billion. Only when a set of income-maximizing subsidies is used would the increase in producer income exceed the surplus disposal cost to the Government.

Summary of Export Subsidies

Although some types of export subsidy schemes to reduce Government grain stocks might increase producer incomes, all options examined involve substantial Government costs. Estimates of Government expenditures given above likely underestimate substantially the costs, particularly under current conditions, where surplus stocks are large.

The cost of export subsidies is likely to be higher than estimated because other exporters would probably retaliate against U.S. export subsidies. Results presented above assumed that other exporters would match the decline in world prices caused by U.S. subsidies and allow the United States to increase its market shares. Most other major exporters would not react passively to U.S. subsidy programs, according to our interviews with key individuals in other countries. Competitors are likely to use countersubsidies to protect their market shares, particularly the EC which is unlikely to allow the United States to gain market share at its expense. The EC probably would retaliate against U.S. subsidies, particularly if these were targeted to EC export markets. Retaliation by other countries, such as Australia and Canada, is also possible. At the very least, competing exporters would be slow to reduce their exports in response to lower world prices created by subsidized U.S. exports. If competitors' exports did not fall, cost of disposing of U.S. surplus stocks would increase.

Although the results suggest that income gains for U.S. grain producers might exceed the cost of targeted subsidies, implementing a program that would achieve this result would be extremely difficult. Only with a complex set of subsidies to maximize returns to U.S. grain farmers would producer income gains exceed Government costs. Such a set of subsidies requires substantial information about likely responses of importers and U.S. competitors to

alternative subsidies. It also requires that these subsidies be carefully chosen and applied in a timely manner. This analysis assumed that such information was available and that implementing an appropriate set of subsidies was possible. In reality, this would be an extremely difficult task.

A further factor is that the size of the stock disposal problem is currently greater than that considered in the period considered above. The United States has extremely large grain inventories and faces a worldwide climate of surplus and increased productive capacity. In this climate, the cost of surplus disposal would probably be much greater than that suggested by the above figures. As of May 1985, CCC and FOR wheat stocks amounted to 28.1 million tons, or 72 percent of last year's exports. Corn stocks in September 1985 stood at 15.5 million tons, or roughly 33 percent of exports. In recent years, world grain trade has stagnated. Disposing of this stock volume in the current international market environment would be difficult and expensive.

MACROECONOMIC EFFECTS

A major cause of the deterioration in the export market for U.S. grains and in the accumulation of surplus stocks has been the unfavorable macroeconomic environment: Rising U.S. dollar, global recession, and high real interest rates. U.S. grain export subsidies to dispose of surpluses would not have been considered if national and global economic conditions had not worsened in the early 1980's. If economic growth rates of the 1970's had continued into the 1980's and the dollar had not appreciated substantially, surplus stock accumulation would have been much more modest. In 1980-84, FOR corn stocks would have been eliminated in an estimated 3 out of 5 years, and CCC stocks would have been zero in the last 2 years. Although more favorable economic conditions would not have had the same effect on wheat stocks, exports and export prices would have been substantially higher. As a result, the need for export subsidies likely would have been reduced substantially. Changes in the world and national economies have significantly affected the income position of U.S. agriculture and have been major factors in the buildup of surpluses and program costs.

PART I

THE ECONOMIC SETTING AND ANALYTICAL CHALLENGE

We have witnessed a sharp reversal in the fortunes of U.S. agriculture since the beginning of this decade. The export-driven prosperity of the 1970's has given way to widespread farm bankruptcy and financial distress as exports declined and commodity prices fell. This reversal roughly coincides with a series of events and changes in key economic variables, all which occurred in the same period. We focus on one potential cause of the current distress: The effect of export embargoes. We also examine one of a wide range of possible policy alternatives which could have been pursued to prevent or ameliorate the distress of the farm sector: The disposal on export markets of surplus Commodity Credit Corporation (CCC) and farmer-owned reserve (FOR) stocks.

Neither the actual effects of the four embargoes considered nor the potential impacts of alternative surplus disposal options can be analyzed without understanding the context in which agricultural policy and trade evolved over the past 15 years. Hence, before proceeding to the analysis of embargo effects in Part II and surplus disposal effects in Part III, it is essential to lay the policy, trade, and macroeconomic groundwork upon which we base our later discussion.

There are five chapters in Part I. Chapter 2 sets forth the study mandate and how we interpreted it. We then translate the mandate into a set of objectives and define the commodity and time period scope of the analysis. In the last part of the chapter, we explain our overall approach to the study and lay out alternatives to readers interested in reading only particular parts of the study.

The next three chapters discuss the agricultural policy framework, the market environment, and the macroeconomic context within which our evaluation of embargoes and surplus disposal alternatives take place. Chapter 3 chronicles the continuing transformation of the farm sector into an industry where fewer, specialized, larger farms use increasing quantities of purchased inputs to produce rising levels of output. This change has made U.S. agriculture increasingly dependent on the nonfarm sector for both inputs (dominantly petroleum based) and credit. Slowly growing domestic demand meant that the higher levels of output found their outlet in explosive international markets in the 1970's and in growing stocks in the 1980's. These growing dependencies on the nonfarm sector and international markets made policy a dominant factor in the 1980's.

The international goods markets changed significantly in the 1970's and 1980's. The overall volume of trade increased more rapidly than did increases in national output. International trade in agricultural commodities increased rapidly as developing countries and centrally planned economies became much more important import markets. Given the pervasive degree of intervention in the agriculture and food sector of most countries, policies greatly influence international markets. All of these factors tend to make international commodity markets relatively insensitive to price changes. However, world trade in grains and oilseeds is highly organized and influenced by merchants who respond rapidly to changing conditions. Chapter 4 details these developments.

The 1970's also saw phenomenal change in international capital and currency markets. The move to floating exchange rates and development of a large integrated international capital market increased macroeconomic interdependence. Therefore, oil price shocks and changes in domestic monetary policies caused exchange rate volatility and allowed the international transmission of inflation and recession. Effects of these factors on U.S. agriculture was heightened by the increasing dependence of the farm sector on the nonfarm economy and on international markets. These subjects are the focus of Chapter 5.

Chapter 6 lays out the nature of the challenge of analyzing export embargoes and export subsidies. The prevalence of domestic policy intervention and the importance of large traders in world commodity markets complicate the challenge. Another complication is that one of the policy changes studied actually happened while the other did not. We use different analytical approaches in each case.

CHAPTER 2

STUDY MANDATE, OBJECTIVES, SCOPE, AND APPROACH

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CHAPTER 2

STUDY MANDATE, OBJECTIVES, SCOPE, AND APPROACH*

Congress mandated a comprehensive, multifaceted analysis of export embargoes and subsidies in the summer of 1985. The mandate directed the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) to complete the study by the end of fiscal year 1986. This volume reports the results of that study. ERS enlisted the help of the International Agricultural Trade Research Consortium (IATRC). A steering committee of members of ERS' International Economics Division (IED) and National Economics Division (NED) and IATRC jointly planned, coordinated, and conducted the study, and reported its results.

This chapter presents the mandate, the study team's interpretation of its meaning, the objectives of the study, an outline of the overall approach, and an overview of the contents of the study report, which follow in Chapters 3 through 24.

CONGRESSIONAL MANDATE

The 1985 Supplemental Appropriations Bill directed ERS to conduct:

> ... a study to determine the losses suffered by U.S. farm producers during the last decade as a result of embargoes and the failure to offer for sale on world markets commodities surplus to domestic needs at competitive prices.

The study was expected to be comprehensive, quantitative, and definitive. Notwithstanding previous unpublished studies on similar questions, the study was to address the twin issues of embargoes and competitive pricing (export subsidies) by using all available expertise and analytical tools.

We focused our efforts by explicitly interpreting the general mandate. This interpretation was relatively straightforward for embargoes. Embargoes of the last decade clearly included the 1980 Soviet embargo and the 1975 sales suspension to the USSR and Poland. Given that the 1975 sales suspension was related to the 1974 Soviet suspension and to the 1973 general embargo of oilseeds and oilseed products (all were implemented because of domestic shortfalls and inflationary concerns), we analyzed the four embargoes since 1973. However, there was confusion in use of terminology. Diplomatic officials would argue that the 1975 action was a "moratorium" and the 1980 action was a "sales suspension." From an economic point of view, they are the same. An export embargo is any unilateral action by an exporting country to restrict all or some of its exports to one or more destinations.

The terms "surplus to domestic needs" and "competitive prices" required more interpretation. "Surplus to domestic needs" could have various meanings. It could mean all commodities produced but not consumed domestically. But, such a definition ignores privately held working stocks and commercial exports, both of which would rise in the absence of any government policy. Thus, we interpreted "surplus to domestic needs" to be those quantities above domestic consumption, private stocks, and commercial exports.

A further complication was our interpretation of the mandate to require analysis over at least a decade. Thus, the question arose: If the United States, through the Commodity Credit Corporation (CCC), had pursued a competitive pricing policy moving all surpluses into international markets, would policies have been different? This question relates to the payment-in-kind program (PIK) in 1983. We assumed that, without public stocks, PIK would not have been needed, and we conducted our export subsidy scenario without PIK. The question also relates to the farmer-owned reserve (FOR). An export-expansion policy might have reduced the incentive for the FOR. We chose two scenarios for much of our analysis: (1) CCC stocks disposed of abroad, and (2) CCC and FOR

*The principal contributor to this chapter was Alex McCalla.

stocks disposed of abroad. One could argue that an aggressive export policy could be a substitute for domestic supply management. Given that such a change would alter fundamentally the fabric of longstanding U.S. domestic policy, we assumed in our analysis that domestic policies other than CCC stocks, PIK, and FOR were in place.

Interpreting "competitive prices" was more difficult. Under various authorizations, the CCC had a wide variety of policy instruments available to it for surplus disposal (see Chapter 17 for a complete listing). Careful examination of these options, however, revealed that most (even Public Law 480, Title II, could be interpreted as a total price subsidy) fell into two economic categories: (1) General subsidies that reduced the economic cost of U.S. exports to all importers directly or indirectly, and (2) targeted subsidies that selectively reduced the economic costs to one or some importers. Thus, we interpreted "competitive prices" to mean that Congress wanted analysis of the implicit and explicit export subsidies, both general and targeted, needed to dispose of supplies that exceed domestic consumption, commercial stocks, and commercial exports.

STUDY OBJECTIVES

The study's objectives were as follows:

- To present analysis and background material for the period 1970-84 of the changing structure of U.S. agriculture and world grain and oilseed markets, the policy evolution of U.S. agriculture, the changing policies of major exporters and importers, and the operation of world commodity markets, especially grain and oilseed markets.

- To define a comprehensive, analytical approach for the study.

- To determine the impacts of export embargoes since 1970 on U.S. agriculture, including onfarm prices, farm income, and program costs, by describing the nature and extent of U.S. export embargoes, and by determining their impact on the following:

  - World markets (including such factors as world prices, trade volume, trade flows, and U.S. exports and export prices) and the behavior of other countries, and

  - The well-being of the U.S. agricultural sector.

- To determine the implications for U.S. agriculture of using export subsidies to dispose of commodities surplus to commercial needs, by taking the following steps:

  - Describing the history of surplus disposal,

  - Identifying the range of policy options open to the CCC,

  - Deducing the expected results of general and targeted subsidies using theory and previous empirical analysis, and

  - Determining what excess supplies would have been available over the period, the level of export subsidy necessary, and the impacts of surplus disposal on world market prices and U.S. farm prices, farm incomes, exports, and program costs.

- To simulate an alternative scenario about external conditions of the 1980's, such as exchange rates, interest rates, and economic growth, and to determine the impacts on U.S. agriculture so that the effects of embargoes and subsidies can be put in perspective with other major forces affecting agricultural trade.

SCOPE OF THE STUDY

Three dimensions of the study needed careful delineation before the analysis could proceed: The events to be evaluated (embargoes), the time period to be analyzed, and the commodities to be covered.

Events

We analyzed the following:

- The general embargo on oilseeds and oilseed products in 1973,

- The moratorium on wheat and feed grain sales to the USSR in 1974,

- The moratoria on grain sales to the USSR and Poland in 1975, and

- The embargo of all agricultural exports (not covered by the U.S.-USSR long-term agreement) to the USSR imposed on January 4, 1980.

We gave relatively greater attention to the 1973 and 1980 embargoes because they represented two different forms of embargoes: General to all importers and targeted against one. Even greater emphasis was given to the 1980 embargo because of its long duration and the resulting domestic policy adjustments.

Time Period

The time period analyzed was 1970 to 1983, 1984, or 1985, depending on the data available. We selected this period for three major reasons:

- It captured the period of rapid increases in U.S. exports and bracketed the period of international market instability from 1972 to 1980,
- It included all four embargoes of interest, and
- It was sufficiently long to allow a detailed dynamic analysis of alternative surplus disposal export policies.

However, we emphasized the 1974-84 period, particularly the period after 1980, because those were the years of large stock accumulation.

Commodity Coverage

The nature of the embargoes under study required the analysis of wheat, feed grains, and oilseeds because these commodities are the largest components of U.S. production, exports, and stocks and because they are the ones for which existing analytical frameworks (models) were available. These commodities received attention in all the forms of analysis conducted. The export stock disposal analysis included, in addition to these, a special analysis of disposal of surplus dairy products because of the large accumulation of dairy stocks in the 1980's. We selectively included additional commodities in the descriptive statistical analysis of the 1980 Soviet embargo where adjustments in import patterns included livestock product imports and in the analysis of domestic impacts where the use of national econometric models allowed exploration of the effects on the U.S. livestock sector in particular.

OVERALL APPROACH TO THE STUDY

The time available (6 months) for analyzing the two scenarios, the diversity and complexity of the issues to be analyzed, and the fact that one part of the analysis (embargoes) was of actual events and the other (export subsidies) of events that did not occur dictated a diverse, pragmatic approach. We decided very early that attempting to construct a coherent empirical analytical framework (a new model) was inappropriate for two reasons:

- Time did not allow the traditional approach of long-term economic research of conceptualizing, constructing, estimating, and simulating a new analytical framework, and
- A single approach probably would not provide useful answers to all questions.

Therefore, we used a wide range of existing analytical techniques and econometric frameworks and drew on the best talent available from across the country and in ERS to pursue a multifaceted attack on each problem. The first crucial step was to fully describe and understand the complexity of the environment in which the two policy actions would have or did occur.

Increased interdependence of U.S. agriculture with the general economy and of the United States with the rest of the world meant that specific policy changes in the agricultural sector had to be analyzed in this broader context. Further, domestic policies in a relatively few large trading countries heavily influence international markets for agricultural commodities and capital. Thus, we needed a comprehensive overview of the environment in which the events occurred, and we needed to develop a broad conceptual framework within which to approach our problems. These form the first part of the study.

In both parts of the study, we began by asking: What does economic theory tell us about what the expected results of embargoes or subsidies ought to be? What does previous analysis of like events suggest about what should have happened? Beyond these two general questions,

the different nature of the two problems dictated somewhat independent approaches. The embargoes happened. Therefore, all of our statistical data included the impact of the embargoes. The basic question is what would have happened without them. To answer this question, we could do two things. First, we could look at what actually happened: Qualitatively by determining what polices changed, descriptively by comparing data from before the embargo to data during and after, and statistically by projecting previous trade flows through the embargo period as a counterfactual case. Second, we could econometrically simulate no-embargo scenarios to develop statistics to compare with what actually happened. We did both. The objective was to determine if these various approaches yielded similar results with respect to impacts on U.S. exports. The results of these approaches could then be used to evaluate impacts on U.S. agriculture.

The analysis of export subsidies required us to determine what would have happened by generating hypothetical data to compare with actual data that reflect the absence of subsidies. Therefore, qualitative country response analyses, descriptive statistics, and statistical projections were not possible. We relied more heavily on trying to determine other countries' reactions and then including these reactions in econometric models to simulate impacts on world markets, U.S. exports, U.S. agriculture, and program costs.

The final piece of analysis was not expressly requested but seemed to be crucially important to understanding the relative importance of export embargoes and potential importance of surplus disposal for the well-being of U.S. agriculture in the 1980's. U.S. agriculture had clearly suffered significant economic distress in the early 1980's, possibly caused by embargoes and the failure to be competitive in international markets. But as we proceeded with our analysis, it became increasingly clear that changes in other factors were also important. Principal among these were radical changes in the domestic and international macroeconomic environment. Thus, we simulated what would have happened to U.S. agriculture if the macroeconomic conditions of the late 1970's had prevailed through the early 1980's. Results suggest that macroeconomic conditions significantly affect the well-being of U.S. agriculture. We do not claim that the scenario could have occurred or that we have fully exhausted the approaches to the question. The scenario is simply a plausible additional explanation of the events of the 1980's.

While this discussion has been presented as a logical linear sequence of events from beginning to end, the actual analysis proceeded simultaneously on all fronts. This report is a reintegration of the analysis into what we hope is a coherent, comprehensive, and defensible analysis.

ALTERNATIVE MENUS FOR READERS

The report is written in a form that presupposes some basic knowledge of economic principles. However, parts of the report require additional knowledge of technical economics and econometrics. Very technical descriptions of the models used are generally in appendices to the relevant chapters. Recognizing that some readers will be interested in both the methodology and results, we included both.

We suggest that readers familiar with general trends in U.S. agriculture, U.S. agricultural policy, and world agricultural trade quickly review Chapter 5 (macroeconomics) and carefully read Chapter 6. For embargo results, read Chapters 7, 9, 10, the results sections of Chapters 11, 12, 13, and 15, and all of Chapter 16. For information on subsidies, read in addition to Chapter 6, Chapter 17, the results sections of Chapters 19, 20, 21, and 22, and all of Chapter 23. We recommend the results of the macroeconomic analysis in Chapter 24 for all readers.

CHAPTER 3

THE EVOLUTION OF U.S. AGRICULTURE AND U.S. AGRICULTURAL POLICY

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CHAPTER 3

THE EVOLUTION OF U.S. AGRICULTURE AND U.S. AGRICULTURAL POLICY*

Agricultural policy has played a major role in the growth and development of the U.S. agricultural sector since the 1930's. U.S. agricultural trade policies and practices are inextricably linked to domestic farm policy. Hence, to fully understand the effect embargoes have had on the sector or to investigate the feasibility of export disposal of surplus stocks, we need to understand the goals and mechanics of U.S. agricultural policy and the evolution of forces affecting the formulation and effectiveness of that policy.

The fundamental objectives of U.S. agricultural policy have remained largely unchanged since the end of World War II, while the agricultural sector has changed tremendously. In particular, agriculture has become increasingly dependent on export markets in the past two decades and increasingly interdependent with both international economies and the rest of the U.S. economy. These changes have transformed the environment in which farm policy operates and have eroded its ability to determine farm sector welfare. This chapter describes the broad framework of American farm policy and discusses its role in the context of the events of the past 15 years.

THE CHANGING STRUCTURE OF U.S. AGRICULTURE

Major changes in the structure of U.S. agriculture over the past 50 years have greatly altered the way production and marketing are carried out and have altered the role of farm policy. These changes occurred in both the organization of production on farms and in the structure and composition of the agricultural sector.

Changes in the Organization of Production

Massive outflow of labor is probably the most dramatic change in the organization of farm production over the past 50 years. The farm population fell by more than two-thirds between 1940 and 1972 (from 30.5 million to 9.6 million people) as growth of higher paying employment opportunities in the industrial and service sectors drew large numbers of people out of agriculture. Consequently, farm numbers fell. Average farm size grew from 175 acres in 1940 to 374 acres in 1970 to 437 acres in 1984 (table 3.1).

Productivity per acre grew as a result of the adoption of advancing technology. Total output rose by almost 150 percent between 1930 and 1980, while total inputs increased by only 7 percent (fig. 3.1). The adoption of new technologies radically changed the input mix of agricultural production in the United States. Expenditures on mechanical power and real estate have remained roughly constant in real terms while labor expenditures have declined (fig. 3.2). Expenditures on chemicals, however, rose sharply, from about $25 billion to over $90 billion (in 1977 dollars) between 1960 and 1980. However, chemical input expenditures have declined in the last 4 years due to farm sector financial problems.

Table 3.1--Farm numbers and sizes

Year	Number of farms 1/	Land in farms	Average size of farms
	Thousands	*Million acres*	*Acres*
1930	6,295	990	157
1935	6,812	1,054	155
1940	6,102	1,065	175
1950	5,648	1,202	213
1960	3,963	1,176	297
1970	2,949	1,102	374
1980	2,433	1,039	427
1981	2,434	1,034	425
1982	2,401	1,028	428
1983	2,370	1,024	432
1984	2,333	1,020	437

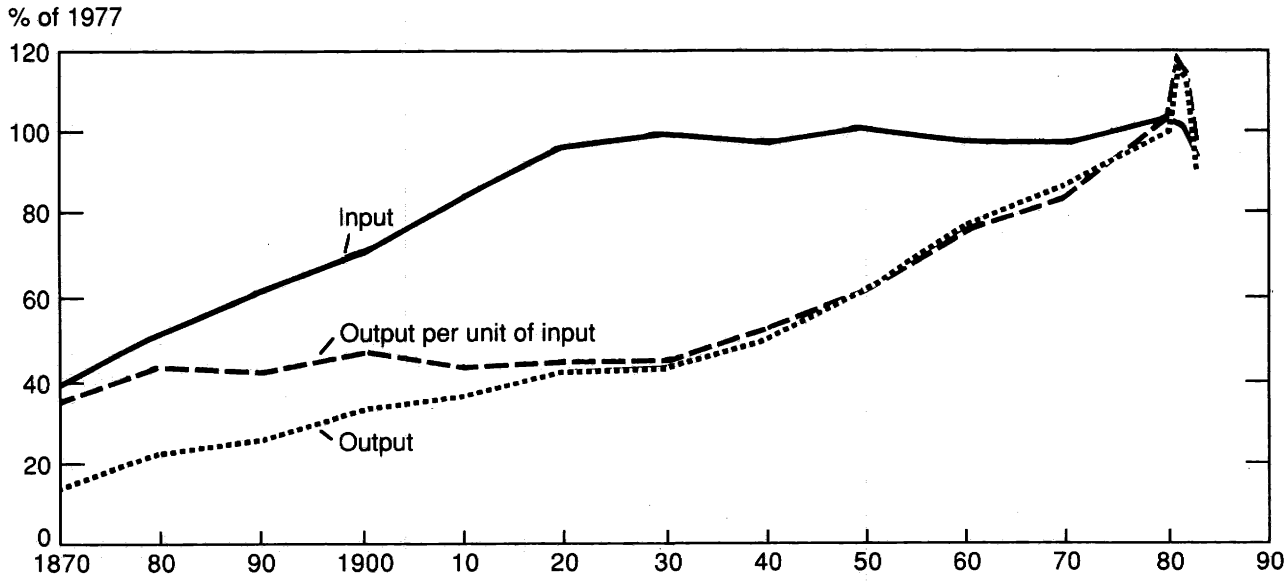
1/ The definition of a farm changed in 1959 and 1974.

Source: USDA.

*The principal contributor to this chapter was Alan Webb.

Figure 3.1

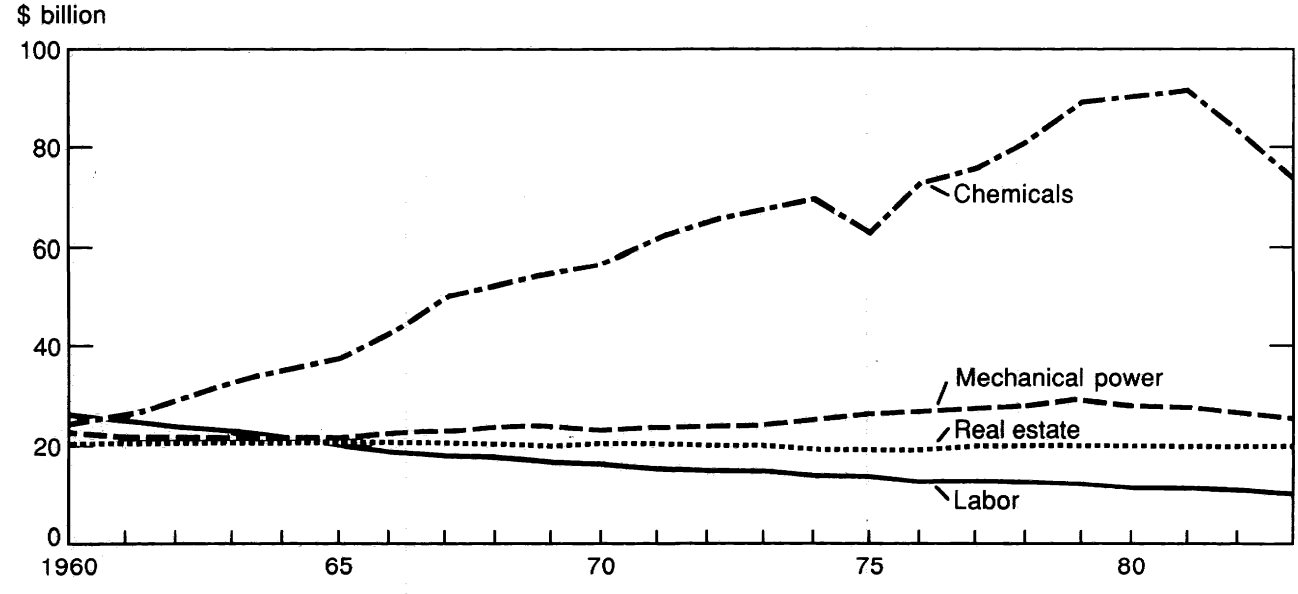
Farm Productivity



1983 preliminary. Source: *(2)*.

Figure 3.2

Changing Mix of Inputs Used in Farm Production



1977 dollars. Source: *(2)*.

Changes in production practices brought about by technological changes increased production expenses as a proportion of gross farm income. In the 1940's, roughly 50 percent of gross farm income was allocated for expenses on purchased livestock feed, seed, fertilizers, depreciation, hired labor, repairs, taxes, interest on farm mortgage debt, and rent to landlords. In the 1970's, farmers spent nearly 70 percent of their gross income on these items. This means that factors affecting costs of these inputs greatly affect net farm incomes.

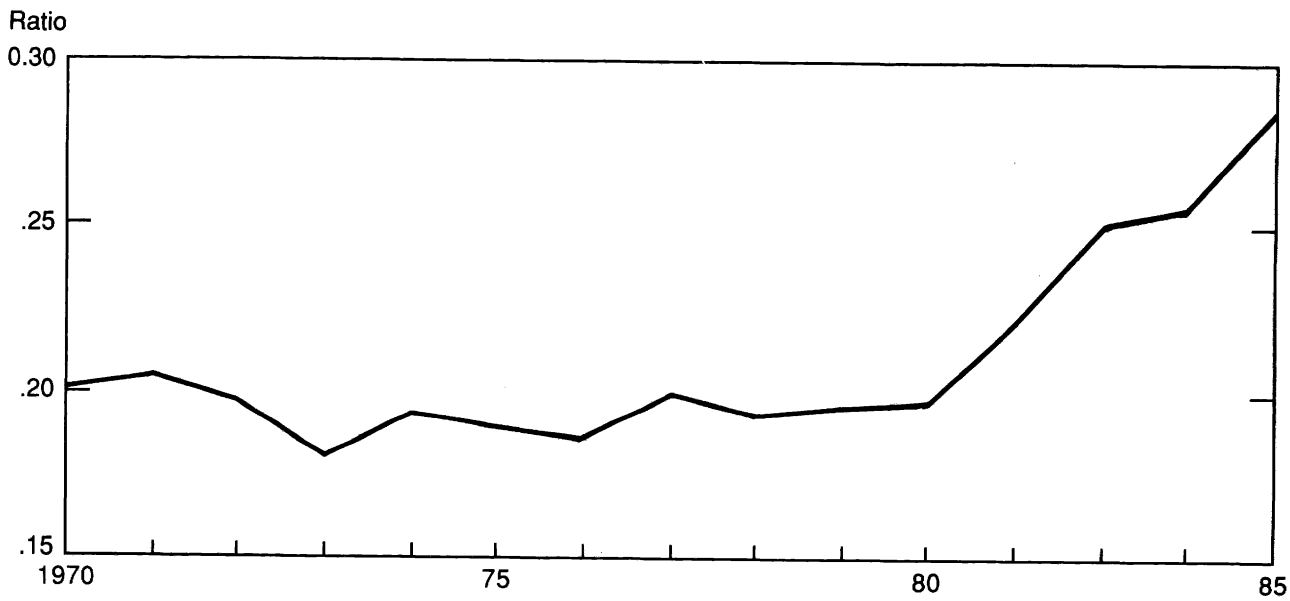
The interest expense component as a proportion of production expenses increased slowly from 3.1 percent in 1950 to 8 percent in 1974. Since then this component has grown rapidly, accounting for 15.1 percent of production expenditures in 1984. High inflation rates and low real interest rates in the 1970's encouraged farmers to borrow money. When inflation declined and real interest rates rose in the 1980's, many farmers were left with high levels of debt, a very costly component of production costs. The farm debt-to-equity ratio (fig. 3.3), not surprisingly, rose from a low below 20 percent in the 1970's to about 30 percent in 1985.

Farming has become increasingly specialized as farmers adopted specialized capital-intensive production technologies that increase advantages of size. The number of farms whose primary commodities were "cash grain" and "other livestock" increased from 21.3 and 32.8 percent in 1969 to 25.7 and 40.5 percent in 1982 (table 3.2). Not only did the number of farms specializing increase, but the farms within both of the two groups relied more heavily on sales of either grain or livestock in 1982 than they had in 1969. The sector as a whole, therefore, is more vulnerable to factors that might affect the prices of only a few commodities.

At the same time, there has been a greater concentration of production among larger farms. Table 3.3 compares farm cash receipts and income across four gross sales size categories. In 1960, the dominant forces in American agricultural production were the 814,000 intermediate-size farms (those selling between $10,000-$99,999 worth of products annually). These farms made up 20 percent of the total number of farms and produced 55 percent of farm output. Small farms (those selling less than $10,000 of product) produced

Figure 3.3

Debt-to-Equity Ratio



Source: *(8)*.

27.6 percent of total output. The remaining farms, the large farms of the 1960's, produced 17.3 percent of the output even though they accounted for less than 1 percent of the total number of farms. Even for small farms, income from farming still made a 40-percent contribution to average family income compared with 85.8 percent for intermediate-size farms.

If we double the top and bottom of our sales classes for intermediate-size farms to $20,000-$199,999 (to make a rough allowance for inflation), the 1982 data reveal a significant transformation. Intermediate-size farms account for 35 percent of total farms and account for 46 percent of output. Large farms now produce almost half of total farm output, even though they account for less than 5 percent of the total number of farms. Small farms are insignificant in terms of farm output, even though they account for more than half of the total number of farms.

Increasing specialization of farms and the growing concentration of production on large farms have meant that many of the small- and medium-size farms have had to rely on off-farm income to continue operating. Small farms now depend almost entirely on nonfarm sources, mid-size farms are at the 50-percent level, while large farms still depend heavily on farm sources (table 3.3). Average incomes on small farms approach the median for all U.S. families even though average net income from farm sources on these farms is negative.

While farm structure has been changing, farm output has doubled. Yet, agriculture's contribution to the national economy in terms of employment and generation of national income has been cut in half. Productivity gains, coupled with the outmigration of a large number of people, have resulted in increased per capita incomes for the farm sector compared with the nonfarm sector. The average per capita income of persons on farms (fig. 3.4), which had been only 38 percent of that of the nonfarm population in 1940, reached equality with the nonfarm sector by 1972 before declining again in the 1980's. Hence, the disparity between rural and urban incomes diminished substantially over the past three decades.

Table 3.2--Farm specialization: Farm sales derived from primary commodity, by type of farm

Type of farm	1969		1982	
	Percent of farms	Share of sales from primary commodity	Percent of farms	Share of sales from primary commodity
		Percent		
Cash grain	21.3	81	25.7	86
Tobacco	5.2	80	5.9	80
Cotton	2.3	69	.9	76
Other field crops	1.8	82	4.5	79
Vegetables	1.1	86	1.4	86
Fruits and nuts	3.1	95	3.8	95
Horticultural specialties	NA	NA	1.3	98
Dairy	15.1	78	7.3	84
Poultry	3.3	94	1.9	95
Animal specialties	NA	NA	2.9	95
Other livestock	32.8	84	40.5	86
Total	86.0	--	97.5	--
Other farms	14.0	less than 50	2.5	less than 50

NA = Not available.
-- = Not applicable.

Source: (2).

Off-farm income now accounts for a large share of the income of the farm population. Figure 3.5 compares net farm income and off-farm income since 1960. Off-farm income has been increasing steadily over most of the 25-year period. Net farm income grew slowly in the 1960's, but increased rapidly in the early 1970's. Since 1972, net farm income has been highly variable, illustrating the inherent riskiness of farming and the wide and disruptive movements in income the farm sector experienced over the past 15 years.

All of these changes in production at the farm level have altered the context in which farm policy was designed to operate. A much smaller segment of the population is engaged in farming compared with 30 years ago. Of those remaining, a large number depend on off-farm income to maintain a standard of living consistent with the nonfarm population. Growing dependence on off-farm income also represents a means of mitigating the fluctuations in income that are associated with the growing specialization of production and dependence on purchased inputs.

Changes in Market Structure

The structure and composition of U.S. agricultural markets has also been changing. Domestic demand for agricultural products has grown slowly; most of the growth in demand has been in foreign markets. Agricultural exports as a percentage of cash receipts (fig. 3.6) increased from slightly more than 10 percent in the 1950's and 1960's to over 20 percent in the 1970's, indicating the growth and importance of foreign markets to the U.S. agricultural sector. Exports account for an even larger proportion of farm output for grains, oilseeds, and cotton. In 1980, the United States exported 63.3 percent of its wheat production, 62.5 percent of its rice, 40.3 percent of its soybeans, 53.3 percent of its cotton, and 35 percent of its feed grains.

Table 3.3--Farm sector data by sales class

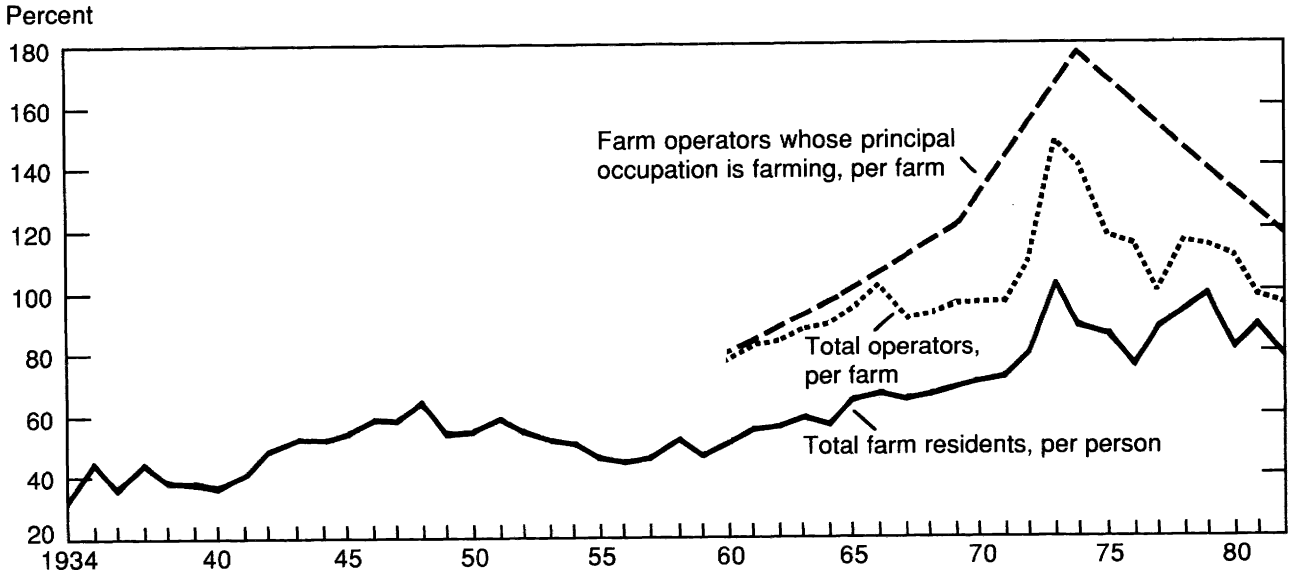
Item	1960			1983			
	Under $10,000	$10,000 -$99,999	Over $100,000	Under $20,000	$20,000- $199,999	Over $200,000	Over $500,000
				Thousands			
Number of farms	3,126	814	23	1,433	830	107	24
				Percent			
Percentage of total	79.0	20.0	0.6	60.0	35.0	4.5	1.0
Percentage of cash receipts	27.6	55.1	17.3	6.8	45.7	47.5	28.9
Percentage of net farm income	43.1	50.5	6.4	1/-1.4	34.5	66.9	48.4
Off-farm income as a percentage of total income of farm families	60.0	14.2	NA	2/101.0	51.2	9.0	5.0
				Dollars			
Average net farm income/farm	1,536	6,891	30,826	-269	11,545	175,582	567,585
Total income from farm and nonfarm sources/average 3/	3,849	8,751	30,826	19,996	23,666	193,332	596,187

NA = Not available.
1/ Percentage is negative because average net farm income was negative.
2/ Exceeds 100 percent because average net farm income was negative.
3/ Median U.S. family income was $5,619 in 1960 and $23,433 in 1982.

Source: (1, 4, 7).

Figure 3.4

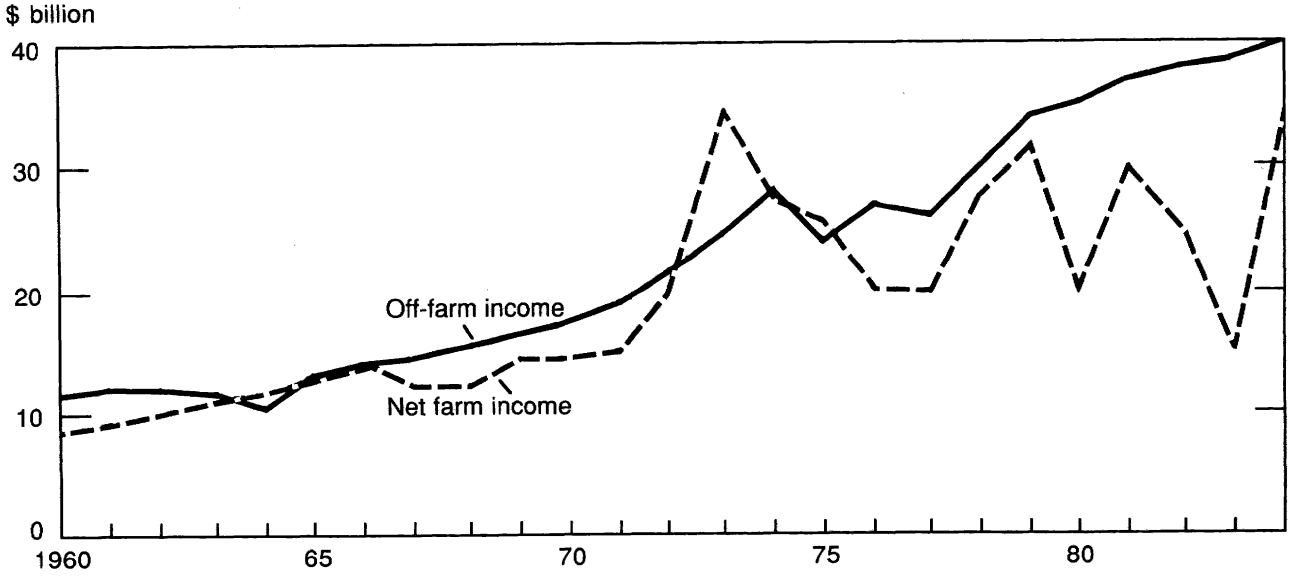
Farm Sector Income as a Percentage of NonFarm Sector Income



Source: *(3)*.

Figure 3.5

Farm and Off-Farm Income



Source: *(8)*.

A change in the commodity composition of U.S. exports accompanied the growth in exports (fig. 3.7). Cotton and tobacco exports have declined from a combined total of 30-40 percent of the value of U.S.agricultural exports in the early 1950's to 10 percent or less in the 1980's. Feed grains and soybeans, on the other hand, have increased from a combined total of 12 percent of exports in 1950 to 46 percent in 1983. Wheat and rice have declined slightly in importance over the past three decades.

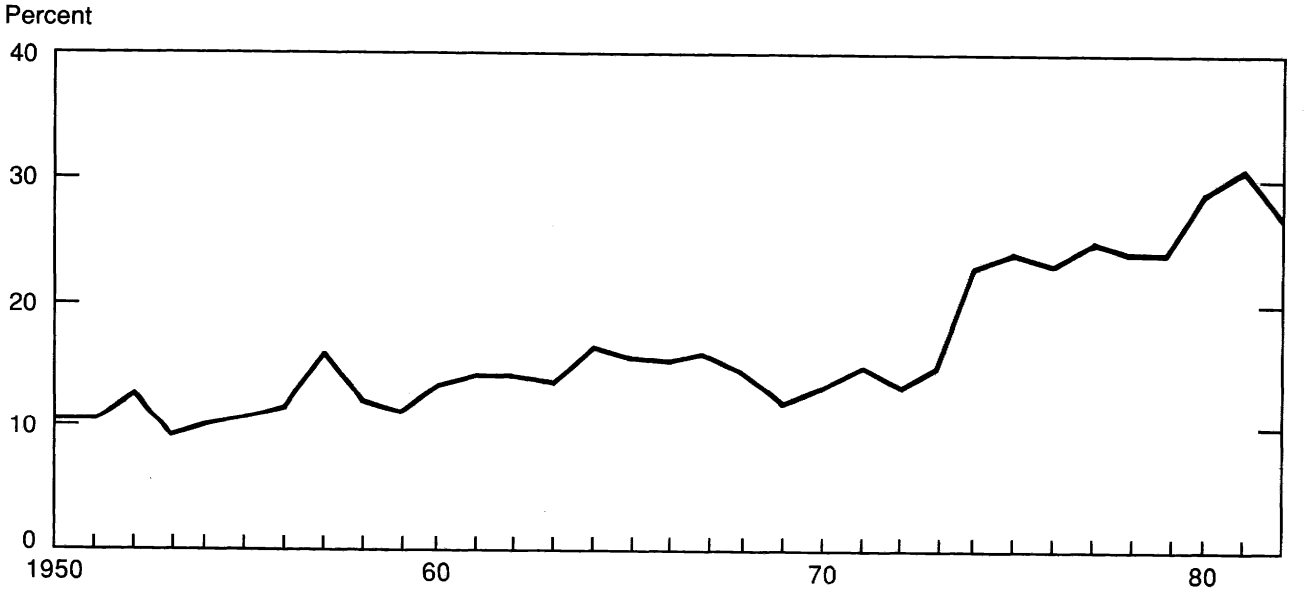
Emergence of corn and soybeans as major exports has also affected how U.S.policymakers view foreign markets. Demand for wheat, rice, and cotton increases relatively little in relation to increases in per capita incomes. A change in income (particularly in developing countries) will induce a relatively large response in consumer demand for meat. This change in meat demand will be transmitted (through a change in demand for imported feedstuffs) to the U.S.agricultural sector. Hence, changes in global income growth rates have a greater effect on trade in soybeans and feed grains because demand is linked closely to consumer demand for meat and livestock products.

Global income growth rates have become very important to the U.S.agricultural sector.

Developments in the political structure and country composition also have affected U.S. export markets in the past two decades. U.S. agricultural exports to Japan and the European Community (EC) have declined in relative importance while markets in centrally planned and developing countries have expanded rapidly since the early 1970's. Centrally planned countries and many developing countries conduct trade through state trading agencies. State trading agencies act as a buffer between forces affecting supply and demand in the domestic markets and forces affecting the world market. As a result, trade policies and practices of the state traders are often more important than fundamental economic forces determining the level of world trade. This introduces a large element of uncertainty into the market. The effect of economic forces on import demand, for example, can be predicted (albeit with some degree of error), but a change in policy such as the Soviet decision to import large quantities of grain in 1972 is much more difficult to anticipate.

Figure 3.6

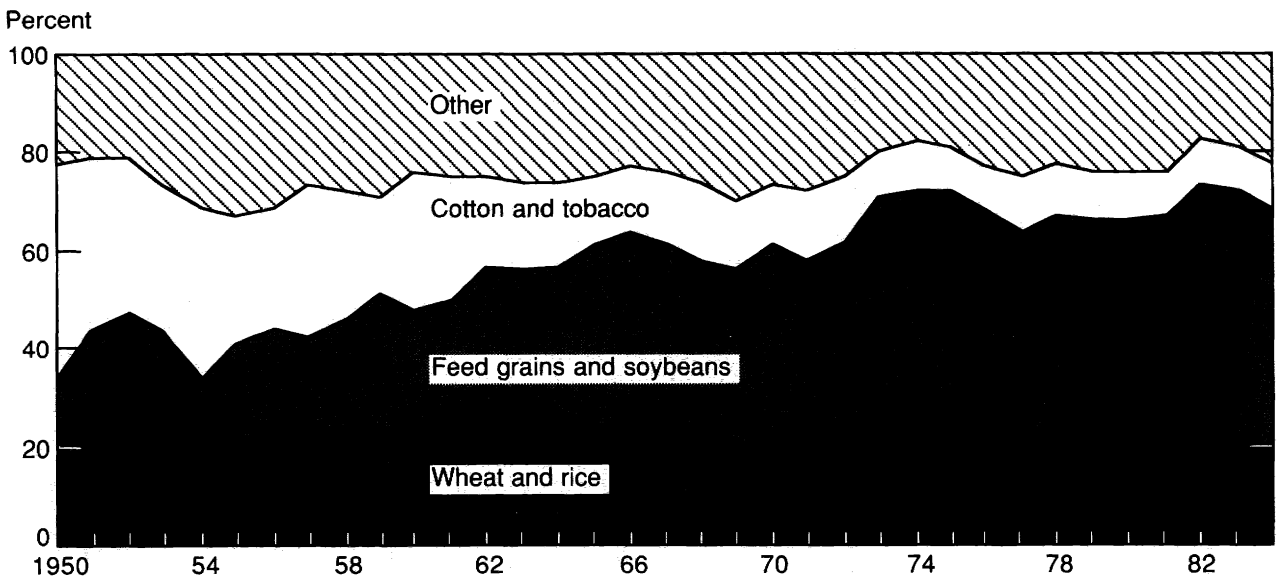
Agricultural Exports as a Percentage of Cash Receipts



Fiscal years. Source: (1).

Figure 3.7

Commodity Shares of U.S. Agricultural Export Value



Source: *(9)*.

Major Structural and Market Trends

Change in the structure of both farm-level production and agricultural markets has meant that U.S. agriculture, which had largely been insulated from business cycles in the rest of the world by farm policy and a reliance on a large stable domestic market, became more susceptible to movements in global income and changes in policies in other countries.

Because individual farmers have become more specialized and dependent on purchased inputs and credit, their costs and resulting net income also have become more sensitive to changes in the global and U.S. macroeconomies. This sensitivity has become especially evident during the 1970's and early 1980's and has profoundly affected the effectiveness of U.S. farm policy. Many of the key determinants of farm sector welfare now lie outside the purview of farm policy.

THE U.S AGRICULTURAL POLICY FRAMEWORK

We focus on policies that affect domestic demand and policies that affect domestic supply. Our intent is to highlight the most significant policies from a trade perspective and show how they fit into the U.S. agricultural policy framework.

Agricultural Policies Affecting Domestic Demand

Government programs which help to expand domestic use of food are primarily dual purpose in nature. These programs enhance demand for agricultural products by effectively transferring income to low-income consumers. Low-income consumers represent the largest potential domestic growth market for agricultural products since they spend a larger proportion of each additional dollar on food than do mid- to high-income consumers. These programs are also intended to help lower income consumers achieve nutritionally adequate diets. The programs include the Food Stamp Program, school lunch and school breakfast programs, and Women, Infants, and Children program (WIC, designed for low-income pregnant and/or lactating women). Between 23-24 million children participate annually in the school lunch program. By 1980, about 21 million people participated in

Table 3.4--Food Stamp Program: Participation and value of coupons issued

Fiscal year 1/	Average monthly participation	Value of coupons issued		
		Total	Paid for by participants	Recipient benefits
	Million	*Million dollars*		
1969	2.9	603.4	374.5	228.8
1970	4.3	1,090.0	540.3	549.7
1971	9.4	2,713.3	1,190.5	1,522.7
1972	11.1	3,308.6	1,511.4	1,797.3
1973	12.2	3,884.0	1,752.5	2,131.4
1974	12.9	4,727.5	2,009.2	2,718.3
1975	17.1	7,265.6	2,880.1	4,385.5
1976	18.5	8,700.2	3,373.7	5,326.5
1977 1/	17.1	8,351.1	3,284.2	5,067.0
1978	16.0	8,279.8	3,140.6	5,139.2
1979	17.7	7,225.5	7,453.1	6,480.2
1980	21.1	8,685.4	2/	8,685.4
1981	22.4	10,629.9	2/	10,629.9
1982 3/	22.1	10,408.7	2/	10,408.7
1983	21.6	11,155.1	2/	11,155.1
1984 4/	20.8	10,688.0	2/	10,688.0

1/ Data for fiscal years July 1 to June 30 for 1969-76; Oct. 1 to Sept. 30 beginning 1977.
2/ Recipient payments phased out effective Jan. 1, 1979; equivalent benefit levels maintained without requiring cash outlay by recipient.
3/ Omits Puerto Rico beginning July 1, 1982, when its nutrition assistance program began.
4/ Preliminary.

Source: USDA.

the Food Stamp Program. This figure is approximately 40 times as large as the number of people receiving direct assistance in the agricultural commodity programs. This number peaked at 22.4 million in 1981 (approximately 10 percent of the U.S. population) before declining slightly (table 3.4).

Federal outlays for domestic food assistance (including the Food Stamp Program, special milk program, school lunch program, the WIC program, food donations, and removal of surplus agricultural commodities) have trended up significantly during 1970-84. The outlay for each year without exception has been larger than the previous year's outlay. In 1970, the outlay for domestic food programs was $1.4 billion, increasing to $18 billion 15 years later.

These programs have had little effect on the domestic demand for primary commodities such as grains and oilseeds. Hence, they are not a factor in the analysis of surplus grain disposal alternatives in Part III. These programs have, however, been important in increasing dairy product demand and, therefore, are an important element in the analysis of dairy surplus disposal (see Chapter 21).

Agricultural Policies Affecting Domestic Supply

There are at least five broad sets of domestic policies or programs affecting agricultural trade: (1) Programs affecting inputs such as Farmers Home Administration (FmHA) financing, (2) land diversion and set-aside programs, (3) income support policies, (4) stocks policies, and (5) export subsidy and food aid policies.

Although there have been significant changes in input policies (such as deregulation of railroad rates and changes in farm credit policies), we do not discuss them in this chapter because they are of minor importance in explaining the major changes in U.S.exports in the past 15 years. Hence, they bear only

peripheral relevance to the effect of embargoes or the surplus disposal of exports. Export subsidy and food aid programs are primarily significant for the surplus disposal analysis and are discussed in Part III of this report. Hence, we focus on income support policies, stock policies, and programs to control production by idling land. These three sets of policies are interlinked components of the U.S. agricultural commodity programs and have a direct bearing on the analyses in both Parts II and III. It is important to understand these linkages in order to understand how commodity policy works and the net impact of that policy on trade.[1]

Price and Income Support Program Operation

The three components of price and income support programs are nonrecourse loans, Government and Commodity Credit Corporation (CCC) stock management activities, and target prices and deficiency payments. Under the nonrecourse loan program, eligible producers may obtain a loan at a specific rate per unit of the commodity by pledging crops in storage from the current year's production as collateral. These loans are called "nonrecourse" because the CCC has no alternative but to take title to the stored commodity as full payment for the loan if the farmer chooses not to repay the loan principal plus interest. Thus, the CCC becomes a guaranteed source of demand for farm commodities. The loan may extend for 1 to 18 months depending on the commodity, but is typically for 9 months. Eligibility for the loan and other program benefits may require participation in any announced acreage reduction or other production control program.

Nonrecourse loans differ from commercial loans in several ways. The interest rate on CCC nonrecourse loans is usually below those offered by commercial banks. Farmers' credit ratings are unaffected by defaulting their collateral (the crop) to the CCC. And, the loan rate may at times be above the full market value of the collateral.

Nonrecourse loans effectively support prices through the option to forfeit. If market prices are above the loan rate plus interest charges during the regular nonrecourse loan period, the producer has an incentive to repay the loan and sell the crop in the open market. But, because program participants always have the option of forfeiting their crops to the CCC whenever market prices do not exceed the loan rate plus interest charges, the loan rate places a minimum (floor) under the price received by participating producers. If enough farmers participate in the program, the market price will tend to be maintained at or above the loan level. In such a case, the CCC loan program tends to benefit all producers, not just those participating in the program. And since the United States is a large country trader, the benefits can extend to producers in other countries as well. Thus, nonparticipants, including foreign producers, become "free riders" who receive higher prices as a result of the action of program participants. However, if participation is low, there may not be enough of the commodity eligible to enter CCC stocks as a result of nonrecourse loan defaults to maintain prices for everyone at or above the loan rate.

The nonrecourse loan also serves as a marketing tool which allows farmers to obtain cash to satisfy immediate obligations to other creditors while retaining control of the commodity they produce. Rather than sell at depressed prices during the harvest season, the producer stores the commodity until later in the marketing year when prices are usually higher. This evens out marketings throughout the year. Some producers use the cash-flow and marketing tool aspects of nonrecourse loans even when market prices are well above the loan rate.

Commodity Stock Management

Accumulation and dispersal of commodity stocks have long been integral parts of U.S. agricultural programs. U.S. stock management programs are aimed at assuring adequate supplies of farm commodities in case of poor crops and at reducing market price and income variability, whereas other programs, such as land retirement, acreage diversion, and target prices, are aimed at providing income and price support. In practice, the stock management and loan programs have also frequently been used to meet the income support objective,

[1]The following sections draw heavily from *(3)*. Italicized numbers in parentheses refer to items in the References at the end of the chapter.

although this has often led to excess stocks accumulation. U.S. stock management programs are commodity oriented, covering wheat, corn, sorghum, barley, oats, rye, Upland cotton, extra-long staple (ELS) cotton, rice, soybeans, sugar, tobacco, peanuts, honey, and dairy products. Wheat, feed grains, rice, and cotton dominate the volume of stock activities. Stock management programs include CCC stocks (both loans outstanding and CCC-owned) and farmer-owned reserve (FOR) stocks.

The CCC acquires stocks of grains, soybeans, and cotton as a direct consequence of its price support activities, either when producers default on nonrecourse loans or by direct purchases of program commodities. There are several restrictions on how the CCC can use stocks it acquires. Legislation prohibits domestic "bargin sales" of CCC-owned commodities. The minimum domestic sales price of CCC-owned grain stocks was 110 percent of the FOR release price for the 1981-85 crops. However, under certain conditions, the CCC is authorized to donate, or sell at reduced prices, its excess commodity stocks on the domestic and international markets. (See Part III for further discussion of the effect of CCC sales on the international market.)

Prices of dairy products are supported by purchases of butter, Cheddar cheese, and nonfat dry milk from manufacturers and handlers. This, in turn, supports prices for milk and cream at the farm level. Domestic food and export donation programs are the most common outlets for surplus dairy stocks acquired under price support activities. CCC dairy stocks may be resold on the domestic market at 110 percent of the purchase price or the market price, whichever is higher.

Payment-in-kind (PIK) programs have also been used to reduce CCC stocks levels and to limit further accumulation of stocks. Under most PIK programs, producers are compensated for idling acreage with units of a particular commodity instead of cash. The 1983 PIK program was the largest acreage and stock reduction program in the Nation's history.

Wide price swings in the early- to mid-1970's led to pressure to create a more stability-oriented stock management program. Regular CCC loans often mature too soon to allow farmers to carry their crops over into subsequent years when supplies may be smaller and prices higher. When low prices persist throughout a crop year, producers with crops under a maturing loan must either default, thereby foregoing potential price increases, or commercially refinance the loan at less attractive terms. The FOR program was authorized by the Food and Agriculture Act of 1977 to provide extended nonrecourse loans to wheat and feed grain farmers. The FOR provides contracts to extend the regular CCC loan for an additional 3-5 years to stabilize grain prices across marketing years and to allow farmers to retain marketing rights of the grain.

The FOR in concept helps stabilize commodity prices by offering producers an incentive to hold stocks for 3-5 years. Farmers agree not to redeem the extended loan unless market prices rise to an announced release price. To encourage participation in the FOR, the Government offers farmers advanced storage payments (currently 26.5 cents per bushel per year for grains other than oats, which is 20 cents), low interest charges (which may be waived after the first year), and sometimes higher rates for reserve loans than for regular CCC loans. Once market prices equal or exceed the release price, storage payments are discontinued, encouraging producers to repay their loans and market their grain. Thus, the FOR is intended to control price variability within a price corridor defined by the reserve loan rate (which was higher than the regular CCC loan rate during 1980-82) and the release price. Since the sale price for CCC-owned stocks is currently 5-10 percent above the FOR release price, farmers are not forced to compete directly against the Government in the release of stocks to the market place.

Target Prices and Deficiency Payments

Experience with high loan rates and ineffective supply control in the 1950's eventually led to the extensive use of direct payments in the 1960's. These payments were intended to supplement lower price supports and to encourage participation in voluntary acreage reduction programs that were employed to deal with the problem of excess production

capacity. The target price and deficiency payment program began with the 1974 crops of wheat, corn, sorghum, and Upland cotton. Barley, oats, rice, and ELS cotton were added later.

The target price for any crop is used to calculate deficiency payments which make up the difference (or deficiency) between an established target price and the higher of (1) the average market price during the first 5 months of the marketing year or (2) the national average loan rate. The cotton deficiency payment is based on the farm price received during the calendar year which contains the first 5 months of the marketing year. No payment is made if the market price exceeds the target price. Eligible producers are assured of receiving, in addition to a loan rate, any announced deficiency payment per unit of output.

Because the market price can vary between the target price and loan rate, there is some basis for saying that the loan and target price programs separate price floors from income support. That is, separate programs are used to accomplish these two objectives, with the deficiency payment program supplementing income above what would be provided by the loans (or by market prices supported by the loans). The gap between the target price and loan rate allows domestic demand and exports to adjust to changing market prices. Domestic supply, however, will respond very little to price movements between the loan rate and target price because producers who participate are guaranteed the target price. However, as long as world prices are above the loan rate, there should be enough adjustment of U.S. demand and exports to prevent the accumulation of excessive government stocks. When world prices are at or near the loan rate, U.S.stocks can increase rapidly.

These responses become relevant in the embargo analysis because Congress increased loan rates as a consequence of the 1980 USSR embargo. The loan rate becomes a key element in the evaluation of the domestic effects of the embargo (see Chapter 13). The relevance of the relationship of loan rates, target prices, and world prices to the surplus disposal part of the study is clear. The volume of grain for surplus disposal (and the cost) increases when loan rates constrain downward price adjustments in the United States.

Land Diversion and Set-Aside Programs

Eligibility for price and income support benefits requires compliance with announced acreage reduction or other supply control programs. When acreage control programs are in effect, a portion of a farm's cropland base must be placed in an approved conserving use.

Since 1977, production eligible for payment has been based on the permitted planted acreage and program yields. The acreage base for deficiency payments to individual producers has been the average of acres planted to a particular crop on their farm over the previous 2 years, plus any diverted or set-aside acreage. Prior to 1977, payments were based on a system of acreage allotments tied to historical planting patterns. Acreage allotments were continued for rice until the 1981 farm legislation, which converted allotments to a current plantings concept. Figure 3.8 shows land diversion patterns since 1970.

Table 3.5 shows how much the Government has spent on the various program components that we have discussed. As the table shows, deficiency payments vary with changing market conditions as do loan activity and storage payments. Another characteristic that stands out is the year-to-year variability in farm program costs.

THE ROLE OF U.S COMMODITY POLICY IN TRADE

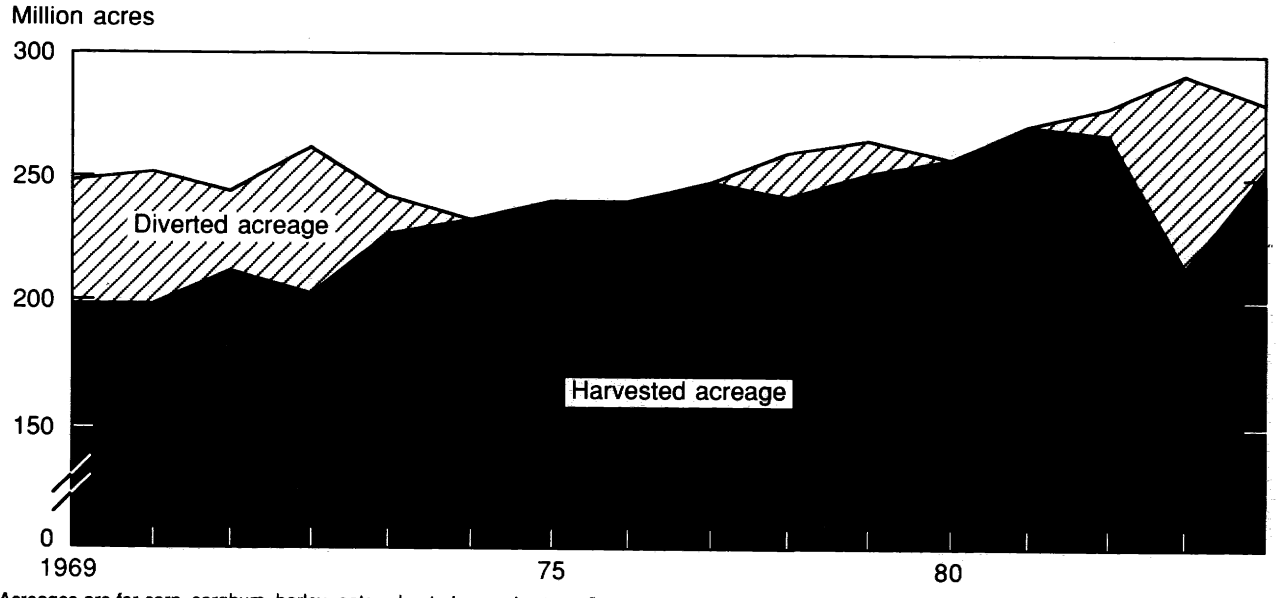
Three events in 1972/73 set into motion a series of forces dominating U.S.agriculture in the 1970's and early 1980's:

- The USSR emerged as a major grain importer. The magnitude of Soviet purchases increased trade and caused an initial increase in prices. Variability and unpredictability of these purchases heightened uncertainty on world grain markets with respect to future trade and prices.

- The Bretton Woods agreement broke down when the dollar was devalued in 1971 and

Figure 3.8

Land Diversion



Acreages are for corn, sorghum, barley, oats, wheat, rice, and cotton. Source: *(1)*.

Table 3.5--USDA deficiency, diversion, disaster, producer storage payments, and loan activity

Fiscal year	Deficiency payments 1/	Diversion payments 2/	Disaster payments 3/	Producer storage payment 5/	Loan activity 5/
			Million dollars		
1970	0	606	0	141	1,102.9
1971	1,628	855	0	110	-287.5
1972	1,877	0	0	79	718.2
1973	2,246	546	0	113	-957.0
1974	1,860	99	0	17	-691.2
1975	4	1	555	0	-86.9
1976	2	0	286	0	453.4
1977 6/	129	0	548	0	2,689.5
1978	1,436	306	526	216	2,391.3
1979	1,025	78	367	247	527.6
1980	79	56	258	254	-66.3
1981	0	0	1,030	32	173.5
1982	1,184	0	306	679	7,015.4
1983	2,779	705	115	964	4,533.6
1984	612	1,504	1	268	-5,162.0

1/ Includes the terms "support payment" for 1970, "set-aside or deficiency payments" for 1971-79, and "deficiency payments" and "support payments" for 1980-84.
2/ Includes the terms "acreage diversion payments" for 1970, "additional set-aside or diversion payments" for 1971-79, and "diversion payments" for 1980-84.
3/ Includes the term "disaster payments" for 1971-84.
4/ Includes the term "producer storage payments" for 1971-84.
5/ Negative number indicates loan repayment.
6/ Includes transition quarter.

Source: (5, 6).

fixed exchange rates were abandoned in 1973. This lowered the foreign currency price of U.S.exports (of which agricultural products were a significant component) and increased the foreign demand for U.S. products relative to those produced in other countries.

- The 1973 Arab oil embargo was enacted and OPEC unilaterally increased petroleum prices. The latter was significant because the United States accommodated the first OPEC price increase with a relatively loose monetary policy. This lessened the adjustments the price increases would have brought about if inflation had not allowed prices of other goods to rise along with the price of petroleum. It also helped create a world financial environment in which banks were eager to lend excess reserves. Many oil importing developing countries took out loans rather then make the domestic economic adjustments the petroleum price increase would have required.

A more comprehensive treatment of these and other changes in the international economic environment are discussed at greater length in Chapter 5. This section draws heavily from *(10)*.

These events resulted in a boom in agricultural trade. U.S.agricultural policy allowed the United States to respond relatively quickly to the sudden surge in demand for grain and oilseeds. The United States, as the world's largest holder of grain stocks, initially had supplies available to meet the short-term increase in demand. When it became apparent in early 1973 that these stocks would not be sufficient, land that had been held out of production by farmers to qualify for Government price supports was released. Between 1972 and 1974, combined wheat, corn, and soybean acreage harvested increased from 150 to 182 million acres. Nevertheless, tightening supply conditions for soybeans and soybean meal in the summer of 1973 led to a 5-day U.S.export embargo of these products followed by partial restriction on exports until supplies from the new crop became available in September. Uncertainty about Soviet import intentions and similar tight market conditions led to temporary restrictions on grain exports to the USSR in 1974 and again in 1975. These actions grew out of the tight and volatile market conditions of the early 1970's. They are discussed at length in Part II of this report.

In response to the surge in demand and the accompanying price increases, farmers expanded production in part by borrowing heavily on their land equity. High commodity prices, appreciating land values, and relatively low real interest rates made agriculture an inviting investment. But, the expansionary monetary policy made conditions look better than they actually were. Price increases generated by the surge in demand drew resources into agriculture and caused the total value of farm sector assets to increase from $326 billion in 1971 to over $1 trillion in 1980 *(1)*, a 67-percent increase in real terms. Much of this increase in farm prices was capitalized into the value of land. Average value of an acre of farmland increased by over 350 percent between 1971 and 1980.

The trend toward reducing Federal involvement in agricultural markets, a reality between 1973 and 1977, was short-lived. By mid-1977, agricultural production had expanded to meet foreign market demands, and export prices for wheat and corn fell to a level which, in real terms, was only about 10 percent above 1971 prices. Farmers who had expanded their production capacity in the first half of the decade in the expectation of continued high prices started to experience financial difficulties. The American Agricultural Movement was organized, and farmers lobbied Congress to increase the target price for wheat, provide additional FmHA credit, raise the minimum cotton loan rate, and increase CCC borrowing authority to finance increased price support activities. Net farm income, falling from $33.8 billion in 1973 to $19.9 billion in 1977, recovered to $27.4 billion in 1978 and $31.7 billion in 1979.

The policy framework which responded quickly to permit the United States to expand exports in response to the surge in demand was far less flexible when confronted with a decline in global demand. This decline occurred when the growth in agricultural export markets of the 1970's reversed suddenly in the 1980's. Three major events between 1979 and 1981 have been associated with the decline in U.S. agricultural exports:

- A change in global macroeconomic conditions resulting from the second oil price shock in 1979 and the shift to a more restrictive monetary policy by the Federal Reserve in fall 1979. Real U.S. interest rates rose rapidly, followed by an appreciation of the dollar and an increase in real interest rates worldwide. A global recession ensued. Countries with large international debts (such as Poland, Argentina, Brazil, Mexico, Nigeria, and others) found that the cost of servicing their debts had increased and their ability to generate foreign exchange earnings to meet debt payments had decreased. Hence, the markets which had been largely responsible for the growth in both global and U.S. agricultural exports in the 1970's, grew much more slowly or declined in the 1980's. Combined with an appreciation of the dollar of 30 percent against major currencies between 1980 and 1983, it is not surprising that the U.S. share of a stagnant or declining world market declined. These events and their implications for U.S. agriculture are discussed in more detail in Chapter 5.

- The 1980 suspension of U.S. grain sales to the USSR. This action cut off a portion of U.S. grain supplies to the most important market for U.S agricultural commodities. The analysis in Part II of this report presents a detailed analysis of the embargo's effects.

- U.S. agricultural policy. The fall of world wheat and corn prices and an increase in the level of loan rates in the early 1980's resulted in U.S. loan rates supporting market prices. The nonrecourse loan program forced the Government to acquire grain stocks to prevent the growing surplus from being exported at prices below the loan rate. Since the United States is the largest exporter of grains, this policy actually provides a price floor at the loan rate level for world grain production. This policy, coupled with an appreciating dollar, can provide an increasing incentive to importers and to competing exporters to produce more grains.

At the same time, increases in target prices mandated by the 1981 farm act gave U.S. farmers more incentive to produce. The overall result was production in excess of what could be sold at loan-supported market prices. The CCC and the FOR rapidly accumulated stocks, eventually forcing the Government to take further action. The result was the 1983 PIK which removed 78 million acres from production and reduced yearend stocks of wheat, coarse grains, and milled rice from 141 million tons in 1982 to 71.4 million tons in 1983. Just as the United States rapidly expanded acreage in the 1970's when markets were tight, it sharply reduced acreage as demand slackened. PIK was a temporary solution to a fundamental disequilibrium due partly to commodity policies inappropriate for prevailing market and macroeconomic conditions.

U.S. agricultural policymakers face a dilemma. The agricultural sector has been in its worst financial crisis since the 1930's. Price and income supports are needed to forestall a worsening of the distress in the sector. Yet high loan rates and target prices inhibit U.S. exports and have been at least partly responsible for the declining U.S. share of world grain markets. Hence, mechanisms for providing income support in U.S. farm policy ultimately resulted in the loss of the very markets which had been responsible for the farm sector's prosperity.

The approach in 1985 farm legislation was to lower loan rates but maintain target prices. Income support remains at previous levels but U.S. export prices can fall allowing the United States to improve its competitive position in international markets. This solution has two drawbacks. First, unless world market prices increase soon, this program could be extremely expensive because it provides an incentive for farmers to produce when there are no markets. Second, maintaining target prices will tend to slow the decline in agricultural land values. This may be desirable if current world prices are expected to increase from their current level in the next year or two. However, if world prices remain at their current level, preventing the decline in land values merely delays the adjustments which are ultimately necessary for the United States to be competitive in world agricultural markets.

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CHAPTER 4

MARKET STRUCTURE, POLICY, AND BEHAVIOR IN WORLD GRAIN AND SOYBEAN MARKETS

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CHAPTER 4

MARKET STRUCTURE, POLICY, AND BEHAVIOR IN WORLD GRAIN AND SOYBEAN MARKETS*

Domestic intervention, particularly the actions of large countries, influences international markets and the effectiveness of other countries' policies (see Chapter 6 for more information). Understanding how and why countries intervene is necessary to modeling international interdependence. To help explain how countries and world markets respond to embargoes and how they respond to general or targeted export subsidies, this chapter summarizes the structure and economic behavior of the world markets for grains and oilseeds from the mid-1960's to the mid-1980's. It provides the background for the analysis of embargoes and subsidies by describing the changing structure of world trade, the policies of the major actors, and the functioning of commodity markets.

This chapter consists of four major sections. The first looks at the production and trade picture for the major nations involved in the world market over the 20-year period. It does not attempt to be exhaustive but illustrates the quantitative dimension of the grain economy and its reliance on international trade. This section also summarizes the forces that affect the behavior of international prices of wheat, corn, and soybeans to show the relevant long-term price trends and how they have unfolded during this period. A rather simple analysis of the extent of change in annual price fluctuations is presented to set the stage for the more detailed examination of policy, market structure, and trade behavior that follows. The next two sections include relatively brief sketches that focus on the production and trade policies of the major international actors in grain and soybean markets other than the United States. These include Canada, Australia, Brazil, Argentina, and European Community (EC) on the export side and Japan, USSR, Eastern Europe, and Egypt on the import side. We present a broad picture of how the governments of both U.S. competitors and U.S. customers intervene to influence the operation of their grain sectors in pursuit of national policy objectives. The sketches clearly show the diversity of policy and decisionmaking that exists across the spectrum of trading nations in the world grains and oilseeds economy. The final section looks at how the private trade actually negotiates and executes commercial trade in grains and oilseeds across international borders. The purpose is to give readers some insight into the process and procedures typically followed as grain moves from exporter to importer, as price is established, and as ownership is transferred.

Some of the important concepts and everyday terms employed in this sector are described and illustrated. Reading this section will not make everyone an expert in this arcane field of commerce, but it will help to provide a realistic setting for the analytical discussions and analyses that appear later in this report. It also provides considerable insight into how world markets work in terms of adjusting to external shocks. The issues of market flexibility and efficiency are critical in later analysis of export embargoes and export subsidies.

International markets adjust quickly to shocks of any sort, including policy shocks. The types of trading firms, transactions, markets, and contracts used in international trade strongly imply that the market can adjust quickly and efficiently to trade barriers. A targeted embargo would likely have limited effects that would dissipate quickly as the market for a substitutable commodity adjusted, in some cases, almost instantaneously. In addition, with all the transactions possible between producer and consumer, the loss of origin identity could possibly make enforcing embargoes very difficult.

PRODUCTION, TRADE, AND PRICES

All data presented here dealing with the behavior of international grain markets over the past 20 years are from official U.S. Department of Agriculture (USDA) sources or from published reports of international agencies.

*The principal contributor to this chapter was James P. Houck.

Production and Trade[1]

We reviewed world markets for wheat, coarse grains, and soybeans by presenting trends in production, trade, stocks, and market shares for major exporters and giving special emphasis to the U.S. role in each market. These market overviews help define the context within which embargoes took place and in which surplus disposal policies would need to be carried out.

Wheat

Wheat is the most important food grain traded. Table 4.1 presents world wheat production, utilization, trade, and stocks data for selected trade years. World production has more than doubled from 238 million tons in 1960/61 to about 514 million tons projected for 1985/86, a 116-percent increase over the 25-year period. Over the years, utilization has been slightly less than production, the difference being changes in stocks. Ending stocks have increased by 33 percent, and stocks as a percentage of utilization have actually declined even though both world and U.S. stocks are at high levels.

Total trade has increased more than 150 percent during the 25-year period. Total U.S. exports and the exports of U.S. competitors have increased, but U.S. exports have risen less than 100 percent, while those of U.S. competitors have increased about 200 percent. In contrast, U.S. wheat exports for 1981/82, the peak U.S. trading year for wheat, rose about 150 percent over those of 1960/61. Note that ending stocks as a percentage of utilization have dropped considerably since 1960/61, reaching a low of 17.5 percent in 1980/81. This drop may reflect the willingness of many countries to depend on world trade and ample international supplies to offset production shortfalls and avoid the high grain storage costs. The tendency for the United States to hold large wheat stocks from one year to the next may reinforce this behavior.

The United States, Canada, Australia, and Argentina are historically the world's major wheat exporters. In the last few years, the EC has increased its wheat exports (fig. 4.1). U.S. exports have fallen since 1981 for several

[1]This section draws heavily on material presented in *(25)*. Italicized numbers in parentheses refer to items in the References at the end of this chapter.

Table 4.1--World wheat production, utilization, trade, and carryover stocks

Year 1/	Production	Utilization	U.S. exports	Non-U.S. exports	Total trade	Ending stocks 2/	Stocks as percentage of utilization
	Million tons						*Percent*
1960/61	238.4	234.8	19.6	22.4	41.9	81.8	34.8
1966/67	306.8	279.9	20.3	35.7	56.0	82.1	29.4
1971/71	350.9	344.2	16.6	35.4	52.0	81.0	23.5
1976/77	421.3	385.8	25.8	37.5	63.3	99.8	26.2
1978/79	446.8	430.2	32.3	39.7	72.0	100.9	23.9
1979/80	424.4	444.2	37.4	48.6	86.0	81.0	18.4
1980/81	442.7	445.6	41.9	52.2	94.1	78.2	17.5
1981/82	448.4	441.5	48.8	52.5	101.3	85.1	19.3
1982/83	479.1	467.8	39.9	58.7	98.6	96.4	20.6
1983/84	490.4	488.4	38.9	64.1	102.9	98.5	20.2
1984/85 3/	513.8	502.7	38.0	67.6	105.6	109.5	21.8
1985/86 4/	514.5	505.7	32.7	64.8	97.5	118.3	23.4

1/ July-June year.
2/ Excludes total stocks in most Communist nations due to lack of published data. Stocks are an aggregate of individual marketing years and do not reflect stocks at a single point in time.
3/ Preliminary.
4/ Projected.

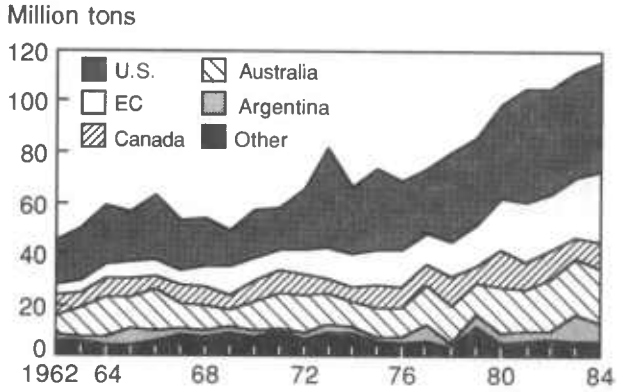
Source: *(23)*. Includes wheat and wheat products.

reasons, including the production success of major competitors and the rising value of the dollar relative to some competitor currencies. The U.S. Government's farm policy of high target and loan prices also has provided incentives for other countries by supporting world prices at relatively high levels. Figure 4.2 shows shares of the world wheat market. The U.S. share has fluctuated around 40 percent. Although the EC share has increased, some of those exports are feed quality wheat, which compete more with U.S. coarse grain exports than with U.S. wheat exports.

Table 4.2 illustrates the changing composition of trade patterns for food grains (wheat and rice) in selected years. Wheat typically makes up 85-90 percent of world trade in food grains. The two major changes in trade patterns for food grains are the increasing world import

Figure 4.1

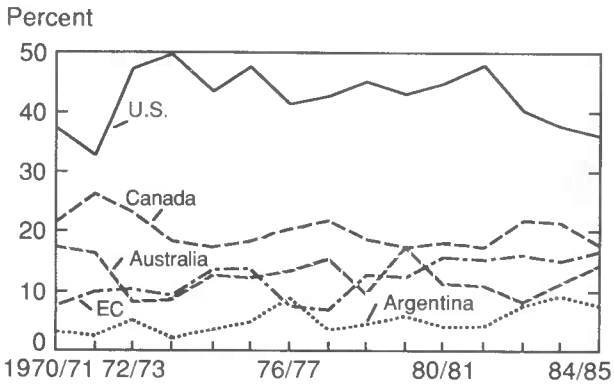
World Wheat and Wheat Flour Exports



Source: *(10)*.

Figure 4.2

Market Shares of World Wheat and Wheat Flour Exports



Crop years. Source: *(23)*.

Table 4.2--Share of food grain exports going to major destinations, by principal source

Exporter and year	Importers: Other developed	Importers: Developing	Importers: Centrally planned
		Percent	
United States:			
1970-72	28	66	6
1975-77	23	64	13
1979-81	22	56	22
1982-84	18	60	22
Other developed:			
1970-72	43	33	23
1975-77	42	35	23
1979-81	31	36	33
1982-84	26	34	40
Developing:			
1970-72	13	77	10
1975-77	9	73	18
1979-81	7	67	26
1982-84	7	64	29
Centrally planned:			
1970-72	63	37	0
1975-77	40	60	0
1979-81	27	73	0
1982-84	24	76	0
World:			
1970-72	35	50	15
1975-77	30	52	18
1979-81	24	49	27
1982-84	20	49	31

Source: *(10)*. The trade table was constructed using the reporting countries' import values or the reporting countries' export values by selecting the largest reported value. Many centrally planned and developing countries do not report either import or export values. The major data deficiency resulting from this nonreporting situation affects trade values when both trading partners are centrally planned and developing countries.

share of centrally planned economies and the declining import share of developed countries. The centrally planned countries' share increased from about 15 percent in 1970-72 to 31 percent in 1982-84, while the developed countries' share declined from about 35 percent in 1970-72 to 20 percent in 1983. These changing import patterns are reflected in U.S. export destinations. In 1970-72, 28 percent of U.S. food grain exports went to other developed countries and almost none went to centrally planned countries. By 1982-84, the export share to developed countries had fallen to 18 percent and the share to centrally planned countries had risen to almost 20 percent. It has since fallen somewhat.

The USSR has emerged since the mid-1960's as a growing, sometimes erratic importer of wheat and flour. Table 4.3 illustrates the development of the USSR's import share since 1964/65.

Table 4.3--USSR's wheat and flour imports as a share of world wheat and flour exports

Year	Percentage of total
	Percent
1964/65	5.2
1965/66	14.6
1966/67	8.5
1967/68	2.9
1968/69	.3
1969/70	2.1
1970/71	.6
1971/72	6.5
1972/73	22.1
1973/74	6.9
1974/75	4.6
1975/76	15.1
1976/77	7.5
1977/78	8.9
1978/79	7.0
1979/80	13.6
1980/81	15.9
1981/82	19.5
1982/83	20.9
1983/84	20.5

Coarse Grains

World coarse grain production has increased about 80 percent over the 25-year period (table 4.4). U.S. exports have increased about 270

Table 4.4--World coarse grain production, utilization, trade, and carryover stocks

Year 1/	Production	Utilization	U.S. exports	Non-U.S. exports	Total trade	Ending stocks 2/	Stocks as percentage of utilization
	Million tons						*Percent*
1960/61	447.9	437.2	15.7	8.3	24.0	109.7	25.1
1966/67	521.2	520.0	20.0	20.0	40.0	76.1	14.6
1971/71	629.9	616.2	24.2	25.1	49.3	87.0	14.1
1976/77	703.5	684.2	50.6	33.3	83.9	78.2	11.4
1978/79	751.7	746.0	60.2	32.5	92.7	92.2	12.4
1979/80	740.6	740.0	71.4	27.8	99.2	92.7	12.5
1980/81	732.0	742.1	69.5	38.5	108.0	82.8	11.2
1981/82	768.6	738.6	58.4	38.0	96.6	113.0	15.3
1982/83	778.8	753.0	54.0	36.2	90.2	138.7	18.4
1983/84	685.1	758.7	55.8	36.7	92.5	65.1	8.6
1984/85 3/	804.4	780.8	58.1	45.1	103.4	88.8	11.4
1985/86 4/	825.4	796.6	51.8	43.0	94.6	118.6	14.9

1/ July-June year.
2/ Excludes total stocks in most Communist nations due to lack of published data. Stocks are an aggregate of individual marketing years and do not reflect stocks at a single point in time.
3/ Preliminary.
4/ Projected.

Source: (*23*). Includes wheat and wheat products.

percent, while U.S. competitor exports have risen 430 percent. This large increase in trade compared with a rather modest increase in world production suggests that importing countries account for most of the increased worldwide utilization of coarse grains. The declining level of stocks as a percentage of utilization also reflects a growing willingness of food-security-conscious countries to depend on imports to develop and maintain an expanding livestock sector.

The major coarse grain exporters are the United States, Canada, South Africa, and Argentina. The United States has been the dominant exporter and also has experienced the largest decline in exports since 1980 (fig. 4.3). The decline in U.S. exports can be traced to the world recession and the dollar's appreciation relative to the currencies of both importers and most other exporters. In addition, the expansion of livestock feeding of the 1970's in several major importing countries has leveled off.

The U.S. export share of the world coarse grain market was about 45 percent in 1970/71 and as high as 70 percent in 1979/80, but has hovered near 60 percent since then (fig. 4.4). Argentina's share decreased at the beginning of the period and became very unstable. However, Argentina has maintained that share since 1979 as world exports have declined.

The most notable change in import trade patterns for feed grains, as with food grains, is the increasing importance of developing and centrally planned countries as importers (table 4.5). Developed countries, excluding the United States, accounted for 79 percent of feed grain imports in 1970-72. Their share declined to 68 percent in 1975-77 and to 49 percent in 1982-84. Increasing import shares of developing and centrally planned countries offset this decline. The developing-country share increased from 9 percent in 1965-67 to 33 percent in 1982-84. The destination of U.S. feed grain exports clearly reflects these changing import shares (table 4.5). In 1970-72, 75 percent of U.S. exports went to other developed countries, compared with 49 percent in 1982-84.

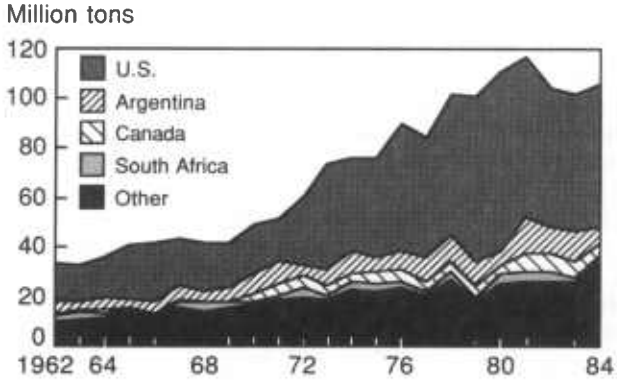
Table 4.6 shows the USSR's role as a major coarse grain importer. The USSR has become a large, but relatively unstable importer of coarse grains, as with wheat, beginning in 1971. Before that, the USSR was usually a net coarse grain exporter.

Soybeans and Related Oilseeds and Products

World production of soybeans, other oilseeds products, and oils during the last 10-15 years has risen over 80 percent, mostly in competitor

Figure 4.3

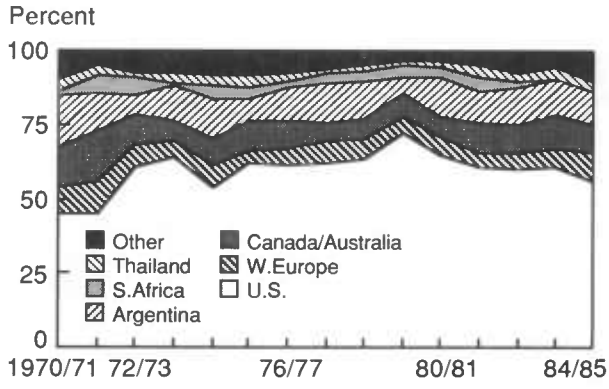
World Coarse Grain Exports



Source: *(10).*

Figure 4.4

Market Shares of World Coarse Grain Exports



Source: *(23).*

Table 4.5--Share of coarse grain exports going to major destinations, by principal source

Exporter and year	Importers: United States	Other developed	Developing	Centrally planned
		Percent		
United States:				
1970-72	0	75	14	10
1975-77	0	66	17	18
1979-81	0	52	27	22
1982-84	0	49	35	16
Other developed:				
1970-72	2	83	5	11
1975-77	2	78	7	13
1979-81	1	61	15	23
1982-84	2	63	22	13
Developing:				
1970-72	0	80	17	2
1975-77	0	59	30	11
1979-81	0	21	30	49
1982-84	0	24	46	30
Centrally planned:				
1970-72	1	89	9	1
1975-77	0	38	52	10
1979-81	2	38	55	5
1982-84	3	50	39	8
World:				
1970-72	1	79	11	9
1975-77	1	68	16	15
1979-81	0	50	24	26
1982-84	1	49	33	17

Source: (*10*). The trade table was constructed using the reporting countries' import values or the reporting countries' export values by selecting the largest reported value. Many centrally planned and developing countries do not report either import or export values. The major data deficiency resulting from this nonreporting situation affects trade values when both trading partners are centrally planned and developing countries.

countries (table 4.7). Increased soybean production in Argentina and Brazil accounts for a large share of the increase in protein meal output. The increase in fats and oils production has changed much less than in protein meal equivalent. Most of the expansion in production occurred outside the United States. A large share of increased U.S. soybean production has been exported as raw beans. In contrast, Brazil and, to a lesser extent, Argentina have increasingly emphasized the export of soybean meal.

Table 4.6--USSR's import share of total world coarse grain trade

Year	Percentage of total
	Percent
1971/72	7.6
1972/73	10.0
1973/74	8.0
1974/75	3.9
1975/76	18.0
1976/77	6.5
1977/78	12.2
1978/79	10.2
1979/80	16.7
1980/81	16.4
1981/82	22.5
1982/83	11.1
1983/84	11.6
1984/85	24.2

Soybean meal is the most important source of world protein meal production (fig. 4.5). Fish and peanut meal have about held their own, but rapeseed and sunflowerseed have gained ground since the mid-1970's.

World fats and oils production is distributed a little more evenly among crops than is protein meal (fig. 4.6). The world total has been growing but most sources of fats and oils have maintained their relative importance to the total.

The United States dominates world soybean exports, with 70 percent of the world market (figs. 4.7 and 4.8). Brazil expanded bean exports beginning in the early 1970's. However, it shifted emphasis to meal in the late 1970's. Argentina expanded exports in 1979 after Brazilian exports contracted. Brazil's importance in the trade of processed soybean products is shown in figures 4.9 and 4.10 for soybean meal and cake. Brazil and the United States are the largest soybean oil exporters (figs. 4.11 and 4.12). Other exporters' shares of oil and meal exports have grown rapidly in the last few years. The EC accounts for much of this growth, exporting the products processed from imported soybeans.

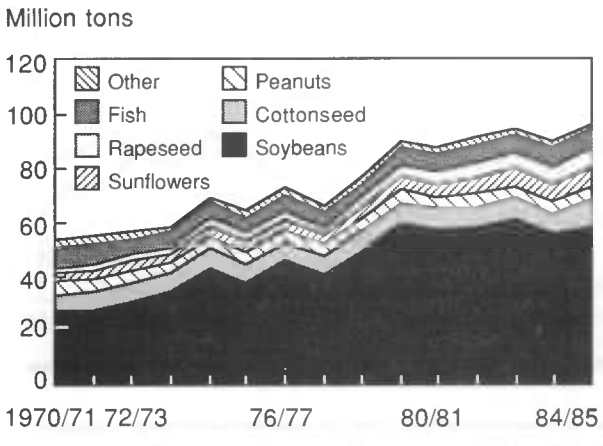
Table 4.7--World, U.S., and foreign production of oilseed products and fats

Item	1972/73	1979/80	1982/83	1983/84	1984/85	Percentage change, 1972-85
	Million tons					Percent
44-percent meal equivalent:						
United States	17.8	27.3	27.0	22.8	24.8	+39
Non-U.S.	35.6	58.8	69.0	68.8	72.8	+104
World	53.4	86.1	96.0	91.4	97.6	+83
Fats and oils production:						
United States	7.8	10.4	10.5	9.6	9.9	+27
Non-U.S.	30.6	41.6	46.8	47.1	50.0	+64
World	38.4	52.0	57.3	56.7	60.0	+56

Source: (*24*) and personal communication with USDA officials.

Figure 4.5

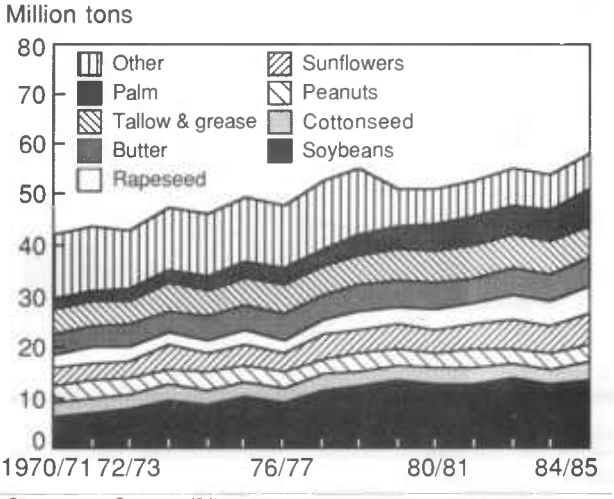
World Protein Meal Production by Type of Product



Crop years. 44- percent protein meal equivalent. Source: *(24).*

Figure 4.6

World Fats and Oils Production by Type of Product



Crop years. Source: *(24).*

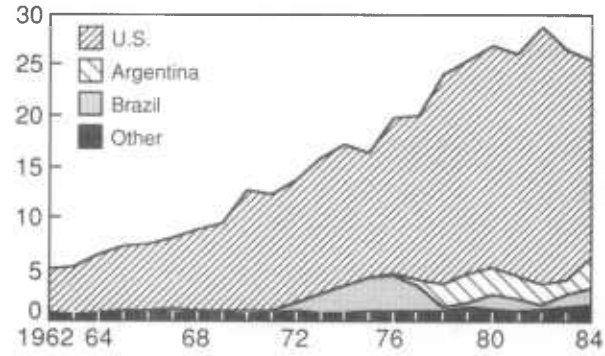
The recent decline in world soybean trade can be traced to several factors. One is a change in the EC import pattern. Increased feeding of surplus wheat to livestock, reduced dairy production, and increased imports of high-protein corn gluten feed have reduced EC soybean imports. Also important to the decline in soybean trade has been reduced imports by developing countries. Since the 1981-83 recession, they have cut back their purchases because of their large foreign debts, the higher real price of soybeans caused by the appreciating dollar relative to their currencies, and a slower growth rate in livestock production.

Oilseed imports by developing and centrally planned countries have less impact on world trade patterns than do food and feed grain imports (table 4.8). Both groups of countries have increased their shares of world oilseed imports, but developed countries, excluding the United States, still accounted for 77 percent in 1982-84.

Figure 4.7

World Soybean Exports

Million tons

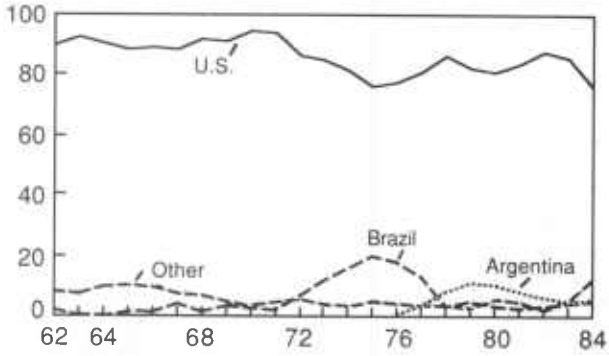


Source: *(10).*

Figure 4.8

Market Shares of World Soybean Exports

Percent

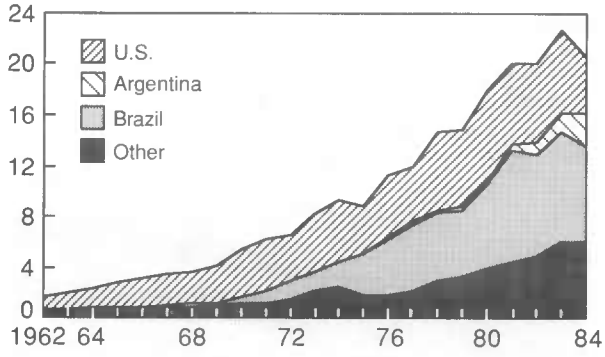


Source: *(10).*

Figure 4.9

World Soymeal and Cake Exports

Million tons

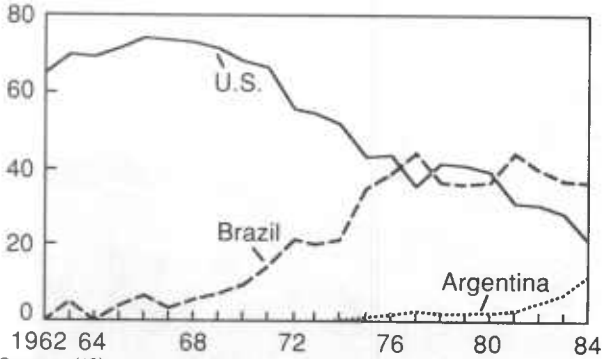


Source: *(10).*

Figure 4.10

Market Shares of World Soymeal and Cake Exports

Percent

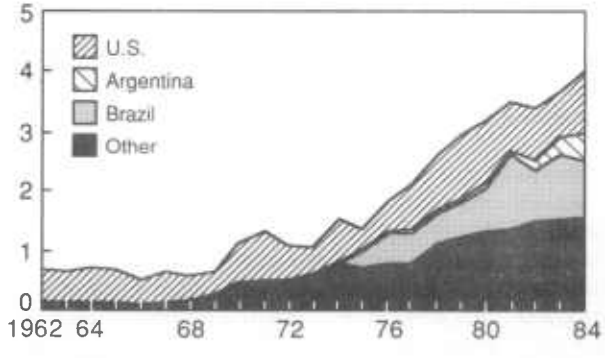


Source: *(10).*

Figure 4.11

World Soybean Oil Exports

Million tons

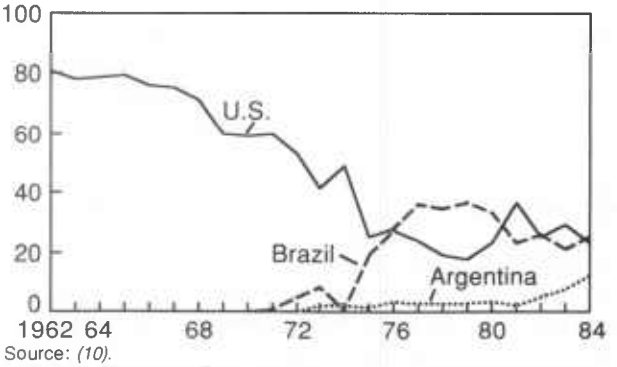


Source: *(10).*

Figure 4.12

Market Shares of World Soybean Oil Exports

Percent



Source: *(10).*

Table 4.8--Share of oilseed exports going to major destinations, by principal source

Exporter and year	Importers: United States	Other developed	Developing	Centrally planned
		Percent		
United States:				
1970-72	0	87	10	2
1975-77	0	83	13	4
1979-81	0	78	15	7
1982-84	0	74	22	4
Other developed:				
1970-72	2	87	7	4
1975-77	3	89	6	2
1979-81	3	89	5	2
1982-84	3	93	3	1
Developing:				
1970-72	6	79	9	5
1975-77	1	74	9	15
1979-81	4	66	15	14
1982-84	2	69	16	12
Centrally planned:				
1970-72	1	99	0	0
1975-77	1	99	0	0
1979-81	23	77	0	0
1982-84	1	98	1	0
World:				
1970-72	2	86	9	3
1975-77	1	81	11	7
1979-81	2	77	14	7
1982-84	1	77	18	5

Source: (*10*). The trade table was constructed using the reporting countries' import values or the reporting countries' export values by selecting the largest reported value. Many centrally planned and developing countries do not report either import or export values. The major data deficiency resulting from this nonreporting situation affects trade values when both trading partners are centrally planned and developing countries.

Prices and Price Behavior

This section briefly discusses the nature of price determination in the international markets for wheat, coarse grains, and soybeans and looks at annual price behavior for wheat, corn, and soybeans from 1965/66 to 1984/85. Both the level and variability of these prices are considered.

Price Determination

Economists often distinguish between two fundamental concepts in commodity market analysis: Price determination and price discovery. Price determination is the manner in which the basic forces of global supply and demand interact with each other to determine the underlying per-unit value of a commodity at any given moment and place. This value will ration available supplies among competing uses (including inventory) in an active market. Price discovery involves the institutional process by which interested parties systematically attempt to find and use the underlying but unknown per-unit values for use in actual purchases and sales transactions.

The fundamental forces of price determination include changes in income, population, preferences, and government policies on the demand side and changes in technology, weather, input supplies and prices, and government policies on the production side. The price discovery process includes the diverse activities of individual traders, futures markets, spot and forward cash markets, market news services, and commodity speculators.

Consider how prices are determined on the international grain and oilseed markets. Distinguishing between national and international markets is important. For many commodities, including grains and oilseeds, national and international markets are often separated wholly or partially by specific domestic and trade policies of participating nations. Trade policies are the complex of tariffs, quotas, variable levies, and export subsidies, all of which in some way disconnect national buyers and sellers from international buyers and sellers. Domestic and international markets for wheat tend to be substantially more isolated from each other than are comparable markets for corn, other coarse grains, and soybeans. Chapter 6 fully develops the implications of domestic intervention for international market analysis.

Government policy decisions strongly influence import decisions in the major wheat importers of Japan, the USSR, Eastern Europe, China, and others (including the EC, which still imports some wheat). Therefore, these countries' domestic markets are generally

disconnected from international markets, at least insofar as prices are concerned. Hence, the wheat import volume demanded by these nations is largely the difference between domestic production and consumption decisions made at prices and under conditions determined by domestic food and agricultural policies. From year to year or month to month, changes in wheat imports by these nations can be virtually unrelated to world market price behavior.

On the export side, governments and government policy decisions act similarly to either disconnect or drive a wedge between national and international wheat markets. For example, the EC exports wheat without much regard for international prices; its export subsidy program effectively bridges the gap between lower and higher world prices, and provides a stable internal price guarantee for EC buyers and sellers.

U.S. wheat production is heavily influenced by domestic support prices: Target prices and, in earlier years, loan rates. Because the United States is a large wheat exporter, these support prices, through their influence on U.S. production, stocks, and exports, have a significant effect on world market prices.

The Canadian and Australian wheat boards can make decisions that markedly affect the behavior of the world market. However, because neither organization substantially subsidizes or taxes its growers despite domestic price discrimination, nor holds sizable season-to-season inventories, they are unable to disconnect their domestic wheat economies from world market prices for any extended period. However, they can quickly adjust short-term export prices to meet market and policy conditions.

Argentine export taxes and exchange rate manipulations partially disconnect wheat producers and consumers from the world wheat market. These interventions keep Argentine domestic prices lower than equivalent world prices.

These policy interventions by major actors in the world wheat market, plus similar schemes conducted by other, smaller trading countries, make the international wheat economy a distorted market. Thus, world wheat prices, arrived at by purchase and sales transactions of both private and government entities, reflect the net effect of basic supply and demand forces as they arise within trading nations and the effects of national policies.

The international soybean market is much more open and free than the wheat market. Price determination across national and international markets for soybeans and related products is substantially less distorted by various domestic and trade policies. The United States, with the lion's share of world production and trade, conducts a rather minimal direct price support program for soybeans, although corn and cotton programs indirectly impinge on U.S. soybean output. The other major exporter, Brazil, has intervened in its soybean export market to promote international sales of meal and to discourage whole bean exports so as to have sufficient domestic oil supplies to maintain low consumer prices. Hence, there is probably somewhat more trade in soybean products and less trade in raw beans than there would be otherwise.

Major soybean importers, like the EC and Japan, maintain relatively open markets for soybeans and protein meals. In fact, the operation of the EC's Common Agricultural Policy for feed grains leads to more soybean imports than otherwise would be the case because low tariff items like cassava can be mixed with protein meal to create substitutes for feed grains. To a large extent, price determination in the international soybean and soybean product markets reflect the international play of basic demand and supply forces.

International prices for corn and other coarse grains are determined in a trade policy environment intermediate between that for wheat and soybeans. The centrally planned importers, which are purchasing an increasing proportion of the world's corn exports, buy according to national plan requirements and centrally allocated foreign exchange reserves. For the EC, high internal support prices, import levies, and other trade constraints curtail consumption, stimulate domestic production, and insulate imports to the EC from changes in world corn prices. However, a large group of other nations, including Japan, collectively import half or more of the world's coarse grain exports. Many of these importers

purchase corn and other feed grains from the open market on a free-trade basis.

On the export side, the United States manages its corn prices and production with domestic programs similar to those for wheat. These price support and acreage reduction programs act to separate U.S. corn producers from the full force of international competition. Argentina exports its corn on the same basis as its wheat; that is, exports are influenced by export taxes and exchange rate interventions. Thus, price determination on the international corn market results from a blend of (1) national policy decisions by some large importers and exporters who insulate their domestic markets to some extent, and (2) a significant amount of open-market interplay of basic demand and supply forces.

Price Behavior and Variability

The price determination and discovery processes discussed in the previous section for wheat, corn, and soybeans create price observations that are reported hourly, daily, weekly, monthly, quarterly, and annually. Elsewhere in this report, relatively shortrun prices by months and quarters are discussed and analyzed. In this overview section, however, we consider three fairly long series of annual price observations.

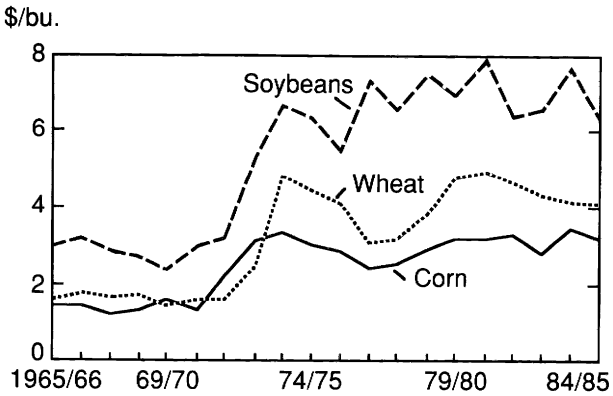
Figures 4.13 and 4.14 show the behavior of representative international prices, real and nominal, of wheat, corn, and soybeans from 1965/66 to 1984/85. These observations are annual average prices formed on open international markets at specific locations. They are the average prices at which the commodities were traded net of all price support or subsidy programs operated by national governments. Nominal prices rose sharply in the early 1970's but since then have shown no discernable trend. Real prices also rose in the early 1970's but have declined steadily since the middle of the decade.

All of the price series show substantial fluctuations from one year to the next. Because the daily and weekly prices from which these averages are calculated are constantly moving, any measure of fluctuation or instability based on averages is bound to be somewhat artificial. Yet, there is broad agreement that world markets for primary agricultural products and other raw materials tend to be volatile from period to period, no matter how fluctuations are measured. Among primary commodities and raw materials traded internationally, grain and oilseed prices tend to be in the lower middle group with regard to annual average price fluctuation and are less volatile than tropical products like coffee, cocoa, and sugar but somewhat less stable than bananas, cotton, or tobacco.

Price fluctuations from period to period are caused by perceived changes in supplies available from production or stocks and shifts

Figure 4.13

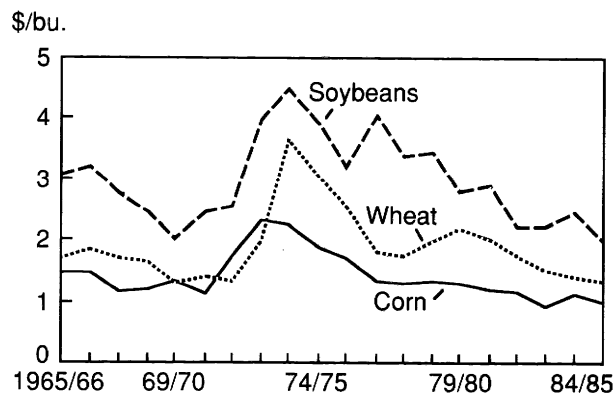
Nominal Export Prices for Wheat, Corn, and Soybeans



Marketing years. Sources: *(9,13,24)*.

Figure 4.14

Real Export Prices for Wheat, Corn, and Soybeans



Marketing years. Prices in 1967 dollars. Sources: *(9,13,24)*.

in demand by users. Because both the shortrun demand and supply functions of the raw products tend to be price-inelastic, small shifts in availabilities or consumption can set off relatively large and sudden price swings. Table 4.9 presents not only the basic price data from which figures 4.13 and 4.14 were developed but also the percentage change in each average price from one year to the next. A quick glance at these annual changes indicates that the prices of all three commodities were subject to both large and small fluctuations from year to year. However, it is not immediately obvious whether this tendency for prices to fluctuate is increasing or decreasing.

Notice the extremely large jumps in wheat prices in 1972/73 and 1973/74. Similarly, corn prices shot upward in 1971/72 and 1972/73 as did soybean prices in 1972/73. These price changes and the peculiar circumstances behind them have been discussed at length in other literature and, to some extent, elsewhere in this report. Here it is sufficient to say that these few years exhibited price fluctuations quite unlike anything before or since in the 20-year span of our data. As explained in Chapter 9, unprecedented price variability was a key factor in creating conditions in which embargoes could become a viable U.S. policy instrument in the 1970's. If these particular years are arbitrarily set aside, what can be said about overall price instability?

Table 4.10 presents average annual percentage price changes for the three commodities when those years of extreme volatility in the early 1970's are omitted from consideration. Three periods are examined for wheat: the 6 years before 1972/73, the 5 years after 1973/74, and the final 6 years in the overall period. The data suggest that price variability for wheat increased during the middle period, but returned to pre-1972 levels in the late stages of the 20-year span.

Table 4.9--International prices and price changes for wheat, corn, and soybeans

Year	Wheat 1/		Corn 2/		Soybeans 3/	
	Price	Percentage change 4/	Price	Percentage change 4/	Price	Percentage change 4/
	Dollars per bushel and percent					
1965/66	1.59	--	1.43	--	2.97	--
1966/67	1.80	13.2	1.45	1.4	3.20	7.7
1967/68	1.68	-6.7	1.21	-16.6	2.84	-11.3
1968/69	1.71	1.8	1.30	7.4	2.69	-5.3
1969/70	1.45	-15.2	1.56	20.0	2.34	-13.0
1970/71	1.64	13.1	1.34	-14.1	2.97	26.9
1971/72	1.64	0	2.17	61.9	3.19	7.4
1972/73	2.48	51.2	3.12	43.8	5.31	66.5
1973/74	4.82	94.4	3.34	7.1	6.65	25.2
1974/75	4.45	-7.7	3.02	-9.6	6.31	-5.1
1975/76	4.13	-7.2	2.87	-5.0	5.46	-13.5
1976/77	3.08	-25.4	2.41	-16.0	7.33	34.2
1977/78	3.16	2.6	2.57	6.6	6.57	-10.4
1978/79	3.83	21.2	2.92	13.6	7.48	13.9
1979/80	4.74	23.8	3.20	9.6	6.93	-7.4
1980/81	4.95	4.4	3.20	0	7.87	13.6
1981/82	4.65	-6.1	3.33	4.1	6.40	-18.7
1982/83	4.32	-7.1	2.79	-16.2	6.55	2.3
1983/84	4.19	-3.0	3.45	23.7	7.64	16.6
1984/85	4.13	-1.4	3.20	-7.2	6.30	-17.5

-- = Not applicable.
1/ #2 hard red winter, f.o.b., gulf.
2/ #2 yellow, f.o.b., gulf.
3/ #2 yellow, c.i.f., Rotterdam.
4/ From the previous year.

Sources: (*9, 13, 24*).

The price variability for corn seems to change little over the 20-year period, after the 2 extreme years are set aside. No matter how the periods are divided, world corn prices tend to fluctuate between 10-12 percent annually.

Soybean prices tend to fluctuate the most annually (fig. 4.13 and table 4.10). After the 1972/73 observation was deleted, the remaining data were divided into three 6-year periods. Soybean price variability clearly escalated in the middle of our 20-year period and seems to have fallen lately. The irregularity of recent changes in annual average soybean prices is evidently pronounced in the sense that a price decrease is likely to immediately follow a price increase, and vice versa. This oscillating tendency is much less obvious for wheat and corn.

A simple statistical analysis of the ungrouped data indicates that there is no systematic trend in price variability over the 20-year period for any of the three commodities. Therefore, making a case that price volatility for grains and oilseeds is systematically increasing or decreasing is difficult, at least when annual percentage price changes are used as the relevant measure. The mid- to late-1970's appears to have been a period of higher than usual price instability for wheat and soybeans, even when the "shock" years are set aside.

Table 4.10--Average annual percentage price changes for wheat, corn, and soybeans on world markets

Item	Average annual price change
	Percent
Wheat:	
1965/66-1971/72	8.3
1974/75-1978/79	12.8
1979/80-1984/85	7.6
Corn:	
1965/66-1970/71	11.9
1974/75-1978/79	9.7
1979/80-1984/85	10.1
Soybeans:	
1965/66-1970/71	11.9
1974/75-1978/79	17.1
1979/80-1984/85	12.7

Source: See table 4.9.

The first and last periods—pre-1972 and post-1980—were times when the United States was accumulating and holding stocks under farm programs in order to support market prices at the loan rate. This prevented wide price variations. The intermediate period was one of stock disposal and limited accumulation. Given the importance of the United States in the wheat and soybean markets, the operation of U.S. domestic policies provides much of the explanation for differences between the periods.

MARKET STRUCTURE AND POLICY OF MAJOR EXPORTERS

A few countries account for a large proportion of world grain and oilseed exports. Canada, Australia, the EC, Argentina, Brazil, and the United States supply approximately 90-95 percent, 85-90 percent, and 95-97 percent of the world's wheat, coarse grain, and soybean exports. Policies in these countries, therefore, have a large effect on world grain prices and trade.

Canada and Australia function primarily as state traders in grains, relying on statutory marketing boards with far-reaching authority. Canadian and Australian farmers, despite various indirect subsidies, receive payments for their grain that are tied closely to seasonal movements in world prices. EC grain farmers, in contrast, are virtually disconnected from the level and fluctuation in international prices by relatively high domestic guaranteed prices and variable import levies and export subsidies.

Grain and oilseeds producers in Argentina and Brazil face uncertain, changeable markets and policies. A variety of government interventions in these markets have worked to both subsidize and tax these products over time and across marketing levels. However, world market prices fundamentally form the upper limit on longrun returns to growers in these Latin nations.

Canada

Canada has long been the world's second largest wheat exporter behind the United States and, recently, the third largest coarse grain exporter behind the United States and Argentina. The Canadian Wheat Board (CWB)

is the sole marketing agency for wheat, oats, and barley grown on the Prairies and destined for export or human consumption in Canada. The CWB generally charges a higher price for wheat sold domestically and is empowered to sell grain for feed on the internal market if it so chooses. The CWB's operations have recently covered 97 percent of Canada's wheat production, 92 percent of its barley production, and 80 percent of its oats output.

So-called "nonboard" grain is produced mainly in the eastern Provinces and is handled by provincial organizations and private traders. The operation of the CWB totally dominates Canada's grain trade because 82 percent of Canada's wheat, 45 percent of its barley, and only 3-4 percent of its oats are exported.

The CWB is an "Agency of the Crown," established in 1935 by an act of the Federal Parliament of Canada. The CWB does not own or manage storage facilities. These facilities are owned privately or by cooperatives and act as interior buying and handling agents for the CWB under agreements negotiated each year.

The CWB exports grain in two major ways. The first and most important is through a contract arranged directly between the CWB and the buyer, often a foreign government or government agency. Approximately 70-80 percent of annual sales are handled in this fashion. A significant and growing proportion of these government-to-government contracts are through long-term agreements. The rest are made indirectly through about two dozen accredited national and multinational grain firms that operate as international market intermediaries. These firms purchase grain from the CWB for their own account or to meet specific sales commitments to foreign customers. In addition, most direct sales made by the CWB also involve these grain firms as accredited export agents furnishing handling services and arranging appropriate documentation.

The CWB may sell directly to any given country as part of a long-term, bilateral agreement, or as an individual, commercial contract with an import buyer. Long-term agreements typically are broad commitments on quantities to be supplied and purchased over several years. Separate contracts specifying prices, credit arrangements, and other details are negotiated under each long-term agreement. The CWB was a pioneer among grain-exporting nations in developing long-term agreements with its major import customers, especially with centrally planned economies.

The CWB adjusts its selling prices daily, taking into account other exporters' grain prices (mainly those of the United States), the exchange value of the Canadian dollar, and other factors, including the size and position of its own inventories. CWB sales are all strictly commercial, either for cash or credit at prevailing market interest rates, on terms up to 3 years.

A fundamental mandate for the CWB is to transfer all sales receipts for grain from the export and domestic markets to growers after charges for transportation, elevation, cleaning, marketing, and administration are deducted. The CWB does not tax returns to growers for other purposes nor does it, except in rare instances, draw additional revenue from the Canadian Government for its operations. Hence, Canadian grain farmers are neither systematically subsidized nor taxed by the CWB's marketing and disbursement operations.

Growers are paid for their production on a price-pooling basis. The principle of this pooling is relatively simple. At delivery to the local elevator, the grain farmer receives an initial payment for the particular grain and its grade, less freight, elevation, and cleaning charges. After the crop year ends, the CWB closes its pool account on each grade. It deducts its expenses for marketing and administration, then disburses the balance to farmers in relation to each producer's delivery record.

The initial payment depends on an early price calculated and announced by the CWB (in consultation with the Federal Government) for individual grains and grades before the beginning of each crop year. This payment may increase or decrease from year to year as the CWB's assessment of world market conditions changes. If the final average selling price (less marketing costs) for any of the individual commodity pools is less than the initial payment, then the Canadian

Government covers the shortfall in that particular pool. This has happened only a few times in the CWB's history.

Although the CWB does not directly control grain production or acreage, it does organize and manage delivery access to local elevators and storage facilities by a complex system of delivery quotas. Inventory management is the central objective: Acquiring grain in accordance with market demand. Farmers receive delivery quota allocations throughout the marketing year in relation to their planted acreage of board-controlled grains. Depending on the production/demand balance in any specific year, grain can be either backed up on farms for later delivery or pulled into the marketing system for more immediate disposition. Yearend farm stocks vary considerably but usually amount to less than 25 percent of total Canadian supplies, with no clear longrun trend evident.

The CWB's stated objective is to end each crop year with delivery quotas high enough to allow all producers to deliver their entire crop. This has not always been achieved. In such cases, farmers can deliver carryover grain on subsequent quotas, but the onfarm storage cost lies solely with the producer. There is no government storage assistance. Only once in the post-World War II period has the Canadian Government attempted directly to take land out of grain production. This was in the surplus-ridden 1969/70 crop year under "Operation LIFT" (Lower Inventories for Tomorrow). The program sought to take wheat land out of production with payments similar to the diversion payments offered under various U.S. farm programs. The CWB cooperated in this effort and changed its delivery quota system to reinforce the LIFT program, which operated for only 1 crop year.

Railway transportation is crucial for Canadian grain, especially Prairie grain. The CWB and, more recently, the Grain Transportation Authority (in cooperation with CWB) are responsible for organizing and allocating available rail cars. Statutory rail rates regulate both the Government-owned Canadian National Railway and the privately owned Canadian Pacific Railway. These regulated rates, held at very low levels for many years, have provided a significant and controversial transportation subsidy for Prairie grain but have also likely contributed to a lack of investment in railway equipment. The Canadian Government is now systematically increasing these rates as part of a plan to phase out this transportation subsidy.

Australia

Australia is a major wheat exporter, historically holding third place behind the United States and Canada. In recent years, however, EC exports have supplanted those from Australia as third largest in the world, even though Australian wheat shipments have not systematically decreased. Although Australia produces and exports some coarse grains, its relative position in that market is quite small compared with that of the United States and Argentina. Therefore, the wheat policy regime in Australia is the relevant one for discussion here.

The Australian Wheat Board (AWB) fully manages and controls Australia's wheat exports and domestic sales. The AWB is a national, statutory board, established in 1948, with monopoly controls over the marketing and pricing of Australian wheat. The AWB, basic authority of which is renewed legislatively every 5 years, controls virtually all aspects of the wheat marketing process, domestic and export. It is operated similarly to the CWB but with some differences.

By law, producers must deliver their marketed wheat to board-licensed elevators or warehouses. The AWB is required to accept all wheat delivered to it or to reimburse farmers for onfarm storage, if necessary, at board-determined rates. The AWB sells wheat to domestic users at separate prices, depending on whether the grain is destined for food use or feed use. Domestic prices historically have been established at higher levels than export prices.

The AWB markets grain into export channels in three main ways. First and most important are direct sales to foreign governments, making up 60 percent of annual exports. Second are sales to private trading firms, which may export at whatever selling price they can negotiate but must designate destination, volume, and date of shipment to the AWB.

Some of these designated sales are to countries with which Australia has arranged long-term, bilateral agreements. Third, the AWB occasionally tenders export wheat for sale to private firms on an open basis. These private firms purchase tendered grain for their own account, meaning that subsequent disposition of it need not be documented to the AWB. The only restriction in such cases is that this tendered wheat cannot be sold to markets where the AWB has bilateral agreements (China, Egypt, Iraq, and USSR).

The AWB adjusts its official selling price daily, taking into account world market conditions (especially U.S. and Canadian prices). AWB sales are for cash or short-term credit at commercial interest rates. Most AWB sales are made for U.S. dollars, with subsequent exchange to Australian dollars managed by the AWB.

Like the CWB, the AWB attempts to transfer all sales receipts for grain to growers after charges for storage, elevation, freight, cleaning, marketing, and administration are covered. The AWB does not systematically tax grower returns for other purposes or attempt to inject subsidies into the wheat economy. Hence, in recent years, Australian returns to farmers for wheat have been closely related to the annual ups and downs of the world market. The higher home consumption price traditionally charged by the AWB sometimes systematically enhances incomes of wheat farmers. This market discrimination policy makes average net return to growers somewhat higher than they otherwise would be if the world price also prevailed for domestic wheat sales.

As with the Canadian system, growers are paid for their wheat on a price-pooling basis. At delivery, the wheat farmer receives an initial payment known as the guaranteed minimum delivery price, less storage, handling, and freight. The basis for making initial payments has changed somewhat over the years. Now, the AWB is using formulas based on a 3-year moving average of world prices, with restrictions on the maximum extent of movement possible from one year to the next.

The AWB closes its pool accounts at the end of each crop year. Up until 1979, the AWB operated a producers' stabilization fund in conjunction with its pool-disbursement scheme. If sales revenues permitted, some surplus was deposited in the stabilization fund, to be used in later years if initial payments and AWB's expenses exceeded actual sales revenue. If the stabilization fund was insufficient to meet payment commitments, the Australian Federal Government covered deficiencies between producer payments and revenues. Although no government funds have been required to support grower payments since 1973/74, in 14 of the previous 25 years such fund transfers had been required.

The AWB generally maintains modest carryover stocks from one season to the next, even though the nation's annual production is unstable. Australian production often doubles or falls by half from one year to the next because of highly variable rainfall.

The EC

The evolution of the EC's internal grain economy has brought the EC to self-sufficiency and beyond, first in wheat and now in all grains, excluding rice.

Coarse grain imports, including corn, have dwindled recently as domestic production has expanded. This phenomenon, coupled with steadily growing wheat exports, has pushed the EC into a leading and controversial role as a net grain exporter, beginning in 1980/81. The EC remains a net importer of soybeans, soybean meal, and to a small extent, coarse grains. The production and trade policies that have fostered these developments are now very important on the international scene.

Wheat

The Common Agricultural Policy (CAP) of the EC-6 (Belgium, West Germany, France, Italy, Luxembourg, and the Netherlands) was forged around a system of high internal grain prices, no production controls, community preference in trade, and a variable import levy (or export subsidy) scheme to shield internal prices from fluctuations in world price levels. The EC began in 1957 as a net importer of wheat and many other agricultural products. However, with the EC's growth of production efficiency, slow demand growth, and the incentives offered

by favorable, stable CAP prices, the EC became increasingly self-sufficient in most classes of wheat, shifting to a net export status in the mid-1970's.

The variable-levy/export-restitution system is the policy mechanism permitting this fundamental trade reversal. The difference between relatively high internal support prices and relatively low c.i.f. (cost, insurance, and freight) world market prices is constantly bridged by a variable tax levied on imports or a variable subsidy available on exports of various types of wheat. These values are calculated daily and publicized to private traders inside and outside the EC. The calculation formulas for levies and subsidies provide a sufficient financial incentive to benefit intra-EC trade at the expense of external sellers and buyers. Still, levied imports cover net deficits for the EC, and net surpluses are mainly pressed onto international markets with export restitutions.

Private traders, millers, and processors handle most day-to-day wheat transactions without direct intervention by the national government or the EC Commission as actual buyers or sellers.

Private traders and price-supporting intervention authorities hold ending wheat stocks. Price support stocks are destined for export sale or domestic disposal and, therefore, do not tend to build in the EC. Even in recent periods of surplus wheat production, total wheat stocks have not exceeded 21 percent of production, usually hovering around 16-18 percent.

Coarse Grains

The EC is still a net coarse grain importer, but the CAP is rapidly pushing it toward self-sufficiency. Imports, largely corn, have fallen rapidly since the mid-1970's and exports, mostly barley, have held stable or edged up slightly. The variable-levy/export-subsidy mechanism and marketing institutions for coarse grains and the absence of production controls promote this movement toward coarse grain self-sufficiency. Coarse grain ending stocks in the EC seldom climb above 10-11 percent of EC production.

Soybeans and Related Products

Soybeans, soybean meal, corn gluten feed, and other high-protein feedstuffs enter the EC without variable levies or other formal quantitative restrictions. This free trade foothold dates back to specific, duty-free bindings on soybeans and most byproduct feeds agreed to by the EC in the 1961 Dillon Round of international trade negotiations sponsored by the General Agreement on Tariffs and Trade (GATT).

These products, representing an exception to general EC policy, cause policy-induced distortions in trade because they are available to domestic processors and feed manufacturers at world prices, while related domestic feedstuffs are priced at higher CAP levels. Hence, soybean products and byproduct feeds, combined with cassava, have increasingly replaced higher priced domestic grains in animal rations in addition to their traditional role as protein-adding supplements.

Argentina

Argentina is an important actor in the world wheat, coarse grain, and soybean markets. In recent years, Argentina ranked fifth among wheat exporters, second behind the United States in coarse grain exports, and third behind the United States and Brazil in soybeans. Because of political instability, frequent changes in government, and abrupt shifts in economic philosophy within and between political regimes, the role of the government in the Argentine grain sector has fluctuated greatly since World War II.

The relatively open-market stance of the Argentine Government in the 1955-73 era was interrupted sharply in the 1974-76 period when the Peron government returned to power and reinstated the policies of nationalization and central economic control that had been in force before 1955. Following a military takeover in 1976, a general return to private enterprise and open markets has evolved across much of the Argentine economy, including agricultural production and trade. Various government agencies still intervene in the agricultural economy, especially on the export side, because Argentina's grain sector depends heavily on

exports. Approximately two-thirds of the country's corn and wheat production is exported as is half of its soybean crop.

The National Grain Board (NGB) has operated since 1956 as the primary agency responsible for government programs in grains and oilseeds. The NGB administers price support programs of grains and oilseeds, levies and collects export taxes, issues export licenses, manages the storage facilities and elevators owned by the government, and occasionally enforces export quotas. Its role and function change with shifts in political regimes and with changes in external markets.

The NGB has authority to negotiate bilateral trade agreements with import buyers. A recent example is a sizable 5-year bilateral agreement with the USSR negotiated in the wake of the 1980 U.S. grain embargo and covering 4.5 million tons annually of corn, sorghum, and soybeans. However, private traders make the actual grain sales and shipping arrangements out of Argentina. Since 1976, the NGB has not assumed ownership of significant quantities of grains or oilseeds. Actual transactions are conducted by approximately 35-40 exporting firms, of which the largest eight handle 60-70 percent of the total volume. Two large cooperative organizations account for about 80-90 percent of grain and oilseed exports.

Grain and oilseed production in Argentina has increased slowly, mainly as yields have increased. Subsidized credit and low direct farm taxation have assisted overall growth in output, but grain and oilseed price supports have not functioned well enough to add much to the stability or level of farm prices. Chronic inflation, ineffective NGB operations, export taxation from time to time, overvaluation of the currency, and complex multiple exchange rate regimes have combined to keep farm grain prices relatively low and only distantly related to world price changes.

Although overvaluation of the Argentine peso is a persistent and serious form of indirect taxation on grain exports, specific export taxes also have played a key role in domestic pricing of export grain. From an *ad valorem* rate of 10 percent in 1965, export taxes on wheat and corn rose intermittently to 50 percent in 1975 during the second Peron government. Taxes were cut to zero in 1977 but reinstated in 1981, reaching 25 percent in 1982. Taxes are currently 16.5 percent for wheat and 22.5 percent for corn. Export taxes on soybeans were instituted in 1974 at 46 percent *ad valorem*, reached 53 percent in 1975, and moved downward until set at zero in mid-1976. Since then, they have followed the export levies on corn and now stand at 23.5 percent.

Most observers believe that Argentina has much potential for expanded grain production and trade, despite formidable obstacles, such as those already mentioned in the economic policy arena plus the traditional landownership pattern that favors grazing and extensive land use rather than more intensive grain production. Much of Argentina's grain handling, transportation, and storage facilities are similarly outmoded and relatively inefficient.

Brazil

Beginning in the early 1970's, Brazil's rapid expansion into soybean production and processing catapulted the country into second place in the world soybean export market. In fact, Brazil has recently overtaken the United States in soybean meal and oil exports, while running a distant second in whole bean exports.

Private traders produce, market, process, and export Brazil's soybeans and products. Brazil's soybean sector has no monopoly export board. However, direct and indirect government intervention in Brazil's domestic and export markets has been pervasive and important in shaping the direction and character of the industry's growth since the early 1970's. These intervention policies can be grouped in three interlocked categories: Production, processing, and trade.

Brazil's rapid production expansion was caused mainly by expansion in area rather than through yield increases. In addition to high market prices for soybeans, generated by the world market in the 1970's and passed to farmers, subsidized production credit and other policies affecting related crops, like coffee and wheat, spurred soybean expansion. The Brazilian Government paid farmers to uproot old coffee trees and plant alternative crops in the late 1960's to curtail surplus coffee production. Much of this area went into soybeans.

In addition, the Government tried to achieve national self-sufficiency in wheat during this period and into the 1970's by means of high support prices for wheat. Soybeans and wheat can be readily double-cropped in many areas of Brazil. The climate is suitable, machinery and other inputs are similar, and the fertilizer used on wheat also benefits the following soybean crop. Hence, soybean and wheat acreage expanded together, with increases in soybean production outdistancing that for wheat.

While production policies and market prices encouraged soybean output, the domestic crushing industry expanded greatly to provide soybean products for domestic use and for export. A complex, ever-changing tangle of domestic market price and trade policies provided much of the impetus for this expansion. These policies sought to assure adequate supplies of oil for domestic consumption while maintaining adequate crushing margins for soybean processors. Policy schemes included price ceilings, export taxes, various subsidies, export controls, and trade "drawbacks." The drawbacks policy involves tax-free soybean imports for domestic crushing and subsequent exportation as meal and/or oil. Its implementation is a consequence of the massive expansion in domestic crushing capacity that has easily outrun the increase in Brazilian production.

The daily application of all the various export controls, taxes, and subsidies that influenced Brazil's emergence as a trader of soybeans and soybean products are focused in the Foreign Trade Office of the Bank of Brazil (CACEX). This office issues export licenses to private traders when it is convinced that all the current policies and trade constraints have been fulfilled.

Brazil's market and trade policies are designed to (1) keep domestic meal and oil prices relatively low, (2) discourage whole bean exports so that ample, cheap raw materials are available for the domestic crushing industry, and (3) promote exports of domestically produced meal and oil. These objectives, along with a desire to keep farm prices for soybeans at a profitable level, are difficult to meet simultaneously and consistently in a fluctuating international environment. Hence, government intervention in all Brazilian soybean-related markets is a constantly changing tangle of frequently conflicting policies.

MARKET STRUCTURE AND POLICY OF MAJOR IMPORTERS

On the import side, grain trade is dispersed over a larger number of countries. This section examines market structure and government policy for grain and oilseed imports for a representative group of countries: Japan, USSR, Eastern Europe, and Egypt.

Japan is a large, steady buyer of grains and oilseeds. Japan is also a wealthy nation with a relatively small, highly protected domestic farm economy. This protection spills over into its grain and oilseed trade policy. The USSR and Eastern Europe are centrally planned economies. Their dealings in world grain and oilseed markets reflect tight state control over import decisions and comprehensive economic planning in all sectors, including agriculture. Egypt is a major wheat importer and is a low income nation. Both commercial and concessional (food aid) shipments have been important in covering growing import requirements caused by an expanding population and substantial food subsidies for consumers.

Although Japan, USSR, Eastern Europe, and Egypt account for a large portion of world grain imports, other groups of nations are also important in the grain economy. For instance, the newly industrialized nations on the Pacific Rim (South Korea, Taiwan, Singapore, and Hong Kong) are growing importers of grains and oilseeds.

In addition, a large number of developing nations in Asia, Africa, and Latin America rely on grain imports to some extent. This group's reliance on imports, as well as its trade policies and practices, varies considerably. These nations, however, have similar characteristics: Growing populations, low per capita income, slow rates of increase in domestic grain production, international credit problems and foreign exchange constraints, and political instability. All affect grain and oilseed import behavior. The importance of these countries is growing in the world wheat market and may grow more in the coarse grain market,

particularly if their incomes grow rapidly. Changes in their macroeconomic policies will significantly affect world markets.

Japan

Japan is a very large, steady import market for international wheat, coarse grains, and soybeans. When single nations are considered, Japan is the world's leading importer of coarse grains and soybeans and has been among the world's top three wheat importers for the last 15 years. Wheat, however, is treated much differently than coarse grains or soybeans in a trade policy context. Wheat, as a food grain, is caught up in Japan's unique rice policy milieu.

Wheat

Wheat and rice are partial consumption substitutes, which create competition between rice production and wheat imports. For a variety of reasons, Japanese rice prices to producers and consumers are very high compared with world levels and are tightly controlled. Rice is the premier, traditional food staple in Japan, still constituting about 30 percent of domestic calorie intake and covering about 45 percent of the nation's cropland. Japan tolerates high price supports to producers and high prices to consumers because it wants to maintain self-sufficiency in rice production and protect small, part-time farmers who account for 85 percent of Japan's farms and produce 80 percent of its rice.

Japan tightly controls wheat and flour sales and correspondingly prices them high to protect this rice price structure without creating surplus stocks. Because Japan produces relatively little wheat, the burden of wheat price and quantity regulation falls upon imports. A high, internal wheat price is sustained by strict import quotas managed by the Japan Food Agency (JFA), an arm of the Ministry of Agriculture, Forestry, and Fisheries.

The JFA sets an annual import quota and allocates it among specific, registered Japanese trading companies that have a shared monopoly over wheat import tenders to the agency. These favored trading companies obtain their wheat supplies from affiliated firms or from vertically integrated export elevators and facilities located in producing nations like the United States. In addition, these designated trading companies also deal with the Canadian and Australian wheat boards and with other, non-Japanese private grain merchants.

The annual wheat import quota is based on estimated domestic demand and supply. Japan's wheat import quotas are stable because Japan is about 3-4 percent self-sufficient in wheat production and well over 100 percent self-sufficient in rice production. And its domestically produced food grain supplies are stable. The slow, steady upward trend in Japan's wheat imports over the past 20-25 years reflects a shift in food preferences away from rice toward a more diverse selection of foods, including other carbohydrates.

Feed Grains and Soybeans

Foreign feed grains and soybeans enter the Japanese market virtually without formal trade restrictions. The domestic output of these commodities is small, and direct payments provide existing producer protection. Rapidly growing demand for meat and livestock products in Japan and the projection for an expanded domestic beef producing and processing industry has maintained Japan's buoyant international demand for feedstuffs. Private trade, including powerful Japanese trading companies and allied organizations, conducts the day-to-day import business, drawing on world market sources, government and private. The domestic market for feedstuffs is also affected by a formal buffer stock and buffer fund system jointly managed by the Ministry of Agriculture, Forestry, and Fisheries and related private and cooperative institutions.

Domestic processing of imported and home-produced beans meets the vast majority of Japan's soybean-product requirements. Japan imports little soybean meal or oil. Domestically crushed imported soybeans make up 93 percent of Japan's meal consumption and 97 percent of its oil consumption. A large portion of domestically produced soybeans is used directly as food, either as green vegetables or in processed, traditional products like tofu and miso. Most imported soybeans move directly to Japan's oilseed crushing industry.

The USSR

The USSR's Ministry of Foreign Trade tightly supervises Soviet grain trade. Exportkhleb, an agency of the Ministry, handles all grain trading arrangements and actual transactions, import and export. This agency is one of 49 foreign trade organizations operating within the Ministry of Foreign Trade, 8 of which deal with agricultural and food products.

Exportkhleb deals directly with both private grain companies and foreign government marketing boards. Since the USSR emerged as a major, regular grain importer during the early 1970's, Exportkhleb has routinely entered the international market to specify quantities and qualities, prices, shipment dates, and origins. In dealing with export nations with state-trading or marketing board systems, Exportkhleb usually buys directly from the agency itself, the Canadian or Australian wheat boards, for example. For purchases from the United States or Argentina, it deals with private grain merchants or cooperatives. Private negotiations are the normal Exportkhleb procedure rather than open, public import tenders.

Individual purchases are not formalized with the standard grain export contracts widely used elsewhere but with special terms prepared by Exportkhleb solely for its own transactions. They are called "Soviet terms" and, over the years, have become standardized and well understood in the trading world.

As the Soviets have become more and more commercial in their negotiation of individual grain import sales, they have increased their commitments to long-term bilateral agreements with export nations. These arrangements are handled in diplomatic channels and typically specify minimum and possibly maximum volumes to be imported annually by the USSR and to be made available by the exporter. Such agreements have been concluded with the United States, Argentina, Canada, and Australia.

Payment for Soviet grain imports traditionally has been "cash against documents," with the U.S. dollar the major currency employed. However, more and more export nations are developing credit arrangements with the USSR for both short- and intermediate-term credits.

Hence, the Ministry of Foreign Trade through Exportkhleb must take into account the foreign exchange position of the USSR in planning and scheduling grain purchases from international sources.

Exportkhleb has some responsibilities in the central planning process of the government in addition to its function as a purchasing and managing agency. Import requirements for major product categories in the USSR generally emerge from a complex planning process involving domestic production targets, consumption (or utilization) goals, inventory management objectives, physical handling capabilities, and foreign exchange considerations.

Exportkhleb makes draft trade recommendations through the Ministry to the State Planning Committee (Gosplan). These are used along with other information to form official plan requirements for international trade and are transmitted back to Exportkhleb via the Ministry. Then Exportkhleb seeks to carry out the plan within the appropriate time period by making the most favorable transactions possible. Because agricultural production in the Soviet Union is highly unpredictable from year to year, it is difficult for outsiders to gauge the amount of grain imports or the composition that will be authorized and pursued. Import plan adjustments for grain are likely to be made continuously throughout any crop year.

Overall, the policy of Soviet planners for the past 12-15 years seems to include a strong commitment to upgrade and stabilize the amount of meat and other livestock products available to consumers. This, in turn, involves expanding and stabilizing the nation's inventory of livestock and its annual production out-turn. As a consequence, the availability of feed grains and other feedstuffs needs to be stabilized and increased. In the face of highly unstable and very slow-growing domestic production, imports of grains and oilseeds have and likely will continue to trend upward but with significant variability from year to year.

Eastern Europe

Eastern European trade with the noncommunist world in virtually all products, including grains, is managed by official state

agencies whose behavior reflects basic government objectives and specific plan requirements. The general model for foreign trade is patterned after (or similar to) the USSR system, already discussed. Nations in this group that play a sizable role in international grain and oilseed trade include Poland, East Germany, Czechoslovakia, Romania, and Hungary.

Operating typically as arms of both the ministries of agriculture and foreign trade, foreign trade agencies (or enterprises) conduct the actual negotiations and transactions. These organizations (Rolimpex in Poland and Koospol in Czechoslovakia, for example) negotiate directly with state and private export traders in a similar vein as USSR's Exportkhleb.

The foreign trade agencies in Eastern Europe, responsible for agricultural trade, respond to import requirements established in their continual national planning process. These grain import requirements generally reflect the net effect of either projected or actual domestic production of grains and livestock, planned consumption or feed utilization targets, and available stocks. Requirements tend to be continually revised as domestic weather and other factors affecting internal production and consumption fluctuate.

An important, chronic constraint in the trade and policy picture of Eastern Europe is scarcity of convertible foreign exchange. Poor general economic performance, low export sales, and/or the lack of outside, hard-currency credits create frequent foreign exchange shortages across the entire trading sector. Central allocation of foreign exchange to various trading agencies then dictates the extent to which planned exports can be acquired. It also makes the Eastern European importing agencies very price conscious in their negotiating behavior with export suppliers. Moreover, to sidestep exchange constraints, numerous Eastern European nations are attempting to promote direct or indirect countertrade arrangements, often in the form of barter. These kinds of arrangements have not become very important as yet in the grain sector.

Egypt

Egypt emerged as a major importer of wheat during the 1970's and early 1980's and now holds third or fourth place among buyers from the world market. Egypt also imports sizable volumes of corn and modest amounts of soybeans. The expanded wheat purchases have been in response to a rapidly growing population, increases in per capita income, and very little corresponding growth in domestic wheat production. A discussion of Egyptian policy indicates the types of policy regimes used by many food-importing developing countries.

Egyptian population growth combined with modest increases in income are the driving forces behind the expansion of bread (wheat) demand. This expansion has been fostered by a system of food subsidies operated by the Egyptian Government in which retail prices of bread and other cereal products have been held very low and stable. To keep the food subsidy expenditures manageable, the government has kept average farm prices for wheat below world prices. Hence, domestic production has lagged demand and consumption growth.

Cereals, mainly wheat products, account for approximately two-thirds of the average daily caloric intake of Egyptian citizens. Imports now represent three-fourths of total wheat consumption. Hence, grain imports and their management are crucial to the Egyptian economy and, in turn, to political stability in that nation. About half of Egypt's annual wheat imports are received as concessional sales on special, long-term credit arrangements with its two principal suppliers, the United States and Australia.

Private enterprises have played virtually no role on the Egyptian side of grain import transactions since the end of World War II. Government agencies and public sector companies dominate most agricultural trade, particularly grains. The General Authority of Supply and Commodities (GASC), an arm of the Egyptian Ministry of Supply and Home Trade, manages overall import control for wheat and other grains (including oilseeds). GASC offers import tenders to only those public sector companies authorized to handle them. The public sector companies conduct the actual transactions with private grain exporters or export boards. The GASC then oversees delivery of imported supplies to domestic firms and agencies.

Egypt has been able to maintain a large demand for imported grains and other basic food commodities partly because GASC receives top priority for the centralized allocation of available foreign exchange. In addition, Egypt's major grain suppliers have been willing to extend low-interest, long-term credits for their products. The United States and some other international sellers recently have offered some special export subsidies and in-kind export bonuses to Egypt (and other Middle East nations).

MECHANICS OF THE INTERNATIONAL GRAIN TRADE

A large segment of international grain trade depends upon interlinked, flexible institutions, the behavior of which makes the world grain and oilseed economy operating between nations virtually a single entity dealing in essentially fungible goods and services. We must know something about how these institutions function in order to understand how they will respond to a policy change such as an embargo or a change in export pricing policies in the United States.

More than 90 percent of the world's wheat trade involves a government agency on one or both sides of the transaction *(17)*. Long-term bilateral agreements between governments affect grain markets and trade flows. Yet, 66-75 percent of all wheat moving between nations passes through both the hands and/or ownership of one or more private grain merchants. When coarse grains and soybeans are also considered, the proportion of sales conducted by private firms is much higher, particularly for soybeans. Furthermore, a large portion of the government-to-government grain trade involves private firms acting as agents on behalf of either the seller or the buyer. Hence, fundamental commercial procedures and activities should be considered for international sales and purchases of grain on either open markets or as part of bilateral agreements between national governments.

Many processes (such as inland transportation, cleaning, elevation, loading, and ocean transportation) in the sale or exchange of grain are necessary. How the process of arranging and paying for these functions affects prices and terms of exchange is discussed.

The Players

Government agricultural and trade policies, trading agreements, and national laws set the dimensions of the playing field within which the private grain trade functions. Direct participation in markets by large export boards, such as those for Canada and Australia also shape the nature of trading activity. Yet, a large share of exporting activity is conducted by private merchandising firms, acting on their own account or as agents of government or government-sanctioned monopoly boards.

A few large multinational firms handle much of the business. They tend to be diversified companies with extensive international information networks. These large firms, although leaders, are not the only players involved. Many smaller organizations, both private and cooperative, conduct business in virtually every market where private trade is sanctioned.

Bilateral Agreements in State Trading

A developing feature of the international grain market in recent years has been bilateral agreements of various durations between two national governments: An exporter and an importer. These agreements are typically 3- to 5-year undertakings arrived at through negotiation in diplomatic channels. They usually specify a minimum annual import commitment by the importing party to the exporter and a commitment by the exporter to supply at least that minimum amount. Of course, bilateral agreements may be wholly or partly suspended upon mutual agreement.

As a rule, specific prices at which agreement quantities change hands are negotiated separately from the overall negotiations as individual shipments are arranged or according to a prior agreement.

Prices for individual grain sales under bilateral agreements on a government-to-government basis are often decided based on a formula involving one or more observations from a well-known commodity market. The futures markets on the Chicago Board of Trade are often used. Specific quotations from that market on appropriate, agreed-upon dates are the basis from which further adjustments are

calculated for such factors as transportation, quality, and handling, thereby yielding the price for any particular government-to-government shipment.

The Grain Merchant's Function

Private grain merchants do not produce grain or oilseeds nor do they process it very much or sell it directly to consumers. These merchants are clear examples of trade intermediaries. Operating across national boundaries, they provide the classic economic functions of merchants, moving products from where they are abundant to where they are scarce. The merchants acquire and manage large inventories, rearrange them into parcels of various sizes and qualities, move them when and where they are needed, arrange for financing and insurance, and transmit price signals daily throughout the system, an important role in the international price discovery process.

Most large- and intermediate-size firms do not attempt to cover each domestic or international grain sale with a specific purchase to meet that particular commitment or vice versa. They stand ready to make a market, so to speak, on both sides by (1) purchasing grain to use their committed capacity in elevator space and transportation and (2) selling grain as opportunities arise around the world or within their scope of operation.

At any given moment, the leading firms own an inventory of grain. It is often very large, has various characteristics, is located in various places, and may be partly in transit. As grain is sold and purchased, this inventory shifts and adjusts. Firms earn or lose money based on how well they manage acquisitions to and disposals from their own inventory and how well they manage the inventory's movement, maintenance, and composition.

Export Sales

Grain traders generally contract with import buyers on the open market through public or private tenders. A tender is basically an invitation by a private or government importer asking for sellers to offer grain to meet specified requirements and to quote a selling price. In the open international markets such as those in Rotterdam, London, or Singapore, bids and offers are continually being made, often through specialized brokers or other affiliates.

Government import agencies may hold public tenders inviting interested sellers to submit bids, usually for large volumes at specific locations and delivery times. Then the agency accepts those that are most attractive in price or other terms. Additional negotiations can follow to cover alternative possible commodity mixes or shipping terms.

A legal contract almost always specifies the terms of individual international grain sales. Several standard contract forms have been developed and modified over the years to efficiently meet these requirements. These standard forms also permit specific special terms and conditions applying to any particular sale to be added. Sales to the USSR are typically made under other terms that are specified in writing by that nation and applicable only to individual shipments. These terms have become sufficiently standardized in recent years so that the trade understands them well and refers to them simply as "Soviet terms."

The most important terms established by the buyer and seller are the grain's quantity and quality, origin, destination, shipping period, delivery terms, price, and payment particulars. Delivery terms refer to how and when ownership passes from seller to buyer. The two most common deliveries for bulk cargo are free-on-board (f.o.b.) and cost, insurance, and freight (c.i.f.). For f.o.b. delivery, the seller is responsible for placing the grain at the end of a loading spout discharging into a cargo vessel. The buyer is responsible for providing the vessel, its subsequent movement, and other details relating to the shipment. For c.i.f. delivery, the seller not only provides the cargo but also covers the loading costs, vessel charter and related expenses, and cargo insurance until the vessel reaches its destination. The buyer pays for unloading and disposing of the grain. The standard contracts, mentioned earlier, contain provisions about responsibility for added expenses caused by delays or other unforeseen events.

Most export grain sales involving private traders are made on forward cash contracts, calling for delivery at specific times up to a year in advance. Some export contracts (called flat price contracts) fix the grain price at the time of sale. Exporters can quote forward prices even for grain they do not own because organized futures markets are available for hedging advance sales. Other export contracts stipulate that the buyer fix the grain price any time before delivery at an agreed "basis" value over the appropriate futures price quotation at the selected time. The latter contracts are called "basis price contracts," the "basis" being the cash price minus futures price at a given moment.

These sales types allow the grain buyer to select somewhat different types of business risk depending upon how the futures market behaves relative to the cash market in the period between the sale and either the delivery time (flat price contract) or the date at which the importer fixes the final price (basis price contract). A thorough discussion of how futures markets behave in relation to cash markets is beyond the scope of this report, but a few relevant points follow.

Futures Markets and Inventory Management

Private grain dealers typically own a sizable inventory of grain at any given time. Some of the inventory may be held physically by the firm, and some may be represented by contracts to accept delivery at a later time. The latter may be futures market purchase contracts or forward cash purchases. The size of the firm's inventory constantly changes as sales and sales commitments deplete it and as purchases and purchaser commitments add to it. The monetary value of this inventory also changes as grain prices change.

Because grain firms handle, merchandise, and deliver grain, they generally seek to protect themselves from the major business risks associated solely with possible changes in their inventory value. When prices are rising, grain can be sold from an unhedged (or unprotected) inventory at prices higher than those at purchase. But when prices are falling, grain can be sold from an unhedged inventory only at prices lower than those at purchase. Most firms judge that the risks associated with the latter situation, including bankruptcy, far outweigh the potential profits that might accrue in the former case. Hence, they use the futures markets to insulate most of their inventory from wide fluctuations in value caused by price level changes and to secure carrying charges for their physical inventories. Once hedging (future market sales made against actual grain purchases or futures market purchases made against grain sales commitments) offsets the major risks of price level, firms are able to concentrate on their main functions of handling, merchandising, and trading.

Although the futures markets for grains and oilseeds allow the trade to manage its inventory risk and thereby provide flexibility, other special aspects of the grain trade also enable firms to operate rather freely on an international scale. These include the nature of the market for ocean transportation, transactions in contracts themselves, and forward markets in currency exchange.

Transportation

Grain buyers and sellers make various transactions in the transportation market. International brokerage firms charter cargo ships and space on a variety of terms and in a variety of sizes and types. This provides much flexibility in the international moving and merchandising of grain. For instance, bulk grain transportation can be considered a commodity purchased and allocated much as the physical products themselves, or commitments can be purchased from vessel owners (usually through brokers) for voyages between major ports. These commitments specify ship arrivals at the trading port within a given period, the grain carriage to stated ports at specified rates, and other relevant details. These commitments are then tradeable themselves.

Ships can be chartered for single voyages, multiple voyages, or for an extended time period. Because freight rates and charter rates fluctuate, sometimes markedly, the management of transportation commitments is very important to profitable merchandising. At any moment, a grain firm may have access to both committed and uncommitted transportation that can be allocated rather

quickly into the most profitable sequence of uses, including the subletting of charters or the sale of other freight commitments. Hence, for c.i.f. sellers and f.o.b. buyers, ocean freight management is a crucial aspect of the grain business, adding to the fluidity of the world market and the basic fungibility of the commodities involved.

Strings, Circles, and Multiple Bills of Lading

Contract strings and circles, which are highly specialized transactions, provide another source of flexibility to sophisticated operators in the international grain trade under some market conditions. Any given lot of grain may be, and usually is, sold and purchased many times as it moves from the farm to the flour or feed mill. Grain may be sold to local elevators, then to larger handlers, perhaps to an export firm, then to an importer or a government board, and finally to a foreign feed miller. This series of transactions might be viewed as a "string," but this term is used in another sense in the grain trade.

A contract string in the grain trade is a series of transactions in which all parties, except the first and the last, are both buyers and sellers of the same lot of grain. What distinguishes this technical string from the sequence described previously is that each of the contracts in the string is for a commodity of the same description, for delivery at the same port (or shipment to the same port), governed by the same contract provisions, and subject to the same delivery period. The transaction prices for the segments in this string may and typically do differ from one segment to another. The contract terms are the same, but the price at which the contract as a whole changes hands before actual delivery varies according to private negotiation.

Strings are often created when the same contract for delivery of grain is sold several times as the commodity moves from one location to another. Purchases and sales of grain contracts do not qualify as strings in this technical sense unless all the relevant terms (such as product, delivery point, delivery period) are the same or very similar for the various transactions "in string." A single actual, physical delivery of the product is common to all the contracts in a string. This "paper" trade arises with f.o.b. contracts as a seller with a contract to deliver a lot of grain at a designated port at a specific time sells the contract obligations to another party. That intermediate buyer of the contract is now obligated to deliver the f.o.b. grain as specified to the original purchaser. This type of intermediary transaction may be extended until a string is quite lengthy with each party, except the original seller and buyer, being obligated on both sides as buyer and seller. Once the commodity is physically delivered and proper notification and documentation are passed through the string, payments are settled and the string dissolves.

Strings among c.i.f. contracts emerge occasionally. These strings are created after a cargo ship is loaded but before the various contract documents reach the last buyer, who will take delivery at the import location. Maneuvering with c.i.f. strings in a rapidly changing market allows traders to delay matching outbound shipments with delivery obligations until the last moment.

Strings are most likely in markets featuring sizable price swings and substantial uncertainty. Speculation and uneven distribution of market information create conditions that lead to contract trading strings. In volatile markets, firms usually wish to delay the matching of particular purchases and sales as long as possible, hoping to arrange more favorable matches (for the firm) in the interim. When markets are stable or moving slowly, stringing tends to dwindle. Paper trading in contracts largely acts as an adjunct to formal futures marketing, enabling traders to hedge or speculate on terms and in ways that are not otherwise possible.

A circle is a series of transactions like a string except that each and every buyer in the circle is also a seller of a product lot of the same description and delivery terms. A circle occurs when a seller of a contract buys it back before the execution date. A circle may have two, three, or more parties, each of which has purchased and then sold the same obligation and each of which remains legally committed on both sides of the transaction. The party that actually delivers the commodity sells that commitment to another party outside the circle, or purchases back a former short sale and initiates the financial and other settlements

within the circle. Such settlements are typically necessary because the contract obligations have traded at various prices among the parties to a circle. Circles can involve both f.o.b. and c.i.f. contracts and can be created within (along) strings. Circles generally are created and dissolved as a result of firms using the paper trade in contracts as a vehicle for hedging a short-term position elsewhere that cannot be covered by usual futures transactions.

String and circle trading in international grain contracts flourished in the middle to late 1970's because grain markets were buoyant and unstable in those years. Since about 1981, grain markets have become soft and stable. Paper trading in contracts has decreased markedly.

An additional dimension is the process of transshipment, where cargo is landed and sold in a port and a new bill of lading is produced. Such transactions would cause loss of identity of the original origin and provide even further flexibility in adjusting trade flows.

Optional Origin and Destination Contracts

Before about 1980-81, importing authorities of some large grain-buying nations, including USSR and India, frequently offered optional origin grain tenders. When negotiated into a sales agreement, the optional origin contract permitted sellers to meet the specified quantity standards with grain from any source or several sources. Such contracts, by allowing sellers more flexibility in managing their commodity, transportation, and financial resources, usually featured lower c.i.f. prices than specific origin transactions. This lower price aspect of optional origin contracts was appealing to large-volume, price-conscious importers to whom quality requirements were not too stringent.

However, use of the optional origin contracts has dwindled in recent years. The political advantage to some buyers, especially the USSR, of identifying the national source of their grain purchases apparently has exceeded savings value available from lower prices. In addition, the soft buyers' market and downward price pressures of recent years work against the money-saving aspects of the optional origin contract.

"Unspecified destination" contracts are also reported to USDA under the USDA sales registry policy. These contracts occur because the firm, not having moved the grain, either prefers that the rest of the trade (and the government) not know about the forward sale or has not determined a final destination. In the case of grain export boards, private firms sometimes buy from the boards "on spec" without identifying the final buyer.

Exchange Rate Protection

Most international prices and sales of grain and oilseeds are denominated in U.S. dollars, which considerably simplifies the negotiating and trading process. However, both buyers and sellers outside the United States may face a serious exchange rate risk. Buyers face a risk of adverse movement in the exchange rate of their currency versus the U.S. dollar between the time they sign the sales contract and the time they transfer the funds and physically own the grain. Similarly, non-U.S. grain sellers are at risk with exchange rate changes between the time they receive payment in U.S. dollars and the time they transfer these sales earnings into domestic currency to reimburse growers and meet other nondollar expenses.

Holders of currency inventories can hedge per-unit values in terms of other currencies through the international network of forward currency markets. This process is comparable to hedging the value of physical inventories or existing purchase and sales commitments on a commodity futures market. Contracts for future delivery or purchase of convertible currencies can be bought and sold readily. Thus, holders of currency inventories can lock in exchange rates at the moment when a sales or purchase contract for grain is signed. This possibility adds flexibility and fluidity to the international grain market by allowing the transfer or partial transfer of an important source of business risk to those willing to bear it.

Concluding Comments on the Mechanics of the Grain Trade

This overview of the mechanics of international grain trade underscores a few important points that nonspecialists need to appreciate. First, this is a complex, sophisticated business. The

firms and institutions that conduct the world's grain trade perform the classic function of merchant in the modern context. In addition, they manage the ancillary operations needed to store, move, reformulate, and finance a huge inventory flow over space and between marketing seasons.

International grain marketing is a highly flexible, fluid, and transnational system. Its ability to use futures markets, forward markets for contracts and currencies, short- and long-term transportation commitments, sophisticated finance markets, and modern technology permits it to overcome or adapt to natural instability and the impediments of national governments.

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CHAPTER 5

EFFECTS OF CHANGES IN THE DOMESTIC AND INTERNATIONAL ECONOMIC ENVIRONMENT ON U.S. AGRICULTURE

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CHAPTER 5

EFFECTS OF CHANGES IN THE DOMESTIC AND INTERNATIONAL ECONOMIC ENVIRONMENT ON U.S. AGRICULTURE*

Developments in the international monetary system and in world energy markets have acted as major catalysts of structural change in the global economy since 1970. As the orientation of U.S. agriculture toward international markets has grown (see Chapter 3), it has become increasingly affected by developments in the global macroeconomy. Fiscal and monetary policies, through their effects on interest rates, inflation, exchange rates, and economic growth, have become important determinants of the welfare of the agricultural sector and rural communities.

This chapter discusses how changes in the domestic and international economic environment affected U.S. agriculture during the 1970-84 period. It focuses particularly on the causes of agriculture's depressed economic condition since the early 1980's.

We begin with a review of changes in world trade since 1970. We then examine three broad sets of changes that have significantly affected world trade in the past decade: Changes in the global monetary system, oil price shocks, and changes in macroeconomic policies. Each of these have affected agriculture.

CHANGES IN WORLD TRADE AND THE TRADE ENVIRONMENT

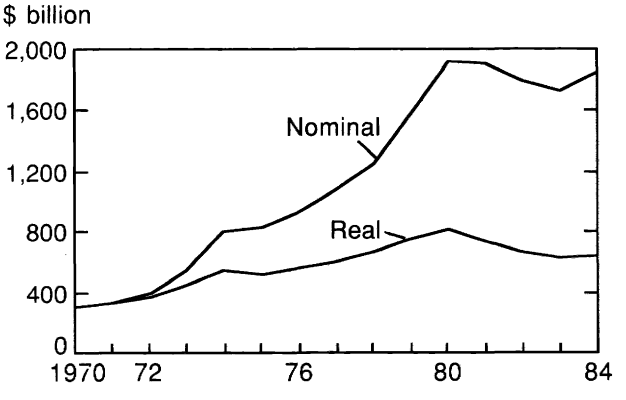
International trade became increasingly important for U.S. agriculture in the 1970's. In 1970, farm exports represented just over 14 percent of the value of farm marketings, reaching 30 percent by 1981. Developments related to world trade became increasingly important for agriculture and farm income.

World and U.S. Trade Since 1970

World trade grew rapidly during the 1970's. The nominal value of world merchandise imports expanded from $300 billion in 1970 to $1.6 trillion in 1979 (fig. 5.1). Even after we adjusted for inflation, the increase was almost 150 percent. Trade volume rose 68 percent over this period at a rate of over 5 percent per year (fig. 5.2). The real trade value increased

Figure 5.1

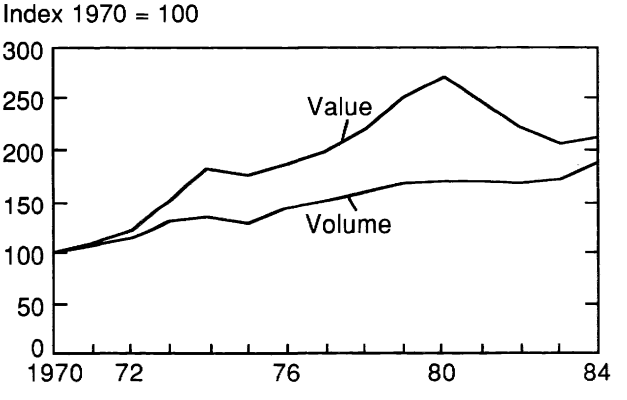
World Import Values



Real values in 1970 dollars. Source: *(17)*.

Figure 5.2

Volume and Real Value of World Trade



Source: *(17)*.

*Contributors to this chapter were David Blandford and Nancy E. Schwartz.

at an even faster rate of just under 10 percent per year. However, stagnation started in the early 1980's. For example, trade volume rose only 1 percent between 1979 and 1980 and remained relatively flat until 1984 when it increased almost 9 percent.

The structure of world trade since 1970 has also changed (table 5.1). The share of the industrialized countries in both world exports and imports, although still dominant, has fallen. Both oil-exporting and oil-importing developing countries have increased their shares of world exports. Oil exporters have also increased their share of world imports.

Agricultural trade expanded rapidly during the 1970's (fig. 5.3). After we adjusted for inflation, trade value increased 70 percent between 1970 and 1980. However, in line with other products, real value fell sharply during the early 1980's. By 1983, for example, trade had declined 35 percent from its 1980 peak. Despite the rapid growth in agricultural trade during the 1970's, agriculture's share of world trade continued its long decline (fig. 5.3). Demand for agricultural products responds less to income growth than does demand for industrial products. Growth in agricultural trade consequently has tended to be lower than trade in other products.

U.S. trade expanded rapidly during the 1970's. After we adjusted for inflation, exports grew at an average annual rate of 9 percent between 1970 and 1980 (fig. 5.4). The corresponding growth rate for imports was 11 percent. Both exports and imports fell in real terms in the early 1980's. By 1983, real exports had dropped 25 percent below their 1980 level compared with an 11-percent decline in real imports over the same period. Despite these reductions, the generally sluggish rate of growth in world trade in the early 1980's meant that the U.S. share of total world exports remained relatively constant at roughly 12 percent (fig. 5.5). The U.S. share of world imports actually increased after 1980, climbing to roughly 18 percent of this total during the economic recovery year of 1984.

Table 5.1--World trade shares by major economic group

Item	1970	1984
	Percent	
Exports:		
Industrial countries	77	70
Oil-exporting developing countries	6	10
Oil-importing developing countries	17	20
Imports:		
Industrial countries	76	72
Oil-exporting developing countries	3	7
Oil-importing developing countries	21	21

Source: (17).

The general growth in U.S. trade throughout the 1970's meant that the ratio of both exports and imports to national income rose steadily. In 1970, values of exports and imports were each roughly 4 percent of gross national product (GNP). By 1980, these ratios had more than doubled. Total trade relative to income has fallen slightly since 1980, principally due to the decline in exports. In terms of the components of U.S. trade, the real value of agricultural exports grew just under 10 percent annually from 1970 to 1980, a total increase of 180 percent (fig. 5.4). This was followed by a 28-percent decline between 1980 and 1984. Industrial exports also grew strongly during the 1970's, expanding at an annual rate of 9.5 percent. They fell 25 percent between 1980 and 1983 (the same percentage as all trade) before rising 6 percent in 1984. Despite the substantial growth in total U.S. imports, real agricultural imports have remained constant since 1970.

U.S. agricultural exports, therefore, have followed closely the pattern of total U.S. exports over the past 15 years, indicating that major factors affecting nonagricultural export growth likely significantly affect agricultural export growth. Agriculture was not the only export-oriented sector to suffer a decline in sales to foreign markets in the early 1980's (fig. 5.4). Hence, export decline, a major source of difficulties in the farm sector in this decade, and elements of a long-term solution are not unique to agriculture.

Trade Liberalization and Protectionism

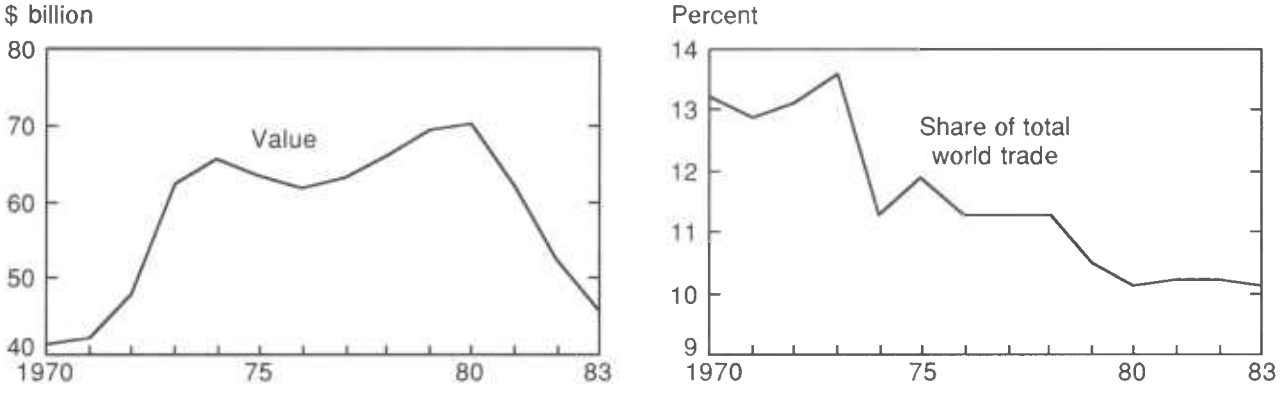
During the 1970's, the seventh in a series of rounds of multilateral trade negotiations (MTN)

was concluded under the General Agreement on Tariffs and Trade (GATT). The Tokyo-Geneva Round lasted from 1973 to 1979, the longest of all the GATT negotiating rounds. Despite limited progress in some areas, most notably agriculture, the MTN substantially reduced most industrial tariffs (table 5.2). It also produced codes to clarify the application of the GATT in such areas as subsidies.

Despite these improvements, tension in trade policy continued to build during the 1970's. Many countries complained of unfair and subsidized competition, and the number of actions by GATT members to offset the effects of alleged violations of the GATT increased. During 1978-81, 12 formal complaints were filed by various countries under the GATT, a number equal to all the complaints filed in prior years since the GATT was signed in 1947. The number of investigations initiated and actions taken under safeguard and antidumping provisions by major countries also increased. For example, the EC initiated 29 investigations

Figure 5.3

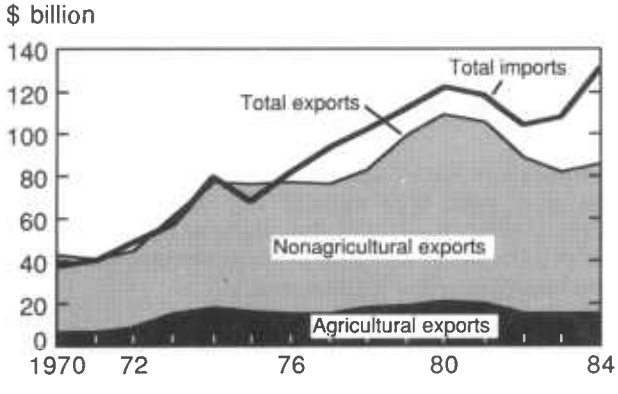
World Agricultural Trade



Values in 1970 dollars. Sources: *(17)* and United Nations

Figure 5.4

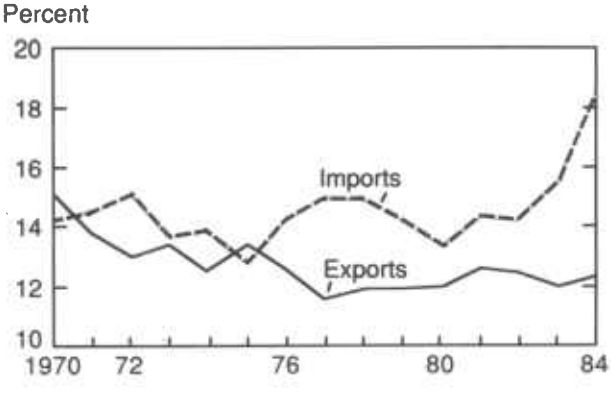
U.S. Trade Values



Values in 1970 dollars. Source: *(5)*.

Figure 5.5

U.S. Share of World Trade



Source: *(17)*.

of this type between 1971 and 1976 and took action to restrict imports in 18 of these cases. In contrast, the EC initiated 230 investigations between 1977 and 1981 and took measures to restrict imports in 182 of these.

The liberal world trading order of the post-war period came under increasing stress during the late 1970's largely due to the changing international economic environment. Instability in the international monetary system, sharp fluctuations in energy prices, and the associated variation in world income substantially affected the world economy and trade and U.S. agriculture.

What Changes World Trade?

Two of the major determinants of international trade are income and exchange rates. Variations in world income strongly affect world trade volume (fig. 5.6). Because trade is sensitive to changes in the rate of world economic growth, it is also sensitive to the factors (such as changes in macroeconomic policies and world energy prices) that influence this growth. During the recession of 1974-75, a sharp decline in world income was associated with an even sharper decline in trade (fig. 5.6). World economic recoveries in 1976-77 and 1983-84 similarly were associated with more rapid increases in trade volume.

Table 5.2--Tariff reductions under GATT multilateral trade negotiations 1/

Commodity	Reduction	Average after multilateral trade negotiations
	Percent	
Wood, pulp, paper, and furniture	40	1.7
Textiles and clothing	19	11.8
Leather, rubber, footwear, and travel goods	14	6.3
Basic metals	31	2.7
Chemicals	38	5.3
Transport equipment	36	5.0
Nonelectrical machinery	47	4.1
Electrical machinery	34	6.1
Minerals, precious stones, and metals	43	2.2
Other manufactures	42	5.5

1/ Weighted averages of cuts agreed by the major industrial countries.

Source: (17).

In comparison, U.S. exports grew as world income grew until 1973, then declined sharply with the world recession in 1973-74 (fig. 5.7). Exports also increased sharply with the world economic recovery in the late 1970's but declined again with the recession of the early 1980's. Changes in income clearly do not account for all variation in U.S. exports. There is a negative correlation between changes in the value of the dollar and exports (fig. 5.8). Statistical analysis (see equation 1 in the Appendix) implies that much of U.S. export variation is related to changes in these two factors. Figure 5.9 compares actual changes in exports to those predicted on the basis of equation 1, which contains income and the effective exchange rate of the dollar. In most cases, the predicted values are close to the actual values, suggesting that world income and the dollar's exchange rate are both important determinants of total U.S. exports.

Several events since the early 1970's have had important implications for U.S. exports. During the last decade, the world moved from a system of fixed to floating exchange rates. Subsequent changes in the international value of the dollar have affected U.S. competitiveness and the balance of trade. In addition, sharp increases in the price of petroleum generated two major shocks to the world economy in the 1970's. Finally, changes in macroeconomic policies have affected growth in the world and the U.S. economies. The following sections discuss these factors and their implications for agricultural exports.

CHANGES IN THE INTERNATIONAL MONETARY SYSTEM

Changes in the international value of the dollar have affected U.S. exports (fig. 5.9). During the 1970's, major developments occurred in the international monetary system within which exchange rates are determined.

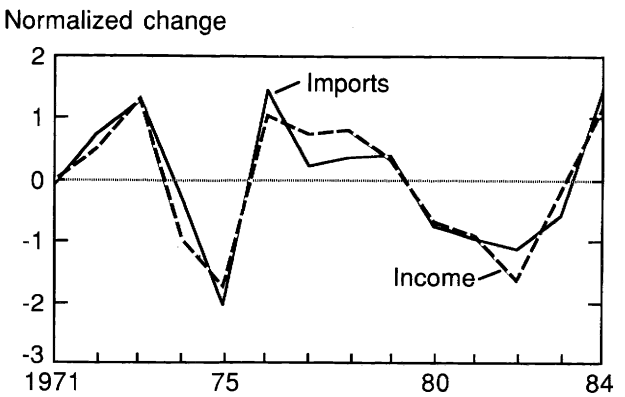
The Change from Fixed to Floating Exchange Rates

Relatively stable exchange rates characterized the world monetary system in the early

1970's. Under the Bretton Woods agreement signed in 1944, the member countries of the International Monetary Fund (IMF) set the value of their currencies in terms of gold. These values were called "par" values. The U.S. dollar was fixed at 1/35th of an ounce of gold (1 ounce of gold = $35) and could not be adjusted. The values of all currencies were essentially fixed in terms of the dollar and were allowed to fluctuate only within a 1-percent band around their par values. A change in the par value was allowed only in the event of a "fundamental disequilibrium;" that is, a persistent deficit (or in theory, a persistent surplus) in the balance of payments. Central banks were expected to buy or sell foreign exchange to maintain their exchange rates within the band. Sales of domestic currency could be used to lower the value of the currency in international markets; purchases were used to increase the currency's value. Temporary deficits in the balance of payments were

Figure 5.6

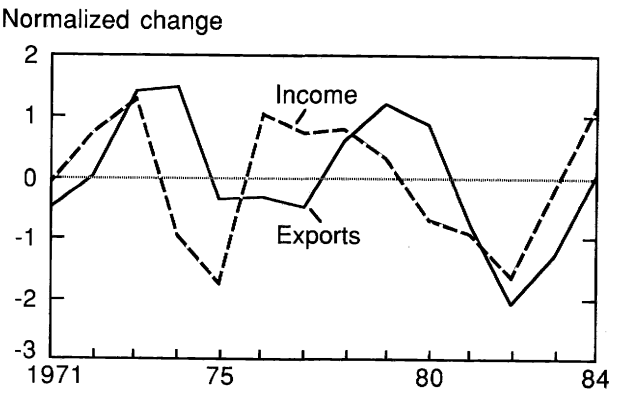
Changes in World Imports and World Income



Normalized change is from previous year. Normalized change = (change - mean change) ÷ standard deviation change. Source: *(17)*.

Figure 5.7

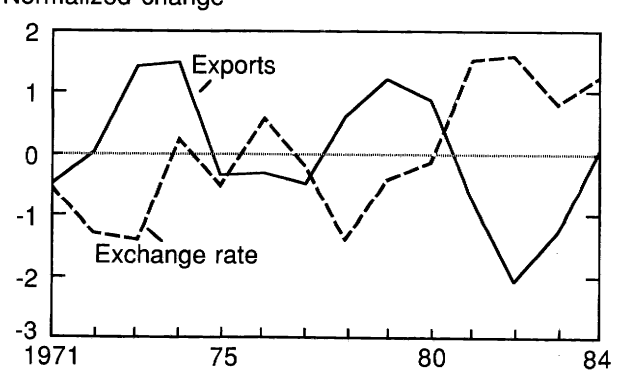
Changes in U.S. Exports and World Income



Normalized change is from previous year. Normalized change = (change - mean change) ÷ standard deviation change. Source: *(17)*.

Figure 5.8

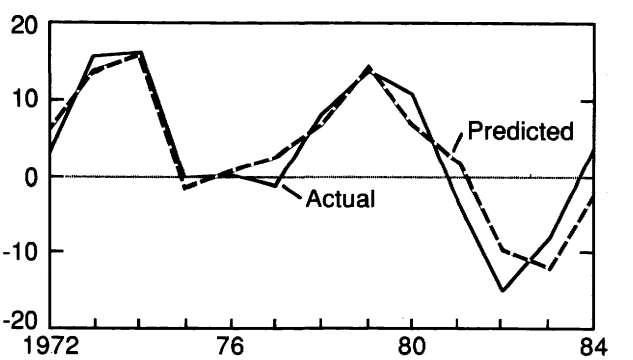
Changes in U.S. Exports and the Value of the Dollar



Normalized change is from previous year. Normalized change = (change - mean change) ÷ standard deviation change.Source: *(17)*.

Figure 5.9

Changes in U.S. Exports as a Function of World Income and the Effective Exchange Rate



Changes in 1970 dollars. Source: *(17)*.

financed out of foreign exchange reserves or through borrowings from other central banks or the IMF. Countries were expected to manage their economies in such a way as to ensure balanced trade on average. However, to eliminate persistent deficits in the balance of payments, some countries, such as Britain and Italy, were allowed to devalue their currencies against gold and the dollar during the life of the Bretton Woods regime.

The Bretton Woods system established the U.S. dollar as the world's principal reserve currency. Because of the size and strength of the U.S. economy, the dollar was used as the principal vehicle for world trade, and as a store of value or monetary asset by both central banks and private companies or individuals. The United States thus had a "seigniorage" position of being able to alter the size of world monetary reserves by increasing or decreasing its money supply. In the 1950's, U.S. expansionary monetary policy had eased the world liquidity shortage. However, by the 1960's, continued rapid U.S. monetary expansion had begun to outstrip international demand for dollars and contributed to increasing overvaluation of the currency. U.S. balance of payments deficits began to grow sharply, creating a glut of dollars held by U.S. trading partners. These countries, especially in Europe, complained that the United States was exporting inflation through its seigniorage position. Rather than restoring balance of payments equilibrium by reducing national income and, hence, the demand for imports, the United States allowed a substantial outflow of dollars to continue. To preserve fixed exchange rates, other countries were forced to increase the supply of their own currencies to buy the excess dollars, thus contributing to domestic inflationary pressures.

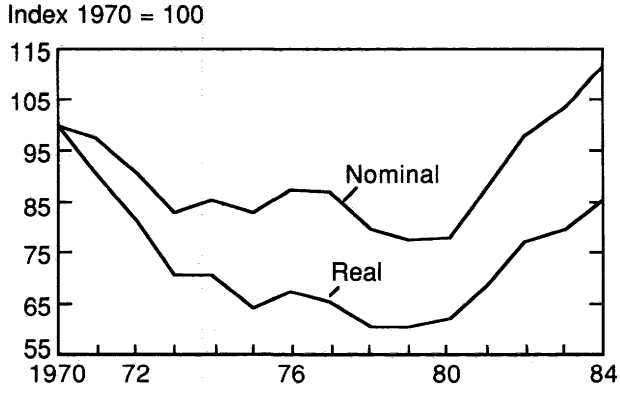
One "solution" to the problem would have been for strong currencies to revalue against the dollar. The United States failed to convince other countries to take such action. As a result, the dollar was finally devalued in 1971, and the official convertibility of the dollar against gold was abandoned. The central banks of other countries could no longer exchange their dollar reserves for gold held by the Federal Reserve, as required under the Bretton Woods system. Hence, from that date, the system essentially collapsed.

The devaluation of the dollar did not eliminate U.S. deficits. By 1973, it was apparent that fixed rates were no longer sustainable. That year, the Japanese yen and major European currencies began to float unofficially against the dollar. Their values were then determined by the volume of purchases and sales in international currency markets (with some intervention by governments to moderate exchange rate changes). For the second time, the dollar was devalued against gold in 1973. While the major trading countries (through the Committee of Twenty) were trying to establish a new international monetary order, the first oil shock by the Organization of Petroleum-Exporting Countries (OPEC) occurred. This oil price hike contributed to high inflation and unemployment and large balance of payments deficits in the major oil-importing countries. The price increase initially strengthened the dollar; however, its value (both nominal and real) remained well below the 1970 level. Between 1973 and 1976, the dollar varied considerably in value (fig. 5.10) but with no clear direction of change.

The IMF finally legitimized floating exchange rates with the Jamaica Accord in 1976. The

Figure 5.10

U.S. Exchange Rates



Source: *(17).*

agreement allowed for limited intervention by central banks in international currency markets (managed floating) to smooth "disorderly" market conditions. But, few constraints were placed on the exchange rate regimes, which member countries would adopt. Most countries decided not to allow their currencies to float freely but rather to peg their values against one of the major world currencies. In 1985, 33 IMF members had managed or freely floating currencies; the other 108 had some type of pegged system (table 5.3). The major European currencies, with some exceptions, have maintained a joint float (termed the "snake") against other currencies since 1973. Despite the large number of countries that still maintained pegged rates, the result of the Jamaica Accord was to subject between two-thirds to four-fifths of world trade to flexible exchange rates *(14)*.[1]

Implications of Floating Exchange Rates

The dollar resumed its decline against other major currencies in late 1976. The decline ended when the Federal Reserve, under the new chairmanship of Paul A. Volcker, instituted a highly restrictive monetary policy in October 1979. This restrictive policy helped to precipitate a major recession that strengthened the dollar and blunted the inflationary effects of the second oil shock in 1978-79 by reducing domestic demand and OPEC oil revenues. World recession and higher real interest rates during the early 1980's worsened the balance of payments deficits of Eastern European and developing countries and substantially increased their debt burdens. An international debt crisis of unprecedented proportions resulted. These events and their implications for the United States are discussed more thoroughly later in this chapter.

Fixed exchange rates had provided considerable stability to the United States. This was lost under flexible exchange rates. In its seigniorage position, the United States essentially established the world inflation rate through its monetary policy. Increased U.S. monetary growth expanded world liquidity and put upward pressure on world prices; lower monetary growth had the opposite effects. For much of the period during which the Bretton Woods system operated, U.S. trade took place under a strong, predictable dollar and under low, predictable inflation. However, to maintain their exchange rates, other countries were forced to lower their domestic demand through fiscal policies to avoid the inflationary effects of expansionary U.S. monetary policy. Furthermore, a major complaint against the Bretton Woods system was that when exchange rate changes did occur, they were abrupt and large. The changes were usually exacerbated by speculators who were protected against large losses by the guarantee of government intervention to defend existing rates. Floating rates were expected to produce smoother adjustments by permitting smaller, more frequent changes and by removing the protection that speculators enjoyed under fixed rates. However, exchange rate changes under floating rates have been much larger and more rapid than anticipated *(19)*.

The high variability has persisted since 1973 for both nominal and real exchange rates (fig. 5.10). This is particularly important because if changes in nominal rates merely reflected adjustments for differential rates of inflation across countries, they might be highly variable but real rates would be stable. The same would be true for relative prices across countries. Stable real rates would be consistent with stable long-term economic growth. Floating exchange rates were also expected to insulate domestic economies from external shocks. For example, a sharp drop in demand for exports should cause the exchange rate to depreciate, compensating for some of the lost income by stimulating new demand for exports. This would also help to restore equilibrium in the balance of trade while stabilizing the domestic economy. In this situation, domestic macroeconomic policies could be oriented toward domestic goals rather than both domestic and balance of payments objectives. However, floating exchange rates generally have not provided the anticipated insulation from external shocks, nor have they balanced trade, as demonstrated by the general

[1]Italicized numbers in parentheses refer to items in the References at the end of this chapter.

Table 5.3--Exchange rate arrangements as of March 31, 1985 1/

Pegged						Flexibility limited vis-à-vis a single currency or group of currencies		More flexible		
Single currency				Currency composite				Adjusted according to a set of indicators	Managed floating	Independently floating
U.S. dollar	French franc	Other	SDR	Other	Single currency 2/	Cooperative arrangements				
Antigua and Barbuda	Lao People's Democratic Republic 3/	Benin	Bhutan (Indian rupee)	Burma	Algeria 3/	Afghanistan 3/	Belgium 3/	Brazil	Argentina	Australia
Bahamas	Liberia	Burkina Faso	Gambia (£ stg.)	Burundi	Austria	Bahrain 4/	Denmark	Chile 3/	Costa Rica 3/	Canada
Barbados	Libya	Cameroon		Guinea 3/	Bangladesh 3/	Ghana	France	Colombia	Ecuador 3/	Dominican Republic
Belize	Nicaragua 3/	Central African Republic	Lesotho	Iran	Botswana	Maldives	West Germany	Peru 3/	Greece	Jamaica
Bolivia		Chad	Swaziland	Jordan	Cape Verde	Qatar 4/	Ireland	Portugal		Japan
						Saudi Arabia 4/		Somalia 3/, 5/		
Djibouti	Oman	Comoros		Kenya 7/	China		Italy 6/		Guinea-Bissau	Lebanon
Dominica	Panama	Congo		Rwanda, São Tome and Principe	Cyprus	United Arab Emirates 4/	Luxembourg 3/		Iceland	New Zealand
Egypt 3/	Paraguay 3/	Equatorial Guinea		Seychelles	Fiji		Netherlands		India 8/	Philippines
El Salvador 3/	St. Christopher and Nevis	Gabon			Finland 7/				Indonesia	South Africa
Ethiopia	St. Lucia	Ivory Coast		Sierra Leone 3/	Guyana				Israel	Uganda
Grenada	St. Vincent and the Grenadines	Mali		Vanuatu	Hungary				Korea	United Kingdom
Guatemala 3/	Sudan 3/	Niger		Viet Nam	Kuwait				Mexico 3/	United States
Haiti	Suriname	Senegal			Madagascar				Morocco	Uruguay
Honduras	Syria	Togo			Malawi				Nigeria	Zaire
Iraq	Trinidad and Tobago				Malaysia				Pakistan	
	Venezuela 3/				Malta				Spain	
	Yemen Arab Republic				Mauritania				Sri Lanka	
	Yemen, People's Democratic Republic				Mauritius				Turkey	
					Mozambique				Western Samoa	
					Nepal				Yugoslavia	
					Norway					
					Papua New Guinea					
					Romania					
					Singapore					
					Solomon Islands					
					Sweden					
					Tanzania					
					Thailand					
					Tunisia					
					Zambia					
					Zimbabwe					

1/ No current information is available relating to Democratic Kampuchea.
2/ All exchange rates have shown limited flexibility vis-à-vis the U.S. dollar.
3/ Member maintains dual exchange markets involving multiple exchange arrangements. The arrangement shown is that maintained in the major market.
4/ Exchange rates are determined on the basis of a fixed relationship to the SDR, within margins of up to ±7.25 percent. However, because of the maintenance of a relatively stable relationship with the U.S. dollar, these margins are not always observed.
5/ The exchange rate is maintained within overall margins of ±7.5 percent about the fixed shilling/SDR relationship; the exchange rate is re-evaluated when indicative margins of ±2.25 percent are exceeded.
6/ Margins of ±6 percent are maintained with respect to the currencies of other countries participating in the exchange rate mechanism of the European Monetary System.
7/ The effective exchange rate, measured by a basket of currencies of the main trading partners, is maintained within margins of ±2.25 percent.
8/ The exchange rate is maintained within margins of ±5 percent on either side of a weighted composite of the currencies of the main trading partners.

Source: (*14*).

deterioration of the U.S. current account balance since 1981 (fig. 5.11) *(14)*.[2]

Integrated Capital Markets

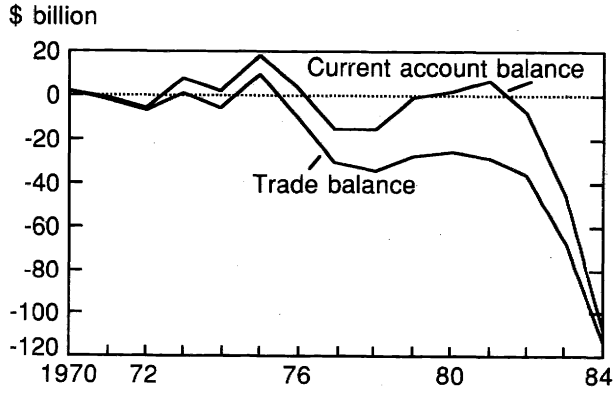
A major reason that the switch to floating exchange rates has not produced the domestic-insulating effects that some economists predicted is the growing integration of world capital markets *(14)*. Between 1977 and 1983 alone, foreign exchange activities of U.S. commercial banks rose from a daily average volume of $5.3 billion to $33.5 billion *(3)*, a disproportionately large increase compared with the growth in world trade over the same period. At the same time, the expansion of Eurodollar and other Eurocurrency accounts has been equally dramatic. Between 1970 and 1981, for example, the volume of dollars and other foreign currencies in Eurocurrency accounts rose from roughly $18 billion to $890 billion *(2)*. The amounts of internationally traded stocks and bonds, including Eurobonds and currency swaps, also have increased markedly. Capital flows can change much more rapidly than trade flows. The increase in the volume of transactions in international capital market has subjected exchange rates to greater variability and may have contributed to persistent disequilibria.

The recycling of OPEC oil revenues accounted for a large share of the increase in capital market transactions during the 1970's. However, policy changes and improved telecommunications also have stimulated increased integration of world capital markets. The removal of the U.S. withholding tax on foreign securities and the liberalization of Japanese capital markets enlarged the market size and increased capital mobility. Computerization and improved communications have been equally important in allowing market participants worldwide to respond almost instantaneously to new information. Increased market size and capital mobility have heightened the influence of short-term factors (such as differences in interest rates across countries) on short-term exchange rate movements, and have enhanced the size and frequency of exchange rate fluctuations *(14)*.

The collapse of Bretton Woods and the integration of world capital markets have not equally affected all currencies. The United States remains the dominant country in world trade, usually accounting for 12-15 percent of world merchandise exports and 13-19 percent of world imports (fig. 5.5). The size and strength of the U.S. economy relative to the economies of other countries have made foreign investors seek U.S. assets and U.S. bank accounts as protection against foreign-currency devaluations (such as in Central and South America). U.S. asset demand has been especially high due to the combined effects of countries wanting to invest in a stable, growing economy (often termed the "safe-haven" effect) and to earn the high real rate of return persistent on U.S. assets since 1979 (see *(18)*, for example). In addition, market activity is skewed towards the United States because

Figure 5.11

U.S. Trade and Current Account Balance



Source: *(17)*.

[2]Several standard concepts are used to identify the components of a country's international transactions in a given year. The trade (or merchandise) balance includes exports and imports of goods. The current account balance includes imports and exports of goods and services (including income from foreign investments) and income transfers between countries, such as aid to developing countries. The current account balance is usually referred to as a country's balance of payments. The current account reflects the amount of a country's foreign saving or borrowing in a given year. A U.S. current account deficit of $100 billion, for example, means that the United States has dissaved or borrowed that amount from abroad. Prior to the adoption of flexible exchange rates, the standard definition of the U.S. balance of payments was the "official settlements" balance, which included certain capital flows.

foreigners can purchase assets or open bank accounts in the United States much easier than can U.S. citizens abroad.

For these reasons, the dollar remains the premier world currency, both as a medium for international trade and as a store of value. The demand for world reserves has not decreased under floating exchange rates, and the U.S. seigniorage position has not been eliminated. Moreover, much of world trade, including most commodity trade, is conducted through dollar-denominated contracts. These factors help to explain why the United States can run a persistent current account deficit without necessarily causing the value of the dollar to decline internationally.

U.S. Exchange Rate and Trade Developments

The nominal effective U.S. exchange rate (fig. 5.10) shows four distinct periods for the dollar since 1970: The 1970-73 decline of about 20 percent, the 1973-77 fluctuation at lower levels, the 1977-80 renewed descent, and the 1980-84 appreciation. The dollar has again entered a period of depreciation since early 1985. In real terms, the dollar actually fell rather steadily until 1979, leveled off, and began rising sharply from 1981 through 1985 (fig. 5.10). The correlation between nominal and real exchange-rate movements has been quite high, contrary to prior expectations that real and nominal exchange rate movements should be quite different because the latter should adjust for inflation differentials between countries (see *(21)*, for example).

U.S. trade volume has moved in concert with exchange rates. The United States, which had alternating periods of relatively modest surplus and deficit in its current account balance since 1976, moved into a major deficit position in 1983 and 1984 (fig. 5.11). U.S. exports declined in response to the appreciating dollar and to sluggish economic growth in the rest of the world, while imports rose in response to the dollar and to accelerating domestic growth. U.S. real output, measured by gross domestic product (GDP), increased by 3.8 percent in 1983 and 6.5 percent in 1984 *(17)*. Despite the worsening trade deficit, the value of the dollar did not depreciate to correct the imbalance and actually continued to appreciate due to sustained high net capital inflows (fig. 5.10). This appreciation severely affected U.S. industries, which rely on export markets or compete with imports. Most of the commodity segments of U.S. agriculture fall into one of these two categories.

More flexible exchange rates have not resulted in predicted benefits: They have not stabilized the domestic economies of floating-currency countries or eliminated persistent disequilibria in the U.S. balance of payments *(1)*. Variations in the value of the dollar overseas have markedly destabilized U.S. trade and the industries that rely upon trade. The last section of this chapter deals with the effects on agriculture in more detail.

THE OIL PRICE SHOCKS AND THEIR AFTERMATH

In addition to the developments in the monetary system, a further catalyst of change in the economic environment facing U.S. agriculture has been changes in the price of energy, particularly petroleum. Figure 5.12 plots world petroleum production since 1970 and oil prices in both nominal and real terms in U.S. dollars per barrel. The first oil shock was in 1973-74 when the price increased roughly 95 percent from less than $4 per barrel to over $7.50 per barrel. The second oil shock was in 1979-81 when the petroleum prices increased to almost $32 per barrel. These sharp increases significantly affected the global economic environment, because of both the disruption they created in the economies of oil-importing countries and the policy responses they generated in these countries.

Impact on Major Economic Groups

The petroleum price hikes dramatically increase the real export earnings of oil-exporting countries. The primary effect of the price increases was to transfer a substantial amount of liquidity from oil importers to oil exporters. As noted above, this precipitated substantially expanded world liquidity and lending, particularly through the Eurodollar and Eurocurrency markets. The price increases also sharply decreased the ratio of central bank reserves to imports in both industrial countries and in the oil-importing

developing countries. In the developing country case, the ratio fell from 32 percent of imports in 1972/73 to 17 percent of imports in 1975. By 1978, the ratio had recovered to roughly 28 percent but fell again to 18 percent in 1981-82 after the second oil shock.

The major effect of the oil price increases was to stimulate global inflation (fig. 5.13). In industrial countries, for example, the rate of increase in consumer prices rose from less than 5 percent in 1972 to over 13 percent in 1974. After the second shock, the rate of consumer price inflation rose from 7 percent in 1979 to 12 percent in 1980. The effect upon the price level in oil-importing developing countries was even more dramatic. In the early 1980's, their average rate of inflation exceeded 45 percent per year.

Sharply increased energy costs precipitated economic recessions in both periods in oil-importing countries (fig. 5.14). The reduction in the economic growth of industrial countries was particularly dramatic in 1974-75. In developing countries, the effects of the second oil shock were more severe than the first. The difference was largely due to the change in the ability of these countries to borrow in order to sustain oil imports and to cushion the effect of the price increase on their domestic economies. The oil-price effect upon growth was weaker during the first oil price shock, primarily because oil-importing countries were able to increase their borrowing. For example, between 1972 and 1973, the real foreign liabilities of deposit banks in the oil-importing developing countries increased 45 percent and continued to increase at an annual average rate of 25 percent through 1981 *(13)*. Real borrowing, conversely, was reduced in the early 1980's. Real foreign bank liabilities of the oil-importing developing countries fell 17 percent between 1981 and 1984. This downturn had significant implications for economic growth and trade in developing countries and for U.S. agricultural exports.

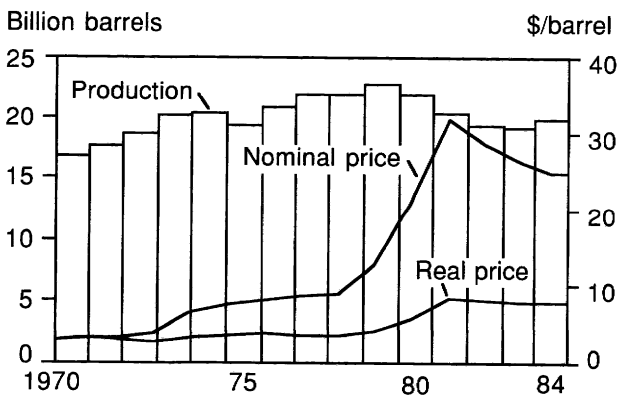
Impact on the United States

Both oil shocks sharply increased the U.S. inflation rate (fig. 5.15). The increase in the consumer price index rose from 3.5 percent in 1972 to 11 percent in 1974. With the second oil shock, the inflation rate increased from 7.6 percent in 1978 to 13.5 percent in 1980. Both oil shocks sent the U.S. economy into recession, and real income (GDP) declined in 1974 and 1975 and in 1980. The U.S. economy briefly recovered in 1981, but growth was negative the following year, reflecting the effects of the significantly different U.S. monetary policy pursued after the second oil shock compared with the first.

Real interest rates became negative during both oil shocks; however, the effect during the first period was more pronounced. Furthermore, there was a sharp, sustained rise in real interest rates after the second oil shock. The

Figure 5.12

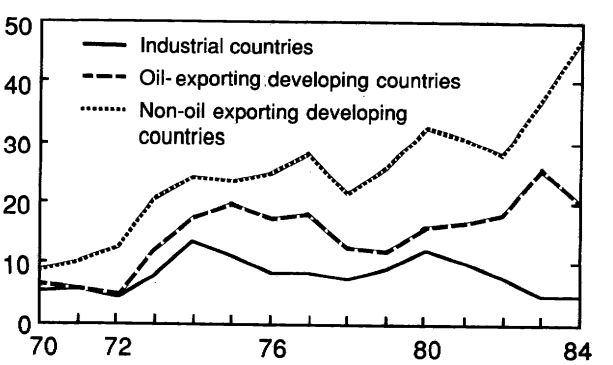
World Petroleum Production and Prices



Source: *(17)*.

Figure 5.13

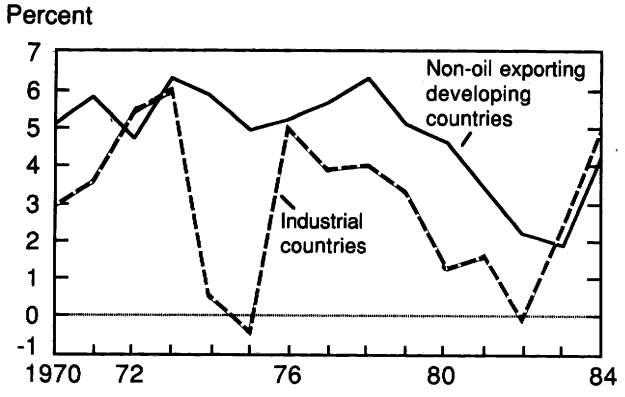
Rate of Change in World Consumer Prices



Percentage change from previous year. Source: *(17)*.

Figure 5.14

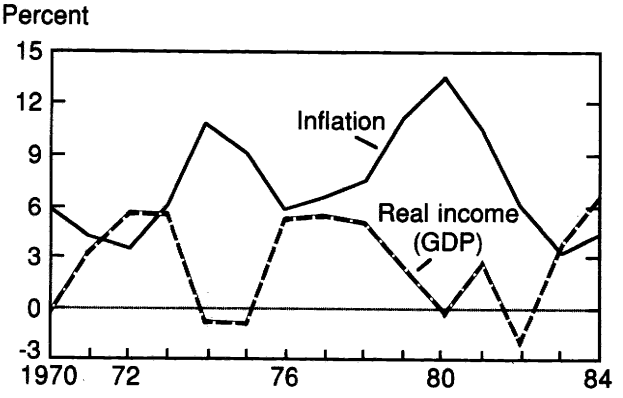
GDP Growth for Industrial and Non-Oil-Exporting Developing Countries



Percentage change from previous year. Source: *(17)*.

Figure 5.15

U.S. Inflation and Real Income Growth



Source: *(17)*.

increased interest rates were associated with more restrictive monetary policy instituted by the Federal Reserve. The broad money supply (M2) increased on average just over 7 percent in 1979-82, compared with an average inflation rate over the period of more than 11 percent. With this degree of contraction in real monetary growth, real interest rates began to rise (fig. 5.16). Rather than accommodating the increase in oil prices after the second oil shock, the Federal Reserve attempted to restrain inflationary pressures by limiting the growth in the money supply. This meant that interest rates increased as public and private borrowers competed for the reduced amount of liquidity available in domestic capital markets. The change to an expansionary fiscal policy in 1982 and 1983 intensified the increase in interest rates.

The Debt Crisis

In addition to the effects on the domestic economy, the second oil shock had international repercussions for agriculture. As indicated earlier, the impact of the first oil shock on the economic growth rate in oil-importing developing countries was considerably less than in industrialized countries. This was because the increased liquidity of oil exporters was partly "recycled" to oil importers through private bank lending. Furthermore, some oil-exporting countries took advantage of the increased value of their physical assets by borrowing to accelerate their economic development programs. By 1978, the total debt of oil-importing developing countries had risen to almost $340 billion, compared with $130 billion in 1973 *(15)*. Through international borrowing, developing countries were able to postpone their adjustment to increased oil prices and to maintain import levels of oil and other products.

With the world recession that followed the second oil shock and the substantial rise in U.S. and world interest rates, the debt situation in many developing countries became critical. The ratio of debt service payments to export earnings in IMF-identified "problem debtors" roughly doubled in 1977-82 to over 40 percent, compared with an average of roughly 20 percent for all developing countries in 1982 *(13)*. Interest payments began to dominate total debt service, while payments of principal fell. Interest payments for problem developing countries rose from an average of 8 percent of export earnings to almost 25 percent in 1977-82. These ratios were substantially higher in many large U.S. food importers, such as Brazil and Mexico. As international confidence in the financial stability of such developing countries declined, private sources of both short- and long-term credit began to dry up, and could not be replaced by the more modest resources available from public

sources. Total net borrowing from all sources fell from $120 billion in 1981 to $49 billion in 1984.

As a result of their difficulties, many developing countries were forced to limit their imports and finally to absorb the reduced real income created by increased energy prices. Efforts were made to restrain domestic demand and to increase exports *(16)*. These measures substantially affected imports by developing countries. Volume and value of imports by oil-importing developing countries fell sharply in 1981 and 1982 (fig. 5.17).

CHANGES IN MACROECONOMIC POLICIES

Policy responses, particularly those in U.S. macroeconomic policies, intensified the effects of changes in the international monetary system and the oil price shocks on the domestic and international economic environment. Variations in fiscal and monetary policies since 1970 have had a considerable effect on U.S. agriculture.

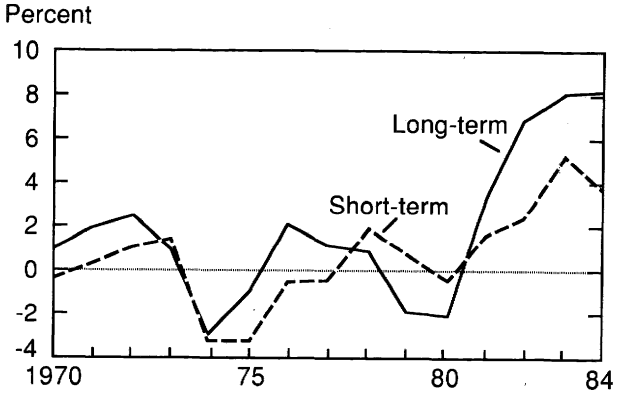
Changes in Fiscal and Monetary Policies

The combination of U.S. fiscal and monetary policies can affect the rate of economic growth, inflation, and interest rates at home and abroad. Fiscal policies affect economic growth in various ways. Increased government spending, for example, is likely to stimulate demand by increasing government purchases of goods and services. Reduced spending is likely to have the opposite effect. Tax decreases can raise both domestic demand and supply, depending on the nature of the tax reduced. Most types of tax reduction, such as that for income taxes, will increase domestic demand for goods and services. Tax reductions designed to increase investment and productivity are likely to affect directly demand and supply.

The effect of changes in fiscal policy depends on monetary policy and the degree to which productive capacity in the economy is being used. An expansionary fiscal policy when the economy is close to its full-employment level will raise interest rates, choking off some of the fiscal stimulus. An attempt to maintain stable interest rates by simultaneously expanding the money supply will likely result in inflationary pressures. U.S. fiscal policy since 1970 has generally been expansionary. The Federal deficit throughout the period has been 2-3 percent of GNP. However, since 1981, this proportion has doubled, mainly due to a combination of tax cuts and increased defense spending. At the beginning of this fiscal expansion, the United States was following a relatively restrictive monetary policy in an

Figure 5.16

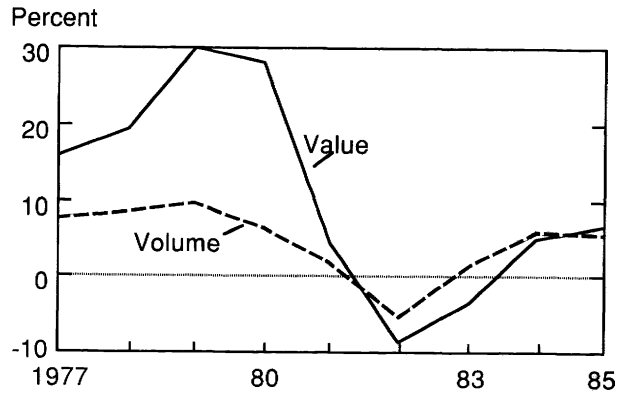
Real U.S. Interest Rates



Source: *(17)*.

Figure 5.17

Changes in Imports of Oil-Importing Developing Countries



Percentage change from previous year. Source: *(17)*.

attempt to dampen the inflationary pressures that resulted from the second oil shock. As a result, the expansion added further pressure to already increasing interest rates (fig. 5.15).

Contractionary and expansionary monetary policies have asymmetric, shortrun effects on the economy. A contractionary policy under flexible exchange rates raises short-term interest rates and lowers domestic demand. The recessions of 1974-75 and 1980-83 were primarily due to slowdowns in the growth rate of the U.S. money supply (fig. 5.15). As noted earlier, a policy switch by the Federal Reserve accompanied the second slowdown. Rather than seeking to target monetary growth toward the stabilization of interest rates, the Federal Reserve decided to maintain relatively stable monetary growth to lower inflationary expectations. This policy change raised real interest rates to historic highs and helped to precipitate a major recession but lowered the inflation rate. Expectations of sustained high Federal deficits in 1981 following the 1981 tax cut and the record-high Federal deficit also contributed to the widespread expectation that a prolonged period of tight monetary policy (and, therefore, high interest rates) would be needed to contain inflation.

Expansionary monetary policy has uncertain effects on demand, interest rates, inflation, and inflationary expectations. The success of monetary policy in stimulating demand depends largely on the level of domestic employment and the amount of excess productive capacity in the economy. The uncertain effects of monetary policy have been especially evident since 1984. For example, the basic U.S. money supply (M1) grew at an average rate of about 12 percent (8 percent for M2) between 1984 and 1986. However, U.S. real economic growth and inflation have been fairly low (about 2 and 3 percent in 1985). Most economists forecast low inflation through, at least, 1987, even taking into account likely increases in the price of imported goods due to the recent fall in the value of the dollar. In fact, despite the recent sharp decline in nominal interest rates, real rates remain at historically high levels.

The change in Federal Reserve policy in the early 1980's produced other important effects in addition to those on interest rates and the inflation rate. Most notably, the stabilization of the monetary growth rate generated record-high fluctuations in real and nominal interest rates over short time periods. For example, the U.S. prime rate rose from an average of 12.5 percent in 1979 to 19 percent in 1981, then fell back to 11 percent in 1983, representing average changes of 50-100 percent within a 1- to 2-year period. The intertemporal fluctuations were even larger. Such instability has added a new degree of uncertainty to borrowing and lending that may contribute to the sustained level of real interest rates because lenders demand risk premiums. Furthermore, instability has contributed to increased volatility in exchange rates, which respond in the short term to interest-rate differentials among countries. These differentials fluctuated principally because other countries are not following macroeconomic policies similar to those in the United States *(9, 18)*. Both of these factors have considerably affected U.S. agriculture.

Impact of Policies upon Exchange Rates

Exchange rates both affect and are affected by macroeconomic policies. These effects largely depend on the exchange rate regime (fixed or flexible) and the degree of capital mobility. The environment in which agriculture and other U.S. export industries have operated since the early 1970's has been one of high capital mobility and flexible exchange rates. In this type of environment, fiscal policy is less effective than monetary policy in influencing the rate of shortrun economic growth. Monetary expansion will generally cause the exchange rate to depreciate as interest rates fall and capital is attracted to overseas markets offering higher returns. The depreciation will generate new export demand, adding to any increases in domestic demand stimulated by the monetary expansion. In contrast, fiscal expansion raises interest rates as the government competes with other borrowers for funds in domestic capital markets. The effectiveness of fiscal policy depends on the tradeoff between any positive effect of increased government expenditures versus the negative effect of higher interest rates on the economic growth rate. These forces also work in the opposite directions on the exchange rate. The net effect may cause the currency to either appreciate or depreciate.

Monetary expansion in an economy close to full employment is likely to be inflationary. In this case, nominal interest rates may increase because of inflationary expectations, and the exchange rate will likely decline. Such inflationary depreciation may create a situation in which monetary expansion contributes to a cycle of inflation followed by depreciation followed by inflation. This cycle may promote little stimulus to economic growth, thereby creating general economic stagflation. This phenomenon may explain the high inflation and depreciating dollar of the mid-1970's *(15)*.

The role of monetary and fiscal policies traditionally has been seen to be the promotion of stable, noninflationary economic growth. And the role of exchange rate regimes has been seen to be the promotion of stable growth in world trade. What constitutes an "equilibrium" exchange rate, however, remains in dispute.[3] The value of the currency under floating exchange rates will adjust to its "market-clearing" value. Government intervention may be used to smooth adjustment (managed floating). Since exchange rates will always reach a market-clearing level, some economists have argued that the exchange rate can never be overvalued or undervalued. The general consensus is, however, that the dollar was undervalued in a long-term sense in the late 1970's and overvalued in the early 1980's. This assessment is based on the effect of the value of the dollar on national output and competitiveness. The low, effective real exchange rate of the late 1970's led to an unsustainably rapid increase in U.S. exports. During the 1980's, the United States has experienced an excessive decline in exports and increase in imports. Both of these periods dramatically affected U.S. agriculture. Neither reflect an equilibrium in terms of the underlying long-term competitive position of the U.S. economy (see *(8)*, for example).

In the long run, exchange rates reflect "purchasing-power parity." That is, they tend toward levels that equalize relative prices across countries and eliminate persisent balance of payments imbalances. However, exchange rates, particularly in the short run, may "overshoot" their longrun equilibria *(6, 8, 9)*. A major reason for this is that many prices may not adjust rapidly in the short run to changes in the economic environment, putting the burden of adjustment on the more flexible prices of which a floating exchange rate is a major example. In this case, a decrease in the monetary growth rate which increases domestic interest rates and attracts capital from abroad will raise the exchange rate above its equilibrium (purchasing-power parity) level. The short-term equilibrium exchange rate, thus, overshoots its longrun equilibrium rate. This could partly explain the high value of the dollar in the early 1980's. In addition, the fiscal expansion of the period also contributed to the rise in long-term interest rates relative to other countries and, thus, induced long-term capital inflows and a sustained currency appreciation *(9, 20)*.

These factors were important in creating the appreciation of the U.S. dollar during the early 1980's. The undervaluation of the dollar in the late 1970's similarly reflects the effect of the opposite combination of circumstances. High U.S. inflation and low interest rates relative to other countries led to capital outflows (notably to West Germany) and an overshooting of the dollar in a downward direction. The tendency for the dollar to overshoot its equilibrium under floating rates has had significant implications for industries which are affected by foreign competition in domestic or overseas markets. As such an industry, U.S. agriculture has felt the influence of changing macroeconomic policies and their effects upon the exchange rate.

Impact of U.S. Policies on Other Countries

The United States is the largest single-country trader, and other countries are linked to the U.S. economy through trade and international financial markets. Therefore, U.S. policy changes substantially influence the output and trade of other countries *(20)*.

U.S. macroeconomic policies that change U.S. income or affect the exchange rate influence U.S. trade and, in turn, foreign trade and income. Because U.S. domestic policies can influence foreign interest rates and given high capital mobility, U.S. and foreign interest rates

[3]**For recent surveys on the theory of exchange rate determination, see *(7, 12, 19)*. See *(11)* for papers and references on the question of overvaluation.**

usually move together. Thus, when U.S. interest rates rose to high real levels in the early 1980's because of a more restrictive monetary policy, real interest rates in other major trading countries also increased as foreign countries experienced net capital outflows to the United States. This contributed to the low rate of economic growth in these countries at the same time that it was low in the United States. Given that world income responds to world trade, the U.S. recession and efforts to control inflation had an intensified effect on trade. Furthermore, increased interest rates and the associated recession were major catalysts in creating the "debt crisis" in the developing world. Thus, U.S. policy considerably influenced global economic growth and trade during this period *(4)*.

Appreciation of the dollar and resumption of U.S. economic growth in 1983-84 partially offset negative effects of U.S. policies on other countries. This substantially increased U.S. imports and consequently stimulated export industries of U.S. trading partners. Net effect of the opposing influences of U.S. policy is difficult to determine and probably differed across countries. However, U.S. policies during the early 1980's likely depressed economic growth and imports in the rest of the world, given that economic growth in much of the world continued to lag substantially behind that in the United States and that the indebtedness of developing countries continued to affect world trade.

In summary, the U.S. macroeconomic environment changed substantially during the 1970's and particularly since 1979. The advent of fluctuating exchange rates and higher capital mobility have led to much wider exchange rate fluctuations than expected at the time of the Jamaica Accord. Fiscal and monetary policies under flexible rates have significantly changed economic growth, interest rates, inflation, and exchange rates in the short run. These, in turn, have affected the economic environment faced by U.S. agriculture.

IMPLICATIONS OF THE CHANGING ENVIRONMENT FOR AGRICULTURE

Changes in domestic and international exchange rates, interest rates, and income growth have significantly affected the supply and demand conditions that U.S. agriculture has had to face in the 1980's.

Changes in the Economic Position of U.S. Agriculture

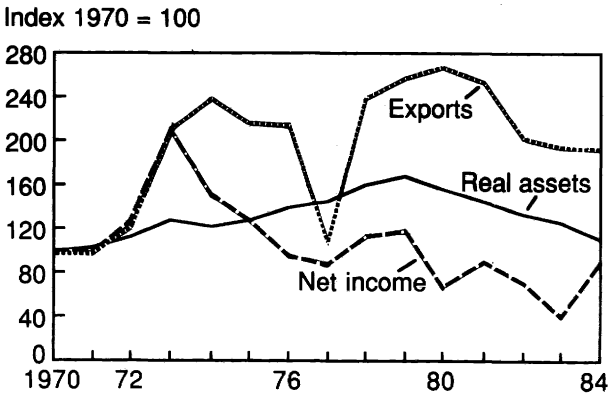
Real exports and net farm income increased sharply in the early 1970's (fig. 5.18). Real net income in agriculture roughly doubled between 1971 and 1973. Despite a subsequent decline, real income was still roughly 17 percent above the level of the early 1970's by the end of the decade. The increase in real net farm income was paralleled by a strong increase in real export values. These also more than doubled between 1971 and 1973 and were roughly 165 percent above the level of the early 1970's by the end of the decade. A substantial increase in farm asset values, particularly for land, accompanied income and export growth. Real asset values increased over 65 percent between 1970 and 1979. Farm real estate accounted for about 75 percent of these asset values in 1979, compared with 68 percent in 1970.

The income and asset position of agriculture dramatically reversed in the early 1980's (fig. 5.18). Real net farm income declined 66 percent between 1979 and 1983. Its recovery in 1984 was primarily due to increased government payments. Agricultural asset values declined roughly 35 percent between 1979 and 1984. Real exports fell 28 percent between 1980 and 1984 and by a similar percentage in 1985. The reversal has severely hurt the well-being of farmers and rural communities.

The size of agriculture's debt increased substantially in the 1970's. Outstanding mortgage debt in 1983 was $113 billion, compared with $30 billion in 1970. With the generally expansionary environment for the sector during the decade, the ratio of debt to gross income increased from 93 percent in 1970 to 144 percent in 1983 (fig. 5.19). However, relative to the asset value, the debt ratio remained relatively constant between 1970 and 1980 at 19-20 percent of equity. Only with the substantial decline in farm asset values in the early 1980's did the ratio of debt-to-equity begin to climb sharply, reaching well over 30 percent by 1985.

Figure 5.18

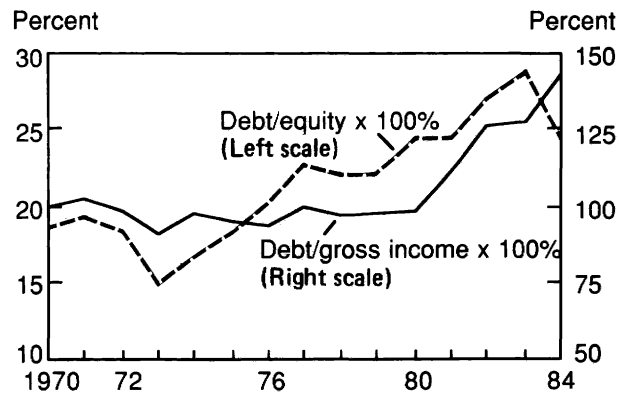
U.S. Farm Sector: Exports, Net Income, and Value of Assets



Source: *(5)*.

Figure 5.19

Ratio of Debt to Gross Income and Equity for U.S. Agriculture



Source: *(5)*.

The major deterioration in the economic position of U.S. agriculture during the 1980's was due to a number of domestic and international factors. Two of the most important influences have been changes in farm exports and in the domestic macroeconomic environment.

Changes in Agricultural Exports

International trade became increasingly important to the well-being of the U.S. agricultural sector during the 1970's. After growing from roughly $7 billion in 1970 to over $43 billion in 1981, agricultural exports began to stagnate in the early 1980's. Many factors contributed to the change in demand for U.S. products overseas. Concerns about the reliability of the United States as a supplier in the wake of the Soviet grain embargo and rapid increases in production in some importing countries probably played a part. However, changes in the macroeconomic environment of trade also substantially affected agricultural and nonagricultural sectors.

In the first section of this chapter, the relationship between changes in world income and in the value of the dollar were shown to be important determinants of total U.S. exports. The same is generally true for agriculture. Figure 5.20 compares the actual year-to-year changes in real exports since the early 1970's and the changes predicted on the basis of variations in world income and in the effective exchange rate of the dollar (see Appendix). Although the simple statistical approach used cannot reflect the historical changes, it clearly supports the general view that macroeconomic forces have substantially affected U.S. agricultural trade. See Chapter 23 for a more extensive analysis of the effect of the changing macroeconomic environment upon agricultural trade and export earnings.

The weakening international value of the dollar during the late 1970's stimulated exports and the appreciating dollar during the early 1980's contributed to the slowdown in trade. The more rapid growth in world incomes, which came to an end with the second oil price shock, similarly affected U.S. exports. Policy changes affecting exchange rates and economic growth in the United States and overseas clearly influenced demand for U.S. agricultural products overseas.

Foreign sales boosted U.S. agricultural prices and incomes. Domestic prices were strongly affected by export variations, particularly for such crops as grains and oilseeds, where the bulk of export growth was concentrated. Figure 5.21 captures this relationship despite the added influence of domestic commodity programs on U.S. farm prices for crops (see Appendix). Because agricultural prices adjust more quickly than manufacturing prices, agricultural prices tend to overshoot their

longrun equilibrium values along with exchange rates. The appreciation of the dollar in response to increasing interest rate differentials between the United States and other countries pressured agricultural prices to fall more than less flexibly priced goods *(10)*.

Changes in the Domestic Economy

The recessionary effects of the U.S. macroeconomic policy response to the second oil shock were not confined solely to exports. The domestic economic recession of the early 1980's also affected domestic agricultural demand, particularly for those products more sensitive to income growth, such as meat and livestock commodities. Per capita consumption of red meat fell 6 percent between 1980 and 1982. The consumption of other income-sensitive products, such as wine and fresh fruit, also declined. However, from the domestic perspective, the most significant changes were in factors affecting production costs and asset values.

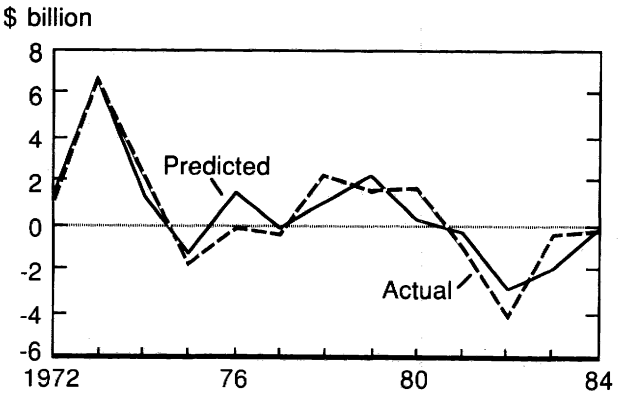
As indicated earlier, the U.S. response to the second oil price shock in 1979 differed substantially from that in 1973-74. The restrictive monetary policy pursued by the Federal Reserve to reduce demand and control inflationary expectations increased real interest rates and moved the United States into a period of economic recession. The rise in interest rates was significant for a domestic agricultural sector that had become more capital-intensive and more leveraged during the previous decade.

Interest payments had been growing during the late 1970's, both as a proportion of total production expenses and relative to cash income (fig. 5.22). In the early 1970's, for example, interest costs accounted for less than 8 percent of agriculture's production expenses and roughly 6 percent of gross cash income. By 1979, these ratios had reached 11 percent and 10 percent. With the increase in interest rates in the early 1980's, interest costs reached 15-16 percent of production expenses and 15 percent of cash receipts in 1982. The cost of most other agricultural inputs also continued to rise (fig. 5.23). The gap between prices paid and prices received by producers widened, producing a severe cost-price squeeze in U.S. agriculture (fig. 5.18).

The change in domestic macroeconomic conditions further affected the agricultural sector. The real value of agricultural assets increased substantially in the 1970's. This increase does not appear to have been closely related to changes in real net farm income (fig. 5.18). Agricultural land was an attractive asset during the inflationary economic climate

Figure 5.20

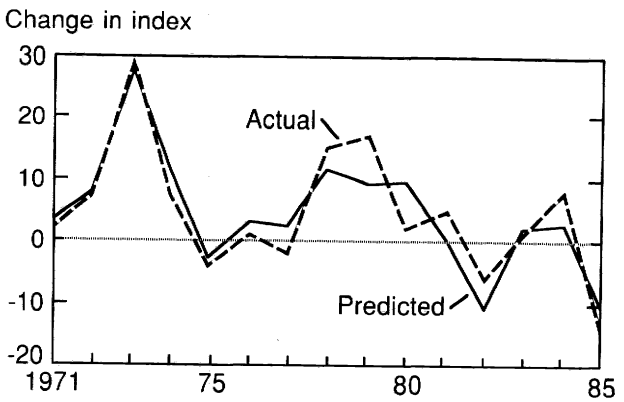
Changes in U.S. Agricultural Exports as a Function of World Income and the Effective Exchange Rate



Changes in 1970 dollars. Sources: *(5,17)*.

Figure 5.21

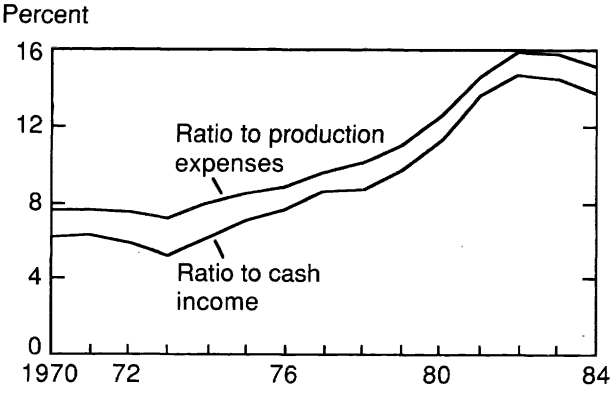
Changes in Crop Prices Received by U.S. Farmers as a Function of Real Agricultural Prices



Base year 1977. Source: *(5)*.

Figure 5.22

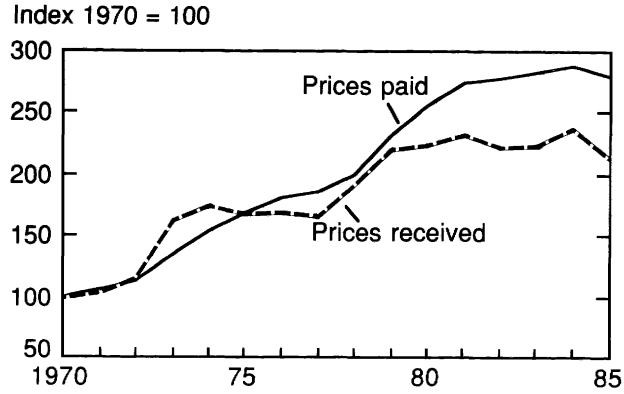
Relative Interest Costs for U.S. Agriculture



Source: USDA.

Figure 5.23

Indices of Prices Received and Prices Paid by U.S. Farmers



Prices paid are for production items. Source: *(5)*.

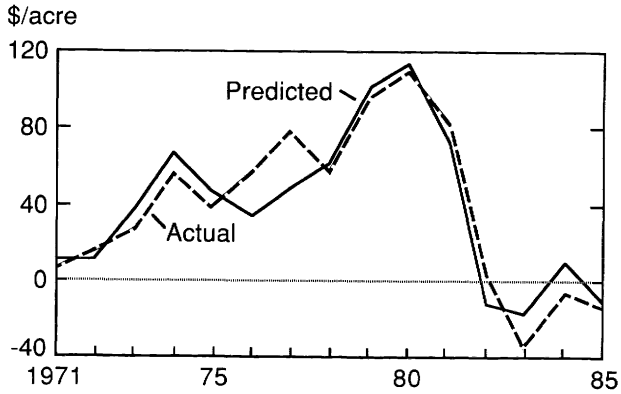
of the late 1970's. With long-term U.S. interest rates at negative real levels, land appeared to be a much better investment prospect than most financial assets (fig. 5.16). Land values increased partly because of their attractiveness as assets, not simply because of their income-earning potential.

With the change in Federal Reserve policies and the rise in real interest rates, other assets began to be attractive to investors. Furthermore, the weakening of agricultural demand and the deteriorating income position of U.S. agriculture contributed to a re-evaluation of the true value of farm real estate. This value began to decline and, thus, intensified the economic distress of producers who had borrowed heavily in order to expand production or to begin farming during the high-priced period of the late 1970's.

Much of the recent variation in land prices can be explained statistically by macroeconomic factors. Figure 5.24 plots the actual changes in the average value of U.S. farm real estate and those predicted on the basis of changes in the rate of inflation rate, real GNP, and the level of real long-term interest rates (see Appendix). Increases in the first two of these factors contribute to increased land prices, while the third depresses real estate demand and, hence, its price.

Figure 5.24

Changes in the Average Value of U.S. Farm Real Estate



Sources: *(5)* and USDA.

The economic environment was changing during the period when the United States was imposing embargoes on agricultural exports and accumulating surplus stocks of agricultural commodities. Therefore, it is relevant to assess the potential impact of the changing economic environment on agriculture in order to place embargo effects and the results of surplus disposal in perspective. To do this, a more complicated statistical approach is required. Chapter 23 describes the analysis and major results.

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APPENDIX

AN ECONOMETRIC ANALYSIS OF EXPORTS, PRICES, AND FARM VALUES

Equation 1. Total U.S. Exports

Ordinary least square: Dependent variable is DUSXR Sample: 1972-84

Variable	Coefficient	Standard error	T-statistic	2-tail significance
Constant	-2.747	3.045	-0.90	0.388
DGDP (-1)	1.606	.706	2.27	.046
DUSFXR (-1)	- .825	.187	-4.42	.001

R-squared	0.84	Mean of dependent variable	3.30
Adjusted R-squared	.81	S.D. of dependent variable	9.43
Standard error of regression	4.10	Sum of squared residual	168.27
Durbin-Watson statistic	1.76	F-statistic	26.68

DUSXR = Year-to-year change in the value of total U.S. exports expressed in billion 1970 dollars.
DGDP = Year-to-year change in an index of real world gross domestic product (1970=100).
DUSFXR = Change in the effective exchange rate of the U.S. dollar (IMF, MERM rate index, 1980=100).

Equation 2. U.S. Agricultural Exports

Ordinary least square: Dependent variable is DUSAX Sample: 1972-84

Variable	Coefficient	Standard error	T-statistic	2-tail significance
Constant	-1.063	0.730	-1.46	0.179
DGDP	.337	.164	2.05	.070
DUSFXR (-1)	-.168	.046	-3.65	.005
DUM73	3.995	1.328	3.01	.015

R-squared	0.85	Mean of dependent variable	0.58
Adjusted R-squared	.80	S.D. of dependent variable	2.55
Standard error of regression	1.14	Sum of squared residual	11.59
Durbin-Watson statistic	2.56	F-statistic	17.15

DUSAX = Year-to-year change in the value of U.S. agricultural exports expressed in billion 1970 dollars.
DGDP = Same as equation 1.
DUSFXR = Same as equation 1.
DUM73 = Dummy variable to capture the sharp increases in exports in 1973.

Equation 3. Crop Prices Received by U.S. Farmers

Ordinary least square: Dependent variable is DRECC Sample: 1971-85

Variable	Coefficient	Standard error	T-statistic	2-tail significance
Constant	3.704	1.171	3.162	0.007
DUSAX	3.555	.458	7.764	0

R-squared	0.83	Mean of dependent variable	4.53
Adjusted R-squared	.81	S.D. of dependent variable	10.34
Standard error of regression	4.52	Sum of squared residual	265.30
Durbin-Watson statistic	2.49	F-statistic	60.28

DRECC = Year-to-year change in the index of crop prices received by U.S. farmers (1970=100).
DUSAX = Same as equation 2.

Equation 4. Value of U.S. Farm Real Estate

Ordinary least square: Dependent variable is DVAL Sample: 1971-84

Variable	Coefficient	Standard error	T-statistic	2-tail significance
Constant	-4.238	13.395	-0.32	0.758
DCPI	3.512	.681	5.15	0
RATE	-7.953	1.346	-5.91	0
DRGNP	.335	.129	2.60	.027

R-squared	0.88	Mean of dependent variable	41.80
Adjusted R-squared	.85	S.D. of dependent variable	41.80
Standard error of regression	16.20	Sum of squared residual	2,639.50
Durbin-Watson statistic	1.39	F-statistic	25.46

DVAL = Year-to-year change in average value of U.S. farm real estate in dollars per acre.
DCPI = Year-to-year change in the U.S. consumer price index (1967=100).
RATE = Real long-term rate of interest (10 year U.S. Treasury Bonds - rate of change in the U.S. consumer price index).
DRGNP = Year-to-year change in U.S. real gross domestic product (1972 dollars).

CHAPTER 6

POLICY INTERDEPENDENCE, COUNTRY RESPONSE, AND THE ANALYTICAL CHALLENGE

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CHAPTER 6

POLICY INTERDEPENDENCE, COUNTRY RESPONSE, AND THE ANALYTICAL CHALLENGE*

This chapter gives a nontechnical overview of the nature, sequence, and rationale for the analysis conducted on embargoes and export subsidies. Its objective is to contribute to understanding what happened or might have happened when such economic measures are applied.

The preceding three chapters have described characteristics of U.S. agriculture and agricultural policy, the nature of world trade in agriculture, policies of major countries, and the changing macroeconomic environment, both domestic and international. In the first sections of this chapter, we take these three key characteristics of the environment in which embargoes occurred, and in which export subsidies would have been applied, and weave them into an analytical description of the interdependencies of domestic policies and international agricultural markets. This description, of critical importance to the analysis of export embargoes and subsidies, gives insight into how countries did, or would, respond to changes in U.S. policy. If many of the nations involved in the international commodity markets designated in the study intervene in agriculture and are large enough to affect world prices, then how they react in policy terms is just as crucial to this analysis as how private sector firms react in economic terms.

Next, we address the question of how to best approach the analysis of export embargoes and subsidies. The challenge is complex because many economic and political forces are at work. We decided early that no single model or approach could address both problems in their entirety. We consequently adopted a pragmatic approach of attacking each problem from as many angles as available within the study's time limits.

The third and fourth sections of the chapter discuss the two elements critical to both parts of the study: (1) The economic responsiveness of national markets to changes in international prices (elasticity of demand for imports) and (2) how much nations respond to changes in other countries' policies.

Much of the research conducted was carried out using partial equilibrium commodity market methods of analysis. We assumed exogenous macroeconomic variables to be constant. It is, however, possible to test the sensitivity of our results to changing macroeconomic variables. We describe our methods briefly in the final section of the chapter.

DOMESTIC INTERVENTION AND ITS EFFECTS ON INTERDEPENDENT WORLD MARKETS

Virtually every country intervenes in its agricultural and food sector, although this intervention takes many forms. What shape the intervention takes depends in large measure on whether the country is an exporter or importer of a particular commodity.

Intervention Characteristics

Three general characteristics of intervention cause economic effects: Differentiating between domestic and border (world) prices, isolating domestic prices, and shifting domestic instability to world markets.

Differentiating Between Domestic and Border Prices

Intervention almost always involves differentiating between domestic producer prices (or consumer prices) and border prices, which results in explicit or implicit taxes and agricultural subsidies. In economic terms, countries place a positive or negative wedge between world (or border) prices and national prices. The size of the wedge may differ between producer and border prices and those of consumer and border prices. The policy instruments countries use to attain them such as tariffs, quotas, price supports, and acreage set-asides vary greatly.

*Contributors to this chapter were Alex F. McCalla, Philip C. Abbott, and Philip Paarlberg.

Importers can maintain domestic producer and consumer prices above border prices by applying tariffs, quotas, or variable levies. These policies tax consumers and subsidize producers. If importers want to maintain domestic prices below border prices, they can use state trading, import subsidies, or food subsidies. They must also control their borders to prevent exports to the world market. Such policies tax producers and subsidize consumers.

Exporters have a more difficult time because maintaining domestic producer prices above border prices means they must subsidize exports in some form and prevent imports from undercutting higher domestic prices. They may carry out these goals by using target prices and deficiency payments (with or without production controls), stockholding, and intervention purchase schemes. Supply control or stock removal actions are effective only if the country applying them is large enough to influence world prices. Depending on which combination of instruments is used, domestic consumers may or may not be taxed. Exporters who wish to maintain domestic prices below border prices can do so by using export taxes, quotas, and export licenses, thereby taxing producers and subsidizing consumers. Our examples of intervention are meant to be illustrative rather than exhaustive *(12)*.[1]

Isolating Domestic Prices

Many of these same policy instruments isolate domestic market prices from international price changes. Countries attempt to isolate their markets because domestic price stability is often a national policy goal. A fixed quota causes total isolation; the quantity of commodities imported would not vary with changes in world prices. Therefore, domestic prices would be solely a function of domestic variables. Nontariff barriers that restrict quantity generally lead to more isolation than do tariffs.

We use price transmission elasticity as a measure of how much domestic markets are isolated. It is shorthand for the percentage change in domestic prices that results from a 1-percent change in world prices. A price transmission elasticity of one means that if world prices rose 10 percent, domestic prices would correspondingly rise 10 percent. An example of this is a competitive market with no transportation costs. A price transmission elasticity of zero means that if world prices fell 10 percent, domestic prices would remain unchanged. It portrays complete isolation and can be attained by imposing a fixed import or export quota, a variable import levy, or a variable export tax. In the real world in which markets are separated by distance, one would expect transmission elasticities to be less than one but greater than or equal to zero. Within this range, the exact value would be a function of the policy instruments chosen.

Why would countries want to differentiate and isolate domestic prices from international prices? The answer lies in domestic policy goals, which often include farmer income support, price stabilization, consumer subsidies, and increased trade. All require domestic prices to be set for domestic reasons. In sum, isolating domestic markets buffers a country from world market fluctuations so that they do not hinder or nullify domestic objectives.

Shifting Domestic Instability to World Markets

Some policy instruments allow countries to prevent the import of price instability from the rest of the world. A fixed import quota, for example, means that a country will import the same quantity regardless of world prices. Thus, a crop shortfall in some other part of the world means that the rest of the world's consumers bear the burden of adjustment to the higher prices. Consumers in the country with the quota are unaffected.

Other policies export domestic instability. Suppose that a country has had a very bad crop. Policies of fixed internal prices and appropriate border instruments will cause the country to export less or import more, to the full extent of the domestic shortfall. The full brunt of adjustment in this case is again borne by foreign consumers.

Implications of policy interventions for world markets are clear. Markets are more unstable as a result. The more widespread the intervention, the more unstable world markets

[1] See chapters 2 and 3 of *(12)* for a more detailed discussion. Italicized numbers in parentheses refer to items listed in the References at the end of this chapter.

become because there are fewer and fewer consumers and producers to adjust to changes in the market.

Intervention, Interdependence, and Trade Policy Analysis Linkages

Domestic intervention causes one other major ripple effect in the world market. That is, if a country is "large," its effect on world markets is significant.

The Country as an Analytical Unit

Countries, rather than private sector firms, are the appropriate units for trade policy analysis because if domestic policies change, individual country net export supplies or import demand will change, thus affecting world markets. Thus, it is critical that country policy be appropriately integrated in world market analysis. The researcher should include variables that capture how and why governments intervene in their food and agricultural sectors. Before conducting analyses, whether *ex post facto* (after the fact) or *ex ante facto* (before the fact), researchers must understand a country's domestic policy goals, the constraints under which it operates (such as budget), and the actual or potential policy instruments available to it. In the embargo part of the study, researchers tried to simulate what happened as a result of actual policy change. To do so, they had to fully understand how other countries actually reacted to U.S. embargoes. To estimate what would have happened without an embargo requires predicting what policies of the United States and other countries would have been. The surplus disposal part of the study analyzes what would have happened if a policy change, such as extensive use of export subsidies, had occurred. Such an analysis requires explicit prediction of how other countries would respond. This before the fact case, then, needs to be compared with what actually happened (no explicit export subsidies).

Large Country Impacts

A conceptually complete analysis of an interdependent world market that links domestic policies could require an understanding of how all countries would react to other nations' policy changes. However, in practical terms, the first and most important step is to understand if the big players, or large countries, actually react or simply pursue policies for domestic reasons. Large countries are defined as those with ability to significantly affect world prices. The first measure of "large" is whether a country's production of a commodity accounts for a significant proportion of global production. For example, China is the world's largest producer of rice, supplying nearly half of total world output, even though a minor trader of rice. But small changes in Chinese production, if vented in world markets, would significantly affect world prices. The analysis presented in Chapter 4 suggests that, under this criterion, obvious candidates for large producer countries of food and feed grains are the USSR, the United States, and the European Community (EC). The second measure of "large" is a nation's export or import volume relative to total world trade. Chapter 4 again suggests that countries such as Canada, Argentina, Brazil, and Australia are obvious candidates because, even though they are much smaller producers of grain and oilseeds than, for instance, the United States, they are large traders, supplying in most years significant quantities of exports.

Traditional economic analysis usually defines "large" in terms of sloping import demand or export supply functions, implying the exercise of market power. This definition coincides with our second measure of "large." For our purpose, however, countries with domestic production large relative to world trade could unintentionally affect world markets by shifting either their import demand or export supply functions. We therefore include both. The implication of size is that for trade policy analysis, the traditional small country assumption used in most analyses seems inappropriate for the task at hand. Changes in domestic policies and other domestic variables in large countries, by definition, alter international prices and trade flows.

The combination of price differentiation, isolation, and size gives rise to several important global trade implications. First, a large country, in pursuing its own policy choice, should take into account how its policy changes will affect world prices and market shares. Not to do so is naive. If, for example, the United States assumed, in its analysis of whether to change the loan rate in 1986, that world prices would be unaffected, it would have made a serious error in predicting cost and other effects of the policy

switch. When a country recognizes that, because of its size, it can influence world markets, it has two options. One is to recognize the impact and factor it into domestic analysis. The other is to choose domestic policy instruments that maximize domestic goals by causing world prices to change favorably, and thus improve its own well being. The analysis of targeted export subsidies, described later in this report, is an example of the second kind of analysis in which market power is exercised. Unilateral actions by large countries that choose tariff or export tax levels can improve national welfare. Collective action in the form of a buyer's or seller's cartel also involves exercise of market power. These concepts are fully developed in Chapter 8. Thus, the first implication of intervention and size is that policy analysis for a particular country should include the impact of policy choice on world prices and market shares.

Second, if one large country recognizes that it influences world markets and chooses its policy instruments and values accordingly, then it follows logically that other large countries also affect world markets. Policy choices made by other large countries potentially alter the effectiveness of the first country's policy. Several examples illustrate this point. Thailand's decisions to eliminate both its export taxes in 1985 and export premium in 1986 on rice caused significant drops in world rice prices, thereby increasing the cost of the U.S. rice program. Or, if, for example, the EC suddenly decided to raise export subsidies, world market prices would fall. Also, under current policies, Canadian farm income would decline and U.S. deficiency payment costs would rise. It would be in the interests of Canada and the United States to understand how and why European policy might change and anticipate the action.

Thus, the key point in this web of policy interdependence is to recognize that all countries, large and small, may alter their policies in response to a change in a large nation's policy. Any policy response should be two-pronged. It should explain how country B reacts to country A's policy changes. It should also try to anticipate how country A would respond to a possible policy change in country B.

Recognizing the importance of large countries' interdependence is vital to this study. For example, when the United States analyzed the potential success of a grain embargo targeted at the USSR, it should have realized that the key to the embargo's effectiveness was how other countries would react. Domestic policy analysis, in other words, should have included the response functions of Canada, Australia, Argentina, and the EC.

The final significant link in our analysis is how other large exporters would respond to general or targeted export subsidies. Thus, country responses (actual and potential) could be indispensible links in any comprehensive analysis. The degree to which countries did respond to embargoes and would react to export subsidies is a testable hypothesis.

THE ANALYTICAL CHALLENGE

How does one approach the analysis of the two major subjects of this study—export embargoes and export subsidies—against the background of the changing structure of U.S. agriculture and agricultural policy, highly integrated world commodity markets, volatile macroeconomic conditions, and interdependence of large countries? The analysis must trace through, conceptually and quantitatively, the following sequence of events:

- An actual or proposed policy change in the United States causes changes in the behavior of the United States in world markets.
- This change induces immediate and short-term fluctuations in world prices and trade flows.
- The change also spurs shifts in other countries' export volume and earnings as world prices and trade flows adapt.
- The action may also induce other countries to alter their policies.
- Joint result of these shifts is a change in U.S. export volumes and prices.
- This action, in turn, causes changes in U.S. prices, composition of commodity sales, farm income, farm program costs, and export earnings.
- Reaction to changes in world markets, in the longer term, may induce long-term structural policy changes in all countries.

Our analysis addressed the basic question: How to simulate impacts quantitatively on U.S. agriculture in the immediate, short, and long term? The challenge was heightened by the study's short timeframe which meant that no new theoretical or empirical models could be developed. In fact, it is unlikely that a single model, no matter how complex, would answer all questions. We, thus, chose a number of existing conceptual and empirical models to test whether each form of analysis yielded consistent results. The remainder of this section is devoted to first discussing some general issues faced in short-term policy analysis. It then lays out in a general sense how the sequence of analysis was conducted, what models were available, and which were used, and presents brief descriptions of the characteristics of these models.

In any modeling of a policy situation, the time period during which a nation experiences a policy shock is of critical importance. It determines the type of data needed and the appropriate kind of analysis. Three of the four embargoes analyzed in this study were short (6 months or less). To detect immediate and short-term responses, we therefore needed daily, weekly, and monthly data. The twin goals of the analysis presented two problems, the first of which was data availability. We discovered that incomplete data or data gaps existed on U.S. export competitors (particularly Argentina and Brazil) and on major importers (particularly the USSR). Reasonably good data existed, however, on weekly, monthly, quarterly, and annual prices and, to a lesser extent, on trade flows pertaining to U.S. markets and exports. The second problem was a lack of stability and continuity of the data series. Price data series are generally continuous and exhibit manageable day-to-day and week-to-week fluctuations. Trade flows, on the other hand, occur in large discrete shipments and often contain numerous observations equal to zero. Trade flow data, for example, may show 100,000 tons one day and none for the next 3 weeks. These kinds of discontinuities create serious roadblocks to traditional econometric and statistical approaches, which may explain why analysts feel more comfortable with quarterly and annual data devoid of short-term fluctuations. Annual data also have the advantage of meshing with farm production which occurs once a year. In sum, traditional quantitative economic analysis is better suited to multiyear policy issues than monthly and weekly issues.

In addition to data problems, a different form of analysis must be used for short-term policy analysis when the timeframe of the problem is short, when the timeframe of the study is short, or both. In very brief time periods, one would expect existing supplies of a commodity to remain essentially fixed. Rising prices may shift wheat use from feed to food, but they cannot stimulate new production. One similarly would expect that in the very short run, consumers do not alter buying patterns as they might during longer periods of sustained price changes. These short-term rigidities allowed us to use something more akin to accounting analysis. We computed changes in revenue, costs, and incomes by multiplying prices times quantities without allowing for economic response. The method is particularly appropriate for forecasting production where short-term supply functions are assumed to be totally inelastic and shortrun demand functions highly inelastic. This type of analysis is well tailored to short timeframes. Simulating shifts of functions rather than movements along functions allowed us to obtain accurate estimates of immediate market responses to external shocks.

We used methodology of this kind in much of the analysis of short-duration embargoes. Where appropriate, we also attempted to use econometric modeling, but it was supplemental to our primary analysis based on descriptive statistics, time series analysis, and qualitative policy response analysis. For the longer term issues relating to the 1980 embargo and export subsidies, we relied more heavily on annual models.

Overall, two principles apply to modeling and quantitative analysis of all sorts. First, model results depend on the structure of the model, its assumptions, statistical validity of the estimated parameters, and, ultimately, quality of the data. Numbers derived from quantitative analysis consequently should be carefully interpreted in the context of the model used. This is not to imply that the choice of model predetermines the answer. It does say, however, that the way in which results are interpreted should be conditioned by how they

were derived. This caveat is particularly important to this analysis because study contributors used current models, some of which were not specifically designed for the analysis undertaken.

Second, price, quantities, and income figures derived from the various forms of analyses should be interpreted not as point projections but as general tendencies and orders of magnitude. The models we chose best captured how economic actors would react to particular shocks. But all models assumed a significant number of other variables to be constant (exogenous). Therefore, the conditional nature of the results must be recognized. Given these caveats, however, we believe the following analysis accurately depicts the direction of general economic tendencies and presents a clear picture of the general magnitudes of change.

The Logical Sequence of Analysis

The first step in the analysis of each of the problems under study was to understand the basic elements of the problem. An appropriate place to start was at the conceptual level. Basic economic theory can be used to deduce qualitatively how economic actors will react to the impact of the policy change on domestic and global prices and quantities. Developing partial equilibrium theoretical models within which either targeted or general embargoes and targeted or general export subsidies are applied also helps to identify critical empirical values upon which quantitative estimates must rest. Thus, once the problem was framed, researchers developed conceptual frameworks that allowed us to reduce the problems to central issues. Chapters 8 and 18 detail this theoretical analysis.

The U.S. export embargoes of the 1970's and 1980's were not the first targeted or general embargoes to have been used by the Nation. Even though the specific subsidy scenario analyzed here is hypothetical rather than actual, considerable history of export assistance exists. It was quite likely, therefore, that prior empirical analysis of other embargoes and subsidy schemes had been conducted. In fact, some had been done on some of the exact kinds of cases as those in our study. Therefore, step two was to review some of the literature for empirical analysis of embargoes and export subsidies to see what they implied for our research. These results are also presented in Chapters 8 and 18.

These two steps were common to both analytical problems and helped identify critical parameters for subsequent empirical analysis. However, for the next steps in the analysis, the nature of the specific problems dictated different approaches. One component of our analysis, embargoes, studied the events that actually happened. This meant that the actual data we had on prices and trade flows depicted real-world impacts caused by embargoes. However, to test what would have happened with an embargo against what would have happened without required a simulation with an alternative scenario. The other component, export subsidies, did not happen in the years under study. The actual data thus represent the "no policy change" scenario. To determine what would have happened, a simulation had to be conducted. As a result, we approached the specific empirical challenge of each part of the study separately.

Embargo Analysis

A country applying an export embargo may either impose a general embargo in which all destinations are cut off from trade, or target the embargo to specific destinations. Both kinds have been used by the United States in the past 15 years. The oilseed embargo of 1973 was a general embargo. In the first 4 days, the United States banned all exports. The United States then transformed it into a partial embargo using export licenses. The entire embargo lasted about 3 months. Annual data and even quarterly data are thus of limited use in quantitative analysis, whereas daily, weekly, or monthly data would likely yield results on impacts. Further, the most obvious effect was expected to have occurred in prices. The 1974 and 1975 sales suspensions were targeted in the first instance against the USSR on grains and oilseeds, and in 1975 against the USSR and Poland. Both involved voluntary deferrals of sales and were brief. The 1980 embargo again targeted the USSR and was of much longer duration, making it more suitable to longer term quantitative analysis using quarterly and annual time series data. We focused mainly on the 1980 embargo

because of its length and the magnitude of suspended sales.

Descriptive Statistics and Time Series Analysis

The first stage in quantitative analysis of embargo impacts was to "let the data speak," looking carefully at actual trade and price patterns to identify shifts that seem out of the ordinary. For instance, did prices suddenly change and deviate from previous trends? Did these changes persist or did market activity revert to previous trends once the embargo ended? Did the total volume of trade and bilateral flows between specific exporters and importers change abruptly, and did these changes persist? In the case of the targeted embargoes, did the USSR change its major suppliers? Did the USSR alter the composition of imports? Did it substitute sorghum for corn, rice for wheat, or meat for feed grains? Or did the USSR reduce consumption or stocks? Significant insights into what actually happened can be gained from the use of descriptive statistical analysis. Therefore, this was the first step in our quantitative analysis of all embargoes, though much greater emphasis is given to the 1973 and 1980 embargoes. Chapters 9 and 10 present results of this analysis.

World Market Modeling

Descriptive statistics are of less value in answering the question of "what would have happened if an embargo had never been applied?" The answer to this question requires some sort of simulation, or, at a minimum, projection of what flows and prices would have been had the embargo not occurred.

There are two general approaches. The first is time series analysis. It is a statistical technique using data from the period preceding the embargo to project what prices and what the pattern of trade would have been without the embargo. It is based in varying degrees of sophistication on the premise that if there had not be an embargo, the previous patterns would have persisted. Validity of this premise, that the past will repeat itself, likely declines the longer the period of disruption. Chapter 10 discusses specific forms of time series models used.

The second is a structural model of either the econometric or simulation variety. An econometric structural model postulates some structural form of economic relationships, employs time series data to estimate critical parameter values, and then uses the parameters to simulate effects of changes in policy instruments on endogenous variables such as prices, quantities, incomes, and costs. The conceptually derived framework together with actual data allow alternative scenarios to be simulated. The simulation approach similarly postulates a set of economic relationships, including explicit assumptions about policymakers' behavior and uses estimated or synthesized coefficients to simulate the "embargo" and "no embargo" cases. Both kinds of models have been extensively used in trade analysis *(15)*. The models can be made more complex by increasing the number of variables and behavioral assumptions, and they can be made larger by adding more countries and commodities.

In general, econometric models are likely to be nonspatial. A nonspatial model is one which stipulates that exporters are prepared to sell varying quantities of a commodity as prices change and importers are willing to buy varying quantities of imports depending on prices. In the models, this behavior is captured in export supply or import demand functions and can be estimated either directly or indirectly by subtracting domestic supply from demand. The functions can then be aggregated into world supply and demand schedules which can be solved for world price. World price can then be projected back to each country. Finally, total country exports or imports can be determined. A nonspatial model is appropriate for certain kinds of trade policy analyses, including those of general embargoes or export subsidies. Note that it yields only a country's total exports or total imports, not information such as how much country B imports from country A.

The analysis of a targeted embargo required additional modeling characteristics. Because country A was denying exports to country B but not to others, theory and common sense suggest that the most likely effects would be alterations of trade flows and possibly, but not necessarily, aggregate volumes of trade and

world prices. These variables dictate the use of models that explicitly include trade flows. The practical solution is to use a spatial model which includes flows from all export origins to all import destinations and incorporates transportation costs.

The family of spatial models, however, are more complicated to use than nonspatial ones. Though they require the same estimates of excess supply and demand functions as do nonspatial models, incorporating policy variables is more difficult. That is because, if the items are discrete, they must be included as constraints rather than exogenous variables. Further, if a spatial model uses a programming solution algorithm of cost minimization, it will choose its optimum pattern of flows to do just that, minimize transportation costs. Thus, in a modeling exercise using the assumption of a homogenous product, the least expensive bilateral flow will be filled first. For example, if the cheapest transportation rate in the world wheat market is between Canada and Western Europe, the model will ship only Canadian wheat to Europe until either European demand is saturated or Canadian supply is exhausted. It will then move to the next cheapest flow and so on until all export origins are exhausted and all import destinations are satisfied at an equilibrium price.

In sum, a spatial model is one which would reflect a purely competitive market in which economic actors react immediately to price changes. While actual trade flows seldom, if ever, show complete specialization of either exporters or importers, unless they are an isolated pair far removed (in cost terms) from other exporters and importers, these models do quite well in simulating actual prices and indicating general market tendencies. Spatial cost minimizing models are also highly sensitive to changes in single parameters. For example, a slight reduction in a bilateral transportation rate could lead the model to completely switch trade patterns. While complete shifts are seldom observed in the real world, partial shifts nearly always conform to economic tendencies. Spatial models do allow the inclusion of quotas, bilateral agreements, and other trade constraints. Thus, we conclude that they provide very useful vehicles for simulating "before" and "after" scenarios. Chapter 11 describes the specific spatial simulation model used in the analysis.

Aside from transport cost minimization, other factors can influence trade flows. They may consist of quality differences, political loyalties or antagonisms, and cultural and taste preferences. Some can be captured in market share models which assume only partial substitutability between commodities originating from different exporters. One frequently used model in this class is the Armington model *(2)*. It postulates that wheat from Canada is similar, although not the same, as wheat originating from the United States. The degree of interchangeability is captured in the elasticity, or degree of substitution, between all pairs of products.

Conceptually, this suggests that the Japanese have one demand function for Canadian wheat and different ones for U.S., Australian, and Argentine wheat. Econometrically, however, given partial substitution, each of these demand equations would have to include prices from all other origins. One would expect prices to be highly correlated, which leads to extreme estimation difficulties, or multicollinearity, and consequent questionable econometric estimates. Armington attempted to avoid this difficulty by using a two-stage estimating process. First, he estimated Japanese import demand for wheat as a function of income, population, a trade-weighted index of world wheat prices, and other commodity prices. Second, he estimated each exporter's market share of the aggregate quantity of wheat exports using relative prices of particular origins. Unlike the complete substitution assumption used in a spatial model, the Armington model's assumptions of partial substitution add rigidities to the process. Those rigidities lead *a priori* to slower rates of adjustment to economic change. Thus, unlike the competitive spatial model, which adjusts to market shocks by making a small number of large changes in flows, the Armington model leads to a large number of small changes in trade flows. Readers should keep this inherent difference in mind when interpreting results in Chapters 11 and 12. Reality lies somewhere in between the two approaches.

The degree of intervention by large countries suggests imperfect markets and significant rigidities. Mechanics of grain trade (explained briefly in Chapter 4) suggest highly flexible, efficient, and competitive markets that adjust quickly. The spatial model reflects the latter

characteristics, while the Armington model partially reflects the former. Both spatial and Armington models were used in analyzing the impact of the 1980 targeted embargo. The modeling solutions generate world market prices and flows under several scenarios that try to distinguish between "embargo" and "no embargo" simulations. The results explicitly estimate U.S. exports and export prices. The world market results are then used as data in the final step of the analysis, which is to determine effects on U.S. agriculture.

Domestic Impact Modeling

Effects of trade flow and price changes which resulted from export embargoes would be expected to have short- and long-term implications for a wide variety of commodities produced in the United States. Changes would not be limited to grains and oilseeds. To evaluate potential impacts, we needed a comprehensive model of the sector which could simulate both "embargo" and "no embargo" scenarios. The desired characteristics had to include comprehensive commodity coverage, explicit intercommodity production linkage, and processing. Where appropriate, the model would also have to incorporate demand factors, a linkage between the livestock and feed grain sectors, and sufficient policy detail to allow analysis of the policy changes that took place during and after the 1980 embargo.

Two such models were potentially available. One was the Food and Agriculture Policy Simulator Model (FAPSIM) developed by the National Economics Division (NED) of the U.S. Department of Agriculture's Economic Research Service (ERS) *(14)*. The second was the Food and Agricultural Policy Research Institute's (FAPRI) national model of U.S. agriculture. Both are annual econometric models with capabilities of performing significant commodity sector disaggregation which is solved for price-quantity equilibrium conditions in individual commodity models. They are dynamic in the sense that they can carry out multiyear analysis. Both treat foreign demand, where appropriate, with a single equation of world demand for U.S. exports. FAPSIM is fully simultaneous, while FAPRI is solved by iterating between crop and livestock submodels.

In the embargo analysis, we chose to use FAPSIM for three pragmatic reasons. First, the spatial equilibrium trade models had to produce results capable of being inserted in the national model. The single export demand functions in FAPSIM lend themselves readily to this task. Second, FAPSIM was currently available and had a record of extensive use in domestic policy analysis. Third, FAPSIM was fully simultaneous.

The recently developed FAPRI trade models lent themselves more readily to the direct analysis of export subsidy analysis *(3, 7, 13)*. Thus, given the magnitude of the analytical tasks in both parts of the study, we chose to share the national modeling between the two. It was our judgment that the models are sufficiently similar to produce comparable results.

The FAPSIM model allowed us to simulate impacts of the embargo in conjunction with alternative policy scenarios. Since FAPSIM was designed specifically to model Government involvement in the agricultural sector via farm commodity and other Federal policy programs, it can analyze the effects of Government policy and external shocks on farm income, food prices, and Government expenses. It can also analyze the supply, utilization, and prices of farm commodities in any given year. Exogenous policy variables encompass individual crop loan rates, target prices, national program yields and acreages, and diversion and set-aside rates. Macroeconomic variables such as population, disposable personal income, wage rates for food processors, petroleum prices, and the nonfood consumer price index are also included exogenously in the model.

FAPSIM includes six livestock commodities (beef, pork, chickens, turkeys, eggs, and dairy products) and eight crops (wheat, corn, oats, barley, sorghum, soybeans, cotton, and rice). Each livestock model consists of a set of equations used to estimate production, market and retail prices, consumption, and ending stocks. Each crop submodel consists of a set of equations used to estimate production, total supply and demand, price, and ending stocks. The model contains linkages between the crop and livestock sectors. These components are

solved simultaneously, allowing policy impacts originating in one sector to affect the other.

One final step had to be taken before we simulated the embargo's impact. To account for a "no embargo" scenario, we had to adjust the model to account for prospective farm policy had no embargo been implemented. (This was vital because several policy adjustments intended to mitigate effects on U.S. agriculture were actually made immediately after the embargo was announced.) Once those policy changes were determined (based in part on policymaker interviews), FAPSIM could be simulated under a variety of scenarios including various levels of embargo effectiveness versus no embargo plus policy change versus no policy change in order to compare impacts on farm prices, farm costs, farm income, and Government costs. That final step allowed us to report our findings on how embargoes affected U.S. agriculture. Chapters 13 and 16 report the findings.

Export Subsidy Analysis

Analyzing export subsidies is analytically the reverse of analyzing embargoes. To examine export subsidies, we needed to simulate what would have happened if export subsidies had been used. What actually happened was the "no policy" case. Because actual data for 1970-84 do not contain the effects of export subsidies, the use of descriptive statistics, time series analysis, and *ex post facto* policy reaction analyses are immediately ruled out. Put simply, an evaluation of a potential policy impact requires use of some form of simulation.

The analytical steps are therefore fewer. They start with a statement of the problem: What would have been the effects on U.S. agriculture and the U.S. Treasury if a policy of disposing of surplus in global markets had been pursued instead of holding the surplus in the form of public stocks?

Stock Disposal Rules, Policy Changes, and Export Availability

We first estimated how much would have been available for export if the United States had chosen to use export subsidies as an alternative to stockholding. This seems like an easy problem. Simply determine desired end-of-year stock levels, subtract them from total stocks, and move the rest into international markets. The problem, however, is more complex and dynamic. Stocks accumulate over a period of years. Thus, next year's ending stocks may contain some of this year's stocks. For this analysis, stock reduction must be simulated dynamically to reverse the dynamic process by which it was accumulated. Note also that privately held stock levels presumably are a function of market prices, supply conditions, and market expectations. Thus, defining a "desired level" of stocks is not a trivial problem.

Our approach to this problem involved two critical decisions. The first was to choose a stock disposal rule. Should the "desired level" be a fixed quantity of wheat, corn, and soybeans? If so, how should it be determined? Or should it be a percentage of use, production, or consumption? Should it relate to the variability of production? Or should it equal that quantity of stocks above what the private sector would hold if there were no government stock activity? The last guideline is consistent with our expectations of economic behavior and was chosen as a dynamic and plausible rule.

Given that rule, how could we determine the amount of stocks available for disposal? The selection of a dynamic decision rule greatly limited the range of models available. Both econometric models of the U.S. economy (FAPSIM and FAPRI) use private sector stock demand equations. The models could then be used to dynamically simulate the period under analysis by factoring in the condition that no public stocks exist. Thus, our first critical decision would be to stipulate that the Commodity Credit Corporation (CCC) would sell all its stocks at the end of the year in which it acquired them.

The second critical decision was to postulate what other policy changes might have occurred. If a stock removal policy had been in effect in the early 1980's, no publicly owned stocks would have accumulated by 1983. Thus, to the extent that excess CCC stocks triggered the 1983 payment-in-kind (PIK) program, their absence would have made the PIK program unnecessary. We therefore eliminated PIK from all export subsidy simulation runs. Further, if export disposal

was the preferred policy for managing surplus, it is also possible that the farmer-owned reserve (FOR) would not have been implemented in 1977. Consequently, for some of our analysis, we make the assumption that both CCC and FOR stocks are disposed of at the end of each year. All other domestic farm policies, including land set-asides, were left intact.

World Market Impacts and Basic Subsidy Levels

Once we arrived at annual surplus supplies, the next stage was to determine what impact the disposal of those supplies would have on world prices. Then subsidy levels could be calculated and the aggregate level of subsidy costs determined. World prices could, in turn, affect U.S. farm prices. For example, if world demand and competing exporter supply conditions both caused world prices to rise above loan rates or even target prices, both farm incomes and Government costs would be affected. It became evident that we needed world trade models that were interactive with U.S. policy change.

At this point, the analytical challenge sharpened. If the policy instrument chosen were a general subsidy (that is, the same subsidy paid for all destinations), a nonspatial model would be appropriate. On the other hand, if the policy were to target subsidies at specific desirable markets, then a spatial model was necessary. A third possibility arose: To explore the optimum combination of targeted and general subsidies. Our approach was to use all approaches to permit us to evaluate comparative results.

Approaching a general subsidy over time demanded a dynamic nonspatial world model. FAPRI has developed world trade models for wheat, feed grains, soybeans, and soymeal that are dynamic, nonspatial, partial equilibrium econometric models *(3, 7, 13)*. They are based on internal supply and demand functions of major countries and regions. The model determines equilibrium prices, quantities, and net trade by equating excess demands and supplies across regions and explicitly linking prices in each region to a world price. Except where they are set by governments, prices are linked to world prices. Linkage equations include bilateral exchange rates and price margins.

The wheat model encompasses the United States, Canada, Australia, Argentina, India, Japan, China, USSR, Eastern Europe, EC, Africa and Middle East, Other Asia, Other South America, and Other West Europe. The rest of the world is an exogenous block. The U.S. part of the wheat model is more complete than that of other regions. However, at least two structural equations for production and total use are specified for most other regions.

The feed grains model includes 12 regions in differing levels of detail. The most complete submodels are for the United States, Canada, EC, Argentina, and Thailand where both supply and demand components are endogenous. The South Africa submodel consists of a net export function, with production exogenous. The demand side is modeled for the USSR, Spain, and Japan; however, production in these countries is exogenous. Net imports are modeled for Eastern Europe, high-income East Asia, and an aggregation of the rest of the world.

The soybean model endogenizes the demand and supply of soybeans, soymeal, and soyoil in the United States, the demand and supply of soybeans and soymeal in Brazil and Argentina, the demand of soybeans and soymeal in the EC-10, Spain, Japan, Eastern Europe, and an aggregate of the other world market economies. The net trade of the USSR and China is also endogenous.

Because these models contained great detail on U.S. sectors, they could be used to both generate excess supplies over time and determine domestic effects, including Government costs. For this reason, FAPRI was chosen for analysis of the entire general subsidy. FAPRI trade models offered the extra advantage of being able to be run interactively with the more detailed FAPRI national model to yield effects on the U.S. livestock sector. In summary, we built our stock disposal rule and the abolition of FOR and PIK into the FAPRI model. We then ran a dynamic 18-year simulation which determined simultaneously excess supply, world market impacts, and, finally, domestic effects. These results show

effects on world prices, non-U.S. exporters, U.S. farm income, and U.S. farm program costs.

Critical to the outcome are assumptions about how other countries would respond; for example, would they meet subsidized prices? We assumed they would in the short term. Another assumption focused on how importer demand would react to price changes. These crucial issues are discussed separately at the end of this chapter. Chapter 19 reports on the results of the dynamic general subsidy analysis.

Looking at the export subsidy issue from an alternative stance, the question arises as to what would happen if the United States had decided to subsidize some markets but not others? Analysis would demand a spatial model with an optimizing decision rule. Our only choice was the Purdue spatial model. Its advantages are country specificity, the ability to produce trade flows, and the capability of determining which countries benefit and which countries lose. Its drawbacks are its static structure (it allows researchers to look at only 1 year at a time) and its lack of linkage to a domestic agricultural sector model.

We used the Purdue spatial model to simulate three subsidy scenarios to estimate the potential effects on subsidy costs. The scenario depicted:

- Use of targeted export subsidies to maximize U.S. farm income less subsidy cost. In this run, the model determines the optimal level of additional exports and the various subsidy levels. In the year in which analysis was done, not all available stocks were sold.
- Use of a general export subsidy to dispose of stocks available in the year of analysis. This allowed us to compare costs between the spatial and nonspatial models.
- Use of optimal combination of targeted subsidies to dispose of all stocks available.

The results were then to be used to calculate costs to the U.S. Treasury. Although they yielded no explicit estimate of impacts on the U.S. commodity sector, they did allow the relative merits of targeted versus general subsidies to be compared (see Chapters 20, 21, and 23 for a full discussion).

Finally, study contributors decided to perform a separate analysis of the potential benefits and costs of disposing of dairy stocks on world markets. In this case, no world dairy model was available to simulate world market impacts. The analysis therefore depends more on conceptual notions and qualitative analysis. Chapter 22 reports on those results.

IMPORT DEMAND ELASTICITIES

In our embargo study, two critical response relationships were singled out. The first was the economic response of agents and countries to price changes. The second was country policy response, which we discuss later in the chapter.

Before using the simulation models in our analysis, we had to specify behavioral parameters. If counterfactual simulations were to be performed, responsiveness of each country's trade to changes in prices would be essential. However, there is no current consensus among economists on the magnitudes of these parameters. Thus, how to determine an appropriate method for setting these parameters was a problem addressed early in this study.

There are two basic ways to determine behavioral parameters:

- Direct econometric estimation.
- Synthesis of functions from knowledge based on existing econometric evidence and expert judgments.

Econometric estimating involves collecting time series or cross-sectional data on all variables included in specifying net trade functions for each trader in the model. Also, to use this technique, several assumptions are required, some of which prove unreliable when applied to world trade data. Given the substantial amount of work needed to use this approach, the existence of substantial prior econometric work to draw upon, and the known problems

associated with direct econometric estimation, we chose the second approach for use in much of this study. A Delphi process was thus adopted to establish parameter values.

We used the Delphi process by compiling existing econometric estimates of demand, stocks adjustment, and international price transmission elasticities for each of the major grain-trading regions or countries included in the spatial equilibrium model. The compilation results were shared among study participants. They developed a consensus on a set of assumptions related to parameters and elasticities. Though these elasticities were not always the result of direct econometric estimation, they are based on considerable experience and prior research. In most cases, values for individual countries are well within the range of econometric estimates published in the literature.

To illustrate exactly how the trade elasticities were determined, we will calculate Mexico's import demand elasticity for wheat. The first step is to determine the demand, stocks, and price transmission elasticities. The agreed-upon values for these parameters were -0.40, 0, and 0.54. (These were shortrun values assuming no supply response.) The elasticity of import demand for a country with respect to the domestic price is a weighted sum of the elasticities of the domestic behavioral relations. The weights measure the relative importance of trade to the country and are given by the reciprocal of the trade share of the activity. In the case of wheat for Mexico, demand is 3.65 million tons, stocks are 0.30 million tons, and imports are 0.736 million tons in the base year 1980. Thus, the weight on the domestic demand elasticity is 4.96 (that is, 3.65/0.736), and the weight on the stocks elasticity is 0.41 (0.30/0.736). Given the domestic elasticities and their respective weights, the import demand elasticity with respect to internal prices equals -1.98 (-0.4 * 4.96 + 0 * 0.41). For this study, the critical relationship is how Mexican wheat imports change in response to border price changes rather than domestic price changes. The import demand elasticity can be converted to border prices by multiplying the internal import demand elasticity by the price transmission elasticity.

The price transmission elasticity of 0.54 reflects the degree of domestic price insulation from border prices. Multiplying the domestic elasticity by 0.54 gives the import demand elasticity with respect to border prices for Mexican wheat imports. It equals -1.07 (-1.98 * 0.54) (table 6.1).

Table 6.1 reports the full set of trade elasticities derived by this method. Table 6.2 contains, for comparison purposes, the trade elasticities included in the FAPRI model used for analyzing general export subsidies. Some elasticities reported in table 6.2 were also taken from the Delphi process. The remainder were based on econometric estimates of supply and demand elasticities used to derive trade elasticities. See the appendix to this chapter for details on how the Delphi approach was used and/or a comparison of synthetic and econometric approaches.

Two further points important to understanding the sensitivity of trade elasticities to parametric changes emerge from this example. (They are discussed in detail in the appendix.) First, the trade elasticity is highly sensitive to the transmission elasticity used. In fact, much of the difference found in Gardiner and Dixit's review results from assumptions about this parameter *(9)*. Second, if traded volumes are low relative to domestic consumption, the weights attached to the domestic demand elasticities are very high. Thus, a change of the domestic demand elasticity from -0.1 to -0.2, for example, could significantly increase the trade elasticity. An implicit small number bias may exist, pushing synthetically derived estimates upwards.

Given the synthesized set of net trade elasticities for all major traders of wheat and feed grains, it is possible to analytically derive net U.S. export demand elasticities for wheat and feed grains. Table 6.3 presents results derived from the Delphi process and deviation from FAPRI country/region elasticities. Directly estimated elasticities used in FAPSIM are also presented for comparison purposes. A quick glance at the table shows the range of estimates resulting from different methodologies. It is not the purpose of this study to enter into a debate on which is

Table 6.1--Trade direct and cross-price elasticities used in the spatial equilibrium trade model

Country/region	Wheat		Coarse grains	
	Pw 1/	Pc 2/	Pc 2/	Pw 1/
United States	1.002	0.0006	1.550	0.0008
Canada	.433	.0003	2.639	.0063
EC	.165	.0003	-.250	-.0004
Western Europe	-.528	-.0022	-2.009	-.0013
Japan	-.037	-.0004	-.526	0
Oceania	.137	.0001	.262	.0010
South Africa	-2.985	-.2279	.940	.0005
Eastern Europe	-.550	-.0105	-.857	-.0149
USSR	-.509	-.0052	-1.401	-.0198
China	-.541	0	0	-.0603
Mexico	-1.071	-.0157	-.923	-.0024
Central America	-.109	-.0007	-.658	-.0055
Brazil	-.084	-.0002	-.703	-.0050
Argentina	.124	.0011	.684	.0017
Venezuela	-.350	-.0006	-.714	-.0030
South America	-.300	-.0010	-1.047	-.0163
Sub-Sahara	-.243	-.0049	-1.693	-.0083
Nigeria	-.040	-.0006	-4.789	-.0152
Egypt	-.178	-.0101	-.741	-.0163
North Africa	-.365	-.0096	-10.609	-.2226
India	-4.514	0	0	-.0050
Southern Asia	-.666	0	0	-.4418
Indonesia	-.255	0	0	-.0222
Thailand	-.259	-.0003	.210	.0002
Southeast Asia	-.395	-.0058	-2.133	-.0156
East Asia	-.374	-.0054	-1.296	-.0127
Middle East	-.546	-.0019	-1.363	-.0125
Rest of world	0	0	0	0

1/ Pw denotes the price of wheat.
2/ Pc denotes the price of coarse grains.

correct. Rather, we used at least two different elasticities in each analysis to check the sensitivity of our overall results to this particular parameter. The embargo analysis of world market impacts obtained from the spatial model used the Delphi elasticities. To test domestic effects, the estimates of the change in U.S. exports derived from the spatial model were introduced into the FAPSIM model. The analysis was run using both the FAPSIM and the Delphi elasticities (see Chapter 13). In the FAPRI analysis of export subsidies, researchers used both the FAPRI and Delphi elasticities. A comparison of these results provides useful evidence on the sensitivities of models.

COUNTRY RESPONSE ANALYSIS

Critical to the entire analysis was the question of how did or how would other countries respond to U.S. policy actions. Our objectives in the analysis were to provide inputs for the modeling effort on policy adjustments and to seek further qualitative evidence on actual and potential embargo and export subsidy responses.

Country Response to Export Embargoes

The need for analysis arose because the ultimate objective of the embargo study was to present quantitative estimates of the effects of

Table 6.2--Trade elasticities from the FAPRI econometric trade model

Country/region	Wheat	Coarse grains
United States	0.979	1.230
Canada	.951	3.238
EC	0	0
Other Western Europe	1/-4.163	2/
Japan	-.043	-.205
Australia	.185	1.590
South Africa	2/	0
Eastern Europe	0	1/-5.128
USSR	0	0
China	0	0
Mexico	2/	2/
Central America	2/	2/
Brazil	3/	2/
Argentina	.270	2.102
Venezuela	3/	2/
Other South America 3/	1/-.378	2/
Sub-Sahara	2/	2/
Nigeria	2/	2/
Egypt	2/	2/
North Africa and Middle East 4/	1/-.306	2/
India	0	2/
Other Asia 5/	1/-.362	2/
Indonesia	5/	2/
Thailand	5/	.548
Southeast Asia	5/	2/
East Asia	5/	1/-.502
Rest of world	1/-1.170	1/-1.699

1/ Elasticities denoted are derived from the Delphi process used by this study team. All others are derived from the econometric estimates in the FAPRI model.
2/ Country or region is not disaggregated in this model and is included in "rest of world."
3/ All of South America, except Argentina.
4/ All of Middle East and North Africa, except Egypt.
5/ All of Asia, except India.

Table 6.3--Derived import demand elasticity facing the United States

Model	Wheat	Coarse grains
Spatial model using Delphi derivation: Midpoint estimates of USSR and Canadian responses	-1.150	-1.648
FAPRI: Short run (1-2 years)	-.56	1/-.94
Long run (3-5 years)	-1.05	1/-1.22
FAPSIM	-.54	1/-.40 2/-1.17

1/ Corn.
2/ Sorghum.

export embargoes on U.S. agriculture. Study staff conducted this analysis using the various models described earlier and discussed in more detail in this chapter's appendix. The pivotal point is that there are critical parameters in these models that reflect policy behavior such as import demand elasticities, changes in values of policy variables (loan rate, export taxes), and supply response. These and other variables are partly premised on policy. Imposing an embargo alters the policy environment. In the case of the 1980 embargo, for example, the actual imposition of the embargo on January 4, 1980, was only the first in a long line of domestic policy responses. These included U.S. policy reactions designed to offset the embargo's harmful effects on grain companies and farmers. The United States also asked other countries and regions such as Canada, Australia, Argentina, and the EC to participate in the embargo. Their responses varied over time, and there appears to be a discrepancy between what action they said they would take and what they actually did. As researchers, we sought full understanding of the policy environment surrounding the embargoes.

There are two basic approaches to any analysis of this kind: Either assume a response function derived from a literature search or try to determine actual behavior from as many sources as can be tapped within the time limits. Study staff adopted the second approach.

The five basic steps in our approach were:

- Review actual trade flows and from them attempt to infer actual policy responses.

- Collect and review published statements by policymakers from various countries, indicating what policy changes were formally announced.

- Review secondary sources on policy change. For example, the United States maintains an extensive system of agricultural attachés abroad. Their reports, frequently in unclassified cables, are available to researchers.

- Review press reports and analysis because events such as embargoes generate them. They are additional sources of secondary information.

- Conduct direct personal interviews. Interviewing was the most complete but also the most time-consuming approach. We conducted interviews with policymakers and analysts involved at the time the embargo decisions were made. Direct interviews have several drawbacks, however. The information they generate is large and diffuse and must be sifted to determine critical points. Also, an interviewer often gets two or more very different stories about the same event due to varying vantage points and the recall ability of the source.

The country analysis approach allowed us to use all of these information sources. Armed with data on trade flows, production, storage levels, and secondary source information gleaned from policy statements, we attempted to weave together the story of immediate, short-term, and longer term policy response. We used this approach for case studies of six countries. We conducted the first, and most extensive, analysis and set of interviews for the United States. We sought a full understanding of the decisionmaking process that led to the embargoes. Were they driven by domestic or international considerations? How much prior analysis of potential domestic impacts was done? How much attention was paid to the way in which other countries would respond? How did subsequent policies unfold?

In addition, we carried out detailed country analysis for the 1980 embargo for Canada, Argentina, the EC, and, to a lesser extent, Australia. Effects on the USSR were also studied in depth. For all embargoes (1973, 1974, 1975, and 1980), we conducted studies on Japan and Brazil in addition to those countries mentioned above.

We used a chronological approach in seeking information and presenting results, which offers the advantage of allowing comparisons of country analyses. Policy interdependence and sequential responses can therefore be determined. In this way, we were able to arrive at some notions of the dynamic interaction of policy actions and reactions over time.

Results of the country analysis and intercountry interdependence are of interest in and of themselves. Moreover, they can provide significant inputs for quantitative analysis even though the data are essentially qualitative. The country analysis for the embargoes of the 1970's is folded into Chapter 9. Chapter 15 presents results of the country response analysis for the 1980 embargo.

Country Response to Export Subsidies

The range of information sources to be tapped for analyzing future policy changes is much more restricted. There are no trade flows to observe, no public policy statements made, no press reports, and no embassy cables. Instead, we face the task of inferring what might happen. Two approaches were obvious. The first was to try to find past cases of similar kinds of subsidies and to deduce how other exporters reacted to them. Recent events such as the U.S. lowering of the loan rate in 1986 and its targeted export subsidies to Egypt in 1983 served as examples.

The second approach was to conduct direct interviews on export subsidies simultaneous with our embargo interviews. This was a more difficult task because policymakers are skeptical of making statements about what a country "might do" for fear of either having it interpreted as a policy statement or, more importantly, indirectly providing useful information to a competitor. Despite these difficulties, both approaches were used and some of the results (see Chapter 21) were incorporated into our quantitative analysis.

THE CONSISTENCY OF EXOGENOUS MACROECONOMIC VARIABLES

All of the analyses described in Parts II and III of this report were undertaken using actual macroeconomic conditions for the period of the analysis (1970-86). The period studied may be a particularly crucial issue for interpretation of embargo analysis results. Recall that the 1980 embargo coincided with the start of a complete reversal of macroeconomic conditions (see Chapter 5). The study team was concerned that the rise in the dollar, the upturn in real interest rates, and U.S. and global recessions so altered agricultural conditions that they overshadowed any negative effects resulting from the 1980 embargo of the USSR. As such, the embargo effects were unlikely to have been the primary cause of the U.S. agricultural problems during the 1980's.

To test the proposition that macroeconomic events were a potentially significant cause of U.S. agriculture's difficulties, we assumed that the macroeconomic conditions prevailing in 1979/80 persisted through the rest of the 1980's. We then reran the FAPRI trade models with altered macroeconomic exogenous variables. The results are quite significant. Chapter 24 presents those results.

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APPENDIX

COMPARING ALTERNATIVE WAYS TO DETERMINE TRADE ELASTICITIES

Appendix table 6.1 reports the elasticities agreed upon by the Delphi process discussed in Chapter 6. For both wheat and coarse grains, there is an international price transmission elasticity, an own-price elasticity of demand, an income elasticity, and an elasticity of stocks adjustment.

Setting Model Parameters Using the Delphi Process

Because the spatial empirical model includes both wheat and coarse grains, the own- and cross-price elasticity relationships must be theoretically valid. Otherwise policy induced shocks could produce behavior inconsistent with received economic theory. Theoretical restrictions on demand functions were used to generate a complete demand system for each region in the model. The price elasticity assumptions had been carefully scrutinized and are assumed to be correct. A linear expenditure demand system (LES) was built from the own-price elasticity estimates. A linear expenditure system satisfies all theoretical restrictions required of a demand system and incorporates a relatively limited number of parameters. Hence, it may be fitted to the base set of market outcomes using the own-price elasticity and one additional parameter, the Frisch parameter. Estimates of income elasticities of demand for both wheat and coarse grains were used to estimate a Frisch parameter for each country. Because the income elasticity for each commodity yields an independent estimate of the Frisch parameter even though the parameter must be a common value for both commodities, the two estimates were averaged to obtain the final value. The own-price elasticities of demand and the Frisch parameter were used to calculate a complete set of price elasticities according to the formulas developed from the linear expenditure system. These elasticities satisfied all the theoretical restrictions required by demand theory.

The 1980 base data used in the development of the linear expenditure system demand model are shown (app. table 6.2). Demand, ending stocks, net imports, and the international price for both wheat and coarse grains are reported. In addition, total expenditure was required to determine the matrix of elasticities from the linear expenditure system (app. table 6.2).

Appendix table 6.3 depicts the calculated demand elasticities which were obtained from this procedure. The own-price elasticities are identical to those agreed upon by this study's staff. Since the average Frisch parameter differs from those calculated from the individual commodity income elasticities reported in appendix table 6.1, the income elasticities calculated using the average Frisch parameter (app. table 6.3) differ. The income elasticity values reported in appendix table 6.3 are similar to the initial values. The net trade functions used in the spatial model rely on the own-price, stock-adjustment, price-transmission, and cross-price elasticities. The own-price, stock-adjustment, and price-transmission

elasticities are unaffected by the income elasticities. However, calculation of the cross-price elasticities uses the income elasticities. As the income effects dominate the substitution effects, the gross cross-price elasticities are negative and small. Thus, an increase in the price of a substitute causes two effects. First, the substitution effect causes consumers to shift use in favor of the commodity whose price is unchanged. Second, the rise in the substitute goods price has the effect of reducing income, thereby lowering purchases of all goods. On balance, the latter effect dominates the former, and the increase in the substitute good price causes a small reduction in use of the good.

Given the complete matrix of demand elasticities, the stocks adjustment elasticities and the price transmission elasticities, the trade elasticities for each region may be calculated. The trade elasticities are shortrun elasticities because they are based on the assumption that demand and stocks adjust to current period price changes while production does not. Table 6.1 lists calculated trade elasticities used in the model.

Given the synthesized set of net trade elasticities for all major traders of wheat and coarse grains, it is possible to analytically derive net U.S. import demand elasticities for wheat and coarse grains. Appendix table 6.4 reports results of those derivations. The reported net import demand elasticities are weighted averages of trade elasticities determined for each of the foreign markets. Both own- and cross-price elasticities are derived by this method and are reported (app. table 6.4). Results of the Delphi

Appendix table 6.1--Elasticity assumptions for spatial equilibrium trade model

Region	Wheat				Coarse grains			
	Transmission	Price	Income	Stocks	Transmission	Price	Income	Stocks
United States	1.00	-0.20	0.10	-1.15	1.00	-0.30	0.25	-1.00
Canada	1.00	-.20	.10	-.70	1.00	-.45	.35	-.50
EC	.10	-.25	.10	-.50	.10	-.35	.35	-.50
Western Europe	.25	-.20	.15	-.50	.70	-.60	.35	-.70
Japan	.10	-.35	.15	0	1.00	-.50	.30	0
Oceania	.90	-.10	.10	-.40	1.00	-.30	.20	0
South Africa	.05	-.30	.20	0	.40	-.40	.20	0
Eastern Europe	.40	-.20	.20	0	.35	-.30	.35	-.30
USSR	.32	-.20	.20	0	.38	-.40	.30	0
China	.20	-.45	.35	0	0	-.10	.20	0
Mexico	.54	-.40	.35	0	.70	-.50	.40	0
Central America	.50	-.40	.35	0	.30	-.50	.40	0
Brazil	.20	-.30	.25	0	.10	-.60	.40	0
Argentina	.50	-.30	.25	0	1.00	-.40	.30	0
Venezuela	1.00	-.30	.25	0	.60	-.60	.40	0
South America	1.00	-.20	.25	0	.60	-.50	.40	0
Sub-Sahara	.40	-.45	.30	0	.30	-.30	.30	0
Nigeria	.14	-.20	.30	0	.20	-.60	.50	0
Egypt	.25	-.50	.35	0	.50	-.30	.30	0
North Africa	.40	-.20	.35	-.50	.90	-.70	.50	-1.00
India	.01	-.50	.40	-1.20	0	-.20	.10	-.60
South Asia	.20	-.50	.40	0	0	-.20	.20	0
Indonesia	.40	-.70	.40	0	0	-.50	.40	0
Thailand	.50	-.40	.35	0	.50	-.80	.50	0
Southeast Asia	.50	-.40	.35	0	.50	-.50	.45	0
East Asia	.60	-.50	.40	0	.60	-.70	.45	-.40
Middle East	.40	-.20	.35	-.50	.90	-.70	.50	-1.00
Rest of world	0	-.70	.40	0	0	-.50	.40	0

Source: Delphi process.

Appendix table 6.2--Base data for demand, stocks, and trade used in the construction of the spatial equilibrium model

Region	Wheat				Coarse grains			
	Demand	Stocks	Imports	Price 1/	Demand	Stocks	Imports	Price 1/
	------- *Million tons* -------			*$/ton*	------ *Million tons* ------			*Mil. dollars*
United States	21.89	27.68	-36.127	175.00	154.32	51.88	-63.348	130.00
Canada	5.23	9.68	-18.082	178.60	18.28	5.50	-4.159	134.59
EC	43.90	8.20	-9.113	177.50	76.33	6.43	11.984	142.30
Western Europe	8.63	3.98	1.760	179.00	32.00	4.50	7.787	144.40
Japan	6.08	1.60	5.682	194.46	19.23	2.35	18.282	146.95
Oceania	3.45	3.85	-12.372	180.10	3.38	.83	-3.868	130.16
South Africa	1.93	.58	.010	200.00	7.78	2.80	-1.324	132.36
Eastern Europe	35.38	.78	5.149	195.20	71.18	2.90	9.079	151.00
USSR	110.43	4.33	13.885	196.64	99.18	3.00	10.759	150.01
China	71.15	0	11.834	203.39	83.98	0	1.733	155.63
Mexico	3.65	.30	.736	190.97	18.93	2.55	7.176	145.05
Central America	1.15	.15	2.112	191.23	3.70	.35	.843	145.90
Brazil	6.68	.73	4.755	193.25	22.33	1.33	1.905	143.26
Argentina	4.10	.55	-4.944	180.50	6.28	.40	-3.673	125.76
Venezuela	.85	0	.729	190.69	2.33	.20	1.175	145.69
South America	4.58	.75	3.054	193.59	5.60	.70	1.605	145.46
Sub-Sahara	3.07	.28	2.270	209.66	23.00	1.16	1.223	154.26
Nigeria	1.43	.12	1.003	209.66	8.90	.32	.223	154.26
Egypt	7.45	.38	5.231	203.10	4.78	2.03	.967	152.46
North Africa	16.84	1.27	4.383	191.58	13.84	2.13	1.003	153.76
India	35.55	5.50	.054	208.19	29.45	1.68	.274	150.86
South Asia	17.60	1.70	2.643	207.19	3.73	0	.018	150.86
Indonesia	1.35	.22	1.482	202.59	4.05	0	.050	152.66
Thailand	.22	.07	.174	202.59	1.18	.15	-2.247	127.46
Southeast Asia	2.63	.42	1.333	199.49	8.20	.33	.961	150.56
East Asia	2.95	.30	2.364	203.21	8.53	1.38	3.021	153.53
Middle East	15.56	8.11	5.251	191.58	7.96	.63	4.094	153.76
Rest of world	.15	0	.060	210.09	1.54	0	1.237	162.46

1/ The U.S. price is the observed price. Others are calculated by adding transport costs.

Sources: Prices and quantities were derived from USDA data bases. Expenditures were derived from data bases.

process suggest that import demand for both types of grain is elastic. The import demand elasticity for wheat is calculated to be -1.15 and that for coarse grains is calculated to be -1.65.

Comparing Synthetic Estimates with Econometric Estimates

This import demand elasticity summarizes the price responsiveness faced by the United States in its export markets. It is commonly used in U.S. agricultural sector models to represent the behavior of the international markets which interact with the U.S. domestic agricultural markets. One U.S. agricultural sector model, FAPSIM, used in this study to evaluate domestic impacts of sales suspension to the USSR, uses this approach to represent international market demand. In the analysis of the 1980 embargo, FAPSIM is run using its own elasticities and the Delphi estimates. The FAPRI models used to analyze export subsidies used both the synthetically derived elasticities and direct econometric estimates of supply and demand elasticities in that evaluation. Since these other methodologies give different estimates of this parameter, it is instructive to consider the problems and advantages of each approach. That will also help put results derived from the Delphi process into perspective.

The state of knowledge on U.S. import demand elasticities is poor for most commodities. Similar problems exist for the parameters needed to implement the Delphi process because demand, stock-adjustment, and price-transmission elasticities for other countries or regions are not

Appendix table 6.3--Demand elasticities matrix calculated from the linear expenditure system

Country/ region	Wheat			Coarse grains		
	Income	Own price	Cross price	Income	Own price	Cross price
United States	0.13	-0.20	-0.001	0.19	-0.30	0
Canada	.12	-.20	-.001	.27	-.45	-.001
EC	.14	-.25	-.001	.20	-.35	-.001
Western Europe	.13	-.20	-.001	.39	-.60	-.001
Japan	.18	-.35	0	.25	-.50	0
Oceania	.08	-.10	0	.24	-.30	-.001
South Africa	.17	-.30	-.003	.23	-.40	-.002
Eastern Europe	.22	-.20	-.004	.32	-.30	-.005
USSR	.17	-.20	-.002	.34	-.40	-.007
China	.51	-.45	-.041	.11	-.10	-.006
Mexico	.34	-.40	-.005	.42	-.50	-.002
Central America	.34	-.40	-.004	.42	-.50	-.003
Brazil	.22	-.30	-.002	.44	-.60	-.002
Argentina	.24	-.30	-.001	.32	-.40	-.002
Venezuela	.22	-.30	-.001	.44	-.60	-.002
South America	.19	-.20	-.001	.49	-.50	-.005
Sub-Sahara	.36	-.45	-.012	.24	-.30	-.001
Nigeria	.21	-.20	-.002	.64	-.60	-.003
Egypt	.41	-.50	-.014	.25	-.30	-.013
North Africa	.20	-.20	-.003	.73	-.70	-.040
India	.31	-.50	-.011	.12	-.20	-.005
South Asia	.44	-.50	-.006	.18	-.20	-.011
Indonesia	.47	-.70	-.004	.33	-.50	-.001
Thailand	.29	-.40	-.000	.58	-.80	-.001
Southeast Asia	.36	-.40	-.006	.44	-.50	-.004
East Asia	.36	-.50	-.007	.50	-.70	-.007
Middle East	.20	-.20	-.001	.72	-.70	-.016
Rest of world	.47	-.70	-.001	.33	-.50	0

Appendix table 6.4--Matrix of import demand elasticity estimates facing the United States for wheat and coarse grains

Commodity	Wheat	Coarse grains
Wheat	-1.150	-0.008
Coarse grains	-.015	-1.648

well known. Gardiner and Dixit recently reviewed the numerous studies on import demand elasticities, which included direct econometric estimation of this parameter and analytical methods similar to the one employed here. They report numerous inconsistencies in the estimated parameters and raise a number of econometric issues *(9)*.

Estimates of the U.S. shortrun wheat import demand elasticity reviewed by Gardiner and Dixit range from -0.1 to nearly -3.1. Shortrun coarse grain elasticities range from -0.3 to -1.5, while elasticities for corn range from -0.17 to -0.6. High substitutability of commodities in an aggregate group should lead to lower aggregate elasticities, with higher elasticities for individual commodities within that aggregate. The reverse is now found in the literature. Furthermore, the group's judgment, as reflected in the synthetically derived elasticities reported here, is that wheat markets are more protected and food demand is price inelastic, while feed demand is more elastic. Hence, wheat import demand

should exhibit less price responsiveness than coarse grains. The literature seems to suggest the opposite.

Several econometric problems can be identified that contribute to the difficulties encountered in estimating these parameters. They include: (1) The effects of policy intervention on the transmission of international prices to a country's domestic economy, (2) the difficulties in estimating cross-price effects with extreme multicollinearity in price data, (3) specification error, given the large number of variables which are candidates for a net import demand function, (4) the need to distinguish between shortrun and longrun adjustment factors, which may differ considerably, (5) the implications of market power for estimating both exporter and importer behavior (and the stability of that behavior), and (6) the management of stockpiles to affect international market outcomes or separate domestic and international markets.

Specification error is of particular concern to the estimation of a single net import demand elasticity facing the United States. Direct econometric estimation of this function assumes that the true specification of the function is known and that the function is stable over the estimation (and simulation) period. However, the literature reviewed by Gardiner and Dixit includes radically different specifications. Further, the changing nature of policy intervention over time or the exercise of market power by another country suggests that the function may not be stable. Net import demand functions represent the difference between supply and demand in all trading regions faced by the exporter. Hence, all variables affecting supply or demand in the domestic market of other countries are included in the specification. This compounds estimation problems by lengthening the list of relevant variables, many of which must be excluded from the specification. The result is potential bias of estimated parameters since included variables capture effects of excluded variables.

Assumptions on distributions of the error term for unbiased or consistent estimation are violated regularly in practice. Econometric estimates require that errors be normally distributed with a mean of zero. The variance of the errors is assumed to be uniform across all observations and the error in one observation is assumed to be independent of any other observation. While violations of these assumptions can be treated by modifying estimating techniques, such modifications are rarely done.

Monte Carlo studies reported by Binkley and McKinzie suggest that the preferred method for determining net import demand is to derive it from the respective supply and demand functions of major traders in an international market *(4)*. This approach serves as the basis for the "calculation methodology" described in Gardiner and Dixit and originally proposed by Johnson and Tweeten *(10, 16)*. It is also the basis for the Delphi process employed here. Calculation methods, which often incorporate judgmental parameter values rather than econometrically estimated values, tend to yield larger estimates of net import demand elasticities than do direct econometric estimates of net import demand functions. Elasticities derived here are on the high side of the range of available estimates, reflecting this tendency.

This outcome is reminiscent of efforts to estimate energy demand parameters for the United States in the early 1970's. Direct econometric estimates yielded inelastic behavioral responses, which were rejected by many analysts based on observations of adjustments occurring in the market. Of particular concern was the effect of multicollinear price data preventing the disentanglement of own-price effects from cross-price effects. More structured specifications, which relied on prior economic theory to constrain estimation, yielded greater estimates of demand response to price. This is now the case for agricultural import demand elasticities. While the methodologies using derivations from behavior of each trader represent a step in this direction, there are lessons yet to be learned about the consequences of multicollinear price data from the energy area. Lack of good data prevents applying the relatively sophisticated econometric methods used in research to energy markets.

Synthetic estimation of import demand behavior also has its problems. Of particular concern is the fact that we do not have precise econometric estimates of the necessary behavioral parameters. Wide variability exists in demand, price transmission, and stocks adjustment elasticities for other countries. Judgment must be applied to choose among the available

estimates and to fill in the gaps which exist. The net import demand elasticities derived by this method are highly sensitive to the particular choices made.

In the Delphi process used here, we recognized that several parameters were quite uncertain. Of greatest concern were the net trade elasticities of the USSR and the elasticities of stock adjustment for the Canadians. The USSR's wheat net trade elasticity was felt to fall in the range from -0.25 to -0.75. Canadian wheat stock adjustment ranged from -0.4 to -1.0. Similarly, wide ranges were set for coarse grains. The previously reported net import demand elasticities assumed that these parameters are in the midpoint of those ranges. When these parameters are set at the high side of the ranges, net import demand elasticities increase to -1.328 for wheat and -1.745 for coarse grains, constituting increases of 15.5 percent and 5.9 percent. Similar declines in the net import demand elasticities are found when these parameters are set at the low end of the established ranges (app. table 6.5).

The derived net import demand elasticities and, hence, the behavior of the spatial equilibrium model are also sensitive to the assumed price transmission elasticities. In fact, much of the difference in the calculation method results reported by Gardiner and Dixit rests in the treatment of transmission elasticities. The very large longrun elasticities originally found by Johnson and Tweeten implicitly assumed that transmission elasticities equaled one; that is, that domestic and international markets were fully linked. Bredahl, Meyers, and Collins used institutional evidence to argue that, for many countries, domestic and international prices were divorced *(5)*. They found much lower net import demand elasticities. Other recent calculation methods use assumptions similar to those of Bredahl, Meyers, and Collins. Their approach admits only two possibilities, however. Either a market is open, with a transmission elasticity equal to one, or protected, with a zero transmission elasticity. The institutional evidence further suggested that most importers intervened; hence, they had zero transmission elasticities.

Econometric evidence provided by Abbott, Liu and Roningen, and Collins suggests, however, that in the protected import markets there was

Appendix table 6.5--Matrix of import demand elasticity estimates facing the United States for wheat and coarse grains with ranges on Canadian and Soviet parameters

Commodity	Wheat	Coarse grains
Upper limit:		
Wheat	-1.328	-0.009
Coarse grains	-.016	-1.745
Lower limit:		
Wheat	-.971	-.008
Coarse grains	-.004	-1.545

partial adjustment of domestic prices to international prices *(1, 11, 6)*. While the studies of Abbott and Liu and Roningen provided only indirect evidence, Collins directly estimated price transmission elasticities. Her results indeed support the partial adjustment hypothesis. More recent results which update these estimates for several Latin American countries provide even greater transmission elasticities. Those estimates plus recent estimates of staff members of the ERS International Economics Division served as the basis for the outcome of the Delphi process reported here. The result is that importers are assumed to be more price responsive here than in most of the previous synthetic methods, especially for coarse grains.

For countries open to international price changes, the net import demand behavior of the spatial equilibrium model is also sensitive to assumptions on domestic demand parameters. For example, Eastern Europe is assumed to have a price transmission elasticity for wheat equal to 0.4. A 1-percent change in the international price causes a 0.4-percent change in domestic prices. Currently, the domestic wheat demand elasticity is set at 0.2. If that parameter is lowered to 0.1, a seemingly small change well within the error bounds of the Delphi process, the U.S. net import demand elasticity for wheat falls to -1.11, or 4 percent. Since the margin of error (and the range of prior econometric evidence) on these parameters is substantial, the potential for error in the net price response faced by the United States is considerable. However, large changes in the estimated net import demand elasticity (large enough to reduce these to the findings from direct econometric

estimation) will require systematically changing many of the assumed parameters.

Moreover, the synthetic approach is one based on identifying explicitly the behavior of the major traders. It offers a number of advantages. Of greatest importance is the fact that the international effects of an embargo cannot be assessed in the framework of a model incorporating only a net price response at the U.S. border. The adjustments in the international market to accommodate the embargo are key to the effects of the embargo and will constitute a shift in, and not movement along, a net import demand function. Furthermore, the results to be presented subsequently will suggest that the price responsiveness of individual traders is not of great importance to assessment of the USSR grain sales suspension. Rather, the structure of the market and institutional factors affecting the USSR's total demand dominate. Unfortunately, the effectiveness of subsidies schemes are closely linked to these parameter estimates. To assess the full range of policy options (including targeted subsidies) and to examine the impacts on competing exporters, individual trader behaviors are needed.

Synthetic methods require fitting the parameters to observed market outcomes. Benchmarking base model results offers the advantage that the effects of exogenous variables, which are essential to econometric estimation, may be ignored when examining policy alternatives and carrying out counterfactual simulations. Benchmarking base model results also avoids problems associated with setting estimation errors for simulation, by letting base solutions correspond exactly to market outcomes. Further, by setting price response parameters based on the full range of econometric evidence and using judgment, parameters improperly signed (inconsistent with economic theory) and the model solution problems they engender may be avoided. The synthesis approach also allows for a broader range of functional forms, including the discontinuous and nonsmooth functions that result from policy interventions such as price support programs.

The net trade elasticities reported in table 6.1, which led to the derived net import demand elasticities found in appendix table 6.5, are used in this study for spatial equilibrium modeling of competitive international markets to assess the U.S. grain sales suspension and to investigate export subsidy options. They are also used to develop a synthetic Armington model which assumes rigidities in exporter market shares. The derived net trade function was used with the domestic U.S. agricultural sector models to examine these same issues and their domestic impacts, with world market changes coming from this international model.

PART II

TRADE EMBARGOES

Part II focuses on the export embargoes imposed by the United States over the last decade and a half in order to determine export embargoes' effects on world markets (including world prices, trade volumes, and trade flows), and on U.S. exports, farm prices, farm income, and Government program costs.

No single analytical approach is ideal for this complex issue. The methodological approach we used is somewhat eclectic. We looked at the embargo issue from as many perspectives as possible using both qualitative and quantitative approaches. We hoped that the various insights into the effect of embargoes on agriculture would be consistent with each other. The more the answers were consistent, the more confident we would be in the overall, general conclusions reached.

A major problem with this approach is that answers from different methodological approaches are not likely to be directly comparable. While we could not overcome this problem, we attempted to minimize the confusion normally associated with trying to compare noncomparable things. We were particularly careful to highlight the different critical assumptions for each methodology and to indicate how these assumptions condition our conclusions. We also attempted to make any exogenous assumptions about the world as consistent across methods and models as possible.

For example, the two approaches that rely on econometrically estimated equations for the pre/post-embargo period (the time series analysis and the quarterly Armington model) caution the reader that their approaches look for changes in structure and discontinuities in data series. These methodologies cannot separate embargo effects from the totality of events occurring at the same time. These results then must be interpreted as providing some sort of upper bound on the embargoes' effects.

A second example involves interpretation of the results from the annual spatial equilibrium model and the annual Armington model. One significant difference between these models is the way they treated commodity substitutability. The spatial equilibrium methodology assumed that the same commodity from different sources are homogeneous and can be substituted for each other. The Armington model, on the other hand, assumed that a commodity from one source is not perfectly substitutable for one from another source. This assumption difference can create different trade patterns when a targeted embargo is imposed on a single trade flow.

Any study of a complex issue using an analytical approach that views a problem from several different perspectives and uses several different methods faces a specific problem. In order to put the logic of the approach into a clear perspective, it is necessary to summarize the embargo behavior and actions, which can lead to telling the embargo story over and over. Although we have tried to minimize this repetitiveness, some remains. We felt that repeating certain information in different sections of the report made the logic of a particular argument clearer to the reader.

CHAPTER 7

HISTORY OF RECENT U.S. EMBARGOES AND TRADE RESTRICTIONS

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CHAPTER 7

HISTORY OF RECENT U.S. EMBARGOES AND TRADE RESTRICTIONS*

The United States has engaged in four major restrictive trade actions affecting agricultural commodities since 1970. The first three actions, a general restriction imposed on exports of selected oilseeds and oilseed products applied in 1973, a moratorium on grain sales to the USSR invoked in 1974, and restrictions on grain sales to the USSR and Poland in 1975, all focused on calming the domestic market during periods of unusual uncertainty. The fourth, an embargo on agricultural goods to the USSR imposed in 1980, differed sharply. Its aim was to advance U.S. foreign policy goals in the confrontation that developed between the United States and the USSR after the invasion of Afghanistan. Its specific intent was to disrupt the flow of U.S. and other Western farm products to the USSR rather than to "calm" the U.S. market. The 1980 embargo lasted 16 months, significantly longer than the embargoes of the 1970's.

THE 1973 OILSEED SALES RESTRICTION

On June 27, 1973, President Nixon announced that the United States was embargoing the export of soybeans, soybean meal and cake, soybean oil, cottonseed, cottonseed meal and cake, and cottonseed oil. Five days later, U.S. Department of Commerce officials replaced the embargo with an export licensing procedure that lasted until September 21 of that year. At first, Commerce Department administrators issued licenses for 50 percent of the unfilled balance of verified soybean export contracts and for 40 percent of the unfilled balance of soybean cake and meal contracts. However, licenses for 100 percent of the volume called for in soybean meal contracts were issued after August 1 and licenses for 100 percent of the volume called for in soybean contracts were issued after September 1. Hence, export restrictions on soybeans were in place for approximately 2 months and those on soybean meal for 1 month.

In imposing the restrictions, the President cited an unexpectedly tight world supply of high protein meals and the uncertainty it generated in the soybean and soybean products market. World soybean output reached a record 49 million tons in 1972/73 and, combined with beginning stocks of almost 3 million tons, would normally have been sufficient to meet global demand. However, a sharp decline in world fishmeal production tightened protein meal supplies and disrupted the market for substitutes, particularly soybeans and soybean meal.

Chronology of Events Related to 1973 Soybean Sales Restrictions[1]

1972

Autumn. Demand for U.S. soybeans and soymeal increased sharply. Wet weather slowed and reduced the U.S. soybean harvest. World weather conditions diminished output of oilseed crops in India, West Africa, Australia, China, and the USSR. Peru's anchovy harvest failed, dampening fishmeal output.

The USSR made large purchases of U.S. soybeans, wheat, and corn following its crop failures.

1973

January. U.S. Department of Agriculture (USDA) relaxed restrictions on set-aside land to increase production of soybeans, feed grains, and food grains.

February. A second devaluation of the U.S. dollar heightened foreign demand for soybeans and oilseed meals.

*Contributors to this chapter were William E. Kost, Patrick O'Brien, Rachel Nugent Sarko, and Alan Webb.

[1]Chronologies in this chapter rely heavily on material presented in *(1)*. Italicized numbers in parentheses refer to items in the References at the end of this chapter.

March. Brazil limited exports and required licenses to export any soybean products. Heavy rains hindered U.S. soybean planting.

Spring. USDA released additional acres for soybean production. Japan built additional soybean stocks by expanding imports.

April. USDA suspended vegetable oil exports under the CCC Export Credit Sales Program.

Summer. The United States suspended export subsidies, which had guaranteed American farmers a fixed export price.

June 13. President Nixon imposed price ceilings on all retail and wholesale prices and announced an export monitoring system to track outflows of agricultural products. Exporters were required to weekly report outstanding sales. The President also requested authority to control agricultural exports.

June 22. The Chicago Board of Trade limited trading of soybean and soymeal futures for July, August, and September to contract liquidation only.

June 27. The U.S. Department of Commerce (USDC) announced an embargo on the export of U.S. soybeans, cottonseeds, and other related products.

June 28. The Chicago Board of Trade suspended trading of soybean contracts for 24 hours. Brazil embargoed soybean oil exports.

July 2. USDC replaced the embargo with an export licensing system for all commodities included in the monitoring program, exempting soybean and cottonseed oil.

July 5. USDC reinstated export license requirements on soybean and cottonseed oil and brought 39 other commodities under restrictions.

July 18. Phase Four of President Nixon's anti-inflation program began, allowing some cost increases to be passed through to consumers.

July 20. USDA announced that there would be no set-asides in 1974 for wheat, feed grains, or cotton.

August 1. USDC issued licenses for 100 percent of soybean meal contracts.

August. Japan switched to imports of soybean meal, an item less tightly restricted by the United States.

September 1. USDC issued licenses for 100 percent of soybean contracts.

September 21. USDC revoked the export licensing system.

October. Brazil prohibited exports of soybeans to meet domestic supply needs.

1974

January. Brazil established export quotas on soymeal.

February. Brazil relaxed restrictions, allowing exports of all products.

August. Brazil imposed registration requirements on soymeal exports.

Chapter 9 presents a more detailed discussion of the events surrounding the 1973 oilseed sales restriction.

THE 1974 AND 1975 TRADE ACTIONS

The United States also took action to restrict agricultural exports in 1974 and 1975. Although the methods used differed from those of 1973, the rationale for intervening was similar. Government officials initiated both actions to "calm" the domestic market during a period of unusual uncertainty about the adequacy of supplies in the face of production shortfalls here and abroad.

The 1974 Moratorium on Sales to the USSR

Deteriorating crop prospects in the United States and several of the largest importing and exporting countries was the major impetus behind the 1974 sales moratorium. In the spring of 1974, world crop supplies were relatively tight, but production prospects were generally favorable. As the growing season progressed, however, world crop conditions

began to deteriorate. The United States and Canada experienced an unusually unfavorable combination of a cold, wet planting season, summer drought, and an early frost. Australia and Argentina faced similar problems later in the year. In the USSR, India, and several Middle Eastern countries, drought also caused sharp declines in grain production.

On August 12, 1974, USDA's Crop Reporting Board estimated the forthcoming domestic corn crop at 4.9 billion bushels, down 1.8 billion from spring and early summer estimates. In October, the board adjusted its forecast downward by another 200 million bushels. This deteriorating crop situation led President Ford to request on October 4 that U.S. grain exporters voluntarily suspend contracts for the delivery of 2.3 million tons of corn and 900,000 tons of wheat to the USSR. Since the restriction was voluntary and the Export Administration Act was not involved, the action was technically a sales moratorium rather than an embargo.

The USDA announced on October 7 a voluntary prior-approval system for exporting wheat, corn, soybeans, soybean cake and meal, and grain sorghum. Barley and oats were added on October 11. Sales of soybeans, soybean meal and oil, cottonseed meal and oil, other vegetable oils, protein animal feeds, and animal fats were eventually also monitored or licensed during at least part of the moratorium period. The United States and the USSR reached an agreement shortly afterwards to allow 1.2 million tons of wheat and 1 million tons of corn to be shipped to the USSR. The moratorium and the voluntary prior-approval system remained in effect until March 6, 1975.

The 1975 Moratoria on Sales to the USSR and Poland

By the spring of 1975, pricing pressures had eased considerably. The 1974 crop, while generally poor, was larger than forecasters had expected. Also, higher prices effectively rationed short supplies. World grain use dropped 37 million tons, while world trade dropped 5 million tons, posting the first decline since 1968/69. Good harvests in the Southern Hemisphere from December through March also helped steady the world market.

The poor 1974 grain harvest, however, had left the U.S. and world grain markets highly vulnerable to supply shocks in 1974/75. World grain stocks at the end of 1973/74 were less than 12 percent of utilization, the lowest in more than 15 years. Thus, despite good prospects for U.S. crops, the market reacted strongly in the summer of 1975 to information that the Soviet grain crop was deteriorating. The Soviet decision to offset domestic production shortfalls with imports during 1972 and 1973 dramatically increased the market's sensitivity to that nation's crop developments. During the summer of 1975, each change in Soviet crop prospects, whether rumored or based on official announcements, caused large swings in U.S. prices and increased the uncertainty facing buyers of U.S. grain, particularly domestic livestock producers.

The U.S. Government instituted the 1975 sales moratorium on grains destined for the USSR chiefly to calm this market uncertainty. The Secretary of Agriculture on August 11 called on the major grain companies to withhold further sales to the USSR until U.S. domestic crop prospects became more certain. This action failed to defuse speculation about the adequacy of U.S. supplies, and prices continued to rise. Corn prices, for example, jumped almost 10 percent during August. On September 9, the President announced plans to negotiate a long-term grain accord with the USSR and extended the moratorium on grain sales through mid-October. The next day, officials included Poland in the sales suspension.

The U.S. Government announced a tentative agreement in September that committed the USSR to minimum purchases of 6 million tons of U.S. grain (3 million tons each of wheat and corn) per year for 5 years. The agreement would run from October 1, 1976, to September 30, 1981. The pact also provided for annual consultations and required the approval of the U.S. Secretary of Agriculture for sales exceeding 8 million tons. With the signing of the agreement on October 20, 1975, the moratorium on grain sales to the Soviets was lifted.

The 3-month moratorium on sales to Poland was closely linked to the Soviet moratorium and manifested concern that U.S. supplies would be inadequate to meet Soviet and Polish

import demands without driving U.S. prices up sharply and worsening inflation. It also promoted the successful negotiations of a 5-year, long-term trade agreement with Poland in which that nation agreed to buy 2.5 million tons of U.S. wheat and corn annually, plus or minus 20 percent depending on the size of the U.S. crops and Polish import needs.

Chronology of Events Related to 1974 and 1975 Grain Moratoria

1974

August 12. USDA revised its estimate of the 1974 corn crop downward to 4.9 billion bushels. On July 25, the USDA had forecast a 1974 corn crop of 5.9 to 6.2 billion bushels. Earlier in the year, it had predicted corn output to reach as high as 6.67 billion bushels in 1974.

September 12. USDA requested daily export sales reports.

October 4. President Ford expressed concern over the Nation's grain stock levels. He requested two large grain companies, Cook and Continental, to voluntarily void export contracts calling for the sale of 2.3 million tons of U.S. corn and 0.9 million tons of U.S. wheat to the USSR.

October 7. The USDA announced a voluntary prior-approval system for export sales of wheat, corn, soybeans, soybean meal, soybean oilcakes, and grain sorghum.

October 10. USDA further reduced its estimate of the 1974 corn crop. It forecasted corn production at 4.7 billion bushels, down 0.2 billion bushels from its August estimate.

October 11. USDA added barley and oats to the list of commodities covered under the voluntary prior-approval system for export sales.

October 19. Following an October 12-15 trip to Moscow, Secretary of the Treasury William E. Simon announced that the USSR had agreed to limit its grain purchases from the United States for the 1974/75 crop year to 2.2 million tons (1 million tons of corn and 1.2 million tons of wheat). That amount equalled 1 million tons less than originally contracted for. The Soviets also agreed to cooperate with the United States in developing a supply and demand data system to help avert surprisingly large sales in the future.

Fall. Due to a bountiful harvest, Europe disposed of large quantities of wheat on world markets. Japanese feed grain demand dropped because of high prices.

1975

March 6. Agriculture Secretary Earl Butz announced the end of the voluntary prior-approval system for export sales of grain, soybeans, and soybean meal. The export reporting system remained in effect.

June 9. USDA revised downward its projection of Soviet grain production, from 210 to 200 million tons. It estimated Soviet grain import requirements at 10 to 15 million tons.

July 7. A USDA team returned from a 3-week inspection tour of Soviet wheat-producing areas and predicted a lower yield than that of 1974.

July 9. USDA revised its estimate of Soviet grain production from 200 to 195 million tons.

July 16. USDA announced the first 1975 sale of 2 million tons of U.S. grains to the Soviets.

July 17. The Canadian Wheat Board announced that the Soviets had purchased 2 million metric tons of high-grade wheat. The USDA announced additional sales of 1.2 million tons of U.S. grains to the Soviets.

July 22. USDA announced additional sales of 1 million tons of wheat to the Soviets.

July 24. USDA asked export firms to notify the Department before making major grain sales to the USSR. USDA revised its estimates of Soviet grain production, from 195 to 185 million tons. Soviet import requirements were estimated at 20 million tons.

July 31 and August 9. At hearings before the Permanent Subcommittee on Investigations of the Senate Committee on Government Operations, Assistant Secretary of Agriculture Richard Bell stated that U.S. grain sales to the USSR included 10.3 million tons of

wheat, corn, and barley. Economic consultant John Schnittker testified that grain sales to the Soviets should be halted until mid-October.

August. Brazil placed an export quota on soybeans.

August 9. Information obtained by the Central Intelligence Agency (CIA) indicated that Soviet grain import requirements could reach 40 million tons.

August 11. The U.S. Secretary of Agriculture called on grain companies to withhold further sales to the USSR until U.S. crop production figures were known. USDA estimated Soviet grain production at 180 million tons. The longshoremen's union initiated a boycott on loading grains bound for the USSR.

August 21. The U.S. Secretary of Agriculture predicted a rise of 1.5 percent in U.S. food prices as a result of grain sales to the USSR, and an annual food-price inflation rate of 9 percent.

August 29. USDA revised its estimate of Soviet grain production, from 180 to 175 million metric tons. It also updated its forecasts of Soviet import requirements to 25 million tons.

September 9. President Ford announced his intention to explore the possibility of a long-term grain agreement with the USSR and extended the moratorium on grain sales to the Soviets until mid-October. After this announcement, the longshoremen's union agreed to end the boycott on loading grains destined for the USSR.

September 10. Without a public announcement, the U.S. Department of State requested through the Polish Embassy that Poland halt grain buying in the United States. Poland had purchased 1.9 million tons of U.S. wheat and corn before that date. On the same day, Under Secretary of State Charles W. Robinson left for Moscow to begin negotiating a long-term grain trade agreement.

September 16. Under Secretary of State Robinson announced in Moscow that the Soviets had agreed in principle to a long-term trade agreement.

September 21. Polish Minister of Agriculture Kazimierz Barcikowski arrived in Washington, D.C., to begin talks on a long-term grain trade agreement.

September 29. Agriculture Secretary Butz and Polish Minister of Agriculture Barcikowski completed discussions between the United States and Poland. The agreement was scheduled to be signed in November.

October 10. USDA released its October 1 crop estimates, showing record harvests for wheat (2.137 billion bushels) and corn (5.737 billion bushels). President Ford announced that he was lifting the embargo on grain sales to Poland because the USDA was forecasting record corn and wheat harvests.

October 20. President Ford announced the signing of a 5-year grain trade agreement with the USSR and ended the embargo on grain sales to the Soviets.

October 24. The United States resumed grain sales to the USSR.

November 27. Agriculture Secretary Butz and Polish Minister of Agriculture Barcikowski exchanged letters concerning a 5-year grain trade agreement. Poland agreed to purchase 2.5 million tons of U.S. wheat and corn each year. This amount would be allowed to fluctuate from year to year by 20 percent, depending on the size of the U.S. grain crops and Polish import needs.

Chapter 9 discusses in more detail the events surrounding the 1974 and 1975 grain moratoria.

THE 1980 EMBARGO

The embargo of 1980 differed from the 1973, 1974, and 1975 actions in several ways. Unlike the trade interruptions of the mid-1970's, imposed to ensure adequacy of domestic supplies and to calm dramatic price movements, the 1980 embargo had little domestic basis. The United States imposed trade sanctions to take advantage of the USSR's growing dependence on imported farm products in an effort to counter Soviet action in Afghanistan. This embargo also lasted much

longer (from January 4, 1980, to April 24, 1981) than the 1973-75 trade suspensions and affected a wider range of products. When in full force, it restricted sales of wheat, feed, soybeans, meat, poultry, dairy products, animal fats, and agrichemicals.

The 1980 trade stoppage was only a partial embargo. The United States continued to honor the U.S.-USSR long-term grain agreement and allowed the Soviets to import the 8-million-ton maximums called for in the fourth and fifth years of the accord, 1979/80 and 1980/81.

Chronology of Events Related to the 1980 Soviet Grain Embargo

January 1979 to May 1981. Brazil alternated between quotas on and suspension of exports of oil, meal, and soybeans.

1979

October 3. The U.S. administration agreed to export a minimum of 20 million tons and a maximum of 25 million tons of grain to the USSR. Specifically, the USSR would import no more than 18 million tons of feed grains and no less than 3 million tons of wheat.

November. A second worldwide oil shock sent the price of a barrel of oil on an upward spiral from $18 to $30.

Early December. The U.S. administration became aware of Soviet troop movements. The U.S. Department of State considered alternative reactions in the event of a Soviet invasion of Afghanistan.

December 25. The National Security Council held a meeting with U.S. Secretary of Agriculture Bergland in which they discussed sanctions. Soviet troops stood poised on Afghanistan's border.

December 26. The Soviets invaded Afghanistan.

December 27. USDA established a small working group to assess the economic effects of an embargo.

1980

January 1. The White House held a meeting in which the CIA and USDA presented disparate statistics on the embargo's effects on the USSR. The USDA estimated a reduction of 2 to 4 percent on Soviet meat consumption, while the CIA estimated a decline of 20 percent.

January 2. Vice President Mondale called a meeting in the White House where a decision was made to assess the embargo's budgetary implications for the Nation.

January 3. President Carter called a Cabinet meeting in which an agreement was made to impose a partial embargo. The President stated that he viewed the Soviet move "as the most serious threat to world peace since World War II." Carter said he did not care if it cost $2 billion to remedy; budgetary savings would have to be made elsewhere.

Secretary of Agriculture Bergland estimated the drop in farm income could total $3.5 billion and stated that there would be structural damage to the U.S. trade position. He predicted greater damage to the United States than to the USSR. Secretary of State Vance urged export of only 8 million tons of grain.

January 4. That evening the President announced that the United States had imposed an embargo. (Exporters and grain companies were notified earlier that day.) Secretary of Agriculture Bergland held a meeting to discuss a farm indemnification program.

January 5. Secretary of Agriculture Bergland announced his intention to change the farm program to offset the effects of the embargo on American farmers.

January 6. USDA officials met with grain companies to develop a buyout program. They reached an agreement whereby the Federal Government would purchase outstanding contracts.

January 7. The Commodity Futures Trading Corporation closed down trading in the commodities market for 2 days.

Vice President Mondale announced that the CCC would purchase, at the contracted price, approximately 10 million tons of corn, 3.7 million tons of wheat, 740,000 tons of soybeans, 400,000 tons of soybean meal, and 30,000 tons of soybean oil.

January 8. USDA officials announced further farm program changes, including actions designed to encourage grain buildups in the FOR. The Federal Government made the difference between release and call prices greater. Other changes included increasing grain storage payments, granting a 1-year interest waiver on the first 13 million tons of corn placed in the FOR, and raising loan prices. The administration also announced that a paid diversion would be authorized if necessary. The market was closed for trading in commodity futures.

January 9. The commodities market reopened and was down the maximum allowed by the Board of Trade.

The longshoremen's union announced a boycott of Soviet cargo, resulting in the back-up of the gulf and east coast ports, and rail transportation systems. President Carter stated that the administration took action with the hope of deterring further aggression, not with the expectation that the Soviets would abandon Afghanistan.

January 10. The commodities market was down the maximum allowed by the Board of Trade.

January 11. The commodities market was down less than the maximum allowed by the Board of Trade.

January 12. Representatives of other exporter nations met with U.S. Government officials. Foreign envoys agreed to "not directly or indirectly replace" the 17 million tons of commodities not shipped by the United States and to limit their exports to normal amounts.

January 13. USDA officials met with grain company chief executive officers and accountants. Corporate accountants presented financial statements to show the amount of contractual obligations to be assumed by Government purchase. White House staff met to discuss what action to take from political and economic standpoints.

January 14. Vice President Mondale announced the terms of buyout contracts.

The United Nations General Assembly adopted a resolution by a vote of 104 to 8 calling for withdrawal of foreign troops from Afghanistan. Representatives from the United States, Brazil, and Argentina discussed withholding soybeans from the USSR. Argentina and Brazil refused to monitor their sales, saying it was a commercial matter.

January 15. The Argentine Government announced its refusal to support the U.S. embargo.

January 17. U.S. press reported a major Soviet purchase of linseed from Argentina.

January 18. President Carter restricted 1980 imports of Soviet ammonia fertilizer (expected to rise from 0.7 million tons to 1.5 million tons) to 1 million tons. This reversed his December 11 decision to override the International Trade Commission (ITC) recommendation that a quota of 1 million tons be imposed for 1980.

January 19. President Carter said he would request PL-480 funds from Congress. The funds would finance emergency grants and aid to help developing countries create reserves for protection against sudden changes in crop productivity. In another action, the USDA announced that it would provide 5,000 tons of chicken for domestic food aid.

January 25. In his State of the Union Address, President Carter warned that the United States would react with force if Soviets approached the Persian Gulf.

February 2. The Soviet mission made sizable grain purchases in Argentina and then headed for Brazil.

February 11. A cable reported a rumor, circulating in French trading circles, that the USSR bought more than 2 million tons of grain and oilseeds through EC traders since the embargo began. Italian traders reportedly resold to the USSR 1 million tons of corn imported from Argentina, while a West

German company was reported to have contracted delivery of 500,000 tons of corn and 400,000 tons of soymeal to USSR.

February 15. Cable from the U.S. Embassy in Brussels reported that the EC had extended the waiting period for licensed goods so that their destinations could be checked.

February 20. President Carter announced the U.S. boycott of the Moscow Summer Olympics.

February 29. Agriculture Secretary Bergland announced there would be no paid land diversion for 1980 crops.

March. Smaller than expected corn crops were harvested in Argentina.

March 10. USDA revised upward its estimates of Soviet grain imports and its forecast of Soviet grain import needs.

March 28. USDA allowed producers with 1978 or 1979 crops in the FOR or with CCC loans to move grain as space permitted and receive assistance to pay for it.

March 30. President Carter extended the Economic Emergency Loan program to September 1981 to make $2 billion available to farmers.

April 30. USDA announced that the USSR would be permitted to purchase up to 8 million tons of grain in the last year of the long-term agreement for shipment after October 1, 1980.

June 10. At a White House meeting, officials discussed the severity of U.S. farmers' plight: Good weather, large crop, inflation, high interest rates, and high production cost because of skyrocketing fuel costs. Advisors laid blame to the embargo. Officials discussed the possibility of increasing loan rates, which would have meant large outlays. They decided on a wheat set-aside program for 1981 slated to start in August.

June 18. President Carter modified trade restrictions to allow U.S. companies to sell non-U.S. grain to the USSR.

July 10. Argentina signed a long-term agreement with the USSR to supply 4 million tons of corn and 0.5 million tons of soybeans annually for 5 years.

July 28. President Carter announced loan rate increases.

September. A Mexican corn drought created strong demand for U.S. agricultural products.

October 22. United States and China signed a 4-year agreement for Chinese annual imports of 6-9 million tons of U.S. grain.

December 3. Mexico signed an agreement to purchase a minimum of 6.15 million tons of grain from the United States in 1981.

December. Canada formally ended its embargo.

1981

March 24. The U.S. Senate passed by voice vote a Sense of the Senate Resolution calling for an end to the embargo.

April 24. President Reagan terminated restrictions on U.S. exports to the USSR.

May 26. A new long-term agreement between Canada and the USSR allowed the USSR to import 4 million tons of wheat, barley, and oats to be increased by 0.5 million tons annually for 5 years.

June 9. The United States and Mexico agreed on a minimum 4.6-million-ton sale of grain to Mexico in 1982.

August 5. U.S. and Soviet officials agreed to extend their long-term agreement for 1 year with the same provisions on Soviet purchases.

December. Brazil removed all restrictions on agricultural trade.

1983

October 1. A new 5-year, long-term agreement between United States and the USSR began with the minimum annual Soviet purchase of 9-12 million tons of at least 4 million tons each of wheat and corn.

Chapter 15 presents a more detailed discussion of the events surrounding the 1980 embargo targeted at the USSR.

A PERSPECTIVE ON EMBARGOES

Four factors influence the magnitude of an embargo's impact on world and domestic markets. The first is what proportion of the embargoed commodity is normally traded on the world market which, in turn, hinges on two elements: The importance of the country that initiates the embargo to world trade and the quantity of exports it decides to withhold from the market. If, for example, New Zealand were to embargo wheat exports, the trade disruption might affect that nation but it would have virtually no impact on the global wheat market. For the four embargoes we examine in this study, the United States is the largest international exporter of the commodities affected.

The proportion of exports withheld from the market by the country initiating the embargo depends on the exact terms of the embargo. Embargoes can be distinguished by either the number of destinations designated or the level of exports to targeted destinations. For example, a general embargo prohibits exports to all destinations, while a targeted embargo affects only exports to selected destinations. A total embargo prohibits all exports of a designated commodity, but a partial embargo affects only a portion of the exports. The 1973 U.S. embargo of oilseeds and oilseed products was a general embargo for only 4 days because it prohibited all oilseed exports to all destinations. Thereafter, it became a general partial embargo because it withheld part of U.S. exports to all destinations. The 1974 and 1975 U.S. embargoes against the USSR were targeted "voluntary" moratoria on grain exports. They restricted all U.S. grain exports to the USSR. The 1980 U.S. embargo of the USSR, however, was a targeted partial embargo. It only prohibited exports in excess of the 8 million tons specified in the U.S.-Soviet grains agreement and affected only exports to the USSR.

A second factor affecting an embargo's impact is its duration. The longer an embargo continues, the greater and more lasting the effects. During a short embargo, importers can draw down stocks, use less desirable domestic substitutes, or simply do without the commodity. Doing without provokes hardship when the embargoed commodity affects food and feed supplies, which is why countries are sensitive to interruptions in the flows of agricultural products. Also, the longer an embargo lasts, the more likely policies and technologies will be put into place that prevent a return to pre-embargo conditions. The 1973, 1974, and 1975 embargoes were relatively short. The 1980 U.S. embargo against the USSR was lengthy, considering that it affected a key commodity such as grain. It remained in force for nearly 16 months.

The third element is the action's timing. Because seasonal production patterns govern almost all agricultural products, an embargo invoked just before harvest may have a much smaller effect than one imposed during the middle of the crop year.

The fourth component, tightness of the market, has a very significant influence on an embargo's impact. Except for the 1974 grain moratorium, the three U.S. embargoes of the early 1970's all took place in tight market conditions during the latter half of the crop year. The export bans were imposed to insure that there were enough grain and oilseed supplies to meet domestic needs. Foreign policy considerations motivated the 1980 embargo. Policymakers invoked it at the midpoint of the wheat crop year and a quarter of the way through the coarse grain and soybean crop years. Though market conditions were tight, policymakers expected adequate grain supplies to be available to meet global demand.

Table 7.1 summarizes the four major U.S. agricultural embargoes based on these factors. The table shows that, although the first three embargoes were more complete than the 1980 action (for example, they included all destinations or all exports to a specified destination), they lasted briefly and came at the end or near the beginning of crop years when markets were tight or supplies uncertain.

Tight conditions imply that most of the adjustments to a shock such as an embargo will take place in the price arena because stock levels are insufficient to make these

Table 7.1--Major U.S. embargoes of agricultural products

Embargo type/date	Type of embargo			Environment	
	Destinations affected	Proportion of exports	Duration	Timing	Market conditions
1973 oilseed embargo:					
June 27-July 2 oilseed and products	All	All	4 days	Middle to end of crop year	Extremely tight
July 2-September 1 soybeans	All	50 percent	2 months	Middle to end of crop year	Extremely tight
July 2-August 1 soymeal	All	60 percent	1 month	Middle to end of crop year	Extremely tight
1974 grains embargo October 4-March 6	USSR	Voluntary, prior approval	5 months	Beginning of crop year	Very tight
1975 grains embargo: August 11-October 24	USSR	Voluntary, prior approval	2 months	End of crop year	Very tight
September 10-October 4	Poland	Voluntary, prior approval	1 month	End of crop year	Very tight
1980 grain and oilseeds January 4, 1980-April 24, 1981					
Wheat	USSR	-4 million tons	16 months	Middle of crop year	Adequate supply
Corn	USSR	-4 million tons	16 months	Early in crop year	Adequate supply
Oilseeds	USSR	All	16 months	Early in crop year	Adequate supply

adjustments. In the summer of 1973, the United States had very limited oilseed supplies available for export. Consequently, prices were used first and the embargo later to ration available stocks.

The 1980 grain embargo covered a much longer time period but took place when world grain supplies were adequate. However, it was subject to more leakages because the action affected only a portion of the U.S.-Soviet bilateral grain flow. Therefore, for the 1980 embargo, we expect the effect on prices to be small but the effect on trade flows to be larger and longer.

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CHAPTER 8

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CHAPTER 8

EMBARGOES: A REVIEW OF CONCEPTUAL, THEORETICAL, AND EMPIRICAL ANALYSES*

In the preceding chapter, we reviewed the circumstances surrounding the four export restrictions that the United States has used for agricultural products in the past 15 years. We noted that different circumstances led to different types of embargoes with different objectives. A general embargo halts some or all of an embargoing country's exports to all importers. A targeted embargo halts some or all of a country's exports to one or more particular importers. General and targeted embargoes take two forms: total and partial (optimal). A total embargo halts all exports of a designated commodity; a partial embargo halts a portion of the exports. Countries use embargoes to increase their domestic supplies, to exert market power by withholding supplies and raising international prices, or to inflict economic harm for diplomatic or other reasons. The result in any case is to lower domestic prices and increase world prices. If other countries join the embargoing country, the result is similar to an export cartel.

This chapter explores the theoretical and empirical literature on economic sanctions, export controls, and embargoes to help clarify the anticipated effects of general embargoes (such as the one in 1973) and targeted embargoes (such as those in 1974, 1975, and 1980). This review has three purposes: First, it shows us what prior expectations were about effects of embargoes on world markets, embargoing countries, and targeted countries. Second, it helps us derive expected effects of particular types of embargoes to identify critical variables for empirical analysis. Third, this review helps us assess quantitative estimates of impacts of past embargoes, particularly the four embargoes studied here. The theoretical framework used in this chapter is generally that of a partial equilibrium analysis and applied welfare economics.

*Contributors to this chapter were Andrew Schmitz and Alex F. McCalla.

GENERAL EMBARGOES

The theory of general embargoes is developed beginning with the simplest case: A two-country world in which one country applies a total embargo. This model is then expanded to include other exporters.

Two-Country Total Embargo Case

Consider embargoes in which two countries trade two goods. In figure 8.1, the United States offers grain for export in exchange for car imports from Japan. The U.S. export supply curve for grain is ES_g, and the import demand curve for Japanese cars is ID_C. The Japanese export supply curve for cars is ES_C, and the import demand curve for U.S. grain is ID_g. Under free trade, the United States exports Q_g of grain at price P_g and imports Q_c of cars at price P_c. Trade gains to the country exporting grain, the United States, is $P_gbd + P_cfe$, and gains to the country exporting cars, Japan, is $P_cfh + P_gba$. Gains from trade for the United States and Japan jointly are abd + efh.

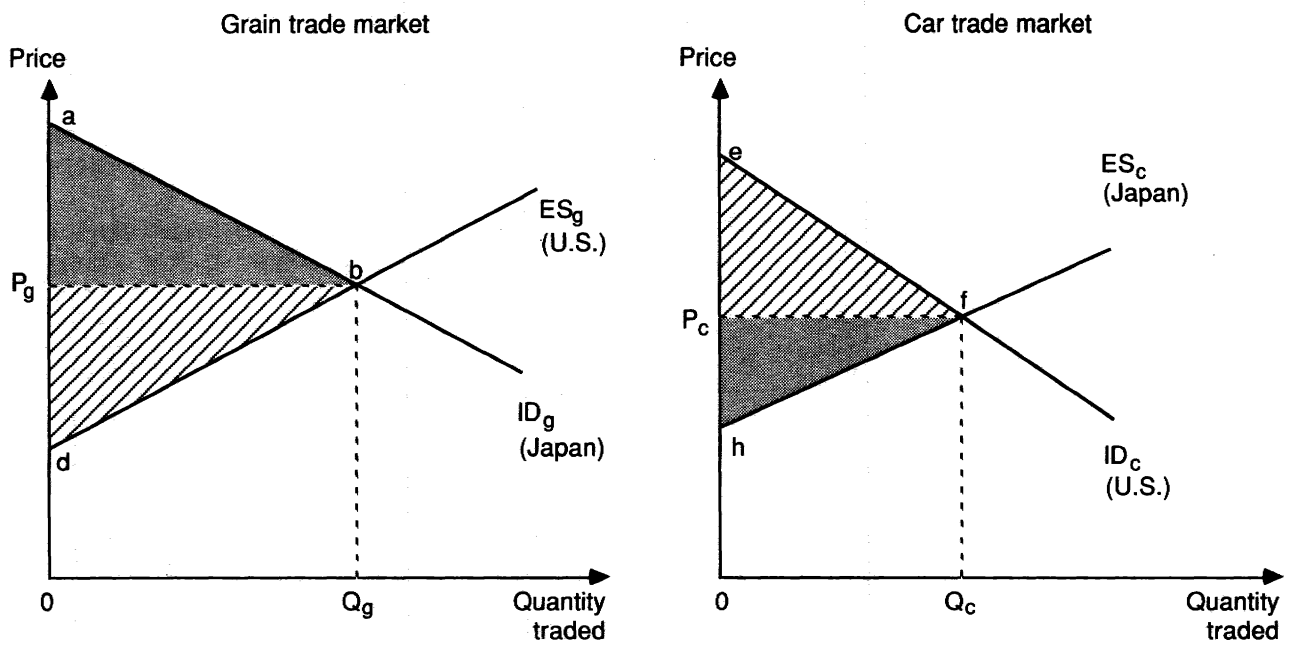
A U.S. embargo against Japan would disrupt the flow of exports and imports between the two nations; aggregate trade gains would be lost. Consider an extreme case in which the United States imposes a total embargo on grain exports to Japan and the Japanese retaliate with a total embargo on car exports to the United States. Both countries would suffer economic losses from the initial U.S. embargo. Both countries would have a combined loss of abd + efh. The United States would lose $P_gbd + P_cfe$. However, if Japan did not retaliate, the United States would lose P_gbd due to the U.S. embargo.

Total Embargo With Competitors Case

In the two-country model, the United States was assumed to be the only grain supplier. However, other countries export grain, too, which changes

Figure 8.1

Two-Country Total Export Embargo

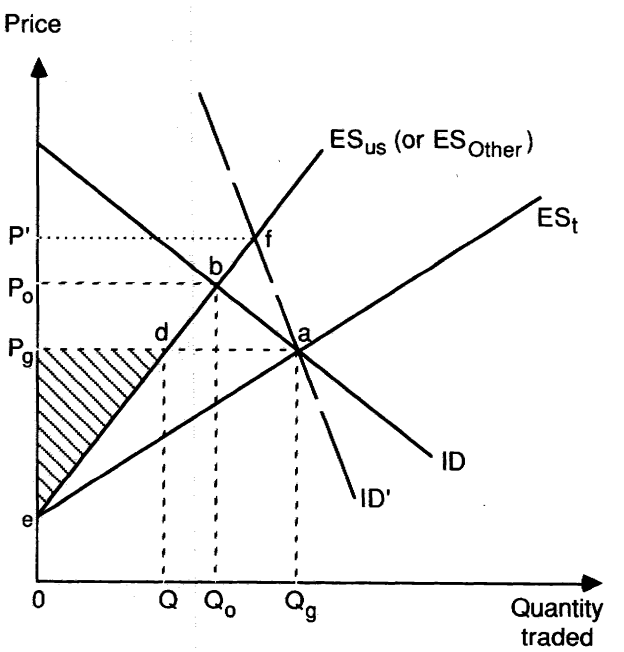


the outcome of a U.S. grain embargo. In figure 8.2, the import demand for grains is ID, and the total export supply curve is ES_t. This schedule includes the United States and other exporters. The free trade price is P_g, and quantity Q_g is exported. Assume that the United States has 50 percent of the market at price P_g, and other exporters have the remaining 50 percent. Also assume that the U.S. excess supply curve is identical to the aggregate for all other exporters. In equilibrium, the United States exports OQ, which equals other countries' exports of QQ_g.

Now assume that the United States imposes a total export embargo, thereby eliminating the U.S. export supply curve. Because the export supply curves for the United States and other countries are the same, the new total market export supply curve becomes $ES_{US} = ES_{Other}$, and the United States loses its trade gains, the cross-hatched area P_gde. However, other exporters gain P_gdbP_o. Importers lose P_obaP_g due to the higher prices brought about by the embargo. Exports after the embargo do not drop

Figure 8.2

Total Export Embargo With Export Competitors



by the full amount of the reduction in U.S. exports. Because the U.S. embargo has changed the total export supply curve, the reduced quantity availability drives up the world market price, and other country suppliers respond accordingly by increasing their exports by QQ_0.

The import demand curve plays a key role in terms of how the U.S. embargo affects gains to other exporters. The more inelastic the import demand curve is, the greater the gains to other exporters are. For example, if the import demand curve were more inelastic (ID'), the net gain to the other exporters from the U.S. embargo would be P_gdfP', which would exceed the gain discussed earlier by the amount $P'fbP_0$.

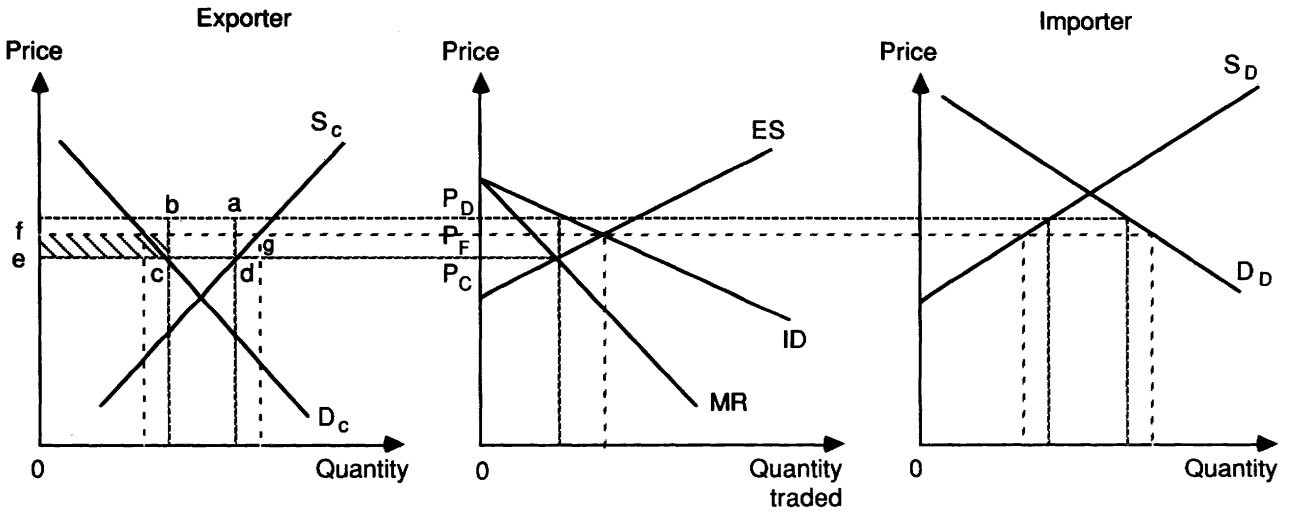
The important point is that when the United States and other countries export a good, a U.S. embargo will not affect an importer or group of importers as much as when the United States is the only exporter. The exception would be if other exporters cooperated in the embargo. If other countries do not cooperate, they gain from the U.S. embargo (increased exports at higher prices), while the United States loses. Hence, the incentive not to cooperate is strong. If countries do not fully cooperate, the embargo affects importers less than it would in the total embargo case. A total embargo where all exporters cooperated would impose an additional economic loss to importers of P_0be.

Optimal Embargo Case

The above models assumed that the United States imposed a total embargo against grain importers and reduced U.S. exports to zero. An optimal export embargo reduces exports but not to the zero level. This type of embargo could improve U.S. welfare. The embargo takes the form of an export tax. In figure 8.3, the United States is the only exporter. The U.S. demand and supply curves for commodity X are D_C and S_C, respectively, while the corresponding schedules for the importer are D_D and S_D. The import demand curve for the importer is ID, the export supply curve for the United States is ES, and the free trade price is P_F. The optimal embargo (that is, the optimal government export tax) is computed by determining where the ES schedule crosses the marginal revenue curve (MR) pertaining to the import demand curve ID. Due to the embargo, the price in the importing country becomes P_D for both consumers and producers, and the U.S. price for both producers

Figure 8.3

Optimal Export Embargo



and consumers becomes P_C. U.S. producers lose defg in economic rent, while the gain in the consumer surplus is the cross-hatched area. The export tax is abcd. The net gain to the United States is the cross-hatched area + abcd - defg. The gain to the exporter from the embargo has to be positive, given that the U.S. supply curve slopes upward.

The embargo in figure 8.3 is optimal for the exporter as a whole because consumer gains and tax revenue exceed producer losses. However, the government could enact an embargo that would maximize only producer welfare (for example, through a producers' export marketing board). In figure 8.4, the free trade price is P_F. The embargoing country equates export supply (ES) to the horizontal sum of the marginal revenue curve in both the domestic and international markets (MR_{ID} + MR_C). The result is that domestic consumers and international consumers pay higher price P_d. The price to domestic producers is P_S, which is above the producers' price in the previous model but still below P_F. Because producers collect the export tax, they are better off with an embargo than with free trade.

In the above models, output has to be reduced in the exporting country in order for the embargo to be effective. However, with this reduced output is associated a higher price, which is not the price needed to bring forth the embargo output. As a result, the exporter has to reduce output below the free trade level for the embargo to be effective.

Several complications arise in assessing the reality of the above model for the United States. First, an explicit export tax is unconstitutional; hence, other instruments are needed to achieve the theoretical result. Second, output controls are difficult to implement for agricultural goods. Third, exports from other countries compete with many U.S. agricultural exports.

Figure 8.5 illustrates the general equilibrium counterpart to the optimal government embargo. This model is referred to later in the discussion of embargo strategies. Offer curve A is country A's offer curve of grain for cars and curve B is country B's offer curve of cars for grain. The free trade price ratio is the slope of P, and the free trade quantities of grain and cars are G_F and C_F. An optimal embargo by country A

Figure 8.4

Optimal Producer Export Embargo

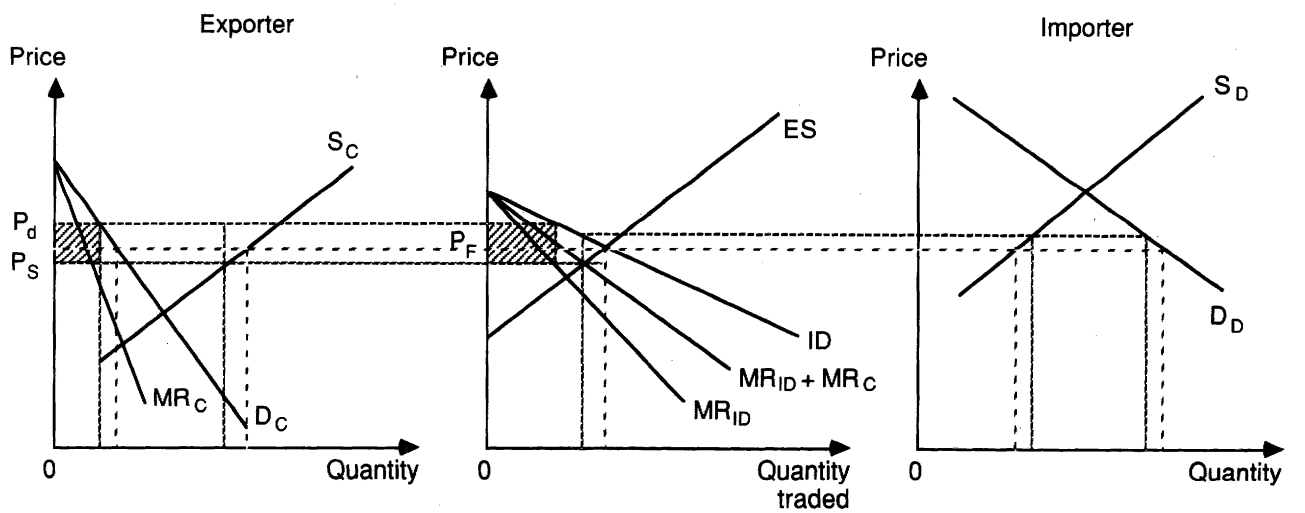
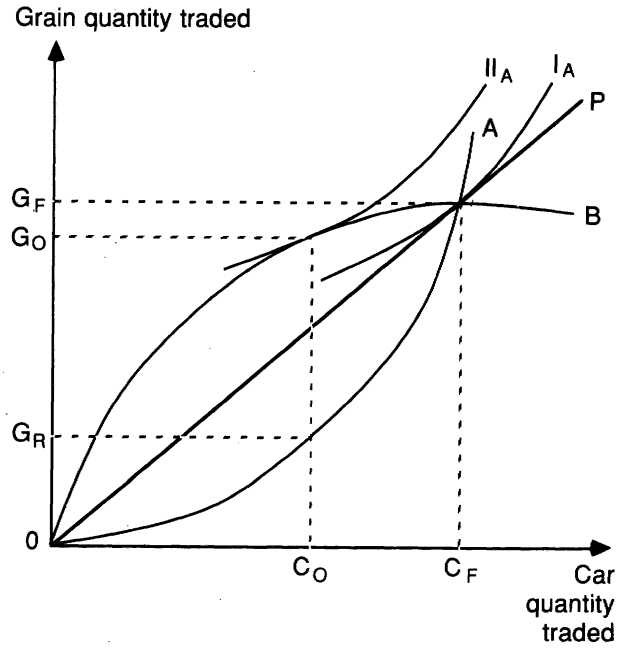


Figure 8.5

Optimal Export Embargo in a General Equilibrium Framework



would move country A from the trade indifference curve I to II. At that point, country A would have maximized its welfare. The optimal trade would be G_0C_0. However, B could retaliate by buying only G_R of grain. If retaliation by both countries continued, the no-trade position would be eventually reached.

Fringe Suppliers

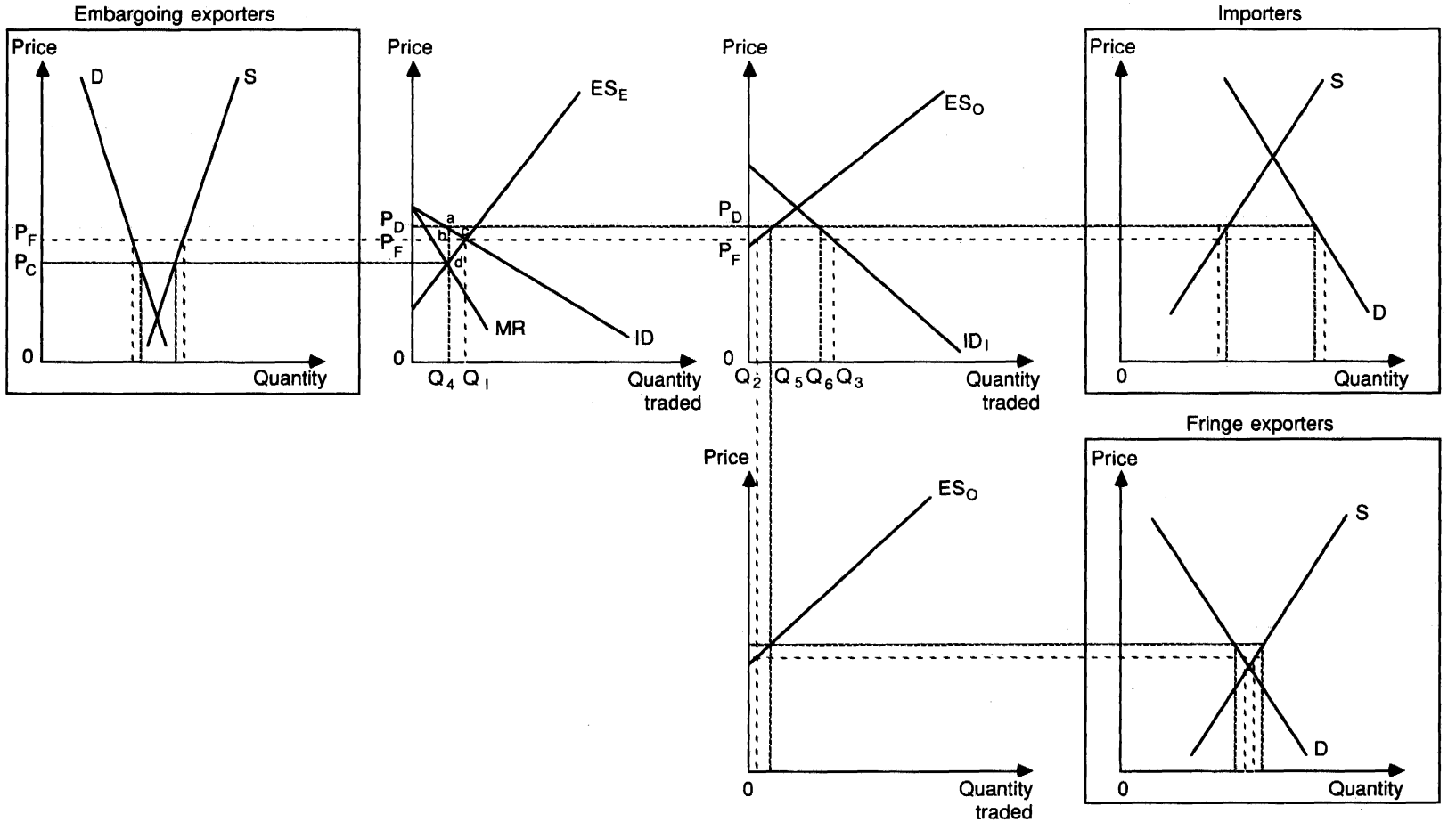
The model in figure 8.2 assumed that more than one country exported a specific good but that the United States restricted exports to zero. The model in figure 8.6 assumes that there are exporters (fringe suppliers) in addition to the United States but that the United States does not cut exports to zero. The conclusion is that, even if other exporters do not cooperate with the United States in an embargo, the United States could gain from an embargo. The United States still may be able to exert market power through an embargo in the presence of competing exporters.

Figure 8.6 presents a model in which certain countries are in the embargo set and others are not. ID_I is the import demand curve of importers derived in the standard way, and ES_O is the export supply curve of the fringe exporters that do not support the embargo derived in the lower panel. The residual import demand ID remaining for the embargo set is the difference between ID_I and ES_O. If the embargo members' supply is ES_E, then the free trade price is P_F. At P_F, the embargoing exporters export Q_1, while the fringe suppliers export Q_2. Importers import Q_3. Note that $Q_3 - Q_2 = Q_1$.

The marginal revenue curve to ID is MR. The embargoing exporters in an optimal embargo equate MR with their export supply curve ES_E, charge price P_D, and export Q_4 ($Q_6 - Q_5$). At this price, the fringe exporters provide Q_5, and the market is cleared. The fringe exporters' price increases from P_F to P_D and their returns increase. The fringe exporters get a free ride, for they can increase price and returns simply by pricing at the embargo price P_D. Note how the relative trade shares have changed. At P_F, the fringe exporters sell Q_2, while those of the embargoing exporters sell $Q_3 - Q_2$. Under the embargo, the fringe exporters sell Q_5, while the

Figure 8.6

Optimal Export Embargo With Fringe Suppliers



embargoing exporters sell $Q_6 - Q_5$. Thus, the fringe exporters gain proportionally more from the embargo than the members of the embargo group because, due to the higher price, the fringe exporters increase output, while the members within the embargo group reduce output. The general conclusions do not change even if the supply curve for the fringe exporters is completely price inelastic.

Figure 8.6 shows that the United States and other countries that form an embargo set gain from an embargo even if fringe competitors exist. This result follows because area P_DabP_F exceeds area bcd. However, cases could be constructed where an embargo by one country or a subset of countries would cause those exporters to lose. This outcome depends on several factors:

- The larger the market shares are of the fringe exporters, the more likely that the embargoing exporters will lose. As market shares of the fringe exporters increase, the import demand curve ID facing the embargoing exporters shifts to the left and reduces their market power. Precise conditions for when a country can gain from an embargo in the presence of competitors have not been established. However, the issue has partly been addressed by Duyne *(12)*; La France, Schmitz, and Zilberman *(23)*; and by Schmitz and others *(31)*.[1] Their results suggest that, if the embargoing exporters have less than 50 percent of the export market, their gains may well be negative.

- The more price elastic the fringe export supply curve is, the less effective the embargo will be. Note in figure 8.6 that the more elastic the fringe export supply curve ES_0 is, the more elastic ID is, thus reducing the market power of the embargoing countries.

- The greater the degree of substitution is among products, the more price elastic the importers demand schedule is. This substitution reduces effectiveness of embargoes either by a subset of countries or by all countries.

Export cooperation is needed to impose the maximum harm against the embargoed countries and to generate the maximum gains to the embargoing exporters. However, divisive forces hamper the effectiveness of oligopoly power through group action. These forces are broken down as follows by Bayard, Pelzman, and Lopez *(4)*: (1) Determining the desired level of export restriction for the various commodities controlled by the embargoing country(ies), (2) allocating reduced exports among the embargo members, (3) sharing the costs and benefits among members, (4) detecting violators of the agreement, (5) enforcing the agreement against violators, (6) controlling nonembargo exports, transshipments, and the development of substitutes and backstop technologies, and (7) responding to targeted importers' retaliation.

TARGETED EMBARGOES

Many real world sanctions involve targeted embargoes where all exporters or a group of exporters embargo only a subset of importers (for example the 1980 U.S. grain embargo against the USSR).

In figure 8.7, the United States imposes an embargo against the USSR. The total import demand schedule is ID_T and export supply is ES_T. The USSR's import demand curve is ID_{USSR}, while the import demand curve for the rest of the world is ID_{ROW}. Importers other than the USSR are fringe buyers. The export supply curve for the United States, Canada, and Australia is ES_d. The free trade price is P_F and exports are Q_F.

Suppose that the USSR buys from only the United States, Canada, and Australia, and these countries jointly impose an embargo of Q_1Q_2. Before the embargo, the price was P_F

[1]Italicized numbers in parentheses refer to items listed in the References at the end of this chapter.

and Soviet imports were Q_2. For the embargoed imports Q_1, the three exporters could raise their asking price to P_1 provided Q_1Q_2 was held off the market and the fringe suppliers did not export to the USSR. The price to the non-Soviet importers would remain at the pre-embargo price P_F. Thus, the embargo generates a two-price world.

For the above results to hold, it is assumed that the embargoing exporters can raise the price to the USSR after the embargo. If prices were agreed to through long-term contracts before the embargo, raising prices could pose difficulties. Also, cooperation is needed from fringe exporters not to ship to the USSR. Even with this assumption, the fringe exporters will not fully cooperate because they do not increase their stockholdings or cut back production as the embargoing exporters do.

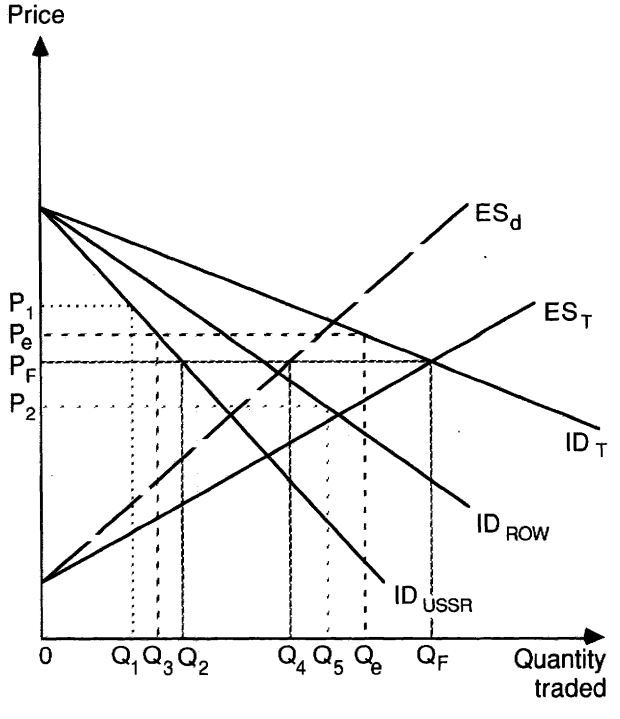
What happens if fringe suppliers are willing to sell to the USSR during the embargo, and Canada, the United States, and Australia hold stocks of Q_1Q_2? The embargo would have less effect on the USSR because of the fringe exporter response. Prices would rise to only P_e in the USSR, and USSR imports would fall from Q_2 to Q_3 because the USSR could compete with other importers for the reduced quantities of grain Q_e. In addition, the fringe exporters may take advantage of the situation by getting rid of any excess stocks, further depressing prices and lessening the embargo's effect.

In the above two cases, the USSR loses because of a price rise accompanied by reduced imports as a result of the embargo. To achieve this result, the United States, Canada, and Australia have to reduce output and/or increase their stock levels. However, even with such actions, can these countries gain from the embargo? The fringe exporters generally will gain as was the case in the general embargo. How much the embargoing exporters gain from an embargo largely depends on their shares of the total export market in the general embargo case and on the targeted importers' shares of the total import market in the targeted embargo case. Given a certain number of fringe suppliers, as the market shares of the embargoed countries become smaller, the likelihood increases that the embargoing exporters will lose. The smaller the market shares are of embargoed importers, the larger the market share is of the non-Soviet (fringe) importers. Thus, the price elasticity of import demand for the fringe and embargoed importers is critical. The more price inelastic these schedules are, the greater the price effect is.

Exporters' stock policy is also important, and the USSR could gain, or at least not lose, from an export embargo (fig. 8.7). Two cases are explored. The first is where the embargoing countries do not hold Q_1Q_2 as stocks but move them into the rest-of-the-world market. This lowers the price in the rest of the world to P_2. The fall in the world price would make it more difficult for fringe suppliers to charge price P_1 in the Soviet market (the cartel problem). To

Figure 8.7

Targeted Export Embargo



the extent that the price to the Soviets falls below P_F, the Soviets would gain from the cartel. Fringe importers clearly gain from the embargo. The USSR receives, in essence, monopsony rents brought about by the embargo.

The above modified model probably is unrealistic because it assumes that the embargoing countries shift the amount embargoed to the non-Soviet market, while nonparticipating exporters do not shift to the USSR. However, if this assumption is relaxed, the effect on the USSR can be negligible. In figure 8.7, the USSR can buy Q_1Q_2 from fringe exporters, and non-Soviet importers can buy Q_1Q_2 from the United States, Canada, and Australia. Figure 8.8 further illustrates this point. Before an embargo by a subset of exporters, including the United States, Argentina (a fringe supplier) exports to markets A, B, and C, as does the United States. However, suppose the United States places an embargo against country A. If the markets are perfectly competitive, the pattern illustrated in figure 8.8 should emerge. The United States would increase its shipments to markets B and C, while Argentina would increase its shipments to market A, which was embargoed by the United States, but decrease its shipments to markets B and C.

Expected Immediate Impacts of an Embargo Against the USSR[2]

Our analysis suggests that success of a targeted embargo such as that against the USSR in 1980 depends on two critical factors: How other exporters behave and what the embargoing country does with quantities of shipments denied.

Other exporters have three options (shown across the top of table 8.1):

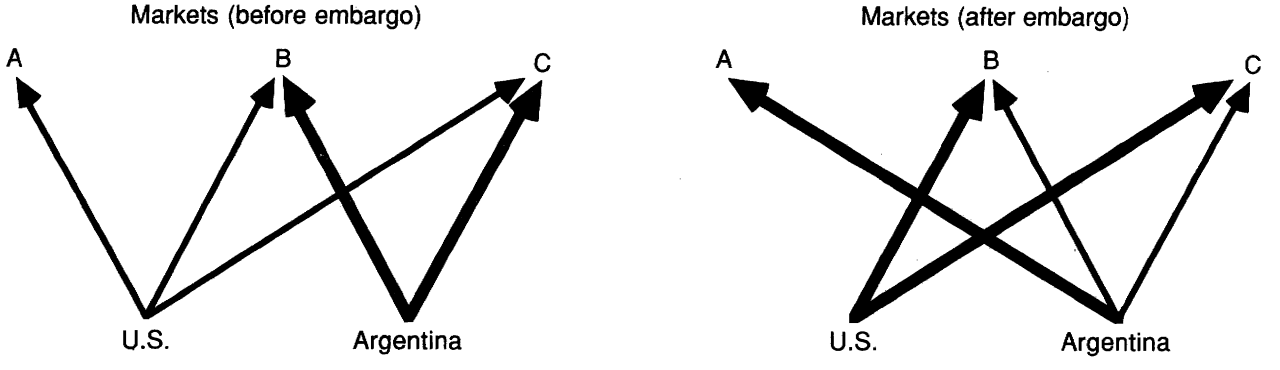
- To cooperate and agree not to increase sales to the USSR.
- Not to cooperate and to shift sales from the non-Soviet to the Soviet market to fill in behind the United States.
- Not to cooperate and to defend their non-Soviet market share out of stocks or increased production.

The United States has two extreme options (and all combinations between):

[2]This approach was suggested by Alex McCalla who also derived the results.

Figure 8.8

Embargos and Market Switching



- To isolate (remove) the embargoed quantities from the market.
- Not to isolate and to shift the embargoed quantities to the rest-of-world market.

We investigated the very short run. We assumed that supplies are fixed. In figure 8.9, total world supply is S_W. World demand is D_W, which is the sum of ID_{ROW-I} and ID_{USSR}, the demand functions for the rest-of-world importers and the USSR. At equilibrium price P_0^W, the rest of the world imports 60 million tons and the USSR imports 40 million tons. Assume that the United States exports 20 million tons to the rest of the world (ES_{US-ROW}) and 25 million tons to the USSR ($ES_{US-USSR}$). The rest-of-world exporters supply the remainder of both markets.

We work through a few cases to illustrate the analysis. Consider Case 1, where exporters cooperate and the United States isolates the embargoed quantity (fig. 8.10). The United States restricts sales to the USSR to 8 million tons and other exporters cooperate. U.S. supply to the USSR shifts to the left by 17 million tons to $ES'_{US-USSR}$, which in turn shifts total supply $ES'_{ROW-USSR}$ + $ES'_{US-USSR}$ to the left by a like amount. Prices to the Soviets rise to P_1^{USSR}, but prices in the rest of the world remain unchanged. Other exporters are better off, and the United States loses export revenue unless the Soviet import demand is inelastic.

In Case 2, the United States does not isolate the embargoed quantity but moves it to the rest of the world, and other exporters cooperate (fig. 8.11). The Soviets get less at a higher price, and prices in the rest of the world fall to P_2^{ROW}. Other exporters are worse off, and the United States is better off only if Soviet demand is inelastic and rest-of-world demand is elastic.

Case 3 is where the United States isolates the embargoed quantity, and other exporters do not cooperate and give up other markets to replace some embargoed sales to the USSR (fig. 8.12). Other exporters reallocate supplies between the two markets until prices are equalized (assuming the same demand elasticities). The equilibrium price is P_3^{ROW}, which is higher than the pre-embargo world price. The Soviets get more grain at a lower price. Other exporters are better off, and the United States is less well off than in Case 1 but potentially better off than in Case 2.

Table 8.1--Framework of the analysis of the U.S embargo against the USSR

United States-- / Other exporters--	COOPERATE They do not increase sales to USSR	DO NOT COOPERATE They shift sales from non-USSR to USSR market	DO NOT COOPERATE AND EXPAND MARKET SHARE They fill in USSR and defend share in rest of world
ISOLATES: It isolates embargoed quantity from rest of world by: Buying export contracts Increasing stocks through: Direct purchasing Expanding FOR	Case 1	Case 3	Case 5
DOES NOT ISOLATE: It does not isolate or is unsuccessful because of leakages or lack of enforcement	Case 2	Case 4 (competitive market case)	Case 6

Figure 8.9

Simple Economics of Targeted Embargoes

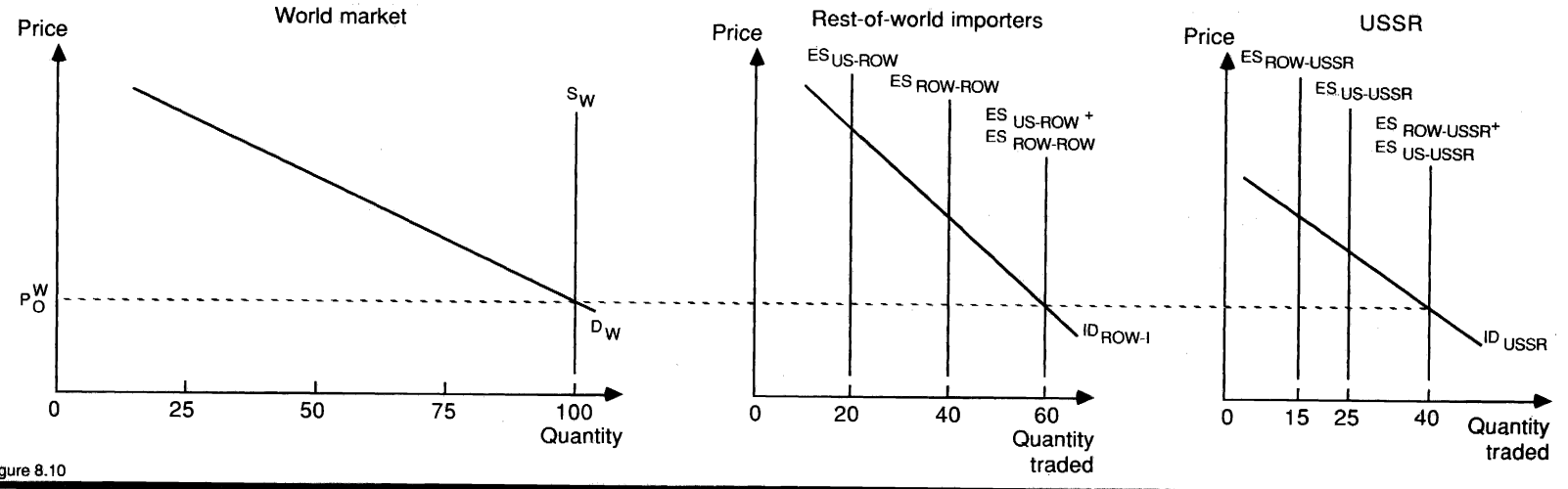
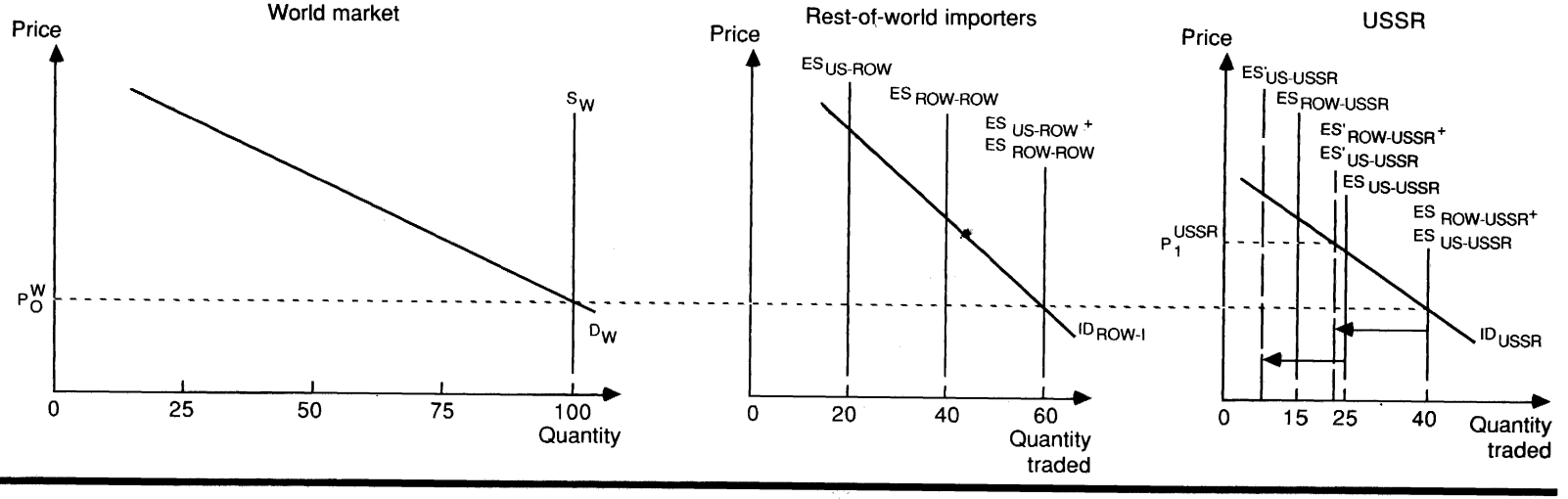


Figure 8.10

Simple Economics of Targeted Embargoes (Case 1)



Assume supplies are fixed in the very short run. Pre-embargo equilibrium: USSR imports = 40, ROW imports = 60, U.S. exports = 45, ROW exports = 55, Total trade = 100, Price = P_O^W.

Figure 8.11

Simple Economics of Targeted Embargoes (Case 2)

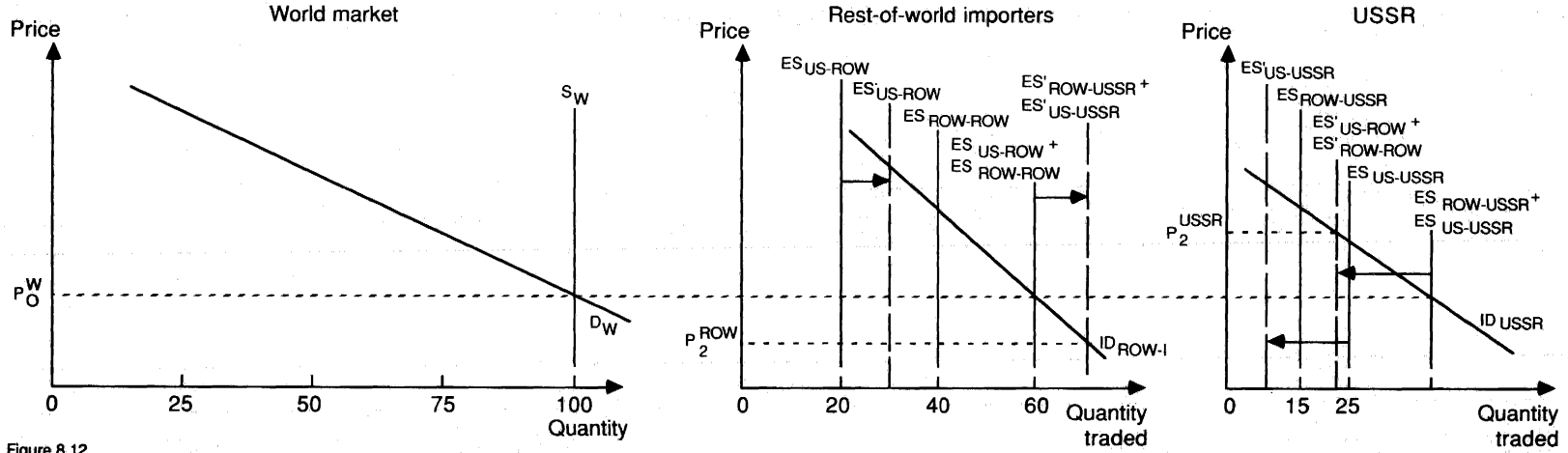
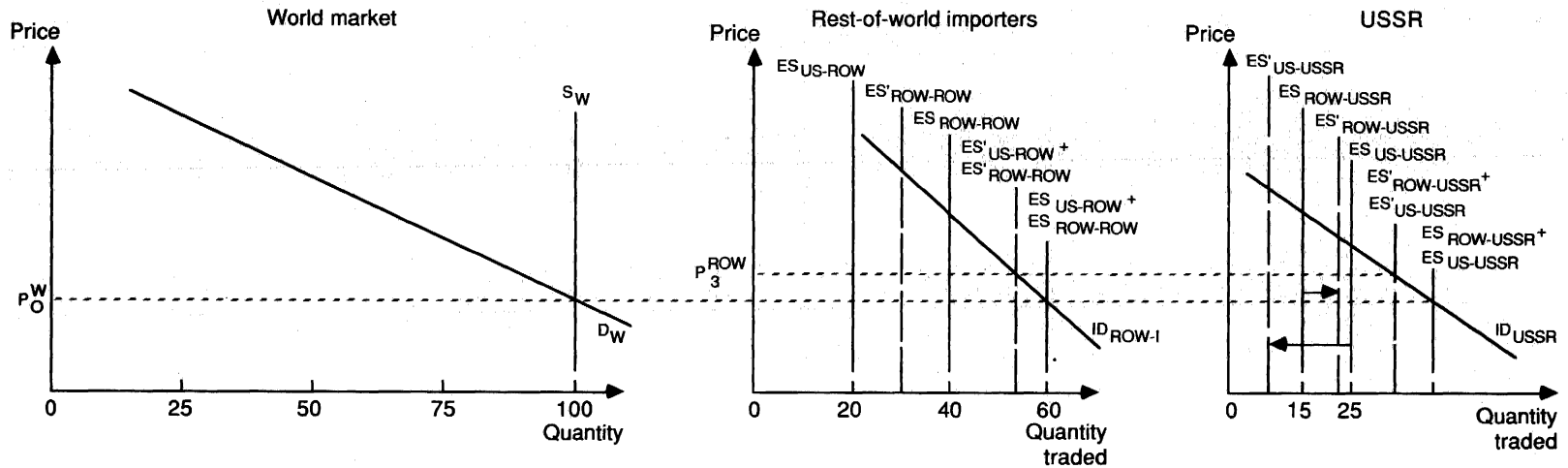


Figure 8.12

Simple Economics of Targeted Embargoes (Case 3)



Assume supplies are fixed in the very short run. Pre-embargo equilibrium: USSR imports = 40, ROW imports = 60, U.S. exports = 45, ROW exports = 55, Total trade = 100, Price = P_O^W.

The graphic analysis is now routine; we present summary results in table 8.2 for all six cases. These cases help us categorize our expectations about what happens to world prices, U.S. exports, and U.S. welfare, but theory cannot tell us which outcome to expect. Another addition to the model is possible. Suppose that port restrictions or delays in shipping schedules reduce Soviet import demand in the embargo year. The same analysis would be redone with D_{USSR} shifted to the left. Prices in the rest of the world would fall below pre-embargo prices in four cases (2, 4, 5, and 6) instead of two (2 and 4).

Analysis in subsequent chapters suggests that only some exporters cooperated. We, however, do have hard information on U.S. attempts to isolate embargoed shipments from the market (table 8.3). The United States apparently isolated around 14 million tons by not reselling all purchased contracts and by direct purchases. Given that total Soviet contracts signed for in 1979/80 were 23.1 million tons and contracts covering 14.33 million tons were purchased, it appears the United States isolated about the equivalent of the embargo at least in the short run. Therefore, Cases 1, 3, and 5 are more possible outcomes. Given this, unless Soviet demand decreased or exports by other exporters increased, neither world nor U.S. prices would be expected to fall much.

Summary of Impacts of Targeted Embargoes

Effects of an embargo for the targeted country and the countries imposing the embargo depend on several factors: Market shares, stock levels, transportation costs, reaction by fringe exporters, nature of the commodity, degree of cooperation among embargoing countries, and the structure of international commodity markets, including long-term agreements, state traders, trade logistics, and futures markets. These factors influence the above models, which approximate real world export embargoes.

The nature and structure of grain trade (described in Chapter 4) are vital factors. For example, in analyzing the 1980 U.S. embargo against the USSR, we should recognize the following:

- The USSR is not the only buyer of wheat and coarse grains nor is the United States the only seller.
- U.S. cash and futures markets are active; that is, there is a world spot market for grains.
- Private, multinational companies that facilitate switching of international shipments carry out the trading.
- Long-term exporter/importer agreements are common.
- Bilateral trade is growing.
- Grain might be shipped between fringe importers and embargoing exporters. Thus, fringe importers that are Soviet allies could buy extra grain from embargoing and nonembargoing exporters and resell it to the USSR, further complicating effectiveness of any embargo.

The cost of carrying out the type of switching suggested in figure 8.8 is an empirical question. However, as markets become more segmented, costs to the USSR and the United States would increase as a result of a U.S. export grain embargo. Added transportation costs and costs due to port congestion would likely be associated with switching. Additional costs would depend on the extent of marketing rings in world grain trade. Factors causing such rings to form include: Canada-USSR long-term agreements, Soviet preference for high-protein wheat, barter and state trading arrangements among nations, milling technologies specific to particular countries, credit arrangements of targeted countries, and political considerations. Little empirical evidence is available on the extent of trading rings.

Table 8.2--Summary results of analysis of the U.S embargo agains the USSR

United States-- / Other exporters--	COOPERATE They do not increase sales to USSR	DO NOT COOPERATE They shift sales from non-USSR to USSR market	DO NOT COOPERATE AND EXPAND MARKET SHARE They fill in USSR and defend share in rest of world
ISOLATES: It isolates embargoed quantity from rest of world by: Buying export contracts Increasing stocks through: Direct purchasing Expanding FOR	Case 1 P_{USSR} (+) I_{USSR} (-) P_{ROW} (+/-) E_{US} (-) E_{ROW-E} (+/-)	Case 3 P_{USSR} (+) I_{USSR} (-) P_{ROW} (+) E_{US} (-) E_{ROW-E} (+/-)	Case 5 P_{USSR} (+) I_{USSR} (-) P_{ROW} (+/-) E_{US} (-) E_{ROW-E} (+)
DOES NOT ISOLATE: It does not isolate or is unsuccessful because of leakages or lack of enforcement	Case 2 P_{USSR} (+) I_{USSR} (-) P_{ROW} (-) E_{US} (+/-) E_{ROW-E} (+/-)	Case 4 P_{USSR} (+/-) I_{USSR} (+/-) P_{ROW} (+/-) E_{US} (+/-) E_{ROW-E} (+/-) (competitive market case)	Case 6 P_{USSR} (+) I_{USSR} (-) P_{ROW} (-) E_{US} (+/-) E_{ROW-E} (+)

Legend:

P_{USSR} = Price in USSR market; P_{ROW} = Price in rest-of-world market; E_{US} = U.S. exports; E_{ROW-E} = Other exporters exports; I_{USSR} = USSR imports; I_{ROW} = Rest-of-world imports

Table 8.3--Post-embargo U.S. purchases and disposals of grain, 1980 embargo

Item	Contracts purchased January 1980	CCC purchases Feb-June 1980	Contracts resold by June 1980	Isolated from market end of Jan.
		Million tons		
Wheat:				
Contracts	4.3		3.2	1.1
CCC actual		4.2		4.2
Total				5.3
Corn:				
Contracts	8.9		6.9	2.0
CCC actual		4.1		4.1
FOR increase				2.5
Total				8.6
Soybeans:				
Contracts	1.13		.9	.23
Total				.23
Total	14.33	8.3	10.0	
Total isolation				14.13

Source: (17).

Added to the above complications is product substitutability. The greater the degree of substitutability among products, the more price elastic is the import demand curve, which, as suggested earlier, reduces impact of an embargo. For example, because the USSR also uses wheat as feed grain, an effective wheat boycott would also embargo feed grains. Also, a country could import meat directly instead of importing grain to feed domestic livestock *(6)*.

EMBARGO STRATEGIES

Countries subject to periodic embargoes are likely to respond in several ways, including implementing a retaliatory embargo, increasing domestic production, diversifying supply sources, and stockpiling.

Retaliation

Trade among nations could cease if targeted countries retaliate against an embargo (fig. 8.1 and 8.5). In this case, an embargo could impose severe economic hardship on all trading partners. Extent of retaliation partly depends on the degree of interdependency between the embargoing exporter and the targeted importer. If, for example, the importer exports few goods to the embargoing exporter, the possibility of retaliation is reduced.

Supply Response and Diversified Supply Sources

Embargoes increase production in the importing nation by shifting the supply curve for the embargoed product, especially if the embargoes are expected to continue for some time or if they recur often. Production will increase if governments assure domestic producers that they will receive import protection and thus a high, stable domestic price. Thus, in the case of risk-averse producers, government policy reduces risk and shifts the supply curve to the right (fig. 8.13). The free trade price is initially P and quantity is Q. With an embargo, if the supply schedule in the importing country shifts to the right, the import demand curve shifts inward to ID'. Once the embargo is removed, export prices and quantities are lower (P_1 and Q_1). Permanent loss to exporters from an embargo equals the cross-hatched area.

An importer could diversify its supply source due to an embargo. For a risk-averse importer, diversification has strong economic support, especially if the supply response mentioned above cannot be achieved due to resource constraints. In figure 8.14, the players are the United States, Japan, and Brazil. Under free trade, price is P_F and quantity is Q_F (before a U.S. embargo). The export supply curve for Brazil is also shown, but at price P_F, Brazil does not export to the Japanese market. If an embargo of OQ_f is imposed, prices in the Japanese market will rise to such a level that Brazil will enter the Japanese market (import Q_1 at price P_1). Japan may well enter into a long-term agreement with Brazil to buy the product by providing this subsidy to Brazil. For example, Japan may want to purchase OQ_1 from Brazil at a long-term agreement price of P_1. This would shift the import demand curve faced by the United States to ID" (where ab = OQ_1). When the embargo is lifted, the U.S. price is no longer P_F. Instead, it becomes price P_2. Because Brazil has taken over a portion of the former U.S. embargoed exports, the United States loses the cross-hatched area due to the embargo. In the long run, this outcome depends on Japan's willingness to continue subsidizing Brazil.

Stockpiling

Stocks can affect results of an embargo. An importing nation with large stocks on hand can weather embargoes much better than it can without stocks. Stockholding strategies of such nations as the USSR are empirically difficult to determine because accurate stock data do not exist. Feder, Just, and Schmitz have shown theoretically that as uncertainty increases, which is clearly the case with embargo threats, storage of the commodity in question increases and the embargoed importers store relatively more than exporters *(14)*. In addition, Tolley and William have derived stockpiling strategy rules for importers based on probability distributions of both the incidence of embargoes

Figure 8.13

Risk Aversion and Supply Response

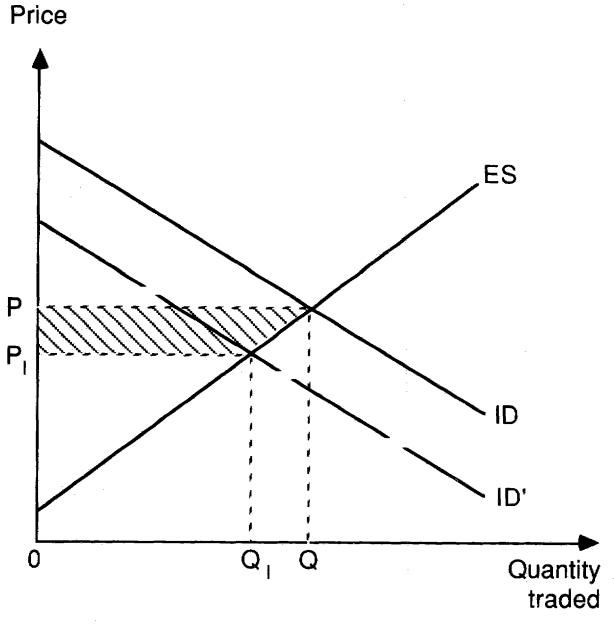
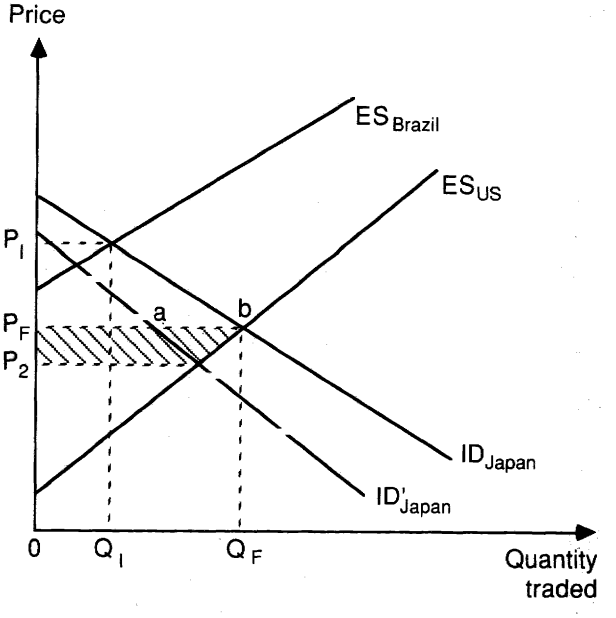


Figure 8.14

Embargoes and Supply Source Diversification



and their duration *(38)*. However, they do not include targeted embargoes in their model, in which, as can be derived from the above results, parameters would have to be incorporated to account for fringe suppliers.

Studies also have been done on stockpiling during famines *(29)*. The rice markets worked poorly in Bangladesh during the 1974 famine, partly due to hoarding given crop prospects. In an embargo situation, crop forecasts clearly are important in determining strategies in reaction to embargoes. In terms of importer strategies, Aiyagari and Riezman use a game theory approach to determine how exporters' strategies interact with importers' strategies in a world of embargo threats *(1)*. Behavior of producers and consumers in importing countries depends on their views on the nature of supply shocks and the price and production strategies of exporting countries. Aiyagari and Riezman analyze the impact of supply shocks, taking into account expectations of agents with regard to similar future events. For example, with respect to oil, they contend *(1)*:

> If a policy of imposing embargoes with some frequency leads to greater exploration, use of less energy intensive technologies or development of substitutes, all of which may lead to a gradual curtailment of demand, then this will have an impact on OPEC's strategy regarding the imposition/non-imposition of such shocks and the frequency of such events.

The intensity of the strategies outlined above (of encouraging increased domestic production and diversifying supply sources) depends on several parameters including the frequency of embargoes.

EMPIRICAL RESULTS

This section presents a selection of results from previous analyses of general and targeted embargoes.

General Embargoes

Shei and Thompson, analyzing the impact of export controls in the world wheat market, concluded that *(34)*:

- A large exporting country might gain sizable shortrun welfare benefits by imposing export restrictions in a tight world supply situation.
- If export demand is inelastic under such conditions, such restrictions could increase export earnings.
- Exporters stand to reap most of the benefits.

They simulated effects of U.S. export controls using a quadratic programming model of world wheat trade for 1972/73 (table 8.4).

With nonprice-responsive importers, when a 26-million-ton export quota was imposed on the model, the U.S. export price more than doubled from $87.70 per ton in the base case to $177.50 per ton. The U.S. domestic price fell from $87.70 to $64.40 per ton. U.S. export revenue increased from $2.4 billion in the base case to $4.6 billion under export controls.

When all importing countries permitted the world market price signals to be transmitted across their frontiers into the domestic markets, the world market price increased much less in response to the shock from U.S. export controls than when they permitted no adjustment to price. The U.S. export price rose from $87.70 to $89.70 per ton in this case compared with $117.50 per ton when no price responsiveness on the part of importers was assumed. U.S. export revenue decreased from $2.4 billion in the base case to $2.3 billion. The demand for U.S. exports, thus, was substantially more elastic in this case than in the nonprice-responsive importer case. The implicit arc elasticity of import demand over the range from 26 million to 27.5 million tons equaled -0.053 in the base case in which no importing countries responded to price. The arc elasticity equaled -2.39 in the price-responsive importers case. As anticipated, the more elastic the import demand was of the rest of the world, the smaller the increase in world market price necessary to ration the available supply when the U.S. imposed export controls.

Shei and Thompson concluded that although the United States and other exporters could gain in the short run by imposing export

Table 8.4--Summary of results of policy simulations with the world wheat trade model

Variable	Observed values in 1980	Base case equilibrium solution values	26-million-ton export quota: With nonprice responsive importers	26-million-ton export quota: With price responsive importers
		Dollars per ton		
Domestic price	82.7	87.7	64.4	64.4
Export price	92.4	87.7	177.5	89.7
		1,000 tons		
Domestic consumption	21,877	23,407	24,908	24,908
Domestic production plus reduction in stocks 1/	50,908	50,908	50,908	50,908
Total export	29,894	27,499	26,000	26,000
		Million dollars		
Export revenue	2,762.2	2,411.7	4,615.0	2,332.2

1/ Total production = 39.3 million tons, and reduction stocks = 11.6 million tons.

Source: *(34)*.

controls, they could be hurt in the long run. Lower U.S. wheat prices would likely reduce domestic production and exportable surplus in the following year. Higher world prices could increase production in the rest of the world, reducing demand for U.S. wheat. In addition, U.S. export controls could encourage importers to diversify their supply sources or alter their agricultural policy to stimulate greater domestic wheat production and self-sufficiency. "This suggests that while the U.S. would probably gain from imposing export controls on wheat in a short crop year, in the longer run such a policy would become more costly in terms of lost consumer and producer surplus" *(34)*.

Williams analyzed the 1973 U.S. general embargo on soybeans and selected oilseed meals and oils *(40)*. During the summer of 1973, Brazilian sales of soybeans and soymeal greatly accelerated. By the end of October 1973, Brazil had shipped 92 percent of its 1973/74 (April-March) exports of soybeans and soymeal compared with an average of 72 percent by that time during the years following the embargo. The shortrun effects of the 1973 embargo on the U.S. soybean industry were fairly clear, but the longrun effects were difficult to assess. Williams ran several simulation models for 3 years subsequent to the embargo and concluded that the United States lost a greater share of the soybean market in the second year following the embargo than in the first. "To the extent that an embargo also damaged the reputation of the U.S. as a reliable supplier of soybeans, the effects of an embargo could be more severe and more enduring" *(40)*.

However, Paarlberg concluded that in none of the cases examined did there appear to be a longrun reduction in demand for U.S. exports as a result of trade restrictions *(27)*. The United States would have lost the overseas soybean markets after 1973 even without the 1973 U.S. export embargo.

Targeted Embargoes

Schnittker and Associates extensively studied the 1980 U.S. embargo against the USSR. They concluded the following *(32)*:

> In describing the action and its effects, it is necessary to recognize economic linkages that go well beyond U.S. borders. When 13 million tons of U.S. corn, 4 million tons of U.S. wheat, and 1.3 million tons of soybeans and products could not be shipped to the USSR between January and October 1980, the Soviets turned to Canada, Australia, and Argentina for grain. Argentina which did not join with the U.S. in limiting grain shipments to the USSR, shipped additional quantities and was then unable to deliver the usual quantities to its regular markets. U.S. sales to some of those markets increased somewhat as a result. However ... other exporting countries also responded to the larger market in the USSR, resulting from the U.S. embargo, by increasing total exports and later by increasing production.

Schnittker and Associates found that another source of lost export earnings, apart from the 18.3 million tons gross loss in shipments to the USSR or the net reduction in U.S. exports to the whole world, was the reduced value per unit of corn, wheat, and soybeans exported to other countries.

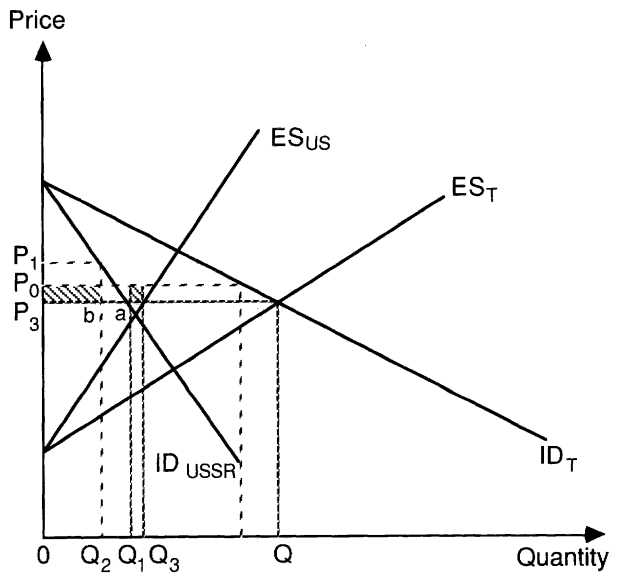
They estimated:

- A loss of $11.4 billion in output of goods and services (0.5 percent of national output),
- Reduced employment equivalent to 310,000 workers (0.3 percent of total employment),
- Reduced personal income of $3.1 billion (0.1 percent of personal income), and
- A loss in export revenue from corn, wheat, and soybeans, of $1.5 billion, $646 million, and $301 million.

We reconstructed figure 8.7 to arrive at results consistent with those of Schnittker and Associates. Their results imply that only the United States carried out the embargo, while Canada and Australia were part of the fringe suppliers. Figure 8.15 is constructed to take into account the market shares of the countries involved. The U.S. export supply curve is ES_{US}, and the total export supply curve is ES_T. The import demand curve for the USSR is ID_{USSR} and the total is ID_T. The world price is P_3, and trade is Q. The fringe suppliers, now including Canada and Australia, supply Q_3Q. Assume that the United States supplies the entire Soviet market and introduces an embargo of Q_1Q_2. If the USSR cannot buy from the fringe suppliers, prices rise to P_1 in the USSR and the United States holds stocks of Q_2Q_1. However, if the fringe suppliers divert supplies from other markets to the USSR, world prices rise to P_0. The fringe suppliers gain both in prices and market share. The United States loses the cross-hatched area less abQ_2Q_1 less storage costs plus stock value. In this case, the United States is assumed to carry out the embargo alone, thus allowing increased sales from other countries to the USSR. This case is likely to lead to a U.S. welfare loss because, for example, the U.S. wheat market share is less than 40 percent and the USSR's import share is less than 30 percent. With these market shares, the United States is unlikely able to exert monopoly power sufficient to result in net welfare gains, especially in view of the earlier discussions of the relatively small amount kept from the Soviet market.

Figure 8.15

Unilateral Targeted Export Embargo



Paddock studied effects of the 1980 grain embargo against the USSR on Canada (table 8.5) *(28)*. Paddock assumed, unlike Schnittker and Associates, that Canada was part of the exporter embargo group. He concluded that the partial embargo reduced revenue to Canadian grain producers an estimated $81 million. "This may seem small compared with total 1980 grain receipts of $5.3 billion, but its relative impact on net income is, of course, more significant" *(28)*.

Table 8.5--Effects of embargo on Canadian agriculture

Item	Quantity	Loss	Total loss
	Mil. bu.	*Cents per bu.*	*Mil. dol.*
Canadian Wheat Board sales:			
Wheat exports	345.8	15.75	54.46
Domestic feed wheat	8.5	15.42	1.31
Oats	18.7	7.47	.60
Barley	49.0	11.13	5.45
Subtotal			61.82
Corn marketings	91.2	14.11	12.87
Subtotal			12.87
Ontario wheat exports	6.3	15.75	.99
Subtotal			.99
Offboard marketings in Western Canada			
Feed wheat	2.4	15.42	.37
Oats	10.0	7.47	.75
Barley	35.8	11.13	3.98
Subtotal			5.10
Total			80.78

Source: *(28)*.

The Paddock model gave a representation of the world split between the USSR and the rest of the world (fig. 8.16). The left panel represents the import demand schedule for Soviet grain imports (ID_{USSR}). The panel on the right represents the rest-of-world import demand schedule (ID_{ROW}), a total import demand schedule (ID_t), and an exporter's export supply schedule (ES). In the nonembargo situation, exporters are considered to adjust supplies to the two markets to equate prices in each market (subject to such factors as variety, quality, and transport cost differentials). The price in both markets is $P_S = P_{ROW}$, and Q_S is the quantity exported to the USSR.

Imposition of the embargo reduces quantity exported to the USSR from Q_S to Q'_S. The USSR import demand schedule to the right of Q'_S is no longer relevant because the embargo rules out exports to the USSR greater than Q'_S. The total demand schedule is shifted to the left to ID'_t. Prices in the rest of the world fall to P'_{ROW}, and the price of imports sold to the USSR rises to P'_S.

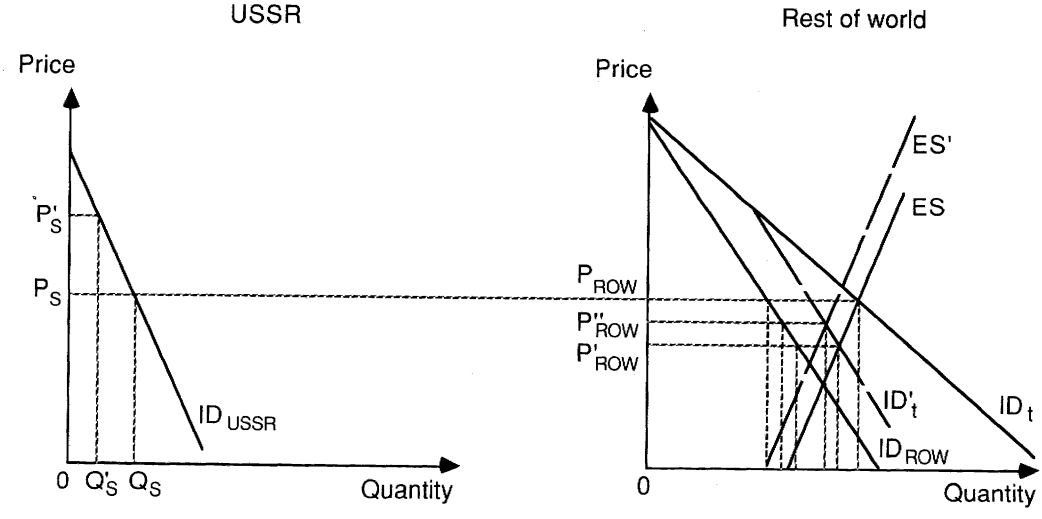
Increased purchases by the CCC and the FOR reduce exportable supplies. That is, they shift the export supply schedule to the left from ES to ES'. These stock acquisitions raise prices from P'_{ROW} to P''_{ROW}. This post-embargo price may be greater or less than the nonembargo price P_{ROW}. The determining factor is whether sufficient stocks are removed from the market to offset the export loss.

U.S. prices can fall while competitor prices rise. Effects of an embargo also depend on the nature of long-term agreements and their price provisions. If agreements are quoted in quantity only and prices are based on Chicago futures, then an embargo-induced drop in Chicago futures could depress Canadian prices. In this case, however, the figure 8.16 price would not rise from P_S to P'_S. As shown, relative prices to the USSR could even fall.

The discrepancy in results between the two empirical studies is partly due to the assumption of whether or not Canada is a fringe supplier or an embargoing country. If Canada cooperates in the embargo, both it and

Figure 8.16

Impact of U.S. Grain Embargo on Canada



the United States could gain from an embargo or both could lose. The Paddock results do not consider the case of net gains. Also, in terms of Paddock's analysis, why couldn't the USSR have obtained the needed supplies from such countries as Argentina, and the United States supply traditional Argentine markets? Also, if the USSR was willing to pay a higher price for reduced imports, why did the export price for a country such as Canada drop? Prices should have increased because the USSR was faced with a reduced supply of imports. As the theory shows, it does not follow that a drop in U.S. prices due to an embargo results in a drop in prices for U.S. competitors. U.S. prices can fall while competitor prices rise.

Results of the Schnittker and Associates study are based on two key assumptions: Canada is not in the embargo set, and the United States could not penetrate nontraditional markets with the excess supply of grain on hand due to the embargo *(32)*. Both of these assumptions are questionable. Thus, the estimates of U.S. losses as a result of the embargo appear to be high.

The U.S. International Trade Commission (USITC) concluded that the 1980 embargo had the following effects *(39)*:

- The U.S. share of the world market for grains, soybeans, and soybean products declined, despite irregular overall increases in U.S. exports of these items over the period.
- Major U.S. competitors in the world grain and soybean markets expanded their production and exports of these commodities to capture a growing share of the world trade; consuming countries accordingly diversified their sources of supply.
- The United States is viewed as an unreliable world agricultural supplier.
- The U.S. Government incurred costs to cushion the adverse effects of the 1980 embargo.
- The embargo was a major factor influencing the decline in the U.S. share of the Soviet wheat and coarse grain market after 1980.
- The embargo was a major factor affecting the lack of U.S. sales of soybeans and soybean products to the USSR.

In addition, the USITC found that the 1973 soybean embargo gained the United States a reputation as being an unreliable supplier of soybeans and soybean products. After the embargo, the U.S. share of the world soybean and soybean product market declined, although exports of such products (after an initial decline) continued to increase.

An Office of Technology Assessment study reported that costs of the grain embargo to the U.S. economy were at least as great as those imposed on the USSR and that the USSR looked elsewhere for its principal agricultural supplier *(26)*.

Luttrell's analysis showed that large quantities of U.S. grain were shipped to nations that normally purchased grain from other sources, thereby permitting these other sources to supply grain to the USSR *(24)*.

Byrne and others concluded, "The U.S. sales suspension apparently caught the Soviet planners by surprise" *(5)*. However, the USSR started purchasing grain from U.S. competitors, reducing feed use, and drawing on its own grain stocks. It protected its new supply sources by signing long-term supply agreements with Argentina, Canada, and Brazil. Even though the U.S. embargo was designed to damage the Soviet feed-livestock economy, the United States held to the commitment included in its long-term agreement with the USSR not to interfere with exports of 6-8 million tons of wheat and corn each year. Because of this commitment, the United States still ranked second among major grain suppliers to the USSR while the embargo was in effect.

Roney concluded that, although the embargo may have had some initial effect on Soviet meat consumption, this effect soon dissipated *(30)*. The United States clearly lost Soviet market shares. However, overall U.S. trade losses are more difficult to evaluate.

Bartlett summarized some of the empirical literature on embargoes. He concluded that *(3)*:

> There is little historical evidence that sanctions have ever achieved their purpose; recent examples of such nonsuccess include the U.S. embargo on grain shipments to the Soviet Union in 1981 and U.S. sanctions against Nicaragua in 1985. More often than not, sanctions end up making the target country more self-sufficient and strengthening its resolve to continue its policies.

Bartlett's study covered both agricultural and nonagricultural goods. For example, Moyer and Mabry studied the U.S. embargo on pipeline equipment to the USSR in 1981/82 and concluded that foreign subsidiaries of U.S. companies could supply much of the equipment needed *(25)*. Thus, the sanctions neither thwarted nor appreciably delayed construction of the Yamal pipeline.

AN ASSESSMENT OF EMPIRICAL STUDIES

The general conclusion emerging from the empirical review is that U.S. export embargoes generally inflict a cost on the U.S. economy. This also appears to be the case when embargoes are evaluated using foreign policy goal criteria. However, one study discussed below suggests that perhaps the 1980 grain embargo was successful in achieving certain foreign policy goals.

The results critically depend on the empirical data available as to the countries actually engaged in the embargo. The Schnittker and Associates study, for example, contended that only the United States imposed the embargo with little or no cooperation from other exporters *(32)*. This and their contention that costs were associated with increased U.S. sales into nontraditional markets give them results showing a significant economic loss to the U.S. economy from the 1980 grain embargo. On the other hand, studies done on the effect on non-U.S. grain exporters (such as Paddock's study on Canada) suggested that other major grain exporters, except Argentina, cooperated in the embargo and that they also lost from the embargo *(28)*. Paddock contended that Argentina received a higher price for wheat as a result of the embargo (table 8.6). However, Hickson, in responding to Paddock's analysis, suggested that Canadian producer prices also increased $4.95 per ton (table 8.7) *(19)*. He contended that Canadian feed grain prices also rose.

In many of the studies, one unresolved issue is the effect the embargo had on prices in the USSR and how this effect was transmitted back to grain exporters. Theory suggests that the USSR could pay a higher or lower price as a result of the embargo, depending on the degree of cooperation among exporters and the level of stocks held by embargoing exporters. Empirical studies suggest that U.S. market share and prices fell due to the 1980 embargo. Theory suggests that perhaps prices could increase as a result of the embargo if the United States were to hold back additional stocks, thus causing world prices to rise. In other words, if Canada and Australia cooperate with the United States in the embargo, perhaps the theoretical optimal embargo could be achieved where producer prices rise for all exporters. Shei and Thompson *(34)* and Schmitz and others *(31)* show empirically what would be needed for exporters to gain from export cooperation. The issue over whether U.S. prices actually rose or fell due to the embargo is highly complex because of many factors, including active futures markets and their role in pricing grain to the USSR. However, because the empirical results generally imply that the USSR paid a higher price for grain as a result of the embargo, the question remains as to which of the exporters, if any, received the higher price. One

Table 8.6--Comparison of fob U.S. and Argentine wheat export prices

Year	U.S. No. 2 HRW ordinary fob gulf July-June	Argentine Trigo Pan July-June	Difference	
		U.S. dollars per ton		
1973/74	177	--	--	
1974/75	166	163	3	Average
1975/76	152	144	8	differential
1976/77	113	104	9	$5.80/ton
1977/78	116	116	0	
1978/79	12	131	9	
1979/80:				
7/27/79	179	186	-7	
8/03/79	168	182	-14	
8/31/79	179	182	-3	
9/07/79	173	175	-2	
9/21/79	181	178	-2	
10/05/79	181	175	6	
10/12/79	181	180	1	
11/02/79	179	173	6	
11/09/79	180	173	7	
11/16/79	181	174	7	
12/14/79	186	178	8	
1/04/80	184	188	-4	
1/18/80	181	195	-14	
1/25/80	180	197	-17	
2/01/80	180	208	-28	
2/08/80	180	225	-45	
2/15/80	176	225	-49	
2/24/80	176	215	-39	
2/29/80	175	215	-40	
3/07/80	177	212	-35	Average
3/28/80	159	215	-56	differential
4/18/80	160	215	-55	-$35.79/ton
4/25/80	159	209	-50	
5/02/80	158	200	-42	
5/09/80	268	200	-32	
5/16/80	165	200	-35	
5/23/80	164	200	-36	
5/30/80	160	197	-37	
6/06/80	158	193	-35	
6/13/80	159	190	-31	

Source: (*28*).

possibility is that much of the price effect was dissipated in the form of higher transportation costs and increased port congestion.

The empirical results clearly show the United States would economically lose if it carried out the 1980 embargo alone. These results seem to follow from market share data. Before the 1980 embargo, the 1978 U.S. wheat export market share was roughly 40 percent, while the total wheat import market share for all centrally planned economies was roughly 23 percent. The coarse grain market share for centrally planned economies was roughly 25 percent. These data suggest that it would be difficult for the United States to carry out an embargo alone and generate a net gain to its economy.

Results of the 1973 soybean embargo are mixed in terms of the U.S. cost. Researchers disagree over the extent to which the United

Table 8.7--Canadian-U.S. wheat price spreads

Date	CWB 1 CWRS 13.5% Thunder Bay	U.S. 3 HRW fob gulf	Spread
	Canadian dollars per ton		
July 1977-June 1978	133.94	127.60	6.34
July 1978-June 1979	171.45	163.80	7.65
July 1979-June 1980	215.53	202.93	12.60

Source: (19).

States lost market share to Brazil. Strong arguments have been made that the increase in Brazil's market share was not related to the 1973 embargo.

Theory suggests several categories to be considered in examining effects of embargoes: Embargoing exporters, fringe exporters, targeted importers, and fringe importers. In the general embargo case, the fringe importers are not of concern. Many empirical studies say relatively little about how embargoed importers were affected and how they responded to the embargo, or the effect of embargoes on fringe exporters and importers. Theory suggests that in response to embargoes, importers could increase production, diversify supply, alter their stockholding policy, and retaliate directly. For example, they could embargo some of their own exports to the embargoing countries. To what extent any or all of the above happened remains an empirical question.

FOREIGN POLICY GOALS

The previous discussion uses an economic framework to analyze the price and quantity effects of embargoes. Hufbauer and Schott recently studied economic sanctions in terms of foreign policy goals *(21)*. They used the following five categories classified according to the major foreign policy objective sought by the embargoing country:

- Modestly change target country policies (modest in the scale of national goals, but often of major importance to participants in the episode), illustrated by the human rights and nuclear nonproliferation cases.
- Destabilize the target government (including, as an ancillary goal, changing the target country policies), illustrated by the U.S. campaign against Castro and the Soviet campaign against Tito.
- Disrupt a minor military adventure, illustrated by the United Kingdom's sanctions against Argentina over the Falkland Islands.
- Impair the military potential of target country, illustrated by World Wars I and II and the COCOM sanctions against the USSR and its allies.
- Make major changes in target country policies (including the surrender of territory), illustrated by the United Nations campaign against South Africa over apartheid and control of Namibia.

Hufbauer and Schott's conclusions are presented in table 8.8. They studied 103

Table 8.8--The failure of sanctions

Policy goal	Pre-1973		1973-84	
	Success	Failure	Success	Failure
	Number			
Modest policy changes	9	3	9	23
Destabilization	9	6	1	3
Disruption of military adventures	5	8	1	4
Military impairment	2	6	0	2
Other major policy changes	2	11	1	3
Total	27	34	12	35

Source: (21).

episodes of trade sanctions since World War I and analyzed their effectiveness in terms of the policy goals outlined earlier. They concluded that sanctions were seldom successful, except against small countries and only when the goals were modest. Also, since 1973, the proportion of cases in which sanctions were successful had fallen from almost half to about one-quarter. They concluded that sanctions were a decreasingly useful policy instrument.

Cooper, with respect to the effectiveness of embargoes in achieving foreign policy goals, disagrees with Hufbauer and Schott in regard to U.S. economic sanctions against Rhodesia in 1965, against the USSR in 1980, and against Japan in 1940/41. As an illustration, Cooper's assessment of the grain embargo follows *(10)*:

> In the case of economic sanctions against the Soviet Union following its invasion of Afghanistan, it was perfectly clear that there was nothing the United States and its allies could do, short of war, to induce the Russians to withdraw from Afghanistan. That was known and understood at the time, although public officials understandably had some reticence about stating publicly that we could not get the Russians to leave Afghanistan. The purpose of the embargo was quite a different one, namely, to present a strong remonstrance at the Soviet actions both to the Soviet Union and, even more importantly, to the rest of the world, especially to other countries in Southern Asia and the Middle East, on whom the Western World depends much more heavily than it does on Afghanistan. The economic sanctions, and particularly the grain embargo, had the desired effect. Paradoxically, the louder American farmers complained about the grain embargo, the more effective it was as a serious statement of U.S. concern about Soviet actions to foreign ears. More conjecturally, it is possible to argue that Afghan resistance would have been greatly weakened if the United States had seemed to acquiesce in the Soviet invasion, confining its protestation to speeches and diplomatic notes. Also more conjecturally, it is possible to argue that Soviet restraint with respect to Poland in the next few years was conditioned by the strong U.S. reaction to the Russian invasion of Afghanistan, a country that was far more remote and far less threatening to direct Western interests than was Poland. There is not much leverage that the United States has with respect to the Soviet Union. But the 1980 embargo showed that the United States was serious in its concerns, short of going to war.

CONCLUSIONS

This chapter highlighted the conceptual issues surrounding both general and targeted export embargoes. Effects of embargoes depend on many factors, including market shares of embargoing exporters, the market shares of embargoed importers, extent of cooperation by competing exporters outside of the export embargo set, price elasticity of import demand, strategies of embargoed importers, degree of substitution among imports, and degree of commodity substitution. With grain embargoes, especially targeted ones, many of the above factors possess characteristics that reduce effectiveness of export embargoes when effectiveness is measured strictly in economic terms. Empirical studies generally conclude that the U.S. economy incurred costs from embargoes equal to or greater than the recipients of the sanctions. These results follow from the nature of the parameters listed above.

U.S. agriculture in the 1980's has several disturbing characteristics, including declining export market shares, excessive stocks on hand, and a declining Soviet market share for U.S. exports. These data are consistent with the empirical evidence on the effect of embargoes. However, to draw the conclusion that these phenomena have been solely due to embargoes is dangerous because other factors, including U.S. loan rate levels, exchange rates, and macroeconomic conditions, have also played a role. These factors have to be quantified in any empirical modeling.

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CHAPTER 9

EXPORT RESTRICTIONS OF THE 1970's

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CHAPTER 9

EXPORT RESTRICTIONS OF THE 1970's*

The 1973 oilseed sales restriction, the 1974 Soviet grain sales moratorium, and the 1975 USSR and Poland grain sales moratorium have not significantly affected U.S. trade levels, U.S. market share, or U.S. farm income. Nor can any explicit change in policies of either importers or exporters be traced to these three trade restrictions.

Trade restrictions in the 1970's were imposed to maintain orderly markets amidst tightening supplies and rising concern over high food prices. The 1980 embargo, on the other hand, was enacted wholly for foreign policy reasons. This is a critical distinction. An embargo imposed for economic reasons (tight supplies) will be removed when economic conditions return to normal (when supplies become more abundant). An embargo imposed for political reasons, however, has no clear endpoint because its objectives are usually not clearly defined. Thus, a political embargo can generate more uncertainty. Because the trade restrictions of the 1970's were imposed for economic reasons, we assess their effects separately from those of the 1980 embargo.

Embargoes of the 1970's successfully mitigated supply shortfalls, but long-term effects on grain markets are still debated. It is unclear, however, that in the short term, embargoes were necessary to bring supply and demand back into balance. And in the long term, other factors such as domestic political exigencies and international economic influences combined to obscure the impact of the trade restrictions. This chapter examines the confluence of events that prompted the restrictions and affected reactions of the United States and relevant trading partners, in both the short and longer terms.

We supplemented empirical evidence by looking at both government and private responses to the embargoes because much conventional wisdom about the effect of embargoes is not borne out by data and because people and governments acted not on what was true but on what they believed to be true. We interviewed people who were directly involved in or affected by the embargoes in the United States, Japan, the European Community (EC), Argentina, Brazil, and Canada (see interviewee list in Chapter 15 appendix). We combined these interviews with statistical and economic analyses of data on production trends, exports, and imports to substantiate or refute recollections of events.

More important, we looked at country policy response because many observers allege that both importers and exporters took deliberate policy actions as a result of the embargoes and that these actions led to the loss of U.S. markets and market share. We wanted to find out if countries changed their agricultural policies either as a result of the embargoes or in response to the tight supply conditions that necessitated the embargoes, or if countries changed their policies as result of other domestic, political, or economic pressures. Also, it is important to know whether policies changed as a direct result of the embargoes, or if they changed in response to other concurrent forces.

THE 1973 SOYBEAN EMBARGO

The embargo of high-protein feedstuffs in 1973 resulted from several economic and policy changes in world agriculture which transformed U.S. agriculture.

Events Leading to the 1973 Soybean Embargo

Prior to the early 1970's, U.S. agriculture was characterized by excess productive capacity and low, stable commodity prices; after the early 1970's, U.S. agriculture was at full production, with high and unstable prices.

The 1972 crop failure in the USSR which resulted in large purchases of food and feed grains and soybeans from the United States was the first critical change in the economic environment. The 1972 USSR sunflower crop

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was only 5 million tons compared with 5.7 million tons in 1971, and 6.1 million tons in 1970. USSR wheat and coarse grain production declined from 171.4 million tons in 1971/72 to 158.8 million tons in 1972/73.

To avoid slaughtering livestock, the Soviets bought 900,000 tons of soybeans and 13.7 million tons of wheat and coarse grains from the United States. The Soviet soybean purchase from the United States was the first since 1965/66, and the grain purchase was up from 2.9 million tons in the preceding crop year. Figure 9.1 shows how the series of events increased U.S. and world prices for grains and oilseeds.

A decline in world fishmeal production further increased demand for and prices of soybeans and soybean meal. Fishmeal is an important competitor with soybean meal in livestock feed rations. Peru, the world's largest producer of fishmeal, produced only 0.423 million tons in 1973 compared with 2.25 million tons in 1970 largely due to a decline in the anchovy catch. World exports of fishmeal dropped from 2.6 million tons in 1972 to 1.3 million tons in 1973.

Worldwide competition for protein meals ensued. The USSR, Western Europe, Venezuela, Mexico, Japan, and Poland bought more U.S. soybeans and meal in an effort to meet protein needs. Recent dollar devaluations lowered the price of U.S. products on the world market and fueled demand for U.S. soybeans.

Wet weather during the 1972 harvest also contributed to deteriorating supply conditions by reducing U.S. soybean yields and by slowing the harvest in many regions of the country. Supplies in the 1971/72 season were already tight; ending stocks of soybeans for 1971/72 were 9.2 percent of U.S. domestic disappearance compared with an average of 23 percent from 1965/66 to 1970/71. Although soybean production in 1972 was 8.1 percent greater than in 1971, the low carryin stock resulted in only a 5.3-percent increase in available supply.

Annual supply and utilization data for the United States (table 9.1) do not clearly show the conditions that provoked the embargo. U.S. supplies were up slightly in 1972/73 over the previous year. Domestic use increased slightly and exports were up by 15 percent. But these

Figure 9.1

Factors Affecting Price Rise of Soybeans and Soybean Meal

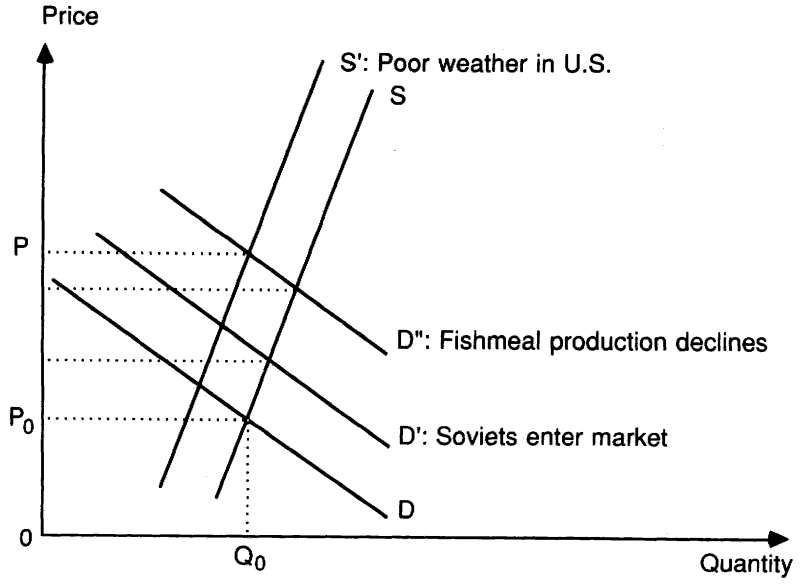


Table 9.1--U.S. soybean and soybean meal supply and utilization

Crop year	Soybeans					Soymeal			
	Production	Beginning stocks	Total exports	Total domestic use	Amount crushed	Production	Beginning stocks	Total exports use	Total domestic
				Million tons					
1970/71	30.7	6.3	11.8	22.4	20.7	16.4	0.12	4.1	12.2
1971/72	32.0	2.7	11.3	21.4	19.6	15.4	.13	3.5	12.0
1972/73	34.6	2.0	13.0	21.7	19.6	15.2	.17	4.3	10.9
1973/74	42.1	1.6	14.7	24.4	22.4	17.8	.17	5.0	12.5
1974/75	33.1	4.7	11.5	21.2	19.1	15.2	.46	3.9	11.4
1975/76	42.1	5.1	15.1	25.5	23.5	18.8	.33	4.7	14.2
1976/77	35.1	6.7	15.4	23.6	21.5	16.8	.32	4.1	12.8
1977/78	48.1	2.8	19.1	27.5	25.2	20.3	.21	5.5	14.8
1978/79	50.9	4.4	20.1	30.3	27.7	22.1	.22	6.0	16.1
1979/80	61.5	4.8	23.8	32.7	30.6	24.6	.24	7.2	17.4
1980/81	48.9	9.8	19.7	30.4	27.8	22.1	.21	6.2	16.0
1981/82	54.1	8.5	25.3	30.4	28.0	22.3	.15	6.3	16.1
1982/83	59.6	6.9	24.6	32.5	30.2	24.2	.16	6.5	17.5
1983/84	44.5	9.4	20.2	28.9	26.8	20.6	.43	4.9	16.0
1984/85	50.6	4.8	16.3	30.5	28.0	22.3	.23	4.5	17.7

changes were small compared with year-to-year shifts in the U.S. soybean complex which have occurred at other times in the past two decades.

The key indicator of the tight market conditions is the level of beginning stocks from 1970/71 through 1973/74, when stocks declined for 4 years (table 9.1). By the beginning of the 1972/73 crop year, stocks were close to minimum pipeline levels. Once this occurred, stocks could not be released to dampen price movements, and price became the only adjustment until the next harvest.

These conditions generated considerable nervousness about the adequacy of soybean supplies for the rest of the crop year. This concern was reflected in the price movements. U.S. cash prices for soybean meal rose from $182 per ton in early January 1973, to a high of $430 per ton in early June. Soybean prices followed a similar pattern. And, Rotterdam price movements copied U.S. price movements. Monthly U.S. and Rotterdam prices for beans and meal doubled between October 1972 and March 1973 before rising sharply again in May and June (figs. 9.2 and 9.3).

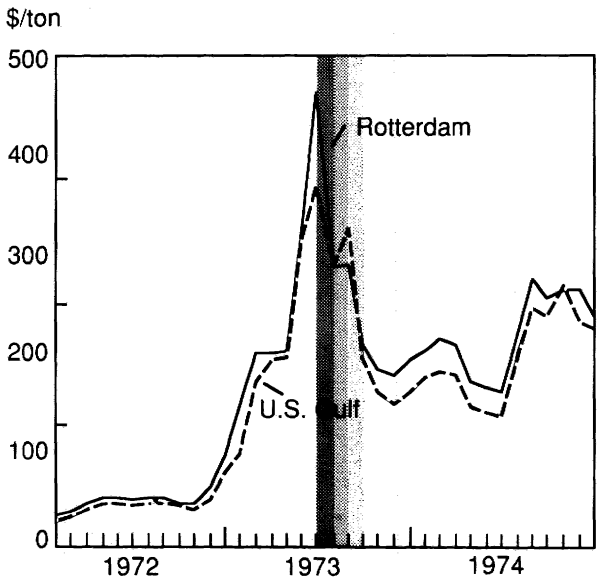
Table 9.2 provides a simple accounting of the quantity of supplies likely available in the U.S. market on April 1, the midpoint in the crop year. It shows that, of the initial supplies of 36.8 million tons, 20.8 million tons had been exported, crushed for domestic use, crushed for export, or used for seed, feed, or waste by April 1. This left 16 million tons for the remainder of the year of which at least 1.5 million tons would have to go for carryout stocks, a pipeline level. That would leave 14.5 million tons available for domestic crush and exports for the last half of 1972/73, or 6.3 million tons less than had been used in the first half of the year. Given the magnitude of this potential shortfall, it is not surprising that prices rose so rapidly.

In response to these tight supply conditions, USDA in January 1973 relaxed planting restrictions on the 1973 feed grain crop and allowed grain and soybean plantings on acreage previously set aside for wheat in an effort to assure increased production of grains and soybeans. In late March, when heavy rains and flooding delayed plantings, an estimated additional 13.5 million acres of feed grain set-aside land was released for feed grains and soybeans. In April, USDA suspended exports of vegetable oils under the CCC export sales program and the barter program. It also curtailed quantities of edible vegetable oils which would be exported under P.L. 480. Both of these were long-term measures and did not ease the current problems of short supply, but may have eased speculative pressures.

Prices still climbed despite these efforts. By April 1973, soybean prices were 119 percent above April 1972 levels, and reached $12.27 per bushel in early June. Under normal conditions,

Figure 9.2

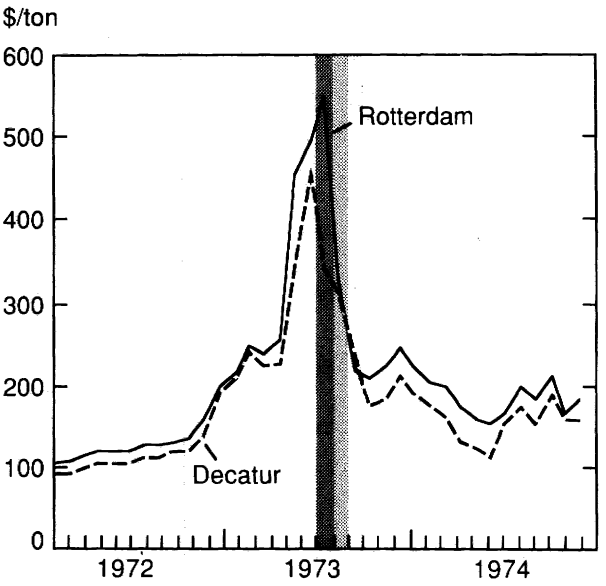
Average Monthly Cash Prices of Soybeans



Source: USDA

Figure 9.3

Average Monthly Cash Prices of Soybean Meal



Source: USDA

such a price runup might have caused concern but probably would not have engendered any Federal reactions. But, in 1973, the United States was making a major effort to fight domestic inflation. Strong domestic expansion pushed price inflation to historically high levels, with food prices rising especially fast. While the Consumer Price Index grew 8.8 percent in 1973, the food portion rose 20.1 percent.

By January 1973, President Nixon had begun removing wage and price controls in Phase III of his anti-inflation program. But, food price increases did not abate, climbing 2 percent from month to month. Efforts to keep a lid on wage increases failed; labor unions demanded that food price increases be slowed before they would discuss any wage concessions.

By May 1973, pressures to control domestic prices by limiting agricultural exports were widespread. Soybean price increases were particularly visible. Soybean prices in June were 200 percent higher than a year earlier. Soybean meal sold for $412 per short ton in June, a 328-percent increase over a year earlier.

Table 9.2--U.S. soybean supply utilization at midpoint of the 1972/73 crop year

		Million tons
Beginning stocks (Oct. 1, 1972):		
Soybeans	2.0	
Meal (bean equivalent)	.2	
Production	34.6	
Total supplies available		36.8
Utilization and exports, first half of crop year:		
Soybeans crushed for domestic use	7.6	
Soybeans crushed for export	3.2	
Seed and feed use	1.1	
Exports	8.9	
Total utilization and exports		20.8
Estimated balance Apr. 1, 1973		16.0
Less ending stocks		1.5
Supplies available for use Apr. 1-Sept. 30, 1973		14.5

Soybean prices are important because of soybeans' use in poultry feed. And chicken was a very visible indicator of rising food prices.

President Nixon responded to the high soybean prices by requesting authority to control agricultural exports and by maintaining some domestic price controls on agricultural products. USDA did not then have the capacity to monitor exports, so the task fell to the Commerce Department which adapted its export monitoring system to track agricultural exports.

Two measures just prior to the imposition of the embargo took some upward pressure out of soybean price movements. On June 13, 1973, President Nixon imposed a 60-day price freeze on all retail and wholesale prices pending the beginning of Phase IV of his inflation control. Then, on June 22, the Chicago Board of Trade limited trading of soybeans and soybean meal futures for July, August, and September to liquidation of contracts, except in cases where traders had physical ownership of these commodities available for delivery.

The decision to impose the embargo was finally triggered on June 27 when the monitoring system at Commerce released data based on reports from exporters showing a surprisingly heavy demand for food and feed grains, soybeans, cottonseed, and soybean and cottonseed meals. For soybean products, reports showed outstanding export commitments equal to three times available supply.

The Embargo Decision

The decision to embargo was influenced almost exclusively by domestic political concerns about inflation, evidenced by the significant role of the Cost of Living Council in the decisionmaking process. Further pressures to embargo soybeans came from U.S. soybean processors who were facing escalating soybean prices and feared shortages. Also, there were rumors, later proved true, that Japan was stocking beans to prepare for a shortage.

Interviews with those close to the decisionmaking process indicate that excessive concern with inflation may have forced the embargo decision when the economics of the soybean market did not warrant such drastic action. The Commerce monitors were unaccustomed to dealing with agricultural markets, where commodities are fungible and where forward contracts often exceed actual deliveries. So, according to one source, the Cost of Living Council and Commerce overreacted to the report that soybeans had been oversold, not knowing that at certain times in the marketing year contracts always exceed supply. Another source indicated that the sales figures were probably inaccurate: Exporters anticipated an embargo and inflated their sales numbers to protect themselves should their contracts be cut across.

There was no apparent concern about foreign repercussions and no apparent consultation with foreign policy advisors, who later had to deal with angry customers. The foreign policy community reportedly learned of the embargo only after the decision was made. Not surprisingly, our trading partners were shocked by the unannounced U.S. actions and immediately began calling USDA officials (including Secretary Butz) to complain. Although it is impossible to substantiate, the neglect of the foreign reactions and foreign policy implications of the soybean embargo may have exacerbated Japanese and European concerns over reliability of the United States as a supplier.

The soybean embargo began on June 27, lasting 4 days. The Office of Export Control in the Commerce Department announced an export licensing scheme on July 2, 1973, effectively ending the embargo. Under the licensing system, exporters were required to report and verify all contracts for exports of embargoed products. Three days later, the licensing system was expanded to place 39 other oilseed products under restrictions.

Later in July, USDA canceled land set-asides for 1974; soybean prices weakened at news of greater acreage. By the beginning of August, licenses were being issued for 100 percent of the soybean meal orders placed in early summer, and prices on the world market were falling. Licensing was discontinued on September 21, 1973, as the new soybean crop came in.

Initial Effect on the United States

A general embargo by a major exporting country should immediately increase prices in

the world market (where supply has been reduced) and reduce prices in the domestic market of the exporter (where the demand for exports has been curtailed thereby reducing overall demand). This did occur in the soybean meal market but only during July (fig. 9.3). For soybeans, however, both U.S. and Rotterdam average monthly prices show a sharp decline after the embargo (fig. 9.2). The reason that the divergence in the two prices does not show up (as it does for the soybean meal prices) is that daily Rotterdam price quotes were suspended for much of early July because there were not enough beans being traded. Daily soybean and soybean meal prices in the United States show the effect of the embargo immediately. On June 27, U.S. soybeans sold for $10.50 per bushel. By July 9, the price of a bushel of U.S. soybeans had fallen to $6.14 (table 9.3). Likewise, meal prices fell from $374 per ton on June 27 to $203 per ton on July 9.

In the 4 months following imposition of the embargo, Rotterdam prices followed the decline in U.S. prices. The immediate decline in world prices seems to indicate that there was already weakness in the market prior to the embargo.

Table 9.3--Soybean and soybean meal daily cash prices, summer 1973

Day	Soybeans 1/			Soybean meal 2/		
	June	July	August	June	July	August
	------Dollars per bushel------			-------Dollars per ton-------		
1	11.54	3/	9.50	395	3/	308
2	3/	9.00	9.20	3/	333	295
3	3/	7.00	9.20	3/	300	285
4	11.44	3/	3/	430	3/	3/
5	12.27	6.50	3/	430	260	3/
6	11.24	6.25	9.50	368	238	275
7	9.60	3/	9.28	335	3/	268
8	10.09	3/	9.50	350	3/	268
9	3/	6.135	9.79	3/	203	280
10	3/	6.21	10.25	3/	205	325
11	10.94	6.45	3/	400	208	3/
12	11.51	7.00	3/	400	235	3/
13	11.10	7.25	10.59	385	280	360
14	9.90	3/	11.25	365	3/	365
15	10.40	3/	9.915	360	3/	325
16	3/	7.65	9.515	3/	310	300
17	3/	7.50	10.055	3/	322	287
18	11.10	10.12	3/	390	315	3/
19	11.18	10.92	3/	390	350	3/
20	11.35	10.30	8.20	390	372	270
21	NA	3/	8.00	390	3/	258
22	11.31	3/	8.75	380	3/	248
23	3/	10.70	8.50	3/	380	242
24	3/	11.00	8.75	3/	345	260
25	11.38	11.40	3/	390	355	3/
26	10.85	10.35	3/	387	345	3/
27	10.50	9.95	8.50	374	317	252
28	NA	3/	8.00	350	3/	233
29	9.00	3/	7.50	340	3/	238
30	3/	9.00	7.50	3/	305	228
31	3/	9.00	7.05	NA	312	225

NA = Not available.
1/ No. 1 yellow soybeans, Chicago Board of Trade closing price.
2/ Decatur price.
3/ These dates are weekends or holidays, no trading.

Source: *Grain Market News*, USDA, Chicago; *Statistical Annual 1973*, Chicago Board of Trade.

The embargo may have broken the cycle of panic buying and speculating which fueled the price increases in late spring 1973.

While the June 27 action clearly restricted sales for several weeks, it appears to have had little effect on U.S. soybean and soybean meal exports for the 1972/73 marketing year as a whole. Smaller export sales in 1972/73 than in 1971/72 were due more to limited supplies and high prices than to export restrictions.

The Japanese had fueled U.S. exports in early 1973 in their efforts to stockpile soybeans. But, export sales began to slow in response to rapidly rising prices in April, May, and June. Given the minimal level of ending stocks, the only way exports could have been much greater than they already were for the 1972/73 crop year would have been to reduce domestic supplies.

The 1973 embargo disrupted domestic markets for only a short time. Farmers temporarily lost sales and exporters were forced to cancel contracts. But, farmers were able to sell every soybean they could produce and exporters were soon in business again, filling first the orders which had been only partially satisfied during the licensing period.

Initial Effect on Importers

The embargo disrupted international markets by reducing supplies to foreign buyers, thereby raising the international price.

Japan

Of all major trading partners, Japan, the most important market for U.S. soybeans, responded most visibly and vehemently to the U.S. embargo, although the response was mostly symbolic. When the embargo was announced, the Japanese were still mindful of the OPEC oil embargo and the sharp increases in the price of oil. Already concerned about rising soybean prices, Japan had been stockpiling soybeans throughout the early spring. The soybean embargo awakened old post-war concerns about food supply, food security, and economic vulnerability; the policy response reflected those concerns.

The Japanese responded to the embargo on two fronts. First, a small government stock of soybeans was established. The government stock initially was 30,000 tons and has since increased to 80,000 tons. This stock was and is used to assuage consumer concerns by demonstrating that the government had responded to prevent a reoccurrence of any supply disruptions or price runups. Despite its political purposes, the stock's economic effectiveness is limited because of its miniscule size, about 8 days' supply.

Japan also funded several hundred Japanese farmers to grow soybeans in Brazil. According to those interviewed in Japan, Brazil, and Argentina, the number of farmers was insignificant and the Japanese Government has severed financial ties with them.

Japan, the most important market for U.S. soybeans, had minimized its exposure by making heavier than normal purchases and by building up stocks in the 3-4 months immediately preceding the embargo. Japan's soybean and other protein meal imports from both the United States and the other suppliers were actually higher in 1973 than in either 1972 or 1974. Total imports of soybeans doubled from 204,000 tons in November 1972 to 425,000 tons in December. Imports of soymeal and cake more than tripled between November and December 1972 from 7,000 to 26,000 tons. Similarly, fishmeal imports doubled from 4,500 to 10,200 tons between December and January (table 9.4). However, as soon as prices returned to normal, Japanese traders returned to cheaper supply sources.

Since restrictions on soybean meal were more liberal after August than restrictions on soybeans, Japan was able to switch to larger meal purchases and limit any loss from August 1 until all restrictions were lifted in October. These two factors changed the seasonal pattern and the product composition of Japan's oilseed imports from the United States but kept the overall volume of soybeans and products imported at roughly the level forecast before the embargo.

Other Importers

The short-term effects of the soybean embargo on other foreign buyers and domestic livestock

producers is less clear but also appear to be minimal. The purpose of a general embargo is to exclude foreign buyers from a market with a limited supply. In the soybean market, this would be expected to benefit domestic livestock producers at the expense of foreign buyers. But, as indicated, prices on both world and U.S. markets fell after the embargo. This suggests that, to the extent that the embargo was responsible for the price decline, it benefited both groups.

Short-Term Effects on U.S. Agriculture

Although it appears there was little or no change in domestic and export demand, there might have been farm income losses. Cash receipts would have been higher even without any measurable change in demand if farmers had been able to market the same volume of soybeans at pre-embargo prices. But, farmers were generally unable to take advantage of the temporarily higher prices possible in the absence of the embargo. Onfarm stocks of soybeans on July 1 were only 930,000 tons, the lowest since 1966. Hence, had farmers received the 1972/73 peak of $364/ton instead of the average $285/ton they actually received for the 660,000 tons marketed between July 1 and September 1, cash receipts for soybeans would have been $52 million, less than 1 percent, higher.

The Foreign Agricultural Service estimates that export revenues would have been $71 million higher if soybean export prices had been at their June level throughout the period, and if export levels during July-September had matched year-earlier levels. However, the timing of the embargo and price movement after the restrictions were lifted suggest that the difference in farm receipts would have been very small. Prices continued well below pre-embargo levels, and oilseed use here and abroad continued at roughly pre-embargo levels. Remember that the new crop was coming to market by the time the embargo was removed, and new crop marketings were a key factor in keeping prices from rising. This suggests that the unusually high prices that preceded the June announcement would not have continued for long even if the restrictions had not been implemented and that season average prices likely would have averaged in the $282-$290/ton range with or without the embargo.

Short-Term Effects on Competitors

Besides the United States, Brazil was the only other major exporter of soybeans at the time of the 1973 embargo. And, because Brazil harvests soybeans in March and April, it was in a unique position to take advantage of the

Table 9.4--Japan: Soybeans, soymeal, and fishmeal imports (monthly)

Year/month	Soybean 1/	Soymeal and cake	Fishmeal and flour	Total
		Tons		
1972:				
September	250,706	1,100	5,937	257,743
October	284,674	1,568	2,008	288,250
November	204,509	7,274	5,687	217,470
December	425,314	26,168	4,562	456,044
1973:				
January	314,954	8,990	10,264	334,217
February	277,901	11,838	5,205	294,944
March	297,140	27,406	7,135	331,681
April	360,901	13,724	4,579	379,204
May	367,892	30,494	11,914	410,300
June	362,947	39,521	5,933	408,401
July	337,644	36,426	13,544	387,614
August	294,033	23,890	6,882	325,805
September	245,087	10,685	10,272	266,044
October	196,059	19,972	2,951	218,982
November	150,628	28,348	5,843	184,459

1/ Excluding flour and meal.

high prices prevailing in the late spring and early summer 1973. Figure 9.4 shows monthly U.S. and Brazilian soybean exports from 1970 through 1976. Both U.S. and Brazilian soybean exports show clear seasonal patterns with the two patterns offsetting one another. Soymeal exports by both countries (fig. 9.5) show less distinct seasonal patterns. But, at least during the months of the embargo, they appear to offset one another.

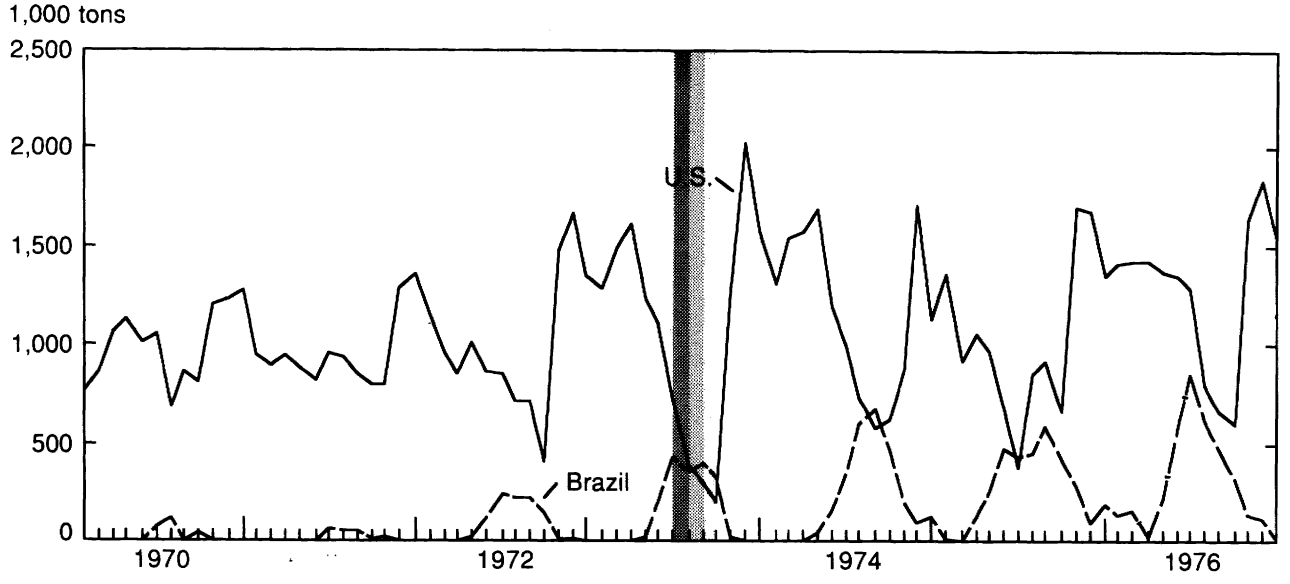
While this evidence shows that Brazilian producers surely benefited from the tight world market supplies and high prices of the first 7 months of 1973, the benefit to them, if any, of the U.S. embargo itself is not as apparent. As indicated, after a brief increase, world bean and meal prices fell sharply soon after the embargo went into effect. Hence, there were only a few days when the United States was out of the market and the Brazilians could have taken advantage of higher prices.

In addition, Brazil was concerned about adequate supplies and stable prices of soyoil for its domestic market. Soybeans and, more important, soyoil are important consumption goods in Brazil. Soyoil alone accounts for over 1 percent of the Brazilian market basket of goods in its inflation index. Rather than taking advantage of the embargo by enacting policies to increase exports, Brazil enacted policies to slow exports and thereby lower domestic prices.

In February 1973, Brazil required export licences for all soybean products. In March, export controls were introduced to ensure supplies to domestic markets. Brazil suspended oil exports in August and prohibited soybean exports in October. Exports were allowed in February 1974, although quantity controls were maintained. In January 1974, export quotas on meal were established. Throughout the remainder of 1974, Brazil imposed registration controls to restrict exports of soybean products. It appears that no policy decision by the Brazilian export agency could be interpreted as encouraging exports of soybean products. In fact, the converse is true; policy decisions during those 2 years prevented, limited, or restricted soybean exports from Brazil in order to ensure supply and low prices

Figure 9.4

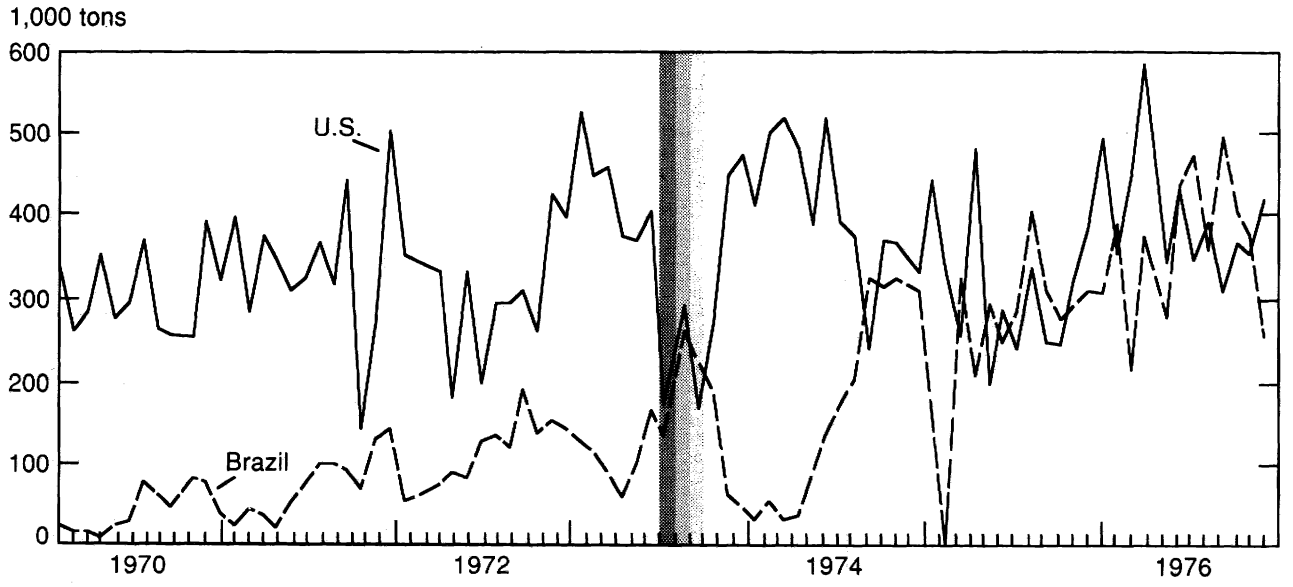
Average Monthly Exports of U.S. and Brazilian Soybeans



Source: USDA

Figure 9.5

Average Monthly Exports of U.S. and Brazilian Soybean Meal



Source: USDA

in the domestic market. (See chronology, Chapter 7, appendix to this chapter, and *(4)*.[1]

Long-Term Effects on Importers

If the embargo has had any quantifiable effect on either importers or competitors over the longer term, we could identify three responses. First, importers would diversify their sources of supply away from the United States. Second, importers would increase their stocks as insurance against future embargoes. Finally, importers and exporters both would be expected to enact policies to increase production and would actually increase production of soybeans or substitutes. But, even if we identify all or some of these responses, they may be due to other economic forces, not the embargo.

In addition to these quantifiable effects of the embargo on trade levels and flows, there may be nonquantifiable effects on the policy environment in importing or exporting countries. While these effects cannot be measured, they are nonetheless important in determining how policies evolve and in affecting international trade negotiations.

Japan

Over the longer term, Japanese policy responded to the soybean embargo, although again in primarily symbolic ways. The Japanese tried to secure supplies from the United States with the 1975 Butz-Abe agreement, obligating the United States to sell and the Japanese to buy 3 million tons of soybeans between 1975 and 1978.

The Japanese Government also provided financial support for trading companies to invest in overseas production, although such investments were small and sometimes unsuccessful. Investments in Indonesian and Thai corn have been abandoned, said interviewees in Japan. The Japanese Government still supports agricultural investment in Brazil, but amounts are insignificant. The Japanese invested in Brazil because of cultural ties with Japanese emigrants living in Sao Paulo and because of

[1]Italicized numbers in parentheses refer to items in the References at the end of this chapter.

Brazil's capacity to grow soybeans, according to our interviews and data from Brazil.

Japan accomplished this investment through the Japanese International Cooperation Agency, consisting of large companies which, through government sponsorship, capitalized a program of investment by Japanese banks for Brazilian soybeans. The Brazilian Ministry of Agriculture set up a pilot agency, the Cerrado Regional Development Program, to jointly finance a credit cooperative for farmers to grow soybeans and other products. The scheme did not get underway until the late 1970's and early 1980's. It was 1982 before any substantive progress was made.

Interviews in Brazil and Japan confirmed that the amounts and results were insignificant. Thus far, 50,000 hectares of soybeans have been subsidized by joint ventures (PRODUCER II) between the Japanese and Brazilian governments, and another 100,000 hectares are under consideration (table 9.5).

The pilot projects have not noticeably increased total soybean production, although production has increased in the Cerrado region where soybeans have not been grown traditionally. If one assumes a yield of 1.8 tons per hectare, the 150,000 hectares in the total project, if devoted wholly to soybeans, would increase Brazilian production by 0.27 million tons, less than 1.5 percent of total 1985 production. If only planned acreage of 84,000 hectares is devoted to soybeans, production would increase by 0.24 million tons.

The common assumption is that the Japanese became concerned about reliability of U.S soybean supplies and turned to Brazil for imports. The Japanese did turn to other markets in 1973, but more likely because of the need to maintain adequate supplies in a tight market than because of the embargo *per se.* Japanese soybean imports from Brazil jumped from 15,000 tons in 1972 to 185,000 tons in 1973 (table 9.6). Similarly, soybean meal imports from Brazil jumped from a negligible quantity in 1972 to 38,000 tons in 1973 (table 9.6).

There is little evidence to suggest that the United States lost significant market share because of the embargo. The U.S. share of the Japanese market for soybeans dropped from 92 percent in 1972 to 88 percent in 1973, but had recovered to 90 percent in 1974 and was back to 92 percent by 1979 (table 9.6).

In the early 1980's, Japan diversified its imports, largely because of the high value of the dollar. But, the extent of this diversification has been insignificant; Japan still relies heavily on the United States. By 1982, the U.S. share of the soybean market in Japan rebounded to 96 percent. Brazil has

Table 9.5--Goals for land development PRODUCER II

Item	Unit	Expanded project	Pilot project	Total
Area to be developed	*Hectares*	100,000	50,000	150,000
Production:	*Tons*			
Soybeans	*do.*	140,000	84,000	224,000
Corn	*do.*	35,000	--	--
Wheat	*do.*	18,000	0	18,000
Coffee	*do.*	19,000	2,500	21,000
Families aided by project	*No.*	250	100	350
Value of production per year, United States	*1,000*	52,800	26,400	79,200

-- = Not available.

Source: (3).

Table 9.6--Japan: Soybean and soybean meal imports by major source, calendar years

Year	United States	Brazil	China	Other	Total	U.S. share
	1,000 tons					Percent
Soybean imports:						
1970	2,952	--	291	1	3,244	91.0
1971	2,927	--	283	2	3,212	91.1
1972	3,126	15	254	1	3,396	92.0
1973	3,210	185	226	14	3,635	88.3
1974	2,924	82	232	6	3,244	90.1
1975	3,041	44	240	9	3,334	91.2
1976	3,287	126	133	8	3,554	92.5
1977	3,428	58	98	18	3,602	95.2
1978	4,143	2	80	35	4,260	97.3
1979	3,839	1	80	35	4,132	92.9
1980	4,226	35	100	40	4,401	96.0
1981	4,022	1	113	61	4,197	95.8
1982	4,196	0	112	36	4,344	96.6
1983	4,646	24	288	37	4,995	93.0
1984	4,181	0	308	26	4,515	92.6
1985	4,345	210	289	66	4,910	88.5
Soybean meal imports:						
1970	70	1	--	1	72	97.2
1971	34	4	1	--	39	87.2
1972	44	--	6	2	52	84.6
1973	232	38	5	2	277	83.8
1974	124	6	2	--	132	93.9
1975	--	16	--	2	18	--
1976	1	19	71	--	3	33.3
1977	237	76	1	--	314	75.5
1978	263	72	--	5	340	77.4
1979	223	54	--	6	283	78.8
1980	239	72	--	15	326	73.3
1981	128	84	--	2	214	59.8
1982	47	38	2	--	87	54.0
1983	38	178	18	--	234	16.2
1984	--	105	11	--	116	--
1985	5	88	41	--	134	3.7

-- = Not available.

Source: Official Japanese trade statistics.

captured a larger share of the Japanese soymeal market since the embargo. In 1972, Japan bought no soymeal from Brazil. In 1974, 5 percent of Japan's soymeal came from Brazil. And, by 1982, Japan was buying 44 percent of its soymeal from the Brazilians.

But keep these numbers in perspective. Japan imports far more soybeans than soymeal. In 1982, soybean imports totaled 4.3 million tons; soymeal imports totaled only 87,000 tons. Furthermore, the U.S. share of the Japanese soybean market has been more consistent over time than has the Brazilian share of the Japanese soymeal market, primarily because Brazil has been even more mercurial in its export policies than has the United States.

There is little evidence to suggest that Japan has changed its domestic policies in direct response to the embargo. Japan began adjusting its production to reflect changing domestic demand well before 1973, driven principally by the rice surplus that had

developed as a result of domestic policies in the post-war period.

Japanese policy has historically encouraged production of rice, a crop central to its farm economy and rural politics. But, policies in the post-war era encouraged overproduction; stock levels reached half of annual production. Japan began to focus on product diversification. Japan's "farm bill" was revised in 1970 to encourage farmers to shift from rice cultivation to commodities for which growth in demand was more promising and Japan was a net importer. In 1977, Japan raised producer prices on wheat, barley, soybeans, and rapeseed in an effort to diversify production, reduce the rice surplus, and reduce imports of these other commodities.

Even though the embargo does not appear to have had a quantifiable effect on Japan's trade patterns, the embargo did have a psychological impact on the Japanese and has affected the context, if not the substance, of Japan's agricultural policy. Coming as it did on the heels of OPEC's oil embargo, the soybean embargo reminded the Japanese of their dependence on imported raw materials and on the vulnerability of their economy to the decisions of foreign governments. Increasing concerns about global food supplies also heightened Japanese awareness.

Most Japanese interviewed said that the concern the embargo created about the reliability of the United States as a supplier has affected subsequent policy debate. As one interviewee said of the U.S.-Japan tensions over beef: "We can't plan to buy more beef from the United States—some year you may decide we can't have any."

The most important effect of the 1973 soybean embargo on the Japanese was to aid protectionists in their drive to increase Japanese self-sufficiency in oilseeds and other products. While the protectionists surely would have found another handle for their arguments, the embargo has provided an expedient example of Japan's vulnerability. Protectionists in Japan use the embargo as a powerful rationale in arguing for higher domestic support and reduced dependence on foreign imports of soy products and other agricultural products.

The European Community

Like the Japanese, the Europeans became more aware of their economic vulnerability as a result of the U.S. soybean and Arab oil embargo. Although there was little immediate policy response, it appears that over the longer term the soybean embargo (and more important the high prices and tight supplies motivating the embargo) did affect EC policies. However, as with Japan, the EC policy response must be examined in the light of overall EC agricultural policy.

The years preceding the embargo were the first years of the Common Agricultural Policy (CAP). The CAP changed relative prices of feedstuffs in Europe, causing hog and cattle producers to shift from corn and other feed grains to manioc and other "junk feed," which could be imported cheaply with no duties. Manioc, however, is pure starch with no protein and needs protein supplements to fulfill livestock protein requirements. The supplement of choice is soymeal. When coupled with the increasing popularity of poultry, soymeal consumption in the EC rose. The soymeal component in feedstuffs averaged 6.4 percent in The Netherlands between 1965 and 1968; by 1969-71, the average had increased to 10.6 percent. Thus, the EC was becoming more dependent on soybeans and soymeal than in the years before the embargo.

This heightened dependency, coupled with the high prices and short supplies that led to the embargo, may have encouraged the French to press for increased domestic oilseed production and may have encouraged the EC to attempt to include soybeans in the CAP for oilseeds. So far, the French have been unsuccessful in efforts to protect soybeans, and the EC has honored its GATT obligation to a zero tariff binding on soybeans and products. Without protection and despite a large producer subsidy, EC soybean production amounts to 3.6 million tons, dwarfed by worldwide production of 70 million tons.

However, one official we interviewed noted that the embargo encouraged discussion within the EC about security of the food supply, particularly in oilseeds. EC support prices for rapeseed and sunflower have benefited from greater increases than for wheat. He

suggested that EC rapeseed production (substituting for soybeans) has been rising, partly as a result of the embargo.

After the embargo, the United States lost market share in the EC market, mostly to Brazil. The U.S. share declined from 80.7 percent in 1972 to 70 percent in 1975, rebounding to 79 percent in 1977. Brazil's share rose from 11 percent in 1972 to 26 percent in 1975, falling thereafter when Argentina entered the market. A close observer of European agriculture attributed Brazil's gain to European nervousness after the embargo which prompted an initial effort to diversify supply sources. There is also evidence that the embargo encouraged France to fund more genetic research in oilseed products (especially rapeseed, sunflowers, and soybeans) than it might otherwise have.

All of this shift cannot be attributed to the embargo. The U.S. share of the European soybean market had begun declining in the first years of the CAP. There was a small drop in the U.S. share of the European soybean and oilseeds market in 1973. But, through the remainder of the 1970's, the U.S. share was unchanged. Then, in 1980/81 it fell off sharply, caused primarily by high U.S. commodity loan rates and a strong dollar pricing U.S. products out of the European market. In addition, Brazilian soymeal has a higher protein content than U.S. soymeal (important because soymeal is used in the EC as a protein supplement), and the Brazilian taxes on soymeal are lower than those on soybeans, thus lowering its relative export price of soymeal.

The common assumption is that the EC did not react to the 1973 embargo as Japan did: By buying elsewhere and by escalating the drive for self-sufficiency. But, the embargo and conditions leading up to it did alter the policy environment. In fact, our interviews in Europe indicate that the 1973 embargo had a greater effect on the EC than previously supposed. It seems that the 4-day soybean embargo may have left a more lasting impression on the Europeans than did the 17-month-long 1980 wheat embargo. One European asserted that, although it is difficult to substantiate, he was certain that the embargo is frequently used by protectionists to show that the EC security (military as well as food) is endangered by the risk of embargoes. Evidently, the debate on the recent EC Green Report on Agricultural Policy referred to the 1973 embargo when arguing for higher price supports. On the other hand, another European grain trader said that while the 1973 embargo drove home the potential for marketing opportunities to U.S. competitors, in the day-to-day markets, price, not political memories, sells grain.

Long-Term Effects on Exporters

The 1973 embargo may have played a role in Brazil's and Argentina's expanded soybean production and exports. However, a close look at the evidence shows that other factors may have played as great, or even greater, a role.

Brazil

Over the longer term, production and exports of soybeans in Brazil have grown. Harvested area increased from 1.3 million hectares in 1970 to 8.8 million hectares in 1980. Production increased from 1.5 million tons to 15.2 million tons over that same period (table 9.7). Export volume rose as well.

Brazilian exports of soybeans and soybean products have shown different patterns of growth since the mid-1960's. Soybean exports fell from 3.5 million tons in 1975 to 0.6 million tons in 1979, and then rebounded to 3.5 million tons in 1985. Brazil's share of world soybean exports rose from 7.9 percent in 1972, to 11.6 percent in 1973, peaked at 22 percent in 1975, and has been falling steadily ever since (figs. 4.7 and 4.8).

Soymeal exports and Brazil's share of the world soymeal market, on the other hand, have risen steadily since the mid-1960's. In 1965, Brazil exported 105,000 tons of soymeal. By 1972, Brazil was shipping 1.5 million tons of soymeal overseas. In 1985, soymeal exports totaled 8.6 million tons. Brazil's share of soymeal exports rose from 16.8 percent in 1972 to 44.8 percent in 1977 and has remained near those levels (figs. 4.9 and 4.10).

Brazil's domestic agricultural policy has encouraged production and exports of soybeans and, especially, soymeal directly and indirectly since the early 1960's. Brazil has attempted to

Table 9.7--Soybean area harvested and production, Brazil, United States, rest of world, and total

Year	Area harvested				Production			
	Brazil	United States	Rest of world	Total	Brazil	United States	Rest of world	Total
	1,000 hectares				1,000 tons			
1965	432	12,462	12,700	25,594	523	19,076	9,640	29,239
1966	491	13,941	11,282	25,714	595	23,146	8,092	31,701
1967	612	14,790	11,135	26,537	716	25,269	10,484	36,469
1968	722	16,109	11,363	28,194	654	26,575	10,545	37,774
1969	906	16,751	11,187	28,844	1,057	30,127	10,515	41,699
1970	1,319	16,729	11,370	29,418	1,509	30,839	10,131	42,479
1971	1,716	17,098	11,187	30,001	2,077	30,675	11,526	44,278
1972	2,840	17,282	11,170	31,292	3,666	32,009	11,526	47,201
1973	3,615	18,488	11,241	33,344	5,012	34,581	9,596	49,189
1974	5,143	22,528	11,606	39,277	7,876	42,118	12,401	62,395
1975	5,824	20,777	11,552	38,153	9,892	33,102	11,647	54,641
1976	6,417	21,698	11,164	39,279	11,227	42,139	12,248	65,614
1977	7,070	19,992	11,127	38,189	12,513	35,070	11,875	59,458
1978	7,782	23,403	12,283	43,468	9,541	48,097	14,576	72,214
1979	8,256	25,764	13,310	47,330	10,240	50,859	16,398	77,497
1980	8,774	28,467	14,199	51,440	15,156	61,525	16,833	93,514
1981	8,501	27,443	13,649	49,593	15,200	48,921	16,859	80,980
1982	8,202	26,776	15,051	50,029	12,835	54,135	19,147	86,117
1983	8,136	28,102	15,844	52,082	14,750	59,610	19,200	93,560
1984	9,320	25,303	15,975	50,598	15,400	44,518	22,880	82,798
1985	9,700	26,755	16,631	53,086	17,500	50,644	23,458	91,602
1986	8,850	24,922	17,448	51,220	12,500	57,113	24,517	94,130

achieve self-sufficiency in wheat by raising support prices and extending credit to wheat farmers. While efforts to expand wheat production have failed, these pro-wheat policies have inadvertently encouraged soybean production. Programs which provide credit to soybean farmers have had a more direct effect on soybean production (see Chapter 4).

Brazil has generally been more supportive of soymeal exports than of soybean exports in an effort to retain some of the value added in processing and, more important, to encourage soyoil production. Encouraging soymeal production increases supply and lowers the price of soyoil. Brazil uses a differential export tax system which favors meal exports. This policy underlies the steady rise in meal exports and the place of Brazilian meal in the EC.

There is no evidence that Brazil took advantage of the U.S. embargo to increase its own exports over the long term. But, Brazil's export policies have oscillated between export promotion and export restriction depending on domestic needs and reactions from the United States and the EC. The emphasis on export production ended in 1972 because world meal prices began to rise, and the Brazilian feed industry demanded protection to keep domestic meal prices low. Since that time, Brazil's domestic agricultural policy has been focused more on maintaining adequate supplies and low prices than on consistently encouraging exports of soybeans or soymeal.

Brazil did devalue the cruzeiro during the 1960's, making Brazilian soybeans cheaper on the world market. But, these devaluations became less frequent after 1974 and the value of the cruzeiro appreciated in real terms, making Brazilian products more expensive on world markets (table 9.8). If Brazil had been trying to promote exports at the expense of other macroeconomic and financial goals, Brazil would have continued to undervalue the cruzeiro after the 1973 embargo.

Brazil's domestic policies have been more preoccupied with obtaining self-sufficiency in wheat, not exporting soybeans. And it has been the failure of the wheat policies that encouraged soybean production, rather than any conscious effort to expand soybean exports. Further, these policies were in place long before the 1973 embargo occurred.

Table 9.8--Brazil: Nominal and real exchange rates

Year	Nominal	Real 1/
	Cruzeiros per dollar	
1971	5.20	51.06
1972	5.93	44.30
1973	6.13	42.91
1974	6.70	40.88
1975	8.13	41.80
1976	10.67	40.96
1977	14.14	40.34
1978	18.07	39.98
1979	26.95	43.41
1980	52.71	52.71
1981	95.12	50.00
1982	179.51	51.65
1983	577.04	70.90
1984	1,848.00	79.74

1/ Nominal exchange rate times ratio of U.S. CPI to Brazilian CPI.

Source: (5).

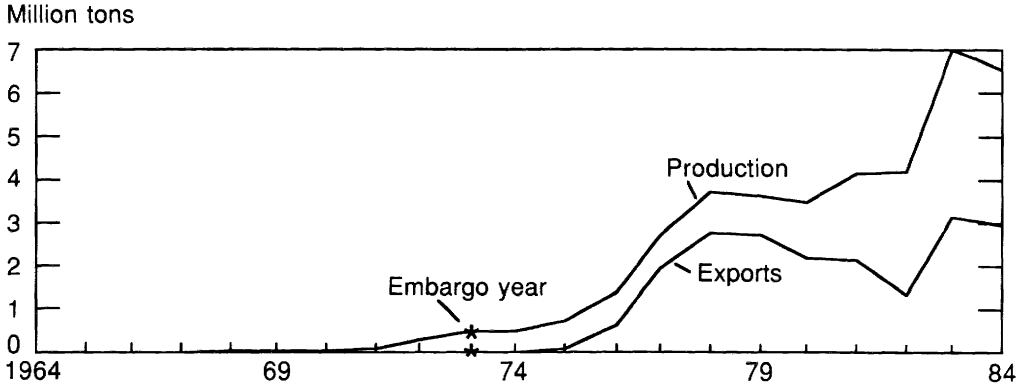
Argentina

Argentina's production of soybeans was negligible in 1973 (fig. 9.6), and it did not begin to export soybeans until 1976. The 1973 embargo might have played a role in Argentina's decision to expand soybean production, but price expectations and the phenomenal success of the neighboring Brazilian soybean sector more likely encouraged the expansion.

The move in 1976 toward a freer market in Argentina was ideological and had more to do with increases in soybean production than the embargo. In that year, export taxes were lowered from 56 percent to almost zero. The Argentine Grain Board was abolished, and grain began to move through private exporters. Although Argentina has since reimposed export taxes, these policies dramatically increased farmer income in Argentina in the mid- to late-1970's and led to increased investment and use of technology, especially herbicides and pesticides. Regional agricultural research institutions were established to develop seeds for the various Argentine subclimates. The total effect of all these policies was to foster dramatic increases in production.

Figure 9.6

Argentine Soybean Production and Exports



Source: USDA

Long-Term Effects on U.S. Agriculture

The greatest long-term effect on U.S. agriculture of the 1973 embargo would come through the world market as a result of supply, demand, and policy responses of trading partners and competitors. However, we can trace no identifiable policy response by a major soybean or soymeal trading country to this embargo.

Although they were probably small, there were some supply and demand responses to the embargo which could affect U.S. agriculture. Richard Henry provides one estimate of the magnitude of these effects *(1)*.

Henry used a dynamic model of monthly price formation to simulate the effect of the 1973 embargo on farm income. His model encompassed the soybean, soyoil, and soymeal markets. Each market included demand from Japan, the EC, and the rest of the world. Market participants' expectations regarding future demand and supply conditions were incorporated using a nonlinear soybean price function based on supply of storage theory. Under the supply of storage theory, the spot price of soybeans is related to expected carryover stocks at the end of the crop years. This is an important feature of the model for examining the events of 1973 because it focuses on the key variable, expected carryout stocks, that was the driving force behind prices that year. In addition, as a nonlinear function, it should do a better job capturing the price behavior of tight markets.

Henry's import demand equations included dummy variables to account for the embargo. To simulate conditions as they would have existed without the embargo, Henry simply removed the dummy variables from the import equations. Simulation results indicate that U.S. soybean and soybean meal exports would have been higher without the embargo which would have led to lower carryout stocks for the 1972/73 crop year. Higher prices would have prevailed over the embargo period and for the following crop year, averaging $6/ton more for soybeans and $5.40/ton more for soybean meal. This represents roughly a 3-percent increase in the prices of both soybeans and soybean meal. The difference between the simulated embargo prices and the nonembargo prices dissipates and completely disappears by September 1974. The higher prices and additional export volumes of the nonembargo scenario represent an additional $260 million in farm income to soybean producers. This represents roughly 8 percent of the total value of U.S. soybeans exported in 1973/74. It does not include additional costs livestock producers and consumers would have to pay for soybeans and soybean products.

Papers by Lamm and Williams provide other estimates of the impact of the embargo *(2, 7)*. Lamm briefly discusses the embargo impact. Like Henry, Lamm uses a monthly model capturing some of the short-term effects. He shows that without the export controls imposed by the embargo, the average price of soybeans would increase $0.27 per bushel and the average price of soybean meal would increase $0.13 per ton. Lamm does not outline how he simulated the embargo, so it is difficult to know whether his model results are realistic.

Williams shows a 1.8-million-ton decline in U.S. exports as a result of the embargo. He simulates the embargo for the 1974/75 crop year, not the 1972/73 crop year when the embargo actually occurred. By 1974/75, Brazil was a larger exporter and a more significant force in the market, and U.S. stocks were higher than they had been during the actual embargo. Williams did not include soymeal in the simulated embargo, thereby distorting the simulated relative prices of beans and meal on the world market. Williams also does not account for the policy changes in Brazil, when we know that Brazil also restricted soybean exports in an effort to control domestic prices. The Williams results, therefore, probably exaggerate the embargo impact.

Conclusions

The 1973 U.S. embargo of oilseeds had minimal short-term effect on U.S. agriculture and no detectable impact beyond the start of the 1974/75 crop year. To some extent, the embargo may have given the United States the stigma of an unreliable supplier. The United States, however, had only very limited supplies for export when the embargo was declared and except for the first 4 days, export contracts were honored for at least 40 percent of their terms.

Brazil, the other major supplier of soybeans, was no more reliable than the United States at the time as it undertook policy measures to protect its own domestic market. Any increased awareness by Brazilian and Argentine farmers of the importance of soybeans was certainly not the critical factor in the increased production in either country.

The embargo did, however, heighten the importance of food security issues in Japan and the EC. In both countries, the embargo gave protectionists a convenient handle to argue for higher domestic support prices and border protection.

Perhaps of greatest importance to U.S. trading partners, the United States undertook longer term policy measures in 1973 to insure that increases in U.S. production could alleviate the tight supply situation in the coming crop year. These policy changes should have offset any country's concern about the availability of soybeans from the United States.

THE 1974 MORATORIUM ON GRAIN SALES TO THE USSR

The huge 1972 USSR grain purchases and the 1973 soybean embargo led U.S. policymakers to install a reporting system for export sales of grain and oilseeds. Originally housed in the Commerce Department, the monitoring system was transferred to USDA in September 1973. USDA required exporters to report sales of over 100,000 tons so it could anticipate tight markets. This system equipped the Government to cope with the short supplies of 1974 and 1975 without having to resort to an embargo.

Events Leading to the 1974 Grain Moratorium

The tight supply situation that led to the 1973 embargo appeared to be improving in the spring of 1974. While supplies were still tight, the production outlook was good. But, as the season progressed, the situation deteriorated. In August 1974, USDA lowered its estimate of the 1974 corn crop to 4.9 billion bushels; earlier forecasts had reached as much as 6.7 billion bushels. Farmers in the United States, Australia, Canada, and Argentina all had problems in planting or harvesting their crops. Drought in India and the Middle East worsened the situation. By fall 1974, Argentina, Australia, and Canada had committed most of their exports; the United States was the only country with large, uncommitted supplies.

The Moratorium Decision

In August 1974, as U.S. export sales accelerated, the monitoring group began meeting weekly at USDA to assess the supply situation. The administration decided that if any importers should be forced to cut back, it should be the Soviets, because they had been making major, but irregular, purchases in the previous 2 years.

Unlike the action of 1973, the moratorium was declared only after extensive consultation on the foreign policy side and with other countries, who agreed to voluntarily limit purchases of the new corn crop to USDA-set target amounts. But, after Secretary of Agriculture Butz urged the USSR to limit its purchases, the USSR attempted purchases of 2.3 million tons of corn and 900,000 tons of wheat. The apparent breach of this unspoken agreement led the United States to suspend these sales. The administration asked the grain companies involved to voluntarily void export contracts until negotiations with the USSR could be completed.

Less than a month later, USDA announced a voluntary export sale reporting system for the major commodities which asked exporters to obtain approval from USDA before making large overseas sales. Almost simultaneously, USDA again lowered its forecast for corn production to 4.7 billion bushels, down 0.2 billion bushels from the August estimate.

Immediate Effects

Wheat and corn prices fell from $4.85 and $3.45 per bushel when the October 1974 moratorium was announced to $3.65 and $2.67 by March 1975. At least part of this 1974 decline in prices, however, was due to factors other than the 1974 Soviet sales moratorium. Pressure on corn supplies eased considerably as demand for feed in the United States dropped sharply in response to higher corn prices and consumer resistance to the higher meat prices.

Feed grain use also declined in Japan. Wheat prices declined because the EC dumped large quantities on world markets. The EC, unlike most major grain producers, had an excellent 1974/75 wheat crop to dispose of and large stocks to draw down.

Total grain trade in 1974/75 was down from previous years. U.S. grain exports were down, and USSR purchases from the United States were 5.6 million tons lower than the 1973/74 level. Clearly, the negotiated 2.2 million tons of corn and wheat allowed the USSR meant lower exports than if they had proceeded with the original 3.2-million-ton order. But, U.S. exports to other countries increased once the price began falling immediately after the moratorium was announced, thus making up some of the 1 million tons of exported grain withheld from the USSR.

Those farmers who marketed their crop after the moratorium received lower prices than if they had held their stocks for later sale. On the other hand, livestock producers and consumers benefited from lower feed and food prices.

Short-Term Effects on Exports

As in the 1973 case, effect of the 1974 and 1975 moratoria on exports is difficult to measure with any precision but appears to have been quite limited. The USSR did not purchase any additional U.S. grain in 1974/75 beyond the 2.2 million tons of corn and wheat allowed to be shipped at the time the action was announced. Thus, the USSR purchased 900,000 tons less than it would have from the United States. However, the 900,000-ton U.S. loss of USSR sales was more than made up by sales to third country markets. The lower prices in effect after the moratorium was announced, combined with added supplies that would have gone to the USSR, encouraged other importers to buy more than they had been expected to purchase prior to the action.

These tradeoffs kept U.S. exports in 1974/75 at roughly the levels expected prior to the moratorium. But, even with these tradeoffs, exports fell somewhat from 1973/74 levels, but due more to the limited U.S. export supplies and high prices than to the moratorium. The 8-percent decline in U.S. corn exports in 1974/75 is about what could have been expected with the 18-percent increase in corn prices generated by strong demand and tight supplies.

THE 1975 MORATORIA ON GRAIN SALES TO THE USSR AND POLAND

The 1975 moratoria arose out of the same market environment that led to the 1974 sales restriction. The most obvious policy change that arose out of the 1975 moratoria on grain sales to the USSR and Poland was the U.S.-USSR long-term grain agreement.

Events Leading to the 1975 Grain Moratoria

Entering the harvest season in 1974/75, world cereal trade was at a low ebb, with prices substantially calmed from a year earlier but with stocks still relatively low. In March 1975, USDA terminated the voluntary prior approval system, although the export reporting system remained in place.

In June 1975, USDA lowered its projections of USSR grain production from 210 to 200 million tons. USDA estimated that the USSR would need to import 10-15 million tons to cover this shortfall. Projections of USSR import demand rose through the year as information of low USSR production trickled in. Through the summer, 1- and 2-million-ton USSR purchases were reported by both the United States and Canada. In July 1975, the USSR refused to allow a group of U.S. congressional representatives to tour farmland.

With memories of the attempted purchases by the USSR a year earlier still fresh, USDA on July 4 requested exporters to notify it of major grain sales to the USSR. That same day, USDA lowered its estimates of the Soviet grain harvest from 195 to 185 million tons.

In late July, members of the Ford administration began expressing concern about large grain sales to the USSR. Inflation (especially food price inflation) was still a problem and the sales to the Soviets heightened fears of higher food prices. On July 31, at a congressional hearing, USDA reported that the USSR had contracted to buy about 10 million tons of grain. Prices escalated and congressional hearings began on the rumor that

the USSR was preparing to pull off another "great grain robbery."

In early August, the Central Intelligence Agency (CIA) reported the USSR might need to purchase as much as 40 million tons of grain. This prompted the longshoremen's union to initiate a boycott on loading grain headed for the Soviet Union. The news also prompted the Secretary of Agriculture to suspend additional grain sales to the USSR the same day, August 11, 1975.

By late August, USDA projected no more than a 25-million-ton import demand from the USSR, but estimates of 9-percent food price inflation (reportedly 1.5 percent of it directly attributable to the USSR purchases to date) induced USDA to maintain the moratorium on USSR purchases.

On September 9, President Ford announced that a purchase agreement would be negotiated between the United States and USSR and extended the moratorium until October. The longshoremen ended their boycott of ships loading grain destined for the USSR.

On September 10, without public announcement, the Department of State asked Poland to halt its grain purchases. State was apparently concerned that the USSR was "saving" grain by not shipping to the Poles and the Poles were making up the difference in U.S. grain. Poland agreed to stop buying grain on the U.S. market. News of the suspension did not become public until 2 weeks later.

Throughout the fall, the USSR and Poland negotiated long-term agreements with the United States. On October 10, President Ford lifted the moratorium on Poland when USDA announced record harvests for wheat and corn. On October 20, the USSR and the United States signed a 5-year grain agreement. Four days later, sales to the USSR were resumed. On November 27, 1975, Poland agreed to purchase 2.5 million tons of corn and wheat from the United States.

Immediate Effects

Immediately after the moratoria were lifted, spot and futures prices dropped somewhat and the wild cycles which had begun in January 1974 calmed substantially by the end of 1975. Prices probably would have continued high in the absence of the U.S. Government intervention until later in 1975 when record U.S. wheat and corn harvests and large harvests elsewhere began.

Even with the moratorium, U.S. exports to the USSR were very strong, and total U.S. exports hit an all-time high, although USSR purchases probably would have been higher without the constraint imposed by the sales suspension. Total USSR imports reached a record of 25.7 million tons, 14 million tons of which were purchased from the United States.

Cash receipts of U.S. grain producers were likely reduced somewhat by the price-dampening effects of the moratoria. But, as in 1974, livestock producers benefited from that price reduction; so, the total effect on U.S. farm income was small.

Announcement of the moratoria on sales to the USSR and Poland and the proposed U.S.-USSR long-term sales agreement in September 1975 also broke speculative pressure on grain prices the following year. September 1975 wheat and corn prices at the farm level averaged $4.11 and $2.76 but fell to $3.58 and $2.33 by November. As with the 1974 action, at least part of the 1975 decline in prices following announcement of the moratoria was due to other factors, one of the most important being the larger supplies available from the other exporters in the fall of 1975 and prospects for good Southern Hemisphere crops in the winter and spring of 1976.

LONG-TERM EFFECTS OF THE 1974 AND 1975 MORATORIA

The 1974 and 1975 moratoria did not hinder U.S. exports of wheat and coarse grains in 1975/76; sales actually hit an all-time high. Combined U.S. wheat and coarse grain exports rose 29 percent to 82 million tons.

Domestic use shrank dramatically in 1974/75 and 1975/76, but due more to the short supply and high prices that led to the restrictions than to the moratoria themselves. To the extent that the actions stabilized a highly volatile market, they probably kept the drop in domestic use of wheat and feed grains from being even greater.

Combining the 1974 and 1975 evidence on exports and domestic use suggests that the moratoria had little impact on the volume of products moving on the market. But, as in the 1973 case, farmers' cash receipts were marginally lower as a result of the actions. Farmers sold at least part of their crops in the summer and fall of 1974 and 1975 at prices below levels that would have prevailed, at least temporarily, without the action.

Moreover, the high prices in effect at the time the moratoria were announced were quite likely temporary and would have weakened even if no action had been taken. Equally important, aggregate farm income losses associated with the actions were even smaller since the high crop receipts possible without the moratoria would have been partially offset by higher livestock feeding costs.

The 1974 and 1975 sales moratoria raised the same longer run questions about the reliability of the United States as a supplier as did the 1973 action. Critics of the actions cite the same factors noted in the 1973 discussion with little, if any, added evidence.

Supporters argue that the actions worked to calm any fears about U.S. reliability. Given the extreme uncertainty that precipitated the moratoria, many importing and exporting countries could have interpreted the U.S. initiatives as positive rather than negative, because they stabilized the domestic U.S. market.

Moreover, the long-term agreements, which were partly a result of the moratoria, provided greater information about Soviet production and import demand, a key area of uncertainty in the grain markets. Webb and Jones argue that the 1975 U.S.-USSR grains agreement had a significant effect on reducing grain price variability *(6)*. The information provided by the existence of the agreement helped importers and exporters alike in making longer term production and consumption plans.

However, the moratoria and, more importantly, the market circumstances that surrounded them quite likely deterred importers from increasing dependence on trade in general and possibly on U.S. exports in particular. The extent to which these two factors offset each other is impossible to estimate.

The long-term effect of the moratoria on U.S. sales to the USSR, the principal target of the actions, is easier to gauge. As a result of the long-term agreement signed in the wake of the 1975 moratorium, the Soviets imported large volumes of U.S. products in the last half of the decade up until the Soviet/Afghanistan embargo. From 1972 to 1979, the United States accounted for 46 percent of Soviet wheat imports, ranging from 29 percent in 1972 to 65 percent in 1973, and a more impressive 71-percent share of Soviet coarse grain imports, ranging from 49 percent to 83 percent.

CONCLUSIONS

The trade restrictions of the 1970's have not significantly affected U.S. trade levels, U.S. market share, or U.S. farm incomes. Nor can any explicit change in the policies of either importers or exporters be traced to the three trade restrictions.

The trade restrictions and, more important, the conditions that led up to those trade restrictions heightened concern about the reliability of the United States as a supplier of agricultural products and the advisability of becoming too heavily dependent on the world market. In part, this is due to the nature of these restrictions. Embargoes and moritoria imposed because of tight supply conditions can be more disruptive than those imposed for political reasons, primarily because "economic" embargoes affect our closest trading partners, who coincidentally may happen to be our closest allies. These allies need not fear an embargo imposed for political reasons, but they have no such assurance about being caught in an embargo imposed for economic reasons.

In addition, economic embargoes can generate an environment that perpetuates their use. When an importer sees prices moving up, it may begin stockpiling in anticipation of an embargo, thereby further driving up prices and triggering the very action the country was trying to insure itself against.

On the other hand, the 1973 embargo did encourage the United States to establish a reporting system to signal supply shortages. To the extent that system is effective in making the market more transparent, it should make the market more stable.

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APPENDIX

CHRONOLOGY OF MAJOR BRAZILIAN POLICIES, NONTAX: 1973-81

The following chronology represents an incomplete list of policies enacted during this period. The intention is to display the highly variable nature of Brazil's export policy.

1973

February. Export licensing for all soybean products

March. Export contingencies on soybeans and soyoil (1 ton to CACEX per 3 tons exported)

July. Soyoil exports suspended

October. Soybean exports prohibited

1974

January. Soymeal export quotas

February. Exports permitted, all products

April. Domestic market contingency for soybeans removed

August. Registration requirements for soymeal

September. Registration requirements change

1975

February. New registration requirements—exports must be registered within 3 days of sale

August. Export quota, soybeans exports related to processing capacity

1976

January. Export quotas for soybeans revised, soyoil exports free

1977

January. Export quotas for soybeans revised, soymeal and soyoil exports free

February. Large share of soybean production reserved for processing

March. Quota for soybeans raised

April. Quotas on soyoil and soymeal exports

1978

January. New export quotas

March. Soybean quota reduced and all soy-related exports suspended

May. Soyoil exports freed

June. Subsidy on oil exports

December. Export quota on soyoil

1979

January. Quotas for sales of soyoil and soymeal into domestic market

March. Exports of soyoil and soymeal suspended

April. Meal exports permitted

1980

January. New export quotas set for soyoil, soymeal, and soybeans

July. Revision of quotas and contingencies

October. Revision of quotas and contingencies

November. Revision of quotas and contingencies

May. Export quota on soybeans

December. Free trade

CHAPTER 10

TRADE EFFECTS OF THE 1980 U.S. GRAIN EMBARGO AGAINST THE USSR

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CHAPTER 10

TRADE EFFECTS OF THE 1980 U.S. GRAIN EMBARGO AGAINST THE USSR*

Tight markets, highly variable prices, inflation, and uncertainty about the adequacy of grain supplies were the key factors generating the agricultural trade restrictions in the 1970's. The 1980 U.S. grain embargo against the USSR stands out in contrast to earlier measures. It was imposed for foreign policy reasons, it lasted 16 months, and fulfillment of its major objective, to impose costs on the USSR, largely depended on the cooperation of other exporting countries.

This chapter, the first in a series of six evaluating effects of the 1980 embargo, examines changes in agricultural trade flows, starting in 1980, and attempts to identify forces, including the embargo itself, which led to these changes. We use supply, utilization, and trade data to highlight stock adjustments, trade flow changes, and shifts in the commodity mix of Soviet imports. We also present an analysis of price movements during the embargo in an effort to draw tentative conclusions about what role the embargo played in price fluctuations. Through time series analyses, we examine trade flow changes, their effects on importer and exporter shares of the world market, and changes in the importer or exporter composition of country and regional markets.

POTENTIAL SOVIET RESPONSES

A large importer such as the USSR can pursue a combination of three broad options for mitigating potential disruption caused by a targeted embargo. One option is to reduce its own grain stocks, which implies a temporal reallocation of grain imports. By drawing down grain stocks by more than they had originally planned, the Soviets could buy time until either alternate sources could be found or the embargo was lifted. We will examine the "timeliness" aspects of the Soviet adjustment by looking at the USSR's supply utilization balance sheet for grain and by observing the Soviet quarterly pattern of grain imports.

A second option for the USSR was to shift to other suppliers, implying a spatial reallocation of grain imports. All alternative suppliers except Argentina promised not to fill the void created by the U.S. grain embargo. We present evidence that this did not happen. The USSR was able to increase purchases from other exporters as well as Argentina.

Finally, the USSR could try substituting alternate commodities for those embargoed. The spatial reallocation of import sources partially resulted in the Soviets reallocating their mix of commodity imports. For the Soviets, who were purchasing U.S. wheat and corn to use as livestock feed or to replace lower quality domestic wheat, alternatives included buying other feed grains such as barley and sorghum, tubers such as manioc, or meat for direct consumption in lieu of feed grains.

Hence, an examination of data surrounding the 1980 embargo should determine the extent to which the USSR drew down stocks, substituted supply sources, and changed the commodity mix of its imports away from U.S. products. To the extent that the USSR was able to do this, it could avoid major changes in its crop production and use. If these adjustments in stocks, supply sources, and commodity mix of imports would not suffice, then the Soviets would have to pursue some combination of an increase in production and a reduction in food and/or feed use.

As the options increased with the passage of time, Soviet decisionmakers may have changed their country's response to the embargo. In the early months of the embargo, the USSR was faced with a fixed level of world production and world grain trading patterns held in place by sales contracts and long-term agreements. As new crops were harvested and contractual obligations fulfilled, the options expanded. Our data should indicate the timepath of USSR adjustment; that is, how that nation responded early in the embargo compared with a year or two later. We will pay special attention to whether Soviet internal changes motivated by

*Contributors to this chapter were Alan Webb, William Wecker, and Karen Spatz.

the embargo were maintained once the embargo was lifted in April 1981.

CHANGES IN AGRICULTURAL TRADE

The impact of the 1980 grain embargo on world trade and prices depends largely on the changes, if any, that the USSR made in its domestic production, utilization, and stocks. We would expect the embargo to result in a combination of an increase in production, a decline in utilization, and a reduction in stocks from what they otherwise would have been. Of course, it is not possible to make a definitive statement about what would have happened had there been no embargo, but a close look at how variables deviated from their historical trends provides clues as to what changes might have occurred.

Adjustments in the Soviet Grain Economy

Table 10.1 shows Soviet production and utilization of wheat and coarse grains for crop years 1975/76 through 1984/85 and the amount by which they exceeded or lagged simple linear time trends estimated for 1960/61 to 1978/79. Hence, the deviations originate from trends set before the embargo. By extrapolating these trends through 1984/85, we

Table 10.1--USSR supply and utilization patterns for wheat and coarse grains 1/

July/June marketing year	Production		Utilization		Production less utilization	Net imports	Change in stock 2/
	Actual	Deviation from trend	Actual	Deviation from trend			
			Million tons				
Wheat:		5a/		5b/			
1975/76	66	-29	87	-13	-21	10	-11
1976/77	97	0	92	-11	5	4	8
1977/78	92	-7	108	3	-16	6	-10
1978/79	121	20	107	-1	14	4	18
1979/80	90	-13	115	4	-25	12	-13
1980/81 3/	98	-7	115	1	-17	16	-1
1981/82 3/, 4/	80	-27	102	-14	-22	19	-3
1982/83 3/, 4/	86	-23	106	-13	-20	19	0
1983/84 3/, 4/	79	-32	97	-25	-18	20	2
1984/85 3/, 4/	73	-40	96	-29	-23	27	4
Coarse grains:		5c/		5d/			
1975/76	66	-22	84	-12	-18	16	-2
1976/77	115	24	116	16	-1	4	3
1977/78	93	0	109	6	-16	11	-5
1978/79	105	9	113	6	-8	9	1
1979/80	81	-17	100	-10	-19	18	-1
1980/81 3/	81	-20	100	-14	-19	18	-1
1981/82 3/, 4/	72	-31	99	-18	-17	26	9
1982/83 3/, 4/	86	-20	98	-23	-12	11	-1
1983/84 3/, 4/	99	-9	109	-13	-10	12	2
1984/85 3/, 4/	86	-25	111	-17	-25	27	2

1/ Totals may not add due to rounding.
2/ Minus denotes withdrawal from stocks.
3/ Data are preliminary for trade, utilization, and stocks change.
4/ Production is estimated because there have been no official USSR production data since the 1980 crop.
5/ Estimated trend equations with base years 1960-79.

Trend equations	Standard error	R^2
a) Y = 47.81 + 2.53X	0.45	0.63
b) Y = 40.93 + 3.46X	.35	.85
c) Y = 63.35 + 1.97X	.45	.41
d) Y = 55.98 + 2.75X	.28	.84

Source: (1).

can estimate what level of production and use the USSR might have attained had the embargo, Soviet policies, and resources permitted continued expansion. We have not presented the full data series in order to conserve space and to focus on the most recent 10-year period. Trend equations are shown at the bottom of table 10.1 with a few relevant statistical parameters. We do not to explain what factors affected Soviet production and utilization—Chapter 14 does this—but we provide a rough benchmark against which year-to-year changes could be measured.

Both wheat and coarse grain output in the USSR were below trend for every year since the January 1980 embargo was announced. Instead of an increase of Soviet grain output and lessening of dependency on the world market in reaction to the embargo, the reverse appears to be true. Bad weather helped reduce production in some years, but a drop in harvested area was also significant. Between 1980/81 and 1984/85, for example, coarse grain area harvested fluctuated between 57.8 and 61.2 million hectares, but wheat area slid from 61.5 to 51.1 million hectares, a 17-percent drop.

Production after 1980 was below the 1960-79 trend. And, beginning in 1980/81 for coarse grains and in 1981/82 for wheat, utilization was also below trend. Although lower Soviet grain utilization could have partly resulted from the embargo, other factors appear to be more important. Declines in Soviet feed use probably would have occurred despite the embargo because of a policy switch in the fall of 1979, causing retrenchment in the livestock sector. As part of this policy change, Soviet policymakers placed emphasis on production and feeding of forage. Thus, total animal units increased every year between 1978 and 1984 despite fluctuating grain availabilities *(2)*.[1]

Table 10.1 shows the production-utilization balance and how the Soviets used net imports and apparent stock changes to fill deficits or remove surpluses in this balance. The data show how production and utilization changes translated into an immediate Soviet short-term response to the embargo and the longer term response. In 1979/80, for example, USSR wheat utilization exceeded domestic output by 25 million tons and corn utilization exceeded production by 19 million tons. For the Soviets, fortunately, the previous crop had been very good. USDA estimated that the USSR was able to replenish its badly depleted grain stocks. This bountiful harvest allowed the USSR to buffer the embargo's initial impact by drawing down stocks during 1979/80.

For the longer term, utilization outstripped wheat production for all but 2 years of the past decade for wheat and for all of the past 10 years for coarse grains. Also, evidence clearly indicates that the deficit grew for both wheat and coarse grains since 1979/80. Thus, even though utilization declined after the embargo took effect in 1979/80, production declined even more, generating a net increase in the Soviet production utilization deficit, which could only be filled with an increase in net imports.

It is thus not surprising that quarterly grain import data available for Soviet grain imports do not show any pronounced decline in grain imports, given past USSR purchasing patterns, even for the early quarters of the embargo. Figures 10.1 and 10.2 show quarterly Soviet imports of wheat and corn over 1970-83. The shaded area marks the period in which the embargo was in effect. Points marked by a bold dot indicate fourth-quarter imports and help show if a seasonal pattern is present. The first and second quarters for wheat and the first and third quarters for corn show declines in Soviet imports, but these declines are no larger than fluctuations in Soviet imports during the preceding 4 years when no embargoes were in effect.

There does appear, however, to be a change in the USSR's quarterly wheat purchasing pattern after the embargo. The period of peak Soviet activity appears to have shifted from the fourth to the first quarter. Figure 10.3, depicting quantity of USSR imports bought in each quarter, shows this shift more clearly. Third- and fourth-quarter buying remained relatively stable in the 4 years since the embargo was imposed, but first- and second-quarter purchases show a strong upward trend. This trend is evidence of a Soviet shift toward Southern Hemisphere suppliers, particularly Argentina.

[1]Italicized numbers in parentheses refer to items in the References at the end of this chapter.

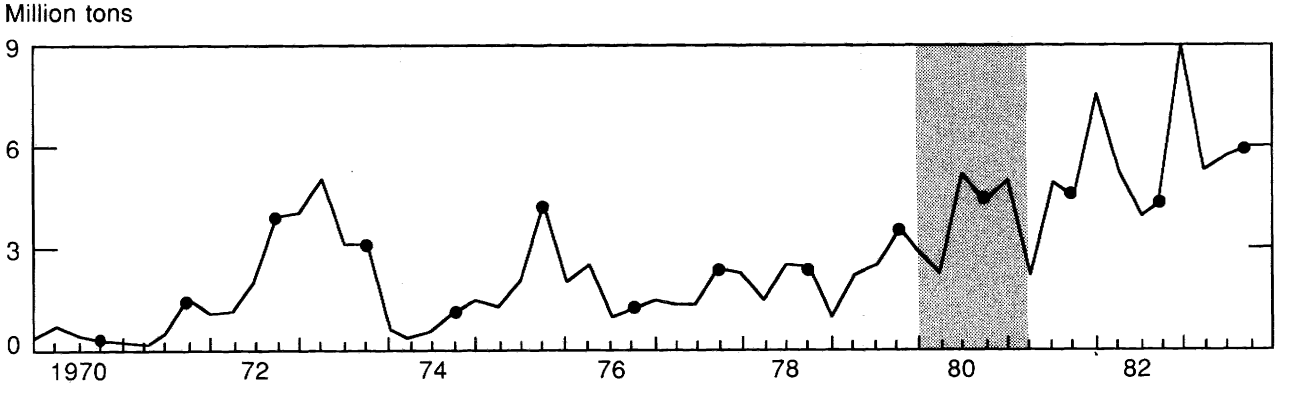
The data do not exhibit any clear shift in quarterly Soviet purchase patterns of corn. The USSR apparently chose to increase wheat, but not corn, imports after 1980. The disparity in buying patterns may point to a substitution of wheat imports for corn imports because fewer large non-U.S. corn suppliers exist than do non-U.S. wheat exporters. The U.S. embargo might have been only one element in the USSR's decision to make this shift.

Adjustments in Trading Patterns

The absence of major changes in the Soviet total grain balance sheet indicates Soviet success in shifting supply sources. Figures 10.4-10.8 show how this has occurred in the world wheat market. Quarterly U.S. wheat exports to the USSR since the 1980 embargo have been erratic but no more so than the

Figure 10.1

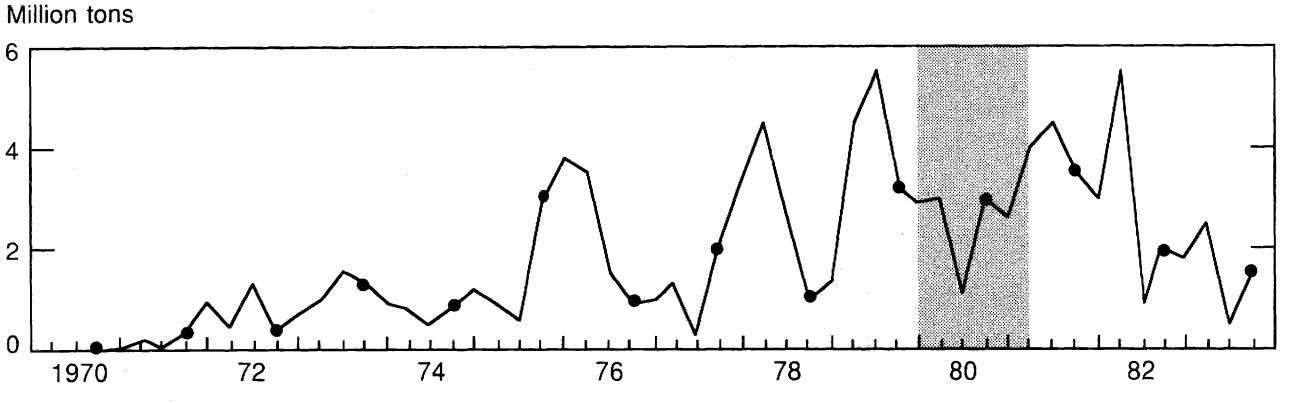
Quarterly World Wheat Exports to the USSR



Dots = Fourth quarter. Shaded area = Embargo period. Source: *(1)*.

Figure 10.2

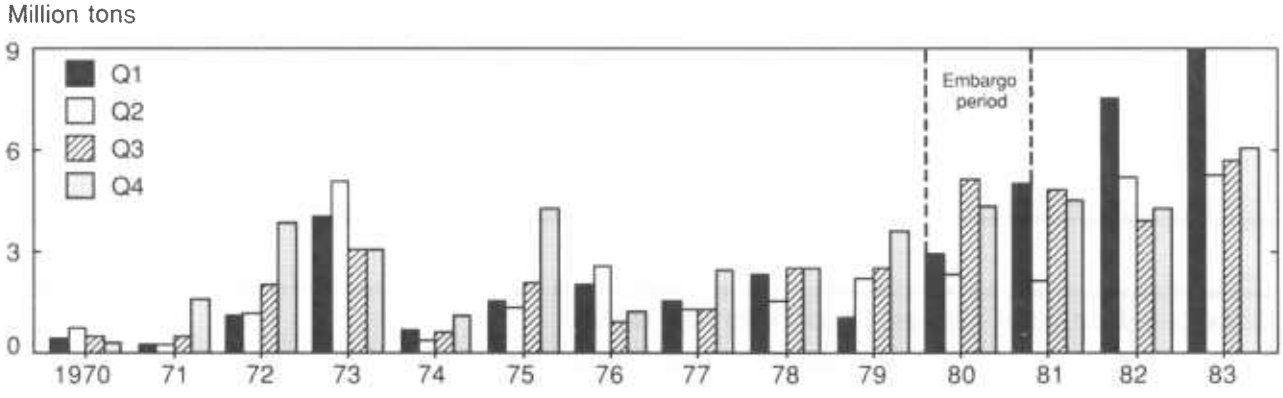
Quarterly World Corn Exports to the USSR



Dots = Fourth quarter. Shaded area = Embargo period. Source: *(1)*.

Figure 10.3

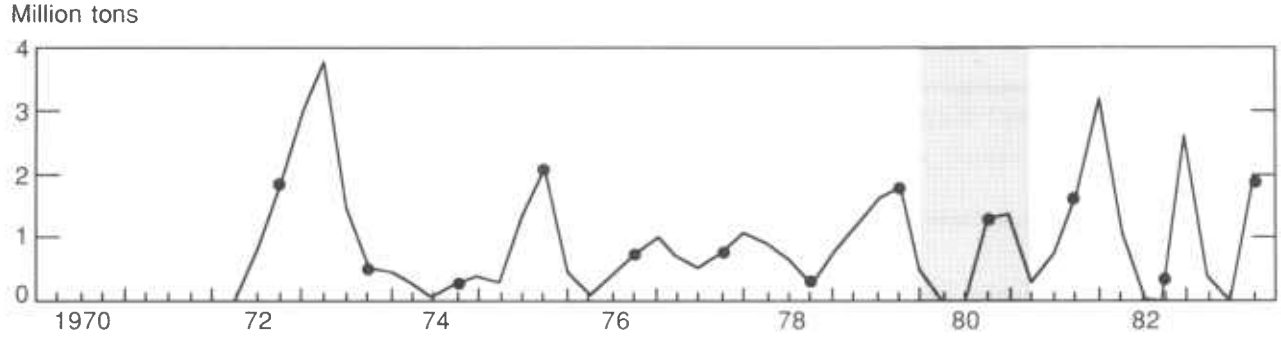
Quarterly USSR Wheat Imports



Source: *(1)*.

Figure 10.4

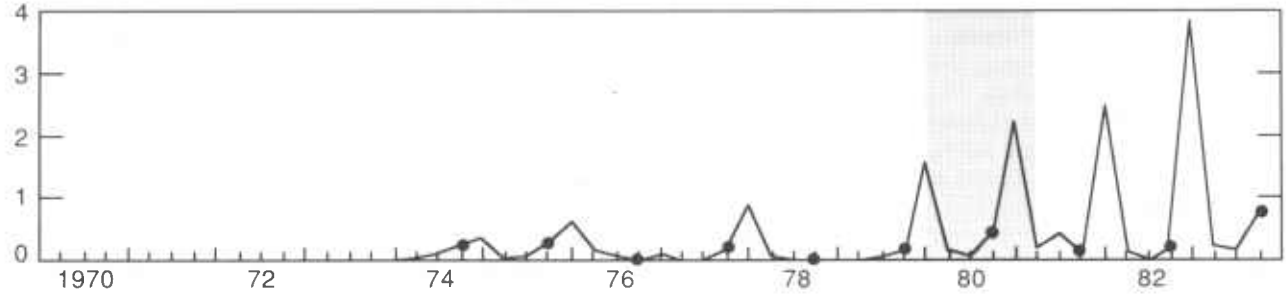
Quarterly U.S. Wheat Exports to the USSR



Dots = Fourth quarter. Shaded area = Embargo period. Sources: *(1,2)*.

Figure 10.5

Quarterly Argentine Wheat Exports to the USSR



Dots = Fourth quarter. Shaded area = Embargo period. Sources: *(1,2)*.

Figure 10.6

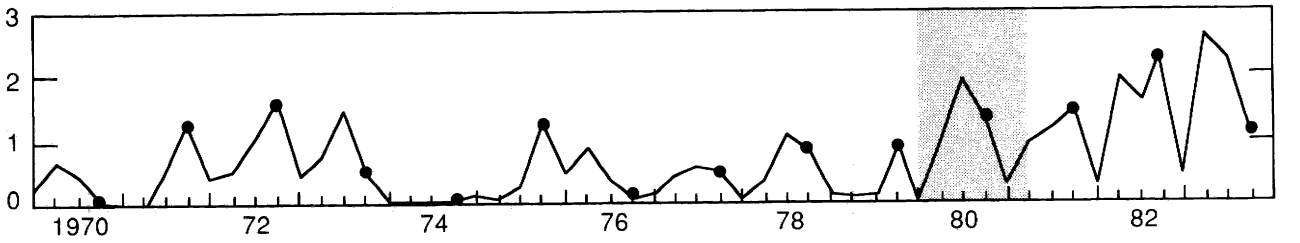
Quarterly Australian Wheat Exports to the USSR



Dots = Fourth quarter. Shaded area = Embargo period. Sources: *(1,2)*.

Figure 10.7

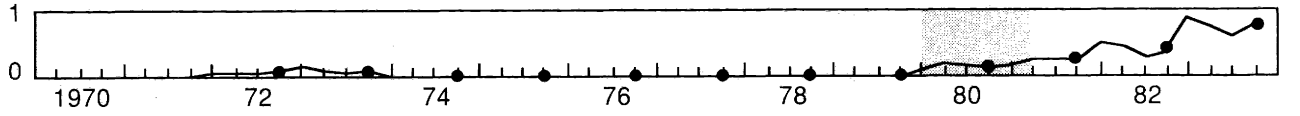
Quarterly Canadian Wheat Exports to the USSR



Dots = Fourth quarter. Shaded area = Embargo period. Sources: *(1,2)*.

Figure 10.8

Quarterly EC Wheat Exports to the USSR



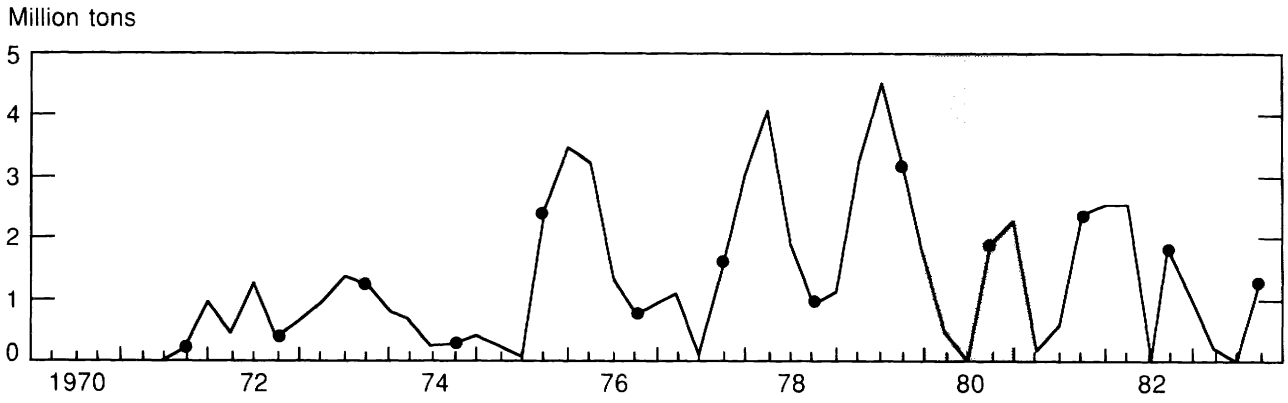
Dots = Fourth quarter. Shaded area = Embargo period. Sources: *(1,2)*.

preceding 7-year period. Among other major wheat exporters, Argentina and the EC experienced the most dramatic increases in exports to the USSR but Australian and Canadian exports also increased, coinciding with the start of the embargo in the first quarter of 1980. However, the increases persisted for Argentina, the EC, and Canada even after the embargo was lifted in the second quarter of 1981. Argentina's limited storage and port capacity and its need to move other commodities (mainly corn and soybeans) through the same facilities after the wheat harvest causes its pronounced seasonal export pattern. As figure 10.3 showed earlier, the USSR has had to shift the timing of its purchases to buy large quantities of wheat from Argentina.

For corn, the Soviet shift in import sources has benefited Argentina. U.S. corn exports to the USSR tapered off after 1980, but the largest decline took place in 1983, 2 years after the embargo was lifted (fig. 10.9). Argentine exports to the USSR increased sharply during the 2 embargo years but declined in the 2 succeeding years (fig. 10.10). The declines in both U.S. and Argentine corn exports to the USSR in the post-embargo years indicate an overall decline in Soviet corn use identified in table 10.1. As with wheat, there is a distinct quarterly pattern to Argentine corn exports, with most of the activity in the second quarter. But unlike wheat, this pattern does not seem to have significantly affected the quarterly purchase pattern of the USSR, partly because no clear pattern existed before the embargo.

Figure 10.9

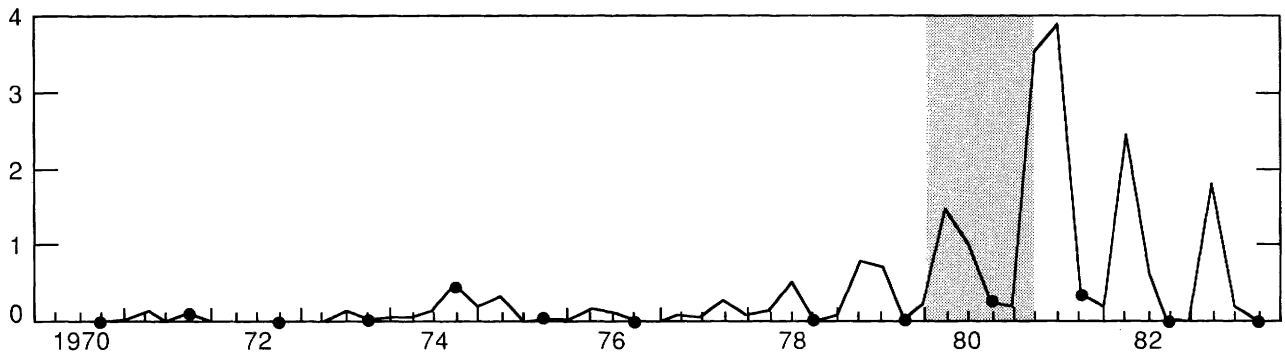
Quarterly U.S. Corn Exports to the USSR



Dots = Fourth quarter. Shaded area = Embargo period. Sources: *(1,2)*.

Figure 10.10

Quarterly Argentine Corn Exports to the USSR



Dots = Fourth quarter. Shaded area = Embargo period. Sources: *(1,2)*.

Adjustments in the Commodity Mix of Soviet Imports

A change in the composition of Soviet commodity imports accompanied changes in the timing and sources of imports. Three types of changes in the mix of Soviet commodity imports took place as a result of the embargo: Substitutions among grains, substitutions between grains and oilseeds, and substitution of meat and livestock product imports for grain imports. The major shift in grains during the embargo was one in which wheat, sorghum, and barley replaced corn (table 10.2). The 4.4-million-ton decline in corn imports between 1979 and 1980 was more than made up by a 5.3-million-ton increase in wheat, a 1.1-million-ton increase in barley, and a 1.5-million-ton rise in sorghum imports. After the embargo, the USSR continued to increase wheat imports, but corn, barley, and sorghum imports showed no strong trend.

Oilseed imports varied too much from year to year to show effects of an embargo. Oilseed meal, however, increased sharply in 1980 and continued to move up through 1983. The rise may be attributed to both the effect of the embargo and the Soviet attempt to improve quality of livestock feed rations.

The embargo could also be expected to generate a switch from grain imports to meat and livestock product imports. This did, in fact, occur. Meat and livestock product imports increased between calendar year 1979 and 1980. Table 10.2 highlights the significance of these increases by converting these products to grain equivalents. Conversion factors used are estimates of how many kilograms of grain the USSR would need to obtain a kilogram of carcass weight meat in the years around 1980. Because the meat category could not be broken down further, we used a simple average of beef and pork conversion factors.

The total for all four meat and livestock categories indicates that the USSR potentially replaced an additional 3.4 million tons of grain by increasing imports of these products. The statistic is, of course, a gross approximation since the quantity of grain needed to produce a kilogram of meat, eggs, or butter will vary widely across the country. Nonetheless, the magnitude of the potential displacement of grain imports is highly significant.

PRICE EFFECTS

The absence of major changes in world price levels during 1980-84 attests to the ability of grain markets to adjust to a targeted embargo,

Table 10.2--USSR grain and livestock product imports

Commodity	1977	1978	1979	1980	1981	1982	1983	1984
				1,000 tons				
Grain 1/, 2/	11,612	24,008	27,428	31,491	46,403	40,392	33,977	44,702
Wheat 1/	6,350	9,024	9,636	14,940	17,326	21,096	23,001	28,162
Barley 1/	53	638	1,288	2,392	4,788	2,665	1,582	1,392
Corn 1/	4,046	13,297	14,606	10,179	16,456	11,462	6,433	12,429
Other grains 1/	66	20	3,547	2,008	3,795	362	29	1,990
Sorghum	0	0	0	1,493	3,967	2,709	2,078	1,990
Oilseed	1,455	966	1,814	1,155	1,459	1,582	1,422	696
Oilseed meal 3/	33	11	69	546	737	1,661	2,411	480
Vegetable oil 4/	126	167	199	357	604	866	708	696
Livestock and meat products:								
Meat	496	133	471	662	727	679	779	691
Poultry	121	52	141	159	253	260	206	114
Eggs (millions)	691	680	767	737	556	526	530	451
Butter	50	39	174	249	215	151	203	198
Livestock products in grain equivalents:								
Meat	6,948	1,855	6,587	9,268	10,172	9503	110	9,677
Poultry	507	216	590	668	1,064	1093	864	4786
Eggs	138	136	153	147	111	105	106	90
Butter	422	329	1,469	2,102	1,815	1274	1,713	16712
Total	8,015	2,536	8,801	12,185	13,162.	11,976	13,594	11,916

1/ ERS estimates since 1976; official USSR sources report only value.
2/ Grain includes wheat, barley, corn, rye, oats, sorghum, milled rice, and wheat flour in wheat equivalents.
3/ ERS estimate.
4/ After 1978 the USSR dropped linseed oil from this category. From 1970-78 linseed oil is included in the figure for edible vegetable oils.

Source: (2).

even though the embargo involves the world's two largest grain trading countries. However, resilience of the international market does not rule out changes in relative prices across exporters after adjustments are made for probable transportation cost increases. As the section on targeted embargoes in Chapter 8 suggests, if trade flows do not adjust or if they adjust slowly, then embargoed U.S. grain that would have been sold to the USSR would be forced onto non-Soviet markets. If those markets are still being supplied by other exporters who have not shifted exports to the Soviet market, prices will fall in the non-Soviet markets. The USSR, on the other hand, should be willing to pay a price premium to induce additional supplies to flow into its market to replace the loss of U.S. exports. Argentina would be expected to extract this premium because it was the only major exporter that declined to cooperate with the U.S. embargo. Note, however, that "cooperation" was very loosely defined and implied only that a cooperating exporter not replace grain that the United States withheld from the Soviet market. Thus, Argentina's ability to extract a premium and to control the size of the premium hinged on how long and by how much other exporters complied in restricting exports to the Soviet market.

The United States experienced a decline in grain prices, but it was short lived. After the announcement of the embargo on Friday, January 4, the Commodity Futures Trading Commission suspended Monday and Tuesday futures trading amid speculation that grain prices would plunge the limit, the maximum that futures prices are allowed to rise or fall in one day. The suspension of trading presumably allowed additional information to emerge about cooperation from other exporters and administration measures to offset domestic effects resulting from the embargo. Nonetheless, prices dropped the limit on Wednesday when markets reopened. On Thursday, the market opened down the limit but prices rallied and, by closing, wheat prices were down 10 cents and corn prices were down 9 cents. By Thursday of the following week, wheat and soybean prices were 8 cents and 20 cents above pre-embargo levels and corn prices had stabilized, closing at 8 cents under pre-embargo prices. In less than 2 weeks, expected declines in U.S. grain prices had largely dissipated.

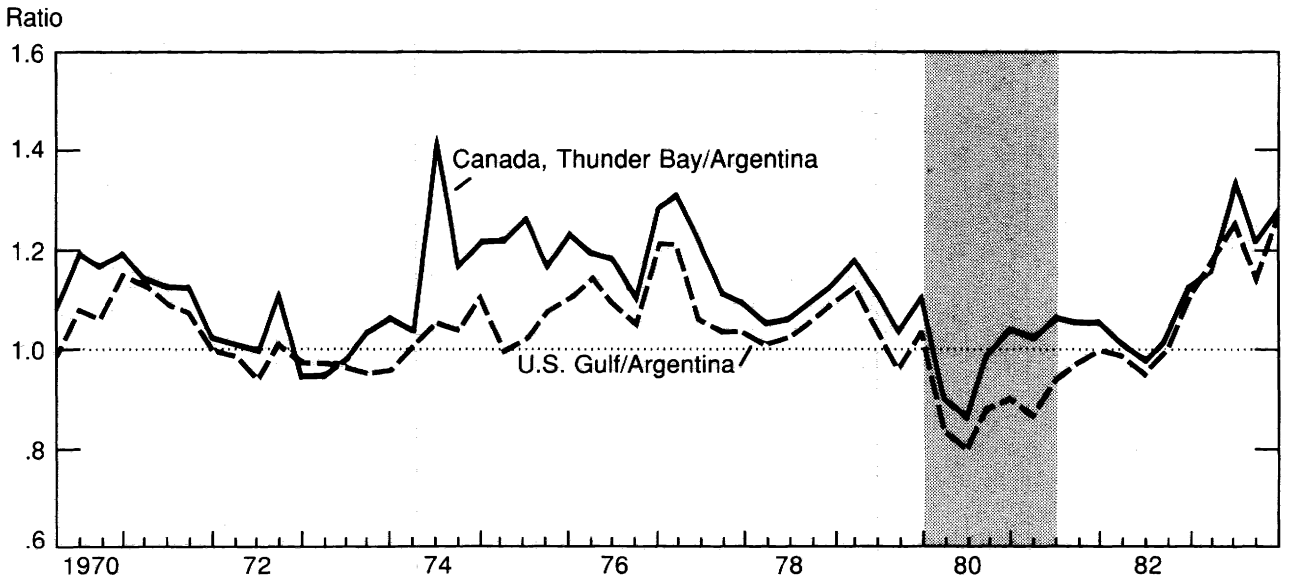
Argentina's favored position in the world grain market, however, did allow it to extract a premium price for its wheat and corn. Figure 10.11 plots the ratios of U.S. and Canadian wheat prices to the price of Argentine wheat. (All prices are in U.S. dollars so that a ratio of one implies that prices are equal.) From the plots, it is clear that both Canadian and U.S. wheat normally sell at a premium to Argentine wheat, and Canadian wheat normally sells at a premium to U.S. wheat. The only times that U.S. wheat prices were equal to or discounted to Argentine wheat between 1970 and 1983 were during 1972/73, when markets were extremely tight, and during the 1980 U.S. grain embargo. In fact, during the first two quarters of the embargo, Argentina was able to sell wheat above U.S. and Canadian wheat prices. By the third quarter of 1980, the USSR was able to find enough alternate grain sources to cause the Argentine premium over Canadian grain to disappear. The action may have been partly triggered by the Canadian decision to begin shipping greater quantities of wheat to the Soviets at the start of the 1980/81 crop year. Interviews with Canadian officials, discussed in Chapter 15, indicate that Canada felt its obligation to support the U.S. embargo extended through only the end of the 1979/80 crop year.

Figure 10.12 plots the ratio of U.S. to Argentine monthly export prices of corn from early 1976 to early 1983. The ratio of the two prices fluctuated between 0.9 and 1.2 for most of this period. In December 1979, U.S. and Argentine prices were rougly equal. But, by the end of the first quarter of 1980, Argentine prices had risen sharply, causing U.S. corn to sell at a 25-percent discount to Argentine corn. The price premium for Argentine corn gradually dissipated over the rest of 1980. By the second quarter of 1981, U.S. corn was selling at a premium to Argentine corn.

Argentine price premiums on wheat and corn had largely disappeared by the time the embargo was lifted in April 1981. The fact that the price premiums dissolved indicates that, from the standpoint of inflicting injury to the USSR, which presumably was paying the Argentine premium, very little was to be gained in a foreign policy sense from continuing the embargo beyond the middle of 1981.

Figure 10.11

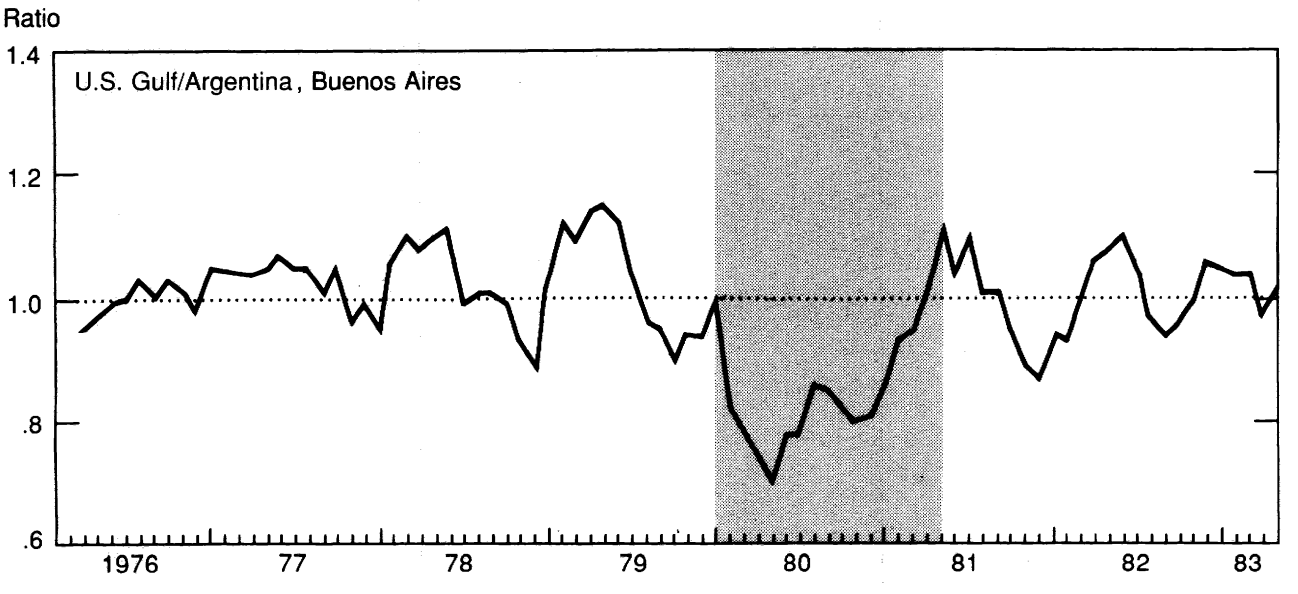
Ratio of Quarterly Wheat Prices



Shaded area = Embargo period. Source: USDA.

Figure 10.12

Ratio of Monthly Corn Export Prices



Shaded area = Embargo period. f.o.b. Source: USDA.

TIME SERIES ANALYSIS

We earlier identified embargo effects in four sets of data: Soviet supply and utilization data for wheat and coarse grains; quarterly trade flows of wheat and corn from major exporters to the USSR; annual Soviet imports of grains, oilseeds, and livestock products; and quarterly wheat and corn export prices. Although supply and utilization data indicate what appear to be significant declines in Soviet grain production and consumption starting about 1980, analysts report that the impetus for these changes were conditions and policy changes predating the embargo (see Chapter 14). This is likely the case since, over the past 5 years, the net effect of these changes has been to increase total Soviet grain imports. Given the USSR's growing dependence on the world market since 1980, the Soviet adjustment that has had the greatest impact on other countries has been the shift in trade flows.

In examining the quarterly commodity inflows to the USSR, we noted a shift away from the United States to all of the other competing exporters, particularly Argentina. However, we have not looked at what the shift implies for the entire market. Trade shifts among exporters at one destination usually imply shifts at other destinations. We will consequently identify changes in the total trade pattern beginning in 1980 and draw conclusions about how the embargo influenced those changes.

The time series procedure we used forecasted world trade patterns for wheat and corn for 1980-83 based on trade patterns before 1980. The difference between the forecasted pattern and the actual pattern is an estimate of unanticipated changes in 1980 and subsequent years. A major unanticipated change was the embargo. The forecast method does not separately distinguish the effect of the embargo on trade flows from effects of other unanticipated factors simultaneously influencing trade flows. The time series method merely enables us to make a "first cut" at determining what the embargo's impact might have been.

We constructed estimates of the unanticipated changes in trade flows for the importing and exporting countries listed in table 10.3.[2] Estimates were prepared for both wheat and corn. However, where the trade flow for a particular country is small (such as Canadian corn exports), we chose to combine the estimated flow with the "other exporter" or "other importer" grouping rather than report the flow separately.

Changes in Importer and Exporter Shares

Our initial analysis focuses on changes in individual importer and exporter shares of total world trade. We assumed in our analysis that the USSR was able to purchase all the grain it wanted in every year after the embargo's announcement. Much of the evidence presented

[2]The trade flow data we used were taken from trade matrices constructed by Enrique E. Figueroa. Quarterly trade flow data were available but were so highly variable that we could place very little confidence in the time series results that might come out of these series. Hence, we chose to use calendar year trade flow data.

Table 10.3--Country categories included in the time series analysis of trade flows

Wheat		Corn	
Importers	*Exporters*	*Importers*	*Exporters*
EC	EC	EC	EC
Egypt	Australia	Egypt	Canada
Japan	Canada	Japan	Argentina
Mexico	Argentina	Mexico	United States
China	United States	South Korea	Other exporters
South Korea	Other exporters	Taiwan	
Taiwan		USSR	
USSR		Other importers	
Other importers			

here and in subsequent chapters indicates that this was the case. Hence, even though importer and exporter shares of the world market may have changed, we assumed that world trade volume was unaffected by the embargo. Therefore, an unanticipated increase in the exports of one country would have been matched somewhere else by an unanticipated loss of exports by another country.

We predicted shares of selected importing and exporting countries, shown in table 10.3, for 1980-83 based on their world trade shares in 1979 and prior years. In brief, we used a simple exponential smoothing time series model [also known as the ARIMA (0,1,1) model] to forecast future values as a weighted average of past values. The most recent data were weighted most heavily and older data weighted less heavily. The weights decrease geometrically. The rate of decrease in the weights depends on the volatility of the time series. The more volatile the series, the more weight is given to the most recent observations and the less weight is given to earlier observations. The more stable the time series, the more nearly equal are the weights. In the "extremely stable" case, in which the data have a constant mean value, each year is weighted equally.[3]

Tables 10.4 and 10.5 show the results of our analysis for wheat and corn trade flows. They depict the unanticipated changes in individual importer and exporter trade shares multiplied by the world trade total for each year from 1980 through 1983.

Estimation Results

Estimates of the changes in importer and exporter shares of world wheat and corn trade between 1970-79 and 1980-83 yield information on how imports and exports have changed and how those changes were distributed. The embargo could have a wide range of effects on trade and trade patterns but, in particular, we chose to focus on two aspects of the results. First, we sought to determine the extent to which shifts in sources and destinations occurred between the two periods. These source-destination changes are shown in the inside of the matrix. Second, we sought to know the extent, if any, to which the embargo might have resulted in a shift in both exports and imports among major traders. This information is in the row and column totals.

We should emphasize two points before reviewing the results. First, a change in sources and destinations does not necessarily imply a change in exporter or importer shares of world trade. If, for example, the United States merely shifted its wheat exports bound for the USSR to China and if Canada shifted its wheat exports bound for China to the USSR, both countries would maintain their respective shares of the world market. Each would have a different set of trading partners, but the total volume of exports from each country would remain unchanged.

Second, some of the shifts in sources, destinations, and trade volumes would have taken place despite the embargo. The time series approach we applied distinguishes between the trade pattern based on information from one period with actual events of a later time period. It does not, however, distinguish between embargo effects and nonembargo effects. Analysts must use their knowledge of the markets, events, and judgments together with the time series results to make this additional distinction.

Wheat. Tables 10.4 and 10.5 show the difference between our forecast and actual 1980-83 trade flows for wheat and corn. In 1980, U.S. wheat exports to the USSR were 3.2 million tons below the predicted level. However, total Soviet imports and Soviet imports from non-U.S. origins were well above the forecasted level. Given the size of the USSR's crop shortfall in 1980, the increase in Soviet imports is not surprising. Also, the combination of the 3.2-million-ton less than expected U.S.-USSR trade and the 4.3-million-ton greater than expected total USSR imports implies that the USSR had to obtain an additional 7.5 million tons from non-U.S. sources. This quantity was distributed fairly evenly across other major exporters with both Australia and Canada selling an additional 2.2 million tons to the USSR, and Argentina exporting an additional 1.7 million tons to the Soviets.

[3] See Chapter 10 appendix for further details on the time series prediction method that we used. Refer particularly to "Case 1" and "Case 2."

Table 10.4--Estimates of changes in wheat trade flows caused by changes in importer/exporter shares 1/, 2/

Item	Egypt	EC	Japan	Mexico	China	Soviet Union	Other importers	Total
				Million tons				
Argentina:								
1980	0	-0.17	0	0	0	1.69	-1.38	0.14
1981	0	-.18	0	0	-0.59	2.33	-2.13	-.57
1982	0	-.19	0	0	-.66	2.08	-2.09	-.85
1983	0	-.14	0	0	2.16	4.29	-1.79	4.52
Australia:								
1980	0.15	0	-0.43	0	-1.14	2.18	-.43	.34
1981	.01	0	-.43	0	-2.11	.61	-1.98	-3.91
1982	.26	0	-.36	0	-1.42	1.13	-.87	-1.27
1983	-.50	0	-.49	0	-3.30	.12	-1.39	-5.55
Canada:								
1980	-.11	-.42	-.40	-.04	-.65	2.19	.75	1.42
1981	.03	-.44	-.46	.03	-.46	1.70	.02	.42
1982	.02	-.77	-.64	.03	-.28	3.87	.44	2.67
1983	-.07	-1.04	-.17	.06	.15	3.98	-.95	1.86
EC:								
1980	.75	-.55	0	0	.18	.56	-.02	.92
1981	-.60	-1.03	0	0	.56	.84	3.04	2.83
1982	-.77	-1.23	0	0	.63	1.52	1.11	1.26
1983	-.72	-2.27	0	0	.78	3.01	2.66	3.46
United States:								
1980	-.43	-.59	-.71	-.32	4.54	-3.18	-2.47	-3.15
1981	.22	-.40	-.97	-.02	5.77	-1.22	-1.10	2.28
1982	.05	-.68	-1.22	-.72	5.07	-1.27	-4.52	-3.29
1983	1.35	-1.66	-1.33	-1.18	.61	-1.02	-3.30	-6.53
Other exporters:								
1980	.22	1.10	.08	.08	-.45	.90	-.17	.34
1981	-.60	-.58	-.16	-.01	-.74	1.12	-.10	-1.06
1982	-.08	.23	-.12	-.12	-.26	1.90	-.03	1.50
1983	-.51	-.37	.04	.23	-2.90	3.33	-.17	2.27
Total:								
1980	-.15	-1.34	-1.46	-.18	2.49	4.34	-3.73	0
1981	-.94	-2.63	-2.02	0	2.44	5.38	-2.24	0
1982	-.53	-2.66	-2.33	-.81	3.08	9.23	-5.96	0
1983	-.45	-5.49	-1.96	-.99	.11	13.73	-4.93	0

1/ Actual minus predicted trade flows.
2/ Totals may not add due to rounding.

The increases in competing exporters' sales to the USSR, however, did not result in correspondingly greater total exports. Australian and Argentine wheat exports were only 340,000 and 140,000 tons greater than predicted. Australia apparently shifted exports away from China, and Argentina shifted exports away from "other importers." Canada, the only major wheat exporter other than the United States to hold substantial stocks, was able to export 1.4 million tons more than predicted. Still, part of Canada's increase in sales to the USSR was offset by declines in Canadian sales to other markets.

For the United States, the 3.2-million-ton apparent sacrifice of wheat sales to the USSR in 1980 corresponds closely to the falloff in total U.S. wheat exports of 3.1 million tons. However, we should recognize that, apart from the unanticipated 4.5-million-ton increase in U.S. sales to China, U.S. exports to all of the

Table 10.5--Estimates of changes in corn trade flows caused by changes in importer/exporter shares 1/, 2/

Item	EC	Japan	Mexico	South Korea	Taiwan	USSR	Other importers	Total
				Million tons				
Argentina:								
1980	-1.30	-0.09	-0.08	-0.01	-0.02	1.73	-2.76	-2.54
1981	-1.33	-.09	-.08	-.01	-.02	6.73	-2.24	2.95
1982	-1.23	-.08	-.07	-.01	-.02	2.19	-1.09	-.29
1983	-.75	-.01	-.07	.05	-.02	.96	-.54	-.38
United States:								
1980	-.12	.88	3.36	-.11	.03	-7.05	7.46	4.44
1981	-2.44	.71	4.21	-.25	-.52	-6.06	2.50	-1.85
1982	-2.97	.16	-1.09	.70	.14	-3.16	.96	-3.81
1983	-5.37	2.56	3.18	1.99	1.58	-7.32	-3.88	-7.24
Other exporters:								
1980	-.20	-.64	-.33	.02	-.33	1.76	-2.19	-1.92
1981	-.46	.10	-.34	.70	.19	.18	-1.46	-1.09
1982	.92	.66	-.28	.38	-.18	.19	2.42	4.11
1983	2.45	1.50	.27	.15	-.57	1.01	2.84	7.64
Total:								
1980	-1.63	.15	2.94	-.10	-.32	-3.57	-2.53	0
1981	-4.23	.72	3.79	.44	-.35	.86	-1.23	0
1982	-3.26	2.19	-1.45	1.07	-.06	-.78	-2.30	0
1983	-3.67	4.06	3.38	2.18	.99	-5.35	-1.58	0

1/ Actual minus predicted trade flows.
2/ Totals may not add due to rounding.

other major U.S. markets were below expectations based on 1970-79 data. This effect implies that nonembargo forces were also playing significant roles in the disappointing performance of U.S. wheat exports. For instance, the second oil price shock had strained the resources of many of the nonoil-exporting developing countries and measures by the U.S. Government to compensate producers for the embargo by increasing loan rates may have also reduced U.S. supply availabilities.

Results presented in table 10.4 can be used to put an upper bound on the embargo's effect on U.S. wheat exports. We compute the upper band by summing the lesser of either the unanticipated increase in total exports or the unanticipated increase in sales to the USSR for all competing exporters. The sum equals 2.8 million tons, representing the addition to other countries' exports as a result of unanticipated increases in Soviet sales that were not offset by unanticipated declines in other markets. That sum is a maximum effect for only 1 year. Because all EC exports were subsidized and Australian exports to the USSR were carried out under the conditions of a long-term agreement signed before the embargo, the major embargo-related cause of the unanticipated decline in 1980 U.S. wheat exports was the expansion of Canadian exports induced by the embargo.

A close look at the results for subsequent years indicates that, in the aftermath of the embargo, U.S. wheat sales to the USSR improved but never recovered to the level predicted from the 1970's data. The evidence suggests that the decline in U.S.-Soviet wheat trade was permanent. It persisted even after the embargo was lifted. The drop in U.S.-Soviet trade, however, does not appear to explain the movements in total U.S. exports. The falloff of U.S. exports to China and "other importers" accounts for poor U.S. wheat sales in 1982 and 1983.

Corn. The embargo appears to have been far less important in its initial impact on U.S. corn exports. Despite the fall in U.S. sales to the USSR, which were off by 7 million tons in 1980, the United States exported a total of 4.4 million tons more than expected. Major competitors in the global corn market appear to

have been unable to take advantage of the situation to expand exports. Exports by Argentina and "other exporters" were erratic. Argentine corn exports were above the anticipated level in 1981 but below that level in 1980, 1982, and 1983. Corn exports by "other exporters" were well below the projected level in 1980; but, by 1983, exports exceeded expectations by 7.6 million tons. Although it is not clear what drove this sales increase of "other exporters," the rise appears to be more closely linked to unanticipated purchasing increases on the part of the EC, Japan, and "other importers."

The embargo, however, appears to have caused individual exporters to make significant shifts in their export destinations. For instance, the United States shifted its corn exports away from the USSR and toward Mexico and "other importers." Argentina shifted corn exports to the USSR and away from every other destination. Similarly, "other exporters" shifted exports to the USSR and away from Mexico, Japan, and "other importers."

Trade Substitution Patterns

We have identified two sources of trade flow changes. First, an individual importer or exporter may increase or decrease its share of the world total. Those changes are reflected in the right-most column and in the bottom row of tables 10.4 and 10.5. Second, a nation may change specific trade sources or destinations even without a change resulting in the amount of its total world share. We term the latter changes "trade substitutions." To estimate the amount of change due to trade substitutions, we subtracted out the changes in import or export share caused by changes in the importing and exporting countries' total share. We then used time series methods to estimate the unanticipated change in the remaining component for 1980-83.[4]

The value of this approach is that it isolates changes in sources and destinations from changes in a country's total trade, which can shift from year to year from changes in production or national policies. The approach, therefore, permits us to focus more clearly on likely embargo effects.

[4]See Chapter 10 appendix for details on the method used. In particular, refer to "Case 3."

Estimate Results

Forecasts of importer and exporter substitutions result from unanticipated changes in wheat and corn trade flows as shown in tables 10.6 and 10.7. These tables generally show the same direction of change as those depicted in tables 10.4 and 10.5, with some exceptions. Take, for example, U.S. wheat exports to Japan in 1983. The direct projection of the U.S.-Japanese share of world trade shown in table 10.4 indicates that U.S. exports to Japan were 1.3 million tons less than anticipated. Note, however, that both Japanese wheat imports and U.S. wheat exports in 1983 were also lower than expected. We incorporated this information into the importer and exporter substitution forecast shown in table 10.6. This forecast says, essentially, given that both U.S. exports and Japanese imports were less than anticipated, U.S.-Japanese wheat trade was actually 80,000 tons greater than expected.

Wheat. Changes in wheat trade flows met expectations. Argentina, Canada, and "other exporters" have higher than projected exports to the USSR in 1980. But each of these exporters also have substantially lower than predicted exports to at least one other market. The United States exports 4.3 million tons less than projected in the first year of the embargo but it compensates for the decline with greater than predicted exports to China and "other importers."

The change in the wheat trade pattern that took place between 1979 and 1980 persisted, for the most part, through the remaining years of the forecast period. U.S. exports to the USSR remain below forecast levels by 3.6 to 3.8 million tons in 1982 and 1983, while combined Argentine and Canadian wheat trade with the USSR continues to exceed the pre-embargo prediction by 2.6 to 2.8 million tons. Australian wheat exports to the USSR vary around the forecast level.

Corn. Data for corn, presented in table 10.7, reveal much the same story. The United States exports nearly 5 million tons less to the USSR than predicted while sales by Argentina and "other exporters" both exceed projections by 2.3 million tons. As a result, the United States exported more to Mexico, the EC, and "other importers."

Table 10.6--Estimates of changes in wheat trade flows caused by importer/exporter substitutions 1, 2/

Item	EC	Egypt	Japan	Mexico	China	USSR	Other importers	Total
				Million tons				
EC:								
1980	-0.43	0.78	0	-0.01	-0.44	-0.33	0.52	0.11
1981	-.83	-.41	-0.05	-.05	-.33	-.51	2.20	.02
1982	-.74	-.46	.06	.06	-.15	-.15	0	.01
1983	-1.12	-.47	-.08	.06	.09	.05	1.57	.01
Australia:								
1980	.08	.09	.19	-.18	.01	-.01	.09	.28
1981	.63	.35	.12	.05	-1.49	.41	-.08	0
1982	.33	.34	.07	.09	-1.05	.03	.20	0
1983	.77	-.03	.13	.11	-1.64	-.31	.48	-.49
Canada:								
1980	-.26	-.25	-.18	.06	-.94	1.23	.34	.01
1981	.04	.04	-.09	.01	-.58	.75	-.17	.01
1982	-.38	-.12	-.26	.10	-.66	1.41	-.08	.01
1983	-.13	-.15	.07	.07	.13	.96	-.91	.01
Argentina:								
1980	-.12	-.03	.02	0	-.13	1.28	-1.13	-.10
1981	-.01	.04	.07	.01	-.55	1.94	-1.50	0
1982	.01	.03	.08	.03	-.50	1.38	-1.03	0
1983	-.18	-.18	-.16	.02	1.10	1.71	-2.31	0
United States:								
1980	.34	-.28	.25	-.15	3.26	-4.32	.91	-.01
1981	.45	.35	-.05	-.01	3.50	-3.62	-.61	0
1982	.63	.24	.13	-.21	2.76	-3.58	.03	0
1983	.91	1.18	.08	-.44	.61	-3.84	1.50	0
Other exporters:								
1980	.40	-.39	.09	.09	-.51	.70	-.37	0
1981	-.27	-.35	-.02	0	-.55	1.03	.17	0
1982	.16	-.02	-.09	-.01	-.40	.90	-.48	.05
1983	-.16	-.34	-.03	.18	-.29	1.44	-.81	0
Total:								
1980	.01	-.09	.38	-.20	1.25	-1.43	.36	.28
1981	.01	.01	-.02	.01	0	0	.02	.03
1982	.01	0	0	.05	0	0	.01	.08
1983	0	.01	0	0	0	0	.48	.46

1/ Actual minus predicted trade flows.
2/ Totals may not add due to rounding.

U.S.-Soviet corn trade strengthened slightly after 1981 when the embargo was lifted, but U.S. exports to the USSR were still 2 to 3 million tons less than predicted. Argentine-USSR corn trade, on the other hand, appears to have weakened slightly in the final 2 years of the period.

CONCLUSIONS

Effects of the 1980 U.S. embargo of grain sales to the USSR are very difficult to identify from agricultural trade data. One reason is that the nature of the embargo itself prevented a large impact. For example, the United States embargoed only the USSR and banned only exports of grains in excess of the 8 million tons guaranteed under the U.S.-Soviet long-term agreement. Moreover, the United States received only partial cooperation from competing exporters, who agreed only that they would not replace the United States in the Soviet market. Argentina would not make a commitment to this very nebulous agreement.

Table 10.7--Estimates of changes in corn trade flows caused by importer/exporter substitutions 1/, 2/

Item	EC	Egypt	Japan	Mexico	China	South Korea	Taiwan	USSR	Other importers	Total
					Million tons					
EC:										
1980	0.20	-0.03	-0.04	-0.19	-0.01	0	0.01	0.20	-0.14	-0.01
1981	-.24	-.03	-.04	-.20	.08	-0.01	.04	.04	.28	-.09
1982	.93	-.06	-.31	.02	.04	-.11	-.03	-.11	-.37	0
1983	-1.58	-.11	-.61	-.33	-.05	-.24	-.15	.22	-.32	-3.17
Argentina:										
1980	-.76	.01	.27	-.13	-.02	.07	.08	2.30	-1.81	0
1981	-1.60	-.12	-.67	-.56	-.01	-.16	-.10	6.13	-2.92	0
1982	-1.00	-.05	-.22	.05	.05	-.08	-.01	2.29	-1.04	-.01
1983	-.48	-.07	-.26	-.29	-.01	-.10	-.08	1.39	-.10	.01
United States:										
1980	-.02	-.14	.21	.91	-.06	-.14	.06	-4.86	4.03	-.01
1981	.74	.10	.65	1.55	-.28	.46	-.26	-6.20	4.15	.90
1982	-.12	.12	.87	-.06	.08	.14	.27	-1.85	.54	0
1983	-1.66	.19	1.32	1.22	.11	.90	1.17	-2.63	-.63	.01
Other exporters:										
1980	.59	.16	-.44	-.59	.09	.06	-.14	2.35	-2.07	.01
1981	1.09	.05	-.02	-.78	.22	.62	.32	.03	-1.51	.02
1982	.11	-.01	-.34	-.08	-.10	.05	-.23	-.34	.88	-.05
1983	.56	-.02	-.43	-.61	-.06	-.55	-.94	1.02	.11	.01
Total:										
1980	0	-.01	.01	0	-.01	0	.01	-.01	0	-.01
1981	-.01	0	-.08	.01	.01	.91	0	0	0	.84
1982	-.07	0	0	-.07	.08	0	0	0	0	-.06
1983	-3.16	-.01	.01	-.01	0	0	0	0	0	-3.16

1/ Actual minus predicted trade flows.
2/ Totals may not add due to rounding.

It is not surprising, then, that the major effect of the embargo appears to be a spatial redistribution of trade flows. Some substitution of grains in the mix of Soviet imports, such as replacing wheat imports with corn imports and substituting meat purchases for grain purchases, probably did occur. But, it is unclear whether the embargo served as the catalyst for this shift. The USSR apparently changed its quarterly pattern of imports to take advantage of greater availability of Argentine grain in the first quarter.

These adjustments were sufficient to prevent major grain price fluctuations. This fact alone would indicate that global grain markets are flexible enough to easily handle a disruption of the size and nature of the 1980 U.S.-Soviet grains embargo.

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APPENDIX

TIME SERIES PREDICTION OF CELL PROPORTIONS IN A CONTINGENCY TABLE

Consider regularly spaced observations on a two-way table. The observations consist of the cell proportions $S_{i,j,t}$, row totals of cell proportions $S_{i,t}$ and column totals of the cell proportions $S_{j,t}$ (i=1,...,I, j=1,...,J, t=1,...,T). In this appendix, we show how to construct predictions of future values of the cell, column, and row proportions. The predicted cell, column, and row proportions each sum to one. The rows of the predicted cell proportions sum to the predicted row proportion, and the columns of the predicted cell proportions sum to the predicted column proportions.

Case 1

Use the linear prediction rule,

$$S'_{i,j,T+1} = \alpha_1 S_{i,j,T} + \alpha_2 S_{i,j,T-1} + \ldots, \quad (1)$$

to predict the cell proportions where the prediction weights α_i, which are common to each cell, sum to one. Any ARIMA model satisfies the condition that the prediction weights sum to one. Predict row and column proportions by summing the predicted cell proportions.

Case 2

Suppose that the cell proportions do not conform to a common model. Collapse the table until the cells do conform. Predict the cell proportions for the collapsed tables as in Case 1. Call these predictions $S'_{i,j,T+1}$. Next, consider each cell of the collapsed table separately. Predict the subcell proportions in each cell of the collapsed table. Call them $q_{i,j,t}$, using the linear prediction rule,

$$q'_{i,j,T+1} = \varphi_1 q_{i,j,T} + \varphi_2 q_{i,j,T-1} + \cdots \quad (2)$$

The predicted subcell proportions $q'_{i,j,T+1}$ sum to one in each of the cells of the collapsed table. Now predict the cell proportions in the original table as the product of the predicted cell proportions in the collapsed table and the predicted subcell proportions $(S'_{i,j,T+1})(q'_{i,j,T+1})$.

Case 3

Suppose that the row and column proportions $S_{i,t}$ and $S_{j,t}$ are known. For each cell in the table, calculate the product of the row and column proportions $(S_{i,t})(S_{j,t})$. Next, form the time series of cell deviations of the actual cell proportions from the product of the margins:

$$d_{i,j,t} = S_{i,j,t} - (S_{i,t})(S_{j,t}), \quad t = 1, 2, \ldots, T. \quad (3)$$

Use the linear prediction rule,

$$d'_{i,j,T+1} = \lambda_1 d_{i,j,T} + \lambda_2 d_{i,j,T-1} + \ldots, \tag{4}$$

to predict the cell deviations where the prediction weights λ_i sum to one. Now form the prediction of the cell proportions $S'_{i,j,T+1}$ by adding the predicted deviation $d'_{i,j,T+1}$ to the actual product of the row and column proportions $(S_{i,T+1})(S_{j,T+1})$:

$$S'_{i,j,T+1} = d'_{i,j,T+1} + (S_{i,T+1})(S_{j,T+1}). \tag{5}$$

CHAPTER 11

MODELING THE IMPACT OF THE 1980 GRAIN EMBARGO

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CHAPTER 11

MODELING THE IMPACT OF THE 1980 GRAIN EMBARGO*

The Carter administration's decision on January 4, 1980, to honor only the maximum level of U.S. wheat and coarse grain sales to the USSR set by the 1975 long-term grain agreement restricted a bilateral trade flow. This chapter uses three modeling approaches to analyze the effects of that sales suspension on the United States, the USSR, and other countries.

Because only one trade flow was restricted, the models used to estimate the consequences of the sales suspension needed to explain bilateral trade flows. Two types of models do so, the spatial equilibrium framework and the Armington framework. The spatial equilibrium model assumes that each type of grain—wheat or coarse grain—is homogeneous and traded in a perfectly competitive international market. Hence, the trade flow pattern which emerges minimizes transport costs as each importer buys from the cheapest source. The Armington model retains the competitive international market assumption, but allows commodities exported by various nations to be imperfect substitutes from the buyer's standpoint. The Armington model recognizes that rigidities in trade flow patterns arise because goods are not homogeneous, bilateral agreements restrict adjustment, and political constraints influence outcomes. These rigidities are represented by a model which determines trade flow patterns according to a "constant elasticity of substitution" structure.

Because both of these models rely on fundamentally different assumptions, yet use a common structure, each can potentially focus on a different set of consequences arising from the U.S. sales suspension. Thus, these models complement one another. The underlying assumptions of each of these models reflect differing perceptions of the behavior of international grain markets.

Neither the spatial equilibrium model nor the Armington model can measure whether a country has the opportunity and incentive to exploit its market power. Because Argentina refused to cooperate with the embargo, it was in a position to exercise market power in the Soviet market. Thus, the third model used was a price discrimination model. It relaxes the competitive market assumptions and allows an exporting country to impose buyer-specific taxes and subsidies in an effort to increase its gains from trade through price discrimination.

Each model, therefore, has a different set of behavioral assumptions which imply a structure to the market. The empirical results obtained largely reflect that structure.

EMPIRICAL IMPLEMENTATION OF ALTERNATIVE APPROACHES

All three of the conceptual frameworks used to analyze the U.S. sales suspension have strengths and weaknesses. Rather than being tied to a particular approach, this study considers implications of the 1980 U.S. sales suspension in each framework. If the approaches yield similar conclusions as to the effects, then confidence in the results is stronger. Our approach was to design models which use the same structure, but which assume alternative forms of market behavior. If different results are obtained, then the differences can be traced to the market behavior assumptions.

This section discusses how the conceptual frameworks considered above are transformed into empirical models which can be used to analyze the partial U.S. trade embargo of 1980. Each of the three models is based on calendar year 1980, the only year for which the embargo was in effect the entire year. Calendar year wheat trade flow data are available in Mackie, Hiemstra, and Rosen *(8)*.[1] For coarse grains, calendar year trade flow

*Contributors to this chapter were Philip C. Abbott and Philip L. Paarlberg.

[1]Italicized numbers in parentheses refer to items listed in the References section at the end of this chapter.

data compiled from USDA are used. Each model is short run, for 1 year only; thus, production is held fixed. Trade behavior reflects adjustments in consumption, feed use, and stocks to world prices.

The Spatial Equilibrium Trade Model

Given elasticities discussed in Chapter 6 and given 1980 observed levels of imports, exports, and the average 1980 world market price, the constant term in the net trade equations could be directly calculated. With this procedure, solution of the model should yield the aggregate quantities exported and imported by each country at the calendar year 1980 price (app. table 11.1).

The final data required to complete the empirical spatial equilibrium model were the matrix of transportation costs and the bilateral trade flow constraints used by Holland and Sharples *(7)*. Policy intervention was incorporated individually via the price transmission elasticities. Thus, the net trade functions gave each region's response to world market (border) prices.

The transportation rates used by Holland and Sharples *(7)* were obtained from Harrer and Binkley *(6)*. Harrer and Binkley examined the transportation of commodities overseas and in the process compiled transportation rates on most of the world's major shipping routes. The original data were from the International Wheat Council and the Maritime Weekly bulletin. These sources gave source/destination shipping charges for heavy grain.

A summary of bilateral trade agreements for the period was provided by Webb and Wilson *(16)*. These restrictions on the quantity of bilateral trade flows were entered directly into the model in the form of minimum and maximum constraints (see appendix). In addition, the United States had informal understandings with several important buyers. These informal understandings generated flow constraints in the empirical model.

The price elasticities incorporated in the spatial equilibrium model represented the best judgment of experts in the area of international agricultural trade. The empirical model which resulted provided a sound basis for analyzing the consequences of the 1980 suspension of U.S. sales to the USSR. It also provided a framework for analyzing surplus disposal alternatives discussed in Part III of this report.

The Armington Model

The spatial equilibrium model is designed to analyze the effects of the 1980 embargo in a competitive world market in which wheat and coarse grains were homogeneous commodities. The Armington model, an alternative to the spatial equilibrium model, is designed to explain trade flows by assuming that the wheat and coarse grain exports of the different exporting countries are imperfect substitutes and therefore nonhomogeneous. Most of the basic model is identical to the spatial equilibrium model. What differs is the rule for determining trade flow patterns. Analyzing the 1980 U.S. sales suspension with the Armington model will show what differences, if any, the allowance for imperfect substitutability makes.

Armington models have had only limited use in research on agricultural commodity markets. The major work in this area was by Grennes, Johnson, and Thursby *(5)*. They estimated a model of world wheat trade in which the elasticity of substitution was assumed to equal 3.0 for all countries. Their research was criticized because this assumption appeared to have little empirical support. It is unlikely that wheats substitute for one another equally well in all markets. Further, the appropriateness of the value of 3.0 itself has been criticized *(13)*.

Because of limited research in this area, we were not able to assign elasticity of substitution parameter values *a priori*. Consequently, we needed direct econometric estimates of elasticities of substitution. Directly estimating these parameters is difficult because the grain prices of major trading nations are highly collinear, thus violating an assumption of the econometric technique. To ease the estimation problems, the Armington approach imposes a separability assumption, which reduces the number of parameters to be estimated (see appendix).

Figueroa's Armington model for world wheat and corn trade provided estimates of the elasticity of substitution that served as the

basis for estimates used to construct an annual Armington model for 1980 which corresponded to the spatial equilibrium model *(4)*. The estimation results for wheat and coarse grains obtained by Figueroa are presented in table 11.1. These estimated parameters vary greatly across nations and commodities. The lowest substitutability in the wheat market (a value of 0.37) occurs for the USSR, where the commodities exported by the major exporting countries do not substitute much for one another. The other extreme (that of high substitutability among wheats) is 8.0 in East Asia; this is the average of the values estimated by Figueroa for Taiwan and South Korea. The elasticity of substitution for coarse grains is similar, ranging from a low of 0.3 in the EC to a high of 7.0 in East Asia.

Table 11.1--Estimates of the elasticity of substitution

Region	Wheat	Coarse grains
Egypt	4.35	6.00
EC	.46	.30
Japan	1.75	5.35
Mexico	6.63	3.15
China	4.06	2.00
East Asia	8.00	7.00
USSR	.37	1.85
Rest of world 1/	3.00	3.00

1/ Assumes the value used by (5).

Source: (4).

The list of countries considered by Figueroa was less inclusive than the list considered in the spatial equilibrium model. To make the country coverage of the two models compatible, we made some assumptions about the elasticities of substitution. Where the regions of the two models corresponded, Figueroa's estimates were used. For countries not considered by Figueroa, the estimates from a similar country were used. For example, the estimate for Mexico was used for Central America, while the average of the parameter estimates for South Korea and Taiwan provided parameter assumptions for the other Asian countries. For regions not represented by Figueroa, the value of 3.0, used by *(5)*, was assigned. Table 11.2 gives the assumed elasticities of substitution for the countries not considered by Figueroa along with the country whose elasticity of substitution provided the assumption.

The Armington import demand function (equation 19 in the appendix) included a country-specific constant. To guarantee that the solution trade flows satisfied each

Table 11.2--Assumed values for the elasticity of substitution, annual Armington model

Region	Elasticity of substitution		Source country
	Wheat	Coarse grains	
Other Western Europe	0.46	0.30	EC
South Africa	3.00	--	Rest of world
Eastern Europe	.37	1.85	USSR
Central America	6.63	3.15	Mexico
Brazil	6.63	3.15	Mexico
Venezuela	6.63	3.15	Mexico
Other South America	6.63	3.15	Mexico
Sub-Sahara	3.00	3.00	Rest of world
Nigeria	3.00	3.00	Rest of world
North Africa	4.35	6.00	Egypt
India	3.00	3.00	Rest of world
Other South Asia	3.00	3.00	Rest of world
Indonesia	8.00	7.00	East Asia
Thailand	8.00	--	East Asia
Southeast Asia	8.00	7.00	East Asia
East Asia	8.00	7.00	East Asia
Middle East	4.35	6.00	Egypt

-- = Not applicable since country is an exporter.

importer's requirements, that equation was converted to a market share equation. As for the spatial equilibrium model, the value of this constant (b_{ij}) was calculated from the 1980 base data once the elasticities of substitution were known. The trade flow data used in the Armington model for wheat and coarse grains are in appendix tables 11.2 and 11.3. The calculated constants for each behavioral equation are given in appendix tables 11.4 and 11.5. A major drawback of the Armington framework is that for zero trade flows, the constant (b_{ij}) is zero, which guarantees that any subsequent flows between those countries will be zero. Thus, a major rerouting of trade flows which can be predicted by a spatial model in response to the U.S. sales suspension is precluded. The export supply functions for the exporters are the same as those used in the spatial equilibrium model. The result of this process is a model which allows for imperfect substitutability, yet reproduces the actual market outcomes for 1980.

Incorporating the U.S. sales suspension in the Armington model was somewhat more difficult than was the case for the spatial equilibrium model. The Armington model is based on utility maximization. The problem is to minimize the costs of a specified level of imports. We incorporated the partial embargo into the Armington model by assuming the USSR objective was to minimize import costs subject to the constraint on U.S.-USSR bilateral grain trade. In effect, this constraint removes U.S.-USSR imports from the minimization problem. The USSR allocates the trade flows of the remaining imports on the basis of cost minimization and their elasticity of substitution with the embargo. To determine effects of the embargo, the pre-1980 Soviet import demand function of the form of equation 19 in the appendix was substituted into the model without the flow constraint on U.S.-USSR trade and without the Argentina-USSR bilateral grain agreement. The Argentina-USSR bilateral grain agreement was removed because the signing of that agreement appeared to be a consequence of the U.S. action.

The Price Discrimination Model

Both the spatial equilibrium and Armington models assume competitive behavior with exogenous policies. Large countries with market power and institutions capable of exercising that market power have the incentive to exploit their influence. In the case of the 1980 U.S. sales suspension, Canada, Australia, and the European Community (EC) agreed not to exploit or undermine the U.S. action. They specifically agreed not to increase sales to the USSR beyond historical and normal levels. Argentina and Brazil did not agree to cooperate with the U.S. policy. Rumors persist that Argentina exploited the U.S. action by increasing sales of wheat and coarse grains to the USSR while charging the Soviets premium prices. Evidence on relative prices in Chapter 10 suggest that these rumors may have some basis. The competitive models were designed to capture the Argentine displacement of U.S. sales in the Soviet market. However, the competitive models, by their structure, cannot determine if the Argentines had the opportunity to add price premiums beyond the additional costs of transportation and handling.

The price discrimination model is designed to consider whether a large country has the incentive to intervene in trade and to what degree. In the case of the 1980 U.S. sales suspension, the model determined what the optimal Argentine policy response should be with and without the U.S. action, and what effect that policy response had on the United States. While the model could not confirm that the Argentines did impose premiums, it suggested their likely behavior. A model solution in which no premiums are imposed would suggest that Argentina had no incentive to exploit the U.S. policy action beyond a competitive response.

The Argentine intervention was captured by including an Argentine objective function and endogenous targeted export taxes and subsidies in the spatial equilibrium model, and by removing the Argentina-USSR grain agreement. By adding an objective function describing Argentine behavior, a policy intervention rule was included in the model (see equations (23) to (27) in the appendix). The Argentine objective function assumed Argentina adopted targeted export taxes/subsidies, which maximized its economic surplus as given by producer and consumer surplus plus tax revenues (or less subsidy costs).

The Argentina-USSR grain agreement was removed because if an exporting country is certain that a buyer will purchase a minimum quantity regardless of the price, then the optimal price to charge would be infinity. The bilateral agreement would be voided if prices were increased greatly, although the bilateral agreement did create the potential for a premium, depending on negotiations between Argentina and the USSR. However, the mathematical computer model treated the minimum sales agreement as a binding minimum quantity constraint, and thus charged a price of infinity. Thus the solution to the problem was unbounded if Argentina was allowed to price discriminate and the Argentina-USSR grain agreement imposed a minimum flow quantity. However, this unbounded solution demonstrated the potential for Argentine market power resulting from signing the bilateral agreement with the USSR and the importance of negotiations between those two countries.

The U.S. Export Supply Equation

We gave the export supply functions for wheat and coarse grains by the United States special consideration because the effects of the 1980 suspension on U.S. prices and quantities were to be incorporated into a detailed model of the U.S. agricultural sector (see Chapter 13). For the results of the international models to be consistent with those obtained from the U.S. model, the U.S. export supply functions used in the international model needed to capture the export supply behavior implicit in the U.S. model.

The U.S. export supply equations used in the international models were synthesized from the net export behavior of the U.S. domestic model developed at Iowa State University (see Chapter 19). The Iowa State model was given several differing exogenous prices for U.S. wheat and coarse grains. For each of the alternative prices, the model yielded a complete supply-utilization balance for wheat and coarse grains, including the quantities which the model predicted that the United States would export. These price and quantity outcomes represent points on the export supply schedule for U.S. wheat and coarse grain exports. By fitting a linear relationship through these points, we could calculate an elasticity of U.S. export supply at base year exports and prices for wheat and coarse grains. This elasticity summarized the export behavior implicit in the Iowa State model.[2]

Results suggest that the U.S. export supply functions for both wheat and coarse grains were elastic in the short run, largely due to U.S. stock adjustment to price changes. The calculated elasticity of export supply for wheat was 1.002 and for coarse grains was 1.55. Thus, for both commodities, a 1-percent change in price caused a more than 1-percent change in U.S. exports.

Given U.S. export supply elasticities, intercepts of the U.S. export supply function were calculated to benchmark the model to 1980 calendar year trade data. The procedure followed was identical to that discussed for other regions.

EFFECTS OF THE 1980 SUSPENSION OF U.S. GRAIN SALES TO THE USSR

This section estimates the effects of the U.S. sales suspension on world markets. Calendar year 1980 data were used as the base which included the embargo's effects. The analysis used the spatial equilibrium model, the Armington model, and the price discrimination model. For each model, we considered several alternative scenarios in an effort to cover a wide range of possible outcomes.

We must recognize that models have generated the results. Models are simplified representations of world trade. They suggest the direction and the magnitude of changes due to the U.S. sales suspension. These models were not forecasting models, and the results cannot be interpreted as such. As with all models, they did not reproduce exactly what happened. The results of the spatial equilibrium model and the price discrimination model are presented together because they have a common structure.

[2]The FAPRI model U.S. export supply equation specification was used instead of the FAPSIM specification. The FAPRI stock behavior equation specification was more consistent with the static international model used here.

Spatial Equilibrium Model and Price Discrimination Model Results

Results for the spatial equilibrium and price discrimination models are presented in tables 11.3-11.10. Six scenarios were analyzed. These scenarios compared the model representation of what occurred in 1980 to alternative world market outcomes had the United States not limited grain sales to the USSR. The base 1980 data included the U.S. sales suspension and the uncooperative Argentine action of signing a supply agreement with the USSR.

Scenario 1 simply removed the U.S.-USSR trade flow limits, thereby allowing the United States to ship as much as it wanted to the USSR. This scenario also assumed that the USSR did not sign a bilateral accord with Argentina which would have required Soviet purchases of Argentine grain. Scenario 1 further assumed that total Soviet grain imports were unaffected by the U.S. action, except to the extent that paying a higher price caused a reduction in the quantity imported according to the Soviet import demand functions.

Some have argued that the sales suspension prevented the USSR from importing as much grain as they would have otherwise purchased. One argument is that the embargo disrupted the timing of deliveries, resulting in bottlenecks at Soviet ports of entry. Port capacity constraints consequently prevented the USSR from replacing all embargoed grain. Another argument is that, during the embargo, the increase in Soviet imports of meat and nongrain feeds identified in Chapter 10 was a replacement of Soviet grain imports resulting from U.S. sanctions.

Scenarios 2 and 3 considered effects of this situation. Scenario 2 compared the embargo

Table 11.3--Changes in world market prices for wheat and coarse grains due to the 1980 U.S. sales suspension, spatial equilibrium model

Country	Base	Scenario 1/			
		1	2	3	6
		U.S. dollars per ton			
Wheat:					
United States	173.88	-0.94	-2.70	-7.90	-0.81
Canada	179.58	1.26	-.50	-5.70	3.09
Australia	177.88	-.14	-1.90	-7.10	-.01
Argentina	182.28	7.46	5.69	.50	-1.43
EC	192.08	2.26	.90	-4.30	-2.11
Other Western Europe	190.48	2.66	.89	-4.30	-2.11
Japan	193.52	-.31	-2.07	-7.27	-.81
Eastern Europe	196.42	.30	-1.47	-6.69	.29
USSR	197.65	3.03	1.27	-3.93	3.09
Mexico	188.89	-.69	-2.45	-7.65	-.81
Brazil	192.24	-.71	-2.48	-7.68	-.81
Egypt	206.35	.36	-1.40	-6.62	3.09
Coarse grains:					
United States	130.26	-.19	-1.85	-6.24	-.34
Canada	134.86	-.19	-1.85	-6.24	.79
Australia	131.45	.91	-.75	-5.14	-3.11
Argentina	130.26	1.91	.54	-3.84	.70
Thailand	129.66	.91	-.75	-5.14	1.89
Eastern Europe	151.26	-.22	-1.85	-6.24	-.34
USSR	151.67	1.37	-.28	-4.65	1.89
Mexico	143.86	-.19	-1.85	-6.24	-.34
Brazil	147.76	1.91	.55	-3.84	-.34

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons. Scenario 6 shows effects of the U.S. embargo when Argentina price discriminates.

Table 11.4--Changes in U.S. wheat and coarse grains trade flows due to the 1980 U.S. sales suspension, spatial equilibrium model

Country	Base	Scenario 1/			
		1	2	3	6
		Million tons			
Wheat:					
Eastern Europe	4.153	3.153	3.153	3.153	3.148
USSR	1.800	-5.380	-5.946	-7.616	-5.385
China	6.798	.894	.997	1.301	.888
Brazil	4.259	.947	1.020	1.237	1.176
Other Southeast Asia	.178	.178	.178	.178	.000
Other	18.708	.016	.039	.109	.007
Total	35.896	-.194	-.559	-1.635	-.166
Coarse grains:					
Eastern Europe	6.678	.304	.713	1.767	2.105
USSR	6.200	-3.161	-5.244	-10.709	-3.071
Brazil	1.100	1.100	1.100	1.100	.000
Other South America	1.567	1.567	1.567	1.567	.606
Other	47.997	.046	.462	1.560	.711
Total	63.542	-.143	-1.400	-4.714	-.255

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons. Scenario 6 shows effects of the U.S. embargo when Argentina price discriminates.

Table 11.5--Changes in Canadian wheat and coarse grain trade flows due to the 1980 U.S. sales suspension, spatial equilibrium model

Country	Base	Scenario 1/			
		1	2	3	6
		Million tons			
Wheat:					
Eastern Europe	0.500	-3.156	-3.310	-3.053	-3.152
USSR	9.612	2.835	2.723	2.393	4.467
North Africa	.294	.144	.144	.144	0
Middle East	.200	.200	.200	.200	0
Other	7.519	.033	.041	.067	-1.180
Total	18.125	.055	-.022	-.250	.135
Coarse grains:					
Eastern Europe	2.275	-.278	-.414	-.772	-2.039
USSR	.763	.263	.263	.263	2.104
Total	4.181	-.015	-.151	-.509	.065

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons. Scenario 6 shows effects of the U.S. embargo when Argentina price discriminates.

Table 11.6--Changes in wheat and coarse grain trade flows for Australia/New Zealand due to the U.S. sales suspension, spatial equilibrium model

Country	Base	Scenario 1/			
		1	2	3	6
		Million tons			
Wheat:					
China	2.000	-0.864	-0.912	-1.053	-0.862
Sub-Sahara	.680	.680	.680	.680	0
Nigeria	.301	.301	.301	.301	0
Other Southeast Asia	1.158	-.178	-.173	-.159	0
Other	8.213	.060	.085	.164	.861
Total	12.352	0	-.017	-.066	-.001
Coarse grains:					
USSR	.681	-.195	-.385	-.920	.781
China	.984	-.023	.068	.354	-.651
East Asia	1.218	.237	.301	.455	-.091
Other	.994	-.013	.010	.070	-.025
Total	3.878	.007	-.006	-.040	.014

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons. Scenario 6 shows effects of the U.S. embargo when Argentina price discriminates.

Table 11.7--Changes in Argentina's wheat and coarse grain trade flows due to the 1980 U.S. sales suspension, spatial equilibrium model

Country	Base	Scenario 1/			
		1	2	3	6
		Million tons			
Wheat:					
USSR	2.500	2.500	2.500	2.500	0
Brazil	0	-.945	-1.015	-1.220	-1.175
Sub-Sahara	1.560	-.726	-.722	-.708	-.044
Nigeria	.690	-.314	-.314	-.313	0
North Africa	0	-.179	-.155	-.086	1.411
Middle East	0	-.250	-.217	-.119	-.184
Other	.200	-.061	-.058	-.052	-.051
Total	4.950	.025	.019	.001	-.003
Coarse grains:					
USSR	3.000	3.000	3.000	3.000	0
Brazil	.763	-1.118	-1.105	-1.064	.003
Other South America	0	-1.575	-1.559	-1.508	-.602
India	0	-.269	-.274	-.274	.025
Other	0	0	-.050	-.231	.587
Total	3.763	.038	.011	-.077	.013

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons. Scenario 6 shows effects of the U.S. embargo when Argentina price discriminates.

solution with a solution in which the USSR imported an additional 3 million tons of total wheat and coarse grains. That is, the U.S. sales suspension caused a 3-million-ton reduction in Soviet imports, a shift in Soviet import demand functions. Allocation of the 3-million-ton change in imports between wheat and coarse grains was based on the composition of the embargoed grain. Embargo impacts given by scenario 3 were based on the assumption that the U.S. sales suspension caused an 11-million-ton reduction in USSR grain imports.

A critical component of the international adjustment to the U.S. sales suspension was the price-responsiveness of Canadian grain stocks and the price responsiveness of Soviet imports. The more price-responsive (elastic) these functions were, the more elastic the import demand curve facing the United States. As the world market became more price-sensitive, the fall in the U.S. price due to the U.S. sales suspension should have been less. We analyzed two situations to test the sensitivity of the results to the parameter value chosen for Canadian stocks elasticity and the USSR import elasticity. Scenario 4 examined the effects of the U.S. sales suspension when the price responsiveness of Canadian stocks was lowered and when the U.S. action reduced Soviet imports 3 million tons.

Scenario 5 examined the case when Canadian stocks and USSR grain imports were assumed more price-responsive and when the U.S. action reduced USSR imports 3 million tons. Comparing results of scenarios 4 and 5 with those of scenario 2 shows the sensitivity of model outcomes to the value of these parameters. Results suggested that changes in price level in world markets were not greatly

Table 11.8--Changes in USSR and Eastern European wheat and coarse grain trade flows due to the 1980 U.S. sales suspension, spatial equilibrium model

Country	Base	Scenario 1/			
		1	2	3	6
		Million tons			
USSR:					
Wheat--					
United States	1.800	-5.380	-5.946	-7.616	-5.385
Canada	9.612	2.835	2.723	2.393	4.467
Argentina	2.500	2.500	2.500	2.500	.805
Total	13.912	-.045	-.723	-2.723	-.113
Coarse grains--					
United States	6.200	-3.161	-5.244	-10.709	-3.071
Canada	.763	.263	.263	.263	2.104
Australia/ New Zealand	.681	-.195	-.385	-.920	.781
Argentina	3.000	3.000	3.000	3.000	.000
Total	10.644	-.093	-2.366	-8.366	-.186
Eastern Europe:					
Wheat--					
United States	4.153	3.153	3.153	3.153	3.148
Canada	.500	-3.156	-3.130	-3.053	-3.152
Total	5.153	-.003	.023	.100	.004
Coarse grains--					
United States	6.678	.304	.713	1.767	2.105
Canada	2.265	-.278	-.414	-.772	-2.039
Other Western Europe	.123	-.017	-.203	-.669	-.048
Total	9.066	.010	.097	.326	.018

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons. Scenario 6 shows effects of the U.S. embargo when Argentina price discriminates.

affected by the value chosen for either the Canadian stocks elasticity or the Soviet import elasticity, and that it was not critical for the analysis of the U.S. sales suspension. The structure of international trade and the determination of trade flow patterns dominated effects of price changes on quantity adjustments. These results consequently were not reported in the tables.

The final scenario (scenario 6) considered the case where Argentina was allowed to price discriminate in an effort to increase its welfare. Argentina was rumored to have charged the Soviets a premium on its grain. This scenario was designed to determine whether Argentina could charge such a premium given the market structure captured in the model. Scenario 6 compares the embargo and no-embargo solutions, with the added complication that Argentina could set export taxes and subsidies to price discriminate.

Spatial Equilibrium Model Price Results

The impacts of the 1980 U.S. sales suspension on trade prices in 1980 are reported in table 11.3. If the Soviets were not compelled to

Table 11.9--Changes in trade value for wheat and coarse grains for selected countries due to the 1980 U.S. sales suspension, spatial equilibrium model

Country	Base	Scenario 1/			
		1	2	3	6
		Million U.S. dollars			
United States: 2/					
Wheat	6,241.7	-67.7	-195.6	-580.9	-58.09
Coarse grains	8,276.9	-30.6	-302.6	-1,039.8	-54.79
Total	14,518.6	-98.3	-498.2	-1,620.7	-112.88
Canada: 2/					
Wheat	3,255.0	32.7	-13.0	-149.6	80.31
Coarse grains	563.9	-2.8	-28.3	-97.9	12.14
Total	3,818.9	29.9	-41.3	-247.5	92.45
Australia/ New Zealand: 2/					
Wheat	2,197.1	-1.9	-26.6	-100.0	-.30
Coarse grains	509.8	4.4	-3.7	-25.4	-10.18
Total	2,706.9	2.5	-30.3	-125.4	-10.48
Argentina: 2/					
Wheat	902.3	41.3	31.6	2.7	-7.47
Coarse grains	490.2	12.3	3.5	-24.7	4.22
Total	1,392.5	53.5	35.1	-22.0	-3.25
USSR: 3/					
Wheat	2,749.6	33.2	-124.5	-603.7	20.81
Coarse grains	1,614.5	.7	-362.4	-1,357.2	-8.21
Total	4,364.1	33.9	-486.9	-1,960.9	12.60
Eastern Europe: 3/					
Wheat	1,012.2	1.1	-2.9	-14.0	-.72
Coarse grains	1,371.3	-.3	-2.0	-5.2	-.36
Total	2,383.5	.8	-4.9	-19.2	-1.08

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons. Scenario 6 shows effects of the U.S. embargo when Argentina price discriminates.
2/ Export revenue changes.
3/ Import cost changes.

reduce grain import demand as a result of the embargo, then U.S. export prices for wheat and coarse grains were virtually unaffected by the sales suspension (scenario 1). The model results suggest that the U.S. action in 1980 lowered the U.S. wheat export price by $0.94 per ton (2.6 cents per bushel). For coarse grains, the price decline was even smaller, $0.19 per ton (less than 0.5 cent per bushel).

Model results for prices for major competitors under scenario 1 show that all competitors in the wheat market except Australia were able to increase prices because of the U.S. policy. Canada charged $1.26 per ton more because of the embargo. Argentina charged $7.46 per ton more for its wheat, while the EC and Other Western Europe charged an added $2.26 and $2.66 per ton. Australia faced more competition from U.S. wheat in Southeast Asia; hence, its price fell slightly, by $0.14 per ton.

In scenario 1, the U.S. sales suspension slightly lowered wheat prices for most importers, with the exception of the Soviet Union, Eastern Europe, and Mediterranean countries. Soviet import prices rose the most, $3.03 per ton with the U.S. action. Eastern Europe paid slightly more since it bought wheat from the United States instead of Canada, thereby incurring additional transportation charges, $0.30 per ton.

Price changes in the coarse grain market were reversed from those in the wheat market, except for Argentina which charged an additional $1.91 per ton under scenario 1. Canadian, EC, and Other Western Europe coarse grain prices were slightly lower with the embargo, while the Australian price was slightly higher.

Effects of the U.S. sales suspension on prices paid by importers of coarse grains were

Table 11.10--Pattern of Argentina's export subsidies and taxes when Argentina price discriminates with and without the 1980 U.S. sales suspension, spatial equilibrium model

Country	Wheat		Coarse grains	
	With suspension	Without suspension	With suspension	Without suspension
	U.S. dollars per ton			
EC	0	0	0	0
Other Western Europe	0	0	0	0
Japan	0	0	0	0
South Africa	-11.06	0	--	--
Eastern Europe	0	0	0	0
USSR	0	0	0	0
China	0	0	0	0
Mexico	0	0	0	0
Other Central America	0	0	0	0
Brazil	0	-10.44	-3.51	-4.56
Venezuela	0	0	0	0
Other South America	0	0	-2.31	-3.36
Sub-Sahara	-19.46	-16.64	-3.34	0
Nigeria	-19.46	-16.64	-3.34	0
Egypt	0	0	0	0
North Africa	-11.16	-11.84	0	1.22
India	0	-12.34	-3.64	-2.46
Other South Asia	0	0	0	0
Indonesia	0	0	0	0
Thailand	0	0	--	--
Other Southeast Asia	0	0	0	0
East Asia	0	0	0	0
Middle East	0	-11.84	0	0
Rest of world	0	0	0	0

-- = Not applicable since these countries export coarse grains.
1/ These solutions allow Argentina to set welfare improving export subsidies and taxes, with and without the U.S. embargo. A negative value indicates an export tax.

negligible. The USSR paid an additional $1.37 per ton. The coarse grain prices paid by Japan, Eastern Europe, Mexico, and the Middle Eastern and North African countries were slightly lower. Brazil suffered the largest price increase ($1.91 per ton), as about 1 million tons it would have received from Argentina were diverted to the USSR. Thus, Brazil incurred higher transport costs because it imported that tonnage from the United States.

Scenarios 2 and 3 assumed that the U.S. sales suspension caused the USSR to reduce imports by 3 and 11 million tons of grain. Because the embargo was assumed to have reduced global import demand, price changes were correspondingly larger. Loss of 3 million tons of USSR grain imports reduced the U.S. wheat price $2.70 per ton (7.3 cents per bushel) and the U.S. coarse grain price by $1.85 per ton (4.8 cents per bushel). The Soviet wheat price increase in this situation was only $1.27 per ton, and the Soviet import price for coarse grains was $0.28 per ton lower. Thus, in scenario 2, the USSR faced a lower coarse grain price with the U.S. sales suspension because the embargo lowered world import demand, which in turn, lowered world prices. With the exception of Argentina, the reduced USSR demand of 3 million tons lowered prices received by competitors. Argentina charged an additional $5.69 per ton for wheat and $0.54 per ton for coarse grains (scenario 2).

When the U.S. embargo was assumed to have reduced USSR imports by 11 million tons, the decline in the U.S. wheat price due to the embargo was $7.90 per ton (21.5 cents per bushel). The decline in the U.S. coarse grain price was $6.24 per ton (15.8 cents per bushel). Except for Argentina's wheat price, the embargo lowered trade prices for all countries. Exporters faced lower prices and importing countries benefited from reduced prices.

Spatial Equilibrium Trade Flow Results

Effects of the U.S. sales suspension to the USSR on the trade levels and flows for major regions are shown in tables 11.4 through 11.8. The U.S. sales limits and the Argentina-USSR bilateral agreement (when total Soviet import demand is unaffected) reduced U.S. wheat exports 194,000 tons. Coarse grain exports were 143,000 tons lower (scenario 1). Despite stability in overall export levels, the sales suspension did cause some major shifts in trade flows. Because of the embargo, the United States shifted 3.153 million tons of wheat and 304,000 tons of coarse grain exports from the USSR to Eastern Europe (scenario 1). The United States also shipped nearly 1 million more tons of wheat to both China and Brazil and supplied 178,000 tons of wheat to Other Southeast Asia when the embargo was in effect. In the coarse grain market, the United States diverted grain to Brazil and Other South America to offset withdrawal of Argentine supplies to those markets.

Trade flow results for the scenarios which assumed that the USSR reduced total grain imports in response to the U.S. policy had similar patterns to those in scenario 1, but the magnitudes were larger. If the USSR reduced imports of grain by 3 million tons, U.S. wheat exports under the embargo were 559,000 tons lower. U.S. exports of coarse grains declined by 1.4 million tons (scenario 2). The level of U.S. wheat exports to the USSR in scenario 2 was 5.946 million tons lower because of the embargo. The U.S. suspension of sales reduced U.S. coarse grain sales to the USSR by 5.244 million tons. Because of the U.S. policy, the United States sold more wheat to China (997,000 tons of wheat) and more grain to Eastern Europe and South America.

The largest losses in total U.S. wheat and coarse grain exports occurred when the USSR was assumed to have lost 11 million tons of total grain imports. Under scenario 3, U.S. wheat exports declined by 1.635 million tons. Coarse grain exports by the United States in scenario 3 were 4.714 million tons lower because of the U.S. embargo.

Changes in trade levels and flows for Canada are presented in table 11.5. The U.S. sales limit and the Argentina-USSR agreement caused Canadian wheat exports to increase by 55,000 tons. Canadian coarse grain exports were 15,000 tons less. These results suggested that the U.S. policy action allowed the Canadians to expand wheat sales, but at the expense of coarse grain exports. If the U.S. embargo reduced Soviet imports by 3 million

tons, Canadian wheat exports declined slightly—22,000 tons—while coarse grain exports fell 151,000 tons (scenario 2). If the decline in Soviet imports was assumed to be 11 million tons, then the model results suggested that Canada lost 250,000 tons of wheat sales and 509,000 tons of coarse grain export (scenario 3).

Trade flow results reported in table 11.5 suggest that the U.S. sales suspension caused Canada to divert exports from Eastern Europe to the USSR. For wheat, Canada reduced exports to Eastern Europe by 3.156 million tons (scenario 1) while coarse grain exports to that region fell by 278,000 tons. Model results predicted that the U.S. embargo caused Canadian wheat exports to the USSR to expand by 2.835 million tons while coarse grain exports increased by 263,000 tons. Spatial equilibrium results also suggested that Canada expanded sales into African and Middle East markets because of the embargo.

Impacts of the U.S. sales suspension on trade levels and flows for Australia/New Zealand are shown in table 11.6. Unless the U.S. policy reduced Soviet imports by 11 million tons (scenario 3), total exports were largely unaffected. Results from scenario 3 suggest that because world import demand fell, the embargo reduced wheat exports by 66,000 tons and lowered coarse grain exports by 40,000 tons, if Soviet imports fell 11 million tons.

Trade flow results in table 11.6 show that the U.S. embargo caused Australia/New Zealand to divert wheat sales from the China to Sub-Saharan Africa, Nigeria, and India. U.S. wheat sales in Southeast Asia displaced Australian wheat in that market. In the coarse grain market, the U.S. sales suspension lowered Australian sales to the USSR and China while exports to East Asia rose to absorb these supplies.

Because Argentina openly refused to cooperate with the U.S. action, that country's reaction was critical. Solution results presented in table 11.7 suggest that unless the Soviet import demand fell by 11 million tons, the U.S. sales limitation allowed Argentina to expand both wheat and coarse grain exports. The comparison given by scenario 1 suggests that Argentina expanded wheat exports by 25,000 tons and coarse grain exports by 38,000 tons in response to the embargo. The scenario which assumed that the sales suspension reduced Soviet imports by 3 million tons predicted that the increase in Argentine exports was less than the figures in scenario 1.

Trade flow results presented in table 11.7 predicted substantial rerouting of Argentine trade patterns in response to the U.S. action. Without the U.S. sales suspension, Argentina would not have supplied any grain to the USSR. With the U.S. action, the Argentines exported 2.5 million tons of wheat and 3 million tons of coarse grains to the USSR. These tonnages were obtained by shorting markets in Brazil, Other South America, Africa, and India.

Changes in trade levels and flows for the USSR and Eastern Europe are given in table 11.8. These results confirm those presented for the exporting countries. In scenario 1, the embargo reduced Soviet wheat imports by 45,000 tons and lowered coarse grain imports by 93,000 tons. Thus, in this case, the USSR was able to replace most of the embargoed grain. Since scenarios 2 and 3 assume that total USSR imports fall, the declines in tonnage were greater. Scenario 3 showed the largest losses, 2.723 million tons of wheat and 8.366 million tons of coarse grain, or a total of 11 million tons. The model suggests that the Soviets compensated for the lost U.S. grain by increasing imports from Canada and Argentina.

Results for Eastern Europe (table 11.8) show approximately the same levels of total imports, unless the Soviets reduced imports by 11 million tons. With an 11-million-ton reduction, Eastern European imports were higher with the U.S. sales suspension. Trade flow results suggest that the U.S. embargo caused the United States to displace Canadian grain exports in that market.

Spatial Equilibrium Model Trade Value Results

The changes in prices and trade levels discussed above translate into changes in export earnings or import costs. These are shown in table 11.9. If the Soviet import demand was unaffected by the embargo (scenario 1), then loss in U.S. export revenue was small ($98.3 million). Of this total, $67.7

million of the loss occurred in the wheat market and $30.6 million occurred in coarse grain exports. If USSR import demand fell 11 million tons as a result of the embargo, then loss in U.S. export earnings was $1.62 billion. This loss resulted because export earnings for wheat were estimated to be $580.9 million lower due to the embargo, while losses for coarse grain exports were $1.04 billion.

Export revenue losses from the U.S. sales suspension for other exporting countries were also small. Canada had the largest loss at $247.5 million. Australia/New Zealand lost at most $125.4 million. Argentina lost only $22 million. Because scenario 3 assumed that the USSR reduced imports by 11 million tons, the U.S. embargo saved the USSR $1.96 billion in import costs.

Under scenario 1, where the USSR import demand was unaffected by the U.S. policy, export earnings for Canada, Australia, and Argentina were higher. Canadian export earnings were about $30 million greater, while Argentine export earnings were $53.5 million higher. Australian earnings were about the same. USSR import costs in this scenario were $33.9 million higher.

Argentina's Price Discrimination Results

Argentina was rumored to have charged the USSR a price premium for its grain as a result of the U.S. sales embargo. The spatial equilibrium results presented above do show an increase in the Argentine price in most scenarios because the signing of the bilateral agreement between Argentina and the Soviet Union forced grain to be shipped on a flow where Argentina had a locational and cost disadvantage. The issue considered in scenario 6 was whether the Argentines placed an additional tax on exports in an effort to increase their welfare. Scenario 6 shows the effect of the U.S. sales limits when Argentina was allowed to endogenously set export taxes and targeted export subsidies.

The price of Argentine wheat falls by $1.43 per ton in response to the U.S. action while the coarse grain price rises by $0.70 per ton (table 11.3). These price changes reflect the fact that Argentina is a small exporter of wheat, a large exporter of coarse grains, and due to its infrastructure, has higher transportation charges than its competitors. Thus, Argentina lacks the market power in the wheat market to exploit the U.S. embargo by discriminatory pricing. In the coarse grain market, Argentina does have market power, although slight, and can raise its price by setting discriminatory export taxes. These results suggest that any premiums obtained by Argentina are due to the bilateral agreement with the USSR, giving the Argentines added market power to exploit in that market.

The U.S. sales suspension with Argentine price discrimination causes slight changes in wheat and coarse grain prices charged by other exporting countries. U.S. wheat prices in scenario 6 are $0.81 per ton lower due to the policy action, while U.S. coarse grain prices are $0.34 per ton lower. Canada is able to use the U.S. withdrawal from the Soviet market to increase prices, $3.09 per ton for wheat and $0.79 per ton for coarse grains. When Argentina is allowed to tax exports, the U.S. embargo lowers wheat prices received by Australia, the EC, and Other Western Europe. Australian coarse grain prices drop by $3.11 per ton.

Effects of the U.S. embargo on the prices paid by importers differ. Prices paid by the USSR rise, while Eastern Europe pays a higher wheat price but a lower coarse grain price. Mexico and Brazil benefit from lower import prices.

Effects of the U.S. sales suspension when Argentina sets export taxes and export subsidies are similar to the spatial equilibrium model results (tables 11.4 and 11.8). The United States shifts its exports from the USSR to Eastern Europe (table 11.4). The United States also increases sales of both wheat and coarse grains to Brazil and increases sales to China. In spite of these shifts, total U.S. wheat exports are only 166,000 tons lower, and total U.S. coarse grain exports are only 225,000 tons lower.

The United States increases its exports to Eastern Europe at the expense of Canada. Canada, in turn, replaces much of the embargoed U.S. grain in the Soviet market. Canada diverts shipments of wheat from other markets besides Eastern Europe. Total Canadian wheat exports in scenario 6 are

135,000 tons greater while coarse grain exports are 65,000 tons greater.

When Argentina is allowed to price discriminate, the U.S. limit on sales to the USSR shifts about 860,000 tons of Australian wheat exports to the USSR from other destinations. Total Australia/New Zealand wheat exports are virtually unchanged. For coarse grains, Australia and New Zealand also increase shipments to the Soviet market, mostly at the expense of exports to China. Total coarse grain exports are 14,000 tons lower.

Results for Argentine trade when that nation can price discriminate are much different from spatial equilibrium results. Earlier results show Argentina increasing exports to the USSR. In scenario 6, Argentina does not capture more of the USSR market (Canada and Australia take the market). Instead, Argentina diverts exports from Brazil to North Africa and other markets given up by Canada and Australia, because the Argentines do not have a bilateral agreement giving them access to the USSR market.

Changes in trade value for selected countries in scenario 6 are shown in table 11.9. The largest loss in export revenue occurred for the United States ($112.88 million). That loss in export revenue was roughly equally divided between wheat and coarse grains: The wheat price fell more than the coarse grain price, but coarse grain exports fell by more. Canada gained $92.45 million in this scenario, mostly in the wheat market. The other major exporters experienced little change in export revenues. The USSR suffered a small increase in import costs ($12.6 million) and paid $20.81 million more for wheat imports, but $8.21 million less for coarse grains. Eastern Europe saved a small amount of foreign exchange because the U.S. embargo lowered U.S. export prices. The small loss in export earnings for Argentina in scenario 6 compared with scenario 1 suggested that any Argentine gain from the U.S. sales suspension was due to the signing of the Argentina-USSR grain agreement rather than an opportunity to exploit market power.

The pattern of export subsidies and taxes set by Argentina with and without the U.S. embargo is presented in table 11.10. With the exception of coarse grain exports to North Africa, all interventions were taxes. The markets taxed were those left to Argentina after the larger exporters divided up the markets. The largest taxes occurred in African markets. When the United States imposed the embargo, the taxes fell as Argentina faced more competition with grain displaced from the USSR market.

Results of the Armington Model

The Armington model used the market behaviors of the spatial equilibrium model and introduced imperfect substitutability in determining sources of supply by importers. Whereas the spatial equilibrium model determined trade flows on the basis of transportation cost differentials, the Armington model explained trade flows by assuming that commodities exported by different countries were not homogeneous. This section presents the impacts of the U.S. suspension of wheat and coarse grain sales to the USSR using the Armington approach.

Because the spatial equilibrium results suggested little impact from the variations in the price responsiveness of Canadian stocks and USSR imports (scenarios 4 and 5) and from the exercise of Argentine market power (scenario 6), only three scenarios were examined with the Armington model. The first scenario assumed that the United States imposed the sales limitations and the Argentines signed the bilateral accord with the USSR, but also assumed that USSR import demand for wheat and coarse grains was unaffected by the U.S. action. Scenario 2 assumed that in addition to the U.S. sales limits and the Argentina-USSR agreement, the U.S. embargo resulted in a decline of USSR grain import demand by 3 million tons. As in the spatial equilibrium model, the allocation of the reduction between wheat and coarse grains was based on the composition of U.S. sales to the USSR. The third scenario assumed that the U.S. policy action reduced USSR grain imports by 11 million tons.

Impact on Prices

Table 11.11 shows changes in prices for selected countries when the embargo was imposed and when the Armington model was

Table 11.11--Changes in world market prices for wheat and coarse grains due to the 1980 U.S. sales suspension for selected countries, Armington model

Country	Base	Scenario 1/ 1	2	3
		U.S. dollars per ton		
Wheat:				
United States	172.74	-4.98	-6.48	-11.45
Canada	177.73	6.49	4.64	-1.60
Australia	175.83	13.60	12.16	7.38
Argentina	180.81	18.55	16.66	10.27
EC	188.78	9.64	8.39	4.24
Other Western Europe	187.47	3.60	2.24	-2.24
Japan	192.21	1.32	-.26	-5.51
Eastern Europe	197.54	2.68	1.14	-3.96
USSR	197.40	4.92	3.29	-2.16
Mexico	187.90	-3.39	-4.95	-10.16
Brazil	195.03	6.46	4.65	-1.41
Egypt	206.92	8.00	6.63	2.06
Coarse grains:				
United States	129.30	-2.44	-3.82	-8.31
Canada	133.58	8.05	7.17	4.35
Australia	129.39	10.23	9.22	6.02
Argentina	126.29	31.54	25.63	7.74
Thailand	126.47	4.78	3.86	1.33
Eastern Europe	150.22	.13	-1.09	-4.95
USSR	150.37	4.99	2.55	-4.40
Mexico	142.90	-2.43	-3.82	-8.31
Brazil	147.13	3.01	.77	-5.33

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons.

used to describe the market. With imperfect substitutability among exporters, price changes should have been larger than those obtained using the spatial equilibrium model. Table 11.11 confirms this expectation. The spatial equilibrium model showed that if Soviet grain import demand was unaffected by the embargo, U.S. wheat prices fell $0.94 per ton (scenario 1). In the Armington model, the price decline was considerably greater at $4.98 per ton (13.6 cents per bushel). Similar results held for coarse grains. In the spatial equilibrium model, the embargo lowered the U.S. coarse grain price by $0.19 per ton; in the Armington model, the U.S. coarse grain price fell by $2.44 per ton (6.2 cents per bushel). Assuming that total USSR grain import demand was adversely affected by the embargo increased the magnitude of these U.S. price declines (scenarios 2 and 3). The largest U.S. price decline occurred if USSR import demand was 11 million tons lower because of the embargo. In that instance, U.S. wheat prices fell by $11.45 per ton (31.2 cents per bushel) and U.S. coarse grain prices were $8.31 per ton lower (21.1 cents per bushel).

For the major competitors, the introduction of imperfect substitutability allowed them to increase prices more than if commodities were perfect substitutes. In scenario 1, the Canadian wheat price increased by $6.49 per ton in the Armington model, compared with only $1.26 per ton in the spatial equilibrium model. The spatial equilibrium model showed that the Canadian coarse grain price fell by $0.19 per ton because Canada shipped on more costly routes. In contrast, the Armington model showed an $8.05-per-ton increase in Canadian coarse grain prices. While the spatial equilibrium model predicted a price decline for wheat and a slight increase in the price of coarse grains for Australia, the Armington model showed increases of $13.60 per ton and $10.23 per ton for wheat and coarse grains. In both models, Argentina

charged higher prices for both grains in response to the U.S. sales suspension. But in the Armington model, price increases were larger: $18.55 per ton for wheat and $31.54 per ton of coarse grains in scenario 1.

If the U.S. action reduced total USSR grain imports, then price increases of the major competitors were moderated. For scenario 3, where Soviet import demand was 11 million tons lower, the Argentine price increased only $10.27 per ton for wheat and $7.74 per ton for coarse grains because the U.S. embargo lowered world import demand. Similar patterns were obtained for the other major competitors. In scenario 3, for instance, the Canadian wheat price fell by $1.60 per ton, and the coarse grain price rose by only $4.35 per ton.

For most importing countries, except for the USSR, the spatial equilibrium model predicted price declines. The Armington model, however, showed import price increases, except in scenario 3. This result was obtained because the assumption of imperfect substitutability limited the extent to which importing countries could shift supplies. This assumption also limited the ability of exporting countries to redirect their grain shipments.

In scenario 1, where Soviet import demand was unaffected, both models predicted that the Soviets would pay more for grain. The Armington model results showed Soviet wheat prices rising by $4.92 per ton and coarse grain prices increasing by $4.99 per ton. These price increases were slightly greater than those obtained by the spatial equilibrium model. When Soviet import demand was affected, the import price increases were smaller and, in scenario 3, the import price fell. The spatial equilibrium results predicted price declines for Soviet import prices under both scenarios 2 and 3.

Effects on U.S. Trade

Table 11.12 shows the changes in U.S. wheat and coarse grain trade flows and total exports

Table 11.12--Changes in U.S. wheat and coarse grain trade flows due to the 1980 U.S. sales suspension, Armington model

Country	Base	Scenario 1/		
		1	2	3
		Million tons		
Wheat:				
Eastern Europe	2.294	0.397	0.403	0.423
USSR	1.807	-5.803	-6.131	-7.226
China	6.353	.911	.918	.943
Other Central America	.953	.229	.225	.209
Brazil	1.786	.563	.550	.504
Other South America	2.484	.463	.456	.434
Egypt	1.440	.329	.332	.339
North Africa	1.429	.254	.257	.267
Indonesia	.819	.275	.274	.274
Middle East	1.158	.262	.268	.274
Total	35.659	-1.031	-1.340	-2.372
Coarse grains:				
Other Western Europe	6.225	.139	.249	.601
Japan	14.943	1.108	1.210	1.556
Eastern Europe	6.706	.201	.258	.443
USSR	4.017	-4.419	-5.960	-10.984
Brazil	1.592	.134	.128	.130
East Asia	2.106	.245	.276	.379
Middle East	1.596	.259	.282	.362
Total	62.816	-1.890	-2.890	-6.280

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentine-Soviet grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons.

due to the U.S. embargo using the Armington model. As with the price changes, the introduction of imperfect substitutability tended to increase the magnitude of the trade adjustments. The structure of the Armington model also allowed for a greater diversity of trade flow adjustments than did the spatial equilibrium results.

Results obtained from the Armington model showed that the U.S. sales suspension lowered U.S. wheat exports between 1.031 million tons (scenario 1) and 2.372 million tons (scenario 3). The corresponding range obtained using the spatial equilibrium model was a reduction of 194,000 tons in scenario 1 and a loss of 1.635 million tons in scenario 3. For coarse grains, total U.S. exports declined between 1.89 million (scenario 1) and 6.28 million tons (scenario 3). The range for the loss in U.S. coarse grain exports in the spatial equilibrium model was 143,000 to 4.714 million tons.

Predicted changes in the regional trade patterns were similar in both models, except that the magnitudes differed and the Armington model structure allowed for a greater number of trade flow adjustments. Because of the embargo, the United States shifted grain originally destined for the USSR to other sources. U.S. wheat exports to the USSR fell between 5.8 and 7.2 million tons, while coarse grain shipments were 4.4 to 11.0 million tons lower. Both models showed increases in U.S. exports to Eastern Europe because of the embargo. But, while the spatial equilibrium model predicted the bulk of the diverted grain moving to Eastern Europe, the Armington model suggested a smaller increase in U.S. sales to that market. The spatial equilibrium model routed the remaining displaced grain to China, Brazil, Other Southeast Asia, and Other South America. The Armington model also increased U.S. exports to these markets but sent much of the quantities which the spatial equilibrium model diverted to Eastern Europe to North Africa, Indonesia, the Middle East, and East Asia as competitors diverted supplies to the USSR.

A major difference between the results of the two models for coarse grains was that the Armington model increased U.S. exports to Other Western Europe and Japan. The Japanese purchased between 1.1 and 1.5 million tons of additional coarse grains from the United States because of the embargo. Other Western Europe purchased up to an additional 601,000 tons from the United States.

Effects on Trade for the Major Competitors

Tables 11.13-11.15 show the changes in wheat and coarse grain trade flows and total exports for the major competitors predicted by the Armington results. Compared with results of the spatial equilibrium model, changes in total exports in the Armington model were of a larger magnitude and there was more rerouting of regional trade due to many small changes rather than a few large changes. The small changes in trade flows occurred because large price changes were needed to redirect trade flows in the Armington model. In the Armington model, diverting exports to the USSR by major competitors allowed the expansion of U.S. exports to non-USSR markets, as shown in table 11.12.

If Soviet import demand for grain was unaffected by the U.S. sales suspension, then the Armington model yielded an increase in Canadian exports of 285,000 tons of wheat and 657,000 tons of coarse grains (table 11.13). In the scenarios which assumed that the U.S. action reduced Soviet imports by 3 and 11 million tons (scenarios 2 and 3), the increase in Canadian exports was less. In scenario 2, Canada expanded wheat exports by 203,000 tons and increased coarse grain exports by 586,000 tons. In scenario 3, Canada expanded coarse grain exports by 354,000 tons, but the reduction in global import demand due to the U.S. embargo was so strong that Canadian wheat exports were 70,000 tons lower because of the U.S. action.

The spatial equilibrium model results suggest that the U.S. embargo diverted Canadian grain from Eastern Europe to the USSR. Because the reduction of Canadian wheat sales to Eastern Europe exceeded the increase in sales to the USSR, Canada expanded shipments to North Africa and the Middle East. The Armington model trade flow results were considerably different. The increase in Canadian sales to the USSR was considerably less: For scenario 1, an increase of 1.016 million tons in the Armington model compared

Table 11.13--Changes in Canadian wheat and coarse grain trade flows due to the 1980 U.S. sales suspension, Armington model

Country	Base	Scenario 1/		
		1	2	3
		Million tons		
Wheat:				
Eastern Europe	1.314	-0.148	-0.127	-0.057
USSR	5.188	1.016	.840	.255
China	2.694	-.212	-.185	-.096
Other	8.848	-.371	-.325	-.172
Total	18.044	.285	.203	-.070
Coarse grains:				
Japan	.778	-.271	-.282	-.315
Eastern Europe	.195	-.021	-.020	-.017
USSR	1.502	1.141	1.072	.845
Other	1.601	-.193	-.184	-.159
Total	4.076	.657	.586	.354

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons.

Table 11.14--Changes in wheat and coarse grain trade flows for Australia/ New Zealand due to the U.S. sales suspension, Armington model

Country	Base	Scenario 1/		
		1	2	3
		Million tons		
Wheat:				
Japan	0.996	-0.122	-0.122	-0.123
USSR	3.394	2.242	2.193	2.028
China	2.030	-.532	-.525	-.499
Egypt	1.733	-.256	-.249	-.227
Other Southeast Asia	.504	-.255	-.251	-.240
East Asia	.255	-.222	-.219	-.210
Middle East	2.261	-.334	-.324	-.292
Other	1.159	-.393	-.388	-.367
Total	12.332	.128	.115	.070
Coarse grains:				
Japan	1.471	-.714	-.722	-.748
USSR	1.244	1.194	1.185	1.154
East Asia	.234	-.140	-.138	-.129
Middle East	.421	-.146	-.143	-.130
Other	.492	-.114	-.110	-.100
Total	3.862	.080	.072	.047

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons.

with 2.835 million tons in the spatial model. For scenario 3, the Armington model yielded only a 255,000-ton increase versus 2.393 million tons in the spatial model. The Armington model showed a slight decrease in grain sales to Eastern Europe: 148,000 tons of wheat and 21,000 tons of coarse grains. Results in table 11.13 suggest that, in contrast to the spatial equilibrium results, Canada met the additional Soviet purchases by increasing total exports and by diverting exports from other markets, including China and Japan. Thus, the increases in Canadian exports to markets outside Eastern Europe shown in the spatial equilibrium model results were not obtained in the Armington model.

Similar differences between the two models were evident in the Armington model results for Australia/New Zealand (table 11.14). The U.S. sales suspension increased wheat exports by these nations from 70,000 tons in scenario 3 to 128,000 tons in scenario 1. The spatial equilibrium model results suggested no change in scenario 1 and a 66,000-ton decrease in scenario 3. Total coarse grain exports in the Armington model increased between 47,000 and 80,000 tons compared with a range of -40,000 to +7,000 tons in the previous results. Both models suggested diversion of wheat sales from China, but the Armington model results were smaller, around 500,000 tons. Unlike the spatial equilibrium model, the Armington model predicted increased sales of both wheat and coarse grains to the USSR. Wheat sales increased around 2 million tons while coarse grain sales grew around 1.2 million tons. Results in table 11.14 also suggested considerable diversion of exports from other markets in Japan, Asia, and the Middle East to the USSR.

Results of the models for Argentina were similar, but magnitudes of changes in trade flows were less in the Armington model results while the increase in total Argentine exports was greater. Total Argentine wheat exports rose between 35,000 and 65,000 tons for scenarios 3 and 1 (table 11.15). If Soviet import demand was unaffected by the U.S. sales suspension, Argentine coarse grain exports increased 631,000 tons. If Soviet import demand fell 11 million tons in response to the U.S. action, then Argentine coarse grain exports were only 155,000 tons higher.

Expansion of Argentine grain exports to the USSR was less in the Armington results. Wheat exports to the USSR increased between 1.2 and 1.4 million tons. Coarse grain exports to the USSR increased 233,000 tons if Soviet imports fell 11 million tons, but Argentine

Table 11.15--Changes in Argentina's wheat and coarse grain trade flows due to the 1980 U.S. sales suspension, Armington model

Country	Base	Scenario 1/		
		1	2	3
		Million tons		
Wheat:				
USSR	2.505	1.418	1.372	1.220
China	.667	-.242	-.233	-.202
Brazil	.984	-.549	-.537	-.496
Other South America	.553	-.462	-.447	-.398
Other	.236	-.100	-.097	-.089
Total	4.945	.065	.058	.035
Coarse grains:				
USSR	2.952	.959	.759	.233
Eastern Europe	.022	-.012	-.009	-.003
Brazil	.102	-.113	-.087	-.031
Other	.608	-.203	-.151	-.044
Total	3.684	.631	.512	.155

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons.

coarse grain exports to the USSR increased by 959,000 tons if total Soviet demand was not shifted by the U.S. embargo. These additional exports to the Soviet Union were obtained at the expense of exports to South America, especially Brazil. Diversion of trade flows by Argentina and other exporters to the USSR provided the markets into which the United States exported grain originally intended for the USSR.

Changes in Soviet Purchase Patterns

Changes in Soviet purchases due to the 1980 U.S. sales suspension as predicted by the Armington model are shown in table 11.16. As expected, U.S. sales of wheat and coarse grains to that market dropped sharply. U.S. wheat exports to the USSR were between 5.8 and 7.2 million tons lower, while coarse grain exports were reduced between 4.4 and 11 million tons. Soviet purchases from Australia/New Zealand increased the most in response to the U.S. action, about 2 million tons of wheat and 1.2 million tons of coarse grains. For wheat, Argentina showed the next largest increase in supplies to the Soviets, 1.4 million tons in scenario 1 and 1.2 million tons in scenario 3. Canada had the second largest increase in exports of coarse grains, between 845,000 and 1.14 million tons. The increase in Canadian wheat exports to the USSR was sensitive to the choice of scenario. In scenario 1, where the Soviet import demand for grain was unaffected by the embargo, Canadian exports rose 1.016 million tons. Scenario 2, where Soviet import demand was 3 million tons lower, yielded an increase in Canadian wheat exports of 840,000 tons. If Soviet import demand was reduced 11 million tons by the U.S. sales limits, then the increase in Canadian wheat exports was only 255,000 tons. In contrast to the case of Canada, the institutional structure of the EC, which yielded a perfectly inelastic excess supply, meant that EC wheat exports to the USSR rose about 1 million tons in each scenario.

Table 11.16 indicates increased imports of coarse grains from the EC, Other Western Europe, and Thailand. Combined, these nations supplied an additional 650,000 tons of coarse grain to the USSR. This diversification of Soviet coarse grain imports was not

Table 11.16--Changes in wheat and coarse grains trade flows for the USSR due to the 1980 U.S. sales suspension, Armington model

Country	Base	Scenario 1/		
		1	2	3
		Million tons		
Wheat:				
United States	1.807	-5.803	-6.131	-7.226
Canada	5.188	1.016	.840	.255
EC	1.010	.995	.994	.992
Other Western Europe	0	0	0	0
Australia/New Zealand	3.339	2.187	2.138	1.973
Argentina	2.505	1.418	1.372	1.220
Total	13.904	.131	-.731	-2.731
Coarse grains:				
United States	4.017	-4.419	-5.960	-10.984
Canada	1.502	1.141	1.072	.845
EC	.346	.095	.047	-.115
Other Western Europe	.319	.287	.280	.260
Australia/New Zealand	1.244	1.194	1.184	1.154
South Africa	0	0	0	0
Argentina	2.952	.959	.759	.233
Thailand	.280	.268	.266	.258
Total	10.659	-.476	-2.351	-8.351

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons.

suggested by the spatial equilibrium model results which suggested increased reliance on Canada and Argentina in response to the U.S. sales suspension.

Introduction of the imperfect substitutability assumption of the Armington approach also caused a larger decline in total Soviet imports. In scenario 1, the Armington model predicted declines in Soviet wheat and coarse grain imports of 131,000 and 476,000 tons. Corresponding results from the spatial equilibrium model were 45,000 and 93,000 tons.

Changes in Trade Value

Because both the price changes and the changes in total trade were greater when imperfect substitution was introduced into the model, the changes in trade value shown in table 11.17 were greater. Spatial equilibrium model solutions yielded losses in U.S. export revenue of between $98 million and $1.62 billion. Armington model results showed larger U.S. export revenue losses of $756 million, if USSR import demand was unaffected, and $2.23 billion when USSR imports were reduced 11 million tons. In both models, U.S. export revenue losses increased substantially when total USSR grain imports were reduced. Except for the magnitude of the losses, the only difference between the two models was that in scenario 1 the Armington model predicted a larger loss in coarse grain exports than it did for wheat. This situation was the reverse of results for scenario 1 in the spatial equilibrium model.

The Armington model export revenue results for the major competitors show export revenue gains in all scenarios (table 11.17). In the spatial equilibrium results, Canada and Australia suffered losses in scenarios 2 and 3

Table 11.17--Changes in trade value for wheat and coarse grains for selected countries due to the 1980 U.S. sales suspension, Armington model

Country	Base	Scenario 1/		
		1	2	3
		Million tons		
United States: 2/				
Wheat	6,159.5	-360.8	-471.1	-845.3
Coarse grains	8,122.0	-395.5	-624.8	-1,386.3
Total	14,281.5	-756.3	-1,096.0	-2,231.6
Canada: 2/				
Wheat	3,207.0	165.9	118.8	-41.9
Coarse grains	544.5	115.3	103.3	63.5
Total	3,751.5	281.2	222.1	22.1
Australia/New Zealand: 2/				
Wheat	2,168.3	188.5	168.8	102.8
Coarse grains	499.7	49.0	44.3	29.3
Total	2,668.0	237.5	213.1	132.0
Argentina: 2/				
Wheat	894.1	102.2	91.9	56.8
Coarse grains	465.2	175.9	146.0	46.9
Total	1,359.3	278.1	237.9	103.7
USSR: 3/				
Wheat	2,744.7	43.1	-96.1	-575.0
Coarse grains	1,602.8	-16.0	-320.3	-1,339.2
Total	4,347.5	27.1	-416.4	-1,914.2

1/ Scenario 1 compares the solution with the U.S. embargo to a solution which removes the U.S. sales limits, removes the Argentina-USSR grain agreement, and assumes Soviet import demand is unaffected. Scenarios 2 and 3 consider the impact of the U.S. embargo when Soviet grain imports are reduced 3 and 11 million tons.
2/ Export revenue change.
3/ Import cost change.

while Argentina suffered a loss in total export revenue in scenario 3 due to a large loss in revenues on coarse grain exports (table 11.9). In the Armington model, Canada increased export earnings between $281 million (scenario 1) and $22.1 million (scenario 3). The declining pattern of export revenue gains was caused by the fall in world import demand due to effects of the U.S. sales limits on total Soviet grain imports. Export revenue gains for Australia/New Zealand ranged between a high of $238 million if USSR import demand was unaffected (scenario 1) to a low of $132 million when USSR import demand was 11 million tons lower (scenario 3). The U.S. sales suspension allowed Argentina to charge a higher price and export a larger quantity, thereby increasing Argentina's export revenues between $104 million and $278 million.

Estimates of the effects of the U.S. sales suspension on USSR import costs by both models were similar. When USSR import demand for grain was unaffected by the U.S. embargo, the Soviets spent more for wheat imports and less for coarse grain imports. Total import costs were $27 million higher. In the scenario where USSR import demand was reduced 3 million tons, import costs were $416 million lower as world demand fell. In scenario 3, where Soviet imports are 11 million tons lower, the USSR saved $1.9 billion in import costs.

CONCLUSIONS

This chapter analyzed impacts of the U.S. suspension of grain sales to the USSR in 1980 using three different modeling approaches. According to the spatial equilibrium model if Soviet import demand was unaffected, U.S. wheat and coarse grain prices of $173.88 and $130.26 per ton were $0.94 and $0.19 per ton lower. U.S. total wheat exports of 35.896 million tons were 194,000 tons lower due to the embargo, and total U.S. coarse grain exports of 63.542 million tons were 143,000 tons lower. The loss in U.S. export earnings was $98 million on a base of $14.52 billion, or 0.6 percent.

For the same scenario, introduction of imperfect substitution in the Armington model suggested larger impacts. U.S. wheat prices fell $4.98 per ton and exports were 1.031 million tons lower. U.S. coarse grain prices were $2.44 per ton lower while exports fell 1.89 million tons. Total loss in export earnings in this instance was estimated at $756 million, or 5.2 percent.

If Soviet total grain imports were adversely affected, effects on the United States were larger. If the Soviets reduced imports of grain by 3 million tons in aggregate, the U.S. wheat price using the spatial equilibrium model was $2.70 per ton lower as the price fell from $176.58 to $173.88 per ton and U.S. exports were 559,000 tons lower. In this case, the U.S. coarse grain price was $1.85 per ton lower and U.S. exports were reduced by 1.4 million tons. The Armington model predicted larger changes for a 3-million-ton decline in Soviet imports.

The largest impacts occurred if the Soviets reduced total grain imports by 11 million tons. The spatial equilibrium model suggested that the U.S. wheat price of $173.88 per ton was $7.90 per ton lower and the coarse grain price of $130.26 per ton was $6.24 per ton lower in this scenario. U.S. wheat exports were reduced 1.635 million tons to 35.896 million tons while U.S. coarse grain exports fell 4.714 million tons to 63.542 million tons. The Armington model predicted that the U.S. wheat price fell by $11.45 per ton, and the U.S. coarse grain price fell by $8.31 per ton. U.S. wheat and coarse grain exports were 2.372 and 6.280 million tons lower.

Trade flow results in the spatial equilibrium model suggest that the United States shifted its exports from the USSR to Eastern Europe and Latin America. Canada diverted its exports from Eastern Europe to the USSR, while Argentine exports to the USSR would have competed with U.S. grain in Latin America. Trade flow results for the Armington model suggest a more diversified reshuffling of U.S. flows and a smaller increase to Eastern Europe.

If Soviet import demand was unaffected by the U.S. policy, then the major U.S. competitors, especially Canada, benefited. In the spatial equilibrium model, if the U.S. sales suspension lowered Soviet imports, then the major competitors suffered, with the exception of Argentina. In contrast, the Armington model results suggested gains in export revenue for all major competitors in all scenarios.

Using a price discrimination model, the analysis considered several alternative forms of behavior for Argentina. If Argentina was allowed to price discriminate in response to the embargo, the results suggested little market power to exploit, especially in the wheat market. Rather the gain to Argentina from the U.S. embargo lay in its signing of the bilateral grain agreement with the USSR which allowed Argentine entry into that market.

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APPENDIX

MODELING FRAMEWORKS USED TO ANALYZE THE 1980 U.S. EMBARGO

Spatial Equilibrium Model

The spatial equilibrium model is primarily concerned with explaining trade flows between countries and how those flows adjust to exogenous policy shocks on the basis of differences in transportation costs (*10*). The model assumes the world market consists of m exporting regions and n importing regions separated by distance--spatial separation. Countries are assumed to behave competitively in the international market and trade homogeneous commodities; that is, the commodity, say wheat, exported by the United States is a perfect substitute for wheat exported by Canada. Policies and transportation costs are included in the model as exogenous variables. Net trade models relating imports or exports by a country or region to its border price (international market price) summarize trading behaviors, which may be subject to domestic interventions. Prices and trade flows are the solution variables of the spatial equilibrium model. For simplicity, all prices and transportation costs are quoted in terms of a common currency (the U.S. dollar); hence, exchange rate effects are included prior to construction of the model. Further, this exposition of the model first considers only a single commodity; however, the empirical model analyzes two goods. (Net trade models are simply modified to include cross-price substitution effects.)

The behavioral equations for internal demand, supply, and stocks adjustment in the m exporting regions may be expressed as a function of the domestic price in the exporting region, P^d_i i = 1, ..., m. These relations are:

Demand: $D_i = D_i(P^d_i); \quad i = 1, ..., m$ (1)

Supply: $S_i = S_i(P^d_i); \quad i = 1, ..., m$ (2)

Stocks adjustment: $Q_i = Q_i(P^d_i) \quad i = 1, ..., m$ (3)

The behavioral equations in the n importing regions are treated in a similar manner where P^d_j is the price of the commodity in importer j.

Demand: $D_j = D_j(P^d_j); \quad j = 1, ..., n$ (4)

Supply: $S_j = S_j(P^d_j); \quad j = 1, ..., n$ (5)

Stocks adjustment: $Q_j = Q_j(P^d_j); \quad j = 1, ..., n$ (6)

As the international market equilibrates international prices, and since government policy interventions may separate movements of domestic and international prices, a relationship between domestic and international prices needs to be specified:

$$P^d_i = P^d_i(P^*_i) \quad (7)$$

where P^*_i is the border price at exporter i's (importer j's) border. The elasticity of price transmission introduced by Bredahl, Meyers, and Collins will be used to implement this relationship (*3*). Furthermore, equation (7) is substituted into (1)-(6) so that domestic demand, supply, and stocks adjustment depend upon the international price through its transmission into domestic prices. For the exporting countries, exports (X_i) are given by the difference between supply and demand plus stocks adjustment. Thus, subtracting ((1) plus (3)) from (2) gives each each exporter's excess supply function:

$$X_i = X_i(P^*_i) = S_i(P^d_i(P^*_i)) - D_i(P^d_i(P^*_i)) - Q_i(P^d_i(P^*_i)); \; i = 1, \ldots, m \tag{8}$$

Excess demand (M_j) by the importing countries is obtained by subtracting supply (5) from demand (4) plus stocks adjustment (6):

$$M_j(P^*_i) = D_j(P^d_j(P^*_j)) + Q_j(P^d_j(P^*_j)) - S_j(P^d_j(P^*_j)); \quad j = 1, \ldots, n \tag{9}$$

The trade flow from exporter i to importer j is denoted X_{ij} and has a transportation cost of T_{ij} which separates prices in the two regions. For each exporter the sum of purchases by importers must equal total exports. Hence:

$$X_i = \sum_{j=1}^{m} X_{ij}; \quad i = 1, \ldots, m \tag{10}$$

Similarly, for each importing country, total purchases must equal the sum of purchases from all exporters:

$$M_j = \sum_{i=1}^{m} X_{ij} \; ; \quad j = 1, \ldots, m \tag{11}$$

For a competitive international market, prices are linked across countries by transportation costs (T_{ij}) and policy interventions (S_{ij}).

$$P^*_j \leq T_{ij} - S_{ij} + P^*_i \tag{12}$$

$$(P^*_j - T_{ij} + S_{ij} - P^*_i) X_{ij} = 0 \tag{13}$$

That is, equation (12) states that no cheaper source be available to an importer than those on which its price is based, and flows occur only from the cheapest exporter to an importer. The inequality of (12) implies that some exporters may not be competitive in some import markets; their prices after transport charges and interventions are added are too high. Those exporters do not supply the markets where they are not competitive, as shown by equation (13).

Schmitz and Bawden (*10*), Shei and Thompson (*11*), and others solve for the competitive international equilibrium corresponding to the solution of equations (8)-(13) through the use of a quadratic programming algorithm maximizing consumer plus producer surplus. Holland and Sharples (*7*) have developed an alternative method based on the fixed point algorithm of McKinnon (*9*), which directly solves equations (8)-(13). The advantage of their approach is its reliability in generating a solution, its flexibility in specifying functional forms for equations (8) and (9), and the existence of software which can be used both to implement this model and the Armington model structure (to be explained subsequently).

Equations (8)-(13) then constitute the basic structure of the spatial equilibrium modeling framework. This framework is well-designed to analyze the effects of a partial (targeted) embargo such as occurred in 1980. That embargo restricted a particular trade flow (that between the United States and the USSR) to a maximum quantity. This constraint can be added to the model by including an additional constraint that a given trade flow (say X_{11}) is less than or equal to a given tonnage, R (see *11*):

$$X_{11} \leq R \tag{14}$$

Since the observed data for 1980 includes the effect of the U.S. sales suspension, the base solution includes constraint (14), while scenarios analyzing the effect of the embargo consist of removing the constraint under a variety of circumstances.

Additional constraints of a form similar to (14), but expressed as less than or equal to constraints, are also specified to represent bilateral agreements when setting minimum trade flows. The base model includes several bilateral agreements which were in place in 1980. The conceptual framework discussed above considers only a single commodity, but other commodities were included in the embargo as well. Extensions of the framework to consider multiple commodities is straightforward. Cross-price elasticities are included in the behavioral functions and the objective function is expanded to capture the welfare effects from the additional commodities. Equations (8) and (9) simply become:

$$X^k_i = X^k_i(P^{i*}_i, ..., P^{k*}_i); \quad i = 1, ..., m \tag{15}$$

$$M^k_j = M^k_j(P^{i*}_j, ..., P^{k*}_j); \quad j = 1, ..., n \tag{16}$$

where X^k_i is net exports by country i of commodity k,

M^k_i is net imports by country i of commodity k, and

P^k_i is the border price of commodity k.

A set of equations similar to (10)-(13) are then specified for each commodity. Bilateral agreements and embargo restrictions as in (14) above, are also included for each commodity. This chapter's empirical analysis considers two commodities: Wheat and coarse grains.

Armington Model

The spatial equilibrium model assumes that the commodities exported are perfect substitutes for one another from the importer's viewpoint. Thus, the law of one price holds for the spatial model. However, there is evidence that commodities of the same category may not be perfect substitutes. Trade is frequently conducted via long established historical, cultural, and political interactions. Commodities vary by quality, nutritional characteristics, and milling characteristics. In practice, the law of one price is not always observed to hold.

A model which recognizes that commodities may be imperfect substitutes was developed by Armington and has been used to analyze world grain trade (*4, 5*). The approach used by Armington is to treat the importer's utility function as separable and introduce a two-stage maximization process as presented by Strotz (*12*). In the first stage, the total level of imports of a commodity by the importer is determined. Subsequently, the total level of imports is allocated to specific exporting countries, where each trade flow is viewed as a separate commodity. These exporter specific commodities are treated as imperfect substitutes.

The exporter behavioral relations and the price linkages are the same as discussed for the spatial equilibrium model. Modifications in the model occur in importer behavior. Initially, the importer is assumed to have a utility function which is separable into branches of commodities, M^k_j, where j denotes the country and k denotes the branch. This function is maximized subject to a total income constraint. The result is to give demand for each branch as a function of indices of prices of goods in that branch and other branches:

$$M^k_j = M^k_j (P^1_j, ..., P^s_j, Y_j); \quad k=1, ..., s \tag{17}$$

where P^k_j is the price index for branch k, and Y_j denotes country j's total expenditure. This is essentially the net import demand function (equation (15)) used in the spatial model, assuming that the resulting trading behavior is the outcome of a utility maximization process, and replacing border prices for commodities with the broad price indices. The second stage maximizes the utility obtained from each branch subject to the total branch allocation constraint given by (17):

$$X^k_{ij} = X^k_{ij} (P^k_{ij}, ..., P^k_{mj}, M^k_j) \tag{18}$$

where X^k_{ij} is the trade flow for commodity k from exporter i to importer j. Hence, it provides an alternative model for explaining trade flow patterns consistent with an overall import demand level, M^k_j.

For a large number of exporting and importing countries, equations (17) and (18) contain too many parameters for an operational model. To simplify the model, Armington introduces two assumptions. The elasticities of substitution in each market are assumed to be constant and the elasticity of substitution between any two products in a particular market is identical to that between any other pair in that same market. These assumptions mean that constant elasticity of substitution functions are imposed on importers; hence, the specific form of (18) used in the model is:

$$X^k_{ij} = M^k_j b_{ij} (P^k_{ij}/P^k_j)^{-\sigma j}; \quad j = 1, ..., n \tag{19}$$

where sj is the constant elasticity of substitution in country j and b_{ij} is a country-specific constant. Furthermore, the branch price index, P^k_j, is specified according to the following relationship:

$$P^k_j = \sum_{i=1}^{m} X^k_{ij} P^k_{ij} / \sum_{i=1}^{m} X^k_{ij} \tag{20}$$

The price index is merely the average price for imports paid by j.

To facilitate model comparisons, it is assumed that the first stage determination of total imports of branch k and the net import demand functions of the spatial equilibrium model are identical. The differences in the two models then are in the treatment of the trade flow patterns. Equation (13), which insured that imports were supplied by the cheapest source, is replaced by equations (19) and (20), the Armington "constant elasticity of substitution" model of determination of trade flow patterns.

In the spatial equilibrium model, trade flows are explained solely by transportation costs. In the Armington framework, each trade flow is explained by a behavioral function which includes the imperfect substitutability of the goods supplied by competing exporters via σj. As the elasticity of substitution increases, the goods tend toward becoming more substitutable, and the Armington model approaches the spatial equilibrium model structure. As the elasticity of substitution falls toward zero, the trade flows become more individual, separate goods.

The effect of the U.S. sales suspension can be analyzed by separating the U.S.-USSR trade flow data into two periods. The first period, prior to 1980, can be used to determine the demand for U.S. grain by the USSR if the embargo had not occurred. This function captures the behavior of the Soviets prior to the embargo. A second function which includes the embargo years can be estimated. This data includes the constraint on U.S.-Soviet trade caused by the embargo. Solution of the model with the two different behavioral equations for the USSR gives estimates of the consequences of U.S. actions.

Price Discrimination Model

Both models discussed assume the international market is essentially competitive on the export side, with policy exogenously determined. Yet large countries with market power can intervene in trade and, thereby, capture rents from other countries. Thus, when the United States imposed a restriction on the flow of exports to the USSR, other countries may have the incentive to adopt pricing policies through taxes or subsidies to exploit the U.S. action. In particular, Argentina is rumored to have exploited the U.S. embargo. The price discrimination model presented here is designed to investigate the reaction of competitor countries to the U.S. action.

Price discrimination can be introduced into the spatial equilibrium model by allowing a competitor to determine a trade intervention endogenously in the model. Policy instruments (S_{ij}'s) become endogenous variables to the model, set to maximize some objective of the price discriminating exporter. An explicit objective function must be set for that exporter, which is maximized by varying its policy instruments, subject to the behavior of the international market, as given by equations (8)-(14) of the spatial model. An individual country has several possible objectives for policy. Maximization of economic surplus, export revenue, export volume, or farmer income are possible objectives. For an exporting country, with some reasonable assumptions, each of these measures can be expressed as a monotonically increasing function of the border price--$F(P^*_i)$. For example, if the country's objective is to maximize export revenue then:

$$F(P^x_i) = P^x_i \, X_i(P^x_i) \tag{21}$$

Because the introduction of the trade intervention shifts rents between countries through explicit price discrimination, the country's objective function must include such returns--$S_{ij}X_{ij}$ where S_{ij} is the policy intervention by exporter i on trade to importer j. Hence, the objective function is given by:

$$Z = F(P^x_i) - \sum_{j=1}^{n} S_{1j}X_{1j} \tag{22}$$

where exporting country 1 is assumed to set an optimal pattern of trade interventions, S_{ij}, j = 1, ..., n, according to the function $F(P_1)$. A complete discussion of the case of countries setting targeted export subsidies is presented by Abbott, Paarlberg, and Sharples (*1*). They show that maximization of equation (22) subject to the equations of the spatial equilibrium model (8) and (13) gives the optimal intervention rule for exporting country 1:

$$S_{1j} = -e_1 + m_j \tag{23}$$

Specifically, the first term is given by:

$$e_1 = (1/(\partial X_1/\partial P^*_1))\ (-\partial F/\partial P^*_1 + X_1(P^*_1)) \tag{24}$$

For a strongly increasing benefit from an increase in exporter 1's border price, e_1 is negative. There is a benefit from increased exports and revenues. If economic surplus is the objective, the second term dominates the first, and e_1 is positive as would be the case for an export tax.

The specification of m_j depends on the characteristics of the exporting country's trade. If exporter 1 is the sole supplier to country j, then:

$$m_j = X_{1j}/(\partial P_j/\partial P^*_j) \tag{25}$$

In this case, m_j is always negative. The optimal policy will tend to be a tax, unless the market in j is very elastic. When the market is shared with another exporter and if the competitor supplies only that market, then m_j becomes:

$$m_j = X_{1j}/(\partial M_j/\partial P^*_j - \partial X_i/\partial P^*_i) \tag{26}$$

Thus, a market appears more elastic if it is shared with a competitor (country i), because changes in exporting country 1's policy cause price changes in the importer which, in turn, cause changes in the competitor. If the competing exporter (exporter i) supplies another market not shared with exporter 1 (country k) the price responsiveness facing country 1 is further increased by country i's ability to expand into that other market. In this instance m_j is given by:

$$m_j = X_{1j}/\partial M_j/\partial P^*_j - \partial X_i/\partial P^*_i + \partial M_k/\partial P^*_k) \tag{27}$$

Optimal policy intervention is given by the above rules. The first principle arising from these results is that a price discriminating monopolist will target the largest export taxes to the most inelastic markets and the largest export subsidies to the most elastic markets. For the case of one import market, Abbott, Paarlberg, and Sharples (*1*) show that this result corresponds to the optimal export tax, which is based on the same principle. Price discrimination will allow subsidies to be optimal for very elastic markets when there is a wide range of observed importer elasticities. These results also highlight the role of competing exporters and of shared markets in determining the elasticity in a given market. In the case of the markets examined here, price-responsive behavior on the part of competing exporters represents a significant source of elasticity which must be taken into account in setting tax or subsidy levels. Exploitation of transport costs and spatial separation, to drive competitors out of markets and price wedges between exporter prices (collect premiums), also depends on the spatial, competitive structure of the remainder of the market.

Abbott, Paarlberg, and Sharples (*1*) use this framework to analyze targeted export subsidies by the United States for wheat using 1979/80 as a base year. Their results suggest that the United States increases its welfare if U.S.-USSR wheat trade is subsidized because the subsidy is necessary to defend the Soviet market from competitors. The imposition of the sales suspension is an implicit tax on that trade flow; thus, it should be welfare-reducing. Further, taxing a flow which should be subsidized opens the Soviet market to other exporters which can adopt policies to exploit the implicit U.S. tax on Soviet trade.

Appendix table 11.1--Linear net import (export) function parameters for regions in the spatial equilibrium model

Region	Wheat			Coarse grains		
	dTw/dPw 1/	dTw/dPc 2/	Constant	dTc/dPc 2/	dTc/dPw 1/	Constant
United States	206.914	0.177	-105.9	755.200	0.301	-34,880.6
Canada	43.796	.045	10,253.9	81.551	.148	-6,843.4
EC	8.493	.019	7,602.9	-21.033	-.030	14,982.3
West Europe	-5.190	-.027	2,692.5	-108.345	-.057	23,442.2
Japan	-1.094	-.017	5,897.3	-65.430	-.003	27,897.6
Oceania	9.420	.006	10,674.7	7.790	.022	2,850.1
South Africa	-.145	-.017	40.9	9.405	.003	78.6
East Europe	-14.500	-.359	8,033.6	-51.513	-.695	16,993.1
USSR	-35.941	-.480	21,024.5	-100.496	-1.084	26,047.6
China	-31.484	0	18,237.5	0	-.514	1,837.5
Mexico	-4.128	-.079	1,535.9	-45.677	-.090	13,818.8
Central America	-1.203	-.010	2,343.4	-3.804	-.024	1,402.7
Brazil	-2.074	-.007	5,156.8	-9.352	-.049	3,254.2
Argentina	3.407	.044	4,323.5	19.975	.034	1,154.9
Venezuela	-1.337	-.003	984.5	-5.757	-.019	2,017.4
South America	-4.732	-.020	3,972.9	-11.550	-.135	3,311.2
Sub-Sahara	-2.636	-.072	2,833.7	-13.419	-.049	3,303.2
Nigeria	-.191	-.004	1,043.6	-6.923	-.016	1,294.4
Egypt	-4.585	-.345	6,214.9	-4.703	-.077	1,699.7
North Africa	-8.358	-.275	6,026.4	-69.174	-1.165	11,862.0
India	-1.171	0	297.7	0	-.007	275.4
South Asia	-8.495	0	4,403.0	0	-.038	26.0
Indonesia	-1.866	0	1,860.0	0	-.006	51.4
Thailand	-.222	0	219.0	3.703	.002	1,774.6
Southeast Asia	-2.637	-.051	1,866.7	-13.616	-.075	3,026.0
East Asia	-4.355	-.083	3,261.7	-25.492	-.189	6,973.1
Middle East	-14.964	-.063	8,127.7	-36.302	-.267	9,727.0
Rest of world	0	0	60.0	0	0	1,237.0

1/ The change in thousand tons of the commodity traded given a $1 per ton change in the wheat price.

2/ The change in thousand tons of the commodity traded given a $1 per ton change in the coarse grain price.

Appendix table 11.2--Wheat trade flows used in the Armington model

Importers	Exporters						Total imports
	United States	Canada	EC	Other Western Europe	Oceania	Argentina	
				1,000 tons			
EC	2,430.9	2,343.1	0	46.9	2.6	73.7	4,897.2
Other Western Europe	1,328.5	192.7	237.8	0	.3	.3	1,759.6
Japan	3,352.4	1,339.8	0	0	990.2	0	5,682.4
South Africa	9.7	0	0	0	0	0	9.7
Eastern Europe	2,352.7	1,325.6	1,471.2	0	0	0	5,149.5
USSR	1,807.4	5,204.0	981.4	0	3,386.3	2,505.4	13,884.5
China	6,368.0	2,668.4	134.3	0	1,997.8	665.7	11,834.2
Mexico	636.1	100.0	0	.1	0	0	736.2
Central America	968.2	894.8	121.0	0	0	128.3	2,112.3
Brazil	1,807.2	1,961.7	0	0	0	986.3	4,755.2
Venezuela	708.9	15.5	0	4.8	0	0	729.2
South America	2,487.3	0	18.5	0	0	548.4	3,054.2
Sub-Sahara	1,035.9	177.2	906.1	0.4	136.0	14.5	2,270.1
Nigeria	949.6	0	53.6	0	0	0	1,003.2
Egypt	1,481.0	21.7	1,977.5	2.5	1,748.9	0	5,231.6
North Africa	1,499.7	754.9	1,980.3	148.0	0	0	4,382.9
India	54.4	0	0	0	0	0	54.4
South Asia	1,806.4	252.2	329.2	0	255.5	0	2,643.3
Indonesia	829.6	0	7.0	0	645.5	0	1,482.1
Thailand	110.5	0.7	0	11.8	50.7	0	173.7
Southeast Asia	819.5	9.8	12.9	0	490.9	0	1,333.1
East Asia	2,048.1	64.5	4.2	0	247.4	0	2,364.2
Middle East	1,235.4	751.7	878.0	0	2,364.2	21.8	5,251.1
Rest of world	0	3.8	0	0	55.9	0	59.7
Total	36,127.4	18,082.1	9,113.0	214.5	12,372.2	4,944.4	

Source: (*8*).

Appendix table 11.3--Coarse grains trade flows used in the Armington model

Importers	Exporters								Total imports
	United States	Canada	EC	Other Western Europe	Oceania	South Africa	Argentina	Thailand	
				1,000 tons					
EC	10,311.9	660.4	0	113.4	53.70	335.5	506.4	2.6	11,983.9
Other Western Europe	6,205.3	59.4	1417.0	0	30.90	73.5	1.3	0	7,787.4
Japan	1,500.9	773.9	29.7	6.7	1,420.10	912.9	19.1	119.2	18,282.5
Eastern Europe	6,714.0	194.6	1871.9	256.9	0	0	20.8	21.0	9,079.2
USSR	4,017.0	1,553.7	351.3	326.4	1,274.80	0	2,952.0	284.1	10,759.3
China	1,583.0	0	0	0	20	0	0	130.4	1,733.4
Mexico	7,176.9	.7	.1	0	0	0	0	0	7,177.7
Central America	768.1	25.9	46.3	0	1.60	0	1.4	0	843.3
Brazil	1,636.7	0	70.1	17.8	82.20	0	98.2	0	1,905.0
Venezuela	1,073.5	12.4	84.7	2.6	.50	0	1.2	0	1,174.9
South America	1,263.2	96.6	36.0	0	180.20	0	29.1	0	1,605.1
Sub-Sahara	709.6	6.2	340.5	8.9	1.00	0	17.8	139.7	1,223.7
Nigeria	159.2	0	61.0	0	0	0	0	3.0	223.2
Egypt	954.5	.4	3.9	8.3	0	0	0	0	967.1
North Africa	499.6	71.2	408.6	21.6	1.60	0	0	0	1,002.6
India	274.2	0	0	0	0	0	0	0	274.2
South Asia	10.8	0	2.3	0	2.40	0	0	2.6	18.1
Indonesia	19.4	0	.3	0	10.60	0	0	20.0	50.3
Southeast Asia	234.0	88.0	12.2	0	115.40	0	0	512.3	961.9
East Asia	2,266.0	12.2	16.6	.1	238.90	2.3	0	484.4	3,020.5
Middle East	1,698.0	250.1	1,150.5	23.2	430.60	0	20.4	521.8	4,094.6
Rest of world	773.1	353.3	89.7	5.7	3.70	0	6.1	5.8	1,237.4
Total	63,348.9	4,159.0	5,992.7	791.6	3,868.20	1,324.2	3,673.8	2,246.9	

Source: USDA.

Appendix table 11.4--Constants in the Armington market share equations for wheat 1/

Importer	Exporters					
	United States	Canada	EC	Other Western Europe	Oceania	Argentina
EC	0.49191	0.48192	0	0.00988	0.00056	0.01568
Other Western Europe	.74981	.11029	.13944	0	.00018	.00018
Japan	.57305	.24916	0	0	.17807	0
South Africa	1.00000	0	0	0	0	0
Eastern Europe	.40777	.23631	.36680	0	0	0
USSR	0	.51335	.14403	0	.34879	0
China	.50616	.24624	.01624	0	.16139	.07393
Mexico	.81574	.19349	0	.00030	0	0
Central America	.37741	.45557	.09852	0	0	.08975
Brazil	.31897	.45727	0	0	0	.23144
Venezuela	.95803	.03274	0	.01302	0	0
South America	.76423	0	.01144	0	0	.23271
Sub-Sahara	.43508	.07124	.43473	.00018	.05467	.00583
Nigeria	.93972	0	.06059	0	0	0
Egypt	.27771	.00371	.37705	.00049	.34116	0
North Africa	.34504	.17149	.44987	.03362	0	0
India	1.00000	0	0	0	0	0
South Asia	.66427	.09881	.15985	0	.08110	0
Indonesia	.56731	0	.01047	0	.42418	0
Thailand	.61075	.00484	0	.13465	.26928	0
Southeast Asia	.60822	.00874	.02371	0	.36434	0
East Asia	.87658	.03691	.00366	0	.08626	0
Middle East	.22142	.13303	.15538	0	.48801	.00427
Rest of world	0	.06724	0	0	.93283	0

1/ Equation (19) in appendix, the Armington import demand equation, is converted into a market share equation to guarantee consistency among exporting countries in each import market.

Appendix Table 11.5--Constants in the Armington market share equation for coarse grains 1/

Importers	Exporters							
	United States	Canada	EC	Other Western Europe	South Africa	Argentina	Oceania	Thailand
	1,000 tons							
EC	0.85808	0.05559	0	0.00951	0.00467	0.02861	0.04326	0.00022
Other Western Europe	.79559	.00769	.18287	0	.00409	.00956	.00017	0
Japan	.79150	.05480	.00231	.00054	.08290	.06137	.00141	.00830
Eastern Europe	.73618	.02134	.20928	.02817	0	0	.00244	.00262
USSR	0	.40127	.09545	.08700	.32924	0	0	.08760
China	.91526	0	0	0	.01127	0	0	.07348
Mexico	.99986	.00012	.00002	0	0	0	0	0
Central America	.89635	.03481	.06549	0	.00231	0	.00198	0
Brazil	.84820	0	.04255	.01046	.04849	0	.05089	0
Venezuela	.89731	.01332	.08637	.00257	.00052	0	.00112	0
South America	.76155	.06704	.02575	0	.12916	0	.01799	0
Sub-Sahara	.60780	.00493	.27453	.00678	.00077	0	.01236	.09465
Nigeria	.72728	0	.26231	0	0	0	0	.01084
Egypt	.99222	.00034	.00254	.00572	0	0	0	0
North Africa	.62436	.08354	.30099	.01591	.00231	0	0	0
India	1.00000	0	0	0	0	0	0	0
South Asia	.59697	0	.14526	0	.10455	0	0	.15664
Indonesia	.38569	0	.00829	0	.17767	0	0	.43237
Southeast Asia	.19453	.08556	.01620	0	.08442	0	0	.63820
East Asia	.78116	.00554	.00738	.00004	.05776	.00056	0	.15173
Middle East	.49007	.06777	.19572	.00395	.14380	0	.00503	.11787
Rest of world	.59394	.30794	.08234	.00509	.00290	0	.00490	.00441

1/ Equation (19) in appendix, the Armington import demand equation, is converted into market share equation to guarantee consistency among exporting countries in each import market.

CHAPTER 12

AN ANALYSIS OF THE U.S. GRAIN EMBARGO USING A QUARTERLY ARMINGTON-TYPE MODEL

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CHAPTER 12

AN ANALYSIS OF THE U.S. GRAIN EMBARGO USING A QUARTERLY ARMINGTON-TYPE MODEL*

The spatial equilibrium framework and the Armington framework (the two models discussed in Chapter 11) use a common structure to examine effects of the 1980 grain embargo. Both frameworks are static simulations of the effect of the embargo on trade in calendar year 1980. This chapter uses a quarterly, econometrically estimated, Armington-type trade flow model to simulate effects of the 1980 embargo over a 4-year period, from the first quarter of 1980 through the fourth quarter of 1983.

A quarterly Armington-type model has several advantages over the static Armington framework used in the previous chapter. As an econometric model, it allows us to conduct statistical tests on the trade parameters to determine their significance. The quarterly data permit us to analyze short-term effects, which is particularly valuable in tracing the dynamic longer term effects of the embargo. The evidence on price changes (Chapter 10) suggests that the effect in the first two quarters may have been significant but that these effects had evaporated by the middle of 1981. As a dynamic model, the quarterly Armington approach helps us determine whether or not the embargo effects persisted from the third quarter of 1981 through the fourth quarter of 1983, after the embargo was lifted.

A quarterly Armington model also has the same general characteristics of the static Armington model. It assumes that wheat, or any other primary commodity, is not homogeneous. Political, historical, and economic ties between trading partners as well as quality differences in the grain itself make wheat a nonhomogeneous good. As such, existing trade patterns reflect rigidities in bilateral trade flows which actually exist in the market. Critics say that, for some applications, the model gives too much emphasis to these rigidities. Validity of this criticism depends partly on the particular application and partly on how one perceives the way markets function; that is, whether markets are perceived as adjusting trade flows quickly to a given shock or whether markets are perceived as adjusting very slowly. Hence, the quarterly Armington framework provides a test of what the embargo effect would be if markets were not as quick to adjust to a change in a bilateral trade flow as is assumed in the spatial equilibrium model.

*Contributors to this chapter were Enrique E. Figueroa and Alan Webb.

DESCRIPTION OF THE ARMINGTON FRAMEWORK

The Armington framework is based on a two-stage, utility maximization process for each importer. In the first stage, the importer decides how much of a commodity (for example, wheat) to import. This stage defines the importer's import demand for wheat. Specification of this stage depends on the parameters normally included in import demand equations (importer country income, prices, domestic production, and other factors). The second stage of the process allocates sources from which the commodity is imported. This stage is a function of relative exporter prices, and it determines the market shares each exporter will have in each importing region. The two stages can be estimated separately.

The model, thus, can define both the total imports and bilateral flows. Researchers can then use the model to assess only total import changes, only flow changes, or both.

The embargo was a bilateral flow restriction on only one flow. However, a restriction on a bilateral flow may affect other flows, total exports, or total imports. Since the model has all exporters and importers, gainers and/or losers from the embargo can be identified.

The quarterly Armington framework can be used to address two issues. First, estimating the first- and second-stage equation parameters before and after the embargo provides statistical evidence of the effect of the embargo on trade. We wish specifically to identify two sets of trade effects, whether the embargo only induced a reallocation of trade flows or whether, in addition, individual

exporters gained or lost world market share (these are similar to the two sets identified in the time series analysis of Chapter 10).

The second issue addressed by the quarterly Armington framework is the magnitude of the trade impact and its persistence over time. For the United States, for example, we wish to know how much the embargo reduced U.S. exports (if at all) and if this change continued after the embargo was lifted in April 1981. A simulation using estimated parameters is used to address these issues.

Estimation of Model Parameters: Testing for Embargo Trade Effects

The embargo was in effect for six quarters: 1980-I through 1981-II. Our research uses quarterly data from 1970-I to 1983-IV. The pre-embargo period is 1970-I to 1979-IV; the post-embargo period is 1981-III to 1983-IV.

We used the same importers and exporters in this analysis as those used in the time series analysis (see table 10.3). A supplement to this report contains data sources and an explanation of how the trade flow series was constructed *(2)*.[1]

FIRST STAGE EQUATIONS

The first stage of the utility maximization process assumes the importer decides how much grain to import based on income level of the country, price of the good in question, price of competing goods, overall level of prices in the country, domestic production of the good, and other country-specific "shifter" variables. The Armington model assumes a price index can be generated for each good and that the price index is a function of the parameters of the second-stage equations and the elasticity of substitution.

Each importer arrives at this import decision independent of the other importers' decisions. We wanted to determine whether a country's import behavior changed after the embargo was imposed. Hence, we estimated three import demand functions for each importer. The first estimate for the entire period (1970-I through 1983-IV) assumes there is no difference in pre- and post-embargo import demand behavior. Estimation of the other two functions (one for 1970-I to 1979-IV and the other for 1980-I to 1983-IV) assumes that demand behavior has, in fact, changed.

First-Stage Results

Results of the three sets of import demand equations for both corn and wheat are shown in tables 12.1 to 12.6. All equations had the same general specification. In a world free of trade barriers, transportation costs, and domestic policy distortions, we would expect changes in wheat import demand to be directly related to changes in income and the corn price index and inversely related to changes in the wheat price index and production in the importing country. Expected signs on the Consumer Price Index and the seasonal dummy variables are ambiguous.

The 1980-83 estimates were based on only 16 observations (with 9 to 10 degrees of freedom). These estimates were not used in the simulation model. Estimated parameters were generally in the range of previous studies. Better estimates of centrally planned economies might be obtained if an appropriate quarterly income proxy were identified. (A population variable was considered but was not used because in the double-log form of the equations' estimates, it was highly collinear with the intercept.)

The trade-weighted import demand elasticity of all the wheat importers is -0.38 for 1971-79 and -0.93 for 1980-1983. World import demand became more responsive to changes in world prices after the embargo.

Domestic wheat production in the European Community (EC), Mexico, and the USSR significantly decreased wheat import demand. China is the only other country where production changes had a significant impact on imports, but China's import demand production elasticity was positive. This result was plausible because China's internal transportation structure makes it cheaper to import grain than to transport it internally.

The USSR import demand equations are most useful in analyzing the effect of the embargo. The proportion of the variation in USSR quarterly imports of wheat (as measured by the

[1] Italicized numbers in parentheses refer to items in the References at the end of this chapter.

Table 12.1--Estimates of first-stage equation using 1971-83 data, wheat import demand 1/, 2/

Importer	Intercept	Income	CPI	Price index		Production	Seasonal dummy or trend variable			Hi/low imports dummy 3/	Statistics		
				Corn	Wheat		Spring	Summer	Fall		Adj. R	D-W	Rho
Egypt	7.94 (1.83)	0.11 (.33)	-0.12 (.22) [t-1]	0.82 (2.57)	-0.71 (2.56)	-0.64 (.96) [t-4]		0.62 (2.58)		0.95 (3.57)	0.84	2.15	-0.20 (1.35)
EC	14.00 (6.98)	.38 (3.52) [t-2]	-.38 (1.83)	-.12 (.64)	-.07 (.29)	-.66 (2.96)	0.05 (1.43)	.04 (.99)	0.13 (3.68)	4/ .27 (2.16)	.90	1.71	.30 (2.10)
Japan	6.32 (1.44)	.30 (.48) [t-4]	-.87 (1.47)	.28 (2.08)	-.22 (1.79)	-.02 (.36)		.31 (1.91)			.97	2.10	-.40 (2.94)
Mexico	41.80 (5.28)	3.20 (1.89)	-2.61 (1.01)	1.55 (1.06)	-.96 (0.73)	-8.16 (5.80)	.16 (1.71)	.27 (.73)	.01 (1.91)	-2.14 (3.63)	.66	1.92	.40 (2.85)
China	.57 (.24)			.54 (1.56) [t-3]	-1.20 (3.29)	1.18 (4.48) [t-4]	.16 (1.08)	.27 (1.80)	.01 (.07)	-1.10 (6.32)	.68	1.58	
S. Korea	5.65 (6.46)	.12 (1.08) [t-4]	-.03 (.13)	.27 (1.68)	-.30 (2.22) [t-2]	0 (.03)				.69 (4.69)	.36	1.54	
Taiwan	2.79 (1.60)	-.78 (1.18) [t-4]	2.20 (2.06)	.43 (1.93)	-.50 (1.98) [t-4]	.04 (.47) [t-4]		-.58 (1.75)		-.98 (3.11)	.35	1.71	
USSR	23.40 (3.67)			.87 (1.44) [t-2]	-1.43 (2.66)	-1.47 (2.35) [t-3]		.88 (2.77)		-1.01 (2.12)	.33	2.02	.60 (5.31)

1/ All variables estimated in log form (except dummy variable), hence coefficients are elasticities.
2/ Blanks in table indicate that a particular variable is not in the equation specification or that the equation was estimated using ordinary least squares (blank Rho statistic).
3/ Positive for quarters with exceptionally high imports and negative for quarters with zero or very small imports.
4/ Trend variable.
Note: t statistics in parentheses and brackets indicate the lag in the variable.

Table 12.2--Estimates of first-stage equation using 1971-79 data, wheat import demand 1/, 2/

Importer	Intercept	Income	CPI	Price index		Production	Seasonal dummy or trend variable			Hi/low imports dummy 3/	Statistics		
				Corn	Wheat		Spring	Summer	Fall		Adj. R	D-W	Rho
Egypt	10.50 (1.61)	-0.24 (.28)	0.47 (.23) [t-1]	0.73 (1.52)	-0.71 (1.75)	-0.88 (1.22) [t-4]		0.76 (2.01)		0.94 (3.15)	0.80	2.19	-0.20 (1.09)
EC	17.70 (5.21)	.36 (2.73) [t-2]	-.72 (2.54)	-.20 (.61)	-.09 (.26)	-.88 (3.09)	0.06 (1.40)	.05 (.91)	.13 (2.66)		.84	1.82	.20 (1.06)
Japan	9.97 (1.86)	-.31 (.41) [t-4]	-.17 (.23)	.03 (2.15)	0 (0)	-.06 (.59)		.37 (1.99)			.98	2.17	-.50 (3.08)
Mexico	44.00 (4.75)	-7.67 (1.37)	12.33 (1.45)	1.40 (.75)	-.03 (.02)	-8.55 (4.83)	-.67 (1.50)	.58 (1.19)	.69 (1.58)	-1.78 (2.75)	.74	1.74	.30 (1.59)
China	2.66 (.72)			.56 (1.31) [t-3]	-1.23 (2.86)	.95 (2.20) [t-4]	.23 (1.07)	.39 (1.86)	.07 (.35)	-1.06 (5.09)	.48	1.62	
S. Korea	7.14 (3.76)	.08 (.55) [t-4]	-.17 (.48)	.24 (.89)	-.27 (1.37) [t-2]	-.15 (.95)				.70 (4.12)	.34	1.49	
Taiwan	.19 (.09)	-1.05 (1.22) [t-4]	3.11 (2.30)	.70 (2.62)	-.71 (2.37) [t-4]	.21 (1.75) [t-4]		-.58 (1.44)		-1.03 (2.97)	.45	1.96	
USSR	24.20 (3.56)			.30 (1.31) [t-2]	-1.52 (2.03)	-1.12 (1.64) [t-3]		.72 (1.93)		-1.09 (2.11)	.30	1.83	.50 (3.19)

1/ All variables estimated in log form (except dummy variable), hence coefficients are elasticities.
2/ Blanks in table indicate that a particular variable is not in the equation specification or that the equation was estimated using ordinary least squares (blank Rho statistic).
3/ Positive for quarters with exceptionally high imports and negative for quarters with zero or very small imports.
Note: t statistics in parentheses and brackets indicate the lag in the variable.

Table 12.3--Estimates of first-stage equation using 1980-83 data, wheat import demand 1/, 2/

Importer	Intercept	Income	CPI	Price index		Production	Seasonal dummy or trend variable			Hi/low imports dummy 3/	Statistics		
				Corn	Wheat		Spring	Summer	Fall		Adj. R	D-W	Rho
Egypt	36.30 (3.23)	0.39 (.24)	-2.77 (1.44) [t-1]	1.93 (3.76)	-5.51 (3.85)						0.53	2.41	
EC	11.00 (3.91)	.22 (1.09) [t-1]	-.37 (.74)	-.11 (.30) [t-4]	-.51 (1.21)						.97	1.78	0.40 (1.53)
Japan	8.28 (.77)	-.31 (.30) [t-4]	1.51 (.82)	.46 (3.83)	-.86 (1.56) [t-2]						.99	1.95	-.50 (2.03)
Mexico	33.50 (7.88)	2.62 (.97)	2.00 (.73)	1.92 (1.74)	-5.63 (4.63)	-4.50 (3.06)					.91	2.43	
China	29.80 (3.30)			.19 (.39) [t-1]	-1.74 (1.31)	-2.35 (3.44)		2.60 (3.02)			.98	2.33	-.40 (1.52)
S. Korea	10.20 (2.19)	.54 (2.70)	2.67 (1.45)	.21 (1.23)	-1.33 (1.73) [t-3]			-2.71 (1.83)			.31	1.68	
Taiwan	27.80 (3.28)	-1.39 (1.53)	1.78 (1.75)	.79 (1.68)	-3.27 (2.87)						.33	2.40	
USSR	30.40 (4.16)			.58 (1.03) [t-2]	-1.76 (3.16) [t-1]	-1.39 (1.62)					.90	2.18	-.30 (1.14)

1/ All variables estimated in log form (except dummy variable), hence coefficients are elasticities.
2/ Blanks in table indicate that a particular variable is not in the equation specification or that the equation was estimated using ordinary least squares (blank Rho statistic).
3/ Positive for quarters with exceptionally high imports and negative for quarters with zero or very small imports.
Note: t statistics in parentheses and brackets indicate the lag in the variable.

Table 12.4--Estimates of first-stage equation using 1971-83 data, corn import demand 1/, 2/

Importer	Intercept	Income	CPI	Price index		Production	Seasonal dummy or trend variable			Hi/low imports dummy 3/	Statistics		
				Corn	Wheat		Spring	Summer	Fall		Adj. R	D-W	Rho
Egypt	-9.78 (1.13)	0.33 (.56)	-0.77 (.72) [t-3]	-0.17 (.75)	0.50 (2.38) [t-4]	1.67 (1.08)		0.93 (3.06)		-3.23 (6.52)	0.92	2.04	-0.30 (2.08)
EC	13.10 (5.79)	.30 (2.06)	-.24 (1.31)	-.75 (3.19)	.72 (2.56)	-.65 (2.29)					.91	2.00	.50 (4.03)
Japan	.06 (.01)	.96 (1.20)	-.10 (.11) [t-3]	-.36 (2.50) [t-4]	.02 (.15)	-.16 (1.78)				-.63 (3.55)	.92	1.68	
Mexico	25.40 (3.22)	-1.11 (.92)	2.71 (1.46) [t-2]	-2.52 (3.70)	2.23 (2.91) [t-2]	-2.92 (2.99) [t-4]				-2.81 (7.21)	.73	1.55	
China	20.90 (2.52)			-2.06 (1.69)	.06 (.06) [t-2]	-.41 (.52) [t-4]	-.53 (1.39)	-1.48 (3.47)	-.38 (.98)	-5.46 (9.80)	.74	1.89	.30 (2.00)
S. Korea	3.04 (1.79)	1.28 (3.61)	-.35 (.46)	-.56 (2.28)	-.05 (.29)	.23 (.70) [t-4]	.06 (.48)	-.28 (2.10)	-.49 (2.23)		.89	2.27	
Taiwan	8.20 (4.81)	1.45 (3.49)	-.94 (1.31)	-.81 (2.53) [t-2]	-.18 (.68)	1.14 (3.34)		(1.75)		(3.11)	.77	2.18	
USSR	14.60 (2.85)			-1.18 (2.25) [t-2]	.93 (1.89)	-1.30 (2.42) [t-3]		1.21 (4.75)			.59	1.77	

1/ All variables estimated in log form (except dummy variable), hence coefficients are elasticities.
2/ Blanks in table indicate that a particular variable is not in the equation specification or that the equation was estimated using ordinary least squares (blank Rho statistic).
3/ Positive for quarters with exceptionally high imports and negative for quarters with zero or very small imports.
Note: t statistics in parentheses and brackets indicate the lag in the variable.

Table 12.5--Estimates of first-stage equation using 1971 to 1979 data, corn import demand 1/, 2/

Importer	Intercept	Income	CPI	Price index		Production	Seasonal dummy or trend variable			Hi/low imports dummy 3/	Statistics		
				Corn	Wheat		Spring	Summer	Fall		Adj. R	D-W	Rho
Egypt	25.00 (2.62)	7.11 (3.15)	-13.97 (2.99) [t-3]	-0.31 (1.25)	1.60 (3.61) [t-4]	-3.86 (2.22) [t-4]		0.74 (1.73)		-3.21 (6.26)	0.90	2.22	
EC	11.00 (5.79)	.11 (2.06) [t-3]	.11 (1.31)	-.51 (3.19)	.61 (2.56)	-.54 (2.29)					.89	2.05	.40 (2.38)
Japan	2.01 (.23)	.78 (.62)	-.06 (.04) [t-3]	-.35 (1.52) [t-4]	.02 (.12)	-.24 (1.66)				-.73 (3.13)	.87	1.82	
Mexico	11.60 (.91)	.25 (.07)	-.54 (.10) [t-2]	-1.74 (1.73)	2.55 (3.01) [t-2]	-1.48 (.94) [t-4]				-2.38 (5.67)	.72	1.55	
China	2.62 (.52)			-3.26 (2.42)	1.71 (1.82) [t-2]	1.58 (1.63) [t-4]		-.97 (2.13)		-5.80 (12.30)	.88	1.54	
S. Korea	2.61 (.90)	1.81 (2.28)	-1.72 (1.17)	-.71 (1.78) [t-2]	.23 (.65)	.70 (1.20) [t-4]	-.18 (.83)	-.46 (2.73)	-.90 (1.81)		.83	2.08	
Taiwan	9.40 (3.87)	-1.62 (1.91) [t-2]	.97 (.88)	-1.15 (1.50)	.67 (1.02)	-.79 (1.39)		2.10 (4.36)			.73	2.14	
USSR	14.90 (2.70)			-1.57 (2.63) [t-3]	.52 (1.02)	-.88 (1.32) [t-2]		1.68 (5.44)			.66	1.77	

1/ All variables estimated in log form (except dummy variable), hence coefficients are elasticities.
2/ Blanks in table indicate that a particular variable is not in the equation specification or that the equation was estimated using ordinary least squares (blank Rho statistic).
3/ Positive for quarters with exceptionally high imports and negative for quarters with zero or very small imports.
Note: t statistics in parentheses and brackets indicate the lag in the variable.

Table 12.6--Estimates of first-stage equation using 1980 to 1983 data, corn import demand 1, 2/

Importer	Intercept	Income	CPI	Price index		Production	Seasonal dummy or trend variable			Hi/low imports dummy 3/	Statistics		
				Corn	Wheat		Spring	Summer	Fall		Adj. R	D-W	Rho
Egypt	29.80 (1.23)	7.48 (3.05)	-6.24 (2.74)	2.28 (2.87)	-3.73 (1.62)	-8.37 (2.14) [t-4]					0.41	2.42	
EC	6.43 (1.98)	.07 (.36)	.64 (.87) [t-3]	-1.34 (2.92)	.99 (2.58)						.99	2.45	-.50 (2.01)
Japan	-31.50 (2.03)	4.05 (2.70)	-3.17 (1.96) [t-3]	.33 (1.64) [t-2]	.14 (.22)						.54	2.01	
Mexico	15.30 (.60)	6.51 (.56)	-4.19 (.39)	-3.42 (1.07)	4.25 (1.26) [t-4]	-5.92 (1.63) [t-4]					.52	1.98	
China	-15.30 (.23)			-12.20 (3.49) [t-1]	2.70 (.39)	7.55 (1.34)					.47	1.72	
S. Korea	-6.93 (.87)	-.43 (.95)	1.68 (2.88) [t-4]	-.69 (2.56) [t-4]	1.38 (1.84)						.97	2.41	-.60 (2.71)
Taiwan	-4.65 (1.06)	1.48 (3.26)	-.85 (1.63)	-.53 (2.92) [t-4]	1.02 (2.89)	.69 (2.32)					.99	2.19	
USSR	23.40 (2.25)			-2.25 (2.75)	1.67 (1.33)	-1.59 (2.70)					.82	2.27	-.40 (1.56)

1/ All variables estimated in log form (except dummy variable), hence coefficients are elasticities.
2/ Blanks in table indicate that a particular variable is not in the equation specification or that the equation was estimated using ordinary least squares (blank Rho statistic).
3/ Positive for quarters with exceptionally high imports and negative for quarters with zero or very small imports.
Note: t statistics in parentheses and brackets indicate the lag in the variable.

adjusted R square) was only 0.33 for 1971-83 and 0.30 for 1971-79 compared with 0.90 for 1980-83. This indicates the erratic nature of Soviet wheat imports in the 1970's.

After the embargo began in the first quarter of 1980, USSR wheat imports can be more easily explained with the "standard" import demand specification. The coefficient on production, wheat price, and corn price increased slightly between 1971-79 and 1980-83. In addition, the summer quarter seasonal dummy was dropped from the 1980-83 equation because it was not significant. This supports the change in the seasonal pattern of Soviet wheat imports first identified in Chapter 10. These results indicate a tendency for Soviet wheat imports to become somewhat more responsive to changes in Soviet wheat production and world wheat and corn prices in the 1980's.

Somewhat different results were obtained in the corn market. Explanatory power of the estimates was considerably higher in the corn market than in the wheat market because the corn demand is more elastic than the wheat demand in the major developed and centrally planned countries where corn is used as a livestock feed. Mexico is the only importer listed for which a large proportion of imported corn is used for food consumption.

The expected signs were the same as for wheat except the import demand for corn was directly related to changes in wheat prices and indirectly related to changes in corn prices. The own-price elasticities for the 1970-83 equations all had the expected sign (negative), and all were significant except for Egypt, which is a minor corn importer. The wheat cross-price elasticities, where they were significant, had the correct sign (positive).

A comparison of USSR corn import demand equation estimates for 1970-79 and 1980-83 reveal an increase in the USSR response to changes in domestic production and to world wheat and corn price changes. As with the wheat equations, the dummy variable indicating greater USSR corn imports in the summer quarter was no longer significant in 1980-83. This indicates a change in the seasonal pattern of USSR corn imports.

The embargo effect, if any, on USSR wheat and corn import demand behavior was a change in USSR seasonal import patterns. Beyond this, there was a somewhat greater USSR import response to changes in production and world prices since the first quarter of 1980, but it is not clear how or whether this change was linked to the embargo.

SECOND-STAGE EQUATIONS

The second-stage equation utility maximization process is assumed to be independent of the first-stage process. Hence the first- and second-stage equations are estimated separately. An importer decides how much of the good to import, and then decides where to buy the good. In this stage, the good is broken into products. A product is defined, say, as wheat from Canada, and another is wheat from Australia.

The implication is that the importer distinguishes among commodities by their origin. Arguments for this interpretation include the fact that wheat from different countries is in fact different (quality and/or taste), and political and/or economic ties or trading arrangements between countries make wheat differ by source. Another implication is that the law of one price need not hold. That is, the border price of, say, Australian wheat in Japan is the same price as for U.S. or Canadian wheat in Japan. Wheat from different origins will command different prices. This implication is a more realistic description of what occurs in the markets because empirical studies have shown the law of one price does not hold in the short run *(3, 4, 5, 6, 7)*.

Just as we estimated the first-stage equations for three periods to determine if the embargo resulted in changes in import demand and behavior, we also estimated the second-stage equation for the same three periods to see if importers have shifted their grain sources. Only two parameters are estimated in the second-stage equations. The first parameter can be interpreted as the share an exporter has when the exporter's landed price is equal to the price index where the index is a weighted average of the landed prices of all the exporters competing in a particular market (the formal derivation of the price index is presented in the appendix, as is the formal presentation of the entire Armington model). The second

parameter is the elasticity of substitution which is defined as the percentage change in the ratio of imports from one country to the imports from another country for a given percentage change in the ratio of import prices. In other words, the elasticity of substitution is the rate at which an importer is induced to alter the ratio of, say, Canadian wheat to U.S. wheat for a change in the landed price of Canadian wheat relative to the price index of wheat.

The Armington model assumes a constant and single elasticity of substitution for each importer. This means that wheat from Canada substitutes for wheat from Australia at the same rate that wheat from the United States substitutes for wheat from Australia and so on for each pair of exporters in each importing country. Also, the model assumes that the elasticity of substitution is constant throughout the sample period. The model thus implies that it makes no difference which two exporting countries are competing and that the rate of substitutability is stable within the estimated time period.

A criticism of the model is that the functional form of the model does not force the shares to sum to one (homogeneity). The model forces the shares to sum to one if the landed price is equal to the price index. This would be true only if the law of one price held. The shares nonetheless approximately sum to one because the price differentials are not large.

This second-stage equation is important in the assessment of embargo effects because, by looking at changes in the elasticity of substitution, one can deduce which markets became more or less responsive to price differentials. Also, changes in the mix of import sources can be deduced from estimates of the other parameter, the share coefficient.

Together with the first-stage estimate, we can assume, as we did in the simulation model later in this chapter, that total demand did not change because of the embargo but that the allocation of imports by source did change. This allows the USSR to change its import sources without changing the level of its import demand.

Second-Stage Results

The Armington second-stage results are useful for two reasons. First, we can use the results to test for a change in the structure of trade flows following the announcement of the embargo. By estimating the second-stage equations for the period preceding the embargo and for the period following the embargo, we can use an F-test to determine whether there has been a significant change in the sources of an importing country's imports and if the importing country has become more or less responsive to relative exporter prices.

The second-stage results also help provide parameters for a quarterly Armington simulation model. The distinction between these two uses must be kept in mind. For the testing for changes in trade flow patterns, we used three additional variants to the second-stage specification discussed above. However, for the simulation model, only the parameters estimated in the original Armington specification were used.

Testing for a Change in Trade Patterns

We specified each of the equations in four different forms. The first was identical to the form used in the first-stage equation; that is, a share parameter (intercept shifter) and an elasticity of substitution parameter. The second specification excluded the share parameter and estimated only the elasticity of substitution. The third specification included a different elasticity of substitution for each exporter and a single-share parameter. This specification did not assume a single elasticity of substitution in each importing market. The fourth specification allowed for both a share estimate for each exporter and an elasticity of substitution for each exporter.

These 12 equations were estimated for each importer in order to identify the specification with the most explanatory power. The USSR specifications used in the simulation model are shown for each of the three time periods in table 12.7; results for the other importers are in the appendix. A comparison of the USSR share parameters across time periods for wheat shows that the United States became less important in 1980-83. The U.S. share of the Soviet market fell from 13 to 3 percent. All the other exporters, except rest of world (ROW), became more important. In particular, Canada's share of the USSR wheat market

Table 12.7--Second-stage equation estimates, USSR 1/

Commodity	Share of parameter (intercept shifter)						Elasticity of substitution	Adjusted R-squared
	Argentina	Australia	Canada	EC	United States	Rest of world		
Wheat:								
1970-83	0.010	0.023	0.153	0.006	0.079	0.121	0.374	0.08
	(2.660)	(.49)	(3.120)	(3.230)	(6.770)	(.300)		
	[.025]	[.059]	[.401]	[.015]	[.208]	[.291]		
1970-79	.004	.017	.140	.001	.127	.114	.186	.10
	(2.070)	(.860)	(2.840)	(2.380)	(3.300)	(6.400)	(.150)	
	[.011]	[.043]	[.348]	[.002]	[.315]	[.282]		
1980-83	.038	.033	.946	.083	.033	.064	5.00	.04
	(1.890)	(.610)	(2.260)	(2.300)	(1.540)	(3.130)	(1.240)	
	[.032]	[.028]	[.790]	[.069]	[.028]	[.054]		
Corn:								
1970-83	.035				.317	.120	-.459	.07
	(1.890)				(3.010)	(5.790)	(.280)	
	[.075]				[.672]	[.254]		
1970-79	.030				.690	.080	1.850	.15
	(1.040)				(4.220)	(6.850)	(.990)	
	[.037]				[.863]	[.099]		
1980-83	.062				.140	.305	-4.450	-.02
	(.270)				(.010)	(1.210)	(1.220)	
	[.123]				[.276]	[.601]		

1/ Blanks in table indicate that a particular variable is not in the equation specification.

Note: Number in parentheses are t-statistics, and numbers in brackets are numbers assumed for simulation.

increased from 14 to 95 percent following announcement of the embargo.

Not only was there a change in shares of the USSR market, a comparison of the elasticities of substitution between the 1970-79 and 1980-83 periods indicates that the USSR became more responsive to the relative exporter price in the latter period. Although the embargo must have played a role in this change, other factors may also have been important. The decline in petroleum and gold prices (the two major earners of foreign exchange for the USSR) may have forced the USSR to become more price discriminating.

Exporter shares of the USSR corn market have changed as well. The U.S. share, averaging 69 percent in the 1970-79 period, fell to 14 percent in 1980-83, the ROW share increased from 8 to 31 percent, and the Argentine share increased from 3 to 6 percent (table 12.7).

The elasticity of substitution parameter, however, is negative in 1980-83. This result is counter to economic theory. It means that the USSR switched to buying corn from the most expensive sources. A look at the conditions existing at the time, however, provides an explanation. The United States is by far the world's largest corn exporter, and it embargoed all but 4 million tons of its exports to the USSR for part of the 1980-83 period. Argentina signed a long-term agreement with the USSR following the embargo and, as shown in Chapter 10, was able to extract a price premium from the USSR for the first year of the embargo. Even in subsequent years, higher Argentina-USSR transportation costs relative to U.S.-USSR transportation costs meant that the USSR had to pay more for corn than if it had bought from the United States.

A Test for Significance

There may have been a change in exporter shares of the USSR market as well as a change in USSR purchase behavior with respect to relative exporter prices (table 12.7). Whether changes in the USSR market, as well as

changes in other import markets, were statistically significant has yet to be determined.

We use the equation specification with the most explanatory power to test for structural change in each market by comparing coefficient estimates based on the three periods. Specifically, it is testing whether the coefficient estimates for 1970-79 are significantly different from the coefficient estimates for 1980-83. If a significant difference can be determined, then we can infer that market structure changed between the two periods.

More importantly, we wish to identify which markets have undergone a structural change, particularly whether there has been a change in the USSR import market. A significant difference in the market between the pre- and post-embargo time periods is perhaps due to the 1980 grain embargo.

If we define the coefficient estimates of 1970-79 by γ_i, the coefficient estimates of 1980-83 by β_i, and i refers to the estimated parameters in the equation, then the null hypothesis is:

$$H_0: \ \beta_1=\gamma_1, \ \beta_2=\gamma_2, \ldots \beta_i=\gamma_i$$

A word of caution: Other changes were occurring in the world during the grain embargo. These changes also influenced markets. A world recession occurred during the late 1970's and early 1980's, the U.S. dollar began to appreciate in the early 1980's, and U.S. grain stocks began to accumulate because of favorable program conditions in 1980 farm legislation.

Table 12.8 presents results of the F-tests done on the second-stage share equation estimates. As noted, specifications differ for various importers.

Five of the 16 tests resulted in rejection of the null hypothesis; that is, in 5 of the 16 markets, a structural change in the market was statistically evident. Two of those five markets were the USSR wheat and corn markets. The USSR was the only country in which both markets changed. Additionally, the F-statistic was large enough to indicate a strong significant change.

As discussed earlier, the USSR became more responsive to price movements after the embargo in the wheat market. It also altered its pattern of imports. In the corn market, the pattern rather than the price effect appears to be the structural change. This may be the result of the USSR-Argentina grain agreement signed during the embargo. It may have created perverse price responsiveness in the corn market.

The Egyptian corn market, the EC corn market, and the Mexican wheat market also changed. The Egyptian corn market was very small and the policies and institutions driving Egyptian corn imports were not a focus of this study.

The EC corn market results indicated a change in quantity effect rather than a price effect. The EC elasticity of substitution was inelastic and stable, but average shares changed considerably. This result was a nonembargo effect which can be attributed to the growing

Table 12.8--Results of F-tests comparing 1970-79 and 1980-83 second stage equation estimates

Country	Wheat				Corn			
	F-statistic (k, n)	Critical F value at 99%	Computed F-stat.	Accept or reject H_0	F-statistic (k, n)	Critical F value at 99%	Computed F-stat.	Accept or reject H_0
Egypt	(6, 264)	2.80	1.74	Accept	(4, 106)*	3.52	8.96	Reject
EC	(7, 311)	2.64	2.03	Accept	(8, 200)*	2.54	3.91	Reject
Japan	(5, 207)	3.02	.58	Accept	(3, 102)	4.02	1.72	Accept
Mexico	(3, 102)	4.02	4.36	Reject	(3, 102)*	4.02	1.37	Accept
China	(7, 310)	2.64	2.55	Accept	(6, 150)*	2.80	2.20	Accept
S. Korea	(4, 104)*	3.53	3.20	Accept	(4, 102)*	3.55	1.42	Accept
Taiwan	(4, 150)	3.32	.73	Accept	(4, 100)*	3.54	1.42	Accept
USSR	(12, 310)*	2.18	3.14	Reject	(6, 150)*	2.80	4.96	Reject

*Comparison of a second-stage equation which has both a slope and intercept shifter. Other comparisons are based on equations which only have an intercept shifter. Choice of which equations to use is based on which provides the most explanatory power.

relative importance of intra-EC trade. The growth in intra-EC trade is a part of a long-term trend resulting from the EC's Common Agricultural Policy. Although the United States clearly lost market share in the EC, this would have occurred with or without the embargo.

THE EMBARGO SIMULATION

We noted earlier that the quarterly Armington framework could be used to address two issues: The embargo's effect on the structure of world wheat and corn trade and the issue of the magnitude and persistence of trade and price effects. Econometric estimates of the preceding section indicate that the seasonal pattern of USSR wheat and corn imports changed following announcement of the embargo as did the sources of USSR imports and USSR import behavior. Certainly the trade flow shifts and the change in the seasonal import pattern were embargo related. The change in USSR import behavior was likely the result of both the embargo and other factors.

Next we estimate the magnitude of the embargo and trace its effects into the post-embargo period to discover whether the embargo had a lasting effect on U.S. exports. We do this by constructing a quarterly Armington simulation model and comparing a no-embargo scenario with an embargo scenario.

The Base Model

The base model is defined as the no-embargo scenario. This model specifies that the embargo did not change import demand. Structurally, the importing countries were not affected by the embargo in their total demand for wheat and corn. Therefore, the import demand equations used are based on estimates determined with the use of the full data set, 1970-I to 1983-IV. The model does assume that the effect, if any, was an allocation effect. The second-stage equation estimates are based on data from 1970-I to 1979-IV period. Thus, trading patterns that evolved in 1970-79 are assumed to continue through 1980-83. (The concept is similar to the one used in the time series forecasts in Chapter 10.)

The Embargo Model

The embargo scenario simulates effects of the embargo. Import demand equations are based on the full period 1970-83. The allocation equation is where the embargo effect would be shown. First, we used the structural tests to determine which importing countries changed their allocation behavior and to determine whether to use the full period, 1979-83, second-stage parameter estimates or the post-embargo period, 1980-83, parameter estimates. For those countries where there has been a significant change in the parameter estimates (the USSR and Mexico for wheat and the USSR, Egypt, and the EC for corn) we used the parameters based on the 1980-I through 1983-IV period. For all the other countries, second-stage estimates from the full data set were used. (In the final run, only the USSR parameter estimate based on 1980-I to 1983-IV was used. Egyptian and Mexican markets were insignificant, and the EC was mostly intra-EC trade.)

Thus, the model simulated only those changes which were statistically defensible. In addition, the model was constrained to limit U.S.-USSR flows to actual flows that occurred during the six quarters that the embargo was in effect. This assured that the simulation did not violate the embargo.

Analysis of the effect is divided into the embargo period and the post-embargo period. It has been argued that the embargo may have had a residual effect beyond the time it was in effect. Means of the simulated results are the statistics which are used for the analysis. Computations of the means are based on the embargo and post-embargo time periods. Total revenue losses or gains can be computed by multiplying the net change in exports by the simulated price of the base model. The simulation covers 1980-I to 1983-IV.

One last issue needs to be addressed. Formulation of the Armington model specifies that the shares of an importer's market (i.e., the b_{ij}'s in the appendix) need to sum to one. Since econometric results are used in the simulation model, the shares did not sum to one. Hence, if the sum of the shares was less than 1.0, then all the shares were scaled "up"

to sum to 1.0. If the sum of the shares was greater than 1.0, then the shares were scaled "down" to sum to 1.0.

Tables 12.9 and 12.10 present simulation results for the wheat and corn markets, respectively. The tables present both embargo and the post-embargo simulation results plus the difference between the base and embargo scenarios. The embargo and post-embargo periods were 1980-I to 1981-II and 1981-III to 1983-IV. Table 12.11 presents the simulated quarterly values of the following variables: Total world wheat exports, total U.S. exports, U.S. export price, USSR imports of U.S. wheat, and USSR imports of Argentine wheat. Table 12.12 presents the values of comparable variables in the corn market (the appendix presents the remaining variables).

Table 12.9--Quarterly means of wheat market variables generated in simulation scenarios for embargo and post-embargo periods

Variable	During embargo period			Post-embargo period		
	Base	Embargo	Change	Base	Embargo	Change
			1,000 tons			
Exports:						
World	22,163.1	22,887.2	724.0	23,706.5	23,576.5	-130.0
Argentina	304.4	282.2	-22.2	323.4	804.1	480.8
Australia	3,026.2	2,741.6	-284.7	3,007.5	2,651.2	-356.2
Canada	6,213.7	7,798.6	1,584.9	5,461.8	5,865.6	403.8
EC	2,502.6	2,916.3	413.6	3,101.2	4,060.0	958.5
United States	8,593.1	8,131.0	-462.1	9,622.2	8,580.0	-1,042.2
Rest of world	1,523.1	1,017.5	-505.6	2,190.4	1,615.4	-575.0
Imports:						
World	21,989.8	2,316.6	326.8	23,505.8	23,207.3	-298.5
China	3,322.6	3,275.4	-47.2	2,493.2	2,472.2	-21.0
Egypt	1,403.3	1,450.7	47.4	1,450.6	1,488.3	37.8
EC	2,539.2	2,514.0	-25.2	2,422.8	2,396.8	-26.1
Japan	1,544.4	1,553.0	8.6	1,554.1	1,563.5	9.4
Mexico	274.0	268.6	-5.4	111.5	113.6	2.2
S. Korea	513.3	522.5	9.2	516.2	527.0	10.8
Taiwan	167.3	169.3	2.0	180.6	183.9	3.4
USSR	2,935.8	3,273.2	337.4	3,750.7	3,435.7	-315.0
USSR imports:						
Argentina	28.5	6.2	-22.3	41.8	514.6	472.9
Australia	125.8	114.6	-11.2	161.8	148.6	-13.2
Canada	1,018.4	2,630.3	1,611.9	1,273.6	1691.7	418.1
EC	5.7	137.4	131.6	7.8	707.5	699.7
United States	919.1	570.8	-348.4	1,183.2	140.5	-1,042.8
Rest of world	840.8	332.3	-508.5	1,088.3	510.8	-577.5
			Exporter/importer currency per 1,000 tons			
Export prices:						
Argentina (1,000)	755.9	754.3	-1.6	5,856.7	5,915.8	59.0
Australia	143.5	144.2	.7	176.2	177.3	1.1
Canada	206.6	207.9	1.3	262.9	263.4	.4
EC	1,127.5	1,126.7	-.8	1,375.7	1,373.9	-1.8
United States	182.3	178.6	-3.6	187.5	179.0	-8.5
Rest of world	187.9	186.7	-1.3	178.2	174.7	-3.5
Import prices:						
Egypt	147.0	145.5	-1.4	139.7	137.7	-2.0
EC	425.2	434.1	8.9	502.4	500.5	-1.9
Japan	47,361.1	45,386.8	-1,974.3	51,847.8	48,903.1	-2,944.7
Mexico	4,243.1	4,172.9	-70.2	14,028.1	13,307.8	-720.3
China	341.5	341.0	-.5	447.7	444.9	-2.8
S. Korea (1,000)	136.6	134.0	-2.7	152.4	145.8	-6.6
Taiwan	7,361.3	7,220.1	-14.2	7,621.0	7,303.4	-317.6
USSR	791.1	806.4	15.3	820.0	838.9	18.9

Table 12.10--Quarterly means of corn market variables generated in simulation scenarios for embargo and post embargo periods

Variable	During embargo period			Post-embargo period		
	Base	Embargo	Change	Base	Embargo	Change
			1,000 tons			
Exports:						
World	17,959.5	17,987.6	28.1	19,765.8	19,346.6	-419.2
Argentina	659.2	1,486.9	827.7	915.4	1,446.5	531.1
EC	837.8	1,321.9	484.1	774.1	1,220.3	446.3
United States	15,099.5	13,772.1	-1,327.4	14,318.8	12,511.2	-1,807.6
Rest of world	1,363.0	1,406.7	43.6	3,757.5	4,168.5	411.0
Imports:						
World	18,357.0	17,916.9	-440.1	20,021.7	20,030.6	8.8
China	211.9	223.3	11.4	169.3	178.8	9.6
Egypt	344.1	340.6	-3.5	388.0	384.1	-3.9
EC	3,408.9	3,285.4	-123.5	3,338.3	3,108.9	-229.4
Japan	2,895.5	2,907.2	11.7	3,386.4	3,411.8	25.3
Mexico	1,023.6	1,046.2	22.6	1,595.9	1,496.3	-99.6
S. Korea	552.3	540.5	-11.9	787.0	776.7	-10.3
Taiwan	734.8	734..5	--00.3	838.0	848.1	10.1
USSR	2,330.0	1,983.5	-346.5	2,856.9	3,163.9	307.0
USSR imports:						
Argentina	219.4	1,079.7	860.4	122.0	721.6	599.6
United States	2,032.6	1,111.2	-921.4	2,556.0	1,164.0	-1,392.0
Rest of world	138.1	135.6	-2.4	128.0	124.6	-3.4
			Exporter/importer currency per 1,000 tons			
Export prices:						
Argentina (1,000)	490.5	493.5	3.0	5,545.6	5,556.5	10.9
United States	133.8	130.6	-3.3	131.4	126.7	-4.7
Rest of world	138.1	135.6	-2.4	128.0	124.6	-3.4
Import prices:						
China	279.4	271.7	-7.7	293.1	285.0	-8.1
Egypt	119.4	123.3	3.9	105.2	107.2	2.0
EC	378.0	405.1	27.1	428.3	469.0	40.8
Japan	38,093.9	37,574.6	-519.3	37,428.9	36,517.4	-911.5
Mexico	3,125.3	3,042.3	-83.0	9,723.6	9,479.7	-243.9
S. Korea (1,000)	118.2	123.3	5.1	114.5	117.7	3.2
Taiwan	5,764.2	5,795.6	31.4	5,680.8	5,645.1	-35.6
USSR	638.9	742.5	103.5	590.5	555.2	-35.4

The simulated quantities and prices are certainly in the range of actual quantities and prices. Additionally, simulated effects are in the direction of what actually occurred and of a plausible magnitude. Significant differences in the markets can be attributed to the structure of the market and also to the nature of the commodity.

The Wheat Market

Average quarterly total world exports of wheat increased by 3 percent during the embargo but there was very little effect after the embargo (table 12.9). U.S. exports were 462,000 tons less as a result of the embargo; Canadian exports averaged 1.585 million tons more per quarter and EC exports increased by 414,000 tons. The United States actually lost more exports after the embargo than during the embargo. U.S. exports were off by over a million tons per quarter after the embargo was lifted. The combination of a strong dollar, a world recession, and increased competition from Europe and Argentina in the face of high U.S. support prices probably contributed to the loss after the embargo. Canada's total exports fell after the embargo was lifted but Canadian exports were still 400,000 tons above the base scenario. EC total exports continued to

Table 12.11--Wheat market quarter-by-quarter simulation results

Year/quarter	World exports		Total U.S. exports		USSR/U.S. trade		U.S. export price	
	Base	Embargo	Base	Embargo	Base	Embargo	Base	Embargo
	1,000 tons						Exporter currency per 1,000 tons	
Embargo period:								
1980-I	21,257.8	21,817.0	8,024.3	7,495.2	840.6	447.5	182.3	177.4
1980-II	22,925.6	23,157.7	9,089.2	7,986.0	1,015.4	0	171.8	163.2
1980-III	24,632.9	24,880.1	9,388.6	8,488.8	848.1	0	176.4	169.4
1980-IV	21,029.3	22,710.9	7,930.5	8,086.7	954.1	1,291.5	185.5	186.9
1981-I	20,567.8	22,262.6	8,159.2	8,459.7	923.8	1,375.5	197.1	200.0
Post-embargo period:								
1981-II	22,565.3	22,494.6	8,966.3	8,269.0	932.4	279.8	180.3	174.5
1981-III	26,445.4	26,444.1	11,341.8	10,142.2	1,296.4	112.1	200.8	192.0
1981-IV	22,665.5	22,507.8	9,414.7	8,350.0	1,120.2	132.1	202.0	192.8
1982-I	21,911.5	21,542.0	8,292.6	7,263.5	1,175.7	146.2	191.5	181.6
1982-II	23,427.8	22,885.6	9,669.0	8,595.1	1,284.0	184.1	174.7	166.7
1982-III	24,672.7	24,400.3	9,218.1	8,357.5	1,011.7	113.2	181.3	174.3
1982-IV	23,616.1	23,611.4	9,067.1	8,108.3	1,077.2	131.9	186.1	178.0
1983-I	22,382.3	22,396.0	9,534.5	8,512.4	1,186.1	135.5	180.9	172.9
1983-II	23,273.9	23,023.7	10,460.3	9,523.2	1,270.0	245.6	155.7	150.0
1983-III	24,515.5	24,525.2	10,289.0	9,217.3	1,098.8	92.4	198.9	190.4
1983-IV	24,154.2	24,428.7	8,934.7	7,730.2	1,311.8	110.9	202.3	191.0

increase even after the embargo. Argentina showed no gain during the embargo, but more than doubled its exports after the embargo. Argentina was a clear post-embargo gainer.

The sources of USSR wheat imports indicate that the United States lost in that market. During the embargo the United States lost 30 percent of its share of the USSR market; afterwards it lost 90 percent. The USSR apparently changed its import pattern. During the embargo, Canada and Europe gained in the Soviet market; after the embargo, Argentina and Europe gained.

World wheat export supply appears to be very inelastic. No appreciable price change was found. All exporters' price changes were less than 1 percent except the U.S. export price. The U.S. export price dropped 2 percent and 4.5 percent during and after the embargo, indicating a very competitive world wheat market and one which the United States did not dominate.

The United States lost $686 million during the six quarters in which the embargo was in effect and $2.69 billion after the embargo, for a total loss of $3.37 billion. This revenue loss is not due solely to the embargo. As indicated earlier, the model cannot distinguish embargo and nonembargo effects. Most, if not all, of the post-embargo revenue losses are likely the result of nonembargo effects.

The Corn Market

Quarterly world corn exports did not change during the embargo and dropped by only 2 percent after the embargo. The post-embargo decline can perhaps best be explained by the fact that the world economy was in a recession in 1982/83. U.S. exports fell by an average of 1.3 million tons per quarter (or 8 percent) during the embargo and by 1.8 million tons per quarter after the embargo was lifted. The larger loss after the embargo can be attributed to shrinkage of the market. The EC increased its exports by 50 percent in the earlier period and 60 percent in the later period, while

Table 12.12--Corn market quarter-by-quarter simulation results

Year/quarter	World exports		Total U.S. exports		USSR/U.S. trade		U.S. export price	
	Base	Embargo	Base	Embargo	Base	Embargo	Base	Embargo
	1,000 tons						Exporter currency per 1,000 tons	
Embargo period:								
1980-I	17,156.0	17,988.1	14,556.7	13,873.1	2,023.0	1,818.0	126.0	124.4
1980-II	18,320.6	17,801.0	15,030.4	13,012.6	2,110.3	484.8	123.0	118.3
1980-III	18,260.4	17,127.2	16,212.7	13,679.2	2,156.6	0	124.3	118.7
1980-IV	19,538.9	20,036.5	16,098.2	15,684.2	1,979.3	1,924.9	140.8	139.8
1981-I	16,993.9	18,062.3	14,464.5	14,257.4	2,044.7	2,278.3	145.2	144.6
Post-embargo period:								
1981-II	17,487.3	16,560.6	14,234.5	12,125.9	1,881.3	160.8	143.4	137.3
1981-III	18,935.5	18,262.0	13,092.8	11,171.9	1,974.5	461.2	149.9	143.5
1981-IV	17,812.0	17,012.2	15,181.8	12,398.8	3,099.3	738.1	134.3	127.1
1982-I	16,875.8	16,292.6	14,175.9	11,990.3	2,999.7	1,214.5	136.4	130.3
1982-II	18,306.9	17,685.9	15,346.9	13,385.7	3,053.7	1,515.7	133.2	128.4
1982-III	22,286.9	22,158.6	14,318.9	12,407.6	3,818.2	2,460.2	117.6	113.1
1982-IV	16,953.6	16,045.8	12,994.3	11,368.2	2,107.7	898.8	124.7	120.3
1983-I	17,773.4	17,836.2	13,577.9	12,227.4	2,066.9	1,068.8	131.0	127.3
1983-II	17,891.8	17,511.1	13,771.1	12,393.4	2,210.3	1,191.8	120.1	118.2
1983-III	25,076.9	24,797.3	18,217.7	16,186.3	2,456.2	843.4	107.0	103.6
1983-IV	25,745.1	25,864.1	12,510.0	11,582.1	1,773.0	1,246.8	159.4	156.1

Argentina increased its exports by 130 percent and 60 percent in the two periods. The EC clearly gained the most, but most of that was intra-EC trade. Argentina generated considerable revenue because of the embargo.

The USSR decreased corn imports from the United States by 45 percent and 50 percent, while increasing imports from Argentina by 860,000 tons per quarter during the embargo and 600,000 tons per quarter afterward. The model shows that the United States permanently lost about half of its share of the USSR corn market.

U.S. export prices fell by 2.8 percent and 3.7 percent, while Argentine export prices rose by less than 1 percent. As in the wheat market, these changes indicate an inelastic supply in the corn market, although one needs to be cautious, because the demand side of the market was shifting also.

The United States lost considerably more revenue in the corn market. During the embargo, the model shows that the United States lost $1.33 billion; after the embargo, the loss was $2.96 billion, for a total loss of $4.29 billion through 1983. As with the wheat market, much of this loss is due to nonembargo factors.

CONCLUSIONS

A quarterly Armington-type trade flow model was used to estimate the effect of the 1980 grain embargo. Econometric estimates were statistically tested for a structural change in the world corn and wheat markets. The estimates were also incorporated into a simulation model to analyze the magnitude of the effect on total exports, total imports, export and import prices, and trade flows. USSR import behavior was shown to have changed structurally.

The United States lost 0.46 and 1.04 million tons of wheat per quarter during the embargo and post-embargo periods. The losses were 1.33 and 1.81 million tons per quarter in the

corn market. Export prices of wheat dropped $3.60 per ton during the embargo and $8.50 after the embargo; corn prices dropped $3.30 per ton during the embargo and $4.70 per ton afterward. Given the structure of the Armington model which inhibits adjustments to a disruption in one trade flow and given that the model estimated has captured many of the macroeconomic changes which took place in the 1980's as well as the effects of the embargo, the estimates of U.S. losses represent an upper bound on the likely impact of the embargo.

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APPENDIX

TECHNICAL METHODOLOGY

The first-stage equation in the quarterly Armington model specifies total imports by the importing region. At this stage, wheat or corn is treated as a homogeneous good. The importer makes a "decision" to import some quantity of the commodity without reference to the import source. Excess demand is specified as:

$$Q_i = f(P^w_i, P^c_i, P_i, Y_i, Prod_i, Z_i) \quad (1)$$

where Q_i = excess demand for corn or wheat.

P^w_i = price index of wheat in country i.

P^c_i = price index of corn in country i.

P_i = consumer price index in country i.

Y_i = gross national product in country i.

$Prod_i$ = production of the commodity in country i.

Z_i = shift dummy variables in country i.

Quantities are in 1,000 tons and prices are expressed in importer i's currency. Computation of price indexes is explained in the following section. The Z_i shift variables can be seasonal dummy variables, dummy variables for quarters of exceptionally large or small imports, or a trend variable. Equation (1) for centrally planned economies has no Y_i nor P_i variables.

Equation (1) is estimated in double-log form with the use of an OLS or GLS estimator. Coefficients on the variables can thus be interpreted as the elasticities.

The second-stage equation is the import-share equation. At this stage, the importer makes the behavioral decision concerning the import mix. The equation is specified as:

$$Q_{ij} = D_{1j}(b_{ij})^{\sigma} Q_i D_{2j}(P_{ij}/P_i)^{-\sigma}, \quad (2)$$

where Q_{ij} = imports in country i from country j.
P_{ij} = the landed price of country j's exports.
σ = the elasticity of substitution in country i.
D_{1j} = a zero one dummy for the jth country's intercept.
D_{2j} = a zero one dummy for the jth country's slope.

The b_{ij} (betas) can be interpreted as the share exporter j has in the ith import market when P_{ij} equals P_i. Theoretically, the b_{ij} should sum to one and each should be in the (0,1) interval. Econometric estimates of the b_{ij}'s did not yield the theoretical values they should have in certain instances. In the simulation model, the b_{ij} are changed to values consistent with the theoretical derivation of the model. If the b_{ij} sum to a number less than one, then each b_{ij} is increased proportionately so as to sum to one. If the b_{ij} sum to a number larger than one, then the b_{ij} that is larger than one (in no instance is more than one b_{ij} larger than one) is scaled down so as to sum to one.

Equation (2) is estimated with a pooled-time-series-cross-sectional estimator and is double-log form. In this manner, the $D_{1j}b_{ij}$ can be interpreted as an intercept shifter for country j and the $D_{2j}(P_{ij}/P_i)^{-\sigma}$ can be interpreted as an elasticity of substitution for country j's price movements. Equation (2) is estimated with no dummy variables. The equation with only the intercept dummy is the theoretically consistent method since only one elasticity of substitution is estimated for each importing country.

Similar to equation (1), equation (2) is also estimated with data from three time periods: 1970 to 1983, 1970 to 1979, and 1980 to 1983.

The price indexes are computed in the following manner:

$$P_i = P_{ij} \left[\sum_{k=1}^{m} b_{ij}^{\sigma}(P_{ij}/P_{ik})^{\sigma-1}\right]^{1/1-\sigma}, \qquad (3)$$

where m = the number of exporters in the import market.
σ = the estimated elasticity of substitution.
b_{ij} = the estimated intercept.

One limitation of the Armington model is that it does not guarantee that import shares will sum to one. Even though the model stipulates that the b_{ij}'s should sum to one and the b_{ij}'s can be interpreted to be the share when P_{ij} equals P_i, there is no guarantee that the shares sum to one when P_{ij} does not equal P_i. However, on average, P_{ij} does equal P_i and thereby "on average" the shares should sum to one.

Appendix table 12.1--Second-stage equation estimates, Egypt 1/

Commodity	Intercept shifter						Elasticity of substitution	Adjusted R-squared
	Argentina	Australia	Canada	EC	United States	Rest of world		
Wheat:								
1970-83		1.41 (11.00) [.67]	0.01 (4.51)	0.04 (7.82)	0.27 (10.6)	0.01 (14.6)	4.36 (4.37)	0.38
1970-79		1.98 (9.97) [.71]	.01 (4.32)	.10 (7.69)	.17 (9.33)	.114 (12.7)	.186 (4.89)	.40
1980-83		.50 (4.41) [.59]	.946 (1.32) [.005]	.003 (2.24)	.003 (4.39) [.39]	.01 (6.00) [.015]	.01 (.27)	.28
Corn:								
1970-83					.77 (8.07) [.974]	.02 (12.5) [.026]	6.04 (4.36)	.38
1970-79					.76 (6.38) [.96]	.03 (10.0) [.04]	6.61 (4.57)	.38
1980-83					.74 (4.16) [.98]	.02 (6.58) [.02]	2.38 (.53)	.37

1/ Blanks in table indicate that that particular variable is not in the equation specification..

Note: Numbers in parentheses are t-statistics; numbers in brackets are numbers assumed for simulation.

Appendix table 12.2--Second-stage equation estimates, European Community 1/

Commodity	Intercept shifter						Elasticity of substitution	Adjusted R-squared
	Argentina	Australia	Canada	EC	United States	Rest of world		
Wheat:								
1970-83	0.001 (5.24)	0 (7.67)	0.275 (7.46)	1.60 (8.24) [.589]	0.125 (6.89)	0.010 (11.4)	0.46 (1.33)	0.21
1970-79	.001 (4.14)	0 (5.97)	.276 (5.84)	1.600 (6.46) [.456]	.258 (5.74)	.010 (9.01)	.35 (.85)	.19
1980-83	.001 (4.07)	.001 (5.94)	1.908 (6.19) [.568]	.309 (5.99)	.114 (5.20)	.007 (8.52)	1.78 (2.59)	.36
Corn:								
1970-83	.070 [.19] [.098]			.301 .74 [.420]	.343 (7.73) [.479]	.003 (11.1) [.004]	.29 (.76)	.28
1970-79	.106 (.76)			.269 (.11)	1.307 (6.44) [.622]	.003 (9.02)	.43 (.92)	.27
1980-83	.027 (1.76) [.061]			.495 (1.69) [.923]	.006 (4.25) [.012]	.002 (6.60) [.006]	.68 (.96)	.37

1/ Blanks in table indicate that that particular variable is not in the equation specification.

Note: Numbers in parentheses are t-statistics; numbers in brackets are numbers assumed for simulation.

Appendix table 12.3--Second-stage equation estimates, Japan 1/

Commodity	Intercept shifter						Elasticity of substitution	Adjusted R-squared
	Argentina	Australia	Canada	EC	United States	Rest of world		
Wheat:								
1970-83		0.134	0.272		0.606	0.003	1.75	0.32
		(6.72)	(2.98)		(9.43)	(13.8)	(2.26)	
1970-79		.134	.270		.579	.003	1.93	.30
		(5.40)	(2.43)		(7.56)	(11.2)	(2.08)	
1980-83		.120	.661		.761	.003	1.11	.37
		(4.03)	(1.80)		(5.73)	(7.90)	(.74)	
		[.078]	[.428]		[.492]	[.002]		
Corn:								
1970-83	.070				.952	.017	5.35	.34
	[.19]				(3.54)	(5.14)	(7.03)	
	[.098]				[.980]	[.020]		
1970-79	.106				.955	.011	4.33	.24
	(.76)				(3.08)	(4.45)	(4.19)	
					[.985]	[.016]		
1980-83	.027				1.206	.044	7.15	.65
	(1.76)				(2.23)	(2.84)	(7.45)	
	[.061]				[.956]	[.041]		

1/ Blanks in table indicate that that particular variable is not in the equation specification.

Note: Numbers in parentheses are t-statistics; numbers in brackets are numbers assumed for simulation.

Appendix table 12.4--Second-stage equation estimates, Mexico 1/

Commodity	Intercept shifter						Elasticity of substitution	Adjusted R-squared
	Argentina	Australia	Canada	EC	United States	Rest of world		
Wheat:								
1970-83					0.431 (1.90) [.853]	0.074 (4.44) [.147]	6.63 (1.93)	0.05
1970-79					.734 (3.79) [.948]	.040 (6.04) [.052]	-1.03 (.31)	.14
1980-83					.161 (.21) [.495]	.154 (1.22) [.505]	17.9 (2.26)	.10
Corn:								
1970-83					.605 (.21) [.495]	.040 (3.83) [.062]	3.15 (2.52)	.07
1970-79					.543 (1.06) [.849]	.010 (3.83) [.151]	3.37 (2.54)	.07
1980-83					.691 (2.17) [.991]	.006 (3.42) [.009]	-.91 (.17)	.09

1/ Blanks in table indicate that that particular variable is not in the equation specification.

Note: Numbers in parentheses are t-statistics; numbers in brackets are numbers assumed for simulation.

Appendix table 12.5--Second-stage equation estimates, China 1/

Commodity	Intercept shifter						Elasticity of substitution	Adjusted R-squared
	Argentina	Australia	Canada	EC	United States	Rest of world		
Wheat:								
1970-83	0.002 (4.82)	0.047 (7.40)	1.101 (9.89) [.945]	0.006 (7.04)	0.033 (8.42)	0.002 (13.4)	4.06 (3.78)	0.26
1970-79	.001 (4.14)	.071 (7.41)	1.000 (9.31) [.914]	.003 (6.13)	.010 (7.61)	.002 (12.9)	4.74 (4.19)	.31
1980-83	.004 (2.07)	.015 (2.56)	19.5 (4.05) [.342]	.267 (3.67)	.369 (3.79)	.003 (5.17)	1.94 (.65)	.18
Corn:								
1970-83	.061 (1.47) [.138]				.332 (2.22) [.761]	.049 (5.09) [.111]	2.03 (1.63)	-.02
1970-79	.108 (1.52) [.220]				.331 (1.78) [.675]	.052 (4.08) [.105]	1.76 (1.16)	.01
1980-83	.016 (.30) [.044]				.311 (1.16) [.838]	.044 (2.81) [.118]	2.04 (.83)	-.03

1/ Blanks in table indicate that that particular variable is not in the equation specification.

Note: Numbers in parentheses are t-statistics; numbers in brackets are numbers assumed Oor simulation.

Appendix table 12.6--Second-stage equation estimates, South Korea 1/

Commodity	Intercept shifter						Elasticity of substitution	Adjusted R-squared
	Argentina	Australia	Canada	EC	United States	Rest of world		
Wheat:								
1970-83					0.989	0.005	7.68	0.44
					(9.41)	(15.3)	(5.92)	
1970-79					.976	.006	7.94	.39
					(7.19)	(12.2)	(5.34)	
1980-83					1.027	.002	7.14	.64
					(5.65)	(8.09)	(2.25)	
					[1.000]			
Corn:								
1970-83					.901	.010	2.66	-.29
					(6.73)	(9.21)	(1.25)	
					[.989]	[.012]		
1970-79					.732	.010	4.79	.35
					(6.61)	(9.28)	(2.20)	
					[.986]	[.014]		
1980-83					.501	.046	-3.55	.15
					(2.09)	(2.62)	(.61)	
					[.954]			

1/ Blanks in table indicate that that particular variable is not in the equation specification.

Note: Numbers in parentheses are t-statistics; numbers in brackets are numbers assumed for simulation.

Appendix table 12.7--Second-stage equation estimates, Taiwan 1/

Commodity	Intercept shifter						Elasticity of substitution	Adjusted R-squared
	Argentina	Australia	Canada	EC	United States	Rest of world		
Wheat:								
1970-83		0.013			1.561	0.051	8.74	0.27
		(1.51)			(7.12)	(10.0)	(2.37)	
					[.936]			
1970-79		.021			1.950	.049	9.53	.23
		(1.73)			(5.57)	(7.77)	(2.12)	
					[.930]			
1980-83		.004			1.561	.049	5.77	.47
		(.12)			(5.48)	(7.62)	(.93)	
					[.947]			
Corn:								
1970-83					.652	.180	14.1	.19
					(2.94)	(5.40)	(5.19)	
					[.783]	[.217]		
1970-79					.513	.255	13.3	.18
					(1.46)	(3.46)	(4.41)	
					[.671]	[.329]		
1980-83					1.229	.053	26.4	.32
					(3.84)	(5.17)	(2.84)	
					[.947]			

1/ Blanks in table indicate that that particular variable is not in the equation specification.

Note: Numbers in parentheses are t-statistics; numbers in brackets are numbers assumed for simulation.

Appendix table 12.8--Exporters' total wheat exports in base model simulation

Year/ quarter	World	United States	Canada	EC	Australia	Argentina	Rest of world
				1,000 tons			
1980-I	21,257.8	8,024.3	5,528.1	1,839.7	3,597.1	1,161.8	1,106.7
1980-II	22,925.8	9,089.2	6,538.3	2,644.2	3,244.2	98.1	1,311.3
1980-III	24,632.9	9,388.6	7,179.2	2,317.1	2,724.4	71.4	2,951.9
1980-IV	21,029.3	7,930.5	6,529.1	2,286.7	2,657.0	50.8	1,574.8
1981-I	20,567.8	8,159.2	5,375.7	2,543.5	3,240.8	276.7	971.7
1981-II	22,565.3	8,966.3	6,131.6	3,384.2	2,693.6	167.2	1,222.1
1981-III	26,445.4	11,341.8	6,441.3	3,362.8	2,652.4	86.9	2,559.9
1981-IV	22,665.5	9,414.7	5,792.4	3,563.3	2,098.9	322.0	1,474.0
1982-I	21,911.5	8,292.6	4,762.7	3,220.2	3,520.0	680.6	1,435.0
1982-II	23,427.8	9,669.0	6,004.3	3,013.8	3,213.6	183.4	1,343.4
1982-III	24,672.7	9,218.1	5,864.6	2,233.7	2,463.3	75.3	4,817.5
1982-IV	23,616.1	9,067.1	4,879.1	2,630.4	2,750.1	152.3	4,138.9
1983-I	22,382.3	9,534.5	4,694.2	3,588.1	2,350.7	875.5	1,338.9
1983-II	23,273.9	10,460.3	4,781.9	3,236.6	2,586.6	425.8	1,782.4
1983-III	24,515.5	10,289.0	5,437.4	2,626.9	4,590.7	136.4	1,434.8
1983-IV	24,154.2	8,934.7	5,959.7	3,536.2	3,847.5	295.1	1,580.7

Appendix table 12.9--Exporters' total wheat exports in embargo model simulation

Year/ quarter	World	United States	Canada	EC	Australia	Argentina	Rest of world
			1,000 tons				
1980-I	21,817.0	7,495.2	7,075.4	2,214.3	3,330.6	1,147.0	554.1
1980-II	23,157.7	7,986.0	8,397.0	3,102.7	2,887.7	73.9	710.0
1980-III	24,880.1	8,488.8	8,581.7	2,659.2	2,380.1	49.2	2,720.8
1980-IV	22,710.9	8,086.7	8,370.2	2,707.8	2,447.6	24.6	1,073.7
1981-I	22,262.6	8,459.7	7,198.9	2,982.1	3,033.8	251.7	336.0
1981-II	22,494.6	8,269.0	7,168.3	3,831.1	2,369.2	146.4	710.2
1981-III	26,444.1	101,421.2	7,864.2	4,103.8	2,357.2	80.1	1,916.2
1981-IV	22,507.8	8,350.5	6,876.9	4,279.9	1,809.9	311.0	879.8
1982-I	21,542.0	7,263.5	5,544.8	4,070.6	3,200.7	683.6	778.5
1982-II	22,885.6	8,595.1	6,635.2	3,882.6	2,870.8	206.6	695.1
1982-III	24,400.3	8,357.5	5,870.8	3,346.8	2,119.9	330.3	4,374.7
1982-IV	23,611.4	8,108.3	4,923.6	3,947.2	2,416.7	577.4	3,637.9
1983-I	22,396.0	8,512.4	4,738.0	4,712.8	2,008.0	1,678.3	746.3
1983-II	23,023.7	9,523.2	4,661.5	4,202.5	2,140.6	1,233.7	1,261.9
1983-III	24,525.5	9,217.3	5,649.5	3,499.1	4,133.7	1,019.1	1,006.2
1983-IV	24,428.7	7,730.2	5,891.1	4,554.5	3,454.5	1,940.8	857.2

Appendix table 12.10--Importers' total imports of wheat in base model simulation

Year/ quarter	Egypt	EC	Japan	Mexico	China	S. Korea	Taiwan	USSR
				1,000 tons				
1980-I	1,344.3	2,559.1	1,556.6	418.8	2,906.3	490.2	134.0	2,707.9
1980-II	1,332.8	2,695.0	1,540.1	276.2	3,349.3	517.3	151.7	3,254.8
1980-III	1,335.3	2,362.7	1,518.9	208.5	4,332.4	508.6	173.8	2,715.1
1980-IV	1,434.9	2,613.0	1,542.9	376.2	3,134.9	540.9	186.3	3,030.6
1981-I	1,465.0	2,427.7	1,545.2	216.9	2,876.6	540.9	168.9	2,935.9
1981-II	1,507.0	2,577.0	1,562.4	147.2	3,336.1	503.0	189.0	2,970.4
1981-III	1,524.0	2,410.8	1,588.5	121.3	3,113.4	519.4	195.9	4,160.9
1981-IV	1,358.3	2,700.2	1,509.3	154.6	2,126.8	508.2	191.7	3,564.4
1982-I	1,447.6	2,441.2	1,551.0	123.9	2,080.5	495.2	177.6	3,727.3
1982-II	1,530.0	2,513.6	1,570.0	89.0	2,495.7	517.0	185.6	4,052.3
1982-III	1,275.2	2,208.4	1,510.6	13.4	2,632.4	493.7	175.3	3,200.8
1982-IV	1,387.3	2,496.2	1,533.1	18.2	2,027.4	526.3	188.5	3,402.7
1983-I	1,472.3	2,387.5	1,569.6	1,2.7	2,152.2	516.8	179.2	3,750.2
1983-II	1,508.4	2,365.4	1,577.8	8.6	2,492.2	539.1	183.3	3,954.2
1983-III	1,336.8	2,193.7	1,511.9	154.1	3,185.2	497.6	162.5	3,517.6
1983-IV	1,665.2	2,510.7	1,638.3	418.3	2,626.0	556.8	165.6	4,175.8

Appendix table 12.11--Importers' total imports of wheat in embargo model simulation

Year/ quarter	Egypt	EC	Japan	Mexico	China	S. Korea	Taiwan	USSR
				1,000 tons				
1980-I	1,398.4	2,530.0	1,569.6	421.8	2,860.9	501.1	136.4	2,965.3
1980-II	1,372.2	2,668.1	1,549.3	269.0	3,286.2	529.4	154.8	3,707.9
1980-III	1,367.0	2,338.3	1,524.3	200.2	4,239.7	518.3	175.9	3,186.0
1980-IV	1,498.1	2,587.7	1,552.6	368.6	3,105.2	548.9	187.6	3,594.3
1981-I	1,526.6	2,404.9	1,554.9	210.9	2,856.2	509.4	169.7	3,394.2
1981-II	1,541.6	2,554.8	1,567.0	141.0	3,304.0	527.6	191.3	2,791.1
1981-III	1,552.7	2,393.0	1,575.2	118.6	3,084.3	517.9	199.2	4,186.1
1981-IV	1,381.7	2,672.3	1,511.8	149.6	2,089.5	519.5	194.1	3,471.7
1982-I	1,485.2	2,415.7	1,558.3	121.4	2,059.1	505.0	180.8	3,352.0
1982-II	1,579.8	2,485.1	1,579.7	87.7	2,489.3	527.5	189.4	3,453.4
1982-III	1,308.2	2,178.9	1,517.8	13.3	2,616.3	502.7	178.3	2,743.1
1982-IV	1,418.2	2,469.7	1,542.8	17.9	2,027.8	536.9	191.6	3,121.4
1983-I	1,518.5	2,361.6	1,582.3	12.8	2,161.1	528.4	183.0	3,400.0
1983-II	1,560.6	2,333.4	1,589.1	8.5	2,478.5	550.0	186.9	3,353.3
1983-III	1,355.1	2,163.3	1,522.7	154.9	3,102.9	508.6	164.9	3,409.1
1983-IV	1,722.9	2,494.1	1,654.6	451.2	2,613.1	573.1	170.6	3,866.5

Appendix table 12.12--USSR imports of wheat in base model simulation

Year/ quarter	Argentina	Australia	Canada	EC	United States	Rest of world
			1,000 tons			
1980-I	27.4	117.5	946.5	5.2	840.6	772.0
1980-II	31.9	139.6	1,133.2	6.3	1,015.4	930.2
1980-III	25.9	115.1	935.1	5.1	848.1	789.8
1980-IV	28.3	128.8	1,047.9	5.8	954.1	868.8
1981-I	28.0	126.7	1,023.7	5.8	923.8	829.6
1981-II	29.4	126.6	1,023.9	5.8	932.4	854.3
1981-III	41.6	177.6	1,437.1	8.4	1,296.4	1,203.6
1981-IV	36.5	152.6	1,225.2	7.2	1,120.2	1,024.6
1982-I	38.9	160.4	1,276.0	7.6	1,175.7	1,070.7
1982-II	42.8	174.1	1,378.2	8.2	1,284.0	1,168.7
1982-III	36.3	137.1	1,079.9	6.7	1,011.7	935.0
1982-IV	39.1	146.8	1,147.4	7.1	1,077.2	991.2
1983-I	44.0	161.0	1,267.1	7.8	1,186.1	1,090.2
1983-II	46.0	170.8	1,319.1	8.1	1,270.0	1,151.6
1983-III	41.5	154.6	1,191.1	7.2	1,098.8	1,031.8
1983-IV	50.5	182.4	1,414.4	8.7	1,311.8	1,215.4

Appendix table 12.13--USSR imports of wheat in embargo model simulation

Year/ quarter	Argentina	Australia	Canada	EC	United States	Rest of world
			1,000 tons			
1980-I	12.2	127.1	2,486.6	92.3	477.5	215.5
1980-II	7.5	123.2	3,024.8	160.7	0	324.7
1980-III	3.6	95.0	2,424.8	84.7	0	556.3
1980-IV	2.3	113.8	2,910.7	131.4	1,291.5	365.9
1981-I	3.2	133.7	2,830.2	176.1	1,375.5	191.7
1981-II	8.2	94.5	2,104.5	178.8	279.8	339.6
1981-III	14.4	128.9	2,933.7	511.6	112.1	555.2
1981-IV	25.0	127.6	2,376.4	434.3	132.1	427.6
1982-I	40.8	146.2	2,094.4	593.6	146.2	411.3
1982-II	64.0	159.8	2,030.6	602.3	184.1	517.5
1982-III	283.5	99.8	1,122.5	889.5	113.2	491.8
1982-IV	456.2	131.9	1,195.1	1,049.9	131.9	490.4
1983-I	834.8	120.5	1,326.9	871.0	135.5	495.3
1983-II	841.3	173.6	1,178.3	704.1	245.6	631.2
1983-III	906.9	154.6	1,191.1	635.9	92.4	600.3
1983-IV	50.5	182.4	1,414.4	781.9	110.9	486.8

Appendix table 12.14--Exporters' export price of wheat in base model simulation

Year/ quarter	United States	Canada	EC*	Australia	Argentina	Rest of world
			Exporter's currency per ton			
1980-I	182.3	185.2	1,058.0	126.9	414,384.8	182.3
1980-II	171.8	187.3	1,078.9	132.8	526,887.1	178.5
1980-III	176.4	199.6	1,111.1	144.1	682,404.6	166.8
1980-IV	185.5	219.0	1,140.1	154.9	872,633.3	195.2
1981-I	197.1	226.1	1,175.6	150.9	906,602.3	221.4
1981-II	180.3	222.0	1,200.9	151.3	1,132,640.5	183.1
1981-III	200.8	233.7	1,244.7	160.2	1,539,905.7	186.0
1981-IV	202.0	250.7	1,279.3	167.8	1,772,289.3	200.2
1982-I	191.5	253.0	1,312.2	165.7	2,406,935.2	195.5
1982-II	174.7	254.2	1,348.2	165.7	2,770,552.5	181.8
1982-III	181.3	273.1	1,358.6	187.0	4,930,877.0	170.6
1982-IV	186.1	277.3	1,390.3	185.9	5,021,319.5	172.6
1983-I	180.9	264.5	1,408.2	185.2	5,776,840.5	169.2
1983-II	155.7	269.2	1,445.2	179.8	7,728,025.0	159.3
1983-III	198.9	269.3	1,475.2	177.0	1,071,310.0	165.3
1983-IV	202.3	283.9	1,494.1	187.7	1,590,740.0	180.8

*--Expressed in French francs.

Appendix table 12.15--Exporters' export price of wheat in embargo model simulation

Year/ quarter	United States	Canada	EC*	Australia	Argentina	Rest of world
			Exporter's currency per ton			
1980-I	177.4	186.4	1,057.1	127.4	414,344.6	180.7
1980-II	163.2	188.6	1,078.1	133.6	525,754.8	175.4
1980-III	169.4	199.6	1,110.4	145.0	680,478.6	163.9
1980-IV	186.9	200.6	1,139.2	155.5	867,844.2	196.1
1981-I	200.0	220.5	1,174.7	151.4	905,951.1	223.0
1981-II	174.5	228.0	1,200.9	152.2	1,131,500.7	180.7
1981-III	192.0	223.0	1,243.6	161.1	1,535,609.3	181.7
1981-IV	192.6	235.1	1,278.3	169.0	1,771,821.1	195.8
1982-I	191.6	251.9	1,310.7	166.5	2,407,015.2	191.3
1982-II	166.7	254.1	1,346.7	166.6	2,773,064.5	178.4
1982-III	174.3	254.9	1,356.1	188.3	4,986,583.5	167.6
1982-IV	178.0	273.1	1,387.7	187.0	5,072,439.5	169.7
1983-I	172.9	264.5	1,406.4	186.6	5,905,479.0	166.0
1983-II	150.0	269.0	1,443.4	181.4	7,790,754.5	157.0
1983-III	190.4	269.6	1,473.3	177.9	10,878,100.0	162.3
1983-IV	191.0	283.9	1,492.4	188.6	16,136,700.0	176.4

*--Expressed in French francs.

Appendix table 12.16--Importers' price index of wheat in base model simulation

Year/ quarter	Egypt	EC*	Japan	Mexico	China	S. Korea	Taiwan	USSR
				Importer's currency per ton				
1980-I	133.5	381.6	49,536.2	4,162.6	301.0	121,444.2	7,206.4	938.0
1980-II	138.7	392.8	47,477.3	3,934.8	312.6	123,938.9	7,282.3	730.0
1980-III	145.5	400.2	46,388.0	4,046.5	317.9	132,126.9	6,862.3	806.5
1980-IV	155.1	436.2	46,574.4	4,304.3	352.1	146,678.6	7,228.3	694.4
1981-I	158.4	469.1	46,911.2	4,662.7	378.9	153,618.2	8,123.9	737.9
1981-II	150.2	471.0	47,279.3	4,347.2	386.4	141,928.4	7,464.1	839.2
1981-III	153.9	509.1	52,663.3	4,961.1	402.0	155,184.1	7,883.0	794.5
1981-IV	154.5	490.5	51,975.1	5,187.4	420.9	156,138.6	8,194.1	829.0
1982-I	146.5	495.9	51,933.7	6,583.3	431.2	152,676.8	7,822.2	851.0
1982-II	140.8	485.4	50,610.3	8,191.5	425.9	14,568.5	7,439.4	788.1
1982-III	140.0	494.5	54,897.0	12,868.4	463.1	151,011.9	7,388.7	810.5
1982-IV	136.7	507.9	55,534.5	13,597.4	473.1	148,296.5	7,448.1	801.1
1983-I	136.2	490.1	49,325.6	18,401.2	456.1	14,638.6	7,220.6	764.7
1983-II	125.5	480.3	45,735.3	17,809.7	460.9	131,365.4	6,503.3	696.1
1983-III	127.0	527.2	52,885.5	24,890.7	459.9	166,153.2	8,070.4	876.3
1983-IV	135.8	542.7	52,916.9	27,790.1	483.8	171,333.7	8,239.1	988.2

*--Expressed in German marks.

Appendix table 12.17--Importers' price index of wheat in embargo model simulation

Year/ quarter	Egypt	EC*	Japan	Mexico	China	S. Korea	Taiwan	USSR
				Importer's currency per ton				
1980-I	132.8	391.2	47,395.0	4,061.3	301.6	118,273.7	7,039.2	926.7
1980-II	136.4	401.9	44,884.8	3,762.8	312.4	118,517.6	6,975.5	732.6
1980-III	143.1	410.6	44,011.8	3,877.3	316.5	127,280.8	6,628.5	844.6
1980-IV	154.3	446.9	45,255.4	4,353.1	351.3	147,000.3	7,243.0	722.1
1981-I	158.0	477.8	45,768.7	4,757.1	379.4	155,018.7	8,189.7	738.7
1981-II	148.3	476.0	45,005.0	4,225.4	384.5	137,644.1	7,244.4	873.2
1981-III	152.2	506.6	49,815.0	4,718.3	400.1	148,699.7	7,573.4	806.9
1981-IV	151.1	492.4	49,017.4	4,959.0	418.8	149,291.2	7,842.9	959.1
1982-I	142.8	499.2	48,825.1	6,279.9	429.1	145,416.5	7,455.4	884.7
1982-II	137.6	491.5	47,696.6	7,865.5	422.9	139,352.6	7,120.4	837.5
1982-III	137.7	492.9	51,907.4	12,334.1	458.0	145,407.6	7,116.9	834.3
1982-IV	134.9	504.5	52,365.1	12,950.5	469.2	141,925.9	7,137.6	816.3
1983-I	134.1	490.0	46,502.6	17,528.9	451.2	140,382.0	6,915.8	773.6
1983-II	123.3	484.6	43,320.5	17,238.9	456.7	126,704.7	6,274.2	738.1
1983-III	127.6	515.1	49,997.9	23,203.7	460.9	158,849.9	7,774.9	878.3
1983-IV	135.7	528.0	49,582.6	25,999.2	481.6	161,954.6	7,821.4	959.6

*--Expressed in German marks.

Appendix table 12.18--Exporters' total corn exports in base model simulation

Year/ quarter	World	United States	EC	Argentina	Rest of world
			1,000 tons		
1980-I	17,156.0	14,556.7	857.9	651.7	1,089.5
1980-II	18,320.6	15,030.4	872.1	608.6	1,809.4
1980-III	18,260.4	16,212.7	886.3	676.7	484.5
1980-IV	19,538.9	16,098.2	814.1	615.5	2,010.9
1981-I	16,993.9	14,464.5	791.7	625.0	1,112.6
1981-II	17,487.3	14,234.5	804.1	777.4	1,671.0
1981-III	18,935.5	13,092.8	826.2	812.2	4,204.1
1981-IV	17,812.0	15,181.8	837.0	704.5	1,088.5
1982-I	16,875.8	14,175.9	780.6	811.7	1,307.4
1982-II	18,306.9	15,346.9	777.0	1,030.3	1,152.5
1982-III	22,286.9	14,318.9	783.1	946.7	6,237.9
1982-IV	16,593.6	12,994.3	755.4	1,068.1	2,135.4
1983-I	17,773.4	13,577.9	753.0	1,059.5	2,382.8
1983-II	17,891.8	13,577.1	781.2	1,348.5	1,990.7
1983-III	25,076.9	18,217.7	748.5	862.6	5,247.9
1983-IV	25,745.1	12,510.0	698.1	709.4	11,827.4

Appendix table 12.19--Exporters' total corn exports in embargo model simulation

Year/ quarter	World	United States	EC	Argentina	Rest of world
			1,000 tons		
1980-I	17,988.1	13,873.1	1,363.2	1,484.4	1,267.2
1980-II	17,801.0	13,012.6	1,368.8	1,512.0	1,907.4
1980-III	17,127.2	13,679.2	1,403.3	1,563.1	481.4
1980-IV	20,386.5	15,684.2	1,287.5	1,398.1	2,016.5
1981-I	18,062.3	14,257.4	1,241.0	1,459.9	1,103.7
1981-II	16,560.6	12,125.9	1,267.2	1,503.7	1,663.5
1981-III	18,262.5	11,171.9	1,284.0	1,607.1	4,198.7
1981-IV	17,012.2	12,398.8	1,303.8	2,134.7	1,174.7
1982-I	16,292.6	11,990.3	1,212.0	1,617.0	1,473.2
1982-II	17,695.9	13,385.7	1,229.0	1,756.9	1,314.1
1982-III	22,158.6	12,407.6	1,244.3	1,269.6	7,236.8
1982-IV	16,045.8	11,368.2	1,185.1	1,256.1	2,236.3
1983-I	17,836.2	12,227.4	1,180.7	1,174.8	3,253.3
1983-II	17,511.1	12,393.4	1,263.0	1,554.9	2,299.6
1983-III	24,797.3	16,186.3	1,238.8	1,285.1	6,086.9
1983-IV	25,864.1	11,582.1	1,062.2	808.5	12,411.1

Appendix table 12.20--Importers' total imports of corn in base model simulation

Year/ quarter	Egypt	EC	Japan	Mexico	China	S. Korea	Taiwan	USSR
				1,000 tons				
1980-I	325.0	3,582.2	2,689.7	1,327.5	381.3	510.5	867.0	2,282.4
1980-II	336.2	3,483.3	2,775.8	1,230.7	207.1	617.0	762.0	2,427.0
1980-III	349.7	3,618.4	2,911.3	1,445.9	79.1	466.2	769.0	2,508.1
1980-IV	345.0	3,288.3	2,889.0	1,223.5	189.0	508.1	707.6	2,268.5
1981-I	356.6	3,166.0	45,768.7	437.3	263.4	518.9	656.7	2,350.8
1981-II	352.1	3,314.9	45,005.0	376.3	151.5	692.9	646.1	2,142.7
1981-III	370.1	3,369.4	49,815.0	476.1	57.6	527.7	604.5	2,269.5
1981-IV	384.8	3,474.8	49,017.4	713.8	220.2	716.2	660.8	3,500.9
1982-I	379.0	3,193.0	48,825.1	326.9	300.2	706.7	800.9	3,372.5
1982-II	380.4	3,327.5	47,696.6	267.4	175.2	894.8	783.3	3,415.2
1982-III	396.7	3,628.4	51,907.4	427.1	79.0	759.3	912.6	4,149.1
1982-IV	382.8	3,303.6	52,365.1	29.3	214.0	789.8	793.2	2,393.6
1983-I	397.6	3,239.2	46,502.6	1,575.8	280.8	808.3	946.6	2,302.0
1983-II	386.9	3,565.6	43,320.5	1,899.5	169.2	1,060.0	1,013.8	2,463.3
1983-III	406.7	3,449.2	49,997.9	6,506.6	69.1	859.8	961.7	2,830.5
1983-IV	394.9	2,831.7	49,582.6	3,736.0	127.0	747.3	902.0	1,871.8

Appendix table 12.21--Importers' total imports of corn in embargo model simulation

Year/ quarter	Egypt	EC	Japan	Mexico	China	S. Korea	Taiwan	USSR
				1,000 tons				
1980-I	321.8	3,436.2	2,692.3	1,290.9	401.3	496.8	860.6	2,043.4
1980-III	346.0	3,495.3	2,937.8	1,500.7	87.6	459.7	781.9	1,928.5
1980-IV	341.3	3,185.6	2,887.7	1,378.7	197.9	492.3	696.6	1,731.6
1981-I	353.4	3,050.4	3,055.3	464.2	269.1	502.8	645.1	1,929.9
1981-II	348.8	3,181.3	3,074.3	395.9	160.7	684.8	652.7	2,239.6
1981-III	367.2	3,200.8	3,061.8	476.1	61.0	522.3	613.0	2,216.2
1981-IV	380.5	3,273.9	3,250.5	713.8	240.8	712.8	678.0	3,499.8
1982-I	373.6	3,015.4	3,422.5	326.9	318.8	701.1	817.4	3,743.4
1982-II	374.9	3,245.9	3,459.4	267.4	182.6	883.4	792.5	3,988.1
1982-III	392.3	3,328.1	3,602.3	427.1	85.0	750.5	921.9	4,965.2
1982-IV	379.4	3,069.7	3,535.1	29.3	221.9	780.6	807.2	2,639.5
1983-I	393.0	3,027.8	3,384.0	1,575.8	290.1	795.5	954.3	2,597.9
1983-II	381.8	3,312.3	3,475.9	1,899.5	180.0	1,042.2	1,017.6	2,902.4
1983-III	406.2	3,082.0	3,630.4	6,506.6	75.6	847.2	975.1	2,946.4
1983-IV	392.0	2,632.9	3,295.0	3,736.0	132.1	731.2	903.4	2,139.5

Appendix table 12.22--USSR imports of corn in base model simulation

Year/ quarter	Argentina	United States	Rest of world
		1,000 tons	
1980-I	179.5	2,023.0	232.9
1980-II	226.5	2,110.3	242.9
1980-III	293.1	2,156.6	248.3
1980-IV	265.0	1,979.3	227.9
1981-I	223.6	2,044.7	235.4
1981-II	128.1	1,881.3	216.6
1981-III	151.9	1,874.5	227.3
1981-IV	242.1	3,099.3	356.8
1982-I	168.8	2,999.7	345.3
1982-II	141.7	3,053.7	351.6
1982-III	113.9	3,818.2	439.6
1982-IV	81.1	2,107.7	242.6
1983-I	67.4	2,066.9	237.9
1983-II	78.2	2,210.3	254.4
1983-III	123.9	2,456.2	282.8
1983-IV	50.3	1,773.0	204.1

Appendix table 12.23--USSR imports of corn in embargo model simulation

Year/ quarter	Argentina	United States	Rest of world
		1,000 tons	
1980-I	1,061.6	1,818.0	859.2
1980-II	1,162.0	484.8	543.8
1980-III	1,196.3	0	309.6
1980-IV	1,069.9	1,924.9	328.7
1981-I	1,092.8	2,278.3	552.0
1981-II	895.4	160.8	1,230.9
1981-III	979.6	461.2	1,002.7
1981-IV	1,722.3	738.1	1,604.9
1982-I	1,237.0	1,214.5	2,640.8
1982-II	929.0	1,515.7	3,295.7
1982-III	521.8	2,460.2	5,349.2
1982-IV	349.3	898.8	1,954.2
1983-I	270.6	1,068.8	2,324.0
1983-II	367.3	1,191.8	2,591.3
1983-III	619.2	843.4	1,833.8
1983-IV	219.2	1,246.8	2,710.9

Appendix table 12.24--Exporters' export price of corn exports in base model simulation

Year/ quarter	United States	Argentina	Rest of world
	Exporter's currency per ton		
1980-I	126.0	316,968.4	123.1
1980-II	123.0	387,165.6	132.7
1980-III	124.3	468,370.7	135.8
1980-IV	140.8	537,263.6	139.6
1981-I	145.2	549,509.6	148.6
1981-II	143.4	683,738.5	148.4
1981-III	149.9	1,049,577.0	156.6
1981-IV	134.3	1,167,482.5	125.5
1982-I	136.4	15,211,762.2	133.5
1982-II	133.2	1,691,099.7	131.4
1982-III	117.6	2,932,326.0	109.5
1982-IV	124.7	4,145,458.7	130.8
1983-I	131.0	5,366,019.0	128.0
1983-II	120.1	7,036,158.5	117.9
1983-III	107.0	11,136,800.0	119.2
1983-IV	159.4	19,409,800.0	124.8

Appendix table 12.25--Exporters' export price of corn exports in embargo model simulation

Year/ quarter	United States	Argentina	Rest of world
	Exporter's currency per ton		
1980-I	124.4	318,931.2	121.8
1980-II	118.3	389,817.0	129.2
1980-III	118.7	471,320.8	131.1
1980-IV	139.8	540,579.5	138.8
1981-I	144.6	553,017.0	148.1
1981-II	137.3	687,129.8	144.4
1981-III	143.5	1,054,962.3	153.0
1981-IV	127.1	1,177,229.3	121.8
1982-I	130.3	1,532,895.8	128.7
1982-II	128.4	1,697,882.5	128.1
1982-III	113.1	2,938,786.7	106.5
1982-IV	120.3	4,150,502.0	127.2
1983-I	127.3	5,370,168.5	125.3
1983-II	116.7	7,043,678.5	115.7
1983-III	103.6	11,170,100.0	116.7
1983-IV	156.1	194,288,000.0	122.8

Appendix table 12.26--Importers' price index of corn in base model simulation

Year/ quarter	Egypt	EC*	Japan	Mexico	China	S. Korea	Taiwan	USSR
				Importer's currency per ton				
1980-I	111.3	321.4	39,108.8	2,867.3	255.7	99,100.8	5,110.3	746.0
1980-II	112.3	339.4	38,365.8	2,840.7	266.5	112,525.3	5,675.9	596.5
1980-III	111.9	337.2	35,745.7	2,893.9	260.4	112,119.3	5,412.0	642.5
1980-IV	126.4	394.2	37,961.3	3,254.2	292.0	131,100.6	5,653.2	557.5
1981-I	129.0	429.8	37,890.7	3,423.4	298.8	129,825.7	6,386.3	580.5
1981-II	125.2	445.9	39,491.0	3,472.2	302.6	124,436.0	6,347.3	710.2
1981-III	124.4	488.9	41,813.1	3,740.6	313.5	125,377.9	6,520.5	662.5
1981-IV	106.2	419.7	36,002.8	3,421.7	279.5	110,992.4	5,558.0	582.6
1982-I	107.8	428.3	38,052.1	4,669.2	288.7	113,044.3	5,829.9	626.8
1982-II	110.1	421.5	38,806.6	6,219.3	290.1	116,707.2	5,998.8	596.2
1982-III	92.4	387.6	35,968.7	8,275.6	266.0	100,606.3	4,930.1	527.5
1982-IV	98.7	403.6	38,292.4	9,211.5	280.0	106,178.4	5,793.0	544.3
1983-I	104.0	402.4	36,384.8	13,320.8	294.1	113,929.5	5,690.6	553.1
1983-II	98.7	402.0	34,572.7	13,681.6	291.1	110,230.3	5,323.0	494.6
1983-III	88.5	409.8	31,826.7	13,702.5	276.1	103,160.1	5,388.8	536.7
1983-IV	121.0	518.2	42,568.2	20,993.1	351.2	145,005.1	5,774.5	780.5

*--Expressed in German marks.

Appendix table 12.27--Importers' price index of corn in embargo model simulation

Year/ quarter	Egypt	EC*	Japan	Mexico	China	S. Korea	Taiwan	USSR
				Importer's currency per ton				
1980-I	116.3	348.0	38,899.5	2,836.6	249.5	104,301.1	5,183.5	811.4
1980-II	114.6	363.7	37,489.4	2,716.6	257.0	116,648.9	5,659.5	696.5
1980-III	113.4	362.0	34,731.1	2,745.3	247.9	115,341.6	5,342.4	831.9
1980-IV	132.7	421.1	37,942.8	3,234.0	285.5	138,706.1	5,761.2	722.4
1981-I	135.3	459.8	37,989.1	3,403.3	295.8	137,264.6	6,517.1	686.5
1981-II	127.2	476.0	38,395.6	3,317.8	294.0	127,441.1	6,309.8	705.8
1981-III	126.0	521.2	40,633.1	3,573.6	304.9	128,171.1	6,466.3	684.2
1981-IV	106.4	456.3	34,587.7	3,256.7	267.6	112,391.1	5,437.1	599.3
1982-I	108.8	465.4	36,862.3	4,472.8	280.4	115,157.3	5,745.4	591.6
1982-II	112.2	459.8	37,861.6	6,004.5	284.3	119,887.9	5,970.6	548.4
1982-III	93.9	433.9	35,009.4	8,021.0	256.7	103,080.8	4,909.5	463.6
1982-IV	100.3	442.5	37,393.3	8,852.0	275.0	108,844.8	5,723.0	508.5
1983-I	106.5	440.5	35,741.4	12,979.9	289.4	117,701.4	5,687.9	503.9
1983-II	101.3	447.6	33,973.1	13,325.8	282.5	113,997.8	5,340.3	450.8
1983-III	90.3	466.1	31,225.6	13,163.4	264.4	106,342.4	5,341.1	519.7
1983-IV	126.0	556.5	41,885.6	21,147.2	344.5	151,498.3	5,829.8	681.2

*--Expressed in German marks.

CHAPTER 13

DOMESTIC EFFECTS OF THE 1980 EMBARGO

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CHAPTER 13

DOMESTIC EFFECTS OF THE 1980 EMBARGO*

The previous two chapters examined world trade and price effects resulting from the embargo. This chapter determines the effect of the 1980 embargo on domestic U.S. prices and farm income from 1980 through 1984.

Two sets of embargo-induced changes affect prices and incomes in the U.S. agricultural sector: (1) the effect of the embargo on U.S. exports, and (2) the commodity policy changes implemented by the United States in the wake of the embargo (Chapter 7) to compensate American farmers for the expected loss of exports. This chapter explicitly considers commodity policy changes and the role they played in determining farm sector income.

The major effect of the embargo was in its first year and fell more heavily on wheat than on corn. This is primarily the result of policy measures (such as Commodity Credit Corporation (CCC) grain purchases) which took place only in the first year of the embargo. Results also generally show that the embargo resulted in higher farm prices, a direct result of the dominance of the offsetting commodity policies enacted to compensate farmers for expected trade loss. Under all scenarios examined in this chapter, the embargo resulted in higher cumulative net farm income over 1979-84. However, results also show that the most that net farm income ever increased was only $2.2 billion. This is a small increase when we consider that cumulative net farm income for the same period was $155.1 billion.

The scenarios we consider contain both a trade dimension and a policy dimension. The FAPSIM model (described in Chapter 6) has considerable detail on Government involvement in the U.S. agricultural sector, but it does not have a well-developed trade sector. Trade effects must be fed into the model with changes in U.S. exports or imports. The trade alternatives we used are taken from the changes in U.S. exports resulting from the first three simulations run in the spatial equilibrium model in Chapter 11.

For the spatial model, we knew that the grain trade flow between the United States and the USSR had to be constrained to a maximum of 8 million tons but we did not know if there also was an effect on the level of Soviet imports. Hence, the spatial model analyzed three alternative effects: No effect, a 3-million-ton decline, and an 11-million-ton decline. The amounts by which U.S. exports of wheat and corn declined in each of these scenarios are shown in table 13.1. These three cases represent alternative reductions in demand for U.S. exports.

For the policy dimensions, we needed to include the changes made in domestic commodity programs in the wake of the embargo to offset potentially adverse effects on the farm sector. These changes included an increase in the CCC and farmer-owned reserve (FOR) loan rates for wheat and feed grains. The FOR release prices,

*Contributors to this chapter were J. Michael Price and Alan Webb.

Table 13.1--Spatial model simulations of declines in U.S. wheat and corn exports under alternative USSR import assumptions

Spatial model scenario	Hypothesized change in USSR imports	Decline in U.S. exports of-- Wheat	Corn
		Million bushels	
SCENARIO I	No change	15.3	11.7
SCENARIO II	3-million-ton decline	41.2	113.8
SCENARIO III	11-million-ton decline	128.9	328.9

call prices, and storage payments for these grains were also increased shortly after the embargo was announced. Later in the 1979 marketing year, the CCC purchased 154.8 million bushels of wheat and 159.5 million bushels of corn to increase farm prices. Since all of these policy changes were initiated as a direct result of the embargo, we must consider their effect on the farm sector in analyzing the embargo.

Although embargo-induced farm policy changes in the 1979 marketing year are fairly well documented, it is less clear how farm policies would have evolved in subsequent years had the embargo never occurred. Policymakers indicate,

Export level assumptions	Policy assumptions		
	EMBARGO	NO EMBARGO	
	Higher (compensating) income supports actual historical policy set 1/	Hypothesized policies; lower price & income supports 1979-84 2/	Hypothesized policies; lower price & income supports 1979-81, actual policy 1982-84
EMBARGO:			
Actual historical level	Base simulation	SCENARIO V	
NO EMBARGO:			
Scenario 1--1979/80 only			
Soviet imports-- no change			
U.S. wheat exports-- +15.3 mil. bu.		SCENARIO I	
U.S. corn exports-- +11.7 mil. bu.			
Scenario 2--1979/80 only			
Soviet imports-- +3 mil. tons			
U.S. wheat exports-- +41.2 mil. bu.	SCENARIO IV	SCENARIO II	SCENARIO VI
U.S. corn exports-- +113.8 mil. bu.			
Scenario 3--1979/80 only			
Soviet imports-- +11 mil. tons			
U.S. wheat exports-- +125.9 mil. bu.		SCENARIO III	
U.S. corn exports-- +328.9 mil. bu.			
Scenario 1--1979-84			
Soviet imports-- no change			
U.S. wheat exports-- +15.3 mil. bu.			
U.S. corn exports-- +11.7 mil. bu.			
Scenario 2--1979-84			
Soviet imports-- +3 mil. tons			
U.S. wheat exports-- +41.2 mil. bu.		SCENARIO VII	
U.S. corn exports-- +113.8 mil. bu.			
Scenario 3--1979-84			
Soviet imports-- +11 mil. tons			
U.S. wheat exports-- +125.9 mil. bu.			
U.S. corn exports-- +328.9 mil. bu.			

1/ App. tables 13.2, 13.4, 13.6, 13.8, 13.10. 2/ App. tables 13.3, 13.5, 13.7, 13.9, 13.11.

however, that the embargo effect on policies after 1979 was to increase loan rates and storage payments by the amount they were increased during the 1979 marketing year. Furthermore, the FOR release and call prices, when viewed as a percentage of the CCC loan rate, would have differed from their actual historical values only in those years in which they were exceeded by the target price. The FOR and CCC loan rates also would have been identical in 1980-82 had the embargo never occurred.

Alternative sets of trade and policy assumptions are laid out in the accompanying box. There are seven scenarios in addition to the base simulation which represent policies and exports as they actually were during and after the embargo. SCENARIOS I, II, III, VI, and VII simulate what conditions would have been without an embargo. SCENARIOS IV and V are merely hypothetical constructions used to examine separately policy effects and trade effects. We use two conventions to help avoid confusion with the scenario discussions in preceding chapters. First, the scenarios in this chapter are typed in upper case letters and are numbered with Roman numerals. This will help the reader distinguish them from the scenarios used in Chapter 11 (which had neither a U.S. policy dimension nor a time dimension).

The second convention we use is to discuss the results in terms of how the embargo affected U.S. agriculture rather than in terms of what conditions would have been like had there been no embargo. The scenario simulations themselves are actually no-embargo scenarios. As long as the discussions are in terms of changes from a base simulation, we can reverse the signs on the results and talk about the effect of the embargo on U.S. agriculture. Some confusion may result, however, if the reader fails to realize that the base simulation represents history and, therefore, includes embargo effects.

All scenarios use two sets of price elasticities of import demand for wheat and corn. The first set, FAPSIM-implied elasticities, are derived from econometric estimation of the import demand for grains. The second set was derived through the Delphi process described in Chapter 6. The FAPSIM elasticities for wheat and corn were approximately one-third to one-half those obtained through the Delphi process. Because of these differences, we decided to analyze the embargo under both sets of assumptions.

We discuss the simulation results for SCENARIOS I, II, and III for both sets of elasticities first. These scenarios are a direct extension of the analysis presented for Scenarios 1, 2, and 3 in Chapter 11. The discussion covers commodity prices, farm income, and Government costs. Because SCENARIOS I, II, and III include combined effects of changes in U.S. exports and changes in U.S. agricultural policies, SCENARIOS IV and V were run to help identify the relative importance of each of these two effects. SCENARIO VI provides alternative assumptions about the duration of the embargo-induced policy changes and SCENARIO VII examines the persistent decline in U.S. exports.

ALTERNATIVE TRADE EFFECTS: SCENARIOS I, II, and III

This section focuses on the domestic effects of the changes in U.S. exports identified in Chapter 11 and the changes in U.S. agriculture policy imposed to buffer the agricultural sector against those effects. This section attempts to answer two key questions:

- Were the commodity policy changes sufficient to offset the decline in farm income which is implied by the decline in U.S. exports?
- How persistent were the embargo-induced changes in prices and income?

Commodity Prices

Farm prices dropped immediately after the embargo was announced. However, prices recovered in 2-3 weeks. Table 13.2 presents estimates of the effect of the embargo (and the compensating policy changes) on season average prices for wheat and corn. Average wheat prices for 1979-84 were 2.6-3.4 percent higher for all three scenarios and for both sets of elasticity assumptions. Average corn prices were 0.1-1.5 percent higher.

Simulation results show that the compensating policies (designed to bolster prices) more than offset downward pressure on prices resulting from the decline in U.S. exports. Three key

policy actions were responsible for these higher prices. First, in the 1979/80 marketing year, the CCC expanded its demand for U.S. grain by purchasing and isolating 154.8 million bushels of wheat and 159.5 million bushels of corn from the market. This policy measure also caused a net increase in the demand for grain (as measured by the difference between the increase in CCC demand and the decline in export demand) for all scenarios except for corn in SCENARIO III (table 13.3). Thus, if we consider only these two factors we see that in all cases but one the embargo raised grain prices during the 1979/80 marketing year.

The second set of policy changes which strengthened farm prices was an increase in the FOR release price. This was particularly significant for wheat, for which the release price was raised by $0.46 per bushel (see Chapter 3 for details on the operation of the FOR). Once the farm price exceeds the release price, FOR storage payments are discontinued, and there are no penalties for removing the crop from the FOR storage program. When this happens, there is very little incentive for holding grain in the reserve. If the wheat FOR release price had not been raised after the embargo was announced, grain would have come out of the reserve at the lower release price. This increase in wheat supplied to the market would have kept the season average price of wheat at or near the pre-embargo release price. By increasing the release price by $0.46, the season average farm price of wheat rose by a like amount in 1979/80 in virtually every case examined.

Although the effects are not as dramatic, the changes in the FOR program also raised corn prices in the 1979/80 marketing year. Table 13.2 indicates that corn prices were from 0.8-5.3 percent higher in 1979/80, despite the fact that the CCC did not acquire sufficient

Table 13.2--Effect of the embargo on farm commodity prices (SCENARIOS, I, II, and III)

Item	Marketing year						Average
	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	
	Dollars per bushel						
Actual:							
Wheat	3.78	3.91	3.66	3.55	3.53	3.38	3.64
Corn	2.52	3.11	2.50	2.68	3.25	2.62	2.78
FAPSIM elasticities:	*Percentage change*						
SCENARIO I--							
Wheat	12.2	2.4	2.1	4.2	- .1	- .4	3.4
Corn	5.3	-1.2	2.3	.2	3.8	-1.4	1.5
SCENARIO II--							
Wheat	12.2	2.5	2.1	4.2	- .1	- .4	3.4
Corn	2.8	-1.3	2.1	.3	3.8	-1.4	1.1
SCENARIO III--							
Wheat	12.2	2.0	2.3	4.2	- .1	- .4	3.4
Corn	.8	-5.1	3.0	- .3	3.8	-1.5	.1
Delphi elasticities:							
SCENARIO I--							
Wheat	12.2	1.9	1.2	4.2	- .1	- .2	3.2
Corn	3.0	- .7	1.2	.4	3.8	- .9	1.1
SCENARIO II--							
Wheat	12.2	1.9	1.2	4.2	- .1	- .2	3.2
Corn	1.6	- .7	1.1	.5	3.8	- .9	.9
SCENARIO III--							
Wheat	9.0	1.3	1.3	4.2	- .1	- .2	2.6
Corn	.8	-4.2	1.7	.2	3.8	-1.0	.2

Table 13.3--Net exogenous change in the demand for grains resulting from the embargo in the 1979/80 marketing year

Scenario	Wheat	Corn
	Million bushels	
SCENARIO I	139.5	148.0
SCENARIO II	113.6	45.9
SCENARIO III	25.9	-169.2

stocks to offset the decline in export demand for corn caused by the embargo in all three of the scenarios examined.

Over the 1980-84 period, the change in FOR policy was the only exogenous policy factor affecting grain demand. With higher loan rates and release prices, the incentives for placing grain in the FOR storage program are increased. This increase in demand for FOR stocks explains why commodity prices were generally higher over this period. The one notable exception was corn in the 1980/81 marketing year, when poor yields placed corn in release status, and FOR stocks were drawn down to zero in that year. The embargo caused the total supply of corn to be higher in 1980/81 because the change in FOR policy increased 1979/80 carryout stocks. With larger buffer stocks, corn prices were lower in 1980/81 as a result of the embargo.

Comparison of the effects among the three scenarios for wheat shows that policy changes dominate effects of the export adjustments associated with the embargo. There is virtually no change from one case to the next for each set of elasticities used in the analysis.

Price effects of the embargo for corn become more pronounced for cases in which the export effects are lower. Here, again, effects of policy changes are the most important elements in examining effects of the embargo. The larger the export effects, the less successful the policy changes were in offsetting their effects.

Differences in the price effects between the two sets of export price elasticities used in the analysis are small in terms of the average price changes for 1979-84. As expected, the Delphi elasticities generally led to smaller price adjustments on a year-to-year basis than the FAPSIM elasticities. The only exceptions were those years in which price movements were constrained by the FOR storage program.

For example, in the 1982/83 marketing year, export demand for wheat was down 15 percent from the previous year. This decreased export demand dropped the season average price for wheat to the CCC loan rate as farmers placed grain under loan. As a result of the embargo, the loan rate for wheat was $0.15 per bushel higher in 1982/83. Hence, the market price of wheat was also $0.15 per bushel higher because the loan rate establishes a price floor for grains.

Farm Income

Tables 13.4 and 13.5 provide estimates of the embargo's effects on receipts, expenses, and net farm income. Note that the farm receipts, expenses, and net income in these tables are on a calendar year basis. The econometric model used to analyze the embargo cannot distinguish between factors affecting prices evenly throughout the crop year and developments like the embargo that are concentrated in one part of the crop year. Thus, the model solutions overstate the embargo's effect in 1979 and understate the effect in 1980. However, the 1981-84 calendar year estimates and the cumulative impact over the 6-year period should be accurate.

The model suggests that the embargo raised net farm income over 1979-84 between $0.2-$2.2 billion. To the extent that net farm income can be used as a measure of the well-being of the agricultural sector, these estimates imply that the policy measures adopted by the Government in response to the embargo more than compensated farmers for loss in export sales.

Farm programs adopted because of the embargo affected differently various categories of farm income. The embargo-related programs generally increased the demand for grains by increasing the incentives for farmers to place their grain in the FOR storage program. Due to the inelastic nature of the supply for crops, these demand shifts result in estimated crop cash receipts that were $1.8-$3.9 billion greater over 1979-84.

Effects on livestock cash receipts reported in tables 13.4 and 13.5 are mixed and reflect both the response of the livestock sector to the year-to-year grain price effects (table 13.2) and the lags involved in altering livestock production. In SCENARIOS I and II, the embargo would have raised cumulative livestock receipts from $0.1-$1.2 billion for 1979-84. In SCENARIO III, cash receipts for the livestock sector were approximately $0.1 billion lower for the same period.

The embargo raised total farm expenses over the period for two reasons. Feed costs are an explicit component of farm expenses. Since grain prices were higher over the period, feed costs paid by livestock producers were also higher. In addition, higher grain prices led to an increase in crop production and greater input use which also increased farm expenses. Over 1979-84, the embargo raised total farm expenses an estimated $0.5-$1.8 billion.

The final component of net farm income is "other" farm income and includes the value of home consumption and direct Government payments to farmers.

The Government policy measures following the announcement of the embargo increased the

Table 13.4--Effects on farm income of the embargo based on FAPSIM import demand elasticities (SCENARIOS I, II, and III)

Item	Calendar years 1979	1980	1981	1982	1983	1984	Total
				Billion dollars			
Actual:							
Farm receipts--							
Livestock	69.2	68.0	69.2	70.3	69.4	72.7	418.8
Crops	62.3	71.8	72.9	72.7	66.8	69.1	415.6
Total	131.5	139.8	142.1	143.0	136.2	141.8	834.4
Other income	14.2	15.8	18.1	20.1	24.9	24.3	117.4
Total expenses	119.0	129.4	135.1	136.9	135.6	139.5	795.5
Net farm income 1/	26.7	26.1	24.0	26.0	25.6	26.7	155.1
				Differences from actual, billion dollars			
SCENARIO I:							
Farm receipts--							
Livestock	0	0	- .1	.3	.5	.5	1.2
Crops	1.0	1.0	.3	.7	.4	.5	3.9
Total	1.0	1.0	.2	.9	.9	1.0	5.0
Other income	0	- .1	0	-1.0	- .3	0	-1.4
Total expenses	.4	.2	0	.3	.5	.4	1.8
Net farm income 1/	.6	.8	.2	- .3	.2	.7	2.2
SCENARIO II:							
Farm receipts--							
Livestock	0	0	0	.2	.2	.2	.6
Crops	.9	.7	.2	.6	.4	.5	3.3
Total	.9	.7	.2	.8	.7	.6	3.9
Other income	0	0	0	-1.0	- .3	.1	-1.2
Total expenses	.3	.1	.1	.3	.4	.2	1.4
Net farm income 1/	.6	.6	.1	- .4	0	.5	1.4
SCENARIO III:							
Farm receipts--							
Livestock	0	0	.2	.5	- .2	- .6	- .1
Crops	.9	.2	- .4	.6	.4	.5	2.2
Total	.9	.2	- .2	1.0	.2	- .1	2.0
Other income	0	.1	0	-1.0	- .2	.1	-1.0
Total expenses	.2	- .2	0	.4	.3	0	.7
Net farm income 1/	.6	.5	- .1	- .3	- .2	.1	.6

1/ Net farm income is not adjusted for changes in the value of inventory.

CCC loan rates for grains over 1979-83. If the average farm price over the first 5 months of the marketing year is less than the established target price for the crop, then the Government is required to make a deficiency payment to all farm program participants. The payment rate is the difference between the target price and the higher of the CCC loan rate or the 5-month average price. By increasing the CCC loan rate and leaving target prices unchanged after the embargo was announced, the Government reduced the maximum rate that would have to be paid on deficiency payments. Thus, these policy changes reduced potential budgetary exposure of the programs. This is reflected in the effects on changes in "other" income in tables 13.4 and 13.5. In calendar years 1982 and 1983, these policy changes caused deficiency payments to be lower in each of the cases examined. As a result, the embargo lowered "other" income an estimated $1.4-$0.4 billion.

Although the embargo moved components of net farm income in different directions, the aggregate effect of the embargo was to increase net farm income over the period. As expected, net farm income was affected more in cases in which effects on grain prices were greater. Therefore, if we were to rank the cases in terms of their effects on net farm income, SCENARIO I was most significant, SCENARIO III was least significant, and SCENARIO II had an intermediate effect.

Table 13.5--Effects on farm income of the embargo based on Delphi import demand elasticities

Item	Calendar years						
	1979	1980	1981	1982	1983	1984	Total
	Billion dollars						
Actual:							
Farm receipts--							
Livestock	69.2	68.0	69.2	70.3	69.4	72.7	418.8
Crops	62.3	71.8	72.9	72.7	66.8	69.1	415.6
Total	131.5	139.8	142.1	143.0	136.2	141.8	834.4
Other income	14.2	15.8	18.1	20.1	24.9	24.3	117.4
Total expenses	119.0	129.4	135.1	136.9	135.6	139.5	795.5
Net farm income 1/	26.7	26.1	24.0	26.0	25.6	26.7	155.1
	Differences from actual, billion dollars						
SCENARIO I:							
Farm receipts--							
Livestock	0	0	- .1	.2	.3	.2	.4
Crops	.9	.7	.2	.5	.4	.5	3.2
Total	.9	.7	.1	.7	.7	.7	3.8
Other income	0	0	0	- .8	- .1	.3	- .6
Total expenses	.3	.1	0	.2	.4	.3	1.3
Net farm income 1/	.6	.6	.1	- .4	- .2	.8	1.9
SCENARIO II:							
Farm receipts--							
Livestock	0	0	0	.1	.1	0	.1
Crops	.9	.5	.1	.5	.4	.5	2.9
Total	.9	.5	.1	.6	.5	.5	3.1
Other income	0	0	.1	- .8	- .1	.4	- .5
Total expenses	.3	0	0	.2	.3	.2	1.0
Net farm income 1/	.6	.5	.1	- .4	.1	.7	1.6
SCENARIO III:							
Farm receipts--							
Livestock	0	0	.2	.4	- .1	- .6	- .1
Other income	.7	.2	- .4	.4	.4	.5	1.8
Total	.7	.2	- .2	.8	.3	- .1	1.4
Other	0	.2	.1	- .9	- .1	.3	- .4
Total expenses	.2	- .2	- .1	.3	.3	0	.5
Net farm income 1/	.5	.5	- .1	- .4	- .1	.3	.2

1/ Net farm income is not adjusted for changes in the value of inventory.

Comparison of results between the two sets of import demand elasticities used in the analysis reveals the same type of pattern. Price effects associated with the Delphi elasticities are generally smaller than those associated with the FAPSIM elasticities. Thus, effects on farm income are generally smaller for the Delphi elasticities.

Government Costs

Table 13.6 describes the effect of the embargo on Government program costs. As described earlier, the increase in CCC loan rates, after the embargo was announced, reduced deficiency payments. With the Delphi import demand elasticities, the deficiency payments decreased by approximately $1.3 billion over 1979-84 in all three scenarios. This compares with a decrease of $1.5-$1.6 billion based on FAPSIM import demand elasticities. Because the embargo did not increase grain prices as much with Delphi elasticities, we would expect the decrease in deficiency payments to be less with this set of elasticities.

FOR storage payments resulting from the embargo were higher over the period for two reasons. First, FOR storage payment rates were increased for all grains immediately after the embargo was announced. Second, the increase in the CCC loan rates for grains caused more grain to enter the FOR. In addition, more grain is apt to enter the FOR when world grain prices are low. The FAPSIM import demand elasticities resulted in greater price increases than did the Delphi elasticities. Hence, FOR storage payments were smaller for FAPSIM results. Overall, storage payments increased from $0.5-$0.9 billion with FAPSIM elasticities, and from $0.9-$1.1 billion with Delphi elasticities.

Table 13.6--Embargo effects on farm program costs 1/

Item	1979	1980	1981	1982	1983	1984	Total
			Differences from actual, million dollars				
FAPSIM elasticities:							
SCENARIO I--							
Deficiency payments	-112.5	0	-1,192.6	-342.5	-21.0	24.4	-1,644.2
FOR storage payments	9.1	24.5	65.1	119.1	137.2	148.6	503.6
Payments to dairy	0	-58.2	-75.1	-66.4	-82.2	-97.5	-379.4
SCENARIO II--							
Deficiency payments	-86.1	0	-1,165.5	-362.7	-13.0	31.6	-1,595.7
FOR storage payments	36.8	37.1	78.8	131.9	151.5	163.0	599.1
Payments to dairy	0	-36.9	-41.5	-41.0	-58.4	-79.0	-256.8
SCENARIO III--							
Deficiency payments	-54.1	0	-1,226.0	-284.8	9.7	42.9	-1,512.3
FOR storage payments	145.0	72.5	109.0	166.0	189.4	201.5	883.4
Payments to dairy	0	-19.8	16.5	14.6	-22.8	-49.9	-61.4
Delphi elasticities:							
SCENARIO I--							
Deficiency payments	-74.9	0	-1,038.9	-351.2	177.2	-31.2	-1,319.0
FOR storage payments	62.7	65.6	113.5	177.8	223.5	232.6	875.7
Payments to dairy	0	-38.0	-48.2	-40.4	-53.2	-77.8	-257.6
SCENARIO II--							
Deficiency payments	-58.9	0	-1,024.0	-359.3	177.8	-27.2	-1,291.6
FOR storage payments	82.2	76.7	125.0	189.1	235.2	244.4	952.6
Payments to dairy	0	-26.4	-29.8	-27.2	-40.4	-67.7	-191.5
SCENARIO III--							
Deficiency payments	-18.6	0	-1,071.4	-308.6	165.1	-23.8	-1,257.3
FOR storage payments	163.5	83.4	128.3	194.2	239.3	248.7	1,057.4
Payments to dairy	0	-19.2	11.3	19.1	-14.5	-47.7	-51.0

1/ The deficiency and FOR payments are reported on a crop year basis. Dairy payments are reported on a calendar year basis.

The final category of Government costs is the cash payments to the dairy industry used to support the price of butter, cheese, and nonfat dry milk. These payments are linked indirectly to crop prices. With higher crop prices implied by the embargo, there tends to be less milk production and decreased Government purchases of manufactured dairy products to support dairy product prices. With crop price increases implied by the Delphi elasticities, the embargo resulted in reduced payments to dairy from $0.1-$0.3 billion over 1979-84. FAPSIM import demand elasticities implied a decrease in dairy program costs of $0.1-$0.4 billion over the same period.

Effects of the embargo on deficiency payments made to farmers clearly dominate the embargo effects on total Government payments in table 13.6. Although it is not really appropriate to aggregate these different costs (because of crop year versus calendar year data) to obtain an effect on total costs for the period, it is obvious that the embargo resulted in fewer total Government payments for the scenarios examined and for both sets of import demand elasticities.

EXPORT VERSUS POLICY CHANGES

Results of SCENARIOS I, II, and III indicate that trade effects of the embargo are more than offset by compensating policies. Even though we roughly know the relative size of the two effects, we do not know if individual effects were large or small. That is, we would like to know if the trade effect, by itself would have been large, and if compensating policies therefore averted a disastrous decline in farm income. Likewise, it would be valuable to know if, in the absence of trade effects, whether policies enacted in the wake of the embargo would have significantly improved welfare of the agricultural sector. SCENARIOS IV and V are designed to address these issues.

Of the three scenarios considered in the previous section, SCENARIO II was deemed the most representative of the export adjustments which probably took place as a result of the embargo. SCENARIO IV contains those trade effects but none of the policy adjustments to the embargo; SCENARIO V has the embargo policy adjustments but none of the trade effects. Table 13.7 shows the embargo price effects for SCENARIOS IV and V as well as those for SCENARIO II which will serve as a basis for comparison.

For SCENARIO IV, the only significant price effect was a 2.8-percent corn price decline in the initial year for the FAPSIM elasticities and a 1.6-percent decline for Delphi elasticities. This reflects the assumption that there was no change in the foreign demand for U.S. grains, except in the marketing year in which the embargo was announced. The reason that there was no price change for wheat was because the farm price was at the FOR release price. Decline in export demand meant that fewer stocks came out of the FOR. Corn, however, was not constrained by operation of FOR stock policies.

Results of SCENARIO V indicate that the embargo-induced policy changes generally increased the farm-level price for wheat and corn over 1979-84. These long-term effects reflect the assumption that the embargo affected farm policies in the years after its announcement.

The policy changes affected two components of demand for grain stocks. In 1979/80, CCC stocks were higher because of the embargo. As mentioned earlier, the CCC purchased and isolated grain from the market for the entire 1979 marketing year in order to offset potential loss in export sales from the embargo.

FOR loan rates and release prices were also higher over 1979-83 as a result of the policy changes associated with the embargo. With higher loan rates and release prices, the incentive for placing grain in the FOR storage program is increased. Therefore, demand for FOR stocks would have been lower if the Government had not adjusted its policies.

With an increase in demand in each of these stock categories, the price of wheat would have been between 3.2-3.4 percent higher on average over 1979-84 under SCENARIO V. Corn would have averaged between 0.9-1.6 percent higher over the same period.

A comparison between SCENARIOS IV and V reveals that the price effects associated with the policy changes are of a larger magnitude than those associated with the export changes.

This suggests that the trade effects of the 1980 embargo were very small. Policy effects (though small for all but the first year of the embargo) were much larger than trade effects. The cumulative estimated trade effects over 1979-84 were a $700-million decline in net farm income for the FAPSIM elasticities and a $300-million decline with the Delphi elasticities. Compensating policies were estimated to have raised net farm income by $1.9 billion (Delphi elasticities) to $2.3 billion (FAPSIM elasticities) over the same 6-year period.

ALTERNATIVE POLICY ASSUMPTIONS (SCENARIO VI)

We have identified in the preceding discussion a set of policies (based on interviews with policymakers) which represent the change most closely associated with attempts to compensate the farm sector for the expected decline in exports. These policy changes are shown in appendix tables 13.1-13.10. Although all of the policy changes represented in these tables were clearly the result of the embargo, there was some disagreement among policymakers on the duration of the changes. In particular, some policymakers have contended that the 1980 embargo had no effect on the content of the Food and Agricultural Adjustment Act of 1981. This implies that CCC loan rates over 1982-84 were not affected by the embargo.

This section examines what would have been the effect of the embargo if the compensating policies were assumed to have lasted only until the 1982 crop year when the 1981 farm legislation took effect (that is, the embargo had

Table 13.7--Separation of export and policy change effects of the embargo on farm commodity prices

Item	Marketing year 1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	Average
			Dollars per bushel				
Base = embargo:							
Wheat	3.78	3.91	3.66	3.55	3.53	3.38	3.64
Corn	2.52	3.11	2.50	2.68	3.25	2.62	2.78
			Percentage change				
FAPSIM elasticities:							
SCENARIO II-- 1/							
Wheat	12.2	2.5	2.1	4.2	- .1	- .4	3.4
Corn	2.8	-1.3	2.1	.3	3.8	-1.4	1.1
SCENARIO IV-- 2/							
Wheat	0	.1	0	0	0	0	0
Corn	-2.8	0	- .3	.2	0	- .1	- .9
SCENARIO V-- 3/							
Wheat	12.2	2.4	2.1	4.2	- .1	- .4	3.4
Corn	5.5	-1.1	2.3	.2	3.8	-1.4	1.6
Delphi elasticities:							
SCENARIO II-- 1/							
Wheat	12.2	1.9	1.2	4.2	- .1	- .2	3.2
Corn	1.6	- .7	1.1	.5	3.8	- .9	.9
SCENARIO IV-- 2/							
Wheat	0	0	0	0	0	0	0
Corn	-1.6	0	- .1	0	0	0	- .3
SCENARIO V-- 3/							
Wheat	12.2	1.9	1.2	4.2	- .1	- .2	3.2
Corn	3.1	- .7	1.2	.4	3.8	- .9	.9

1/ Combined trade and policy effects.
2/ Trade effects.
3/ Policy effects.

no effect on 1981 farm legislation). We use the trade effects represented in Scenario 2 from Chapter 11 and incorporate the changes in policies, but for only 1979-81, to construct SCENARIO VI. SCENARIO II, which has the same trade effect but the long-term policy effects, will be used as a basis for comparison. Policy assumptions for both scenarios are shown in table 13.8.

Only the CCC and FOR loan rates are presented in the table because these are the only variables which differ across scenarios. The loan rates for sorghum, barley, and oats were also adjusted between scenarios to be consistent with corn in the analysis.

Because the assumptions used to analyze these scenarios are virtually identical over 1979-84, effects associated with the scenarios are also similar. Table 13.9 presents the price effects under both SCENARIOS II and VI. Price changes associated with each crop are identical between the two scenarios for 1979-81, because the underlying policy assumptions are identical for this period. The embargo would have raised loan rates under SCENARIO II for the 1982/83 to 1983/84 period. For this reason, SCENARIO II shows the embargo resulting in higher prices than does SCENARIO VI over this period.

The only significant difference in price effects between the two scenarios is for wheat in the 1982 marketing year. As discussed earlier, wheat price was at the CCC loan rate in 1982 because of low export demand. Model results indicate that if the CCC loan rate had been $0.15 per bushel (4.3 percent) higher in 1982, then crop prices would also have been $0.15 per bushel higher due to demand conditions.

Because commodity prices averaged higher because of the embargo under both policy scenarios, net farm income was also higher. Under SCENARIO II, cumulative net farm income was estimated to be $1.4-$1.6 billion higher over 1979-84. This compares with a $0.7-$0.9-billion increase under SCENARIO VI. Differences in these effects are small when we consider that the cumulative net farm income was $155.1 billion for the period.

As expected, the difference in Government program costs between the two scenarios was also very minor. Under both scenarios, Government costs were lower because of the embargo.

ALTERNATIVE EXPORT ASSUMPTIONS (SCENARIO VII)

Export adjustments used to analyze effects of the 1980 embargo are based on the assumption that the embargo affected the foreign demand for U.S. products only in the 1979/80 marketing year. Import demand for U.S. grains was unaffected in all subsequent years. There is some evidence, however, that the USSR may have permanently shifted away from imported grain by switching to meat imports and domestically produced nongrain feeds. As a result, there would have been a permanent reduction in Soviet import demand.

Hence, an alternative export scenario was analyzed in order to determine potential effects on domestic markets of a sustained reduction in demand for U.S. exports over the 1979-84 marketing years. Again, SCENARIO II is used as a basis for comparison. SCENARIO VII contains the same trade effects as SCENARIO II but assumes that the trade effects persist over the study period. The policy assumption in both scenarios, of course, is the same.

Table 13.10 provides estimates of the price impacts associated for both SCENARIOS II and VII. For SCENARIO VII, wheat prices were estimated to be 1.9 to 2.2 percent higher as a result of the embargo. This compares with a 3.2- to 3.4-percent increase in prices under SCENARIO II. The implication is that the policy changes enacted by the Government as a result of the embargo were more than adequate to offset the decline in wheat exports even if the export changes persisted over the entire 1979-84 period.

The corn situation is different. For a permanent decline in exports (SCENARIO VII), prices were estimated to be 0.5-1 percent lower on average in 1979-84, because of the embargo. Corn prices would have been 0.9-1.1 percent higher on average in SCENARIO II. This implies that assumptions concerning the duration of effects of the embargo on exports are crucial for determining the direction of the effects of the embargo on corn prices.

Table 13.8--Alternative policy assumptions

Item	1978	1979	1980	1981	1982	1983	1984	1985
				Dollars per bushel				
Wheat CCC loan:								
Historical	2.35	2.50	3.00	3.20	3.55	3.65	3.30	3.30
SCENARIO II 1/	2.35	2.35	2.85	3.05	3.40	3.50	3.30	3.30
SCENARIO VI 2/	2.35	2.35	2.85	3.05	3.55	3.65	3.30	3.30
Wheat FOR loan:								
Historical	2.35	2.50	3.30	3.50	4.00	3.65	3.30	3.30
SCENARIO II 1/	2.35	2.35	2.85	3.05	3.40	3.50	3.30	3.30
SCENARIO VI 2/	2.35	2.35	2.85	3.05	3.55	3.65	3.30	3.30
Corn CCC loan:								
Historical	2.00	2.10	2.25	2.40	2.55	2.65	2.55	2.55
SCENARIO II 1/	2.00	2.00	2.15	2.30	2.45	2.55	2.55	2.55
SCENARIO VI 2/	2.00	2.00	2.15	2.30	2.55	2.65	2.55	2.55
Corn FOR loan:								
Historical	2.00	2.10	2.40	2.55	2.90	2.65	2.55	2.55
SCENARIO II 1/	2.00	2.00	2.15	2.30	2.45	2.55	2.55	2.55
SCENARIO VI 2/	2.00	2.00	2.15	2.30	2.55	2.65	2.55	2.55

1/ Embargo changed 1981 farm legislation.
2/ Embargo did not change 1981 farm legislation.

Table 13.9--Effects of the embargo on farm commodity prices under alternative policy assumptions

Item	Marketing year						Average
	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	
				Dollars per bushel			
Actual:							
Wheat	3.78	3.91	3.66	3.55	3.53	3.38	3.64
Corn	2.52	3.11	2.50	2.68	3.25	2.62	2.78
				Percentage change			
FAPSIM elasticities:							
SCENARIO II-- 1/							
Wheat	12.2	2.5	2.1	4.2	-.1	-.4	3.4
Corn	2.8	-1.3	2.1	.3	3.8	-1.4	1.1
SCENARIO VI-- 2/							
Wheat	12.2	2.5	2.1	0	-3.4	.7	2.4
Corn	2.8	-1.3	1.2	-.9	0	-.2	.4
Delphi elasticities:							
SCENARIO II-- 1/							
Wheat	12.2	1.9	1.2	4.2	-.1	-.2	3.2
Corn	1.6	-.7	1.1	.5	3.8	-.9	.9
SCENARIO VI-- 2/							
Wheat	12.2	1.9	1.2	0	0	0	2.6
Corn	1.6	-.7	1.1	-.3	0	0	..3

1/ Embargo changed 1981 farm legislation.
2/ Embargo did not change 1981 farm legislation.

With lower corn prices and higher wheat prices from the embargo (given a sustained change in import demand), cumulative net farm income would have been higher for 1979-84. According to table 13.11, net farm income was $0.2-$0.4 billion lower in SCENARIO VII than in SCENARIO II.

CONCLUSIONS

Price effects of the seven embargo scenarios considered here are summarized in table 13.12. The embargo raised farm prices under all wheat scenarios and all but two of the corn scenarios. This is the direct result of the

Table 13.10--Effects of the embargo on farm commodity prices under alternative trade effect assumptions

Item	Marketing year						Average
	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	
	Dollars per bushel						
Actual:							
Wheat	3.78	3.91	3.66	3.55	3.53	3.38	3.64
Corn	2.52	3.11	2.50	2.68	3.25	2.62	2.78
	Percentage change						
FAPSIM elasticities:							
SCENARIO II-- 1/							
Wheat	12.2	2.5	2.1	4.2	-.1	-.4	3.4
Corn	2.8	-1.3	2.1	.3	3.8	-1.4	1.1
SCENARIO VII-- 2/							
Wheat	12.2	.1	-.3	4.2	-2.1	-2.8	1.9
Corn	2.8	-4.8	.1	-1.9	3.8	-5.7	-1.0
Delphi elasticities:							
SCENARIO II-- 1/							
Wheat	12.2	1.9	1.2	4.2	-.1	-.2	3.2
Corn	1.6	-.7	1.1	.5	3.8	-.9	.9
SCENARIO VII-- 2/							
Wheat	12.2	.4	-.3	4.2	-1.7	-1.7	2.2
Corn	1.6	-2.6	-.4	-1.0	2.3	-3.0	-.5

1/ One-year trade effect.
2/ Permanent trade effect.

Table 13.11--Effects of the embargo on net farm income under alternative trade effect assumptions

Item	1979	1980	1981	1982	1983	1984	Total
	Billion dollars						
Actual	26.7	26.1	24.0	26.0	25.6	26.7	155.1
	Differences from actual, billion dollars						
FAPSIM elasticities:							
SCENARIO II 1/	.6	.6	.1	- .4	0	.5	1.4
SCENARIO VII 2/	.6	.5	- .3	- .1	.1	.2	1.0
Delphi elasticities:							
SCENARIO II 1/	.6	.5	.1	- .4	.1	.7	1.6
SCENARIO VII 2/	.6	.4	- .1	- .1	.1	.4	1.4

dominance of the offsetting commodity policies enacted to compensate farmers for expected trade losses. The two exceptions where corn prices declined as a result of the embargo were SCENARIO IV (which did not include compensating policies) and SCENARIO VII (which assumed a permanent decline in U.S. exports).

Table 13.12 also shows that the major effect of the embargo was in the first year and fell more heavily on wheat than on corn. This is primarily the result of policy measures (such as the CCC purchases of grain) which took place in only the first year of the embargo.

Finally, there is very little difference between the price effects for wheat under the FAPSIM and Delphi import demand elasticity alternatives. For corn, the differences in price impacts are somewhat larger between the two sets of elasticities, but because the impacts themselves are small, the differences are small as well.

Under all of the scenarios examined, cumulative net farm income was higher in 1979-84 as a result of the embargo. However, the results also show that the most net farm income increased was only $2.2 billion. This is not a large effect when we consider that cumulative net farm income for the same period was $155.1 billion.

The analysis suggests that the changes in Government payments would not have been large when weighed against total cumulative payments for the period. Results do suggest, however, that Government payments in the wake of the embargo were lower for all scenarios, except for SCENARIO VII where the embargo caused a permanent decline in the demand for U.S. agricultural products.

Table 13.12--Comparison of the price effects of the embargo for alternative scenarios

SCENARIOS 1/		Duration (crop years)	FAPSIM elasticities				Delphi elasticities			
			Wheat		Corn		Wheat		Corn	
			First year	Average	First year	Average	First year	Average	First year	Average
			Percentage change							
I	TE: Small PE: Compensation	1979 1979-84	12.2	3.4	5.3	1.5	12.2	3.2	3.0	1.1
II	TE: Medium PE: Compensation	1979 1979-84	12.2	3.4	2.8	1.1	12.2	3.2	1.6	.9
III	TE: Large PE: Compensation	1979 1979-84	12.2	3.4	.8	.1	9.0	2.6	.8	.2
IV	TE: Medium PE: No compensation	1979 --	0	0	-2.8	-.9	0	0	-1.6	- .3
V	TE: None PE: Compensation	-- 1979-84	12.2	3.4	5.5	1.6	12.2	3.2	3.1	.9
VI	TE: Medium PE: Compensation	1979 1979-81	12.2	2.4	2.8	.4	12.2	2.6	1.6	.3
VII	TE: Medium PE: Compensation	1979-84 1979-84	12.2	1.9	2.8	-1.0	12.2	2.2	1.6	- .5

-- = not applicable.
1/ TE = trade effect; PE = policy effect.

Appendix table 13.1--Historical wheat policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.250	0.265	0.265	0.265	0.265	0.265	0.265	0.265
CCC loan	2.35	2.50	3.00	3.20	3.55	3.65	3.30	3.30
FOR loan	2.35	2.50	3.30	3.50	4.00	3.65	3.30	3.30
Release	3.29	3.75	4.20	4.65	4.65	4.65	4.45	4.45
Call	4.11	4.63	5.25	4.65	NA	NA	NA	NA
CCC sales	4.23	4.75	5.83	6.22	7.04	6.57	5.64	5.45
Target	3.40	3.40	3.63	3.81	4.05	4.30	4.38	4.38
				Percent				
As a percentage of CCC loan:								
Release	140.0	150.0	140.0	145.3	131.0	127.4	134.8	134.8
Call	174.9	185.2	175.0	145.3	NA	NA	NA	NA
CCC sales	180.0	190.0	194.3	194.4	198.3	180.0	170.9	165.2
Target	144.7	136.0	121.0	119.1	114.1	117.8	132.7	132.7

NA = Not applicable.

Appendix table 13.2--Alternative wheat policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
CCC loan	2.35	2.35	2.85	3.05	3.40	3.50	3.30	3.30
FOR loan	2.35	2.35	2.85	3.05	3.40	3.50	3.30	3.30
Release	3.29	3.29	3.99	4.43	4.45	4.46	4.45	4.45
Call	4.11	4.11	4.99	4.43	NA	NA	NA	NA
CCC sales	4.23	4.23	5.54	5.93	6.74	6.30	5.64	5.45
Target	3.40	3.40	3.63	3.81	4.05	4.30	4.38	4.38
				Percent				
As a percentage of CCC loan:								
Release	140.0	140.0	140.0	145.3	131.0	127.4	134.8	134.8
Call	174.9	174.9	175.0	145.3	NA	NA	NA	NA
CCC sales	180.0	180.0	194.3	194.4	198.3	180.0	170.9	165.2
Target	144.7	144.7	127.4	124.9	119.1	122.9	132.7	132.7

NA = Not applicable.

Appendix table 13.3--Historical corn policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.250	0.265	0.265	0.265	0.265	0.265	0.265	0.265
CCC loan	2.00	2.10	2.25	2.40	2.55	2.65	2.55	2.55
FOR loan	2.00	2.10	2.40	2.55	2.90	2.65	2.55	2.55
Release	2.50	2.63	2.81	3.15	3.25	3.25	3.25	3.25
Call	2.80	3.05	3.26	3.15	NA	NA	NA	NA
CCC sales	3.00	3.15	3.42	3.31	3.80	3.87	3.90	3.90
Target	2.20	2.35	2.40	2.70	2.86	2.90	3.03	3.03
				Percent				
As a percentage of CCC loan								
Release	125.0	125.2	124.9	131.3	127.5	122.6	127.5	127.5
Call	140.0	145.2	144.9	131.3	NA	NA	NA	NA
CCC sales	150.0	150.0	152.0	137.9	149.0	146.0	152.0	152.9
Target	110.0	111.9	106.7	112.5	112.2	109.4	118.8	118.8

NA = Not applicable.

Appendix table 13.4--Alternative corn policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
CCC loan	2.00	2.00	2.15	2.30	2.45	2.55	2.55	2.55
FOR loan	2.00	2.00	2.15	2.30	2.45	2.55	2.55	2.55
Release	2.50	2.50	2.69	3.02	3.12	3.13	3.25	3.25
Call	2.80	2.80	3.12	3.02	NA	NA	NA	NA
CCC sales	3.00	3.00	3.27	3.17	3.65	3.72	3.90	3.90
Target	2.20	2.35	2.40	2.70	2.86	2.90	3.03	3.03
				Percent				
As a percentage of CCC loan:								
Release	125.0	125.2	124.9	131.3	127.5	122.6	127.5	127.5
Call	140.0	140.0	144.9	131.3	NA	NA	NA	NA
CCC sales	150.0	150.0	152.0	137.9	149.0	146.0	152.9	152.9
Target	110.0	117.5	111.6	117.4	116.7	113.7	118.8	118.8

NA = Not applicable.

Appendix table 13.5--Historical sorghum policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.250	0.265	0.265	0.265	0.265	0.265	0.265	0.265
CCC loan	1.90	2.00	2.14	2.28	2.42	2.52	2.42	2.42
FOR loan	1.90	2.00	2.28	2.42	2.75	2.52	2.42	2.42
Release	2.38	2.50	2.68	3.00	3.10	3.10	3.10	3.10
Call	2.66	2.90	3.10	3.00	NA	NA	NA	NA
CCC sales	2.85	3.00	3.26	3.15	3.60	3.68	3.70	3.70
Target	2.28	2.34	2.50	2.55	2.60	2.72	2.88	2.88
				Percent				
As a percentage of CCC loan:								
Release	125.3	125.0	125.2	131.6	128.1	123.0	128.0	128.1
Call	140.0	145.0	144.9	131.6	NA	NA	NA	NA
CCC sales	150.0	150.0	152.3	138.2	148.8	146.0	152.9	152.9
Target	120.0	117.0	116.8	111.8	107.4	107.9	119.0	119.0

NA = Not applicable.

Appendix table 13.6--Alternative sorghum policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
CCC loan	1.90	1.90	2.04	2.18	2.32	2.42	2.42	2.42
FOR loan	1.90	1.90	2.04	2.18	2.32	2.42	2.42	2.42
Release	2.38	2.38	2.55	2.87	2.97	2.98	3.10	3.10
Call	2.66	2.66	2.96	2.87	NA	NA	NA	NA
CCC sales	2.85	2.85	3.11	3.01	3.45	3.53	3.70	3.70
Target	2.28	2.34	2.50	2.55	2.60	2.72	2.88	2.88
				Percent				
As a percentage of CCC loan:								
Release	125.3	125.0	125.2	131.6	128.1	123.0	128.1	128.1
Call	140.0	140.0	144.9	131.6	NA	NA	NA	NA
CCC sales	150.0	150.0	152.3	138.2	148.8	146.0	152.9	152.9
Target	120.0	123.2	122.5	117.0	112.1	112.4	119.0	119.0

NA = Not applicable.

Appendix table 13.7--Historical barley policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.250	0.265	0.265	0.265	0.265	0.265	0.265	0.265
CCC loan	1.63	1.71	1.83	1.95	2.08	2.16	2.08	2.08
FOR loan	1.63	1.71	1.95	2.07	2.37	2.16	2.08	2.08
Release	2.04	2.14	2.29	2.55	2.65	2.65	2.65	2.65
Call	2.28	2.48	2.65	2.55	NA	NA	NA	NA
CCC sales	2.44	2.57	2.78	2.68	3.34	3.05	3.33	3.33
Target	2.25	2.40	2.55	2.60	2.60	2.60	2.60	2.60
				Percent				
As a percentage of CCC loan:								
Release	125.2	125.1	125.1	130.8	127.4	122.7	127.4	127.4
Call	139.9	145.0	144.8	130.8	NA	NA	NA	NA
CCC sales	149.7	150.3	151.9	137.4	160.6	141.2	160.1	160.1
Target	138.0	140.4	139.3	133.3	125.0	120.4	125.0	125.0

NA = Not applicable.

Appendix table 13.8--Alternative barley policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
CCC loan	1.63	1.63	1.75	1.87	2.00	2.08	2.08	2.08
FOR loan	1.63	1.63	1.75	1.87	2.00	2.08	2.08	2.08
Release	2.04	2.04	2.19	2.45	2.60	2.60	2.65	2.65
Call	2.28	2.28	2.53	2.45	NA	NA	NA	NA
CCC sales	2.44	2.45	2.66	2.57	3.21	2.94	3.33	3.33
Target	2.25	2.40	2.55	2.60	2.60	2.60	2.60	2.60
				Percent				
As a percentage of CCC loan:								
Release	125.2	125.1	125.1	130.8	130.0	125.0	127.4	127.4
Call	139.9	139.9	144.8	130.8	NA	NA	NA	NA
CCC sales	149.7	150.3	151.9	137.4	160.6	141.2	160.1	160.1
Target	138.0	147.2	145.7	138.0	130.0	125.0	125.0	125.0

NA = Not applicable.

Appendix table 13.9--Historical oat policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.190	0.200	0.200	0.200	0.200	0.200	0.200	0.200
CCC loan	1.03	1.08	1.16	1.24	1.31	1.36	1.31	1.31
FOR loan	1.03	1.08	1.23	1.31	1.49	1.36	1.31	1.31
Release	1.29	1.35	1.45	1.55	1.65	1.65	1.65	1.65
Call	1.44	1.57	1.68	1.55	NA	NA	NA	NA
CCC sales	1.54	1.62	1.76	1.63	2.29	1.89	2.04	2.04
Target	NA	NA	NA	NA	1.50	1.60	1.60	1.60
				Percent				
As a percentage of CCC loan:								
Release	125.2	125.0	125.0	125.0	126.0	121.3	126.0	126.0
Call	139.8	145.4	144.8	125.0	NA	NA	NA	NA
CCC sales	149.5	150.0	151.7	131.5	174.8	139.0	155.7	155.7
Target	NA	NA	NA	NA	114.5	117.6	122.1	122.1

NA = Not applicable.

Appendix table 13.10--Alternative oat policy instruments

Item	1978	1979	1980	1981	1982	1983	1984	1985
				$/bushel				
FOR storage	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190
CCC loan	1.03	1.03	1.11	1.19	1.26	1.31	1.31	1.31
FOR loan	1.03	1.03	1.11	1.19	1.26	1.31	1.31	1.31
Release	1.29	1.29	1.39	1.49	1.59	1.60	1.65	1.65
Call	1.44	1.44	1.61	1.49	NA	NA	NA	NA
CCC sales	1.54	1.55	1.68	1.56	2.20	1.82	2.04	2.04
Target	NA	NA	NA	NA	1.50	1.60	1.60	1.60
				Percent				
As a percentage of CCC loan:								
Release	125.2	125.0	125.0	125.0	126.0	122.1	126.0	126.0
Call	139.8	139.8	144.8	125.0	NA	NA	NA	NA
CCC sales	149.5	150.0	151.7	131.5	174.8	139.0	155.7	155.7
Target	NA	NA	NA	NA	119.0	122.1	122.1	122.1

NA = Not applicable.

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CHAPTER 14

SOVIET RESPONSE TO THE 1980 U.S. GRAIN EMBARGO*

Chapter 10's trade and time series analysis identified three changes in Soviet import patterns beginning in 1980. The timing of Soviet imports shifted toward larger first-quarter purchases of wheat; import sources shifted away from the United States and toward all other exporters, especially Argentina; and the mix of imports shifted away from corn to other grains, including wheat and barley, and from feedstuffs to animal products.

We noted these events in Chapter 10. But, for most of these cases, we did not address the issue of the extent to which these changes may have been the result of nonembargo causes related to agricultural and food policies within the USSR. Soviet grain imports are a function of domestic supply's ability to meet domestic needs and the USSR's financial ability and willingness to expend foreign exchange to buy these imports instead of rationing demand or reallocating domestic resources. Moreover, import decisions at a given time reflect previous performance and events, expectations, and the confluence of current events. This chapter will analyze the 1980 embargo in the context of events and constraints affecting Soviet agricultural policy in the 1980's. A better understanding of the forces shaping Soviet policy will help us to put the embargo into perspective with changes that were already underway in the USSR and to identify possible short- and long-term changes in Soviet agricultural policy resulting from the embargo.

SOVIET RESPONSE TO THE EMBARGO

The embargo probably inconvenienced the Soviet authorities, but evidence suggests that they surmised that they could survive a U.S. embargo without drastic disruptions to the domestic economy. Did the embargo induce the USSR to become more self-sufficient and less reliant upon imports in the long run? The USSR might want to depend less on grain imports for several reasons, not the least being the drain on its hard currency reserves, while developments in world energy markets are seriously setting back its ability to earn foreign exchange. Given the evidence that the USSR covered much, if not most, of its import needs from alternative sources, despite the 1980 embargo, the embargo seems to have played a secondary role in altering the longer term policy perspective of the USSR.

Coarse grain imports have been sporadic since the embargo was lifted, but total grain imports have exceeded pre-embargo levels (table 14.1). The USSR has been concerned about the heavy reliance of its livestock sector on imported feed grains for some time. It has been unsuccessful, however, in expanding domestic feed grain production. Any substitution of domestic production for imports has primarily been in the form of nongrain feed sources. The USSR will probably continue to look for ways to reduce reliance on feed grains because of the strain they impose on scarce foreign exchange. The USSR apparently began a major effort in 1982 to correct its hard currency position *(16)*.[1] In the 1970's, its balance of payments situation had been relatively strong because of increasing energy exports and prices. This trend reversed, beginning in 1982. Sensitized by Eastern Europe's experience to the dangers of an exposed debt position, the USSR apparently hesitated to run up its import bills. However, to date, the USSR has not been willing to curtail grain imports enough to eliminate growth in the livestock sector.

Developments in the Grain-Livestock Sector

The 1980 embargo was expected to force the USSR to back off on its policy of expanding meat production and consumption. Although earlier studies reported shortfalls in grain imports immediately following the sales suspension, the delay in imports only slightly affected meat output and consumption. Meat

*Contributors to this chapter were Kathryn Zeimetz, James R. Jones, and Hassan Mohammadi.

[1]Italicized numbers in parentheses refer to items in the References at the end of this chapter.

output fell from 15.3 million tons in 1979 to 15.1 million tons in 1980 (table 14.1), but livestock inventories did not decline drastically.[2] Moreover, output resumed its growth trend in 1982 and reached a record high of 16.7 million tons by 1983. This and increased meat imports allowed the USSR to increase per capita consumption of meat from 1981 to 1983 by about 3 kilograms *(9)*. Meat consumption is still far below the Soviet scientific consumption norm of 78 kilograms per capita or the food program's 1990 target of 70 kilograms per capita *(6)*. This is a function of the poor performance of Soviet grain production in the 1980's relative to Soviet goals, which are discussed below.

The embargo's effects on the USSR should be viewed in the context of what has happened to Soviet grain production after the embargo. Soviet production successes in the 1970's raised analysts' expectations concerning USSR grain production (table 14.2). Annual Soviet grain production in 1976-80 averaged 205 million tons, 23 million tons a year higher than in 1971-75. Grain production in 1971-75 averaged 14 million tons a year higher than the preceding 5-year period. Furthermore, the USSR had outlined programs to continue increasing grain yields and forage production and had lowered the expected growth rate in meat production.

It is not surprising then that pre-embargo studies generally projected Soviet grain production in 1981-85 at an annual average of over 220 million tons, meat production around 19 million tons, and grain imports between 10-20 million tons. For example, Green used a model developed by Stanford and Wharton to forecast average annual Soviet grain production in 1981-85 at 238-248 million tons *(11)*. Desai used several different methods and consistently projected Soviet grain production over the same period to average about 235 million tons *(7)*. Beaucourt concluded the following *(1)*:

> However gross the above estimates, those elements we do have indicate that the Soviet Union will totally satisfy its own grain needs on the average during the next decade, thanks to the enormous resources allocated to agriculture.

[2]Meat imports in 1980 increased 210,000 tons from 611,000 tons in 1979, thus covering most of the reduced output. Imports climbed further in 1981 to 980,000 tons and remained at about this level through 1983.

Table 14.1--Soviet feed livestock indicators

Year	Grain production 1/	Net grain imports	Grain fed	Total feed supplies 2/	Total animal units 3/	Meat production 4/	Meat imports 4/
	Million tons				Units	Million tons	
1973/74	222	5	105	392	138	14.6	515
1974/75	196	0	107	369	142	15.0	515
1975/76	140	25	89	334	136	13.6	362
1976/77	224	8	112	396	138	14.7	617
1977/78	196	17	122	401	144	15.5	184
1978/79	237	13	125	416	147	15.3	611
1979/80	179	30	123	392	149	15.1	821
1980/81	189	34	119	397	149	15.2	980
1981/82	160	46	116	384	151	15.4	939
1982/83	180	32	117	413	153	16.4	985
1983/84	190	32	123	433	156	16.7	800
1984/85	170	54	124	426	157	NA	NA

NA = Not available.
1/Bunkerweight. 1981-84 are USDA estimates.
2/ In oat unit equivalents.
3/ As of January 1 beginning with 1974. In terms of cow equivalents, conversion ratios are as follows: Cattle (other than cows) 0.6, hogs 0.3, sheep and goats 0.1, horses 1.0, and poultry 0.02.
4/ For calendar year beginning 1974.

A study by the Central Intelligence Agency (CIA) came closer to actual levels but still had Soviet grain production in 1985 in the range of 212-238 million tons *(5)*.

Projections of Soviet grain imports associated with such production figures were consistent. For example, the CIA study predicted 1985 imports of about 16 million tons if grain production totaled 238 million tons or imports of 26 million tons if production totaled 212 million tons. Desai had net imports ranging from about zero to 18 million tons with production at about 223-260 million tons *(7)*. In a 1978 global study, USDA forecast Soviet grain imports for 1985 at 4-11 million tons *(18)*.

However, production fell to an average of 178 million tons in the 1981-85 post-embargo period. Post-1978 grain shortfalls have overshadowed even the most extreme estimates of the embargo's effects on Soviet grain availability. Soviet grain production for 1981-85 fell about 27 million tons from the average 1976-80 level. Furthermore, even the 1979 and 1980 crops dropped far below the record highs of 1973, 1976, and 1978. An obvious Soviet reaction to the 1980 embargo would have been to increase grain production to reduce its dependence on imports. Quite the opposite occurred. Grain production declined and imports increased.

Fulfillment of USSR targets is an indicator of performance. Grain production in the 11th

Table 14.2--Soviet area, yield, and production of grain

Item	Wheat			Rye	Barley	Oats	Corn	Other 1/	Total grain
	Winter	Spring	Total						
				1,000 hectares					
Area:									
1966-70 average	18,280	48,894	67,174	11,505	20,331	8,680	3,517	10,876	122,083
1971-75 average	18,443	43,025	61,468	8,500	28,370	11,310	3,596	10,743	123,987
1976-80 average	20,471	40,240	60,711	7,714	34,011	12,080	2,969	10,421	127,905
1981	20,305	38,927	59,232	7,551	31,781	12,470	3,545	10,980	125,559
1982	20,438	36,840	57,278	9,829	29,706	11,489	4,161	10,549	123,012
1983	16,850	33,973	50,823	10,334	31,679	12,389	3,894	11,690	120,809
1984	17,956	33,105	51,061	9,420	30,426	12,806	3,919	11,980	119,612
1985	17,996	32,269	50,265	9,520	29,058	12,604	4,482	12,010	117,939
1981-85 average	18,709	35,023	53,733	7,821	30,530	12,352	4,897	11,442	121,386
				Tons per hectare					
Yield: 3/									
1966-70 average	1.96	1.11	1.34	1.12	1.50	1.38	2.72	1.16	1.37
1971-75 average	2.26	1.10	1.45	1.35	1.53	1.31	2.84	1.19	1.46
1976-80 average	2.48	1.22	1.64	1.41	1.62	1.42	3.22	1.21	1.60
1981 2/	1.97	1.03	1.35	1.26	1.18	1.20	2.26	.91	1.27
1982 2/	2.30	1.06	1.50	1.42	1.38	1.35	3.24	.95	1.46
1983 2/	2.22	1.22	1.55	1.35	1.70	1.37	3.08	1.20	1.57
1984 2/	2.23	1.00	1.43	1.42	1.38	1.27	3.19	1.06	1.42
1985 2/	2.44	1.21	1.65	1.47	1.62	1.37	3.01	1.25	1.61
1981-85 average	2.23	1.10	1.50	1.38	1.45	1.31	2.96	1.07	1.47
				1,000 tons					
Production:									
1966-70 average	35,888	54,304	90,192	12,834	30,454	11,938	9,558	12,585	167,561
1971-75 average	41,590	47,345	88,935	11,493	43,289	14,812	10,215	12,810	181,554
1976-80 average	50,725	48,948	99,673	10,880	55,150	17,161	9,568	12,595	205,027
1981 2/	40,000	40,000	80,000	9,500	37,500	15,000	8,000	10,000	160,000
1982 2/	47,000	39,000	86,000	14,000	41,000	15,500	13,500	10,000	180,000
1983 2/	37,400	41,600	79,000	14,000	54,000	17,000	12,000	14,000	190,000
1984 2/	40,000	33,000	73,000	13,400	42,100	16,300	12,500	12,700	170,000
1985 2/	44,000	39,000	83,000	14,000	47,200	17,300	13,500	15,000	190,000
1981-85 average	41,600	38,520	80,200	12,980	44,360	16,220	11,900	12,340	178,000

1/ Includes millet, buckwheat, rice, pulses, and miscellaneous grains.
2/ USDA estimates.
3/ Yields may not calculate exactly, due to rounding.

Source: *(26)*.

5-year plan (1981-85) reached 74 percent of the targeted production goals, after reaching 93 percent of the targeted goals in the two preceding 5-year plans (1971-80). Sunflowerseed production fell short of planned production by an even greater percentage. On the other hand, meat output reached 94 percent of its targeted level, partly due to better use of nongrain feed sources. The USSR reduced reliance on grain feeding in the early 1980's. But, grain imports continued to play a major role.

Although it is not possible to separate effects of the prolonged shortfalls in grain production on Soviet agricultural and trade policies from effects of the partial U.S. embargo, Soviet responses in managing the feed/livestock economy seem explainable even in the absence of the embargo.

No historical precedents or Soviet policy discussions indicate that the USSR would have been willing to import annually an additional 5-10 million tons of grain after the embargo to increase per capita annual meat consumption at a time of continued grain shortfalls. For example, net grain imports from 1974/75 through 1978/79 averaged 13 million tons. Soviet per capita meat consumption was 57 kilograms in 1975, 56 kilograms in 1976 and 1977, 57 kilograms in 1978, and after the second record-high harvest, 58 kilograms in 1979.

Net grain imports in marketing years 1981/82 to 1984/85 averaged over 40 million tons. At this level, the USSR had been able to increase slightly per capita meat, milk, and egg consumption and livestock inventories. Although the USSR may have wanted to push livestock production further and may not have wanted to push the campaign to increase forage production so vigorously, precedents, policies, and programs in the pre-embargo period suggested this to be unlikely. In addition, the USSR was forced to reassess the prospects for growth in export earnings in the post-embargo period as the terms of trade deteriorated for its major export items.

Despite the embargo, the USSR has not backed away from its commitment to reduce grain area and increase clean summer fallow. Grain area is down more than 8 million hectares from 126.6 million hectares in 1980, as summer fallow has increased. The USSR hopes that the program to increase the clean summer fallow area will increase total production and productivity, despite the fact that such fallow practices have been held recently in less repute in such similar climatic areas as Canada.

One possible reason why Soviet grain imports would have been higher without the embargo is the assumption that the USSR would not have pursued as aggressively the program to reduce the ratio of grain fed to meat production. Large investments were made in machinery and facilities for harvesting, handling, and storing nongrain feeds. The USSR also increased fertilizer application and devoted new irrigated and drained lands to roughage crops. Nongrain feed supplies increased an estimated 27 percent between 1979/80 and 1985/86. Meanwhile, concentrate feeds from feed grain remained unchanged in the early 1980's *(26)*.

This emphasis on forage production, however, increased in the late 1970's before the embargo, and it can be argued that forage production would have received high priority regardless of the embargo because of the grain production problems the Soviets have had since 1978. The ratio between grain fed and meat production increased from 6.9 in 1970/71 to 8.2 in 1979/80. The increase resulted partly from decreased feeding efficiency but mostly from increased reliance on grain as a percentage of total feed supplies and a lack of attention to nongrain feed use. The increased dependence on grain was due to slower growth of forage supplies relative to grain; increased industrialization of poultry, egg, milk, and to a lesser extent, hog production; and increased reliance on mixed feeds. As early as 1974, Schoonover, noting the growing feed deficit in the USSR, speculated *(19)*:

> Beyond certain limits, which really cannot be identified because of the nature of the influencing variables, additional [grain] imports become untenable, and domestic policies must be altered to correct the imbalance. One of the first corrections, on the supply side, will probably be policies to sharply improve forage crop production in the USSR. Fundamental improvement of hay meadows and pastures, perhaps with a large share of fertilizer increases allocated to this work, is a likely course of action.

Development of improved facilities for storage and use of silage is another good possibility.

Related to this change, one would expect increased emphasis on long-term beef production.

The USSR announced the 1981-85 plans at a special assembly on agriculture in July 1978, midway through the previous plan period. The timing was unusual. The plans came on the heels of the 1976 and 1978 record-high grain harvests. The plan for increasing meat production was far more ambitious than had been the previous plan. Brezhnev placed top priority among meats on beef production. At the same assembly, a decree outlining plans for resources directed into forage crop production and goals for forage crop output by 1985 was approved *(20)*.

The USSR, in fact, has cut the ratio of grain fed to meat production from 8.2 in 1980 to 7.4 in 1984. The ratio reached a low in 1983 when Soviet forage production reached a record high. However, the declines were also related to the major shortfalls in grain production, especially the effect of the 1981 grain crop, which is estimated to be the lowest since 1975. A similar decline was evident after the low 1975 harvest when the grain fed to meat ratio was 6.6.

Another issue is whether the USSR slaughtered enough livestock to have a long-term effect on its demand for grain imports. Despite the shortfall in domestic grain production and the embargo, Soviet livestock numbers continued to increase from 147.3 million head (cow-equivalent units) in 1979 to 148.7 million head in 1980 and 1981 (table 14.1). These numbers continued to increase until they reached 157 million in 1985. The USSR announced a shift to less emphasis on livestock numbers in 1985, and inventories are expected to decline in the near future. However, this by itself will not reduce feed grain demand because emphasis is on increased meat production through increased feeding efficiency and not on inventory growth. In the absence of stress slaughtering reducing livestock inventory in 1980 and 1981, it is difficult to attribute any major effect on livestock numbers to the embargo.

Brezhnev cited the embargo when he announced development of the Food Program in 1980. However, even without the grain embargo, the floundering domestic agricultural sector would have prompted efforts to increase agricultural production and productivity. Details of the Food Program were presented in May 1982. The program, as described by its authors, was a "radical" solution to the USSR's "food problem." The "food problem" was the stagnation in per capita diet improvement, despite rapidly rising production costs. The USSR's food problem in the latter half of the 1970's resulted from declining growth rates in domestic gross agricultural production despite substantial grain harvests, increased imports of grains and other agricultural raw materials, and increased domestic expenditures for agricultural commodities and inputs. Soviet data imply that over 1966-70, agricultural production costs grew at an average rate of 4.7 percent per year, while output growth slowed to less than 1 percent per year. The Soviet agricultural economy had bigger problems than the embargo.

The Food Program has a large number of elements, many of which continue previous programs, including land reclamation, forage production, and collective contracts. The Food Program, however, probably is marginally affecting agricultural production and efficiency. It does not contain provisions to improve the effects of the following Soviet policies:

- To maximize production, even though the USSR's agricultural input mechanisms are insufficient,
- To improve regional self-sufficiency, even though the USSR does not invest enough in the rural transportation infrastructure,
- To set prices administratively, which prevents cross-sector and cross-commodity measurement of productivity and efficiency and fails to keep pace with changes in technical production,
- To use performance indicators that do not account for quality and that retard implementation of technological innovations,
- To equalize workers' incomes, regardless of their capabilities and efforts, and

- To concentrate on capital goods rather than consumer goods, thereby limiting worker incentives.

Export Terms of Trade Versus the Embargo

With 1970 world market prices, the USSR had to sell over 40 barrels of oil to the West to buy a ton of grain. By 1975, it had to sell about 13 barrels and, by 1980, about 5 barrels. In 1970, a ton of grain cost over an ounce and a half of gold; in 1975, less than an ounce; and by 1980, less than a quarter of an ounce. However, the 1970's trend of improving terms of trade for oil and gold versus grain ended in the 1980's. In 1984, it took almost 50 percent more oil to buy a ton of corn in the world market than it had in 1982 and about 12 percent more oil to buy a ton of wheat. It took about 80 percent more gold to buy a ton of corn in 1984 than it had in 1980, and almost 50 percent more gold to buy a ton of wheat. Furthermore, growth in demand for Soviet energy exports in western countries has been less in the 1980's than the USSR anticipated, while maintaining Soviet oil and coal production has been increasingly difficult. Soviet hard currency earnings (when standardized on the dollar using published Soviet exchange rates) have taken a dive in recent years because of the severe drop in energy prices, which account for as much as 70 percent of total hard currency earnings.

Adjusting for the official Soviet exchange rate for U.S. dollars, Soviet exports of oil and oil products in 1984 decreased slightly from 1983. Grain imports, however, increased $1.6 billion. ERS estimates that the USSR spent over $33 billion for grain imports (nominal value) during 1980-84, almost all of it requiring hard currency. In the previous 5 years, the USSR spent less than half that amount. At a time when the USSR faces stagnating growth in hard currency earnings and continued high grain import requirements, it has found itself with declining cotton exports, the need for higher imports of sugar and cotton, and the growing need for western technology imports.

The problem is on the verge of becoming chronic. Estimates suggest that the USSR's hard currency export earnings could fall as much as $8-$9 billion in 1986 from 1984 because of declining international petroleum prices and stagnating export volumes *(13)*. This shortfall is approximately 30 percent of the value of total Soviet hard currency imports in 1984 and is as much as the USSR has ever paid for grain imports in any one year. The estimated effect of the embargo on Soviet import value above ($70 million) was less than 1 percent of this amount, so the USSR probably views the prospect of another embargo as a minor issue compared with the terms of trade effect varying export earnings for other reasons.

ESTIMATES FROM PREVIOUS STUDIES

In 1979/80, the year the embargo was imposed, the Soviet grain crop fell roughly 20 million tons below the average production for the preceding 5 years. One way of examining the embargo's effects is to look at how the USSR responded to crop failures in the past.

Earlier studies contended that the USSR covered most of the grain affected by the U.S. embargo from alternative sources *(9, 15, 16, 23, 24, 25, 27)*. Several efforts have been made to determine how much the USSR normally would increase imports in a year following a crop shortfall. Import and production data are relatively reliable and less conjectural than other information on Soviet affairs.

The Soviet reaction to poor harvests depends on a number of factors, including the extent and nature of the harvest failure, the state of the economy, the weight assigned to such objectives as maintaining or increasing meat production and consumption, and expectations *(3)*. When Soviet grain production falls short, increased imports are only part of the adjustment. When crop production falls, as it did rather abruptly in the crop year of the embargo, planners must weigh the consequences of reducing grain inventories, livestock herds, and the feeding of animals and poultry against the cost of spending foreign exchange to buy imports. Importing meat rather than grain, which the USSR did during the embargo, is also an option.

Expectations further complicate tradeoffs and their effects on imports. Brada pointed out the following *(3)*:

> Since poor harvests are by their nature exceptional occurrences, one might assume that planners facing a poor harvest form an expectation that such abnormal circumstances will not arise again in the following one or two years, and that what they must do is to...deal with the shortfall by increasing imports in the year of the poor harvest or the subsequent year. The delay in increasing imports may occur...because the factors leading to the poor harvest may only become evident during the harvest season, thus leaving little scope for increasing imports in the current calendar year...alternatively imports may be delayed for balance of payments reasons. A strategy for conserving foreign exchange might dictate delaying imports to obtain a more favorable price (or, of course, speeding up imports to take advantage of depressed prices).

If the harvest shortfall follows a succession of earlier failures, expectations and the adjustment process will differ.

Because of the above considerations, we can only approximate the effect of harvest shortfalls on imports. Estimates by Desai *(7)* and Bond and Green *(2)* suggested total grain imports would increase 2 million tons for each 10-million-ton shortfall. Carson, Love, and Keller-Griesmar, on the other hand, estimated that the USSR imports 75 percent of any shortfall in planned grain production *(4)*. The large range of estimates is due partly to the complex nature of adjustments and partly to whether the production shortfall is measured as a deviation from trend, or planned production, or the previous year's production.

Using the estimate that a 3-million-ton increase in imports would ordinarily offset a 10-million-ton reduction in grain production from the previous year, the USSR imports during crop year 1979/80 were very near the projected level.[3] Grain production fell 58 million tons, and grain imports rose 17 million tons, near the 17.4 million tons estimated (table 14.1). However, a rather wide confidence interval probably bounds this estimate. Simulated values deviated from actual values during other observed years, and therefore, the correspondence during the embargo could be spurious.

The USSR had its second largest grain output in 1976/77 at 224 million tons. Grain production peaked in 1978/79 for both the pre- and post-embargo period. Because of these record harvests, the USSR posted record-high stocks and slaughter weights, and annual meat production passed 15 million tons. The amount of Soviet grain imports consequently seems to have been well within a normal range.

AN ECONOMETRIC MODEL OF SOVIET GRAIN IMPORTS

One way to determine the relative importance of each of the major factors, including the embargo, that could have been responsible for changes in Soviet import behavior is to estimate an econometric model of the Soviet grain and livestock sector. This is not an easy task given the poor quality of data on the USSR. Hence, the model estimated was relatively simple, and the results should be interpreted as indicative of likely effects rather than definitive effects.

The econometric model of Soviet import behavior for feed grains and wheat was constructed to test the hypothesis that the 1980 U.S. embargo significantly affected Soviet imports. The model and its results are detailed in the appendix. A dummy variable applicable to the time period of the embargo was used to capture a potential shock in Soviet grain import behavior beyond the normal changes due to varying domestic grain output, meat production trends, foreign exchange availability, and international commodity terms of trade. The USSR rescheduling of suspended U.S. grain shipments has been conjectured to have created capacity constraints. If true, this would shift the intercept of the Soviet import demand function because the USSR would demand less during the relevant period. Coefficients of the embargo dummy in the wheat import equation were statistically insignificant. The feed grain equation results, however, suggested a statistically significant negative shock that may

[3]This is a rounded simple average of the modeled estimates for wheat and feed grains reported above and is justified on the basis that the shortfall in crop year 1979/80 was almost evenly divided between the two categories of grains.

have been due to the embargo. The implied import shift due to this shock was about 4 million tons during the first year of the embargo.[4]

An important consideration is whether the USSR significantly curbed shipments because of the unfavorable terms of trade or the hard currency effect of possibly paying higher prices for grain from alternative sources. The coefficient in the feed grain import model suggests that the USSR was not very responsive to variations in feed grain prices. Wheat imports, on the other hand, were modestly responsive to price variation. This dichotomy seems surprising, but variation in wheat stocks through time relative to feed grain stocks may bear out the difference in price response. Nevertheless, estimates from this model can be questioned. Other empirical work on agricultural imports in centrally planned economies varies widely regarding price response *(8)*. Therefore, the estimates should probably be viewed as suggestive, but this analysis does not use them as official estimates of price response.

Whether the price effects of the embargo affected Soviet imports depends partially on whether imports respond to price changes. A related issue is how much prices varied in response to the embargo. Freight patterns were altered from their more optimal routes as the USSR purchased from alternative exporters, who shifted their sales from developing-country markets that were supplied, in turn, by the United States.[5] The resulting distortion of trade flows presumably increased transportation and handling costs to the USSR.

Because many forces besides the embargo affected international freight rates and grain prices, determining the embargo's effect from published price data is difficult.[6] The model reported in Chapter 11 simulated what happened to Soviet imports and prices. In the scenario used in the spatial equilibrium model that assumed no constraints on Soviet port capacity, the embargo increased the price to the USSR a maximum of $3.09 per ton for wheat and $1.89 per ton for coarse grains. Net Soviet wheat imports totaled 14 million tons in 1980, and coarse grain imports totaled 14.3 million tons. Thus, the embargo increased the USSR grain bill by approximately $70 million. This is about 1.4 percent of the $4.9 billion spent for net wheat and coarse grain imports in 1980. So, the embargo's price or terms of trade effects on the USSR were relatively minor. In the absence of the Soviet port congestion, the embargo would have denied the USSR 138,000 tons of grain, which is less than half of 1 percent of its net imports in 1980. Under the scenarios that assumed port constraints, the spatial model projected reduced USSR import prices during the embargo because of the correspondingly reduced world demand.

The price effect of the embargo was probably inconsequential, so the issue returns to whether the USSR was denied grain because the embargo disrupted normal shipping schedules and created port constraints. Reports of port congestion were based on the USSR having to bunch shipments and use smaller vessels in transporting grain from Argentina. Given the even greater quantities of grain that were shipped through Soviet ports in the year following the embargo, substantiating the Soviet capacity problems is difficult. Also, northern ports were reported as the site of this congestion. But, because the embargo was announced in January, grain coming through these ports would normally have been shipped later even without the embargo.

Modeling efforts have been of limited value in resolving this issue. Previous studies failed to show a significant effect. But, Carson, Love, and Keller-Griesmar estimated that the USSR

[4]The model, as specified, does not capture substitution between wheat and other grains and, therefore, the shock variable in the feed grain equation may partly reflect a reduction in coarse grain imports that were replaced by wheat.

[5]The USSR was speculated to have made up part of the shortfall in U.S. grains during the embargo by transshipping grain from Eastern Europe. Neither statistics nor the spatial equilibrium analysis in Chapter 10 support this speculation. The USSR apparently imported much of its grain from Argentina and Canada at prices modestly higher than they would have been if the United States had not suspended part of its exports. The United States picked up the traditional markets of Argentina and Canada.

[6]Unconfirmed reports suggest that the USSR may have paid lower prices when they re-entered the market to replace U.S. grain orders than those at which they had originally contracted.

purchased about 10 million tons less grain because of the embargo *(4)*.

Other indicators in the Soviet economy such as how much additional grain the USSR needed to cover the 1979/80 crop shortfall and how much meat output suffered in 1980 failed to provide clear evidence of the embargo denying the USSR large amounts of grain.

U.S. MARKET SHARE AFTER THE EMBARGO

Although the embargo likely had only a marginal effect on the overall midterm level of grain imports, it probably had a continuing effect on the U.S. market share. However, the U.S. share likely could have contracted even without the embargo as the U.S.-USSR detente in the 1970's faded and exporters' production capacity, largely spurred by events unrelated to the embargo, outstripped lagging world demand.

The USSR returned to some of its old suppliers during the embargo. Although the USSR was a net grain exporter during most of the 1960's and early 1970's, it imported 36 million tons of grain, mostly wheat, from 1960 through 1971. Canada sold the USSR grain in 10 of those 12 years and accounted for almost 60 percent of Soviet grain imports. Australia accounted for 9 percent of Soviet imports. Argentina sold the USSR grain in 9 of the 12 years, accounting for 8 percent of USSR grain imports. France accounted for 7 percent of USSR grain imports in the period, exporting 2.6 million tons. From 1960 to 1971, the United States accounted for 5 percent of Soviet grain imports, all of it in a large sale in 1964.

In 1972, the USSR apparently decided to depend more on grain imports to help offset the effects of the grain harvest shortfall and, in 1973, the emphasis on coarse grain imports was confirmed. In 1966-71, the USSR imported an average of 483,000 tons of coarse grains per year, of which the United States supplied none. In 1973, the USSR imported 7.4 million tons of coarse grains, of which the United States supplied 65 percent. This precipitous improvement in U.S. market share may have been related to several U.S. actions regarding the Soviets.

In December 1971, Soviet Premier Aleksei Kosygin and U.S. Secretary of Commerce Maurice Stans explored a trade agreement that was negotiated and signed in the summer of 1972 *(22)*. The USSR also proposed joining with the United States in a gas pipeline project. President Nixon, by executive order, opened the Export-Import Bank to the USSR in October 1972. Anxious to limit the variability in Soviet grain imports, the United States in 1975 negotiated a 5-year grain agreement with the USSR that extended from October 1976 through September 1981.

One factor that probably delayed the United States regaining its 1970's share of Soviet grain imports was the continual tension over renewing the U.S.-USSR long-term grain agreement, which was to expire in September 1981. The partial embargo was lifted on April 24, 1981. On August 5, 1981, U.S. and USSR negotiators extended the grain agreement for 1 year. On December 29, 1981, President Reagan announced seven new economic sanctions against the USSR because of its "heavy and direct responsibility for the repression in Poland." One of the sanctions was postponing negotiations on a new U.S.-USSR long-term grain agreement. In August 1982, the U.S.-USSR grain agreement was given a second 1-year extension.

At the beginning of 1983, the United States had not announced whether it would renegotiate a new long-term grain agreement with the USSR or let the 1975 pact expire. The USSR curtailed its usual pattern of grain imports from the United States. From October through December 1982, the United States shipped no wheat to the USSR compared with 1.3-1.9 million tons shipped during each of the same 3 months in 1979, 1980, and 1981. From March through June 1983, corn shipments were only 6 percent of their level during the same period in 1982. The USSR held its purchases to near the minimum called for in the 1975 agreement. On April 22, 1983, the President announced U.S. willingness to negotiate with the USSR on a new agreement. On May 17, U.S. officials announced that the USSR had accepted the proposal to negotiate. On July 28, the United States announced that a 5-year agreement was signed. The agreement guarantees the United States up to 3 million tons of additional grain sales each

agreement year and the USSR up to an additional 4 million tons of U.S. grain each agreement year. With the signing of the agreement, the USSR resumed purchases from the United States.

After the embargo, not only did the USSR expand grain imports from other suppliers, it also entered into high-volume, long-term grain agreements with Argentina and Canada. How much these resulted from exporter pressure to take advantage of the U.S. partial embargo or from Soviet anxiety about a more unified use of grain embargoes to affect Soviet policy decisions is not known. Argentina's agreement, which extended from 1980 to 1985, authorized the USSR to purchase annually 4 million tons of corn and sorghum and 500,000 tons of soybeans from private commercial firms. Canada set a precedent of multiyear grain agreements with the USSR in the 1960's. In May 1981, Canada announced an agreement covering August 1981 through July 1986, which called for 4 million tons of wheat, barley, and oat exports to the USSR in 1981/82, increasing 500,000 tons annually for the duration of the agreement. Because of the high level of Soviet imports since the partial embargo, these agreement minimums were insufficient to deny the United States its previous market shares. However, the USSR has regularly exceeded the agreement minimums in buying from these countries. Officials in Canada, Argentina, and the USSR have spoken of renewing the agreements.

The embargo probably had little mid-term effect on USSR soybean imports. The USSR's ability to crush soybeans and to handle soybean meal without large spoilage losses probably limited expanded soybean imports. However, the loss of market share has been persistent. The USSR entered into long-term agreements with Brazil and Argentina at levels that, combined with the stagnation in growth of Soviet soybean imports, have limited the U.S. market share.

Brazil's agreement runs from January 1982 through December 1986. It authorizes the USSR to purchase a minimum of 500,000 tons of soybeans and 400,000 tons of soybean meal annually from private firms and cooperatives.

The USSR began importing soybean meal after the 1980 embargo. Although the United States has not directly participated in this market, it has benefited because it is a major supplier of beans to The Netherlands, which in turn, has been a major supplier of soybean meal to the USSR. Soviet soybean and soybean meal imports have declined recently. This may well be the result not only of the handling problems that have dogged Soviet efforts to increase meal use but also the decision to husband hard currency for continuing high grain imports.

CONCLUSIONS

The embargo undoubtedly delayed short-term Soviet imports while grain purchasing and shipping were rearranged, but the effect on meat output and consumption was nominal. Grain stock drawdowns and increased meat imports covered most of the initial effects of delayed or denied grain shipments. Long-term meat output does not seem to have suffered significantly. In addition, unreliable Soviet grain production in the 1980's has probably impressed Soviet policymakers more than the perceived unreliability of international markets due to the U.S. embargoes of the 1970's and 1980's. Grain production since the embargo apparently remains at about the same level to which it had fallen in the crop year preceding the embargo. Therefore, there is little clear supporting evidence that the 1980 embargo affected the USSR's total import demand for grain. The 1980 embargo, like the earlier embargoes, apparently has had little longrun effect on the USSR's willingness to rely on international grain markets. The USSR has diversified its import sources and relies less on the United States since the embargo. To what extent the 1980 embargo is responsible for the loss of the U.S. market share in Soviet agricultural trade as opposed to competitive considerations (such as the strong U.S. dollar and domestic price support measures) and the general reversal of detente between the two powers is not clear.

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APPENDIX

A MODEL OF SOVIET GRAIN IMPORT BEHAVIOR AND THE EMBARGO

The econometric model of Soviet grain imports consisted of four structural equations: Aggregate import expenditures, domestic meat output, net feed grain imports, and net wheat imports. Decisions concerning wheat and feed grain imports were part of the balance of payments adjustment mechanism. Variations in foreign exchange earnings (F) and reserves (R) affected aggregate import expenditures (M) in the import exchange equation. The specific effect of this foreign exchange allocation mechanism on grain imports was measured by the coefficients associated with aggregate import expenditures in the feed grain import (FGI) and wheat import (WI) equations. Domestic output of feed grain (DOFG) and wheat (DOW) and availability of grains (DAV) affected meat production (DMP), which, along with variations in income (GNP), interacted with foreign exchange earnings and world import prices in explaining Soviet grain imports. A dummy variable (EMBARGO) was added in the feed grain and wheat import equations to capture the effect of the embargo on Soviet imports.

Aggregate Import Exchange Equation

Aggregate import behavior was traditionally specified so that the flow of imports was a function of import prices relative to prices of domestically produced substitutes and aggregate domestic economic activity *(14)*. Hemphill argued that this approach needed to be modified in applications to developed countries to account for the effects of trade relations, particularly foreign exchange restrictions *(12)*.[7]

[7]Scobie applied Hemphill's model that takes into account the effects of foreign exchange receipts on aggregate import behavior to wheat import policy in Egypt *(21)*.

Centrally planned economies share with developing countries a propensity to ration foreign exchange and insulate domestic prices from the effects of world price movements. Given the rigidity of the bureaucracy and ideological framework of centrally planned countries, world price movements have little direct effect in these economies via the domestic price structure. Jones and Miller argued, however, that the hard currency effect of world price variations needed to be taken into account in measuring import response to price movements *(13)*.

Following Hemphill and Scobie, the aggregate import expenditures function was specified as follows *(12, 21)*:

$$M_t = M(1, F_t, R_{t-1}, DF_t, e_{1t}),$$

where:

M_t = Aggregate import expenditures at time t,
F_t = Foreign exchange earnings during period t,
R_{t-1} = Reserve holdings at the beginning of the period,
DF_t = Changes in foreign exchange earnings from time t to t-1,
1 = The intercept, and
e_{1t} = Stochastic error term.

Hemphill showed that the coefficients of F and R were positive assuming that the desired levels of longrun import expenditures (M*) and foreign exchange earnings (F*) were equal *(12)*. The coefficient of DF, on the other hand, depended on the perceived nature of the change in foreign exchange earnings. If the change was expected to be transitory, the expected sign was negative, and if the change was expected to be permanent, the expected sign was positive.

Domestic Meat Production

The domestic meat output equation may be viewed as the reduced form for a system of equations representing the domestic meat market subject to nonprice rationing. The principal factors determining domestic meat production were grain availability and consumer income and were specified as follows:

$$DMP_t = DMP(1, DAV_t, GNP_t, DUM_t, e_{2t}),$$

where:

DMP_t = Domestic meat output at time t,
DAV_t = Grain availability at time t,
GNP_t = Level of income at time t,
DUM_t = Dummy variable with values of 1 for 1964 and 1976, 0 otherwise, and
e_{2t} = Stochastic error term.

The variable DUM was designed to capture the decline in output following a period of distress slaughtering.

Net Feed Grain Imports

The structural equation describing Soviet net feed grain imports was specified as follows:

$$FGI_t = FGI(1, TFGO_t, DMP_t, M_t, DOFG_{t-1}, EMBARGO_t, e_{3t}),$$

where the effect of foreign exchange constraints was captured through the aggregate import expenditure variable (M_t) and the following:

FGI_t = Net feed grain imports at time t, $TFGO_t$ = Feed grain relative price at time t,
$DOFG_{t-1}$ = Domestic output of feed grain at time t-1, and
$EMBARGO_t$ = A dummy variable with a value of 1 for 1980 and a value of 0.4 for 1981 (reflecting the lifting of the embargo on April 24, 1981; zero otherwise).

The EMBARGO variable was designed to capture changes in Soviet feed grain import behavior during the embargo due to an inability to import grain. DMP and M were as above.

Net Wheat Imports

The structural form of the net wheat import equation was specified as follows:

$$WI_t = WI(1, TWO_t, GNP_t, M_t, DOW_{t-1}, EMBARGO_t, e_{4t}),$$

where:

WI_t = Net wheat imports at time t,
DOW_{t-1} = Domestic wheat output at time t-1,
TWO_t = Wheat relative price at time t, and
e_{4t} = Stochastic error term at time t.

GNP_t, M_t, and EMBARGO are as above.

In addition to the four stochastic equations, the model contained seven identities. The complete structure of the model is given in appendix table 14.1. The endogenous and exogenous variables are defined in appendix tables 14.2 and 14.3.

Estimation and Results

The model was estimated using data for 1960-83. Observations for 1960 and 1961 were eliminated from the estimation process due to data transformations and lags in the model. All monetary variables were expressed in real terms. Foreign variables were expressed in constant 1980 U.S. dollars, using the deflator of unit value of exports from developed to developing countries. Although this unit value price index might not be the most appropriate deflator for Soviet foreign trade, it was the best proxy available. The structural equations of the model were estimated using the three-stage least squares technique available in Troll and were corrected for serial correlation. The results are reported in appendix table 14.4.

Aggregate Import Exchange Equation

The overall performance of the total import equation was satisfactory. Three variables—reserves (R), foreign exchange earnings (F), and changes in foreign exchange earnings (DF)—explained 93 percent of the variation in real import expenditures. All variables had correct signs, but only F was statistically significant.

Data on Soviet foreign exchange reserves before the 1970's were not available. The accumulated trade balance of the USSR with the industrial west was used as a proxy for reserves. Following this approach, the intercept of the import expenditure exchange equation reflected the initial effect of reserve holdings. The accumulated difference between exports and imports with the hard currency trading partners reflected the ensuing effect of change in the level of foreign exchange reserves. This was an approximation of changes in net reserves because it ignored other sources of foreign earnings that could support imports without

Appendix table 14.1--Summary of behavioral equations and identities

Endogenous variables	Equations and identities
Behavioral equations:	
Aggregate import exchange equation	$M_t = (1, F_t, R_{t-1}, DF_t, e_{1t})$
Meat production	$DMP_t = DMP(1, DAV_t, GNP_t, DUM_t, e_{2t})$
Net feed grain imports	$FGI_t = FGI(1, TFGO_t, DMP_t, M_t, DOFG_{t-1}, EMBARGO_t, e_{3t})$
Net wheat imports	$WI_t = WI(1, TWO_t, GNP_t, M_t, DOW_{t-1}, EMBARGO_t, e_{4t})$
Identities:	
Balance of payments	$R_t = R_{t-1}+F_t-M_t$
Change in foreign exchange receipts	$DF_t = F_t - F_{t-1}$
Grain availability	$DAV_t = DOW_{t-1}+DOFG_{t-1}+WI_t+FGI_t$
Feed grain price	$FGP_t = FGIV_t/FGI_t$
Wheat price	$WP_t = WIV_t/WI_t$
Feed grain relative price	$TFGO_t = FGP_t/OP_t$
Wheat relative price	$TWO_t = WP_t/OP_t$

drawing down reserves. Gold exports were included in the foreign exchange earnings from imports, but gold reserves as a component of foreign exchange reserves and credit were indirectly accounted for by using the proxies selected in this study.

The insignificant role of DF in explaining aggregate imports was a possible indicator of the equality of foreign exchange earnings to their longrun desired (planned) level *(12)*. There were at least two possible explanations for the insignificant role of lagged reserves in explaining aggregate imports. The proxy above contained measurement error, or the level of foreign exchange reserves might not have been an important determinant of aggregate import behavior.

An alternative version of the model tested the significance of the overall terms of trade in explaining aggregate import expenditures. The results were statistically insignificant, and this variable was dropped from the model. Inclusion of the variable, however, led to the embargo variable in the feed grain equation becoming statistically insignificant.

Appendix table 14.2--Means, standard deviations, and descriptions of endogenous variables

Name	Unit 1/	Mean	Standard deviation	Description
DMP	*1,000 tons*	12,846.30	2,601.19	Domestic meat production
M	*$ million*	14,037.40	9,197.78	Hard currency import expenditures, deflated
FGI	*1,000 million*	5,164.29	7,865.23	Net feed grain imports, quantity
WI	*1,000 million*	4,697.03	9,387.12	Net wheat imports, quantity
FGIV	*$ million*	496.59	1,163.35	Net feed grain imports, value
WIV	*$ million*	659.45	1,760.97	Net wheat imports, value
DAV	*1,000 tons*	169,705.00	41,301.50	Domestic grain availability
PFG	*$/ton*	450.48	886.44	Net import unit value of feed grain, deflated
PW	*$/ton*	215.16	77.75	Net import unit value of wheat, deflated
TFGO	*Ratio*	12.21	27.12	Feed grain price/oil price
TWO	*Ratio*	4.05	2.96	Wheat price/oil price

1/ Dollars are in U.S. dollars.

Appendix table 14.3--Means, standard deviations, and descriptions of exogenous variables

Name	Unit 1/	Mean	Standard deviation	Description
DOW	*1,000 tons*	84,476.70	16,309.90	Domestic output of wheat
DOFG	*1,000 tons*	75,334.10	18,287.80	Domestic output of feed grain
GNP	*Billion rubles*	399.47	114.23	Gross national product, constant prices
TOT	--	1.35	.34	Aggregate terms of trade, ratio of export to import prices
F	*$ million*	11,642.00	8,250.25	Hard currency export earnings
R	*$ million*	22,985.90	20,298.40	Foreign exchange reserves proxy (accumulated trade balance deficits)
DUM	*Dummy variable*	--	--	Value of 1 for 1964 and 1976; 0 otherwise
EMBARGO	*Dummy variable*	--	--	Value of 1 for 1980 and 0.4 for 1981; 0 otherwise
OP	*$/ton*	--	--	Oil price, deflated

-- = Not applicable.
1/ Dollars are in U.S. dollars.

Appendix table 14.4--Estimates of structural coefficients 1/, 2/, 3/

Equation	R^2 4/	Rho 5/
(1) Aggregate import exchange equation		
M = 2,600.9 + 0.067 R_{-1} + 0.886 F - 0.12 DF (1.86) (0.56) (3.14) (-0.52) [0.11] [0.73]	0.93	0.37
(2) Domestic meat output:		
DMP = 3,415.03 + 12.28 GNP + 0.027 DAV - 617.6 DUM (6.64) (7.05) (6.49) (-2.87) [0.38] [0.36]	.85	.08
(3) Net feed grain imports:		
FGI = -34,680 - 6.66 TFGO + 5.26 DMP + 0.08 M - 0.40 $DOFG_{-1}$ -4,175 EMBARGO (-3.91) (-0.35) (6.24) (0.47) (-7.95) (-1.93) [-0.05] [7.44] [1.14]	.67	.33
(4) Net wheat imports:		
WI = 46,549.3 -1,923.31 TWO -82.42 GNP + 1.24 M -0.21 DOW_{-1} - 1,455.9 EMBARGO (5.05) (-4.63) (-3.29) (6.05) (-6.01) (-0.68) [-1.66] [-7.00] [3.71]	.76	.50

1/ See appendix tables 14.2 and 14.3 for definitions of the variables.
2/ Numbers in parentheses refer to values of the student t statistic.
3/ Numbers in brackets refer to elasticities (where relevant); they are evaluated at the sample means.
4/ Coefficient of multiple determination adjusted for degrees of freedom.
5/ Estimates of the first order autocorrelation coefficient.

Domestic Meat Output

The three variables GNP, DAV, and DUM explained 85 percent of the variation in domestic meat output. Domestic meat production, however, was surprisingly inelastic with respect to GNP. Grain availability (DAV) was a very important shifter of domestic meat production. For every 1-percent increase (decrease) in DAV, either in the form of domestic production or imports, domestic meat production was expected to increase (decrease) one-third of 1 percent.

The binary variable DUM was intended to capture the effect of distress slaughtering at year t-1 on year t's output. The variable was highly significant and had the correct sign. This indicated that meat production had to be reduced following a period of distress slaughtering or liquidation of livestock and poultry inventories.

Net Feed Grain Imports

The performance of the feed grain import equations was relatively weak compared with the other equations of the model. The equation explained 67 percent of the variation in net feed grain imports. Domestic meat output (DMP) and the previous period's domestic output of feed grain were important shifters of the import function. Feed grain imports were highly sensitive to DMP. Increasing meat production by 1 percent was expected to increase feed grain imports more than 7 percent. Feed grain imports, however, showed a slightly elastic but statistically insignificant response to total import expenditures. Feed grain imports were also highly correlated to the deviations in domestic output. About 40 percent of fluctuations in domestic output were fulfilled by feed grain imports.

The binary variable EMBARGO was intended to capture the effect of the 1980 U.S. embargo on Soviet import behavior during the embargo. No prior assumption about the sign of this variable was assumed. The empirical findings indicated that the embargo had a negative, statistically significant effect on feed grain imports. The embargo reduced feed grain imports about 4 million tons in the first year.

The feed grain equation was estimated under two additional modifications not reported above. First, a binary variable was used to reflect the changes in Soviet import policies after 1972. The hypothesis that the USSR changed its feed grain import behavior after 1972 was strongly rejected. Second, the feed grain equation was modified to capture the effect of current and lagged variations in domestic output. Again, the hypothesis that current output variations affected feed grain imports was rejected.

Finally, in the alternative model with a terms of trade variable, the embargo variable in the feed grain equation was very insignificant. The empirical findings indicated that the amount of feed grain denied the USSR would range between zero and 4 million tons for the first year of the embargo before netting out the grain equivalent of added meat imports.

Wheat Imports

The wheat import equation explained 80 percent of the variation in net wheat imports to the USSR during the study period. All the variables, except EMBARGO, were highly significant and had the correct signs. The coefficient of the wheat price/oil price terms of trade was negative as expected. Net wheat import elasticity with respect to this commodity-specific terms of trade variable was relatively elastic.

Wheat imports were relatively elastic with respect to total import variations due to changes in hard currency financial capacity. Results implied that a 1-percent increase in total imports increased wheat imports approximately 3 percent. The greater responsiveness of wheat imports to both price and import capacity relative to feed grain imports may be explained with Soviet observed stock adjustment behavior. USDA data showed much greater variability in stocks of wheat than in coarse grains through time. If wheat prices rose or import capacity declined, imports may have been cut back and compensated for by drawing down stocks.

Wheat imports also responded to fluctuations in domestic output. Close to one-fifth of any variation in domestic wheat production was offset by a change in imports. The coefficient for GNP implied that imports were inversely related and elastic with respect to this variable. The results also failed to show any significant effect of the embargo on wheat imports.

The two modifications mentioned earlier in alternative feed grain imports specifications were also applied to the wheat import equation. Again, the binary variable representing changes in import behavior in 1972 and current wheat production were statistically insignificant and were not reported.

CHAPTER 15

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CHAPTER 15

THE 1980 EMBARGO: THE U.S. AND FOREIGN COUNTRY POLICY RESPONSE*

The 1980 grain embargo was unlike any of the previous actions because its motivating factor was political, not economic. Because subsequent policy actions, both in the United States and abroad, were also influenced by political considerations, we look beyond the purely economic framework used in previous chapters to trace and evaluate policy actions. This chapter supplements preceding quantitative analyses with a more qualitative assessment of how our competitors and customers responded to the U.S. embargo.

We used several methods to gather information on country policy response, but we primarily relied on a series of interviews with persons directly involved in or affected by the embargo in the United States, Japan, the European Community (EC), Argentina, Brazil, and Canada (a list of those interviewed is in the appendix.) These interviews are supplemented with relevant articles, memoirs, newsclippings, official cables, and reports. Where possible, we tried to substantiate or refute people's perceptions of events with data and the results of the econometric studies found in the preceding chapters. As agreed, we preserved the interviewees' anonymity. Individuals were referred to by name only where the information discussed was already in the public record.

This qualitative analysis is particularly important in understanding the aftermath of the 1980 embargo for several reasons. First, as with the embargoes of the 1970's, much conventional wisdom existed about the repercussions of the 1980 action that was not supported by data. But, regardless of the data, people and governments have acted, not on what is true, but on what they believed to be true. Anyone trying to assess effects of the embargo must understand what people and governments believed and how they acted on those beliefs.

Second, numerous charges emerged that country X or Y "cheated" and sold grain to the USSR. To assess such allegations, one must know if, how, and why public and private actors circumvented stated government policies.

Third, and most important, many observers alleged that both importers and exporters took deliberate actions as a result of the embargo and that those actions led to the loss of U.S. markets and market share. To assess these allegations, we examined whether countries did, in fact, change their agricultural policies as a result of the embargo, or whether they changed their policies in response to other economic and political forces.

THE 1980 GRAIN EMBARGO

On January 4, 1980, in response to the USSR's invasion of Afghanistan on December 26, 1979, President Carter declared an embargo on all exports of wheat, feed grains, soybeans, meats, poultry, dairy products, and some animal fats to the USSR. Grain sales up to the maximum quantities previously agreed to in the U.S.-USSR long-term agreement were permitted. The embargo was lifted by President Reagan on April 24, 1981.

The Global Environment

The global economy was in transition at the time of the embargo. It was the beginning of the end of the global boom in income and trade growth. During the 1970's, developed countries had tried to soften the impact of the oil price hikes by increasing international liquidity and sustaining high rates of inflation and low interest rates. World income growth was strong. From 1976 to 1980, Europe's economies grew 3.4 percent annually, and Japan's grew 5 percent annually. With a relatively weak U.S. dollar and strong agricultural production encouraged by strong export demand, U.S. agriculture was able to take advantage of the robust growth in world trade.

*Contributors to this chapter were George E. Rossmiller, Rachel Nugent Sarko, M. Ann Tutwiler, and Alex F. McCalla.

By 1980 those trends were beginning to reverse. Many countries were damaged by the second oil price hike, which raised oil from $18 to $30 a barrel in the fall of 1979. Developed countries responded to this second oil shock by slowing growth in their money supply to prevent further inflation. These contractionary policies pushed the world into recession. At the same time, major oil importers, including most developing countries, needed more foreign exchange to pay for more expensive oil. But many of these countries were reaching their borrowing limits in the international capital markets and faced rising concerns over servicing their debts. In addition, their products confronted shrinking export markets and swelling protectionism. Unable to borrow or earn foreign exchange, they found their ability to continue importing grain from the United States was contracting.

Australia, suffering from drought and low stocks, expected a poor harvest in the fall of 1979. Argentina was in the midst of a relatively good harvest. Canada had begun a program to expand its export capacity and was ready to start an export drive.

In 1975, the United States signed a long-term grain agreement with the USSR which obligated the USSR to import (and the United States to export) 6 million tons of grain. The USSR could import up to 8 million tons without consulting the United States. The maximum amount of grain the USSR could import under the agreement was 25 million tons. In November 1979, the United States agreed to export a minimum of 20 million tons and a maximum of 25 million tons of grain to the USSR under the 1975 5-year grain agreement. The USSR agreed to import no more than 18 million tons of feed grains and no less than 3 million tons of wheat. In November 1979, the USSR approached that 21 million tons, and the United States expected a strong selling season.

The Decision to Embargo

President Carter and State Department officials had known by late 1979 that USSR troops were gathering near the Afghan border but, preoccupied with the Iranian hostage crisis, had spent little time developing possible responses. The National Security Council assessed various options, including a grain embargo, in early December. Its analysis was reportedly based on a Central Intelligence Agency (CIA) report estimating that a total grain embargo would drop USSR meat consumption 20 percent. According to one person interviewed, the National Security Council staff analysis determined that of all possible options open to the United States short of a military response, withholding agricultural commodities would cause the greatest harm to the USSR.

USSR troops overran Afghanistan on December 26, 1979. President Carter, shocked and outraged, publicly called the invasion "the greatest threat to world peace since World War II." Carter felt he had to do more than merely recall the U.S. ambassador to Moscow for consultations. According to those interviewed and written accounts, the President, consulting with his National Security Advisor and others, decided to react quickly and forcefully.

Some of his advisors believe that Carter's feeling of betrayal by Soviet leader Brezhnev was more important than the Cabinet or staff advice. Several interviewees close to the President felt he appeared to have decided upon a course of action before seeking widespread advice.

President Carter confronted a range of domestic and foreign policy problems at the time of the USSR invasion which pushed him to respond forcefully. In early January, Carter faced the Iowa caucus, the start of the 1980 Presidential primary season. Carter was seen as weak and indecisive on foreign policy issues, and his opponents—principally Ronald Reagan—were seen as tough and resolute, particularly on USSR issues. Carter could not afford to risk charges of weakness and vacillation in the face of the invasion.

One of the President's foreign policy vulnerabilities was the SALT II treaty. He had spent 2-1/2 years reaching agreement on the arms limitation treaty with the USSR and considered it one of the major achievements of his Presidency. He was attempting to obtain Senate ratification of the treaty. Carter's political opponents charged that the treaty would give the USSR ample opportunity to build missiles without adequate verification. The invasion certainly called into question Soviet motives and trustworthiness.

Compounding Carter's foreign policy difficulties was the feeling of helplessness, within the administration and around the country, caused by the Iranian hostage situation. The President was preoccupied with and angered by the limited choices available to end the standoff with the Iranians.

On December 25—the day before the USSR invasion—Secretary of Agriculture Bob Bergland attended a National Security Council (NSC) meeting at the White House. The NSC discussed possible sanctions against the USSR should it invade Afghanistan. A grain embargo was among the options. Bergland and Vice President Mondale strenuously opposed a grain embargo for political and economic reasons. They thought it would weaken the President's chances for re-election, it would weaken his popularity and thereby weaken his ability to respond forcefully to the USSR, it would not work because other exporters would not cooperate, and the effects would be short term because the USSR would find substitute sources of supply. The Secretaries of State and Defense joined National Security Advisor Brzezinski in arguing that a strong foreign policy stance was essential and that domestic political considerations should not enter the decision process.

White House counsel Lloyd Cutler argued that the long-term agreement should be honored and the agreed 8 million tons should be shipped to the USSR during the 1979/80 agreement year. He argued that the long-term agreement was a legally binding, government-to-government agreement and that the United States did not want to appear unreliable by ignoring the commitment. A related argument emerged that the United States might jeopardize other agreements with the USSR, such as the SALT II treaty, if it violated the basic agreement.

In the week following the invasion, the President discussed possible responses with Brzezinski and Secretary of State Vance, and held daily NSC meetings. During this period, the State Department began preparing an options paper, based in large part on the early December NSC analysis. NSC staff presented the options paper directly to the President. There was no involvement of administration domestic advisors in these early stages of the decision process (possibly because of an investigation into alleged U.S. Department of Agriculture (USDA) leaks, making the foreign policy community nervous about including USDA officials in a debate about potential grain embargoes).

Military responses were quickly discarded, as were purely diplomatic options. An agricultural embargo quickly emerged as the most plausible alternative. The consultation required under the 1980 long-term U.S.-USSR grain agreement had just been completed in November 1979. The United States knew that the USSR planned to use the imported grain to increase USSR meat consumption, a long-time USSR goal. Cutting off grain to the USSR would be a highly visible response to the invasion.

The embargo was also a message to the USSR that the United States would not tolerate USSR military incursions in sovereign nations. One senior foreign policy advisor argued that it would reassure our Persian Gulf allies that we would protect them from USSR aggression and warn the USSR to stay out of the Persian Gulf. Although certainly plausible, this argument does not seem to have figured in the initial White House discussion, but certainly was in the background of the discussions.

Carter did not think that the partial embargo against the USSR would force the Soviets out of Afghanistan. What he hoped to achieve was deterrence, retaliation, and an expression of moral outrage. Several years after leaving office, he said the embargo was intended to send a message to the Soviets that the world would not stand by and allow that kind of action to go unanswered. He said, "History will decide whether the embargo was right or wrong."

Carter had little prior knowledge of how an indefinite suspension of agricultural trade would affect the USSR and the United States. In the days before the President announced the embargo, a small USDA team tried to prepare some economic assessment of the impact of the partial grain embargo. They concluded that a partial embargo with all other exporters fully cooperating would reduce actual USSR meat consumption only 2-4 percent.

USDA estimates were at odds with those made by the CIA earlier in 1979. The CIA assumed

the United States would totally restrict grain exports to the USSR and that other exporters would cooperate fully. Under those assumptions, their analysis indicated that a grain embargo would reduce the USSR's planned meat consumption by 20 percent.

CIA substantially overestimated the impact on USSR meat consumption, while the USDA estimates were eventually vindicated. However, CIA used several assumptions which, though reasonable then, did not materialize. One was that other exporters would not fill the void left by the Americans in the USSR market, and another was that limited Soviet port capacity, coupled with the USSR's drought-reduced grain harvests, would result in USSR grain shortages requiring a reduction of livestock herds anyway. Therefore, the 20-percent figure represented more than effects of the U.S. embargo on USSR consumption.

It is unclear from our sources whether the President or other principal decisionmakers saw the USDA results before the final decision was made. Some of those interviewed recalled NSC discussions about which numbers were correct. Carter's close advisors assert he saw only the CIA analysis. Evidence suggests that the lower estimates did not surface until later.

On January 2, 1980, Mondale met with officials of USDA, the Council of Economic Advisors, and the White House to discuss possible budgetary implications of a grain embargo and how to mitigate the embargo's damage to the markets. Persons attending that meeting recall that the embargo was presented almost as a *fait accompli.*

By the Cabinet meeting on January 3, the decision to embargo grain sales to the USSR had been made. At that meeting, the President and his advisors, on the urging of Mondale and Bergland, decided to indemnify farmers for losses from the embargo. Bergland estimated possible costs to the U.S. farm community at $3.5 billion in 1980.

On January 4, 1980, after grain markets had closed, Carter announced that the United States would embargo all grain sales to the USSR above and beyond the 8 million tons covered in the long-term agreement. He called for the embargo under the Export Administration Act of 1979, allowing the President to declare export controls without consent of Congress on national security grounds.

The sanctions against the USSR also included the usual cessation of diplomatic and cultural exchange: Delayed opening of consular offices in New York and Kiev, deferred consideration of the SALT II treaty, deferred economic and cultural exchange, review of all high technology licensing and cessation of those exports, restricted Soviet fishing in U.S. waters, and cessation of Aeroflot flights into the United States. The United States eventually boycotted the 1980 Olympics at Moscow.

IMMEDIATE EFFECTS AND U.S. POLICY RESPONSE

According to one top grain company official, the trade had foreseen the likelihood of the embargo shortly before it was announced and had begun estimating exposure and potential losses if and when an embargo was announced. His company, for example, estimated losses of $50 million in 19 different areas such as the futures market, barge commitments, and ocean vessel shipping commitments.

The grain trading companies met with government officials in Washington on January 6, explained these technical trading operations, and outlined what they thought the extent of market destruction would be if the contracts were not picked up. At the end of the day-long meeting, the traders and government officials agreed that contracts held by U.S. grain companies would be compensated. This left some companies with losses to absorb on operations that their foreign subsidiaries had contracted for with the USSR because the U.S. Government made it a condition of the indemnification plan that the foreign subsidiaries, like the U.S.-based operations, had to cease shipping grain to the USSR. Yet, the foreign subsidiaries of U.S. parent companies were not eligible for U.S. Government compensation. (In late June, the Government began to allow U.S. firms and their subsidiaries to ship third-country grain, allegedly in response to threats of lawsuits

against American companies from other exporting countries.)

These transactions were completed by the following week. The companies agreed to deliver the grain on a schedule arranged by USDA and to allocate the 2.5 million tons of grain remaining to be shipped under the long-term agreement among themselves. Two companies did not accept the terms and did not comply with the embargo. The U.S. Government eventually bought 202 separate contracts (a $2.39-billion value) from 13 export companies.

The program to compensate American farmers for the embargo took longer to complete and was more complex than the deals made with grain companies. In meetings leading to the embargo decision, President Carter had declared that he would spend whatever it cost to preserve farm income, but how to do it was a complicated matter. A later USDA estimate said the domestic impacts of the embargo would be a $3-billion decline in farm income, absent offsetting actions, from the 17 million tons of contracted sales that were suspended, and $0.15-0.20 declines in commodity prices. No tangible effect on the exchange rate was expected because the suspension affected only $2 billion out of the total U.S. trade account of $180 billion.

On January 5, Bergland announced relief measures USDA was considering for farmers, including increased wheat and corn loan rates, raising release levels of the farmer-owned reserve (FOR), waiving first-year interest on grain entering FOR, increasing export credit guarantees, and increasing gasohol production incentives. USDA announced program details on January 8 (table 15.1). USDA promised to announce in the spring whether a paid diversion would be authorized for 1980 crops. It was later decided that price levels did not warrant a paid diversion program. USDA also requested authorization to establish a food security reserve of 4 million tons of wheat to be acquired by the Commodity Credit Corporation (CCC) from embargoed supplies.

Table 15.1--Immediate policy responses by USDA to embargo decision announced on January 8, 1980

-- Increase in wheat loan price from $2.35 to $2.50 per bushel
-- Increase in corn loan price from $2.00 to $2.10 per bushel, with comparable increases in loan prices for the other feed grains
-- Increase the reserve release price from $3.29 to $4.63 a bushel for wheat--representing 150 percent of the new loan price
-- Increase the reserve call price from $4.11 to $4.63 a bushel for wheat--representing 185 percent of the new loan price
-- Increase the reserve release price from $2.50 to $2.63 a bushel for corn--representing 125 percent of the new loan price
-- Increase the reserve call price from $2.80 to $3.05 a bushel for corn--representing 145 percent of the new loan price
-- Increase the reserve release and call prices for the other feed grains comparable to corn
-- Waive first year interest costs for the first 13 million tons of corn entering the reserve
-- Increase reserve storage payments from 25 to 26-1/2 cents a bushel for all reserve commodities except oats, which was increased from 19 to 20 cents a bushel
-- Purchase 4 million tons of wheat, including the assumption of the contractual obligation on up to 3.7 million tons that were not shipped to the USSR
-- Offer to assume contractual obligation on up to 10 million tons of corn

Intermediate-term policy responses revolved primarily around income protection for farmers. The farm economy was in poor condition because of higher production costs from oil price increases, tight credit at high interest rates, and lower crop prices resulting from good weather. In March, USDA asked Congress to allow noneligible 1979 corn into FOR, and President Carter extended the Economic Emergency Loan program to September 1981, making farmers eligible for $2 billion in loan assistance. In April, USDA announced that the 8 million tons of exports to the USSR covered in the long-term agreement would be available to the USSR at the start of the agreement year on October 1, 1980.

In early June, Bergland, Mondale, and high-level agricultural officials attended a White House meeting to discuss the farm situation. The group was considering policy changes that could improve the general farm economy. They decided not to implement a wheat set-aside for the 1981 crop.

The same group, this time including the President, met again on July 1. One participant's notes show that the group believed the embargo was being blamed for all the problems in the farm economy but that perception was not based in fact. They realized that, even if it was too late to improve farm incomes, they could do something about prices. The President expressed concern about the effects on inflation of raising loan rates, but added that abandoning the embargo would have international consequences. He concluded that the group should decide how to take action while minimizing the budgetary consequences.

At the end of that month, loan rates were raised again: To $3 a bushel on wheat, to $2.25 on corn, and to $5.02 on soybeans. In early December, Carter signed P.L. 96-494, authorizing an additional $300 million in emergency loans to farmers and requiring minimum prices on reserve-held grain while waiving the interest charged on the reserve loans.

The administration response was designed to minimize the impact of the embargo decision on domestic agriculture. There was some sentiment, muted at first, that the farm community was being singled out to bear the burden of an important foreign policy decision and that it should be reimbursed for any costs that would befall it. Administration officials apparently agreed, or wanted to avoid angering politically potent farm interests, and implemented the policies described above. However, as the season wore on, the embargo was blamed for a multitude of farm problems. It became increasingly difficult for the administration to distinguish effects of the embargo on farmers from other events affecting farm prices and farm costs.

Critics often assert that lower commodity prices caused by the embargo lowered farm incomes. The markets were closed for the first 2 days after the embargo announcement. When they re-opened, prices initially dropped the limit on both the first and second day, less than the limit on the third day, and then stabilized. (Price limits vary across commodities and exchanges. For example, wheat traded on the Chicago Board of Trade has a daily maximum price fluctuation of 20 cents; corn has a limit of 10 cents.) However, the markets were soon functioning normally and prices initially declined, but recovered to their pre-embargo levels in late spring.

Our quantitative analysis shows that the embargo and the subsequent policy actions to counteract the embargo may have raised prices above what they would have been had the embargo and the accompanying policies not been imposed. Wheat prices were 2.6-3.4 percent higher than they would otherwise have been, and corn prices were 0.1-1.5 percent higher (see Chapter 13).

The models in Chapter 11 show that, without the extraordinary policy measures taken to compensate farmers, prices would have been only slightly lower (if at all) than they would have been without the embargo. Under the most likely scenario, a small decline in USSR imports, U.S. wheat and corn prices would have been approximately 0.01-2 percent lower as a result of the embargo. This means that U.S. policy actions actually overcompensated farmers.

But regardless of what prices would have been in the absence of the embargo, farmers saw prices drop after the embargo. Prices began to turn down when record harvests in the

Southern Hemisphere began, but rebounded when weather soured in the Northern Hemisphere that summer. Another factor that probably contributed to the low prices early in the year may have been a drop in speculative demand because of high prevailing interest rates which increased carrying costs.

Because prices dropped when many farmers needed planting funds, some suffered a loss by selling crops at temporarily depressed prices. This phenomenon appears to be limited since only 10.2 percent of 1979 output was sold during the first 2 months of the embargo compared with 10.6 percent of 1978 output sold during January and February of 1979. This indicates that the lower prices actually changed farmer behavior very little that spring. Again, statistical analysis (see Chapter 13) shows that farmer income was higher than it would otherwise have been if the embargo had not been declared. Although production costs and feed costs were somewhat higher as a result of the embargo, net farmer income was up $200 million to $2.2 billion over what it would have been without the embargo.

Other Exporters' Reactions

On January 4, several hours before the public announcement, USDA officials began notifying exporting countries in an 11th-hour attempt to win support and cooperation. The embargo decision had been kept secret because a leak could have devastated commodity markets. USDA officials met the following week in Washington with representatives from other major grain exporters (Canada, Australia, Argentina, and the EC). A second meeting was held with soybean exporters (Brazil and Argentina) 2 days later.

Cooperation of other grain exporting countries was crucial to the success of the embargo if success meant denying grain to USSR consumers. In spite of how critical their cooperation was to the success of the embargo, the United States does not seem to have gone to great lengths to assure cooperation. Calls to foreign governments were not issued at high levels. A mid-level USDA bureaucrat was given the task of contacting his counterparts in Europe, Canada, Australia, and Argentina. According to those interviewed in these countries, this caused consternation and indignation. As in the 1973 soybean embargo, more attention to foreign allies may have avoided many problems.

Despite the low level of communication, some cooperation was obtained at a January 12 meeting when U.S. officials asked those countries to ship no more than "normal and traditional" amounts of grain to the USSR for the duration of the embargo. All except Argentina agreed to cooperate. No specific quantities were identified as "normal," but the U.S. officials evidently felt that was the maximum commitment they could hope to get. Inability to obtain a stronger commitment from other exporters proved critical. Canada and Australia both used this imprecise definition to ship more than what the United States called "normal and traditional" amounts to the USSR.

European Community

The decision to assist the United States in its effort to punish the USSR was not a particularly difficult one for the Europeans, but it was based on political alliances, not on economic calculations. The European spokesman agreed to comply with the U.S. request to ship no more than "normal and traditional" quantities to the USSR but said that he "was not enthusiastic."

The EC's agricultural policy made it technically easy for the EC to comply with the embargo. The Common Agricultural Policy, with high producer prices, had encouraged overproduction in the EC. Following adoption of the CAP, the EC had become a net exporter of cereals, beef, and sugar. The EC began offering export restitutions in order to dispose of its surplus commodities. The export restitution system which licenses for specific destinations made it particularly easy for the EC to monitor and control exports to the USSR during the embargo.

The EC Commission determines in advance how much can be exported to particular destinations and declares an amount of subsidy to be paid on those exports. It simply declared the USSR to be an ineligible destination for export restitutions and ceased issuing licenses for exports to the USSR above and beyond what it considered "normal and traditional." The EC also suspended shipments of dairy and

meat products to the USSR above normal levels.

The press frequently alleged that significant amounts of grain leaked from various ports within Europe and that transshipment occurred regularly. Our interviews established that 1-1.5 million tons of EC grain were shipped to the USSR after the embargo because export licenses had already been granted and could not be revoked. Some of these licenses were held by U.S. firms with European offices which could not ship to the USSR. The U.S. firms sold the licenses to European companies which were not prevented from shipping already licensed grain to the USSR. It is commonly believed in the trade that a number of foreign companies profited considerably by doing business with the USSR while U.S. companies were prohibited from carrying out that trade.

The EC, more than any other exporter, tried to comply with the commitment made to the United States. But the nature of the grain trade complicated its efforts. The grain trade is a series of strings and circles (see Chapter 4).

It is often impossible to trace one barge of grain from origination to destination. Hence, it is impossible to know exactly how much grain reached the USSR through European channels; but in any case, the amount would not be large.

Canada

When the United States asked Canada to limit grain shipments to the USSR to "normal and traditional" amounts, the United States put Canada in an uncomfortable position. It would be difficult for Canada to undermine its close ally and trading partner, but it was nearing the culmination of a long process of expanding production and exporting capacity of agricultural commodities. Canadians were on the verge of an export drive.

Canada had large grain stocks on hand in late 1979. Internal transportation constraints had limited export capacity, and acreage had recently increased by 3 million acres. A heavy investment in covered rail cars and branch rail line improvement was scheduled to reach fruition in late 1979, enabling Canada to greatly expand grain exports by the 1980's. A final factor contributing to Canada's reluctance to endorse the embargo was the imminent renegotiation of its own long-term agreement with the USSR in which Canada hoped to incorporate an annual increase in quantities.

Interviews with Canadian officials revealed that the decision to participate in the embargo was, as in the EC, based on foreign policy reasons. The agricultural interests, not wanting to mix politics and the market, opposed the embargo and insisted that Canadian farmers be compensated for losses resulting from the embargo. The Government agreed and eventually paid out $81 million (Canadian) to farmers through the Western Grains Stabilization Fund.

Canada agreed to cooperate; but, like the other cooperating countries, it did not specify a stated quantity of exports. There was a considerable amount of discussion in Canada over the definition of "normal and traditional." The initial suggestion within Canadian agricultural circles was 3.6 million tons of all grain, well in excess of the shipments since 1976/77, but below the 4.4 million tons of wheat alone shipped in 1972/73. The number was later increased to 4.5 million tons, considered appropriate because it was about the amount shipped in 1972/73, and because it was the amount obtained by multiplying the 1975/76 export quantity of 3.24 million tons by the 136-percent growth in world trade since then. The 1975/76 export amount was considered to be the last "normal" year of Canadian exports because domestic transportation constraints inhibited exports in subsequent years.

Allegations that Canada cheated and exported more than the "normal" amounts agreed to in the January 12 meeting need to be assessed with one critical distinction in mind. The Canadians counted their compliance on a crop year basis, while the United States measured compliance on the basis of calendar year statistics. According to calendar year figures, the Canadians did export more to the USSR during the embargo than in the years immediately preceding it. However, if one looks at the crop year statistics used by Canada, it is not so clear that it breached the agreement.

The Canadians shipped only 3.5 million tons of wheat and barley to the USSR in crop year

1979/80, and 5.5 million tons in the 1980/81 crop year beginning August 1, 1980. According to Canadian crop year data, the amount of wheat (Canada's main export crop) exported to the USSR was 2.6 million tons in 1979/80 and 4 million tons in 1980/81.

According to U.S. calendar year data, Canada exported 4.2 million tons of wheat to the USSR in 1980. But, the bulk of those exports (3.2 million tons) came during the latter half of 1980, which was a new crop year for the Canadians. They assert that they fully complied with the U.S. request to refrain from exploiting the embargo during the 1979/80 crop year.

It is unclear whether the Canadians initially agreed to the embargo for only the 1979/80 crop year, as they forcefully assert. However, numbers show that they shipped only 20,000 tons of wheat in the first quarter of 1980 and only 960,000 tons in the second quarter, suggesting that they complied with the U.S. request during their 1979/80 crop year. The crop year 1979/80 exports of 2.6 million tons were fairly consistent with recent year shipments to the USSR.

Further, the Canadians did not materially alter their share of the USSR or world wheat markets in the 2 crop years covered by the embargo. Canadians asserted in interviews that Canada's share of the USSR market was lower in 1979/80 than in the 4-year periods immediately before or after.

The Canadian Government, new in February 1980, slowly increased exports beginning in the second quarter of 1980 and continued increasing exports through the remainder of the year. By December 1, 1980, the Trudeau government announced that Canada would no longer participate in the embargo, saying that it was falling behind other exporters in sales to the USSR. The Canadians also complained that the United States was stealing Canada's traditional position in the Chinese market.

Statistical analysis (Chapter 10) shows that the Canadian share of the USSR market increased as a result of the embargo, but the Canadian share of other markets fell. The time series analyses and models in the preceding chapters suggest that Canadian trade flows changed significantly as a result of the embargo. Total exports rose, and Canada diverted grain from Eastern Europe to fill the USSR demand.

Australia

Australia, in a drought when the embargo was declared, expected a poor crop that year. The Australian representative to the January 12 meeting agreed to cooperate on the "normal and traditional" basis, secure in the knowledge that the temptation to cheat would be minimal. Further, since the Australians had already signed a long-term agreement with the USSR spelling out what amounts would be shipped in 1977-81, they had no trouble identifying "normal and traditional" amounts. Whether Australia would have increased sales to the USSR in the absence of the long-term agreement cannot be determined. But certainly, the long-term agreement gave the Australians a convenient umbrella under which to expand exports.

The 1980 embargo may have caused some allocational changes that would not otherwise have occurred. The USSR share of Australian exports grew to 24 percent from 8 percent between 1979 and 1980, and settled back to 17 percent in the 2 years after the embargo. While Australian exports grew only 5 percent between 1979 and 1980, the amount exported to the USSR grew 300 percent in that period. But, total wheat exports from Australia to all destinations increased from 1978 to 1979 by over 4 million tons, and increased again in 1980 by only 600,000 tons.

Overall, the econometric models do not show a significant change in the level of total exports as a result of the embargo. The direction of trade, however, has altered. During and after the embargo, the United States became active in the Chinese market, which had been a major market for Australian wheat.

Argentina

The Argentines did not hear about the grain embargo until January 5, when they read it in the papers. Attempts by USDA officials to reach their counterparts in Argentina failed because the Argentines were on vacation. Lower level Argentine officials, meeting on January 7, assumed Argentina would go along

with the embargo and were discussing how it could be implemented. But, higher level officials reacted quite differently. A variety of economic and political factors entered into Argentina's decision. The debate about whether to join the embargo involved the ministers of commerce, agriculture, foreign affairs, and economy. Three considerations drove Argentina's decision:

- First, and foremost, Argentina in 1979 derived nearly 80 percent of its foreign exchange from agricultural exports and nearly 70 percent of its agricultural exports are grains. Argentina had harvested a bumper crop that year, and having no storage facilities, was in need of markets. More important, Argentina faced a current account deficit which could have totaled $8.5 billion without the embargo. The increased grain sales would be one way out. As one grain trader put it, "the embargo was a gift to Argentina."

- Second, while Argentina had fairly good relations with the United States and Argentine officials were friendly with their counterparts in the United States, the two countries had difficulties over human rights. Some of the ministers reportedly felt they had to support the USSR because the USSR was Argentina's only ally in the United Nations on the human rights issue.

- Third, Argentina was offended by the attitude of the United States. Many of those we talked to were quite surprised that the initial contact about the embargo had not been made from President to President. They also emphasized that the U.S. attitude was arrogant. "Argentina would have the opportunity to come to Washington and sign on to the embargo."

There were other considerations. Argentina wanted to express its independence from the United States. The Argentines firmly believed that an embargo would not work and that it was an affront to the free market system. Argentina also feared that an embargo would increase the drive for self-sufficiency in some of its markets, a risk it could not afford.

The USSR also applied pressure to the Argentine Government. A USSR mission evidently met with officials of the Grain Board several days after the United States had announced the embargo to negotiate a long-term agreement. However, officials we talked with insisted that the USSR pressure came after the decision had been made.

The initial strategy decided by Argentina's ministers and approved by their President was to refuse to join, but also to promise that the government would take no action to assist the USSR. It was this decision they took to the United States and the exporters meeting. Some of those present recall that Argentina's representative had initially seemed cooperative but grew increasingly reticent. By the end of the day, it was clear to some that Argentina would not comply with the U.S. request. Argentina's position was either misunderstood or misquoted after that meeting, and the U.S. announcement did not coincide with Argentina's policy. This misunderstanding exacerbated tensions over the way the embargo notification had been handled and may have forced Argentina to come out more forcefully against the embargo than it might have otherwise.

The following day, the Argentine spokesman held a press conference in Washington to announce that Argentina would not participate in the embargo. But Argentina did not qualify its refusal to participate (as it had originally intended) by promising it would not directly assist the USSR in obtaining grain. Argentine officials were quite angry with the way the United States had handled the situation and decided against even partial cooperation.

Argentina's exports to the USSR increased markedly in 1980 and 1981, with the USSR taking 80 percent of Argentina's grain. Corn exports totaled 1.6 million tons in 1979, 4.4 million tons in 1980, and 12.4 million tons in 1981. Wheat exports were 200,000 tons in 1979, reaching 3.1 million tons by 1981.

The econometric models show that Argentina gained more than any other exporter from the embargo. Argentina's wheat prices in 1980 averaged $5.69 to $7.46 per ton higher than they would have been without the embargo. Argentine exports to the USSR were also higher than they would have been because Argentina shifted away from its traditional markets in Brazil, Africa, and India. Statistical analysis (Chapter 10) supports

conclusions of the models, and shows that Argentina experienced the most dramatic and persistent increases in exports to the USSR.

While exports to the USSR in 1980 and 1981 were considerably larger than exports in previous years, there is no evidence that the government did anything directly to influence—positively or negatively—the level of exports in those 2 years. This was partly because Argentina's government does not interfere in grain markets for financial and philosophical reasons. It was also partly due to pressure from Argentina's farmers and the premiums paid by the USSR. Argentina had no way to control grain flows. In many cases, grain was rerouted midsea and shipped to the highest bidder. For a time, the USSR paid a premium of approximately $20 per ton for Argentine corn and $15 per ton for wheat. The government negotiated two long-term agreements following the embargo which affected export levels in subsequent years.

The Argentine example may have encouraged others to circumvent the embargo and may have indirectly undermined the embargo, according to those interviewed.

USSR

We were not able to conduct first-hand interviews in the USSR. However, we discussed the policy response of USSR officials with knowledgeable European and American grain traders who have years of experience in dealing with Exportkhleb (the USSR purchasing agency) and USSR policy.

After the United States declared the partial grain embargo against the USSR for invading Afghanistan, the USSR had three possible strategies for replacing the embargoed grain. The Soviets could draw down stocks, they could shift trading partners, and/or they could shift into substitute commodities (see Chapter 10). Our interviews shed light on the latter two strategies.

Within days of the embargo, the USSR began to replace the 17 million tons or more of grains that it had intended to buy from the United States. A team was in Argentina within 4 days of the embargo announcement to negotiate immediate purchases, and a long-term agreement with Argentina was in place soon after. USSR wheat imports from Australia hit record highs in the first two quarters of 1980. By the second quarter, Canadian exports to the USSR were becoming substantial after dropping to near zero in the first quarter.

Close observers of USSR behavior at the time recall that the USSR was not in a rush to replace the entire amount of U.S. grain being withheld, but that it replaced it gradually during the course of the entire year, thus minimizing the effect on market prices.

It is not clear whether the USSR obtained any grain covertly, primarily from Eastern and Western Europe. USDA announced at the outset that it expected up to 4 million tons of grain to be transshipped through Eastern Europe and the Mideast over the course of the embargo. But the traders who were interviewed felt that little, if any, transshipment from the Eastern Bloc countries to the USSR took place. The traders also said that the USSR did not wish to buy U.S. grain during the embargo out of principle, even if they could get it, further discounting the possibility of large transshipments. The figures show that they in fact bought less U.S. grain during the last period of the embargo and in subsequent years than they were offered.

Many rumors of leakage from Western Europe may have referred to shipments of EC grain already licensed for the USSR, but that were shipped after the embargo was imposed. That accounts for 1-1.5 million tons, according to our sources, but observations of those shipments may have led to the perception that quantities were much greater and thereby fed the rumors.

Traders agree that the USSR was willing to pay some premium to obtain grain from other countries during the embargo. Obviously, the USSR had to use less than optimal shipping routes and pay for more expensive shipping. The price differential prompted some change in trade flows. Argentina, for example, abandoned traditional markets in Italy, Spain, and Japan in order to benefit from the higher price ($15-$20 per ton over fob gulf) offered by the USSR.

The price ratios analyzed in Chapter 10 substantiate traders' perceptions. The USSR

did pay a premium for wheat and coarse grains. Assuming the USSR imported as much as it would have without the embargo, although from sources other than the United States, the USSR paid an estimated $34 million more for grain than it otherwise would have paid without the embargo.

However, USSR import demand did not drop because of the higher price. This may be because the prices the USSR would have paid for U.S. grain under the long-term agreement were already quite high. This argument is plausible because U.S. wheat prices were indeed relatively high in mid- to late-1979 when the contracts were made. For the last 6 months of 1979, U.S. farmgate prices averaged $3.87 per bushel for wheat. In January 1980, farmgate prices were $3.74 per bushel, rising to $3.78 per bushel in February.

The embargo appears to have had a limited effect on consumption in the USSR. According to one trader, meat consumption has not changed appreciably in 10 years, and did not change during the embargo. Statistical analysis shows that the USSR decreased cattle feeding by only 2 million tons in 1980, primarily because it drew down grain stocks. The few statistics available on USSR meat consumption and production show that meat output fell from 15,300 tons in 1979 to 15,000 tons in 1980. By 1982, output was back on trend with a record output of 16,500 tons. Including meat imports, per capita consumption increased by 3 kilograms between 1981 and 1983. There is no evidence that the USSR reduced meat consumption, although it may have substituted some meat imports for grain imports.

Model results support conclusions from our interviews that the embargo did not deprive the USSR of food. The embargo forced the USSR to look elsewhere for grain imports and in the process the USSR discovered that other suppliers could meet its needs.

LONG-TERM EFFECTS AND U.S. POLICY RESPONSES

The embargo undoubtedly prompted some U.S. policy changes. The Embargo Protection Clause, added to the Food and Agriculture Act of 1981, requires USDA to make payments to producers or to increase loan rates if agricultural exports are restricted for national security or foreign policy purposes and a similar ban is not placed on all other U.S. exports. The Export Contract Sanctity Clause, added to the Commodity Futures Trading Act in January 1983, prevents invalidation of sales contracts entered into prior to an embargo and requires delivery of commodities covered by the sales agreement within 270 days of the imposition of an embargo. Both pieces of legislation were intended to discourage embargoes.

Although loan rates were raised to buffer farmers from the effects of the embargo, evidence suggests that these increases may have been forthcoming in any case. Loan rates rose twice during the embargo to $3 on wheat, $2.25 on corn, and $5.02 on soybeans. Rates were raised again in 1981 farm legislation to $3.20 on wheat, $2.40 on corn, and constant on soybeans. However, looking at loan rate increases since the early 1970's (table 15.2), we see clearly that loan rates are usually adjusted for inflation to maintain a certain real loan rate for farmers. These adjustments are often made with a time lag because they require congressional action; at the time of the embargo, loan rates needed inflation adjustment. Even after the series of changes in 1980-81, real loan rates were still below levels of 5 years earlier.

The embargo may have made the United States a supplier of last resort for the USSR. The United States clearly has received a smaller share of the USSR import market in grains since 1979 when it supplied 83 percent of coarse grains, 99 percent of soybeans and soybean products, and 57 percent of wheat imports. In 1982, the United States supplied only 20 percent of USSR coarse grain and wheat import needs and 14 percent of soybeans and soybean products. By 1985, the U.S. share of the USSR market climbed to just under 30 percent.

However, this change in the U.S. position is related to a number of factors, not just the embargo. The USSR is very price conscious, and U.S. prices have not always been competitive with other suppliers in the recent past. The embargo forced the USSR to look to

Table 15.2--Nominal and real loan rates in the United States (1987=100)

Year	Corn		Wheat		Soybeans	
	Nominal	Real	Nominal	Real	Nominal	Real
			Dollars			
1975/76	1.10	0.64	1.37	0.80	0	0
1976/77	1.50	.83	2.25	1.24	2.50	1.47
1977/78	2.00	1.02	2.25	1.15	3.50	1.93
1978/79	2.00	.92	2.35	1.08	4.50	2.30
1979/80	2.10	.85	2.50	1.01	4.50	2.07
1980/81	2.25	.82	3.00	1.10	5.02	1.82
1981/82	2.40	.83	3.20	1.11	5.02	1.84
1982/83	2.55	.87	3.55	1.21	5.02	1.74

Source: Reference (22).

other potential suppliers for grain and made the USSR realize that other countries were able to provide adequate supplies of acceptable quality. According to traders very familiar with Exportkhleb, the embargo reassured the Soviets that other countries could fill their needs. This reassurance overcame their prior preference for U.S. grain and made the other exporters contenders for the USSR market.

Those same traders assert that the USSR has no political resistance to purchasing U.S. grain; it buys for price. Some traders believe that the Soviets will always buy minimum quantities of grain from the U.S. grain trade just to maintain their contacts with the U.S. grain companies and to preserve some influence (even if imaginary) in the U.S. political system.

The lesson that does emerge, however, is that the dependence of one country on another for trade is a myth. Threatening to cut off trade may be an effective deterrent to errant behavior, but the threat loses some of its force when the offending country finds it can fill its needs elsewhere. The USSR now knows that it can always fill its grain import needs.

Many observers blame the decline of U.S. market share on the embargo, claiming it tarnished the U.S. image as a reliable supplier. The U.S. world market share declined between 1978/79 and 1982/83 from 45 percent to 41 percent in wheat, from 65 percent to 59 percent in coarse grains, and from 63 percent to 58 percent in soybeans and soybean products. However, the U.S. share of the non-USSR import market rose during the embargo period from the normal 48 percent to 51 percent for wheat and from 65 percent to 79 percent for coarse grains, partly because of a favorable relative price facing non-USSR importers.

The U.S. share of total world exports would have fallen even without the embargo because of the strengthening dollar and high U.S. commodity loan rates. U.S. agricultural exports peaked in volume in 1980 and in value the following year, but the growth rate was already slowing, and U.S. agricultural exports were being pinched by world recession. By 1982, the higher dollar, the recession, and high loan rates began dragging on U.S. agricultural exports.

The 1980-84 period was one of slow worldwide growth in income and trade, caused by a U.S. (and other developed countries) policy mix of tight monetary policies and high interest rates. These conditions traditionally hurt the U.S. trade position because U.S. agricultural policy encourages supply to adjust more to swings in international trade than do the policies of other countries. At the same time, other countries became active in marketing their own surpluses either because of growing surpluses and the attendant costs or because they realized they could not influence the market price. Finally, developing countries suffering from heavy debt burdens have had to cut back on imports and increase exports in order to preserve foreign exchange.

Other Exporters

No exporting country we studied encouraged production or expanded exports on the basis of

the embargo. Countries such as Argentina were able to profit from the embargo in the short term, but they pursued agricultural policies in the longer term which have discouraged exports. Australia, Canada, and the EC have increased both acreage and exports, but primarily in response to policies unrelated to the embargo.

European Community

The EC has clearly increased its exports to the USSR since the embargo. But domestic EC policies had more to do with this increase than did the embargo. The Common Agricultural Policy (CAP) continued to set high support prices and encourage excess production, which the EC exported. The CAP was in place prior to 1980, and the Europeans were already expanding grain and livestock exports. They would be a strong competitor of the United States, with or without the embargo.

Statistical analysis shows that the EC experienced sustained growth in trade with the USSR after the embargo. But, unlike some of the countries that did not have trading relationships with the USSR and that greatly expanded shipments to the USSR during the embargo, the EC expanded sales to the USSR market after the embargo largely by virtue of its price competitiveness as a result of its use of export restitutions.

Canada

The embargo influenced Canadian policy by strengthening the tendency to make long-term agreements with grain purchasers. The Canadian-USSR long-term agreement was renewed in 1981, as scheduled, at 5 million tons annually, up from the previous annual level of 3 million tons. Long-term agreements now account for 80-90 percent of total Canadian wheat exports.

The Canadians exported greatly increased quantities of wheat to the USSR in the years after the embargo, but this must be attributed in large part to the increased production and export capacity that had been building for several years before the embargo.

Australia

Australia has increased its export presence in the international market, but this is a direct result of domestic economic pressures and the 1977 agreement with the USSR, not the 1980 embargo.

The Australian Wheat Board is responsible for purchasing wheat from individual Australian farmers and then marketing it. In the past, the advance payments to farmers for wheat came directly from the government and were a form of money creation. As acreage and exports expanded, this became a problem because the money supply was increasing more rapidly than the economy could absorb, causing increased inflation.

The Australian Wheat Board then financed farmers' payments by borrowing in Australian capital markets, but it soon became obvious that the domestic capital market was too small. Interest rates rose sharply because of the sudden surge in capital demand and the Wheat Board turned to international capital markets. Once in the international capital market, the Australian Wheat Board became acutely aware of the time value of money and of Australia's relative share of the world wheat market.

Australia began to realize that holding wheat stocks in hopes of boosting prices was not only ineffective but costly. Australia was better off selling its wheat immediately and banking cash at world interest rates. As a result, the Australian Wheat Board now sells wheat on world markets as quickly as possible and for whatever price it can obtain in order to pay off international debts. Cost of holding wheat now equals the cost of paying interest on this money. This policy was changing about the time the embargo occurred and is one possible explanation for the sudden, but apparently planned, increase in Australian exports. Thus, the change in the financing arrangements of the Wheat Board increased emphasis on expanding exports.

Argentina

The allegations that Argentina got into the USSR market because of the U.S. embargo are partly true. Prior to the embargo, Argentina

was the exporter of last resort for the USSR. Argentina's limited port facilities, which have to be precisely scheduled and which cannot handle large, cost-effective ships, meant that freight costs from Buenos Aires to the USSR were substantially higher than from other ports. However, high U.S. loan rates, coupled with the value of the dollar, compensated for the higher shipping costs and encouraged the USSR to look to Argentina during the first half of the 1980's.

The embargo led to closer ties between the USSR and Argentina. Exportkhleb became very friendly with the Argentine military government and developed good contacts with Argentina-based grain companies. The USSR negotiated a long-term agreement with Argentina in 1980 and a second one in 1981. The first agreement required the USSR to buy 4 million tons of corn and sorghum annually, with a minimum of 500,000 tons of sorghum through 1985. The second required the USSR to buy 60,000-100,000 tons of beef. There is no mention of wheat. Since both the USSR and Argentina are cash-only traders, it is to their mutual benefit to do business together.

But given the USSR's preoccupation with finding the lowest possible price, it is unlikely that this introduction would be sufficient to keep the USSR in Argentina's market. The rising value of the dollar and high U.S. loan rates have done more to keep the USSR in Argentina's market than did the embargo. And, Argentina is not a reliable supplier either, with strikes, inefficient ports, and uncertain harvests. Meanwhile, Argentina is becoming less reliant on the USSR market. Argentina is selling its increased grain production to Morocco, Egypt, and other countries.

There is no evidence that Argentina changed any operating procedures or policies to increase its share of the world market as a result of the embargo. Argentina has historically negotiated long-term agreements. With tight transportation and storage facilities, Argentina must carefully schedule all grain shipments. Long-term agreements facilitate that scheduling and stabilize shipping. Furthermore, Argentina has found long-term agreements an inexpensive way to get into a credit-based market.

Argentina cannot afford to subsidize its producers. In fact, until 1976, Argentina taxed its producers to finance industrial development. Then, in 1976, Argentina freed its agricultural economy by lowering export taxes from 56 percent to almost zero and by abolishing its Grain Board. Grain began to move through private channels. These policies changed relative prices and dramatically increased farmer income. Farmers invested these windfall gains in technology, especially herbicides and fertilizer, and new seed varieties. Management practices also improved and double cropping began.

In 1981, the year after the embargo, export taxes were reintroduced as a way to finance the government. The average level of these taxes was initially 10 percent. In 1986, the average level of export taxes reached almost 25 percent. Taxes are 16.5 percent on wheat, 22.5 percent on corn, and 28.5 percent on soybeans. In addition, International Monetary Fund (IMF) conditionality programs have required Argentina to maintain the value of its exchange rate. In April 1986, the official exchange rate was overvalued by approximately 10 percent, in effect taxing agricultural exports another 10 percent on top of the export taxes.

The embargo encouraged production to some extent. Premiums paid for 1980 and 1981 crops increased farmer income and sent price signals to expand production. But, effects were probably limited in scope. Even with the export taxes, overvalued exchange rate and poor port facilities, Argentina has been able to undersell U.S. products.

Corn provides a telling example. U.S. corn at gulf ports in April 1986 sold for $105 per ton. Argentine corn at Buenos Aires sold for $87 per ton. Export taxes, the effective tax from the exchange rate overvaluation, and transportation and storage charges reduced the farm price to $38 per ton. The U.S. farmer receives $98 per ton, three times the price received by the Argentine farmer.

USSR

Although the USSR has been purchasing less grain from the United States, the reasons extend beyond the embargo. Other factors are also responsible.

Prior to 1973, the USSR relied largely on Canada for its wheat imports, supplemented by small amounts from Argentina, France, and the United States, in that order. Then, the USSR radically changed its import policies, deciding to rely on imported grain to meet livestock feed demand. In the spirit of detente prevailing then, the USSR turned to the United States to fill much of that demand. In 1973, the USSR increased coarse grain imports from the yearly average of 0.5 million tons to 7.4 million tons, 65 percent from the United States. The 1970's saw much U.S.-USSR cooperation on activities such as the gas pipeline in 1972 and several trade agreements, including the 5-year grain agreement beginning in 1976.

After the 1980 embargo, detente died and the USSR was in a less conciliatory mood toward the United States. There was considerable tension between the two countries when the long-term grain agreement expired in 1981 and two temporary extensions were required before a new agreement could be reached in July 1983. During this period of uncertainty, the United States criticized the USSR over its activities in Poland, and the USSR was negotiating long-term agreements with Canada and Brazil.

The USSR purchased very little U.S. grain after the expiration of the 1976-81 long-term agreement even under extensions of that agreement. During the last quarter of 1980, when it was allowed to purchase the 8 million tons agreed to in the last year of the long-term agreement, the USSR bought only 3.2 million tons. The United States was reluctant to enter into negotiations for foreign policy reasons, and the USSR may have tried to pressure the United States toward the negotiating table. After the long-term agreement was signed in 1983, the USSR substantially increased grain imports from the United States, despite its own good harvest in 1983/84.

Economic factors are equally important to political factors. The Soviets are price conscious purchasers and have looked elsewhere for grain imports because U.S. grain was expensive in the early 1980's. U.S. loan rates have kept U.S. prices above world market prices and have encouraged competition abroad. In recent years, price competition from grain exporting countries has become fierce and the USSR has taken advantage of those opportunities.

The embargo apparently altered USSR buying habits. Prior to the embargo, the USSR tended to come into the market one time for all its import needs, thus raising prices. After the embargo, the USSR seemed more certain of obtaining needed imports from the world market and buying over the course of a year. Statistical analysis sheds some light on this change in behavior. The USSR altered its seasonal buying pattern to accommodate purchases from the Southern Hemisphere (see Chapter 10). Peak buying activity shifted dramatically from the fourth to the first quarter in the years after the embargo.

To the extent that the large and erratic USSR purchases led to high and unstable prices prior to the embargo, the change in USSR purchasing patterns has smoothed out price fluctuations on the world markets. While fluctuations may have been relatively small in the short run, market uncertainty over the size of USSR purchases and the timing creates some instability and higher prices. The USSR acts much like any other buyer in any other market: It seeks the best price. Similarly, over the long run, the market responds to the supply and demand of the USSR as to that of any other market participant.

CONCLUSIONS

The immediate success of the embargo and its long-term effects on U.S. agriculture depend critically on the policy response (or lack thereof) of U.S. competitors and customers.

Our interviews indicate that of all U.S. competitors, the EC complied with the embargo the most completely and for the longest duration. Their decision was based on political alliances and their compliance was facilitated by an export restitution system which allowed them to identify destinations for every shipment of grain. Despite their willingness and efforts to comply, the fluidity of the international grain market frustrated the EC's efforts to totally curtail grain shipments through their ports to the USSR. Our interviews clearly indicated that an

undetermined (although probably small) amount of grain did leak through Europe, despite those countries' best intentions.

Canada reluctantly agreed to comply with the U.S. request. Despite large stocks and expanded export capacity, Canada would have had difficulty denying cooperation to its close ally and trading partner. Like the other cooperators, Canada never specified the exact amount of grain it would deny the USSR; nor did Canada specify how long it would comply with the embargo. The U.S. allegations that Canada cheated need to be assessed against one critical factor: The Canadians counted their compliance by crop year and the United States by calendar year.

Australia also agreed to comply with the embargo, but had little temptation to cheat due to a drought which left them with little grain to sell. Furthermore, a year earlier, Australia had negotiated a long-term agreement with the USSR that allowed for substantial increases in shipments and that made it easier for them to rationalize "normal" if not "traditional" amounts.

Several considerations drove Argentina's decision not to comply with the embargo. Argentina derived almost 50 percent of its total export earnings from grain exports and needed the foreign exchange earnings to repay foreign debt, Argentina was under fire by the United States for human rights abuses, and Argentina was offended by U.S. presumptions that it would automatically comply with the embargo. And, as an export-dependent country, Argentina could not afford to see other countries increase their drive for self-sufficiency. Also, Argentina wanted to express independence from the United States. Finally, the USSR did apply some pressure to the Argentine Government.

Initially, Argentina decided not to join but also decided not to assist the Soviets in obtaining grain. After the United States mishandled the notification and the announcement of Argentina's decision, Argentina announced it would not join, but did not reiterate the earlier intent not to fill in behind the United States.

At first, the USSR replaced much of the embargoed grain through purchases from Argentina, and to a lesser extent, Brazil. As the embargo wore on, the Soviets were able to buy grain from Canada, which had ceased complying, and Australia, with which it had a long-term agreement. It is not clear that the Soviets obtained grain covertly (many traders said that the USSR was as reluctant to buy U.S. or EC grain as these exporters were to sell it). The USSR also replaced some of the embargoed grain with substitute commodities, such as meat and sorghum.

In the longer term, we can find no evidence that any exporting country changed any policies that materially affected its exports directly as a result of the embargo. Canada was already prepared to expand its exports, having made substantial investments in rail and shipping facilities. The embargo did encourage the Canandians to negotiate long-term agreements both to insure against future embargoes and to secure their market position. Most of Canada's increased exports can be attributed to the investments in export facilities made before the 1980 embargo.

The EC's exports to the USSR have also increased, not because of any explicit policy changes after the embargo, but because of longstanding EC policies encouraging excess production and requiring export subsidies.

Australia has increased its presence in export markets but not because of embargo related policy changes. After the 1980 drought, Australia realized that the quantity it exported had little influence over prices, so it had little incentive to hold stocks. Further, Australia recently began to finance its Wheat Board operations through borrowing in international capital markets and now finds it less costly to sell the commodities and bank the cash.

Argentina did enter the USSR market as a result of the embargo, but that country's rapid export expansion was due to policy changes made 5 years prior to the embargo. In 1976, Argentina liberalized its grain markets. Farmers invested their windfall gains in new technologies, especially herbicides, pesticides, fertilizers, and new seed varieties. Since 1981, Argentine policy has in fact discriminated against agricultural exports. Export taxes averaged 25 percent in 1986, and the exchange rate taxed agriculture an additional 10 percent. Argentina has negotiated a number of long-term agreements with the USSR and other buyers. These agreements are a useful

marketing tool for a country which cannot afford to offer credit, and they facilitate the scheduling of shipments to make the best use of Argentina's limited port facilities. In addition, Argentina's high interest and inflation rates have discouraged stockholding and encouraged producers to market their crops as soon as possible regardless of price.

The USSR, on the other hand, has changed policies since the embargo, but it is likely it would have changed its policies in any event. The embargo, if nothing else, taught the USSR that it could rely on the international market to fill its import demands. It also taught the Soviets to be price conscious at a time when the United States priced itself out of the market. Since the embargo, the USSR has purchased the bulk of its grain from less expensive sources, particularly in the Southern Hemisphere, rather than from the United States. High U.S. prices and the death of detent may have had more to do with changed Soviet buying patterns than did the embargo.

We can find no case in any of the exporting countries we interviewed of decisions to encourage production or expand exports being made on the basis of the embargo. Countries such as Argentina were able to profit from the embargo in the short term, but in the longer term they pursued agricultural policies which have discouraged exports. And countries such as Australia, Canada, and the EC have increased both acreage and exports, but primarily in response to policies unrelated to the embargo.

When the embargo was imposed in January 1980, international economic events had already taken place that would have caused a downturn in U.S. exports and the severe financial stress of the agricultural sector anyway. The second oil price hike in 1979, followed by the tightening of monetary policy by the developed countries, resulted in worldwide economic recession and falling demand for agricultural exports in general.

These conditions were exacerbated by the results of the U.S. tight monetary and loose fiscal policy: An increase in interest rates and the value of the dollar. When coupled with high commodity loan rates, the expensive dollar made the United States noncompetitive in a declining market. U.S. loan rates provided an umbrella under which producers in other countries could expand their production and exports in a virtually risk-free environment.

The embargo may have obscured the importance of the exchange rates, interest rates, and the macroeconomic policy mix for the seemingly unrelated decline in U.S. agricultural exports. To the extent that the embargo became a scapegoat and diverted policymakers' attention from the real problems facing U.S. agriculture, the embargo may have delayed efforts to resolve the problems and may have exacerbated and extended the crisis.

A major conclusion from the 1980 USSR grain embargo is that political embargoes, while they may send a political message, cannot achieve their economic objectives for several reasons. First, the economic incentives to undercut a political embargo are strong indeed. The United States attempted to form an after-the-fact cartel with other grain exporters to deny the USSR needed supplies. Just as with the OPEC cartel a few years later, the international reasons for binding together are soon overridden by domestic, economic, and political pressures to exploit the situation and sell more than "normal and traditional" supplies.

Second, the objectives set for political embargoes, unlike those established for economic embargoes, are vague and qualitative. The distinction between the 1970's restrictions and the 1980 embargo illustrates the point. The 1970's actions were taken to obtain clear and objective economic goals: To lower prices and increase supplies. Our trading partners could be assured that we would lift the embargo when prices stabilized and supplies increased. The 1980 embargo was taken to obtain political goals: To deter, to punish, and to express outrage. There was no objective indicator when, and under what conditions, the embargo would be lifted.

To the extent that the political nature of the 1980 action engendered any insecurity in our trading partners, it also affected world markets and U.S. trade. However, any effects have been swamped by international economic forces and by our own agricultural policies. In the final analysis, prices, not politics, determine who will produce, what will be produced, and how much will be produced.

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APPENDIX

LIST OF INTERVIEWEES

Name	Title[1]	Principal embargo discussed
United States		
David Aaron	National Security Council staff	1980
Dawson Ahalt	President's Cost of Living Council	1973
Robert Bergland	Secretary of Agriculture	1980
Richard Cooper	Asst. Secretary for Economics, State Dept.	1980
Lloyd Cutler	White House Counsel	1980
Lynn Daft	Agriculture Policy Advisor, White House	1980
Tim Deal	National Security Council staff	1980
Stuart Eisenstadt	Domestic Policy Advisor to the President	1980
Dale Hathaway	Under Secretary of Agriculture for Int'l Affairs and Commodity Programs	1980
Howard Hjort	Asst. Secretary for Economics, USDA	1980
Dan Marcuss	General Counsel, USDA	1980
Leo Mayer	Agricultural Economist, Council of Economic Advisors	1973
Walter Mondale	Vice President	1980
Thomas R. Saylor	Associate Administrator, FAS, USDA	1980
Gary Seevers	Council of Economic Advisors	1973
Wayne Sharp	Agriculture Counselor, U.S. Mission to EC	1980
Vernon Sorenson	Asst. Admin. for Int'l Trade Policy, USDA	1980

[1]With the exception of Argentina, the titles listed are the titles the individuals held during the period of the embargo discussed.

Argentina		
Carlos C. Boutell	Economic Analyst for the Grain Board	1980
Jorge Cort	President, Grain Board (1986)	1980
Horacio F. Harper	Director, La Plata Cereal (1986)	1980
David Lacroze	President, Grain Board	1980
Lucio G. Reca	Secretary of Agriculture (1986)	1980
Marlelo Regunaga	Manager Economics Division, Grain Board (1986)	1980
Jorge Zorreguieta	Secretary of Agriculture	1980
Australia		
Tim Ryan	Australian Wheat Board	1980
Brazil		
Leila T. de Almeida	Center for Agricultural Studies	1973
Layra Aslaniar	Brazilian Inst. of Geography and Statistics	1973
Sergio A. Barroso	Vice President, Cargill S.A.	1973
Erly Brandao	Int'l Programs Advisor, IICA/EMBRAPA	1973
Marina Brasil	Commercial Division I.E.A.	1973
Albrecht Bussem	METEOR Industry and Trade S.A.	1973
Terezinha Iza Cezar	Brazilian Inst. of Geography and Statistics	1973
Jorge Donoso	SAMRIG	1973
Rubem Dreyer	Private Consultant	1973
Sadi Grimm	EMPASC	1973
Stanley Haar	Continental Grain	1973
Paul Hoffman	Agriculture Officer, American Consulte	1973
Jose Hermeto Hoffmann	Economics and Statistics Foundation	1973
Mauro De Rezende Lopes	Economic Studies	1973
Alberto Momma	CAE/MIN Agriculture	1973
Maria Jose Cyhlar Monteiro	Vargas Foundation for Agriculture Studies	1973
Paul Sergio Monteiro	Grains General Manager, Interbras	1973
Sergio Morosini	Agricultural Engineer	1973
Silmar Cezar Muller	Editor, Safras and Mercado	1973
Octavio Nobrega	Agronomist, Ministry of Agriculture, State of San Paulo	1973
Roy Paiva	Former Director of Research, Ag. Economic Research Institute of San Paulo	1973
Fernando Saldanha	Prof. of Catholic University, De Janiero	1973
Antonio Carlos Maltos Da Silva	Executive Director, Soybean Association of Rio Grande de Sul	1973
Gabriel Liuz S. Peixoto Da Silva	Research Analyst, Agricultural Economic Research Institute of San Paulo	1973
Paolo Roberto Nones Da Silva	Economics and Statistics Foundation	1973
Valdemero Takaki	Director, Agro-Industrial Development of the Cerrado	1973
Fabio G.B. Triguerinho	Assn. of Vegetable Oil Industries of Brazil	1973
James Truran	Agriculture Counselor, American Embassy	1973
Canada		
Harold Bjarneson	Economist, Wheat Board	1980
Harvey Brooks	Canadian Wheat Board, Price and Foreign Competition Analysis	1980

John B. Irvine	Canadian Wheat Board	1980
James Liebfried	Commissioner, Canadian Wheat Board	1980
Maggie M.K. Liu	Canadian Wheat Board, Price and Foreign Competition Analysis	1980
William Miner	Agriculture Canada, Grains Group	1980
Brian Oleson	Agriculture Canada, Grains Group	1980
Bob Roehle	Canadian Wheat Board, Market Analysis	1980
Gerry Trant	Agriculture Canada	1980
European Community		
Mr. Marinucci	International Relations, Ag. Directorate, EC	1980
Helmut Von Verscher	Deputy Director General for Agriculture, EC	1980
Claude Villain	Director General for Agriculture, EC	1980
Aart de Zeeuw	Dir. Genl for Ag., Ag. Ministry Netherlands	1980
Japan		
Shigeru Endo	Mitsui and Co., Ltd.	1973
Yujiro Hayami	Forum for Policy Innovation	1980
Tsutomu Kuranishi	National Federation of Agricultural Cooperative Associations (ZENNOH)	1973
Seiji Mori	General Affairs Dept., Food Agency, MAFF	1973
Koji Nagasaka	C. Itoh and Co., Ltd.	1973
Yoshio Sone	U.S. Wheat Associates, Director	1973
Tetsihiro Yamamoto	Marubeni Corporation	1973
Susumu Yamaji	Japan Economic Journal	1973
Yoshihide Uchimura	Economic Affairs Bureau & Vice Minister, MAFF	1973
Grain companies		
Jacques Belilos	Polygrain	1980
Gerard Emmler	Tradegrain	1980
Daniel Huber	Cargill	1980
Walter Klein	Bunge Corporation	1980
Berthold Mayers	Finagrain	1980
Ray Rogers	Finagrain	1980
David Swanson	Finagrain	1980
Chris Vanhonacker	Finagrain	1980
International organizations		
Jean-Henri Barotte	Executive Secretary, Int'l Wheat Council	1980
Jean Marc Lucq	Director of Agriculture, GATT	1980
A.W. De Maria	Economist, International Wheat Council	1980
Paul Shanahan	Economist, GATT	1980
Albert Simantov	Director, Agricultural Directorate, OECD	1980

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CHAPTER 16

OVERALL EFFECTS OF EMBARGOES ON U.S. AGRICULTURE*

Purpose of the Part II analysis of the four agricultural export embargoes imposed by the United States over the last decade was to determine the effects export embargoes have had on U.S. agriculture, trade, and Government program expenditures since 1970.

We analyzed the 1973 general embargo on oilseeds and products, the 1974 moratorium on grain sales to the USSR, the 1975 moratoria on grain sales to the USSR and Poland, and the 1980 embargo on all agricultural products to the USSR. Our major focus was on the 1980 embargo because of its longer duration and because of the related domestic policy adjustments that occurred.

We examined the embargoes from several perspectives. The results were surprisingly consistent: The direct effect of embargoes on U.S. agriculture was relatively small. Trade adjusted enough to prevent major fluctuations in grain prices. This indicates world grain markets are flexible enough to handle a disruption of the size and nature of the 1980 embargo and that, therefore, some degree of competition exists in world agricultural markets. This competition precludes any one player from effectively exercising market power via embargoes. The embargo effects were so small that it is unlikely they were the root of the problems U.S. agriculture faces in the 1980's.

We used several different models and methodologies to assess effects of embargoes on U.S. and world agriculture. We felt that no single methodological approach, nor single model, could provide complete embargo analysis. If different approaches to the analysis of embargoes generated similar results, we could be more confident in our general conclusions.

We began with a review of the economic theory related to the analysis of embargoes. This was followed with a descriptive and time series analysis of trade and price patterns to see if there were any discernable changes after the embargoes were imposed. We interviewed individuals who were in positions of authority in the United States and other affected countries at the time of the embargoes in order to determine how the embargoes may have changed policy.

The short duration of the 1973, 1974, and 1975 embargoes and the lack of structural economic models of comparably short time dimensions prevented us from attempting structural model simulations for these three embargoes. The 1980 embargo did last long enough for existing structural models to be useful. Since the 1980 embargo was targeted at the USSR, the structural models used had to incorporate source/destination trade flows. However, the structure of world grain markets and conflicting perceptions on how they function give mixed signals on the most appropriate modeling techniques for analyzing effects of embargoes. On one hand, the degree of intervention by large countries suggests imperfect markets and significant market rigidities. On the other hand, the mechanics of the grain trade suggest a highly flexible, efficient, and competitive market which adjusts quickly to shocks. Thus, we used different world trade models to reflect these differing views of how grain markets function.

We used a static annual spatial equilibrium model that depended on the assumption that each commodity is traded in a competitive international market and commodities are assumed perfect substitutes from all sources of supply. We also used a static annual Armington trade flow model and a quarterly dynamic Armington trade flow model. Armington type models retain the competitive market assumption but assume that importers see commodities from different sources as imperfect substitutes for each other. This approach captures trade flow rigidities due to export quality differences across countries and political factors, such as bilateral agreements and preferences for stable export arrangements or diversified supply sources that inhibit trade flow adjustments. Results from these two model types should bracket the true response to any embargo, since one approach assumes complete trade flow adjustment and the

*Principal contributor to this chapter was William E. Kost.

other only partial adjustment to changing patterns of border prices among exporters.

The static annual spatial equilibrium model was also modified to allow simulations under noncompetitive assumptions. This price discrimination model allowed us to consider whether a large country has the incentive to exploit its market power and intervene in the market. It was designed to evaluate the contention that Argentina exploited the 1980 embargo by increasing sales and charging premium prices to the USSR.

Finally, for the purpose of analyzing the U.S. domestic impacts of the embargo, an annual dynamic U.S. agricultural sector model was used to trace the effect of the change in U.S. exports on U.S. agriculture.[1]

THEORETICAL CONCLUSIONS[2]

We first looked at embargo effects that one would anticipate based on economic theory. From a theoretical perspective, we distinguished between a general embargo imposed by a country against all customers and a targeted embargo imposed against only one or some subgroup of customers.

In a two-country world, a general embargo disrupts the trade flow between the two nations and thereby reduces global welfare. If the embargoed country retaliates, trade and welfare are further reduced. Such retaliation could completely eliminate trade between the two countries, and all gains from trade would be eliminated.

It is more realistic to consider a multicountry world where there are other exporters. If one exporting country imposes a general embargo, importing countries' welfare declines. Less is available on the world market, driving prices up and thereby reducing imports. Other competing exporters gain from this embargo because, from their perspective, demand for their products has increased. They can now sell more at a higher price. In this case, world trade does not fall by the full amount of the embargo because competitors increase exports, partially offsetting the global effect of the embargo.

The nature of the import demand curve affects how much other exporters gain in this case. The more inelastic the import demand curve, the larger the price rise and therefore the larger the gain to other exporters and the less importing countries' imports are reduced. The greater the degree of substitution among products, the more price elastic the import demand schedule and, therefore, the less effective the embargo on any commodity. These two cases also highlight the importance of the extent of the market controlled by the various exporters. The larger share of the market controlled by the embargoing exporter, or the more the other exporters are willing to cooperate with the embargoer, the larger the effect on the importing country and the more effective the embargo. It also follows that the more elastic the other exporters' export supply curve, the less effective the embargo since other exporters will respond more to any given price rise.

The two general embargo cases assume that the embargoing country's total embargo reduces its exports to zero. However, if the embargo is not total, it is possible that the embargoing country could actually improve its welfare by imposing an optimal partial export embargo (essentially equivalent to an export tax). This type embargo raises prices in importing countries and lowers prices in the embargoing country. Conceivably, the general welfare of the exporter improves as the consumer gains and export tax revenues exceed producer losses.

An optimal embargo could maximize producer welfare through, for example, a producers' export marketing board. In this case the producer group can allocate supply to raise prices to both importers and domestic consumers, making them both worse off. The producer price could be above the producer price in the optimal tax case but still below the free trade price. However, since the producers are essentially collecting the tax, they could actually be better off than under free trade.

[1]Chapter 10 has a more detailed discussion of the time series analysis of the 1980 embargo, Chapter 11 a more thorough discussion of the static annual trade flow models, Chapter 12 a more thorough discussion of the quarterly trade flow model, and Chapter 13 a more thorough discussion of the U.S. agricultural sector model.

[2]Chapter 8 has a more thorough discussion of embargo theory.

The above two optimum embargo cases would require the exporter to reduce output or increase stocks to be effective.

A targeted embargo imposed against only selected importers modifies the foregoing analysis slightly. To be effective, a targeted embargo relies on cooperation from competing exporters. The embargoing exporters must be able to enforce the price rise in the embargoed importer. This, in effect, generates a two-price world. If other nonembargoing exporters respond to the higher price in one import market, the embargo is less effective.

Stock policy is also important. The embargoing exporters could decide to not hold the embargoed quantities off the market and, instead, move them into the other importers' market. This increased supply will lower prices in the other importers' market. With this lower world price, the other exporters will be less able to charge a price premium to the embargoed importer. In fact, under some conditions, the embargoed importer might actually be better off, as it could buy from the other exporters at this lowered world price. Other importers clearly gain from this scenario.

However, it is likely that other exporters would also consider switching markets. As the embargoing exporter ships more to the other importers, the other exporters most likely would ship more to the embargoed importer. Under this situation, the trade flows adjust but total trade levels would remain relatively unchanged for all countries. One would also expect world price levels to remain relatively unchanged in this case. They might rise slightly because the new trade flow routes might be suboptimal. If, however, the commodities from the various exporters are not perfect substitutes for each other, this readjustment would only be partial, and the effect of the embargo would be correspondingly greater on all countries.

Conceivably, in addition to increasing shipments to the embargoed importer, other exporters might take policy actions to defend their traditional markets when the embargoing exporter tries to shift its market. In this case, the other exporters' world market share would rise.

Countries facing an embargo can respond in several ways. If there is a relatively high degree of trade interdependence between the embargoing exporter and the embargoed importer, the importer can retaliate with effective sanctions of its own on other commodities. As mentioned above, the embargoed importer can, in the short run, attempt to diversify supply and, in the long run, increase domestic production. These supply responses could persist long after any embargo is removed. Also in the short run, embargoed importers could reduce stocks instead of reducing consumption and in the longer run could decide to hold more stocks in order to reduce risk from future embargoes.

THE 1973 OILSEED SALES RESTRICTION[3]

The 1973 oilseed sales restriction involved a general embargo on U.S. exports of soybeans and soybean meal to all destinations for about 1 month for soybean meal and 2 months for soybeans. The restriction was imposed because of a rapid runup of domestic prices. The Consumer Price Index had risen by just under 9 percent in 1973, and the CPI food component had increased by more than 20 percent. Prospect of tightening meat supplies threatened to drive food costs even higher. This situation was partly due to an unexpectedly tight world supply of high-protein meals and the consequent uncertainty in the soybean market. The market had reacted to this tight supply situation through sharp price increases. Inability of livestock producers, both at home and abroad, to quickly adjust production and, therefore, feed demand to tightening input supplies further exacerbated the price rises. There was genuine concern that the United States would run out of soybeans, leaving livestock producers with insufficient meal to maintain production.

During the embargo, world market prices for soybean meal increased and domestic prices declined. However, in the 4 months following the embargo, world soybean and soybean meal prices trended downward. This price decline implies that some market weakness may have existed prior to the U.S. embargo, even though the embargo probably helped break the cycle of panic buying and speculation that fueled the runup of prices early in 1973.

[3]Chapter 9 has a more thorough discussion of the 1973 oilseed sales restriction.

Because it was of such short duration, the embargo had little if any effect on U.S. soybean and soybean meal exports for the marketing year as a whole. Shipments were actually above the levels expected early in the year, though smaller than levels in the previous year.

The 1973 embargo did disrupt international markets for a short period by reducing supplies to foreign buyers and thereby raising international prices. Since Japan had been making larger than normal purchases and building stocks in the 3-4 months before the embargo, the effect on them was less than if they had not accumulated stocks. Also, since soybean meal restrictions were more liberal after August than soybean restrictions, Japan was able to switch purchases to include more soybean meal. Thus, the seasonal pattern and product mix changed, but overall Japanese soybean and product imports remained roughly at the level forecast before the embargo action was taken. Effects on other foreign buyers also appear to have been minimal.

Brazil was the only other major soybean exporter at the time of the 1973 embargo. Since Brazil harvests soybeans in March and April, it was in a position to take advantage of the high prices in late spring and early summer of 1973. But it is not clear that they benefited specifically from the U.S. embargo. The embargo lasted only a short time, and international prices fell sharply shortly after the embargo went into effect. Thus, there were only a few days for Brazil to take advantage of the embargo. In addition, Brazil was concerned about adequate supplies and stable prices in its domestic market. Rather than taking advantage of the embargo by promoting exports, it enacted policies that slowed exports and lowered domestic prices. It was therefore no more a reliable supplier than the United States.

Thus, there seems to have been little or no change in U.S. domestic and export demand. Effect on farm income is less clear. Cash receipts would have been higher if farmers had been able to market the same volume of products at pre-embargo prices. Had farmers received the 1972/73 peak price for marketings between July 1 and September 1, cash receipts for soybeans would have been $52 million, less than 1 percent, higher. But farmers were not in a position to take advantage of the temporarily higher prices that might have been possible in the absence of the embargo since onfarm soybean stocks were at their lowest since 1966. Also, from a U.S. welfare viewpoint, a portion of any loss to these farmers would be offset by consumer gains due to lower food prices, especially beef, and by livestock producer gains due to lower protein feedstuff prices.

While the 1973 embargo had minimal short-term effect on U.S. agriculture and no detectable effect beyond the start of the 1974/75 crop year, it did raise the issue of the United States as a reliable supplier and heightened the importance of food security issues in Japan and the European Community (EC). The embargo gave protectionists, especially in the EC, a target to use in arguing for higher domestic support prices and trade protection.

Over the longer term, Japan increased long-term soybean purchase agreements with the United States. It also provided financial support to trading companies for overseas production investment. These investments were generally quite small and sometimes unsuccessful. For example, Japan invested in Brazil because of cultural ties with Japanese emigrants living in Sao Paulo and because of Brazil's capacity to produce soybeans. The Brazil program did not get underway until the late 1970's and early 1980's. These pilot projects have not contributed significantly to increased soybean production in Brazil.

There is little evidence to suggest that the United States lost significant Japanese market share because of the embargo. Japan did turn to other markets in 1973, but most likely because of its need to maintain adequate supplies in a tight world market rather than because of the embargo itself. The U.S. soybean share dropped from 92 percent in 1972 to 88 percent in 1973, but recovered to 90 percent in 1974 and was back to 92 percent by 1979. In the early 1980's, Japan diversified its imports, largely because of the high value of the dollar. But, it still relies heavily on the United States.

Brazil did capture a larger share of the Japanese soymeal market after the embargo. In 1972, no soymeal came from Brazil. In 1974, 5 percent came from Brazil. And, by 1982, 44 percent of Japan's soymeal imports came from Brazil. This really is not very significant, since Japan imports far more soybeans than soymeal (4.3 million tons of soybeans, but only 87,000 tons of soymeal in 1982).

Brazil's production and exports of soybeans and particularly soymeal have grown. But, there is no evidence that Brazil took advantage of the embargo to increase exports in the long run.

There was little immediate policy response in the EC, but in the longer run the embargo (and more important the high prices and tight supplies motivating the embargo) did affect EC policy. The embargo may have caused France to press unsuccessfully for including soybeans in the EC's Common Agricultural Policy (CAP). Food security issues were raised. To foster increased production, EC support prices for rapeseed and sunflower were raised more than wheat prices. France also increased production research on oilseed crops.

Argentina's soybean production was negligible in 1973, and that country did not begin exporting soybeans until 1976. If the 1973 embargo played a role in Argentina's decision to expand soybean production, it was insignificant in comparison to the role played by price expectations, Argentine export policy, and the example of the phenomenal success of neighboring Brazil's soybean sector.

More important to the rest of the world, the United States undertook longer term policy measures in 1973 to ensure that increases in U.S. production could offset the tight supply situation in the next year. These policy changes likely helped offset concerns about the availability of U.S. soybeans in the future. The embargo also caused the United States to establish a reporting system that signals supply shortages. The added information that system provides should make the market more stable.

THE 1974 AND 1975 GRAIN MORATORIA[4]

The United States restricted grain exports in 1974 and 1975. As in 1973, these actions were intended to calm the domestic market during periods of uncertainty about the adequacy of domestic supply. The 1974 and 1975 moratoria, unlike the general embargo of 1973, were targeted to particular destinations: The USSR in both years and Poland in 1975. The 1974 moratorium was tied to unfavorable weather and the resulting deteriorating crop prospects in the United States and other large grain trading countries. The poor grain crop in 1974/75 left the world and U.S. grain markets vulnerable to supply shocks in 1975/76. The 1975 moratorium was initiated to reduce the market effects of poor USSR grain production prospects.

The moratoria combined with several other developments to help calm cash and futures markets for grain. Weakening demand for feed in the United States and abroad, increased EC exports, and the U.S.-USSR long-term sales agreement also helped reduce speculative pressures on grain prices. These other factors actually had a larger effect on market prices than did the moratoria.

The effect on U.S. exports was negligible. Additional sales to other markets more than made up for reduced USSR sales. Quantities made available by the moratoria and the reduced prices induced other countries to buy more from the United States. Exports in 1974/75 were at levels expected prior to the 1974 moratorium, and exports in 1975/76 were at a record high.

The effect on U.S. farmers' cash receipts was minimal. Grain farmers' cash receipts were marginally lower as a result of the moratoria. Livestock producers and consumers, of course, benefited from lower feed and food costs. Even so, the effects of the moratoria were short-lived. Prices would have fallen even if the moratoria had not been imposed.

These moratoria were viewed by our trading partners as part of a set of positive initiatives

[4]Chapter 9 has a more thorough discussion of the 1974 and 1975 grain moratoria.

to stabilize world markets by stabilizing the U.S. domestic market. More important, these actions convinced the USSR and Poland, which had previously been notorious for adding instability to the market, to sign long-term grain agreements.

THE 1980 SOVIET EMBARGO[5]

The 1980 USSR grain embargo differed from the embargoes of the 1970's which were imposed to ensure available supplies and calm volatile price movements. The 1980 embargo was imposed in response to the USSR invasion of Afghanistan. It was designed to exert political pressure on the USSR, which had become increasingly dependent on agricultural imports from the United States. It was a targeted embargo, targeted at the USSR, and it was only a partial embargo by the United States. The USSR was still allowed to import the 8 million tons guaranteed under the long-term agreement. This embargo lasted significantly longer (15 months) and affected a wider range of products (grains, soybeans and products, meat, poultry, dairy products, animal fats, and agrichemicals) than the trade sanctions of the 1970's.

To increase effectiveness of the embargo, the United States sought cooperation from the private grain trade and competing exporters. All but two private grain trading firms agreed to stop shipping grain to the USSR in exchange for financial compensation. Australia, Canada, and the EC agreed to ship no more than "normal and traditional" amounts of grain to the USSR during the embargo. Argentina did not participate in the embargo.

Specific policy actions were taken to offset any negative effects on the U.S. farmer. These included Government purchasing of existing USSR sales contracts, increasing loan rates for wheat and corn, raising grain call and release prices in the farmer-owned reserve (FOR), and waiving first-year interest payments on grain entering the reserve, increasing reserve storage payments, Commodity Credit Corporation (CCC) direct purchases of grain, and extending the emergency loan program.

[5]Chapters 10-15 have a more thorough discussion of the 1980 USSR embargo.

Chapters 10-15 discussed the 1980 embargo in great detail. The analytical model assumptions, constraints, and results were reported in Chapters 10-13. Chapter 14 took a detailed look at the embargo from the Soviet perspective. Chapter 15 supplemented the quantitative modeling results with a qualitative assessment, based heavily on interviews, of how the principal participants in the world grain market reacted to the 1980 embargo. It focused on trade flows and adjustments and on country policy responses to the embargo.

No single model or analytical approach was adequate for analyzing the effect of this embargo. We therefore used all approaches and existing models that we felt were appropriate. To the extent that the conclusions from the different methodological approaches are consistent with each other, we are more confident with our conclusions.

The first, and simplest, approach considered was to look at USSR and world agricultural trade data to see if any discontinuities at the time of the embargo could be identified (Chapter 10). This proved to be difficult. As we have seen from the theoretical discussion, the nature of a targeted, partial embargo where other exporters only partially cooperated, precluded a large impact. In addition, other changes that could be confused with embargo effects were taking place in world markets. The trade data indicated that the major effect of the embargo was a spatial redistribution of trade flows. There seemed to be some substitution of wheat and other grains for corn by the USSR, as well as some substitution of meat imports for grain imports.

The first attempt to quantify the effect on the USSR was based on estimating simple time trends on data for the pre-embargo period. Forecast deviations from extrapolating these trends gives a gross indication of USSR adjustments. One caveat is important. These deviations from trend represent the effect of all factors, not just the embargo, that changed at the time of the embargo.

USSR wheat and coarse grain production has been below trend every year since the embargo, indicating that it did not increase production and reduce its dependence on world markets. Utilization has also been below trend, possibly

influenced by the embargo, but other factors appear more important. Even before the embargo, the USSR had begun to retrench its livestock sector and increase emphasis on forage feed for livestock.

Quarterly grain import data do not show any pronounced decline in Soviet grain imports. The Soviets did apparently change their quarterly pattern of wheat imports to take advantage of greater Argentine grain availabilities in the first quarter. Wheat, sorghum, and barley were substituted for corn at the time of the embargo. Since the embargo ended, wheat imports have continued to increase. No discernable deviation in oilseed imports was detected. Soviet oilseed meal imports rose sharply in 1980 and continued to rise through 1983. This may have been due in part to the embargo, but was also heavily influenced by an attempt to improve quality of livestock feed rations. In addition, meat and livestock product imports were substituted for grain imports.

Absence of major change in the USSR total grain balance sheet indicates the success of the USSR in shifting sources of supply. These adjustments were insufficient to prevent the time series analysis from detecting major fluctuations in quarterly wheat or corn prices.

A second attempt to look at the embargo trade effects involved developing a time series model to estimate unanticipated changes in trade flows (Chapter 10). Based on the descriptive evidence, this model assumed that the USSR could purchase all the grain it wanted from the world market and attempted to calculate the unanticipated changes in trade flows from one country to another. This approach distinguishes between a pattern of trade based on information from one time period with what actually occurred in a later time period. It does not isolate embargo effects only.

This time series method indicated that U.S. wheat exports to the USSR were 3.2 million tons below the predicted level while total Soviet wheat imports were 4.3 million tons greater than expected in 1980. Thus, the USSR had to obtain an additional 7.5 million tons of wheat from non-U.S. sources. These imports were fairly evenly distributed among other major exporters. These increased sales to the USSR did not increase other exporters' total exports. Australia apparently shifted exports from China. Argentina shifted exports from other importers. Canada, holding substantial stocks, was able to increase exports 1.4 million tons more than predicted even though it, too, shifted markets.

For the United States, this 3.2-million-ton loss in the USSR market corresponds closely to the total loss of U.S. wheat exports of 3.1 million tons. However, the United States also faced exports below expectations in all its major markets except China where there was an unanticipated increase of 4.5 million tons. Nonembargo forces were obviously significant that year, too.

This time series method also indicated that U.S. corn exports to the USSR were 7 million tons below expectations in 1980. However, total U.S. corn exports were 4.4 million tons more than expected. Major competitors appear to have been unable to take advantage of the embargo to expand their exports. Individual trade flows did shift significantly. U.S. exports shifted away from the USSR and to Mexico and other importers. Argentina and other exporters shifted away from their traditional markets to the USSR.

This time series analysis allows us to put an upper bound on the embargo's effects on U.S. trade. The effects would be represented by the additions to other countries' exports as a result of unanticipated increases in Soviet sales not offset by unanticipated declines in other markets. Calculations show that U.S. wheat exports could have declined by no more than 2.8 million tons in 1980. Subsequent year analysis indicates that U.S. wheat exports to the USSR improved but never recovered to the level predicted from the 1970's data. U.S. wheat exports still averaged about 1.6 million tons lower. U.S. corn exports could have declined by no more than 4.5 million tons in 1980. U.S. corn exports to the USSR also never recovered in subsequent years, averaging 1.2 million tons lower than predicted based on 1970's data.

The third approach to evaluating the effect of the 1980 embargo involved using a static annual spatial equilibrium world trade flow model to simulate embargo/no-embargo scenarios (Chapter 11). The spatial equilibrium model assumes that each commodity is

homogeneous and traded in perfectly competitive international markets. Trade flow patterns resulting from such a model minimize world transport costs as each importer buys from the cheapest source.

Three spatial equilibrium model alternative simulations are summarized in tables 16.1 to 16.3. The "no change in Soviet demand" alternative evaluated the effect of limiting the U.S.-USSR trade flow but allowing the USSR to replace as much of the embargoed grain as possible from other sources. Some have argued that the embargo prevented the USSR from timing deliveries to avoid port bottlenecks, thereby preventing them from replacing all embargoed grain. The "-3-million-ton USSR demand" scenario evaluated the case where the USSR was not able to replace 3 million tons of grain (a 3-million-ton reduction in Soviet demand). The "-11-million-ton USSR demand" assumed the USSR was not able to replace 11 million tons of grain. All three scenarios assumed that the USSR signed a bilateral accord with Argentina. These three scenarios bracket the various hypotheses in the literature. Analyses of the USSR market in this study indicated that if the Soviet import demand curve for grain did shift, it was not by a large amount. Therefore, the second scenario (the -3-million-ton shift) is considered the most realistic of the three scenarios and will be the one summarized here.

The embargo had very little effect on U.S. agricultural exports of wheat and coarse grain. The spatial equilibrium model results showed U.S. wheat exports under the embargo to be 0.559 million tons lower. U.S. wheat exports to the USSR were 5.946 million tons lower, but exports to China, Eastern Europe, and South America were larger. Canadian wheat exports were unchanged, and that country diverted exports from Eastern Europe to the USSR. Australia/New Zealand trade was unaffected. Argentina refused to cooperate with the U.S. embargo. While total exports were essentially unchanged, Argentina substantially rerouted wheat trade away from traditional markets to the USSR.

U.S. coarse grain exports declined by 1.4 million tons. U.S. coarse grain exports to the USSR were 5.244 million tons lower, but exports were diverted to South America and Eastern Europe. Canadian coarse grain

Table 16.1--Annual changes in U.S. exports due to 1980 USSR embargo

Model/scenario	Wheat		Coarse grain	
	Embargo period	Post-embargo 1/	Embargo period	Post-embargo 1/
	Million tons			
Spatial equilibrium model:				
No change in USSR demand	-0.194	--	-0.143	--
-3-million-ton USSR demand	-.559	--	-1.400	--
-11-million-ton USSR demand	-1.635	--	-4.714	--
Annual Armington model:				
No change in USSR demand	-1.031	--	-1.890	--
-3-million-ton USSR demand	-1.340	--	-2.890	--
-11-million-ton USSR demand	-2.372	--	-6.280	--
Time series analysis 2/	-2.780	-1.637	-4.460	-1.163
Quarterly Armington model 3/	-1.848	-4.169	4/-5.310	4/-7.230

-- = Not applicable.
1/ The models do not distinguish between embargo-related, long-term effects and other factors affecting the market during the post-embargo period.
2/ Computed by summing the lesser of either the unanticipated increase in total exports or the unanticipated increase in sales to the USSR for all competing exporters. It represents the addition to other countries' exporters as a result of unanticipated increases in USSR sales not offset by unanticipated declines in other markets.
3/ Annual averages.
4/ Corn.

exports were down slightly, and that country diverted exports from Eastern Europe to the USSR. Australia/New Zealand trade was unaffected. Argentine total coarse grain exports were essentially unchanged, but the embargo caused substantial rerouting of trade away from their traditional markets to the USSR.

The embargo's minor effect on total trade volume meant its effect on world grain prices was also minor. The spatial equilibrium model generated a 7.3-cents-per-bushel lower wheat price and a 4.8-cents-per-bushel lower coarse grain price in the United States. The USSR wheat price increased $1.27 per ton. The USSR coarse grain price was lower by $0.28

Table 16.2--Changes in U.S. trade price due to 1980 USSR embargo

Model/scenario	Wheat		Coarse grain	
	Embargo period	Post-embargo 1/	Embargo period	Post-embargo 1/
	Dollars per bushel			
Spatial equilibrium model:				
No change in USSR demand	-0.026	--	-0.005	--
-3-million-ton USSR demand	-.073	--	-.048	--
-11-million-ton USSR demand	-.215	--	-.158	--
Annual Armington model:				
No change in USSR demand	-.136	--	-.062	--
-3-million-ton USSR demand	-.177	--	-.097	--
-11-million-ton USSR demand	-.312	--	-.211	--
Time series analysis	0	0	0	0
Quarterly Armington model	-.098	-.232	2/-.084	2/-.119

-- = Not applicable.
1/ The models do not distinguish between embargo-related, long-term impacts and other factors affecting the market during the post-embargo period.
2/ Corn.

Table 16.3--Annual changes in U.S. trade value due to 1980 USSR embargo

Model/scenario	Wheat		Coarse grain		Total grain	
	Embargo period	Post-embargo 1/	Embargo period	Post-embargo 1/	Embargo period	Post-embargo 1/
	Million dollars					
Spatial equilibrium model:						
No change in USSR demand	-67.7	--	-30.6	--	-98.3	
-3-million-ton USSR demand	-195.6	--	-302.6	--	-498.2	
-11-million-ton USSR demand	-580.9	--	-1,039.8	--	-1,620.7	
Annual Armington model:						
No change in USSR demand	-360.8	--	-395.5	--	-756.3	
-3-million-ton USSR demand	-471.1	--	-624.8	--	-1,096.0	
-11-million-ton USSR demand	-845.3	--	-1,386.3	--	-2,231.6	
Time series analysis	--	--	--	--	--	--
Quarterly Armington model 2/	-457	-1,076	3/-886	3/-1,184	-1,343	-2,260

-- = Not applicable.
1/ The models do not distinguish between embargo-related, long-term impacts and other factors affecting the market during the post-embargo period.
2/ Annual averages.
3/ Corn.

per ton because world import demand was lower. With the exception of Argentina, the reduced USSR demand lowered prices received by other exporters. Argentina was able to charge an added $5.69 per ton for wheat and $0.54 per ton for coarse grain.

These price and trade level changes can be translated into changes in trade value. The embargo led to a $498.2-million loss in U.S. grain exports (a $195.6-million loss in U.S. wheat exports plus a $302.6-million loss in U.S. coarse grain exports). This is only 3.4 percent of grain trade value in 1980.

The fourth approach to evaluating the effect of the 1980 embargo involved a price discrimination variant of the static spatial equilibrium trade flow model (Chapter 11). Argentina was rumored to have charged the USSR a price premium for grain as a result of the embargo. The spatial equilibrium model showed an increase in Argentine prices in most scenarios. The Argentine price increased because the Argentina-USSR bilateral agreement forced grain to be shipped on a route where Argentina had a locational and cost disadvantage. When Argentina was allowed to price discriminate, simulation results suggested that little market power existed to exploit, especially in the wheat market. Any gain Argentina got from the U.S. embargo lay in the signing of the bilateral agreement which allowed it entry into a new market.

The fifth approach evaluating the effect of the 1980 embargo involved using an annual static Armington world trade flow model to simulate embargo/no-embargo scenarios (Chapter 11). The Armington model assumes that commodities exported by different countries are imperfect substitutes from the buyer's viewpoint.

Three Armington model alternative simulations are also summarized in tables 16.1 to 16.3. The Armington model scenario assumptions are identical to those of the spatial equilibrium model. Again, only the 3-million-ton reduction in USSR grain demand scenario is summarized here.

As expected, introducing the assumption of imperfect substitution increased both the number of equilibrium trade flows and reduced the magnitude of any trade adjustments, since only partial adjustment in trade flow patterns to any trade shock would take place. While the magnitudes were larger, the changes in U.S. trade and prices in the Armington model and the spatial equilibrium model were similar. The spatial equilibrium model generally showed a few large changes in the regional trade pattern while the Armington model generally showed more and smaller changes in the regional trade pattern.

The Armington model results showed U.S. wheat exports under the embargo to be 1.34 million tons lower. U.S. wheat exports to the USSR were 6.131 million tons lower. U.S. exports were diverted to China, South America, and Eastern Europe, but to a smaller degree than in the spatial equilibrium model. Wheat was also diverted to several other markets. Canada and Australia/New Zealand exports were reduced by 0.203 and 0.115 million tons, and they both diverted exports from other markets to the USSR. Australia/New Zealand, unlike the spatial equilibrium model simulation, diverted wheat to the USSR market. Argentina-USSR trade expanded less in the Armington model simulations than in the spatial market simulations.

U.S. coarse grain exports declined by 2.89 million tons. U.S. coarse grain exports to the USSR were 5.96 million tons lower, but exports were diverted to Japan and other markets. Canadian exports were up 0.586 million tons, and they diverted exports from other markets to the USSR. Australia/New Zealand trade was unaffected. Argentine total coarse grain exports were essentially unchanged but the embargo caused substantial rerouting of trade away from markets in Japan, Asia, and the Middle East to the USSR. Argentina increased total coarse grain exports by 0.512 million tons and increased its exports to the USSR by 0.759 million tons.

As with the spatial equilibrium simulations, coarse grain prices fell slightly less than wheat prices. The Armington model generated a 17.7-cents-per-bushel lower wheat price and a 9.7-cents-per-bushel lower coarse grain price in the United States. USSR wheat and coarse grain prices increased $3.29 and $2.55 per ton. Introducing imperfect substitutability allowed major competitors to increase prices more than if commodities were perfect substitutes.

Because both price and U.S. trade level changes were greater for the Armington model than for the spatial equilibrium model, trade value changes were also greater. The embargo led to a $1,096-million loss in U.S. grain exports (a $471.1-million loss in wheat exports plus a $624.8-million loss in coarse grain exports). Even this is only 7.7 percent of grain trade value in 1980.

The sixth approach to evaluating the effect of the 1980 embargo involved using a quarterly dynamic Armington world trade flow model to evaluate whether the embargo changed import demand behavior and to simulate embargo/no-embargo scenarios (Chapter 12).

Since the quarterly Armington model was econometrically estimated, estimated import demand equations can be tested to see if structural change occurred between the pre- and post-embargo periods. Results indicate the world wheat import demand became more price responsive after the embargo. After the embargo, USSR wheat and corn import demand became more responsive to price and production changes. The increase in price responsiveness may have been partly due to the embargo, but declines in petroleum and gold prices, two major USSR foreign exchange earners, were equally if not more important. This analysis also confirmed the earlier observed change (Chapter 10) in the seasonal pattern of USSR wheat and corn imports. Results also confirmed earlier time series, spatial equilibrium, and annual Armington model results (Chapters 10 and 11) showing change in exporter shares of the USSR grain market. The United States lost USSR market share in both wheat (from 13 to 3 percent) and corn (from 69 to 14 percent). The quarterly Armington model indicates that Canada, in particular, increased market share of the USSR wheat market.

A comparison of the quarterly Armington model embargo/no-embargo simulations indicates that world wheat exports fell by 3 percent during the embargo but recovered afterwards. U.S. wheat export losses of 1.848 million tons were minimized because of partially offsetting increased exports to other countries. The model shows U.S. wheat export losses to be larger after the embargo than during the embargo, but that loss is more likely due to the combination of a strong dollar, a world recession, and increased competition from Argentina and the EC in the face of high U.S. support prices than it is to the continuing effects of the embargo.

The quarterly Armington model indicated that world corn exports did not change during the embargo and dropped only 2 percent after the embargo. This post-embargo decline can probably best be explained by the 1982-83 world economic recession. U.S. corn exports were 5.31 million tons lower per year during the embargo and 7.23 million tons lower per year during the post-embargo period. The larger losses after the embargo probably are attributed to total market shrinkage. The model indicates that the United States lost the USSR market permanently to Argentina.

Wheat prices did not change appreciably between the quarterly Armington model simulations. The U.S. wheat price fell by 9.8 cents per bushel during the embargo. The large drop in demand dropped the model's wheat prices 23.2 cents per bushel after the embargo. U.S. corn prices fell by 8.4 cents per bushel during the embargo and 11.9 cents after (again because of the drop in demand).

Summary results of various quantitative approaches to analyzing the 1980 embargo effects on U.S. agricultural trade appear in tables 16.1 to 16.3. They give a range of possible embargo effects under differing assumptions.

Estimates of U.S. wheat export losses from the embargo ranged from 0.6 to 2.8 million tons. This represents a 1.7- to 7.8-percent loss in wheat exports. Estimates of U.S. coarse grain export losses due to the embargo ranged from 1.4-5.3 million tons, or a loss of 2.2-8.4 percent.

Wheat and coarse grain price changes from the embargo were relatively insignificant. Wheat prices fell by only 7-18 cents per bushel. Coarse grain prices declined by 5-10 cents per bushel.

The embargo reduced value of U.S. wheat exports $195.6 million to $471.7 million. Value of U.S. coarse grain exports declined $302.6 million to $886 million. Total grain

trade loss estimates ranged from $498.2 million to $1,343 million.

The seventh approach evaluating effects of the 1980 embargo used the above-generated trade results in a detailed U.S. agricultural sector model to translate trade effects back to their effect on U.S. farmers (Chapter 13). There are two sets of embargo-induced changes affecting U.S. farm prices and incomes: Effect of the embargo on U.S. exports and the U.S. commodity policy changes implemented in the wake of the embargo to compensate U.S. farmers for anticipated export losses. These changes included an increase in Commodity Credit Corporation (CCC) and FOR loan rates for wheat and feed grains; increased FOR release prices, call prices, and storage payments for these grains; and CCC purchases of wheat and corn to increase farm prices. U.S. export shocks used to drive the U.S. agricultural sector model are taken from the spatial equilibrium model. Table 16.4 summarizes effects on U.S. agriculture of the same three scenarios already discussed. Most likely of these three scenarios is the "-3-million-ton Soviet demand" scenario.

Under this scenario, the 1979-84 average farm price of wheat increased by $0.12 per bushel, and the average farm price of corn increased by $0.03 per bushel due to the embargo. Model results show an increase in farm income of $600 million instead of a loss. This appears to be inconsistent. But, this scenario's results are based on two assumptions: That the embargo occurred and that the Government made policy changes designed to compensate farmers for any possible losses. These results indicate that positive effects of the compensating policy changes more than offset negative effects of the embargo itself (see Chapter 13). Changes in domestic farm programs put upward pressure on prices. The CCC expanded its demand for grain by purchasing and isolating 154.8 million bushels of wheat and 159.5 million bushels of corn from the market. The wheat release price in the FOR was raised and loan rates for both wheat and corn were raised.[6]

Under all scenarios examined, net farm income in 1979-84 was higher with the embargo than without. However, the maximum cumulative increase in income for this 6-year period was only $2.2 billion. This represented only a 1.4-percent increase over the $155.1-billion cumulative net farm income over the same period in the absence of the embargo.

[6]For the embargo trade effects alone (excluding effects due to the related policy adjustments) scenario, the only significant price effect was a 1.6-percent decline in corn price. Farm price of wheat was at the FOR release price and therefore did not change.

Table 16.4--Changes in U.S. farm prices, net farm income, and farm program costs due to the 1980 USSR embargo

Variable	No change in USSR demand	-3-million-ton USSR demand change	-11-million-ton USSR demand change
		Dollars per bushel	
Wheat average farm price change	0.12	0.12	0.09
Corn average farm price change	.03	.03	.01
		Million dollars	
Net farm income change:			
1979	600	600	500
1979-84 cumulative	1,900	1,600	200
Farm program cost change: 1/			
1979	-12.2	23.3	144.9
1979-84 cumulative	-700.9	-530.5	-250.9

1/ Change in deficiency payments plus change in FOR storage payments plus change in dairy payments.

The U.S. agricultural sector model results show that farm program costs rose by $23.3 million in 1979/80 because of the embargo and related policy changes. This figure is the sum of the $58.9-million saving in deficiency payments and the $82.2-million increase in FOR storage payments (see Chapter 13).

Despite the immediate cost of the embargo, cost of direct payments operations in the longer term was reduced. The increase in loan rates lowered the amount of deficiency payments paid to farmers. Higher feed costs reduced dairy production and dairy price support operation costs. Although storage costs increased as result of the changes made in the reserve program, net effect from the above changes was savings to the Government of about $530.5 million during 1979-84.

Up to this point, the embargo analysis has relied heavily on the use of models and quantitative techniques. The final approach to the problem looked at the U.S. and foreign country political and policy responses that the embargo generated (Chapters 14 and 15). We used several methods to gather information, but primarily relied on literature reviews and interviews with persons directly involved in or affected by the embargo in the United States, Japan, the EC, Argentina, Brazil, and Canada.

With respect to USSR behavior, some delays occurred while grain purchases and shipments were rearranged. Stock drawdowns and increased meat imports covered most of the effect of delayed or denied grain imports. There was no evidence that long-term meat output suffered from the embargo. The embargo also had little longrun effect on Soviet willingness to rely on international grain markets. The USSR did diversify its import sources and relied less on the United States. The fact that it could diversify probably assuaged any fears that the Soviets may have had of vulnerability in international markets. It is unclear whether the loss in U.S. market share over the longer run was due to the embargo or to changed competitive conditions and the general reversal of detente between the two countries.

We could find no exporting country where the embargo caused decisions to encourage production or expand exports. Argentina was able to profit from the embargo in the short run, but it pursued longer run policies that have discouraged exports. Australia, Canada, and the EC increased production and exports but primarily in response to U.S. policies unrelated to the embargo.

The embargo shifted global trading patterns, but did not cause significant change in international market prices. It may have accelerated changes in exporters' production that were likely anyway. The EC, Canada, and Australia already had policy changes underway which encouraged increased exports.

The 1980 USSR grain embargo demonstrates that while political embargoes may or may not meet political objectives, they seldom achieve their economic objectives. Economic incentives to undercut a targeted embargo are strong. The United States was unable to form an after-the-fact cartel with other grain exporters to deny the USSR needed grain. Price, not politics, determines who produces what and how much as well as who gets it.

The analysis in Part II indicates that these embargoes did not cause the agricultural crisis of the 1980's. All analyses undertaken in Part II assumed actual macroeconomic conditions for the period of analysis. As identified in Chapter 5, a significant change in macroeconomic conditions also occurred during the early 1980's. An alternative hypothesis that these changing macroeconomic conditions had a significant negative impact on U.S. agriculture is tested in Part IV. However, before looking at this alternative hypothesis, we turn to Part III where we examine whether export subsidies for surplus disposal would have prevented the farm crisis of the 1980's.

PART III

SURPLUS DISPOSAL AND EXPORT SUBSIDIES

Part III examines adjustments in U.S. commodity surplus management practices for wheat, coarse grains, and dairy. We focus on export disposal as a way to reduce stocks. Stock levels are important because of their relationship to market price behavior which in turn relates to farm income prospects.

The nonrecourse commodity loans for grains and the established support price for milk effectively support market prices by isolating existing supplies from market channels. These excess supplies become stocks that are owned or controlled by the Commodity Credit Corporation (CCC). With large stock levels, a change in demand or a production shortfall will have little effect on the market price. When stock levels are small, the same changes in demand or production can have a large effect on price as the market functions to allocate available supplies among competing buyers. Expanding stock levels can become a costly surplus rather than a prudent buffer against future shortages.

Stocks can expand to a surplus point for several reasons. Favorable weather can put production above trend. Demand for a commodity may drop unexpectedly from what it was when production was planned. Price support levels that keep prices above what they would be without supports may encourage producers to plan to produce more than what the market will absorb.

U.S. programs to encourage additional use of surplus stocks range from giveaways under domestic and foreign donation programs to credit guarantee programs that reduce the risk of commercial transactions. Despite these programs, stocks expanded to surplus levels at various times in recent years. Once stocks reach surplus levels, price depressing effects of large seasonal supplies are carried over to subsequent seasons.

The U.S. reluctance or inability to dispose of surplus stocks before the next production period has resulted in stocks increasing to the point that land-idling programs have been used to reduce production enough to lower stock levels. The inability to dispose of surplus stocks in export markets stems from several factors, including the adherence of the United States to a free trade philosophy and the additionality issue; that is, whether subsidized use "adds" to total demand or simply substitutes for commercial flows.

Part III discusses the U.S. alternative of disposing of annual production so that ending stocks do not reach surplus levels. This would allow each subsequent production period to be unencumbered by surplus stocks from prior production periods. This philosophy could be implemented by disposing of excess stocks primarily in foreign markets and possibly in domestic markets, too. We do not consider stock disposal in the domestic market because the potential is not large relative to the amount of surplus commodities.

Export enhancement programs generally fall under one of the three categories:

- Applying a general subsidy payment (either in cash or in-kind) to foreign sales to lower the cost to foreign buyers. Foreign consumers benefit, but foreign producers in exporting countries and producers in importing countries suffer from lower prices in the short run.

- Targeting buyers for assistance based on identified need or to offset subsidies that other sellers might offer. Targeted assistance can include a subsidy payment, credit terms, acceptance of local currency, or donation.

- Promoting market access by negotiating trade agreements, by advertising or providing technical support, or by providing monetary and technical aid to build infrastructure related to receiving, processing, and distributing commodities or processed products.

We decided not to consider additional food aid donations under P.L. 480 as an alternative for additional disposal. The number of recipients with unmet food needs is limited as is their ability to receive and distribute food aid. Further, the actual amounts that would be absorbed by eligible countries is subject to differences of interpretation and opinion. We assumed that donation levels would be held at prior and present levels and that disposal of U.S. surplus stocks would focus on sales transactions.

We focused on two possibilities for exporting surplus stocks. The first, a general export subsidy, provides a direct program to maximize the quantity exported. The second, targeted export assistance, is evaluated under two alternatives. One alternative is to maximize farm income (which will not necessarily dispose of all surplus stocks), and the other is to make income as high as possible while disposing of all excess stocks.

Although we could have considered other forms of subsidies given the range of options open to the Government, the options break down to two general conditions of disposal. The commodities are either given away or actions are taken to make them cheaper to buy. General and targeted subsidies indicate how much cheaper the commodity would have to be in order to induce additional exports.

To us, the important considerations were the cost of moving the surplus into the commercial export market and evaluating the resulting effects on the domestic agricultural sector. Other subsidy methods would result in similar costs and similar effects given the defined amounts targeted for disposal. Domestic intervention involves differentiating border prices from domestic prices. The same concept can be accomplished in several ways.

A precise demarcation of the level at which stocks become surplus was unnecessary to examine a policy to dispose of surplus stocks in the export market. As a working guideline, we considered stocks owned by the CCC and stocks held in the farmer-owned reserve (FOR) as surplus stocks. This

concept of surplus stocks is consistent with a nonrecourse loan program that operates as a market stabilizing policy instrument. This would leave stockholding in private hands and allow market prospects to determine stock levels. CCC inventories and FOR accumulations are stocks that the trade and producers choose not to hold in anticipation of near-term marketing opportunities.

We imposed a limitation in the empirical analysis. Stocks were not disposed of in the export market if, after applying the subsidy, the implied U.S. farm price received for an additional unit of commodity in the export market was below the cost of variable inputs (including labor). No economic rationale exists for producing a commodity if its value is less than cost of production. We applied this limitation to commercial transactions but not to humanitarian aid.

CHAPTER 17

U.S. GOVERNMENT COMMODITIES STOCKS DISPOSAL

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CHAPTER 17

U.S. GOVERNMENT COMMODITIES STOCKS DISPOSAL*

The congressional mandate calling for this study indicates there has been a failure on the part of the Federal Government to offer surplus commodities for sale on world markets. This chapter summarizes authorities and programs available to the U.S. Government and their use in recent years. The historical information provides background for considering ways in which to carry out more aggressive export disposal programs.

Private, profit-oriented merchandisers, made up of large multinational firms and smaller domestic firms, handle the bulk of export commodity transactions. Government authorities and programs are not intended to displace current or future commercial transactions. Rather, they aim to expand exports by attracting additional import customers or by making it possible for current customers to buy or receive larger quantities.

The Commodity Credit Corporation (CCC) carries out Government-authorized commodity transferrals. It carries out most Government authorities by making benefits available in such a way that private-sector firms can make transactions that otherwise would not be made. In the case of barter, donations, or other humanitarian aid, recipients are likely to arrange transactions with Government officials; otherwise, transactions are arranged with officials of private firms.

The CCC is a wholly owned Government corporation created to stabilize, support, and protect farm income and prices; to assist in maintaining balanced and adequate supplies of agricultural commodities and their products; and to facilitate the orderly distribution of commodities. Executive Order No. 6340 created the CCC as a separate agency on October 16, 1933. The Commodity Credit Corporation Charter Act, passed in 1948, and subsequent amendments, passed in 1949, made the CCC part of the U.S. Department of Agriculture (USDA) and placed its operations under the supervision and direction of the Secretary of Agriculture. P.L. 480 (Agricultural Trade Development and Assistance Act of 1954) programs and other export authorities pertaining to agriculture are administered through the same structure as the CCC. Congress has directed the CCC to use (to the maximum extent practicable and consistent with its purposes and conduct of business) the customary channels, facilities, and arrangements of trade and commerce in carrying on purchasing, selling, warehousing, transporting, processing, and handling operations.

The CCC assumes ownership as a result of price support activities, principally through the nonrecourse loan provisions. Producer default on nonrecourse loans for price supported commodities typically triggers CCC ownership, and the commodity is transferred to the CCC. Producer loan default is an option when the per-unit level of the price support loan which the CCC has extended is higher than prevailing market prices or export market prices. In this situation, producers default on their loans and the CCC assumes ownership of commodities. Producers keep the loan proceeds, and the interest due on the loan is waived. The CCC then holds the commodities in inventories until market prices rise enough to allow the CCC to sell or dispose of it under other options.

CCC INVENTORY DISPOSAL

Once the CCC acquires inventories, it has five possible ways in which to dispose of them. Inventories can be drawn down through sales, Section 5 arrangements, donations in the United States and abroad, barter for specific foreign goods, and transfer to other Government agencies.

Sales

Section 407 of the Agricultural Act of 1949 allows the CCC to sell any farm commodity owned or controlled by it, subject to the following restriction:

*Contributors to this chapter were Rosanna Mentzer Morrison and Milton H. Ericksen.

- A basic agricultural commodity or a storable nonbasic commodity cannot be sold unless it brings a price at least 5 percent above prevailing support price plus reasonable carrying charges. CCC dairy stocks may be resold on the domestic market at 110 percent of the purchase price or the market price, whichever is higher.

Subsequent legislation has modified the basic restriction for sales of grain in the following ways:

- As a result of the 1973 Agricultural and Consumer Protection Act, the minimum domestic sales price of CCC-owned grain for the 1974-77 crops was set at 115 percent of the current national average loan rate plus carrying charges.

- As a result of the Food and Agricultural Act of 1977, the percentage restriction for grain was set at 150 percent of the loan rate. This change was a result of introducing the farmer-owned reserve (FOR) to the 1977 Act. In the event of a strong market that would push prices above the reserve release, the higher CCC resale minimum would keep CCC inventories off the market until farmers had a chance to sell grain which they had held under the FOR.

These restrictions do not apply to sales of certain commodities (such as peanut oil, oilseed oil, wood, and deteriorated commodities in danger of spoilage, or for seed or feed if such sales will not substantially impair the price support programs); to sales for certain uses (such as for export, for new or byproduct uses of the commodity, or for uses other than the commodity's primary one); or to instances involving establishment of claims for wrongful acts.

Section 1001 of the Agriculture and Food Act of 1981, which amended Section 110 of the Agriculture Act of 1949, stipulated that the CCC could not sell any of its wheat or feed grain stocks at less than 110 percent of the FOR release price and that export market sales were not exempt from this sales price restriction. The Continuing Appropriations Act for fiscal year 1984 provided that in order to restore the U.S. share of world markets and to restore capital to the CCC, the Secretary of Agriculture can waive the Section 1001 sales restrictions to allow sales for export.

Except during 1982-84, the CCC has apparently had the authority to accept whatever price was offered by a buyer purchasing for export sales. The CCC can also sell its feed stocks at reduced prices to individuals in disaster areas. The CCC, however, must receive more than 75 percent of the county loan rate.

Section 5 of the CCC Charter Act

Section 5 of the Commodity Credit Corporation Charter Act of 1948 includes a broad authorization for CCC to export, cause to be exported, or aid in developing foreign markets for U.S. agricultural commodities. For example, in 1983 the CCC donated wheat from CCC stocks to flour millers who in turn sold wheat flour to Egypt at reduced prices. In the same year, CCC stocks of butter and cheese were sold to Egypt at world market prices. These sales were negotiated under Section 5.

The 1983 payment in kind (PIK) acreage reduction operated under Section 5 authority.

The Export Enhancement Program (EEP), begun in June 1985, was also instituted under Section 5 authorities. Exporters are reimbursed with CCC-owned commodities to make up the difference between the U.S. and world price. Section 1127 of the Food Security Act of 1985 now mandates a similar program under which commodities acquired by the CCC would be provided to U.S. exporters, users, processors, and foreign purchasers. The 1985 Act mandate ends on September 30, 1990.

Donations

Under numerous circumstances, the CCC can make its stocks available to needy individuals and institutions either at minimal cost for processing, packaging, and handling, or as an outright donation. Stocks are made available for disaster relief and other domestic programs. Other legislation stipulates that the Secretary can use CCC facilities and services to carry out efforts such as the National School Lunch Program and the Section 32 program.

The United States, through the CCC, is also authorized to donate publicly held stocks to

foreign recipients. P.L. 480 is the primary authority under which the United States provides commodity aid to foreign countries. The CCC acts as the operating agency for administering all P.L. 480 authorizations and distributing donations of CCC stocks.

Title II, P.L. 480, provides food donations directly to recipient governments. Donations can also be carried out through the United Nations World Food Program and private relief agencies like Catholic Relief Services and CARE. Section 401, P.L. 480, states that no commodity can be donated if its domestic supply would be reduced below the level needed to meet domestic requirements, adequate carryover, and anticipated commercial export sales. Later legislation stipulated that a portion of existing supply could be used if the Secretary of Agriculture deemed it met urgent humanitarian needs. No agricultural commodity may be financed or donated unless the recipient country has adequate storage capabilities. Donated commodities are prohibited from displacing commercial sales or causing production or marketing disincentives in the recipient country.

Legislation passed in 1977 established minimum quantities of food aid to be provided under Title II. It also designated how much of the minimum should be distributed through nonprofit voluntary agencies and the World Food Program. The 1977 minimum was set at 1.6 million tons. Since 1982, the minimum has remained at 1.7 million tons. Nonprofit voluntary agencies and the World Food Program can currently distribute 70 percent of the minimum. The President may grant an exception to the minimum if he determines that such a quantity could not be used effectively. Provisions also state that minimum quantities are not to exceed the quantities available for disposal, with famine and urgent relief getting priority.

Before 1977, legislators capped annual funding at $600 million. The spending ceiling rose to $750 million in 1977 and to $1 billion in 1981.

To prevent waste of stored U.S. commodities, Section 416 of the Agricultural Act of 1949 provided for the CCC to donate commodities to foreign nations. The Food for Peace Act of 1966 deleted the foreign donations from Section 416. However, the Omnibus Budget Reconciliation Act of 1982 amended Section 416 to allow dairy products to be donated to needy persons outside the United States. Donations of dairy products under Section 416 are to be coordinated with P.L. 480 but can be treated as an addition to assistance programmed under P.L. 480.

Section 502 of the Agricultural Programs Adjustment Act of 1984 added two subsections to Section 416. The first subsection stipulated that CCC surplus dairy products and wheat may be furnished to the Secretary of Agriculture for carrying out Title II of P.L. 480. Also, agreements can be made to provide these commodities in installments over an extended period. Dairy products and wheat may also be sold or bartered if:

- The sales and barter are incidental to the donations;
- The proceeds are used to finance distributing, handling, and processing of the donated commodities in the importing country; or
- The sales and barter are made to intergovernmental organizations that normally distribute food.

Costs of dairy products and wheat are in excess of P.L. 480 funding and are not to be considered as international affairs and finance expenditures. Wheat and dairy products exported in this way are not to compete with quantities traditionally reserved for domestic feeding programs or agencies.

The second subsection set up a 2-year pilot program under which the CCC was to exchange surplus dairy products for 20,000 tons of ultra high temperature (UHT) milk each year. Under the pilot, UHT milk was to be available for donation to needy persons outside the United States through foreign governments and public and nonprofit humanitarian organizations. The law mandates that UHT milk donations be coordinated with P.L. 480 activities, but be earmarked as an addition to the P.L. 480 programmed assistance level.

The Food and Agricultural Act of 1977 amended the Agricultural Act of 1949 by adding a section encouraging the President to

establish and maintain a U.S. food reserve as part of an international emergency food reserve to be tapped during foreign food emergencies.

The Food Security Wheat Reserve Act of 1980 (P.L. 96-494) directs the President to establish a temporary reserve stock of up to 4 million tons of wheat. Initially, it is to be built up from CCC-owned wheat. This reserve is earmarked for emergency humanitarian needs in developing countries. It may be replenished from CCC-owned wheat or through purchases from producers. Funds for buying wheat from producers must be authorized by appropriation acts. By law, the reserve will not be replenished after September 30, 1985. The President can release wheat from the reserve on a donation or sale basis whenever domestic wheat supply is so limited that stocks cannot be made available under P.L. 480. However, up to 300,000 tons may be released regardless of the domestic situation if the President determines that the recipient country has suffered a major disaster. Wheat released from the reserve can be used for carrying out P.L. 480.

Barter Programs

The CCC Charter Act of 1948 allows the Secretary of Agriculture to accept strategic and critical materials produced abroad in exchange for CCC stocks. Materials thus acquired by the CCC are transferred to the national stockpile under approval of the Munition Board of the National Military Establishment and, since 1979, under approval of the President.

These powers were further defined in Section 310 of the Agricultural Trade Development and Assistance Act of 1954 to include bartering for strategic materials that the United States does not produce in large enough amounts or which cannot be easily or inexpensively stored; for materials, goods, or equipment required for foreign economic and military aid; for materials or equipment needed in large quantities for offshore construction programs; or to meet requirements of U.S. Government agencies.

The CCC is allowed to barter with any country of the free world. However, the Secretary of Agriculture must assure that barters or exchanges will not unduly disrupt world prices of agricultural commodities or replace commercial sales. Barter of agricultural commodities is limited to exchange for materials originating in the country to which the surplus agricultural commodities are exported and under arrangements preventing resale of the U.S. barter commodities to other countries.

In November 1981, President Reagan directed the Federal Emergency Management Agency to procure Jamaican bauxite, raw material for aluminum. The CCC signed an agreement with Jamaica to exchange CCC dairy products for bauxite. In 1982-85, 33,000 tons of CCC nonfat dry milk, anhydrous milkfat, and butter oil were traded. The previous barter agreement, signed in 1967, involved exchanging cotton, tobacco, and other commodities owned by the CCC for Australian rutile, used to coat welding rods. Between 1950 and 1967, about 60 strategic materials from more than 50 countries were added to Federal stockpiles as a result of USDA barter activity.

Transfers to Government Agencies

The CCC can dispose of surplus commodities by transferring or selling them to other Government agencies who use them domestically or at U.S. installations abroad. For instance, during the late 1970's to early 1980's, the CCC sold commodities to USDA's Food and Nutrition Service. It also sold commodities to the Defense Department for U.S. military bases.

HISTORICAL EXPERIENCE

Tables 17.1-17.5 summarize how CCC inventories were disposed of during the past 16 years, displaying total dispositions and percentages of the total for the various disposition categories. CCC inventories include surplus commodities in storage, commodities the CCC acquired from price support loans that it owns solely "on paper," and commodities purchased to fulfill a donation objective. The categories are defined as:

Domestic sales. Commercial sales of CCC inventories in the United States.

Foreign sales. Commercial sales of CCC inventories to other countries. These could

Table 17.1--Disposition of CCC feed grain inventories 1/

Fiscal year	Sales 2/		PIK payments	Barter	P.L. 480, Title II	Donations		Tranfers		Total
	Domestic	Foreign				Domestic	Foreign	Domestic	Foreign	
	Percent									*1,000 tons 3/*
1970	41.6	38.0	13.8	0	4.3	2.3	0	0.1	0	2,997.49
1971	18.9	14.5	62.0	0	3.6	.9	0	0	0	8,430.74
1972	33.9	42.5	10.8	0	8.5	4.2	0	.1	0	2,628.07
1973	92.7	1.0	0	0	4.6	1.6	0	0	0	5,328.53
1974	84.2	0	0	0	14.3	1.4	0	.1	0	3,658.04
1975	70.6	0	0	0	25.0	4.2	0	.1	0	954.08
1976 4/	64.9	0	0	0	34.9	.1	0	.1	0	691.14
1977	33.9	0	0	0	63.4	2.4	0	.3	0	249.52
1978	.8	0	0	0	95.2	3.7	0	.3	0	288.19
1979	11.5	0	0	0	82.7	5.6	0	.2	0	255.41
1980	9.5	0	0	0	88.8	1.5	0	.2	0	365.64
1981	44.3	0	0	0	49.3	5.8	0	.7	0	801.76
1982	47.7	0	0	0	50.5	1.3	0	.5	0	398.46
1983	37.7	0	0	0	59.4	2.7	0	.1	0	385.03
1984	3.4	1.6	92.8	0	1.7	.5	0	0	0	25,284.26
1985	8.6	6.9	53.5	0	28.4	2.7	0	0	0	4,579.75

1/ Table does not include inventory adjustments and recoveries.
2/ Could include P.L. 480, Title I and Title III sales.
3/ Converted to metric tons based on conversion factors in table 1 of *Conversion Factors and Weights and Measures*, SB-616, U.S. Dept. Agr., Mar. 1979.
4/ Fiscal year 1976 includes the transition quarter of July 1 to September 30, 1976.

Source: (2).

Table 17.2--Disposition of CCC wheat inventories 1/

Fiscal year	Sales 2/		PIK payments	Barter	P.L. 480, Title II	Donations		Tranfers		Total
	Domestic	Foreign				Domestic	Foreign	Domestic	Foreign	
	Percent									*1,000 tons 3/*
1970	16.9	29.3	0	0	28.4	25.4	0	0	0	886.43
1971	44.7	25.9	0	0	20.2	9.2	0	0	0	2,714.91
1972	4.7	21.8	0	0	63.9	9.6	0	0	0	2,412.66
1973	73.0	5.6	0	0	18.5	2.9	0	0	0	7,875.71
1974	78.2	.5	0	0	16.2	5.1	0	0	0	4,069.16
1975	32.6	0	0	0	66.2	1.1	0	.1	0	994.71
1976 4/	1.3	0	0	0	91.0	7.5	0	.1	0	639.92
1977	.1	0	0	0	98.8	1.1	0	0	0	946.07
1978	.6	0	0	0	95.9	3.5	0	0	0	924.76
1979	.3	0	0	0	99.0	.7	0	0	0	1,029.51
1980	1.2	0	0	0	90.2	8.6	0	0	0	588.02
1981	.7	0	0	0	96.7	2.6	0	0	0	1,058.29
1982	2.2	0	0	0	92.9	4.9	0	0	0	709.47
1983	30.6	0	0	0	67.3	2.1	0	0	0	1,839.47
1984	1.6	11.1	75.4	0	11.1	.9	0	0	0	5,428.54
1985	17.1	13.4	16.2	0	49.4	4.0	0	0	0	2,718.23

1/ Table does not include inventory adjustments and recoveries.
2/ Could include P.L. 480, Title I and Title III sales.
3/ Converted to metric tons based on conversion factors in table 1 of *Conversion Factors and Weights and Measures*, SB-616, U.S. Dept. Agr., Mar. 1979
4/ Fiscal year 1976 includes the transition quarter of July 1 to September 30, 1976.

Source: (2).

Table 17.3--Disposition of CCC rice inventories 1/

Fiscal year	Sales 2/		PIK payments	Barter	P.L. 480, Title II	Donations		Tranfers		Total
	Domestic	Foreign				Domestic	Foreign	Domestic	Foreign	
	Percent									*1,000 tons 3/*
1970	6.3	35.7	0	0	0	58.0	0	0	0	85.821
1971	1.1	31.6	0	0	0	67.3	0	0	0	81.656
1972	.7	19.4	0	0	66.6	13.4	0	0	0	372.363
1973	26.6	15.9	0	0	22.1	35.4	0	0	0	149.042
1974	0	0	0	0	0	100.0	0	0	0	35.358
1975	.3	0	0	0	41.3	58.3	0	0	0	13.613
1976 4/	.4	0	0	0	0	99.6	0	0	0	12.428
1977	1.5	0	0	0	56.6	9.8	0	32.1	0	43.953
1978	76.2	0	0	0	19.2	1.1	0	3.5	0	337.298
1979	10.6	0	0	0	71.7	4.4	0	13.3	0	105.325
1980	38.9	0	0	0	53.4	2.2	0	5.6	0	253.594
1981	8.9	0	0	0	53.1	9.6	0	28.4	0	219.750
1982	0	0	0	0	91.6	4.3	0	4.1	0	80.556
1983	.3	0	0	0	68.1	23.1	0	8.6	0	39.366
1984	2.3	6.6	73.5	0	16.0	1.6	0	0	0	1,001.588
1985	1.9	40.9	31.5	0	19.0	6.7	0	0	0	782.695

1/ Table does not include inventory adjustments and recoveries.
2/ Could include P.L. 480, Title I and Title III sales.
3/ Converted to metric tons based on conversion factors in table 1 of *Conversion Factors and Weights and Measures*, SB-616, U.S. Dept. Agr., Mar. 1979.
4/ Fiscal year 1976 includes the transition quarter of July 1 to September 30, 1976.

Source: (2).

Table 17.4--Disposition of CCC oilseed inventories 1/

Fiscal year	Sales 2/		PIK payments	Barter	P.L. 480, Title II	Donations		Tranfers		Total
	Domestic	Foreign				Domestic	Foreign	Domestic	Foreign	
	Percent									*1,000 tons 3/*
1970	95.4	3.7	0	0	0	0.9	0	0	0	2,437.138
1971	98.6	.7	0	0	0	.7	0	0	0	5,530.624
1972	83.0	9.8	0	0	1.1	6.1	0	0	0	350.518
1973	79.1	20.3	0	0	.1	.5	0	0	0	529.998
1974	93.9	.4	0	0	5.6	.1	0	0	0	17.501
1975	15.7	0	0	0	84.3	0	0	0	0	1.005
1976 4/	.1	0	0	0	44.1	55.8	0	0	0	130.501
1977	8.3	0	0	0	18.2	36.2	0	37.4	0	82.133
1978	40.0	0	0	0	21.1	12.3	0	26.6	0	105.414
1979	20.1	0	0	0	6.4	30.1	0	43.5	0	24.861
1980	.1	0	0	0	2.2	29.1	0	68.6	0	18.901
1981	.7	0	0	0	4.4	18.2	0	76.6	0	6.029
1982	27.1	0	0	0	9.0	61.1	0	2.8	0	6.973
1983	93.2	0	0	0	.1	3.2	0	3.6	0	125.643
1984	98.6	0	0	0	.2	1.1	0	0	0	453.322
1985 5/	130.2	0	0	0	-.6	-29.6	0	0	0	-15.072

1/ Table does not include inventory adjustments and recoveries.
2/ Could include P.L. 480, Title I and Title III sales.
3/ Converted to metric tons based on conversion factors in table 1 of *Conversion Factors and Weights and Measures*, SB-616, U.S. Dept. Agr., Mar. 1979.
4/ Fiscal year 1976 includes the transition quarter of July 1 to September 30, 1976.
5/ Percentages over 100 and negative quantities result from adjustments for prior years' activity.

Source: (2).

Table 17.5--Disposition of CCC dairy inventories 1/

Fiscal year	Sales 2/		PIK payments	Barter	P.L. 480, Title II	Donations		Tranfers		Total
	Domestic	Foreign				Domestic	Foreign	Domestic	Foreign	
	Percent									*1,000 tons 3/*
1970	1.3	6.3	0	0	39.2	30.6	0	22.5	0.1	338.206
1971	0	9.9	0	0	39.0	37.3	0	13.6	.2	363.004
1972	.4	24.7	0	0	29.7	37.1	0	7.8	.3	388.606
1973	8.7	10.0	0	0	13.2	67.5	0	0	.5	194.250
1974	.4	0	0	0	0	99.6	0	0	0	65.984
1975	.8	0	0	0	30.0	69.2	0	0	0	147.825
1976 4/	38.2	0	0	0	25.3	36.5	0	0	0	136.601
1977	17.8	0	0	0	36.2	4.9	0	41.0	.1	158.615
1978	9.9	8.3	0	0	31.2	15.5	0	33.7	1.4	218.546
1979	15.4	6.2	0	0	29.2	16.0	0	31.7	1.6	224.826
1980	12.6	14.5	0	0	22.5	26.3	0	22.4	1.7	260.167
1981	30.5	8.8	0	0	23.1	32.5	0	4.0	1.1	428.816
1982	41.1	0	0	1.1	16.5	39.8	0	.4	1.1	453.627
1983	2.9	10.3	0	.6	24.0	60.9	.5	.2	.5	687.971
1984	9.1	6.2	0	1.6	19.6	49.6	13.5	0	.5	790.915
1985	3.5	6.5	0	1.1	14.0	54.6	19.8	0	.5	1,050.459

1/ Table does not include inventory adjustments and recoveries.
2/ Could include P.L. 480, Title I and Title III sales.
3/ Converted to metric tons based on conversion factors in table 1 of *Conversion Factors and Weights and Measures*, SB-616, U.S. Dept. Agr., Mar. 1979.
4/ Fiscal year 1976 includes the transition quarter of July 1 to September 30, 1976.

Source: (2).

include sales resulting from P.L. 480 Title I and Title III loans.

PIK payments. CCC stocks in storage used in lieu of cash as payments to farmers for idling acreage. (See table 17.6 for total PIK commodities.)

Barter. CCC inventories exchanged for strategic materials produced abroad.

P.L. 480. Donations of CCC inventories to foreign countries under P.L. 480 Title II. (Donations under Title I stopped in the late 1960's.)

Domestic donations. Donations of CCC inventories to needy U.S. individuals and institutions.

Foreign donations. A disposal option that was repealed in 1967 and did not reappear until 1983. Amendments to Section 416 of the Agricultural Act of 1949 allow the donation of CCC dairy products, wheat, and rice to needy persons outside the United States. The Food Security Act of 1985 broadens this option to cover all edible CCC commodities.

Domestic transfers. Transfers or sales of CCC inventories to other Government agencies such as USDA's Food and Nutrition Service.

Foreign transfers. Transfers or sales of CCC inventories to the Defense Department for U.S. military bases abroad.

The tables show foreign grain and oilseed sales ending after the price increases of the early 1970's and not resuming until the mid-1980's when CCC inventories accumulated because of depressed prices. Wheat, rice, oilseeds, and dairy products that can be processed into foodstuffs show relatively larger domestic donation outlets than do feed grains. Domestic sales and P.L. 480 are widely used disposal outlets for CCC inventories. Most widely used disposal methods for dairy product stocks are donations and P.L. 480.

The PIK payments for the 1983 domestic grain programs are included, with the bulk of the payments clustering around fiscal year 1984. A large share of PIK payments represented outstanding regular and FOR loans with the CCC which were converted to CCC inventories and then simultaneously disbursed to producers (table 17.6). This phenomenon explains the large increases in CCC inventories during 1984.

COMMERCIAL EXPORT AIDS

The U.S. Government also provides support to enhance U.S. agricultural exports through subsidy payments to U.S. exporters, direct loans to importers, and loan guarantees for credit arranged through commercial channels. Even if no CCC inventories are involved, CCC offices are used for arranging and administering these aids.

Export Payments

Section 32 of the Agricultural Adjustment Act of 1935 authorized export payment programs. Wheat payments were made under authority of the International Wheat Agreement Act of 1949. However, CCC also made payments under its permanent charter authority. Between 1956 and 1966, CCC made payments by issuing commodity certificates redeemable for CCC-owned stocks. When CCC-held stocks were unavailable, payments reverted to cash.

Credit-Stimulated Export Expansion

Credit has served as an important instrument in expanding market demand for U.S. commodities. CCC has used both direct credit and credit guarantees. Another form of credit, authorized under the Mutual Security Act of 1951 and later incorporated under P.L. 480, involved sales to importers with payment in local currencies. Local currencies, often nonconvertible, would be deposited in a U.S.-controlled account and then used by the importing nation for a variety of trade-enhancement purposes. The importing country, for example, might make loans to promote further trade.

In 1959, Congress added long-term dollar credit sales to the provisions of P.L. 480. Under this program, importing countries can buy agricultural commodities with loans at low-interest rates and repay in dollars or convertible currencies spread out over a 20- to 40-year period.

Table 17.6--Sources of CCC commodities for PIK payments, 1983-85

Year/ commodity	Loan repayments	Inventory	Supplement	Total PIK
		Tons		
1983:				
Corn	92,607	0	3,023,319	3,115,926
Sorghum	41,040	0	512,794	553,834
Wheat	2,859,488	0	968,865	3,828,353
Rough rice	76,596	0	0	76,596
Upland cotton	2,434	0	0	2,434
1984:				
Corn	20,750,533	21,282,875	361,615	42,395,023
Sorghum	1,986,006	2,182,098	69,979	4,238,083
Wheat	8,565,603	4,093,346	100,620	12,759,570
Rough rice	970,643	736,314	0	1,706,957
Upland cotton	559,019	336,648	38,075	933,742
1985:				
Corn	64,888	2,345,802	5,828	2,416,518
Sorghum	20,148	103,042	3,637	126,827
Wheat	1,349,281	440,934	3,081	1,793,297
Rough rice	1,055	246,255	0	247,310
Upland cotton	7,576	3,919	9,616	21,111
Total	37,346,917	31,771,233	5,097,429	74,215,579

Source: USDA, Agricultural Stabilization and Conservation Service.

CCC can make direct, short-term loans to importers under authority of its permanent charter. When this authority (commonly referred to as GSM-5) has been used, U.S. exporters would sell to importers with payments deferred up to 3 years. CCC reimburses the exporter and holds the importer's note. The interest rate it charges importers reflects the Government's ability to borrow at favorable rates and has usually been set at no more than 1.5 points above the Government's own payback rates.

CCC credit guarantees have been available since 1979. A GSM-101 program, operating during 1979-81, provided exporters with guarantees on loans in the event of default caused by risks such as embargoes, foreign exchange restrictions, or hostilities. In 1981, legislators added a GSM-102 program extending the guarantees to defaults resulting from inability to pay. These guarantees enable banks to provide financing in excess of regular lending limits and to lengthen loan periods. The guarantee may also foster lower interest rates.

A combination credit program bringing together the GSM-5 and GSM-102 programs was first used in 1982. This combination, referred to as "blended credit," consists of direct CCC credit issued under GSM-5 with an interest waiver and a credit guarantee on the remaining commercially provided credit. The result is a credit repayment period stretching up to 3 years at a reduced interest rate. Approximately 20 percent of the credit package consists of interest-free direct credit from CCC. The United States has targeted blended credit principally to developing countries.

The Agriculture and Food Act of 1981 created the Agricultural Export Credit Revolving Fund. The fund was designed to help finance commercial exports of U.S. commodities. The commodities could come from either private stocks or CCC stocks on 3-year credit terms. The legislation's intent was to use the revolving fund only when good potential existed for enhancing commercial demand for U.S. commodities. However, funds have not been appropriated; thus, the authorization has not been used.

A somewhat different form of credit enhancement, the Commodity Import Program (CIP), emerged in 1961 as a part of the larger Economic Support Fund, a foreign aid program administered by the U.S. Agency for International Development (AID). AID makes CIP dollars available to a recipient country on a loan or grant basis. The recipient nation then uses the loan or grant to buy U.S. goods. Since 1981, Federal law has mandated that at least 15 percent of CIP funds be used to purchase U.S. farm commodities and related products. In 1984, CIP funding amounted to $500-$600 million. CIP differs from other export enhancement programs: It is not administered through CCC and it is relatively small.

Export Market Development

Market development efforts can also be considered a form of subsidy, although the effects are much less direct than the above programs and may show up only over the longer term. Market development programs promote products including branded products, furnish support services that educate foreign users and processors, and provide technical services focusing on food processing and product use.

A major U.S. program used since 1956 to promote exports is the cooperator program administered by USDA's Foreign Agricultural Service (FAS). The program was launched after P.L. 480 provided the legislative authorization and initial source of funds. FAS, whose goal is to develop, maintain, and expand long-term commercial markets for U.S. commodity exports, promotes cooperation between U.S. nonprofit producer organizations and governments, firms, or trade associations in other countries.

In 1971, the United States initiated an export incentive program to help firms establish markets for brand-name, consumer-ready U.S. agricultural products. In 1978, agricultural trade offices were set up in selected regions to facilitate export market development. FAS launched an Agricultural Information Marketing Service, a free-of-charge, computer-based referral system that links up foreign markets with domestic suppliers, foreign importer bids, and trade statistics. Congress enacted legislation in 1982 to enable the private sector to develop trading companies that could include agricultural commodity marketing.

GOVERNMENT INVOLVEMENT IN AGRICULTURAL EXPORTS

The U.S. Government provides a range of programs to boost agricultural exports. The dollar value of U.S. agricultural commodities sold or donated in foreign markets under several programs is contrasted with total agricultural exports (table 17.7). In the last 30 years, Government-financed exports under the sales for foreign currencies and credit programs of P.L. 480, Title I, and other foreign donation programs have ranged between $1-$1.7 billion, but their importance declined as total agricultural exports grew from $4 billion in 1956-60 to a high of $44 billion in 1981. Cash exports largely contributed to this increase. Cash exports accounted for about 90-92 percent of total agricultural exports during the mid-1970's and early 1980's. From 1983-86, however, this percentage dropped to about 85 percent. CCC credit sales constituted the most active group of Government-assisted programs in recent years.

Authorization stipulations commonly forbid export enhancement from interfering with commercial sales in domestic and export markets. Recent legislation, however, also reflects concern over possible effects on farmers in recipient countries.

The programs result in a cost to the U.S. Government in one form or another. Some authorizations require an immediate, direct appropriation. The credit guarantee programs may require a delayed appropriation in the event of a default. The CCC donation, barter, and PIK programs bar CCC from receiving subsequent revenues from inventory disposal sales. In those cases, appropriations are needed to replace capital losses incurred by the CCC. Reducing CCC inventories could save money if storage costs and/or losses from commodity deterioration exceeded the disposal sales value. CCC sales transacted at competitive export market prices that are below the loan rate would also require subsequent appropriations to replace capital losses and cover storage and handling costs.

Table 17.7--U.S. Government-financed, Government-assisted, and cash exports

Fiscal year	Government-financed exports		Government-assisted commercial exports			CCC barter	Cash exports 5/	Total
	P.L. 480, Title 1 1/	Other 2/	With export payment 3/	Credit sales CCC 4/	Credit sales Ex-Im Bank			
	Million dollars							
Average:								
1956-60	710.4	685.0	980.0	11.5	81.7	0	1,624.4	4,093
1961-65	1,109.9	405.8	1,144.0	68.1	70.0	35.9	2,632.3	5,466
1966-70	927.8	294.4	1,087.4	203.4	58.8	300.3	3,580.9	6,453
1971	539.4	539.2	1,602.0	390.8	97.3	869.8	3,916.5	7,955
1972	677.4	446.1	1,514.0	371.6	86.3	875.9	4,270.7	8,242
1973	658.5	371.7	2,496.0	1,028.5	66.4	1,088.3	9,274.6	14,984
1974	575.4	366.5	736.0	297.9	69.9	294.0	19,219.3	21,559
1975	762.0	460.0	0	248.6	89.3	5.0	20,252.1	21,817
1976	649.1	470.9	0	618.5	6/ 77.6	0	20,925.9	22,742
1977	762.1	760.7	0	755.3	6/ 77.6	0	21,618.3	23,974
1978	737.4	812.5	0	1,582.6	6/ 77.6	0	24,078.9	27,289
1979	792.8	698.5	0	1,590.7	6/ 77.6	0	28,819.4	31,979
1980	865.3	659.0	0	1,416.0	6/ 77.6	0	37,463.1	40,481
1981	789.7	702.4	0	1,873.0	48.0	0	40,366.9	43,780
1982	722.3	467.4	0	1,393.1	60.4	6.7	36,451.1	39,095
1983	809.7	525.6	103.5	4,069.1	91.7	6.3	29,169.9	34,769
1984	762.7	719.4	15.1	3,830.3	86.9	11.9	32,600.7	38,027
1985	723.6	943.5	35.9	2,806.7	71.0	9.5	26,596.8	31,187

1/ P.L. 480 Title I dollar credit and sales for foreign currencies (long-term credit) plus Title III sales.

2/ P.L. 480 Title II and Section 416 donations, P.L. 480 barter, and AID (Mutual Security Act) programs.

3/ CCC sales at reduced prices. 1984 and 1985 figures reflect competitive bid sales to African countries (proceeds value, not cost to CCC).

4/ Sales under GSM-5, GSM-101, GSM-102, GSM-201, and GSM-301 programs plus blended credit.

5/ Cash exports are the residual of total agricultural exports reported in FATUS [see (3) of References] minus Government-financed and -assisted exports.

6/ Averages for 1976-80 were used because of insufficient data.

Sources: (*1*, *2*, *3*) and USDA, Agricultural Stabilization and Conservation Service data.

Although export enhancement programs require additional appropriations, overall benefits may outweigh costs. The next chapter examines theoretical effects of export subsidies and reviews previous studies of subsidy programs.

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CHAPTER 18

THE ECONOMICS OF EXPORT SUBSIDIES

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CHAPTER 18

THE ECONOMICS OF EXPORT SUBSIDIES*

The Commodity Credit Corporation (CCC) has a wide range of policy programs available to dispose of stocks overseas and at home. These programs can be categorized into two broad classes: Those which implicitly or explicitly reduce the price paid by some or all foreign buyers, and those which attempt to increase total demand for a commodity by releasing an income constraint. The first category can be subdivided into general export subsidies (the export subsidy is available to all buyers) and targeted export subsidies (the subsidy is available to only some buyers). Both subsidy and demand expansion programs seek to expand U.S. agricultural exports, but the first lowers price and therefore moves down the demand function while the second expands demand by shifting the demand function outwards. The term export enhancement is used to cover both kinds of programs.

These programs differ in terms of producer benefits and consumer and Government costs in the United States and in terms of the distribution of benefits and costs abroad. Before proceeding to empirical analysis of export enhancement programs, it is necessary to explore what theory suggests should be the results of various kinds of subsidy and demand expansion programs. This chapter deals with the development of theoretical models that explore the theory of subsidies and demand expansion. It also presents a partial review of previous empirical analysis.

PRICE REDUCTIONS WITH EXPORT SUBSIDIES

We define an export subsidy as any direct or indirect financial assistance offered by a government or quasi-government agency which lowers world market price below either free trade prices or previously existing market prices. The subsidy can be direct (paid to exporters), or indirect (paid via income transfers to importers or domestic producers and/or consumers). Economic implications are that a subsidy influences market prices, the volume and value of trade, producer and consumer welfare both in the subsidizing country and abroad, and government costs. The models initially assume that other countries react passively, simply meeting U.S. prices (moving along their export supply functions). They do not adjust domestic policies or retaliate, and importers do not intervene. These assumptions are subsequently relaxed.

A General, Uniform Export Subsidy

A general, uniform export subsidy is one offered to all countries and is the same amount for all buyers. The analysis begins with a simple two-country world where there is one exporter (the United States) and all other exporters and importers are aggregated into the rest of the world (ROW).

Two-Country Model

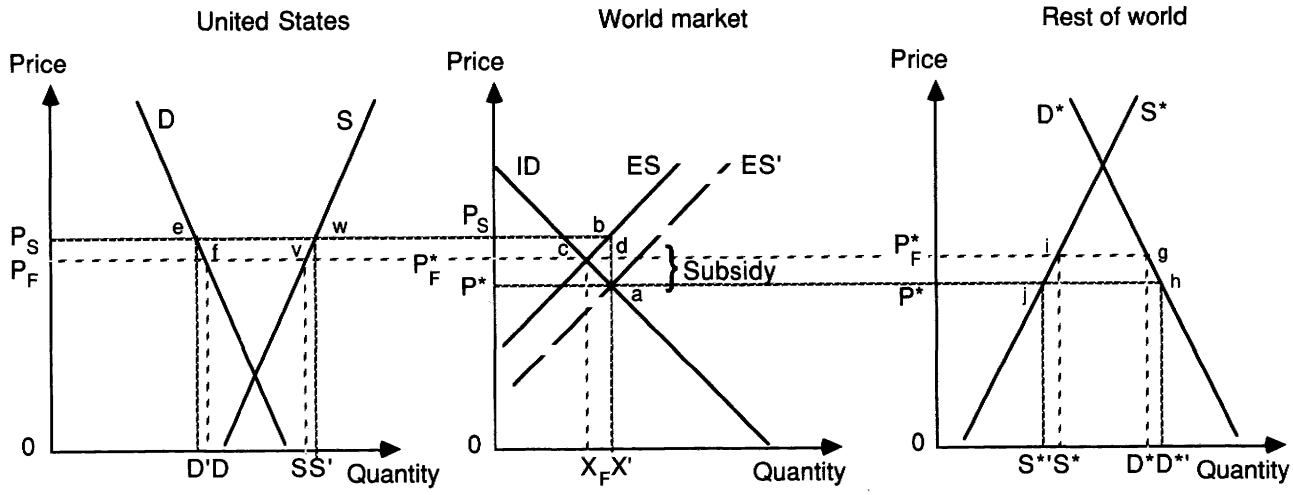
This basic model was presented in Chapter 8, but its critical assumptions bear repeating. The model considers one homogeneous agricultural commodity at a time, assuming that all other prices, income, population, technology, and consumer tastes are unaffected by changes in that commodity market. It also ignores transportation and handling charges, and assumes that exchange rates are fixed. Policies are treated as exogenous for all countries. The United States and other traders do not initially interfere with trade.

Under these assumptions, the initial equilibrium in the world market occurs where the import demand schedule intersects the U.S. export supply schedule (fig. 18.1). The world market price is given as P^*_F, and the quantity

*Contributors to this chapter were Philip Paarlberg, Andrew Schmitz, and Alex McCalla.

Figure 18.1

Trade Implications of a U.S. Export Subsidy



of U.S. exports is X_F. In the United States, the price is P_F. At this price, the quantity demanded is given by D and the quantity supplied by S. In the rest of world, the price of P^*_F yields a quantity demanded of D^* and a quantity supplied of S^*. In this model, the level of U.S. exports, X_F, equals the difference between demand and supply in both regions at price P^*_F.

Suppose the United States introduces a per unit export subsidy of b-a. (The analysis could easily be modified to include percentage or other kinds of subsidies.) The subsidy is perceived by the rest of world as an outward shift in the U.S. export supply schedule to ES'. The export subsidy lowers the price to the rest of world to P^*, thereby increasing U.S. exports from X_F to X'. Exports increase because importers purchase more at the lower price, and competing exporters export less. The increase in U.S. exports raises the U.S. price because consumption must fall and supply must expand to meet the increased need for exports. Competitive trade forces the resulting price differential to equal the subsidy. The U.S. price increases to P_S, thus consumption drops to D', and the quantity supplied expands to S'. In the rest of the world, the decline in price increases consumption to $D^{*'}$, and the quantity supplied falls to $S^{*'}$. The subsidy drives world prices below free trade prices. U.S. consumers are taxed by the export subsidy, but producers are implicitly subsidized with the price increase resulting from the export subsidy.

Magnitudes of the adjustments are determined by the price elasticities of the demand and supply schedules in both regions. For example, the more elastic the demand and supply relations in the rest of world, the more elastic is the import demand. As this relation becomes more elastic, the decline in the world market price is less, the expansion in U.S. exports is greater, and more of the subsidy is reflected in a higher U.S. domestic price. When the import demand is elastic, the percentage decline in the export price will be less than the percentage increase in the quantity of exports. Hence, U.S. export revenues rise. When the import demand is inelastic, U.S. export revenues fall. Thus, in the analyses of hypothetical U.S. surplus stock disposal schemes presented in subsequent chapters, the magnitude of import demand elasticities used are critical to the outcomes reported. This issue was discussed at length in Chapter 6.

Changes in the U.S. and the rest of world income distribution can also be determined using the familiar concepts of producer and consumer surplus. The U.S. export subsidy changes these measures. The rise in the U.S. domestic price and the increase in supply raises producer surplus P_FP_Swv (a gain to producers). However, the U.S. domestic price increase also reduces quantity demanded; thus, consumer surplus falls (P_FP_Sef). The loss in consumer welfare is less than the gain in producer welfare. This difference is borne by U.S. taxpayers as part of the subsidy costs. In the rest of the world, prices fall, the quantity demanded rises, and the quantity supplied contracts. This means that foreign consumers benefit from the price decline and the consumption increase ($P^* P^*_F gh$). Foreign producers lose welfare due to the price decline ($P^* P^*_F ij$). The increase in foreign consumer welfare exceeds the loss of foreign producers. The difference is paid for by U.S. taxpayers in the form of subsidy costs. Thus, of the total U.S. subsidy costs of the policy ($P^* P_S ba$), part is transferred to U.S. producers (P_FP_Sbd), and part is transferred to foreign consumers ($P^* P_F da$).

In summary, the general, uniform U.S. export subsidy raises the U.S. price, lowers the world price, and increases U.S. exports. U.S. producers and foreign consumers gain, while U.S. consumers and foreign producers suffer. U.S. taxpayers pay for some benefits received by U.S. producers and for some of the gain to foreign consumers.

Gains or Losses from Trade

Thus far, the analysis has assumed that the decision was to apply an export subsidy of b-a. However, the analysis would be identical were the decision process reversed, and if it were decided for domestic political reasons to guarantee U.S. producers a fixed price (P_S) and move excess supplies into world markets using an export subsidy. The necessary subsidy would be b-a. If domestic prices were increased, the necessary export subsidy would need to be increased.

This model can also explore the question of the effect of an export subsidy on U.S. gains or losses from trade. This is relevant because in trade theory, gains from trade explain why nations trade in the first place. Thus, the gain from trade is an additional appropriate evaluative criterion *(21)*.[1]

Figure 18.2 contains the same basic model with the import demand from the rest of the world (ID) added to U.S. domestic demand. We begin from the no-trade situation of P_A in the United States and P_{ROW} in the world market. With free trade, gains to the United States are abc and gains to the world are def. If the United States introduced a price support subsidy program fixing internal price P_S, U.S. producers produce Q_2 which, when marketed, drives the price to P'_F. Now assume U.S. consumers buy at the world price. The rest of the world clearly gains (dfgh). However, whether the United States gains or loses depends on the size of the cross-hatched area versus the original gains from trade (abc). As drawn, U.S. gains from trade given the export subsidy are actually negative (that is, the cross-hatched area is greater than area abc). From the U.S. societal point of view, implementing an export subsidy results in eroded gains from trade even though the volume of trade is greater than under free trade.

Suppose, however, that the United States decides, as in the original model, to change domestic consumers' price P_S (fig. 18.3). U.S. consumers would contract consumption from Q_0 to Q_1. Thus, to clear markets, the United States would have to export $Q_2 - Q_1$ which would drive prices on world markets to P''_F and increase the export subsidy to $P_S - P''_F$.

Importers gain further (gijh), but effects on the United States are more complex. U.S. consumers lose $P'_F klP_S$ in consumer surplus. Whether the export subsidy is more or less expensive depends on the relative sizes of the

[1] Italicized numbers in parentheses refer to items in the References at the end of this chapter.

Figure 18.2

Export Subsidy's Effect on Gains from Trade

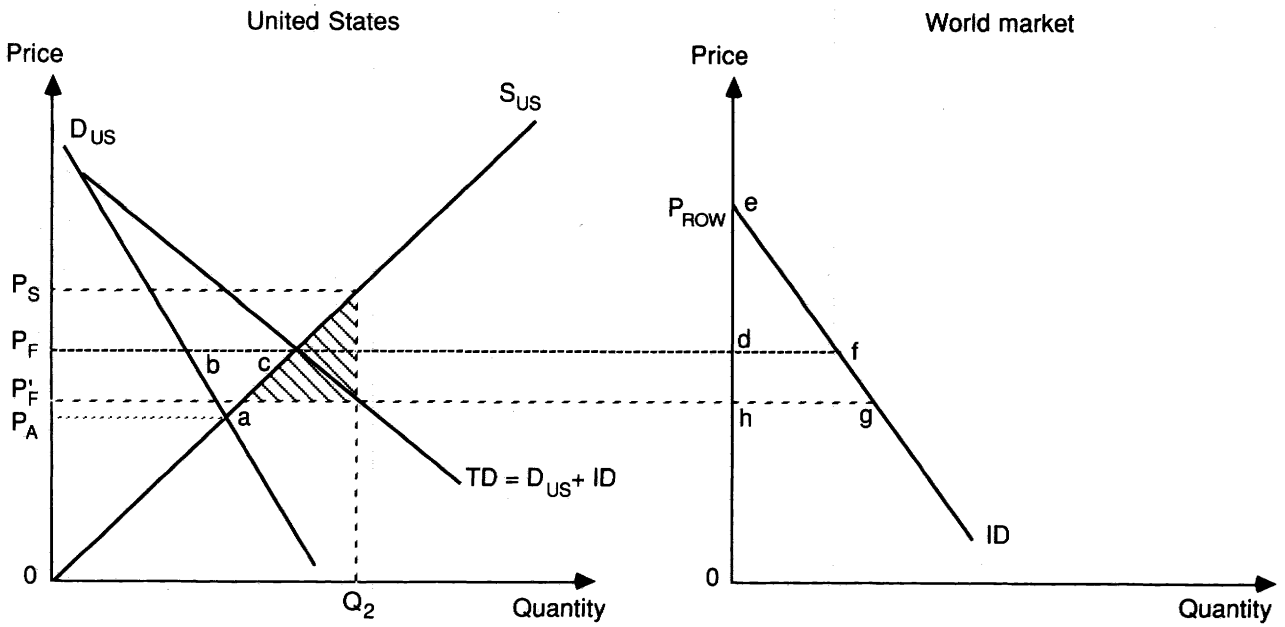
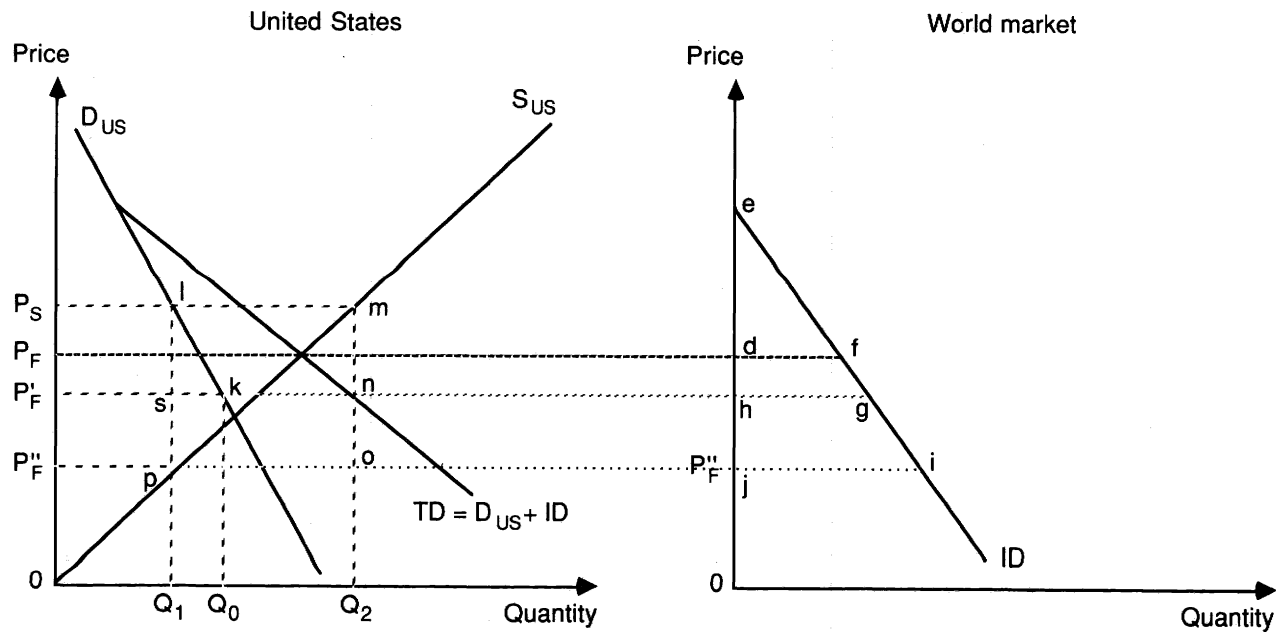


Figure 18.3

Gains From Trade with Consumer Tax



rectangles $P_S P'_F nm$ and lmop. Lower costs would offset some consumer surplus losses but not all. Viewed from the U.S. standpoint, net costs of farm programs may rise and gains from trade become more negative.

Targeted Export Subsidies

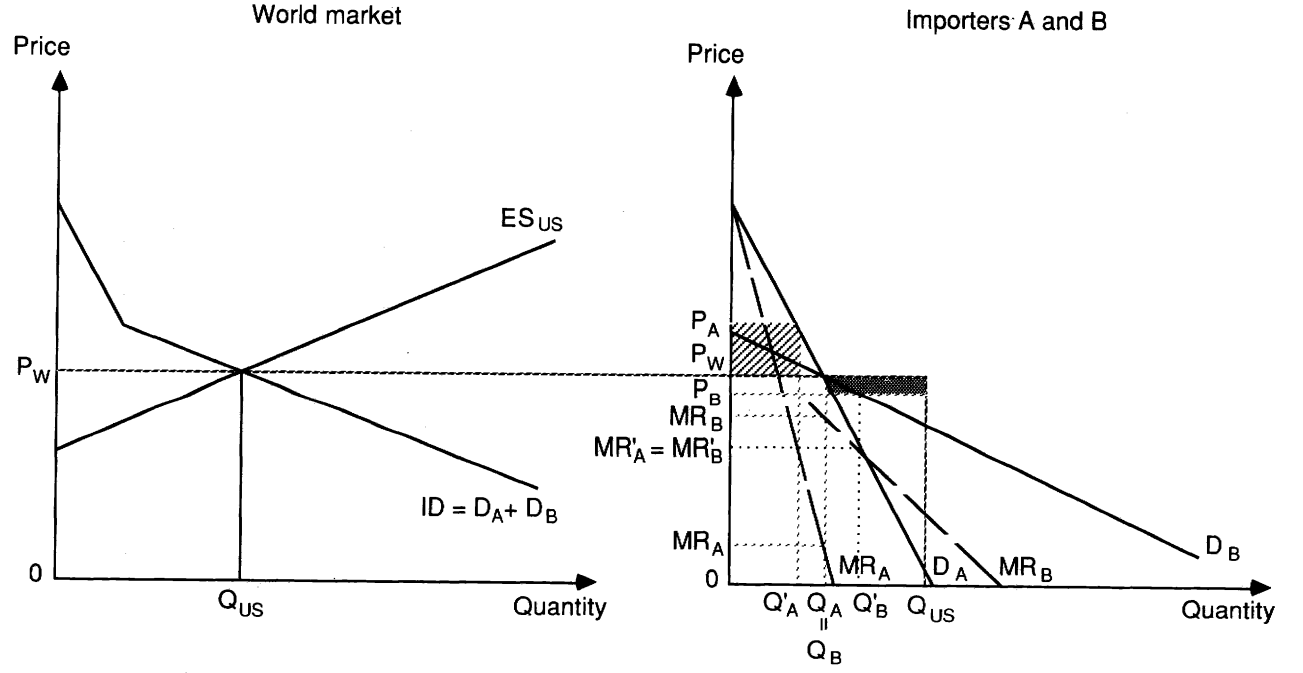
Discussion has focused so far on general subsidies applied to all destinations. But many U.S. policies discriminate among destinations by making the subsidy available to only some importers. For example, shipments under P.L. 480 are targeted toward many developing countries. Other targeted expansion schemes include credit subsidies, export bonus schemes, and export payment-in-kind (PIK) programs.

From a purely economic viewpoint, targeting subsidies would be sensible only if the import demand elasticities were different among markets. If the elasticities were not different, the optimal policy for a large exporter, assuming no retaliation, would be an export tax, not a subsidy.

To investigate the economics of targeted subsidies, we begin with the classic price discrimination model. In figure 18.4, importers A and B have different demand functions, D_A and D_B. The left panel shows U.S. export supply ES_{US} and world import demand ID, which is the sum of $D_A + D_B$ (for simplicity the two importers are assumed not to produce the commodity). In a competitive solution, world price is P_W and the United States sells Q_{US}. Note, however, that at the quantities sold to A and B, Q_A and Q_B (drawn as equal for simplicity), marginal revenue in market A, MR_A is considerably below marginal revenue in market B, MR_B. Economic rationality tells us that the United States would be better off reallocating from market A to market B until the marginal revenues are equal in both markets (shown as $MR'_A = MR'_B$) thus charging P_A in market A for the lesser quantity Q'_A while selling more in market B (Q'_B) and charging a lower price, P_B. Foreign exchange earnings would rise by the cross-hatched area less the shaded area. This model does not contain explicit subsidies. The

Figure 18.4

Classic Price Discrimination Model



government or a monopolistic trading agency price discriminates between markets while selling a fixed volume of output. Implicitly, however, the monopolist is taxing market A and subsidizing market B relative to the competitive solution.

The above model is incomplete in two senses. First, it has no domestic U.S. demand, and it has no internal price policy in the United States. The introduction of the two elements makes price discrimination among international markets potentially profitable for the United States. One further practical constraint must be added: The U.S. Constitution prohibits explicit export taxes. The modified model is presented in figure 18.5. The two import markets, A and B, are again represented by demand function, D_A and D_B. World import demand is ID. Given no policy in the United States, world (and U.S.) price is P_W with the United States exporting Q_T made up of Q_A imported by importer A and Q_B by importer B. If the United States decided on a domestic price to producers and consumers of P_S, exports would expand to Q'_T with an export subsidy of $P_S - P'_W$. If the United States did not target the subsidy, both A and B would increase imports at the lower world price.

But under the same logic as the price discrimination model, charging the same to both importers is less desirable because the revenue from the last ton sold in market A is less than market B. The United States could reallocate sales from market A to market B until the marginal revenues are the same. But as drawn, the price in market A would exceed P_S and thus be unconstitutional. However, the United States is still better off charging P_S in market A, allocating the remainder ($Q'_T - Q'_A$) to market B, and paying an export subsidy to reduce price to P_B. Export earnings are greater than under the uniform subsidy case, and subsidy costs are lower.

An analysis of a targeted export subsidy program in a partial equilibrium model was developed by Sharples which includes an additional exporter *(25)*. This model assumes that the world consists of four regions: The United States, Other Exporters, Egypt, and Other Importers. Policies are again assumed as given. Prior to the U.S. targeted export subsidy, the world market price is P^*_F (fig. 18.6). The world price is transmitted into the four markets to yield the quantities exported and imported by each nation ($P^*_F = P_1 = P_2 = P_3 = P_4$).

Figure 18.5

Targeted Export Subsidies

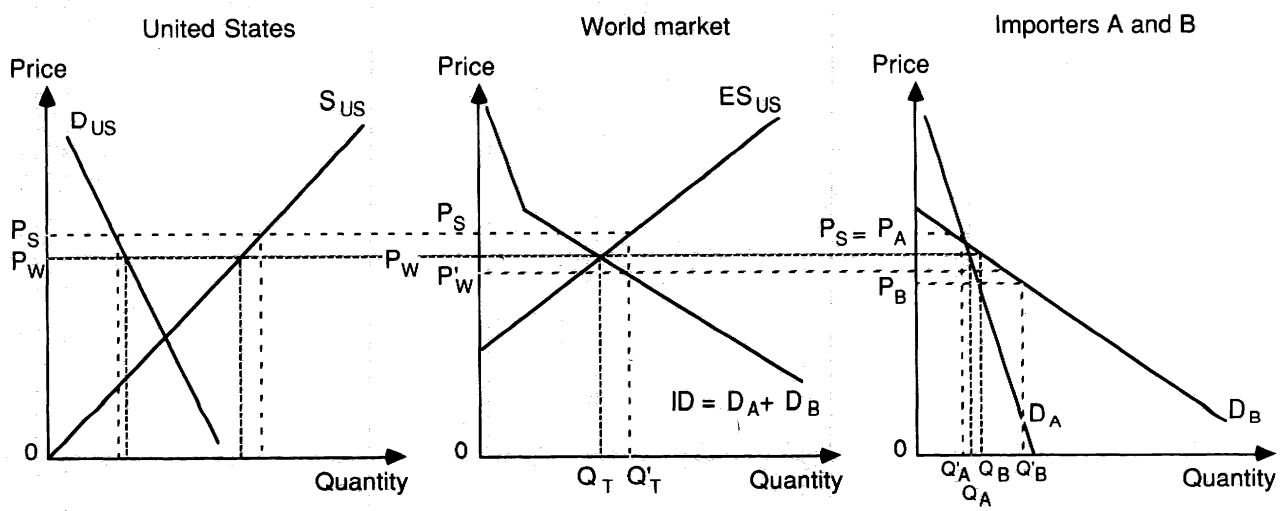
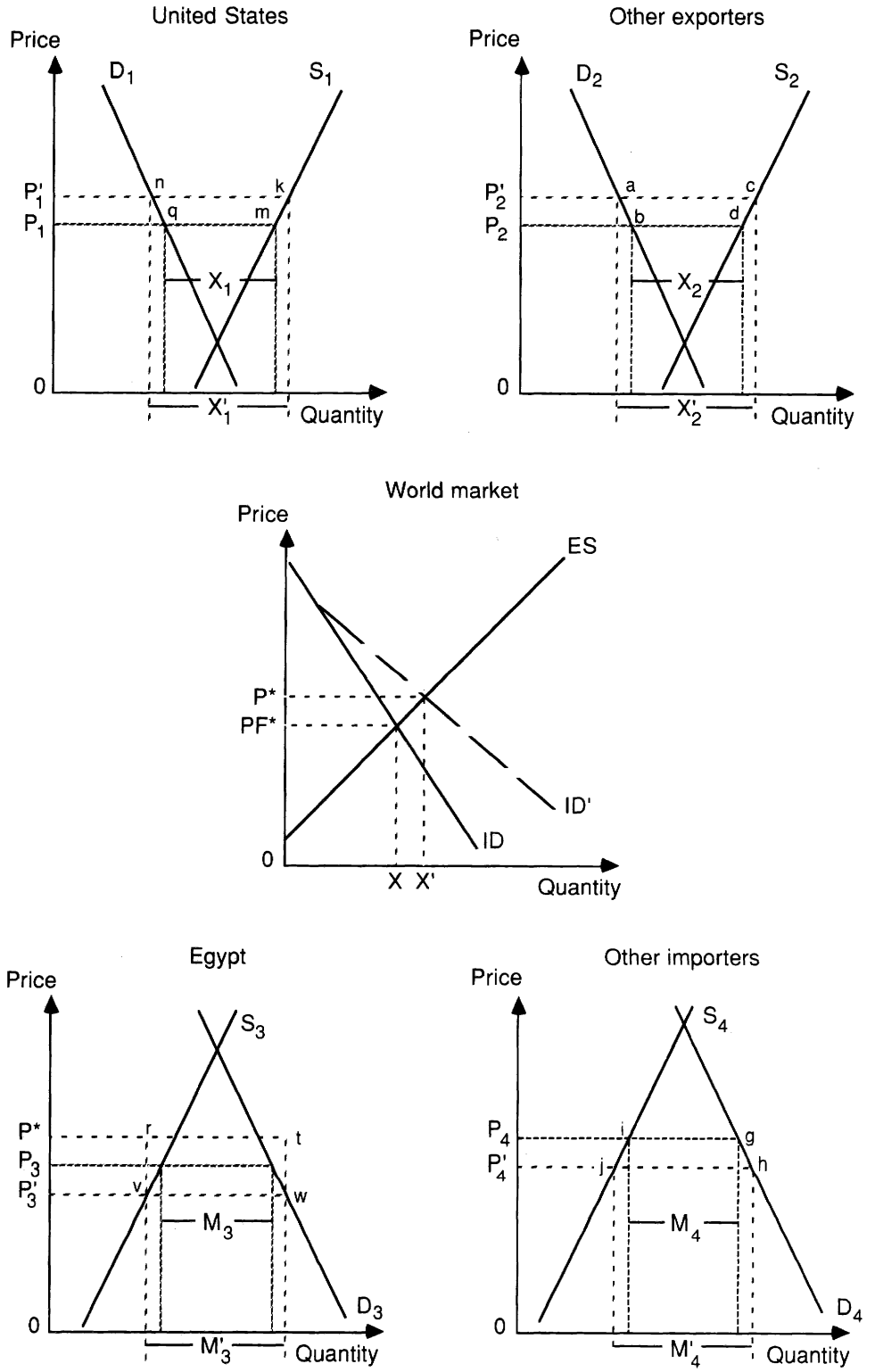


Figure 18.6

Targeted Export Subsidies with Other Exporters



Suppose that the United States decides to offer an export subsidy to only Egypt on the entire level of purchases from the United States. Thus, only Egypt sees an effectively lower price on its imports, which effectively shifts Egypt's and, therefore, world import demand to ID'. The result is that world trade expands from X to X', and the world price rises from P^*_F to P^*.($P^* = P'_1 = P'_2 = P'_4$). The rise in the world market price causes Other Importers to reduce purchases, while expanding exports of both the United States and Other Exporters.

In this analysis, the Other Exporters, in aggregate, increase their welfare as the world price rises and exports expand. The gain in producer surplus is $P_2P'_2cd$, which exceeds the loss in consumer surplus, $P_2P'_2ab$. As in the conventional subsidy case (fig. 18.1), Egypt is better off because the increase in consumer surplus exceeds the loss in producer surplus, and Egypt receives a welfare transfer from U.S. taxpayers. Other importers fare worse because the higher world market prices cause consumer surplus to fall ($P_4P'_4gh$) which is more than the gain in producer surplus ($P_4P'_4ij$).

The effect of the targeted export subsidy on U.S. welfare is ambiguous. The increase in the world market price and the expansion of U.S. exports increase U.S. producer surplus ($P_1P'_1km$) and lower consumer surplus ($P_1P'_1nq$). But U.S. taxpayers pay the subsidy costs (vrtw). Abbott, Paarlberg, and Sharples examined the conditions for a welfare gain to an exporting country offering a targeted export subsidy in a general equilibrium model *(4)*. They cited three conditions which create the potential for a welfare gain to the exporting country imposing a targeted subsidy:

- The income effect for the good in the subsidizing country is low.
- The initial level of the subsidy is low.
- The income effect in the targeted country is large and dominates the substitution effects in the subsidizing country and in nations excluded from the subsidy.

Under these conditions, an exporting country can exploit differences in import demand price elasticities to increase its aggregate welfare. Although the exporting country using the targeted subsidy may gain or lose, the targeted importer (Egypt) and other exporters clearly will gain. Hence, net gains, if any, to the United States from a targeted export subsidy program will be smaller than net gains to the targeted importer and competing exporters.

The simple model used by Sharples disguises some additional aspects of targeted subsidies *(25)*. Some of the strategic motives for targeted export subsidies are explored by Abbott, Paarlberg, and Sharples in a partial equilibrium model with several exporters and several importers *(4)*. The formal model was outlined in the Chapter 11 appendix. In that analysis, it was used as a pure price discrimination model. Here it is used as a constrained targeted export subsidy model. As already shown, the two are theoretically identical.

Assuming other exporters do not retaliate, targeted subsidies can be used to expand demand as in Sharples' model, to expand market share, and to defend market share. Equation (25) in the Chapter 11 appendix shows that the subsidies tend to be given to countries with relatively elastic import demands in order to expand the market. This condition is analogous to the general equilibrium result that a positive welfare gain for the subsidizing country is related to the relative income and substitution effects.

When a market is shared with a competing exporter, then the optimal intervention is given by equation (26) in Chapter 11. This equation shows that a market may appear more elastic if the quantity exported to that market by the subsidizing country adjusts to price changes resulting from the withdrawal of the competitor in addition to adjusting to a price-induced increase in import demand. For example, assume that the USSR, an importer, has a nearly perfectly inelastic import demand. According to *(25)*, a targeted export subsidy will not likely increase U.S. welfare. If,

however, the USSR is supplied by another exporting country with a relatively elastic export supply, then from *(26)*, the possibility of a subsidy increases. Thus, even a market with a perfectly inelastic import demand is a candidate for a subsidy when shared with a very price-responsive competitor. In this instance, export subsidies are a strategic policy aimed to expand market share at the expense of other exporters rather than a policy that only moves importers along their demand function for your product. Differences in transport costs in markets could also lead to additional possibilities for targeted subsidies (equation (27), Chapter 11).

In summary, targeted export subsidies have a demand expansion potential and are a strategic policy tool. The theory suggests that to improve the subsidizing country's welfare, subsidies are targeted to the most elastic markets. Further, subsidies are targeted to countries which are shared with competitors in order to exploit the price elasticity of the competitor's export supply.

Other exporters may oppose targeted subsidies by the United States. This issue is discussed in detail in subsequent sections. If other exporters seek to maintain their market share, then the United States may be unsuccessful in substantially increasing market share. This is so because this type of response from the fringe makes the demand for U.S. products by the targeted nations relatively less elastic, thereby reducing their attractiveness. However, even if this were the case, targeted subsidies, which essentially are a form of price discrimination, may be a less costly policy for expanding exports than a global, uniform subsidy.

DEMAND EXPANSION PROGRAMS

The second category of CCC programs discussed are those designed to shift the import demand function by transferring income overseas. Effects of income transfer programs are best analyzed in a general equilibrium framework as done by Abbott and McCarthy *(2, 3)*.

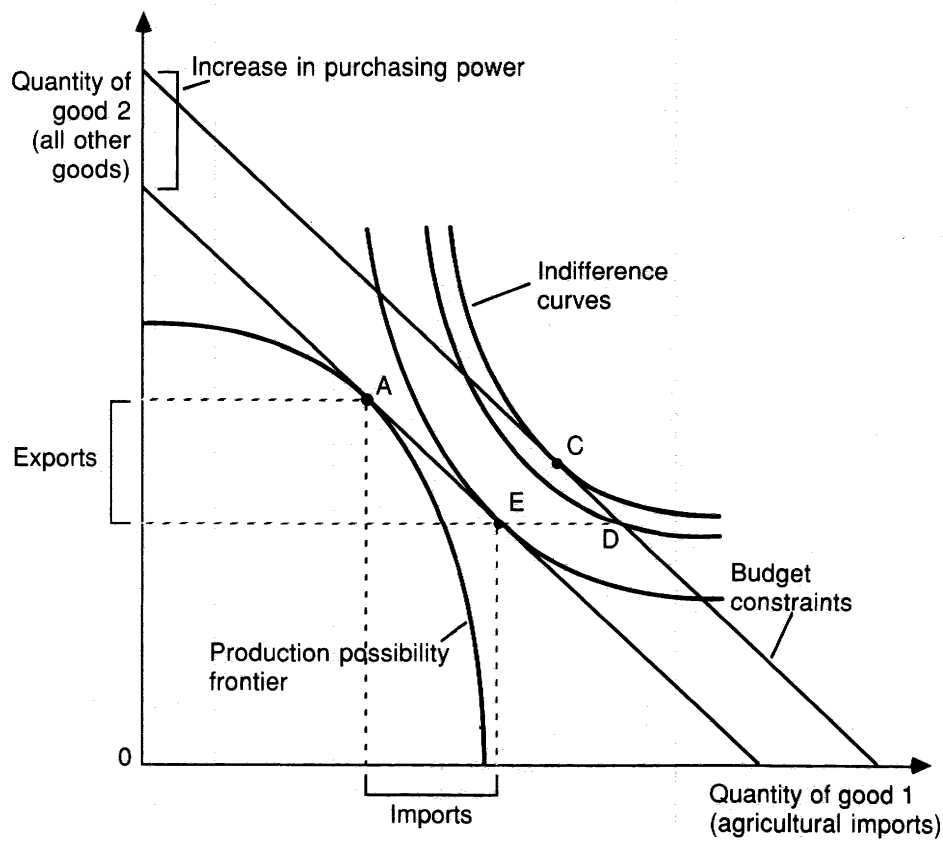
Their model is shown in figure 18.7. The economy is assumed to produce two goods under constant returns to scale as given by the production possibility frontier. Good 1 is an agricultural good, which is imported. Good 2 is a composite of all other goods in the economy and is assumed to be the export good. The budget constraint evaluated at world prices gives the country's income, which can be supplemented by foreign borrowing and aid transfers. When there are no external inflows, then the production composition of the economy is determined where the budget constraint is tangent to the production possibilities frontier (point A, in fig. 18.7).

Consumption of both goods is determined by maximizing social utility subject to the national budget constraint. The optimal condition for this problem is that consumption is determined where the budget constraint is tangent to the social indifference curve (point E). Having determined the optimal consumption and production bundles, the quantity imported and exported can be found by comparing points A and E. As shown in figure 18.7, the country imports agricultural goods and exports the composite good.

This framework can analyze the effect of either an income transfer or an extension of credit. The effect of either policy is to supply a net inflow of purchasing power, thereby shifting the budget constraint out. The transfer expands consumption from point E to point C where a higher indifference curve is tangent to the new budget constraint. Thus, the transfer has raised the welfare of the receiving country. Note that the budget constraint retains its original slope as given by international prices. The extent to which consumption of a good increases depends on the income effect. If demand is very responsive to income increases or the agricultural good is a large share of total expenditure, then consumption increases greatly. If demand is income inelastic or the good constitutes a small share of total expenditure, as may be true for agricultural goods, the consumption increase is slight.

Figure 18.7

Simple General Equilibrium Model of Importer Response to Price and Income Interventions



Most CCC demand expansion programs require that the increased imports (shown as the movement from E to C) are in excess of purchases which would have been made. If the United States further required that the total impact be focused on food imports, the country would move to point D where all of the consumption increase occurs in food. The country is less well off than if it could increase consumption of both goods (point C) but clearly better off than with no assistance (point E). This results in less of a welfare gain to the receiving country and provides an incentive to avoid or ignore the restriction. This illustrates the additionality problem associated with food aid and credit programs.

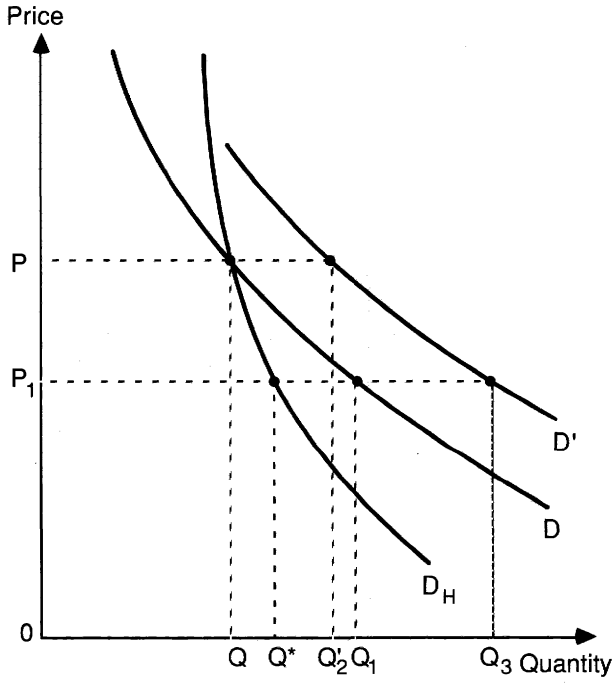
Two important conclusions emerge from this simple model. First, the critical parameter determining the change in consumption of agricultural goods is the marginal propensity to consume. If the income effect for agricultural goods or the consumption share is low, then income transfer programs have little demand expansion effects. Most of the income increase is channeled into purchases of the composite commodity. Second, there are costs associated with purchase restrictions on food aid such that resulting purchases are only partially additional.

The above discussion of export subsidy and demand expansion programs clearly indicates

that care must be taken when using terms such as demand expansion, export enhancement programs, credit subsidies, and income enhancement. Given that some programs lower price along a given demand curve while others attempt to shift the demand curve and some do both, it has led to confusion about the empirical estimation of demand relations and the meaning of reported import elasticities of demand. Figure 18.8 illustrates the issues. Suppose D is the demand curve for a group of importing nations, and the United States decides to target this group of countries with programs to increase exports. One instrument would be for the United States to merely lower the price through a two-for-one type of program. If price drops from P to P_1 and exporters are not restricted, consumption increases from Q to Q_1. But what is the nature of the demand function? If D is the ordinary, or Marshallian, demand curve, the income effect due to a price fall is already incorporated. However, corresponding to D is the Hicksian demand curve D_H which is a compensated demand function which shows the effect of a price fall holding real income constant. This is another way of illustrating the income effect of price changes. As price falls from P to P_1 consumption increases from Q to Q^* due to the substitution effect, and consumption increases from Q^* to Q_1 because of the income effect. Thus, direct subsidies have a "demand enhancing" effect from the substitution and income effects. An income transfer program or one that releases a foreign exchange constraint could also result in an increase in demand by shifting the demand curve to D'. In this case, for a given price P, the demand shift results in an increase in consumption of QQ'_2. A combination of an export subsidy program and a credit subsidy (blended credit) could both shift D and lower price. In this case, exports would increase to Q_3. Promotional activities could shift the ordinary demand rightward through changing consumer preferences but would not involve a price reduction.

Figure 18.8

Price Effects, Demand Expansion, and Credit Constraints



These points illustrate the need for care in attempting to empirically evaluate responsiveness of importers to demand enhancement programs. Empirical estimates of food demand elasticities for various regions of the world vary considerably. It is often difficult to determine exactly what price elasticity of demand is being reported or estimated. For example, with reference to figure 18.8, do empirical demand functions which regress price on quantity measure the price elasticity for D_H where real income is fixed or do they measure it for D? If the income effect is large, the associated elasticities of the two demand curves could be quite different. Some studies are not clear on what elasticity is being reported. If all one is interested in is final impacts, knowledge of the elasticity of D is important. However, further information is needed to address the question of additionality.

There is some literature on the effect of various targeted export subsidies. For example, Abbott shows that a price subsidy may have a greater impact on expanding demand (i.e. through moving along an ordinary demand curve) than

certain types of credit subsidies *(1)*. He argues that, for commodities such as wheat, use of aid or credit without constraints is unlikely to appreciably augment import demand. The effect of a credit subsidy is to expand expenditure, and the allocation depends on the income elasticities of demand. As Abbott and McCarthy argue, a credit subsidy shifts out the budget constraint faced by a country at fixed international prices, but it does not lower the import price *(2)*. However, studies by Grigsby *(9, 10)* seem to imply that credit provided through various types of U.S. programs expand the demand for grain. This would be especially true where credit is tied to the actual purchase of the commodity and in cases where programs contain both price and credit elements. In cases of tied credit, real prices are lowered which is also the case of a direct price subsidy. Credit and low interest rates could expand demand since to receive the expanded credits, purchases would actually have to be made.

TRADE EFFECTS OF U.S. COMMODITY PROGRAMS

Subsequent chapters analyze alternative policies for reducing excess U.S. public stocks by subsidizing exports. These stocks arise because of U.S. domestic commodity programs which alter world market prices and trade quantities. Thus, before proceeding to the empirical analyses, we must understand the trade effects of U.S. domestic commodity programs. This discussion focuses on four types of policies which in combination are the mainstays of U.S. programs: Target prices and the associated deficiency payments; loan rates; land retirement programs, such as set-aside, paid diversion, and PIK; and public stocks.

The theoretical framework suggests that target prices can be perceived by foreign nations as implicit export subsidies, and loan rates and land retirement programs can be viewed as implicit export taxes. These conclusions can best be understood by considering the effect of the loan rate and the target price on U.S. supply and demand schedules, and correspondingly, on export supply. The U.S. Government acts as the buyer of last resort under the nonrecourse loan program by purchasing commodities for stocks at the loan rate. Thus, U.S. prices are prevented from dropping much below the loan rate. The nonrecourse loan distorts the U.S. demand schedule by making it perfectly elastic (flat) at the loan rate (fig. 18.9, left panel). Loan rates act as a price floor for commodity prices. The distorted demand schedule becomes DaD'. As a result, the export supply schedule (fig. 18.9, ES in the center panel) is also perfectly elastic at the loan rate.

Since 1973, U.S. grain policy has included direct cash deficiency payments to eligible producers whenever the market price fell below the target price. This payment is designed to offset the difference between the market price and the target price. The target price and deficiency payment program distort the U.S. supply schedule, making it perfectly inelastic (vertical) for prices between the target price and the loan rate. This distortion in the U.S. supply schedule distorts export supply (fig. 18.9, center panel). Between the target price and the loan rate, the distorted U.S. export supply schedule is less elastic than the export supply schedule would have been without the target price and deficiency payment distortion. Net effect of the loan rate and deficiency payments on the export supply schedule is shown by the distorted schedule (fig. 18.9, solid line from LR to ES).

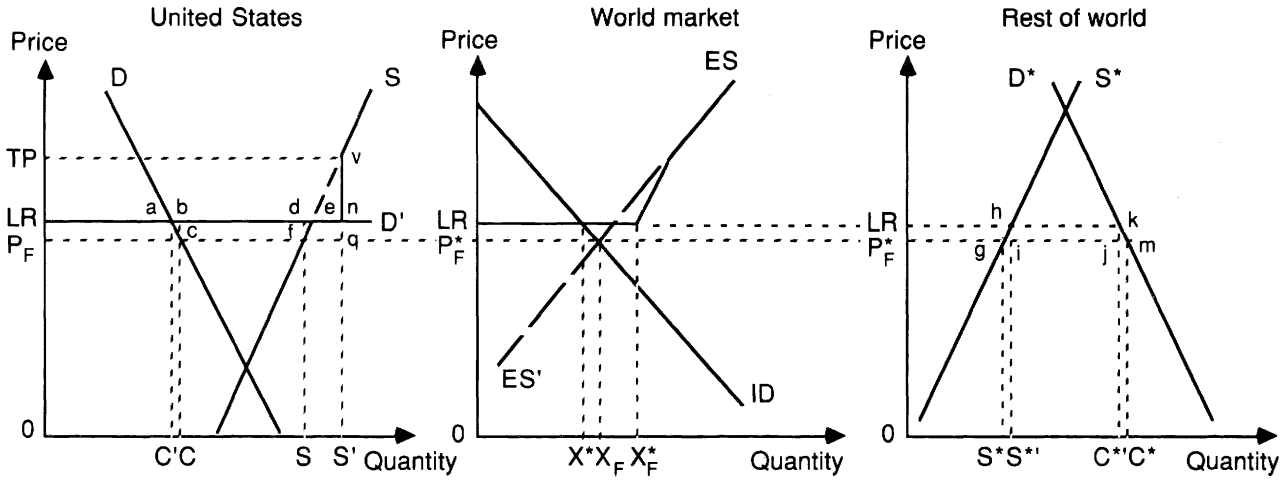
Loan Rates and Target Prices

The market equilibrium price and the quantity of U.S.exports are determined where the export supply schedule of the United States intersects the import demand of the rest of world. When the loan rate is the market price, as in figure 18.9, this intersection occurs in the perfectly elastic portion of the U.S. export supply schedule. The level of U.S. exports is given by X^*.

If there were no U.S. loan rate policy, the equilibrium world price and U.S. export quantity would be determined by the intersection of the undistorted U.S. export supply schedule (ES ES') with the import

Figure 18.9

Trade Implications of U.S. Loan Rate and Target Price with Low Import Demand



demand schedule, ID. The resulting equilibrium world price is given by PF^* and the quantity of U.S. exports by X_F. The world market equilibrium price would be lower, and the quantity of U.S. exports would be greater than the solution with the loan rate policy. Thus, from the perspective of foreign nations, a binding U.S. loan rate is defined as an export tax because it raises the world price above free trade price and lowers U.S. exports. Magnitude of the price and export changes depends on the price elasticities of the behavioral relations.

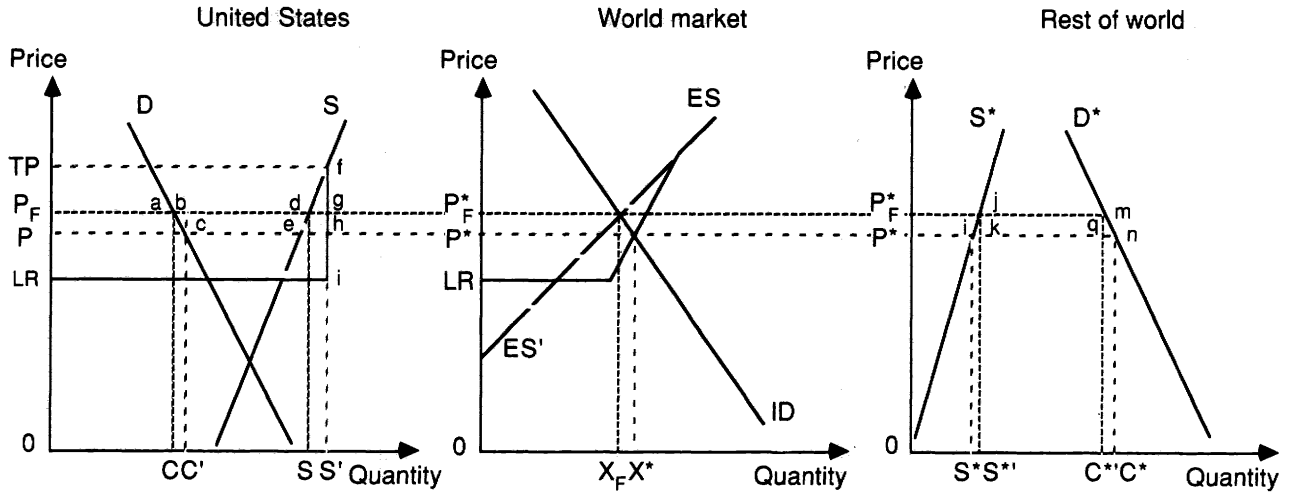
The higher world and U.S. prices resulting from the U.S. loan rate affect production and use in the United States and other countries. Production in both regions increases in response to the higher price. U.S. production rises from S to S', while foreign production increases from S^* to $S^{*'}$. Thus, the U.S. loan rate acts as a price support for foreign and U.S. producers. The higher world market price reduces consumption overseas, $C^{*'}$ compared with C^*. U.S. consumption of the commodity changes in two ways. First, millers, livestock feeders, and other users face a higher price; hence, use is less than in the absence of the loan rate. Second, the difference between production and private consumption (S'-C') exceeds the quantity exported (X^*), resulting in the accumulation of public stocks ((S'-C')-X^* or X^*_F-X_F). These are the public stocks whose subsidized disposal in world markets is analyzed in Chapters 19 and 20.

Income changes resulting from the loan rate can be traced to producers and consumers at home and abroad. The higher price faced by U.S. and foreign consumers suggests a loss of consumer surplus, areas P_FLRac and P_F^*LRkm, respectively (fig. 18.9). Because the loan rate supports producer prices in both regions, producer surplus rises by area P_FTPvf in the United States and by area P_F^*LRhg overseas. Expanded production in both regions pulls additional resources into agriculture. Because the loan rate acts as an export tax, U.S. farmers receive an income transfer from foreign consumers (area cbdf equals area ihkj). U.S. taxpayers pay an implicit subsidy to producers as the Government purchases stocks to support the price at the loan rate, and taxpayers pay deficiency payments of LRTPvn.

A second case is illustrated in figure 18.10, where the market-clearing price falls between

Figure 18.10

Trade Implications of the U.S. Loan Rate and Target Price with Moderate Demand



the target price and the loan rate (that is, the loan rate is not effective). The free market price would be PF and the quantity of U.S. exports X_F. When the U.S. target price is operational, the distorted U.S. export supply equals import demand at a world price, P^*, and the U.S. exports quantity, X^*. Figure 18.10 shows that the world market price, when the operational target price is P^*, is less than the price that would have prevailed without the distortions, P^*_F. Because the world market price is lowered by U.S. policy, exports (X^*) are correspondingly greater than the undistorted level, (X_F). The U.S. target price and associated deficiency payment appear to other countries as an export subsidy which lowers the world price and promotes U.S. exports.

The fall in the world market price can be explained by recognizing that, in the absence of land retirement programs, payments to U.S. farmers encourage additional production. The U.S. and foreign consumer price must fall to absorb this additional production thereby expanding use. Consumer surplus in both regions increases (areas PP_Fac and $P^*\ P^*_Fmn$) as U.S. policy implicitly subsidizes both groups. Because U.S. farmers receive the target price and expand production, U.S. policy also subsidizes U.S. farmers; producer surplus rises by P_FTPfd. Foreign producers suffer as their prices fall. Producer surplus in the rest of world declines by area $P^*\ P^*_Fji$. Declines in foreign production result in resources leaving the agricultural sector. Thus, U.S. taxpayers and foreign producers subsidize U.S. producers, U.S. consumers, and foreign consumers. Area kjmq represents the subsidy received by foreign consumers from U.S. taxpayers.

If the loan rate were binding between P^*_F and P^*, the combination of target prices and loan rates could also be interpreted as an export subsidy given that market price (the loan rate) is below free trade price.

Land Retirement Programs

The analysis of the effects of the target price and the loan rate assumed that the U.S. Government did not have a land retirement program. Compliance with set-aside or paid diversion programs, however, is necessary in most years for producers to receive program benefits, such as deficiency payments or

nonrecourse loans. Tying program benefits to participation in land retirement programs can offset the export subsidy aspects of the target price policy, but does not change the export tax effects of the loan rate. When the loan rate is the effective market price, land retirement programs reduce buildup of public stocks but do not raise prices.

Consequences of a land retirement program when only the target price is operational are shown in figure 18.11. The initial equilibrium price, which would have prevailed without the target price policy, is $P^{*'}$ and trade is $X^{*'}$. Quantity of U.S. exports with the target price policy (TP) is X^*. Land retirement shifts the U.S. domestic supply schedule inward (left). This shift in the U.S. domestic supply schedule shifts the U.S. export supply schedule to the left for prices above the loan rate to ES'.

The land retirement program raises world market equilibrium price to $P^{*'}$ and reduces U.S. exports from X^* to $X^{*'}$. If supply were managed such that the new price $P^{*'}$ was the same as the preintervention price, then the acreage reduction program would exactly offset export subsidy effects of the target price. The net result is to raise U.S. producer income without distorting trade. If the actual supply shift is greater than that shown, this would result in an implicit export tax rather than an implicit export subsidy. If the actual supply shift is less than that shown, the implicit export subsidy, although smaller, remains.

Figure 18.12 shows the effect of the land retirement program when prices are at the loan rate. The shift in the U.S. export supply schedule does not change the world market price, which remains at the loan rate. Because the world market price is unaffected, exports are unchanged, and the loan rate continues to act as an implicit export tax. The only change in this scenario is that the amount of stocks accumulated by the U.S. Government falls from $(X^*\text{-}k)$ to $(X^*\text{-}k')$ as a result of reduced production. Thus, land retirement programs substitute for stockholding given a target price and loan rate program.

U.S. Grain Stocks

An important feature of U.S. commodity programs is the willingness of the U.S. Government to hold stocks. In theory, stockholding could be used to help stabilize commodity price variations. But, too

Figure 18.11

U.S. Land Retirement Program with Target Price

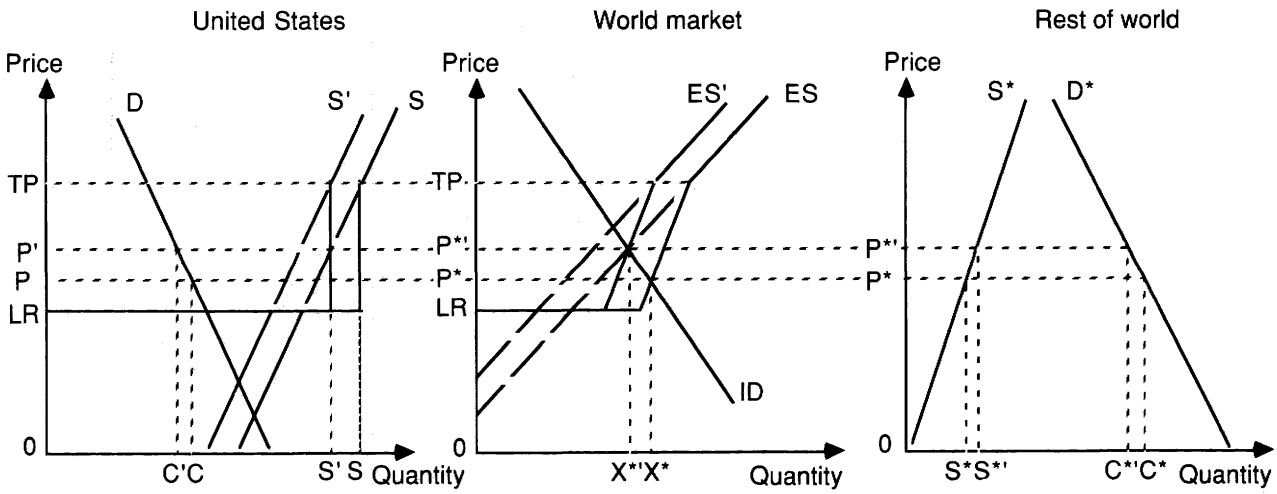


Figure 18.12

U.S. Land Retirement Program with Loan Rate Effective

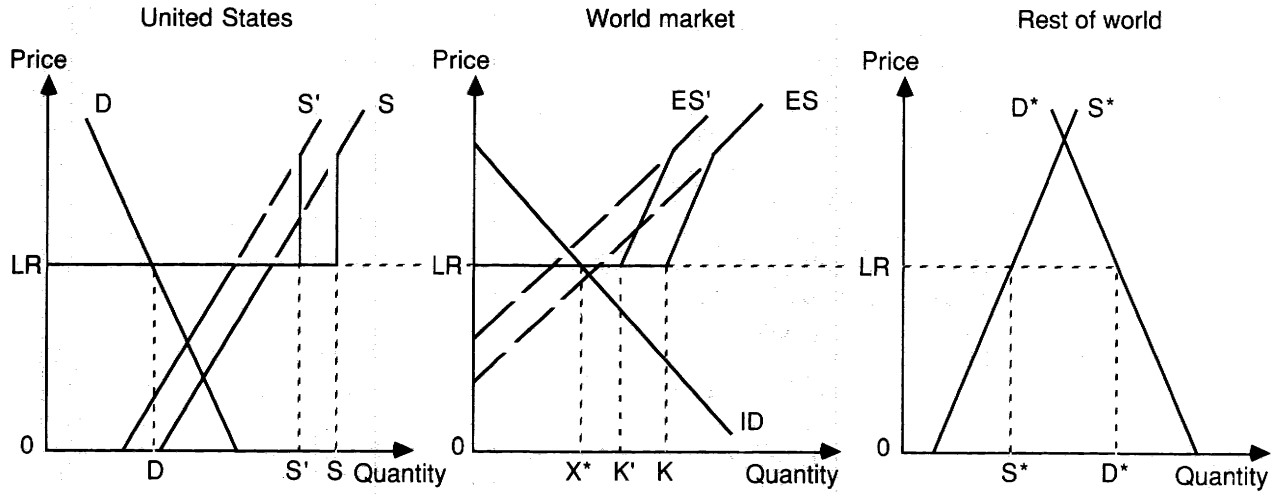
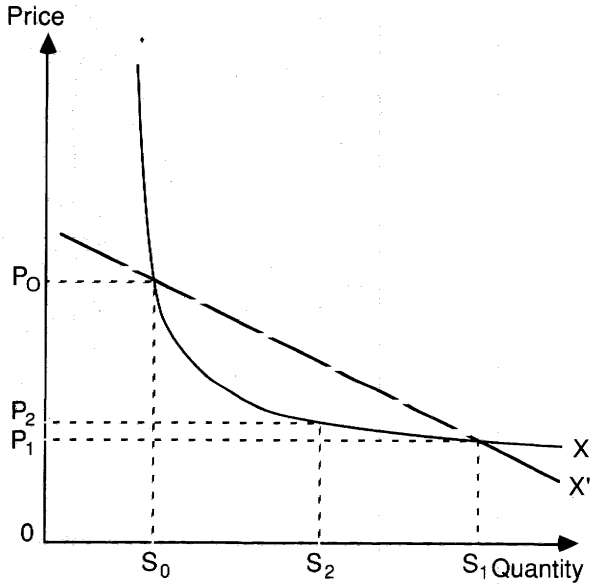


Figure 18.13

Stock Demand and Price Response



frequently, loan rates and target prices have been set at levels which accumulate public stocks.

Grain stocks can be classified into two types: Working stocks and carryover stocks. The former are stocks in the pipeline on the way to the consumer and remain as a relatively constant proportion of consumption. Carryover stocks refer to the residual held over as insurance against shortages. They are held because they are expected to increase in value. The quantity of carryover stocks may be very sensitive to economic conditions, and therefore, highly variable from year to year.

It is crucial in modeling impacts of stock reductions to know whether carryover stock demand is linear or nonlinear. Studies included in a survey by Schmitz strongly suggest that it may be nonlinear *(22)*. Figure 18.13 illustrates the point. If stock demand is X rather than X', then reducing stocks from S_1 to S_2 has little effect on prices. This suggests that stocks beyond certain levels overhang the market, depressing prices. At the other extreme, reductions of stocks below S_0 would significantly affect prices. If econometric models estimate a linear relationship, price impacts for stocks above S_2 or below S_0 could be wrong.

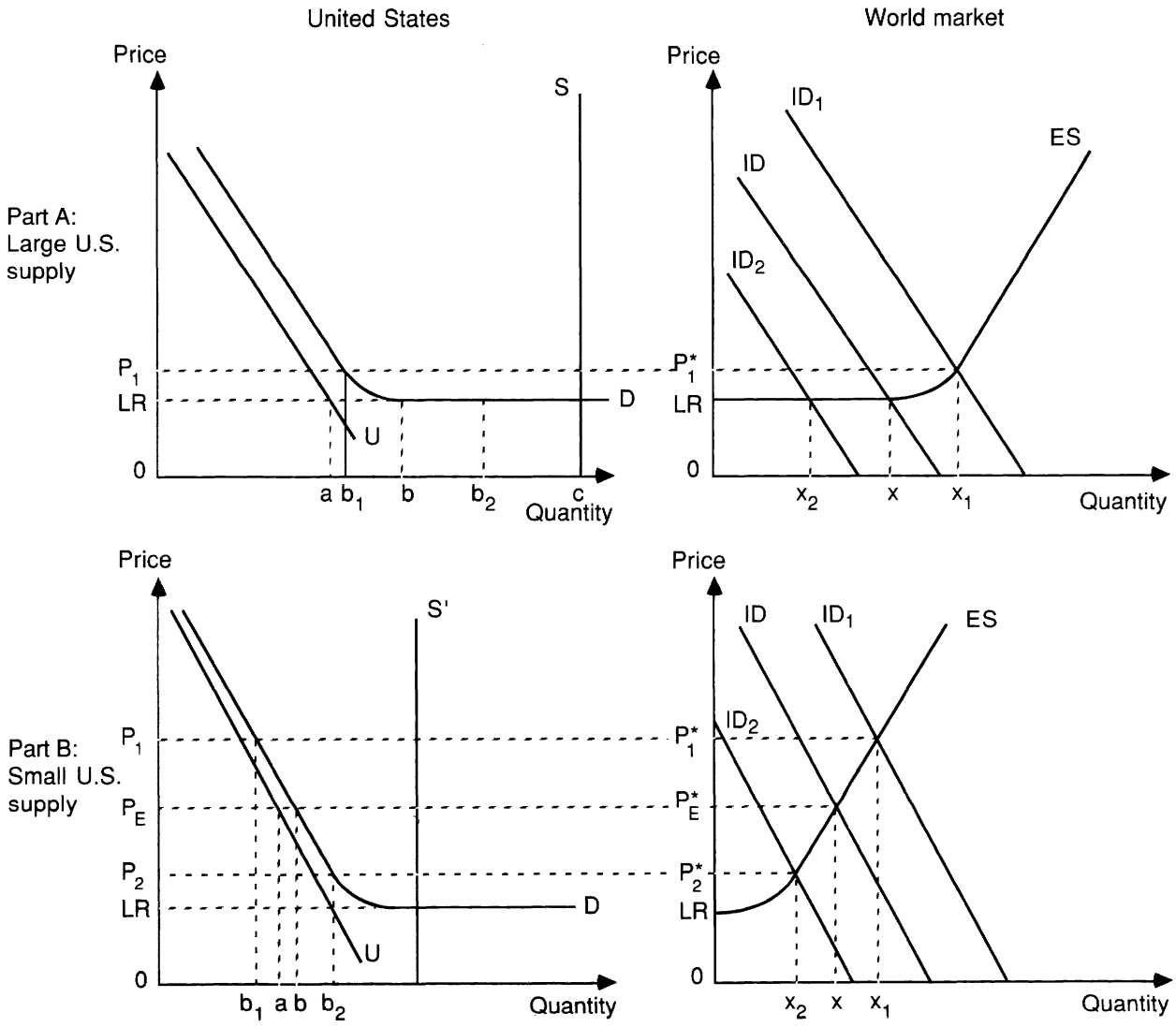
Stocks play a key role in the linkage between U.S. domestic and trade policies. The

economics of that linkage and the effect of two stock levels on the U.S. and world market is shown in figure 18.14. The three-panel diagram used in previous sections is modified for this analysis. In part A and part B, the foreign country is eliminated for simplicity. Shortrun (1 year) supply and demand curves show that supply equals production plus beginning stocks, supply is not responsive to current price (perfectly inelastic), and the demand for ending stocks (working plus carryover stocks) is nonlinear and is added to the demand for domestic use (U) to equal total domestic demand (D). The difference between curves D and U represents the demand for ending stocks, both public and private.

The U.S. export supply (curve ES) is derived by subtracting total demand (D) from total supply (S). The import demand of the rest of world is represented by ID. In part A, the United States holds large quantities of

Figure 18.14

Price Stability Implications of Large or Small U.S. Stocks



beginning stocks, and the market clears at the loan rate, LR. At that price, the United States consumes the quantity a and exports the quantity x (equivalent to c-b in the U.S. market diagram). Ending stocks of quantity b-a are carried over to the next year.

A shortage somewhere in the world could shift import demand out to ID_1, or a surplus could shift it back to ID_2. The shortage would force the market price up to P^*_1, but a contraction in import demand (ID_2) would not lower the market price. U.S. stocks demand, because of the price support policy, would hold the price at the loan rate, LR. Foreign market conditions could produce major shifts in the foreign demand for U.S. grain without affecting world price.

Stockholding by the United States is costly, and other nations (both importers and exporters) benefit. If in previous years the United States has pursued an alternative policy of reduced stocks as shown in part B where S' is to the left of S, then the market clears at price PE under normal import demand (ID). Now suppose import demand shifts as before. The shifts in foreign demand imply much more price variability under these conditions of reduced U.S. public stocks. The strong import demand would force the market price up to P^*_1, and the weak import demand would force the price down to P^*_2. The price differential is much wider than in part A. The reduction in U.S. beginning public stocks creates the potential for greater price variability in the world market.

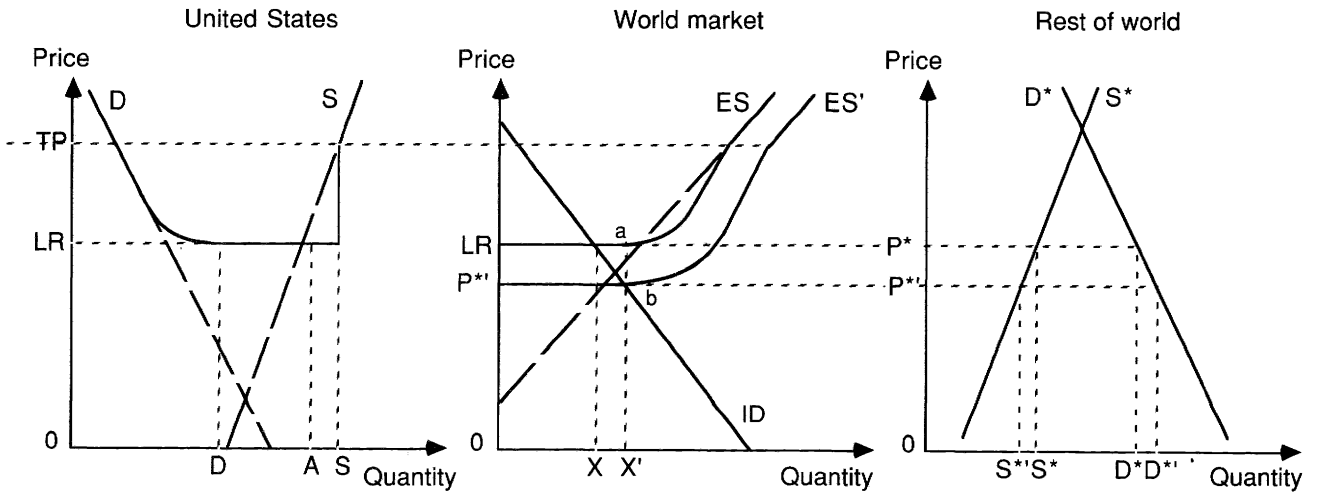
Export Subsidies and U.S. Commodity Programs

Having developed conceptual frameworks for export subsidies and for the trade effects of U.S. domestic commodity programs, the results obtained can be integrated into a framework which analyzes a U.S. export subsidy in the context of U.S. commodity programs. This shows in figure 18.15, which provides the basic conceptual model for the empirical analyses of surplus stock disposal presented in the following chapters.

In figure 18.15, the United States operates a target price and nonrecourse loan program as described previously. The target price introduces the perfectly inelastic segment in the U.S. supply schedule, while the nonrecourse

Figure 18.15

U.S. Export Subsidy with U.S. Domestic Commodity Programs and Prices at the Loan Rate



loan program introduces the perfectly elastic portion of the U.S. domestic demand. The nonlinear relationship between ending stocks and price as presented in figure 18.13 is shown by the curved portion of the U.S. demand schedule. Thus, the market has a potential for stock overhang. As in the earlier models, subtracting domestic demand from supply at each price gives the U.S. export supply schedule, denoted ES in the center panel.

Given the import demand shown by ID, the initial market equilibrium price is given by the U.S. loan rate, LR. At this price, U.S. exports are X. Because the quantity of U.S. exports at LR is less than the excess supply of the United States (S-D), the U.S. Government accumulates public stocks of AS.

If the U.S. Government is unwilling to hold these additional public stocks, it can dispose of these quantities in the world market by offering an export subsidy. The export subsidy shifts the U.S. export supply schedule as viewed by foreign nations outward to ES'. The subsidy causes the world price to fall from P^* to $P^{*'}$ and introduces a wedge between the U.S. price at LR and the world market price equivalent to the export subsidy. The lower world market price causes U.S. exports to expand from X to X'. Because of the stock overhang, the increase in U.S. exports is not large enough to raise the price in the U.S. market above the loan rate. Hence, the full effect of the subsidy on price appears as a lower world price.

As drawn in figure 18.15, the increase in U.S. exports is slightly larger than the public stock accumulation, and total ending stocks in the United States are lower. Over several years, successive reductions in stocks could raise U.S. prices above the loan rate. U.S. domestic prices would also rise if the import demand drawn in figure 18.15 were further to the right. This would increase the U.S. price given the same export subsidy. However, the nonlinear stocks relationship shows that the initial price increase would still be small.

Welfare changes from the U.S. export subsidy in the presence of commodity programs can also be determined from figure 18.15. In the rest of world, the lower price causes a loss of producer surplus and a gain in consumer surplus. As in figure 18.1, part of the foreign consumer gain is paid for by U.S. taxpayers. Since the U.S. price does not rise in this case, all of the subsidy costs ($P^{*'}$LRab) are transferred overseas as a gain to foreign consumers. However, U.S. taxpayers do benefit through reduced costs for purchasing and storing public stocks. Whether the net cost to U.S. taxpayers is greater or not is an empirical issue which depends on the level of the subsidy, the increase in exports, and the reduction of stocks.

The model just developed forms the basic theoretical structure for the empirical analyses in Chapters 19 and 20. The model suggests that a U.S. export subsidy could reduce U.S. public stocks, but that most of the benefits are captured by the rest of the world. Because of stock overhang, U.S. prices are slow to rise above the loan rate. The increase in U.S. exports is obtained from releasing public stocks. U.S. taxpayers save expenditures on the nonrecourse loan program, but foreign consumers capture the subsidy costs at the expense of U.S. taxpayers. The net result is an empirical issue examined in later chapters.

One final point needs to be emphasized. The nature of the total demand curve for U.S. exports is important in determining effects of farm price supports. If ID in figure 18.15 were more steeply sloped (more inelastic), it would require a larger subsidy (lower world price) to move quantity X'-X. Domestic costs for deficiency payments would be unchanged but subsidy costs would rise. Further, if import demand were inelastic, export earnings would fall. While international effects of lowering the loan would be the same, domestic costs would rise for deficiency payments. Supply control programs would also alter domestic and international costs. The point is that deficiency payments costs, export subsidies, and storage costs are interrelated. A change in a policy parameter such as loan rate, target price, or implementation of an export subsidy involves complex tradeoffs which need careful analysis.

THE BEHAVIOR OF COMPETING EXPORTERS

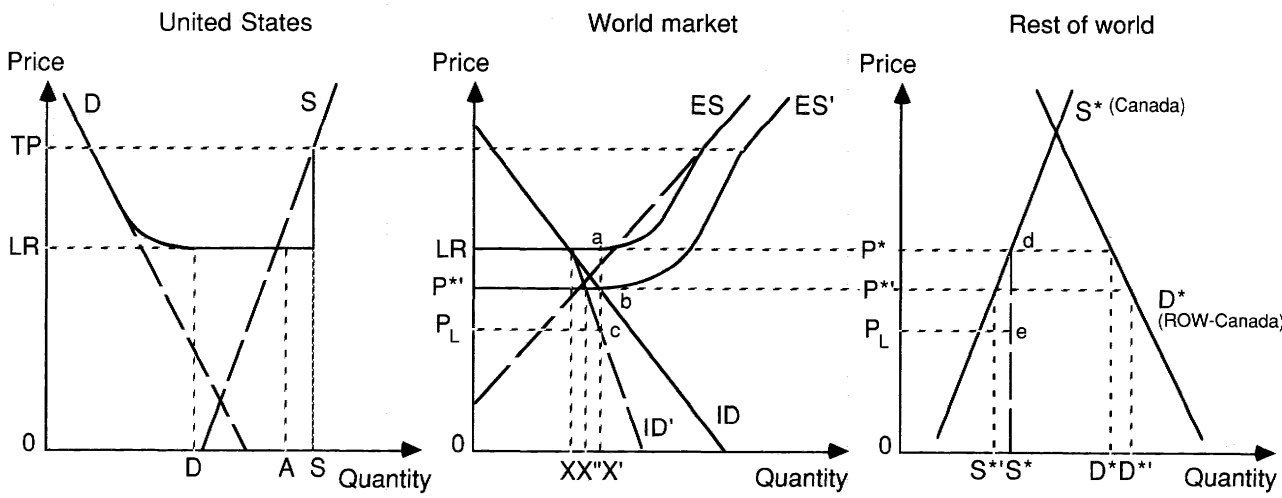
To date, the analysis has either assumed that the United States is the only exporter or that other exporters simply meet world prices; that is, they move along their export supply functions. However, other exporters could respond to an export subsidy program, general or targeted, in at least two ways. First, they could choose to implement new policies (or alter existing ones) to shelter their producers from falling world prices. Second, they could aggressively retaliate against U.S. subsidies by price wars or export subsidies to defend absolute or relative market shares. Because passivity on the behalf of other large exporters may be a questionable assumption, we investigate several cases.

Domestic Policy Changes by Other Exporters

A domestic policy response in other exporters can be shown with a modification of figure 18.15. This is shown in figure 18.16 where we redefine S^* as the net export supply function from, say, Canada. D^* is then the net import demand of the rest of the world less Canada. Before the export subsidy, world price was at the loan rate (LR), the United States was exporting X (DA) and holding stocks of AS. Canada was exporting S^*. With the implementation of the subsidy, prices in the rest of the world drop to $P^{*'}$ and U.S. exports increase to X'. The increase in exports results both from an expansion in import demand D^* to $D^{*'}$ and a contraction of Canadian exports to $S^{*'}$. Canadian producers are clearly worse off. Suppose Canada had (or implemented) a target price deficiency payment to guarantee her producers P^* (recall the assumption is that the United States has a similar program to guarantee her producers price TP). The result would be to make Canadian excess supply perfectly inelastic below P^* (assuming Canadian consumers pay P^* also). This would kink ID at P^*, making it more inelastic as is shown with ID'. Result of the Canadian domestic policy is that world prices fall to $P^{*'}$, but U.S. exports expand only to X'' rather than X', and the United States again holds stocks. If the United States wished to increase exports to X', an additional export subsidy of $P^{*'}$-P_L would be necessary, lowering world price to P_L. To summarize, a U.S. export subsidy

Figure 18.16

U.S. Export Subsidy with U.S. Domestic Commodity Programs and Exporter Domestic Support



program to dispose of a fixed amount X'-X now becomes more expensive (the increase in cost is $P^{*'}bcP_L$) when Canada responds by guaranteeing its producers the old world price. Note also that the U.S. subsidy also increases costs of Canada's farm policy by $P^{*}deP_L$.

It is immediately clear that domestic policy response by other exporters either renders the U.S. export subsidy program less effective or greatly increases the cost of the program to move a fixed quantity of stocks. This follows because domestic intervention by other exporters makes the excess demand facing the United States more inelastic.

Defense of Market Share

The second case to be considered is where other exporters respond to U.S. subsidies with trade policy in the form of retaliatory export subsidies in an effort to retain their market share. Cost of retaliatory subsidies is proportional to the volume of exports. The larger the trade level, the more costly are retaliatory export subsidies. Research in this area shows that a price war can erupt as exporters compete to retain market share *(5, 15)*.

Figures 18.17 and 18.18 illustrate how a policy of defending market share can result in a price war in international markets. In figure 18.17, ID is the import demand faced by Canada in the world wheat market and ID^{*} is the import demand jointly faced by the United States and Canada. The schedule MS denotes the minimum acceptable market share for Canada, which the Canadian Wheat Board is prepared to defend by engaging in a trade war. Figure 18.17 depicts a stable market equilibrium prior to the U.S. export subsidy at a world price of PF. Canadian exports are given by XC, and U.S. exports are XF-XC. According to the market share relation, Canada's minimum acceptable share is XA; hence, the maximum allowable U.S. share is XF-XA. In this situation, actual U.S. exports are less than the maximum share desired by Canada.

Figure 18.17

Stable World Market Pricing

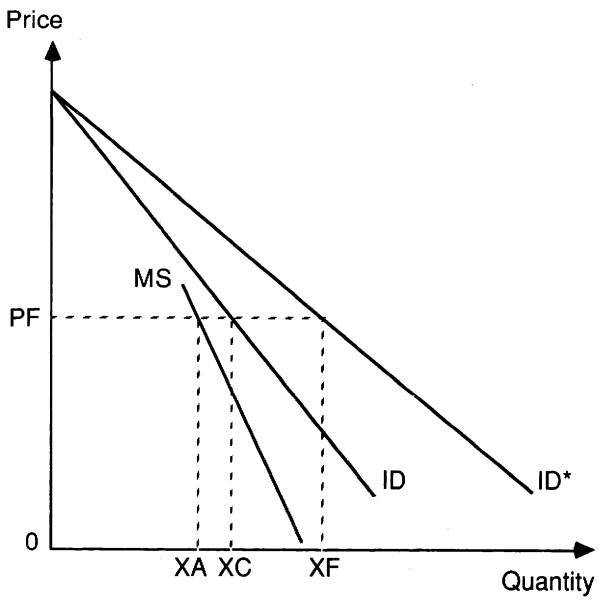
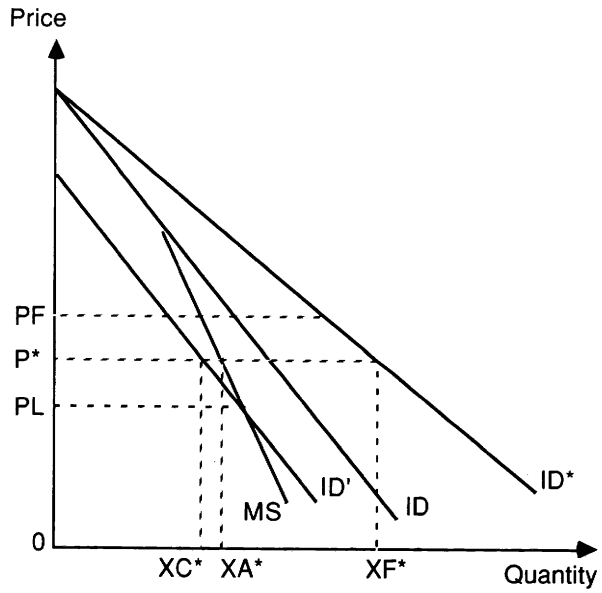


Figure 18.18

Canadian Retaliation to a U.S. Export Subsidy



Suppose that the United States introduces the export subsidy as shown previously. That subsidy lowers world price to P^* and increases U.S. exports by shifting the U.S. export supply to the right. This is shown in figure 18.18 by a reduction in the import demand facing Canada from ID to ID'. At the new world price, P^*, Canada exports XC^* and the United States exports XF^*-XC^*. Unlike the situation depicted in figure 18.17, with the subsidy, U.S. exports exceed the market share permitted by the Canadians, XF^*-XA^*.

The Canadians have three choices. First, they could re-evaluate their notion of a minimum acceptable share. This is, in effect, what the model in figure 18.1 assumed. Second, they could negotiate a reduction of the subsidy with the United States to shift ID' right such that the minimum Canadian share is restored at P^*. Third, the Canadians could retaliate by starting a price war to regain market share. The lower bound of the price war occurs at PL, where the Canadians obtain their minimum acceptable share. Whether the world price declines to PL depends on the reaction of the United States. The price can stabilize anywhere between P^* and PL depending on whether the United States reduces the subsidy enough to give the Canadians their acceptable share.

The subsidy may or may not increase U.S. market share, depending on how market shares prior to the U.S. export subsidy are related to the acceptable shares. If initial shares correspond to the acceptable shares, Canadian retaliation simply restores the shares at a lower price. If the United States is initially below its allowable share, the subsidy policy can increase its share.

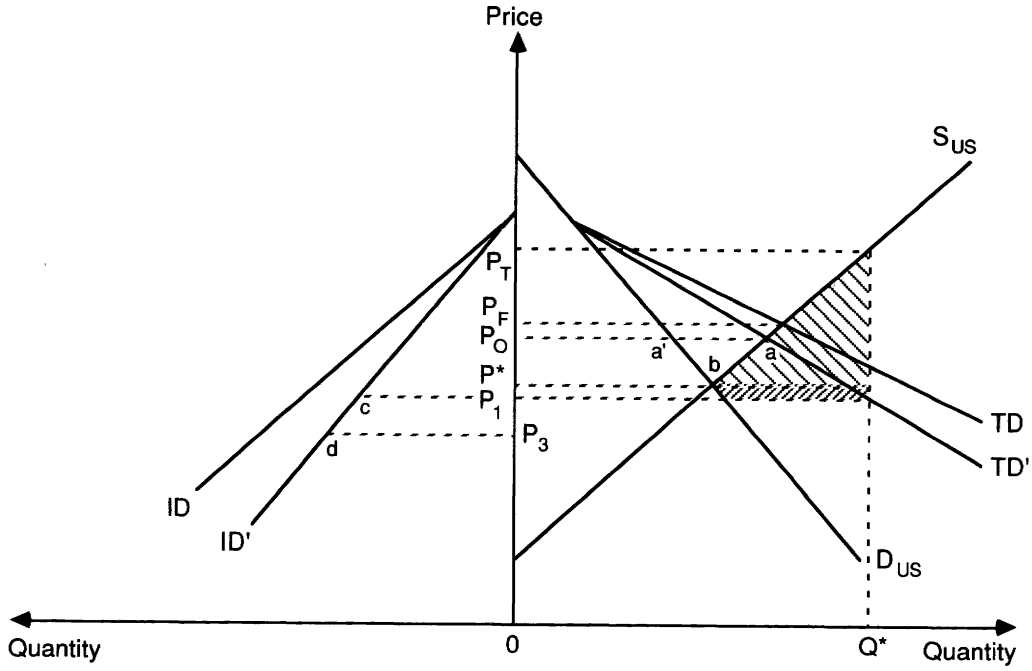
Targeted subsidies by the United States could also meet opposition from fringe exporters. For example, if Canada and Australia wished to maintain their market in those areas where the United States has instigated targeted subsidies, the United States may be unsuccessful in increasing market share substantially. Also, this type of response from the fringe makes the demand for U.S. products by the targeted nations relatively more price inelastic. However, even if this is the case, targeted subsidies which essentially provide a price discrimination mechanism could well prove to be less costly than disposing of excess stocks entirely by paying a general subsidy. A problem arises because the fringe exporters would shift and attempt to increase sales in high-income markets. This would then require the United States to use defensive subsidies to protect its high-income markets. A war of targeted or general subsidies would drive world prices very low and greatly increase costs. It could also cause a severe farm depression in importing nations which do not intervene. We return to this point in the next section.

EFFECTS OF IMPORTER POLICIES

Our analysis so far assumed that importers do not distort the import demand schedule facing the United States by production subsidies, tariffs, quotas, and/or price supports. However, in reality, this is seldom the case. Distortions introduced by importers shift the import demand curve inward while at the same time making it more price inelastic *(21, 22)*. This is illustrated in figure 18.19 where ID' is the distorted import demand curve which shifts total demand to inward TD'. In the absence of U.S. price supports, the distorted trade price is P^O which is below the free trade price P_F. The United States clearly loses from importer distortions. Now, if producer price is to be supported at P_T in the United States, the net cost to the United States is greater by the double cross-hatched area than in the earlier case of no importer distortions. Since the import price P_1 falls below P^*, the price that would have existed without import distortions, the loss from trade now becomes larger than before (the cross-hatched area minus a'ab). This has happened even though total U.S. output Q^* has not changed. Net cost to the United States from the price support system and the export subsidy increases because importer distortions have reduced the size of the import market. Thus, for a given quantity of exports to clear the market, prices have to fall further than they would without importer

Figure 18.19

Export Subsidies in the Presence of Importer Distortions



distortions. As a result, for a given U.S. producer target price, the greater the degree of distortions imposed by importers, the larger the actual export subsidy needed.

If the producer target price PT is to remain unchanged, U.S. deficiency payments and/or the cost of export subsidies increases as importers impose more and more distortions. Given these distortions, is the appropriate U.S. policy response more subsidies? If the U.S. intent is to achieve the maximum gains from trade and/or minimize the net cost of farm programs, such a strategy may not work unless U.S. subsidies are able to inflict hardships on importers such that they will remove their distortions, thus causing ID' to shift back to ID. However, whether governments will allow this to happen is questionable since by lowering the import price in the presence of distortions, importers gain. For example, if price is lowered to P_3, from higher price supports, importers gain an additional P_1cdP_3. At price P_3, the gains from trade for importers exceed those at price P^* where no importer distortions were present. Thus, if distortions are present in importing nations, it does not follow that these will be removed if exporters put in place subsidy distortions *(13)*.

As has been emphasized, for a given U.S. farm price support level, the economic cost to the United States critically depends on the price elasticity of the excess demand curve facing the United States. The more price inelastic the import demand schedule, the greater is the cost of export subsidies. From the U.S. standpoint, the unfortunate feature is that when importing countries impose domestic subsidies, quotas, and the like, this demand curve becomes more price inelastic relative to a nondistorted import demand schedule.

There is an additional problem with estimates that suggest low international transmission price elasticities, especially for wheat. This means that there is not a one-to-one correspondence between international prices and domestic prices. World prices can drop, but domestic prices remain unaffected. Thus, for example, a drop in the price to an importer due to a price subsidy need not affect demand even if the internal demand curve is price elastic. For example, if an importing country gives a price subsidy for consumers which results in an internal price below the import price, lowering export price by a subsidy will merely reduce the Government consumer subsidy costs (the country will not necessarily import more because consumption has not changed because internal prices have not changed). To illustrate the point that often there is no relationship between export prices and internal price, the price that millers pay for wheat in Japan is at least three times the import price. Lowering or raising this price by export taxes or subsidies does not affect consumer demand for bread as internal prices are not affected by the export price. This phenomenon can give rise to both low international transmission price elasticities and low import demand elasticities. These factors make the task of export expansion more difficult.

EMPIRICAL ANALYSES OF EXPORT PROGRAMS

This section discusses empirical results obtained by previous researchers analyzing trade effects of U.S. export programs. The studies are grouped into four categories. The first two categories consist of studies which directly analyze hypothetical U.S. export subsidies and studies which assess the impact of U.S. sales programs to expand demand. U.S. commodity programs have implicit export subsidy or tax effects from the perspective of other countries. The last two categories analyze export promotion programs and U.S. commodity programs.

Export Subsidies

Export subsidies are one of the most common forms of trade interventions by exporting countries; the United States is no exception. Until the early 1970's, the United States used export subsidies extensively. During the early 1980's, the United States again occasionally subsidized exports.

Despite the frequent use of export subsidies, empirical analysis is limited because most of the conceptual issues of export subsidies are well-known. Most analyses consist of staff analysis performed by Government agencies as part of the input into policy decisions. What differs in the analyses are the parameter values used for determining results. As shown above, effects of an export subsidy are largely conditional on values of the import demand and export supply elasticities used. These elasticities determine the incidence of the price changes, the increase in exports, and changes in trade value.

Results of one analysis of hypothetical U.S. export subsidies for wheat are shown in table 18.1 *(19)*. These results illustrate the important role of the elasticity of import demand to the conclusions. If the import demand facing the United States in world wheat markets is inelastic, increases in the U.S. domestic price and in exports are slight, while the decline in the world (export) price is large. With an inelastic import demand, U.S. export revenue falls. For example, Salathe and Langley show that if the import demand elasticity is -0.25, a 15-percent export subsidy raises the U.S. domestic price and U.S. wheat exports by 1.8 and 3.3 percent *(19)*. The export price for U.S. wheat in world markets falls 13.2 percent, while export revenue is 10.3 percent lower. Using 1985/86 crop year values, the subsidy costs the United States $0.7 billion.

In contrast, if the import demand facing the United States is more elastic, U.S. domestic prices and exports will show greater increases, while the export (world) price will fall less. Further, if the import demand is elastic, then

the subsidy raises export revenue. These conclusions are demonstrated in table 18.1. If the import demand elasticity is assumed to equal -4.0, then the 15-percent subsidy raises U.S. domestic wheat prices by 8.4 percent and U.S. wheat exports by 26.6 percent. In this instance, the export price in world markets falls by only 6.6 percent, and the export revenue earned by the United States on wheat trade rises 18.2 percent.

Results of other export subsidy analyses for U.S. wheat exports are given in table 18.2. These results are consistent with those of Salathe and Langley *(19)*. For wheat, export subsidies of 14-20 percent cause U.S. wheat exports to rise 6-14 percent. U.S. wheat prices rise 5-16 percent, while prices in the world market fall 4-11 percent. The subsidy costs necessary to obtain this expansion in exports range from $1 billion to $1.9 billion. The cost estimates differ because analysts used different base periods with differing price levels and export volumes. Nevertheless, all studies show that export subsidies are extremely costly to taxpayers.

One study reported in table 18.2 analyzed export subsidies in a slightly different framework. Results obtained by Sharples in a USDA staff analysis dated May 15, 1984, show a much larger expansion in U.S. wheat exports than reported by other researchers for similar subsidy levels *(24)*. For an export subsidy of 21.2 percent, U.S. wheat exports expand 21.4 percent. This large expansion occurs for two reasons. First, Sharples assumes that the import demand elasticity

Table 18.1--Effects of a U.S. export subsidy for wheat when the elasticity of import demand varies

Elasticity of import demand	Export subsidy	Change in-- U.S. price	World price	U.S. exports	Export revenue	Subsidy costs
	Percent					*Billion dollars*
-0.25	15	1.8	-13.2	3.3	-10.3	0.7
- .50	15	3.0	-12.0	6.0	-6.7	.7
-1.00	15	5.1	-9.9	9.9	-.1	.8
-2.00	15	6.3	-8.7	17.5	7.2	.8
-4.00	15	8.4	-6.6	26.6	18.2	.9

Source: (*19*).

Table 18.2--Estimates of the effect of a U.S. export subsidy for wheat in previous research

Study	Elasticity of import demand	Export subsidy	Change in-- U.S. price	World price	U.S. exports	Export revenue	Subsidy costs
		Percent					*Billion dollars*
1	-1.5	20.0	15.8	-4.2	6.2	2.2	1.9
2	1/-.7	14.3	5.0	-9.3	6.7	-3.2	1.0
2	2/-1.5	14.3	10.0	-4.3	6.7	1.9	1.0
3	-1.0	21.2	3/	-21.2	21.4	-4.9	1.6
4	1/-.8	20.0	12.1	-10.3	8.6	-2.6	1.0
4	2/-1.2	20.0	10.9	-11.2	14.1	1.2	1.0

1/ Shortrun import demand elasticity.
2/ Longrun import demand elasticity.
3/ U.S. price assumed fixed at the loan rate.

Sources: (*17*, *24*, *26*, *28*).

facing the United States in the world wheat market equals -1.0. Thus, the increase in U.S. wheat exports matches the decline in world prices caused by the subsidy. Second, Sharples assumes that the U.S. loan rate supports the world price; thus, the import demand and export supply schedules intersect in the perfectly elastic portion of the export supply schedule. When the loan rate supports the price, the full subsidy may be felt in the market as a decline in the world price because of the stock overhang shown in figure 18.15, a 21.2-percent decline. Consequently, the increase in U.S. exports is greater for a given export subsidy under these circumstances.

Table 18.2 results also show that, in the long run, once production begins to adjust to the price changes induced by the subsidy, the expansion of U.S. wheat exports is greater. Further, while there are shortrun losses in U.S. export revenue, the United States improves its export earnings in the long run.

Results of export subsidy analyses for coarse grains are given in table 18.3. These are consistent with the results obtained for wheat and with the conceptual model presented earlier. An export subsidy on coarse grains of 18-20 percent raises the U.S. domestic price of coarse grains 4-7 percent. The U.S. export (world) price falls 14-15 percent. In the short run, U.S. coarse grain exports are 9-10 percent greater, but U.S. export revenue is 7-8 percent lower. In the long run, U.S. coarse grain exports are about 20 percent greater and export revenue is about 3 percent higher.

Export subsidies are sometimes advocated as a means of pressuring the EC to reform its grain policy. Objective of the subsidy would be to reduce world prices and as a result place additional budgetary stress on the EC. The theoretical model of export subsidies developed previously shows that the cost of matching the U.S. export subsidy depends on the decline in the world price and the level of the competitor's exports. The studies reviewed suggest a decline in world prices of 4-15 percent. For the EC, with small net exports compared with those of the United States, added cost of the subsidies is slight relative to U.S. outlays. Paarlberg and Sharples estimate that for $1 of additional export subsidy cost on wheat by the EC, the United States must pay $10 given the 1980 market situation *(17)*. With the increase in EC net exports in the early 1980's, U.S. leverage improves. By 1985/86, ERS estimated that $5 of subsidy payment on wheat would cause a $1 increase in EC subsidy costs. Thus, given the ERS subsidy cost estimate of $1 billion for the United States, the EC spends an additional $200 million. For coarse grain, the cost comparison in 1985/86 is an unfavorable 30 to 1 because of the small level of EC exports compared with the level of U.S. coarse grain exports.

These studies considered a uniform, global U.S. export subsidy. As discussed in the previous

Table 18.3--Estimates of effects of a U.S. export subsidy for coarse grains

Study	Elasticity of import demand	Export subsidy	Change in-- U.S. price	Change in-- World price	Change in-- U.S. exports	Change in-- Export revenue	Subsidy costs
			Percent				Billion dollars
1	-0.5	18.2	3.6	-14.5	8.7	-8.4	1.3
2	1/-.6	20.0	5.0	-15.8	10.2	-7.3	1.1
2	2/-1.4	20.0	7.3	-14.2	19.6	2.6	1.3

1/ Shortrun import demand elasticity.
2/ Longrun import demand elasticity.

Sources: (*23*, *28*).

sections, export subsidies can be targeted to specific buyers. As the economics of targeted export subsidies is a relatively new research area, empirical analysis is limited. Table 18.4 shows the results of Abbott, Paarlberg, and Sharples in an analysis of hypothetical targeted U.S. wheat export subsidies *(4)*. Unlike the global subsidy which is exogenously imposed on the model, the model determines the pattern and magnitudes of targeted subsidies. The United States is assigned an objective for the subsidy program, and the optimal pattern and magnitudes of subsidies are selected to maximize the objective. Table 18.4 reports results of three scenarios. The first scenario assumes that the United States selects uniform, targeted subsidies to maximize its economic surplus. This scenario yields subsidies of either zero or 2.3 percent of the base U.S. price. The U.S. domestic price rises 1.2 percent, and U.S. wheat exports are 0.9 percent greater. Cost of the program is only $0.08 billion. Economic surplus and farm income are 0.2 and 1.2 percent higher.

The remaining two scenarios shown in table 18.4 allow the United States to pay discriminatory targeted subsidies. If the U.S. objective is to maximize economic surplus, the optimal subsidies are zero for most nations and are no higher than 2.3 percent of the U.S. wheat price. The subsidies raise the U.S. domestic wheat price by 1 percent and expand wheat exports by 0.7 percent. The program costs $0.06 billion and raises U.S. economic surplus by 0.3 percent. The economic surplus increases more in this case compared with the uniform subsidies because the latter adds a constraint that all positive subsidies are identical. Adding a constraint to an optimization problem lowers the objective function value if that constraint is binding.

If the U.S. objective is to maximize farm income, then optimal export subsidies range from 0-19.8 percent. The U.S. wheat price is 4.4 percent greater and U.S. wheat exports are 3.3 percent higher. Because the subsidies are given to more countries and are larger, cost of the program is greater, $0.38 billion. While U.S. farm income is 4.4 percent greater, U.S. economic surplus falls 1.1 percent.

The theoretical framework for analyzing targeted export subsidies discussed previously showed that the countries which receive subsidies either have a relatively price-responsive import demand or are shared with a major competitor. The Abbott, Paarlberg, and Sharples analysis conforms with the theory *(4)*. For the two scenarios in which the United States maximizes economic surplus, Eastern Europe and China receive subsidies to exploit an elastic import demand. These two nations are assumed to be price responsive because they face a shortage of foreign exchange. East Asia and the USSR are subsidized to defend U.S. market share against Australia and Canada. In the scenario which maximizes U.S. farm income, Brazilian and European importers are included in the list of countries receiving subsidies to defend against

Table 18.4--Effects of targeted subsidies for wheat

Policy	Subsidy	Change in-- U.S. price	U.S. exports	Economic surplus	Farm income	Subsidy costs
		Percent				*Billion dollars*
Uniform	0-2.3	1.2	0.9	0.2	1.2	0.08
Discriminatory:						
Surplus	0-2.3	1.0	.7	.3	1.0	.06
Income	0-19.8	4.4	3.3	-1.1	4.4	.38

Source: *(4)*.

competitors. The remaining countries in the model do not receive a subsidy. These results depend on the assumption of no importer response other than meeting U.S. price. While it is theoretically and empirically difficult to include retaliation or domestic policy response, it is clear, *a priori*, that addition of these reactions would reduce U.S. gains from targeted subsidies.

Demand Expansion Programs

The United States has several programs providing food aid or credit to eligible nations. There is considerable debate on whether these programs can be analyzed as export subsidies, as we have done above by calculating the subsidy-equivalent of the program, or whether such programs must be treated as income transfers. The theoretical presentation shows that if these programs are treated as income transfers, then the critical parameter is the income elasticity of demand for the grain and the share of expenditure devoted to consumption of the grain. Abbott argues that, for wheat, these parameters are typically small.

The effect of P.L. 480 food shipments on importing nations has been extensively studied. Results suggest that the net increase in a country's imports depends on the individual country and the institutions through which food aid is distributed. By law, P.L. 480 shipments are to be in excess of commercial exports. Abbott and McCarthy demonstrate that the incentive to avoid this restriction is strong *(2, 3)*. Abbott measures the cost imposed on importers by this additionality constraint. For Mexico, the cost is almost 15 percent of the value of the aid (credit), while for many other nations the cost is as high as 35 percent. Thus, these nations have a considerable incentive to avoid the additionality constraint. Sarris, Abbott, and Taylor examine world grain trade and conclude that concessional sales in most countries are only partially additional *(20)*. In the case of Brazil, Hall concludes that a 1,000-ton increase of P.L. 480 wheat shipments causes an 893.5-ton decrease in commercial imports *(12)*. Thus, for Brazil, the additionality appears to be around 10 percent. In an econometric analysis of P.L. 480 shipments, Smith and Love report that the additionality factor for total U.S. wheat exports is 20-25 percent the first year, and 10-20 percent after 5 years for a sustained change *(27)*.

In contrast to these results, there is evidence that the additionality can be higher. Rogers, Srivastava, and Heady find that distribution of food aid in India through fair price shops causes an increase in demand because these shops distribute aid in a low-priced concessional market *(18)*. Removing this institutional structure reduces the impact of aid to 10 percent of the level with the fair price shops. Gardner and Parker examine the Egyptian market in detail *(8)*. They argue that Egypt is a large potential market, but that food aid and credit guarantees are needed to tap that potential. Mekonnan develops a cereal import demand model for the principal food aid recipient African countries *(16)*. The study uses pooled, cross-sectional, time-series data for nine countries over 1970-77. Shortrun response elasticities for price, income, production, food aid, and export are -0.295, 0.262,-0.140, 0.096, and 0.295. The corresponding longrun response elasticities for price, income, production, food aid, and exports are -0.789, 0.700, -0.374, 0.257, and 0.789. Of particular interest is the conclusion that food aid and commercial imports are complementary. For African countries, this may be due to food aid's effect on influencing tastes to diverge from traditional diets.

While there are individual countries where income transfer programs greatly increase demand, studies of overall effects of such programs on U.S. exports suggest substantial displacement of commercial exports. This occurs because income effects of such transfers are low and because the constraint on additionality is costly, and countries have the incentive to avoid such conditions.

Export Promotion Programs

Another set of programs attempts to expand demand through promotional activities. Williams analyzed the return from U.S. soybean export market development *(30)*. Expenditures are financed by contributions from soybean growers, the U.S. Government, and third-party contributors in the host country. Williams estimated that returns to all contributors averaged roughly $62 per dollar invested between 1970 and 1980, while grower returns averaged slightly lower at $58 per dollar invested. Gunjal estimated the returns from Canada's grain export market promotion and found that these expenditures yielded returns well above the market rate of interest *(11)*. Grigsby considered the effect of market development programs on Japanese import demand for coarse grains and soybeans from 1966-80 *(9)*. As in the other studies, the rate of return is estimated to be high.

Effects of U.S. Commodity Programs

From the perspective of other countries, U.S. commodity programs have effects similar to trade interventions. In an earlier section of this chapter, we showed that the target price by itself appears to foreigners as an export subsidy. In contrast, loan rates and land retirement programs appear as export taxes. The following discussion reports analysis that calculates the net effect of U.S. commodity programs.

Zellner argues that the 1985 crop year policies, if extended into the 1986 crop year, effectively tax U.S. wheat and corn exports if there are land retirement programs, or if the loan rate is effective *(31)*. For wheat, if only the target price of $4.38 per bushel is effective (market prices between $4.38 and $3.30 per bushel) then U.S. wheat exports receive an implicit export subsidy of between $1.03 and $1.37 per bushel depending on the strength of import demand. As land retirement programs are incorporated, the implicit subsidy shifts to an implicit export tax. In the case of a 20-percent acreage retirement plus a 10-percent paid diversion, the implicit export tax ranges from $0.63 to $0.71 per bushel, again depending on import demand. When the U.S. wheat price settles on the $3.30 per bushel loan rate, the implicit U.S. export tax rises to between $0.49 and $1.33 per bushel. Results are similar for corn. When only the target price is effective, the implicit export subsidy ranges between $0.47 and $0.53 per bushel. Land retirement programs shift the implicit export subsidy to a tax. If the U.S. price is supported by the $2.55 per bushel loan rate, then the implicit export tax on corn ranges from $0.27 to $0.43 per bushel.

During the debate over 1985 U.S. farm legislation, one proposal considered eliminating U.S. commodity programs. Several studies analyzed this option. While none of these studies directly estimate the implicit trade intervention due to the programs, their projections of export levels with and without programs give clues to the nature of U.S. intervention. One study shows that movement to a more market-oriented agricultural policy expands both wheat and corn exports over 1985/86 to 1989/90 compared with a continuation of programs established by the 1981 legislation *(29)*. These results suggest the overall effect of U.S. policies in recent years has been to implicitly tax exports of wheat and corn. An analysis by ERS does not project exports for a continuation of policies. However, the projections for exports without price supports exceed the levels expected by most analysts.

As shown by Zellner, whether U.S. commodity policies implicitly tax or subsidize exports depends on whether land is being taken out of production and whether the loan rate is the effective floor price *(31)*. Two studies concerned about the environmental costs of U.S. commodity programs add another dimension to the issue. Chambers, Doering, and Schmitz argue that price supports encourage output expansion and implicitly subsidize exports *(6)*. However, the world market price does not fully reflect the social cost of these exports because the environmental costs are excluded from the private costs. This suggests that the appropriate U.S. export

policy to recover these external costs is a tax. They argue that for corn the price needed to cover the full social costs of production on average for the period 1978-80 is $3.68-$4.04 per bushel, but the average market price for that period is $2.68 per bushel. For wheat, the full social costs are $5.17-$5.96 per bushel, while the average market price is $3.57 per bushel. A similar linkage between social costs, exports, and price supports is presented by Doering, Schmitz, and Miranowski *(7)*.

Summary of Previous Empirical Research

We considered four categories of previous empirical research. The first examined various analyses of export subsidies. Results suggest that a policy of subsidizing U.S. exports can expand trade volume and raise U.S. domestic commodity prices. However, such subsidies are costly and will likely reduce U.S. export earnings in the short run. Specific results are largely contingent on the elasticity of import demand used in the analysis. The more elastic that relation, the greater the increase in the U.S. price and exports. Further, as import demand becomes elastic, export earnings increase in response to the subsidy. An analysis of targeted export subsidies for wheat suggests that the optimal level of these interventions are small and that centrally planned economies are the most likely targets (Chapter 20).

Studies which examine the impact of concessional sales programs were also reviewed. While there appears to be individual countries with a high additionality, such nations also appear to be the exception rather than the rule. Analyses of U.S. food aid programs suggest an additionality factor of 10-20 percent. The low additionality factor occurs for two reasons. First, the additionality constraint is costly, and countries have the incentive to avoid the constraint. Second, income elasticities and expenditure shares for grains, particularly wheat, are low.

The final group of studies reviewed considered the aggregate effect of U.S. commodity programs on U.S. exports. It is not possible to generalize the net effect of these programs, since the net effect is contingent on the market situation. If only target prices are effective, the U.S. commodity programs implicitly subsidize exports and may yield a world market price which does not fully reflect social costs of producing for the export market. Loan rates and land retirement programs appear to foreign nations as implicit export taxes, thereby discouraging purchases and encouraging competing supplies.

CONCLUSIONS

This chapter developed the theoretical underpinnings of surplus stocks disposal which is used in the empirical analyses presented in subsequent chapters. The chapter began by analyzing a global, uniform export subsidy. That model shows that a U.S. export subsidy increases U.S. exports and market share by lowering world price. To meet the additional exports, the U.S. domestic price rises. U.S. producers and foreign consumers benefit from the policy, while U.S. consumers and taxpayers and foreign producers suffer. The model assumes that competitors react to the fall in the world price by reducing exports. A discussion of competitor retaliation shows how a trade war can erupt as competitors try to regain market share.

Because many of the CCC export programs are buyer specific, we discussed the theory of targeted export subsidies. This framework showed that export subsidies are targeted to nations with relatively elastic import demand schedules. Targeted subsidies are also strategic policies aimed at markets shared with competitors. Such subsidies can be used to expand or defend market share and to exploit the import demand elasticity of markets which cannot be supplied because of transportation cost disadvantages. In contrast to the global subsidy, U.S. social welfare can be increased by targeted export subsidies. However, conditions necessary to support this result are stringent.

The third section of this chapter considered a framework for analyzing CCC programs which transfer income. Two parameters emerge as critical in this model. The income elasticity of demand and the budget share combine to give the income effect. The income effect gives the degree to which demand of a particular commodity expands in response to the transfer. The second parameter is the additionality factor. Most CCC income transfer programs include the restriction that aid shipments are to be fully additional. This restriction is costly to receiving nations, and they have the incentive to avoid the restriction. Hence, most aid shipments are not fully additional.

In the section on U.S. domestic commodity policies in an open-economy framework, we argued that other nations see our loan rates and land retirement programs as implicit export taxes. In contrast, target prices appear as an implicit export subsidy. These policies are critical to the surplus disposal analyses in later chapters. Target prices encourage surplus production while the loan program diverts this additional output into public stocks. When loan rates set market prices, land retirement programs can reduce accumulation of public stocks. When prices are above the loan rate, land retirement programs implicitly tax exports. We also considered implications of a low level of U.S. public stocks on world price variability and found that reductions in U.S. public stocks contribute to price instability. We integrated these frameworks into a theoretical model of surplus stock disposal using export subsidies in the presence of U.S. domestic commodity programs. This framework shows that an export subsidy can be effective at avoiding stock increases, but that foreign consumers benefit at the expense of U.S. taxpayers.

We also reviewed previous empirical research on the trade effects of U.S. export programs. The importance of the price elasticity of import demand to the price, quantity, and revenue effects of export subsidies are demonstrated. Further, we showed that export subsidies can be costly solutions to stock surpluses. The theoretical propositions of targeted export subsidies are also illustrated. In regard to income transfer programs, previous research suggests that, in aggregate, income effects for agricultural commodities are small, and the additionality factor is low. Studies of trade effects of U.S. domestic programs suggest that, on balance, U.S. exports are implicitly taxed and that the programs lead to stock increases.

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CHAPTER 19

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CHAPTER 19

EXPORT DISPOSAL OF WHEAT AND CORN STOCKS BY THE UNITED STATES: A QUANTITATIVE ANALYSIS FOR 1977-84*

Government and farmer-owned reserve (FOR) wheat stocks have exceeded a billion bushels several times in recent years, and corn stocks reached 2-1/2 billion bushels in 1982/83. Buildup of these stocks in 1982/83 led to massive acreage reductions under the payment-in-kind (PIK) program when Government-owned stocks were used to pay farmers for idling cropland.

Although strict rules govern the release of Commodity Credit Corporation (CCC) and FOR stocks on the domestic market, there is much more flexibility in disposing of these commodities abroad. As an alternative to allowing stocks to accumulate, export disposal schemes could be used whenever stocks would otherwise be in surplus. Although numerous export incentive programs have operated in the past decade (Chapter 17), no general export subsidy program has been attempted since the early 1970's.

This chapter evaluates a hypothetical generalized export subsidy designed to prevent Government stocks from accumulating. This subsidy is the most direct procedure for surplus disposal, and it avoids the potentially difficult problem of Government-sponsored exports displacing commercial exports. Results indicate that, with a U.S. surplus disposal/export subsidy policy over the past 8 years, world market prices would have been much more variable and substantially lower than they actually were during the 1980's. U.S. exports and market share would have increased as the lower prices raised foreign demand and as competitors' exports declined somewhat.

ANALYTICAL METHOD

This chapter examines what would have happened over the 1977/78 to 1984/85 crop years if the United States had adopted an export disposal policy using export subsidies. We chose 1977/78 as the starting year because that was the first year after the export boom of the early 1970's that prices and loan rates converged and Government stocks began to accumulate. Consequences of using the hypothetical export subsidy scenario are compared with actual conditions during this period.

The analysis is illustrated in figure 19.1. The actual price and quantity levels are represented by P_0 (price), D_0 (domestic use), I_0 (private stocks), X_0 (exports), and CCC_0 (Government stocks). The sale of Government stocks shifts CCC_0 to zero (CCC). Both theoretical and empirical research show that public stocks displace private stocks to some degree. In the empirical models used, private corn stocks decrease (increase) by 0.47 bushel for every bushel added to (removed from) public stocks. The corresponding substitution rate for wheat is 0.21 for each 1-bushel change in public stocks. Thus, private stock demand shifts to the right by less than the change in Government stocks as seen in figure 19.1. The decline in total domestic demand to $D+I_1+CCC_1$ and the increase in net export supply to ES_1 are the net effects of the stock shifts.

If no export subsidy were employed, the increase in market surplus would depress both domestic and export prices to PX* (if the loan rate were not above PX*). However, an export subsidy exactly equal to s_1 would keep domestic prices constant at P_0 and drive the export price down to PX_1. For this analysis, a subsidy was determined annually which would allow the complete disposal of Government stocks while keeping domestic prices at actual historical levels. The only constraint imposed was that the subsidy could not be so large as to drive export prices below the U.S. variable costs of production for wheat and corn. If that occurred, it would be equivalent to subsidizing variable inputs used in the production of the exported commodity.

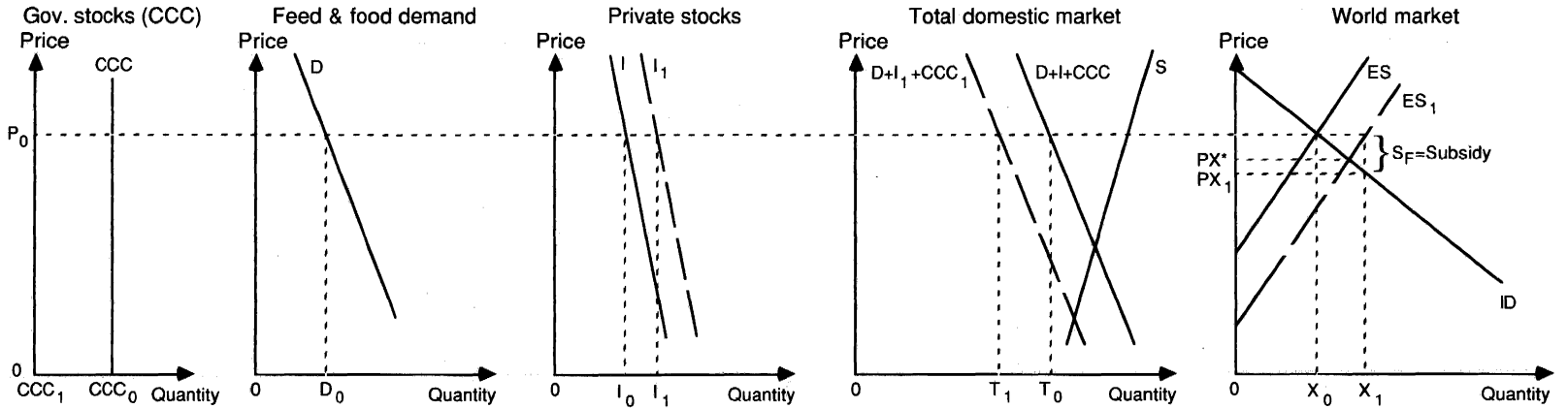
Regional Trade Model

The econometric regional trade model we discuss was developed by the Food and

*Contributors to this chapter were William H. Meyers, S. Devadoss, and Michael Helmar.

Figure 19.1

Export Stock Disposal Model



Agricultural Policy Research Institute (FAPRI) at Iowa State University. The model includes wheat, coarse grains, soybeans, and soymeal, and explicitly incorporates exchange rates and price transmission relationships between countries and regions. A dynamic, nonspatial equilibrium approach is used in this model. The basic elements of a nonspatial equilibrium supply and demand model are illustrated in figure 19.2. The model determines net imports and exports but does not show trade flows between specific regions. The net demands of importers (ID_I) less the net supplies of other exporters (ES_O) is the net import demand facing the U.S. market (ID).

Major importers and exporters for each commodity are included in the model. Included countries differ from commodity to commodity. The regional coverage and the endogenous components of internal markets are evident in the appendix tables of structural elasticities (app. tables 19.1-19.7). Those countries for which parameters have not been directly estimated with econometric techniques have been assigned price and income response elasticities based on the best judgment of the project team. These elasticities are converted to net import elasticities and reported in appendix table 19.8. Chapter 6 summarizes all the net trade elasticities. These models make it possible to determine the level and cost of the subsidy necessary to dispose of the Government stocks and to determine effects of this program on foreign importers and exporters.

The magnitude of the elasticities of import demand facing the United States is crucial to any analysis of export performance and is the subject of considerable debate. The cost of the export subsidy program evaluated in this study would decrease if import demand were more responsive to price changes (more elastic), simply because a given increase in export supplies can be disposed of with a smaller subsidy. Thus, a sensitivity analysis was conducted using the more elastic (shortrun) import demand elasticity assumptions of the Purdue model (Chapter 20) as shown:

	FAPRI model	*Purdue model*
Import demand elasticities for		
wheat	-0.56	-1.15
corn	-1.04	-1.65

The higher elasticity provides a lower bound on the export subsidy cost. Some would argue that the import demand elasticities should be even smaller than those in the FAPRI model. If so, the subsidy costs would be higher than those estimated with FAPRI elasticities.

Assumptions for the Export Subsidy Scenarios

To quantitatively evaluate the effect of an export subsidy stocks disposal program, operational rules and key assumptions need to be made about the Government's stock and price objectives, the policy instruments applied, the relationship to other U.S. commodity programs, and the response of other exporters. The rules adopted for this analysis represent a general form of export subsidy that could be used in place of Government stock programs.

The assumptions established are as follows:

- The Government's stock objective is to eliminate public stocks. Public stocks include Government-owned CCC stocks and Government-controlled FOR stocks. Two scenarios were evaluated. In one scenario, only CCC stocks were exported. In the second scenario, both CCC and FOR stocks were exported. The latter case is not currently feasible, since under current law farmers retain the marketing rights for their FOR stocks.

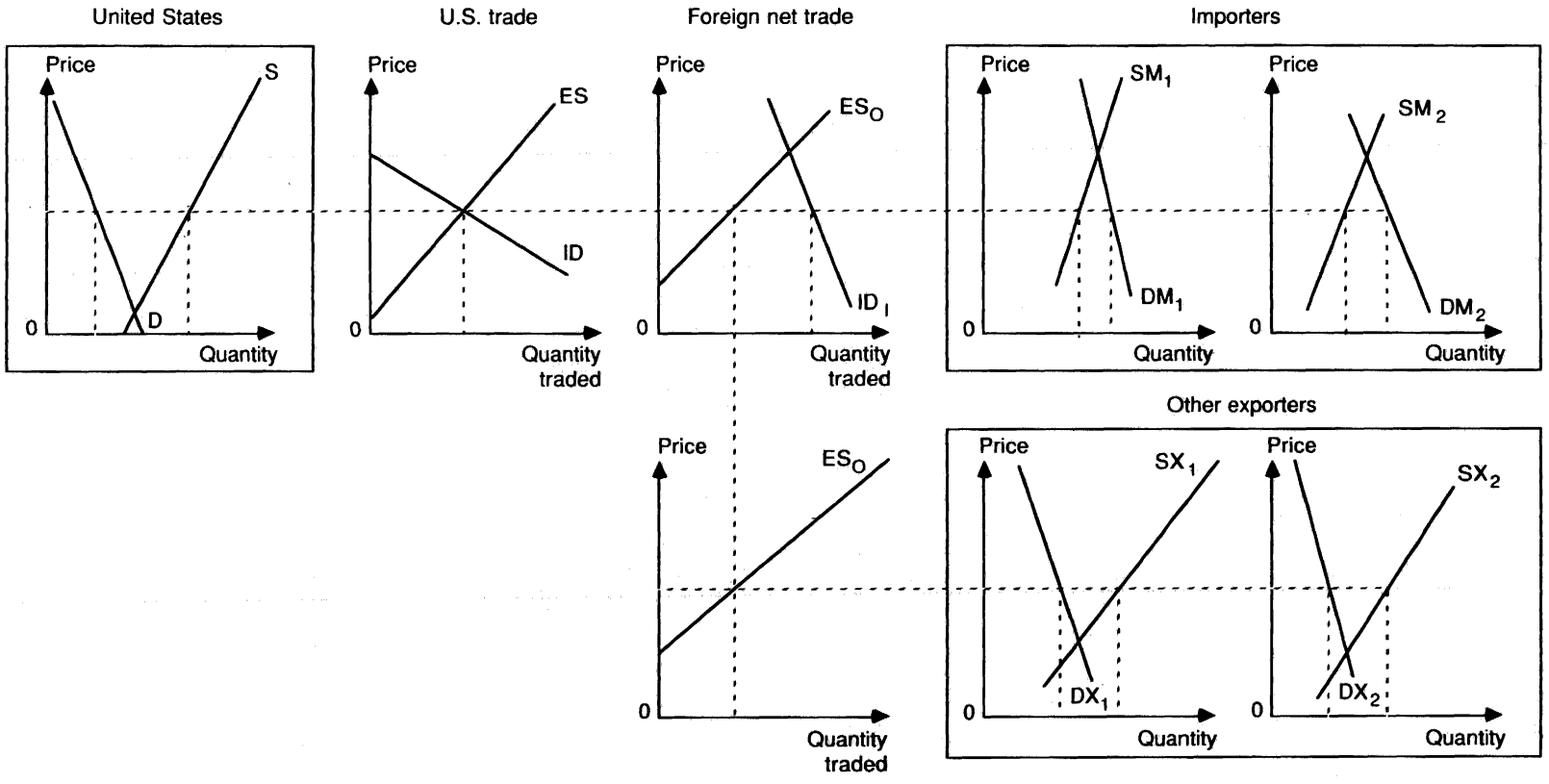
- The stocks to be disposed of are sold through commercial channels.

- The export subsidy applies to all exports and is set at a level which allows all surpluses to be exported while meeting the price objective of keeping domestic farm prices at the same level they would have been without stocks disposal.

- The export sales price, which is the farm price minus the export subsidy, is not permitted to be lower than the U.S. variable cost of production per bushel. If this minimum price rule is violated, the quantity of the stocks disposal is reduced until the condition is met. The surplus stocks that are not disposed of as a result of this rule are added to the stocks available for disposal the following year. (The variable costs used to

Figure 19.2

The FAPRI Regional Trade Model



implement this rule are given in appendix table 19.9).

- U.S. commodity program provisions were held unchanged except that the PIK acreage reduction programs in 1983/84 and 1984/85 (wheat) were eliminated. Since the stocks disposal program would eliminate one of the main motivations for the PIK program, it is unlikely that the PIK program would have been needed.

- It is assumed that the European Community (EC) would increase its export subsidies to match the decline in world prices in order to maintain its export volume. The other exporters would follow their normal pattern of response to changing world prices and would not make policy changes.

Analytical Procedures

Consequences of the surplus disposal policy are estimated by first simulating a baseline with the model from 1977/78 to 1984/85 and then simulating the alternative policy scenarios over the same period. Changes from the baseline are a measure of the dynamic effects of alternative policies over the 8 years.

The steps involved are as follows:

- Set ending public stocks to zero in 1977/78 and pay a subsidy on all export sales sufficient to hold farm prices at their original level. If the minimum price rule is violated, public stocks would be held at the level necessary to keep the export sales price from falling below the U.S. variable cost of production.

- The model then estimates effects on U.S. stocks and exports, on export prices, and on the import and exports of other countries. As long as U.S. prices remain at their initial level, there are no effects on domestic use or production.

- Beginning stocks for 1978/79 (the next crop year) are adjusted for reductions in ending stocks of the previous year; the whole process is then repeated. (In fact, there was no year when the export prices declined to the variable minimum.)

- If there are no ending year public stocks, export subsidies are not paid. As a result, the U.S. farm price could be above or below its historical level in response to price or stock changes in the previous year.

- Program cost and farm income effects of these scenarios are estimated from changes in prices, quantities, and subsidies that were derived in the analysis.

- The analysis was repeated to test sensitivity by using the higher U.S. export demand elasticities from the Purdue spatial model.

RESULTS OF THE EVALUATION

Results of the surplus public stocks disposal analysis are discussed first with respect to the wheat and corn commodity effects in the United States and in major importing and exporting countries and regions. Then, we discuss effects on aggregate volume and value of exports, Government cost, and net farm income. Finally, we evaluate sensitivity of the results to higher import demand elasticities.

Wheat

Effects of surplus disposal of wheat stocks on U.S. supply, use, stocks, and price are presented in table 19.1. For CCC stock disposal only, the export subsidy ranged from zero to $37.48 per ton and averaged nearly $10 per ton per year. On average, over the 8-year period, the release of only CCC stocks reduces total ending stocks by more than 10 percent (3.39 million tons) and increases exports by more than 9 percent (3.56 million tons) annually. Since the export subsidy is set to hold the domestic price, CCC stocks disposal in the foreign market did not significantly affect the domestic price. The largest domestic price change was a 2.8-percent drop in 1983/84. There was no export subsidy that year, and the increased production from removing PIK was larger than the change in stocks.

When both CCC and FOR stocks are released, total stocks decrease by nearly 50 percent (15.77 million tons) on average, and exports increase by more than 15 percent (5.99 million tons). The wedge between the domestic price and the world price increases, leading to a

higher average subsidy of $16.53 per ton and a maximum subsidy of $50.71 per ton in 1982/83.

Effects of U.S. stocks disposal on net exports by the exporters are shown in table 19.2. Average net exports of Canada, Australia, and Argentina decline over the period and are replaced by higher U.S. exports. EC exports remain unaffected, since as assumed, its policy is to increase subsidies as prices fall.

Estimated cost to the EC of the additional subsidies is $1 billion and $1.3 billion in the two cases. The United States gains more from increases in total trade than from reductions in competitors' exports. The average annual increase in U.S. exports when both CCC and FOR stocks are sold is about 6 million tons, 75 percent of which comes from an increase in total trade. Average U.S. trade share gain is 2.38 percent in the CCC case and 4.23 percent in the FOR + CCC case. In the years with

Table 19.1--Effects of surplus wheat stocks disposal on U.S. supply, use, stocks, and prices

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
					Million tons				
Actual:									
Production	55.70	48.30	58.10	64.80	75.80	75.30	65.90	70.60	64.31
Beginning stocks	30.30	32.10	25.10	24.50	26.84	31.46	41.01	37.96	31.16
Domestic use	23.40	22.80	21.31	21.31	23.05	24.71	30.24	31.38	24.78
Exports	30.60	32.50	37.42	41.20	48.20	41.07	38.89	38.75	38.58
Ending stocks	32.10	25.10	24.50	26.84	31.46	41.01	37.96	38.57	32.19
CCC	1.31	1.39	5.11	5.43	5.18	5.23	5.17	10.29	4.89
FOR	9.24	10.67	5.55	9.80	15.29	28.87	26.89	22.53	16.11
					Dollars per ton				
Price	85.61	109.50	138.89	143.67	134.11	130.44	129.71	124.19	124.52
					Million tons				
CCC disposal, change from actual:									
Production	0	0	0	0	0	.21	18.59	5.97	3.09
Beginning stocks	0	-.77	-1.06	-3.58	-4.19	-4.21	-12.64	3.61	-2.85
Domestic use	.02	0	.03	0	-.12	.09	.41	.03	.06
Exports	.75	.29	2.49	.61	.14	8.47	1.92	13.86	3.56
Ending stocks	-.77	-1.06	-3.58	-4.19	-4.21	-12.64	3.61	-4.30	-3.39
CCC	-1.31	-1.39	-5.11	-5.43	-5.18	-5.23	-5.17	-10.29	-4.89
FOR	0	0	0	0	0	0	0	0	0
					Dollars per ton				
Price	0	-.01	-.02	.03	1	-.02	-3.57	.62	-.25
Subsidy	3.67	.73	8.08	1.84	0	28.29	0	37.48	9.92
					Million tons				
FOR + CCC disposal, change from actual:									
Production	0	0	0	.37	.13	.05	18.56	6.44	3.19
Beginning stocks	0	-6.55	-9.17	-8.80	-11.33	-15.47	-34.42	-18.05	-12.97
Domestic use	.12	.03	-.37	.03	.04	.16	0	0	0
Exports	6.43	2.59	.01	2.87	4.23	18.84	2.20	10.72	5.99
Ending stocks	-6.55	-9.17	-8.80	-11.33	-15.47	-34.42	-18.05	-22.34	-15.77
CCC	-1.31	-1.39	-5.11	-5.43	-5.18	-5.23	-5.17	-10.29	-4.89
FOR	-9.24	-10.67	-5.55	-9.80	-15.29	-28.87	-26.89	-22.53	-16.11
					Dollars per ton				
Price	-.01	-.02	3.19	.03	0	-.01	.01	.63	.48
Subsidy	25.72	5.51	0	9.92	12.86	50.71	0	27.19	16.53

large export subsidies, 1982/83 and 1984/85, the U.S. trade share gains 7 to nearly 11 percent over the actual levels.

The U.S. subsidy on exports leads to an increase in imports by most of the importers (table 19.3). India, USSR, China, and Eastern Europe are assumed to insulate domestic markets from world price changes, so their imports are not affected. Total imports by importers are estimated to increase by an average of 3.5 percent in the CCC case and 5.5 percent in the FOR + CCC case. The largest import responses occurred in the years with the largest subsidies, 8 to 18 percent in 1984/85 for the CCC case and 8 to 12 percent in 1982/83 for the FOR + CCC case.

Table 19.2--Effects of surplus wheat stocks disposal on net exports by exporters and the U.S. market share

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
					Million tons				
Actual:									
Canada	15.90	13.50	15.00	17.00	17.60	21.40	21.80	19.40	17.70
Australia	11.10	6.70	15.00	10.60	11.00	8.10	10.60	15.30	11.05
EC	-.50	4.20	5.10	10.20	10.80	11.70	11.80	15.30	8.58
Argentina	1.80	4.10	4.80	3.90	4.30	7.50	9.70	8.00	5.51
Total non-U.S.	28.30	28.50	39.90	41.70	43.70	48.70	53.90	58.00	42.84
United States	30.60	32.50	37.42	41.20	48.20	41.07	38.89	38.75	38.58
					Percent				
Export share	51.95	53.28	48.40	49.70	52.45	45.75	41.91	40.05	47.94
					Million tons				
Total	58.90	61.00	77.32	82.90	91.90	89.77	92.79	96.75	81.42
CCC disposal, change from actual:									
Canada	-.10	-.09	-.32	-.29	-.38	-.81	-.89	-1.76	-.58
Australia	-.04	.03	-.07	.05	.02	-.25	.19	-.26	-.04
EC	0	0	0	0	0	0	0	0	0
Argentina	-.01	-.04	-.01	-.04	-.01	-.03	-.26	-.08	-.06
Total non-U.S.	-.15	-.10	-.40	-.28	-.37	-1.08	-.97	-2.10	-.68
United States	.75	.29	2.49	.61	.14	8.47	1.92	13.86	3.56
					Percent				
Export share	.74	.31	1.86	.53	.28	5.24	1.62	8.43	2.38
					Million tons				
Total	.60	.19	2.09	.33	-.23	7.38	.95	11.76	2.88
FOR + CCC disposal, change from actual:									
Canada	.67	-.66	-.80	-.84	-.81	-1.89	-2.11	-2.72	-1.31
Australia	-.29	.20	.06	-.13	-.04	-.34	.37	-.23	-.05
EC	0	0	0	0	0	0	0	0	0
Argentina	-.04	-.25	-.03	.01	-.07	-.21	-.45	-.03	-.13
Total non-U.S.	-.99	-.71	-.77	-.97	-.91	-2.43	-2.20	-2.99	-1.50
United States	6.43	2.59	.01	2.87	4.23	18.84	2.20	10.72	5.99
					Percent				
Export share	5.60	2.53	.50	2.27	2.61	10.67	2.37	7.30	4.23
					Million tons				
Total	5.44	1.88	-.76	1.90	3.31	16.41	0	7.74	4.49

Under the program being evaluated, the export subsidy replaces stocks as the means of supporting and stabilizing domestic prices. Subsidies rather than CCC and FOR stocks change from year to year in response to changing supply and demand conditions. Thus, export prices and world prices become more variable. The U.S. farm price less the export subsidy fluctuates more than the actual price, and is substantially lower, especially in the 1980's (fig. 19.3 and table 19.4). The larger disposal program (FOR + CCC) also generates larger effects on world prices. There is, of course, a cost to this subsidy. Under the CCC case, the subsidy cost alone varies from zero to nearly $2 billion (1984/85) and averages about $490 million per year (table 19.4). In the FOR + CCC case, the highest annual cost is $3 billion in 1982/83, and the average is about $830 million annually. There are some compensating savings in CCC storage costs and FOR storage payments; in some years, the CCC sales price is greater than the loan rate (assumed acquisition cost). These adjustments reduce net costs by about $75 million in the CCC case and $270 million in the FOR + CCC case. There is also the consideration that, under current programs, the Government owns an asset at the end of 1984/85 crop year equal to the value of CCC stocks. If these are valued at the loan rate, the estimated net cost for the 8-year period is $4.5 million for the CCC case and about $5.7 billion for the FOR + CCC case. Averaged over the study period the costs are $571 million and $715 million per year.

There is debate over how to count the costs of the PIK program and the savings associated

Table 19.3--Effects of surplus wheat stocks disposal on net imports by importers

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
					Million tons				
Actual:									
Japan	5.71	5.66	5.49	5.70	5.60	5.80	5.90	5.60	5.68
India	-.24	-.56	-.48	0	2.26	2.39	2.50	.15	.75
USSR	5.55	3.60	11.60	15.50	19.00	19.70	20.00	27.10	15.26
China	8.60	8.05	8.90	13.80	13.20	13.00	9.60	7.40	10.32
Eastern Europe	2.66	2.20	5.00	3.40	4.30	2.20	1.50	-1.50	2.47
Africa and Middle East	13.69	12.76	17.08	17.04	18.27	16.99	22.85	24.99	17.96
Other Asia	13.03	12.05	12.56	11.19	11.17	12.09	12.98	14.21	12.41
Other Latin America	7.02	7.64	8.54	7.57	8.30	8.19	8.52	8.97	8.09
Other Western Europe	.53	1.39	1.28	.45	1.29	-.52	.34	-.46	.54
Rest of world	2.35	8.22	7.36	8.25	8.52	9.93	8.60	10.29	7.94
Total	58.90	61.00	77.32	82.90	91.90	89.77	92.79	96.75	81.42
CCC disposal, change from actual:									
Japan	0	0	.01	0	0	.02	0	.03	.01
India	0	0	0	0	0	0	0	0	0
USSR	0	0	0	0	0	0	0	0	0
China	0	0	0	0	0	0	0	0	0
Eastern Europe	0	0	0	0	0	0	0	0	0
Africa and Middle East	.18	.02	.32	.07	-.04	1.42	.21	2.86	.63
Other Asia	.20	.03	.28	.05	-.03	1.21	.15	1.94	.48
Other Latin Amrica	.11	.02	.20	.04	-.02	.86	.10	1.28	.32
Other Western Europe	.08	.04	.42	.03	-.04	.28	.06	.46	.17
Rest of world	.02	.09	.86	.14	-.09	3.59	.43	5.18	1.28
Total	.60	.19	2.09	.33	-.23	7.38	.95	11.76	2.88
FOR + CCC disposal, change from actual:									
Japan	.03	0	0	.01	.01	.04	0	.02	.01
India	0	0	0	0	0	0	0	0	0
USSR	0	0	0	0	0	0	0	0	0
China	0	0	0	0	0	0	0	0	0
Eastern Europe	0	0	0	0	0	0	0	0	0
Africa and Middle East	1.45	.21	-.12	.39	.57	3.00	0	1.91	.93
Other Asia	1.64	.24	-.11	.30	.41	2.57	0	1.29	.79
Other Latin America	.92	.16	-.08	.21	.32	1.83	0	.85	.53
Other Western Europe	1.27	.40	-.14	.17	.68	.37	0	.38	.39
Rest of world	.14	.86	-.32	.81	1.32	8.58	0	3.28	1.84
Total	5.44	1.88	-.76	1.90	3.31	16.41	0	7.74	4.49

with eliminating the program. The value of the PIK entitlements to wheat producers is shown in table 19.4 for comparison with the subsidy costs. If these figures represent the savings associated with removing PIK, the net cost of the subsidy program is reduced by $2.5 billion. The resulting average annual cost would then be $262 million and $406 million for the CCC and FOR + CCC options, respectively.

Corn

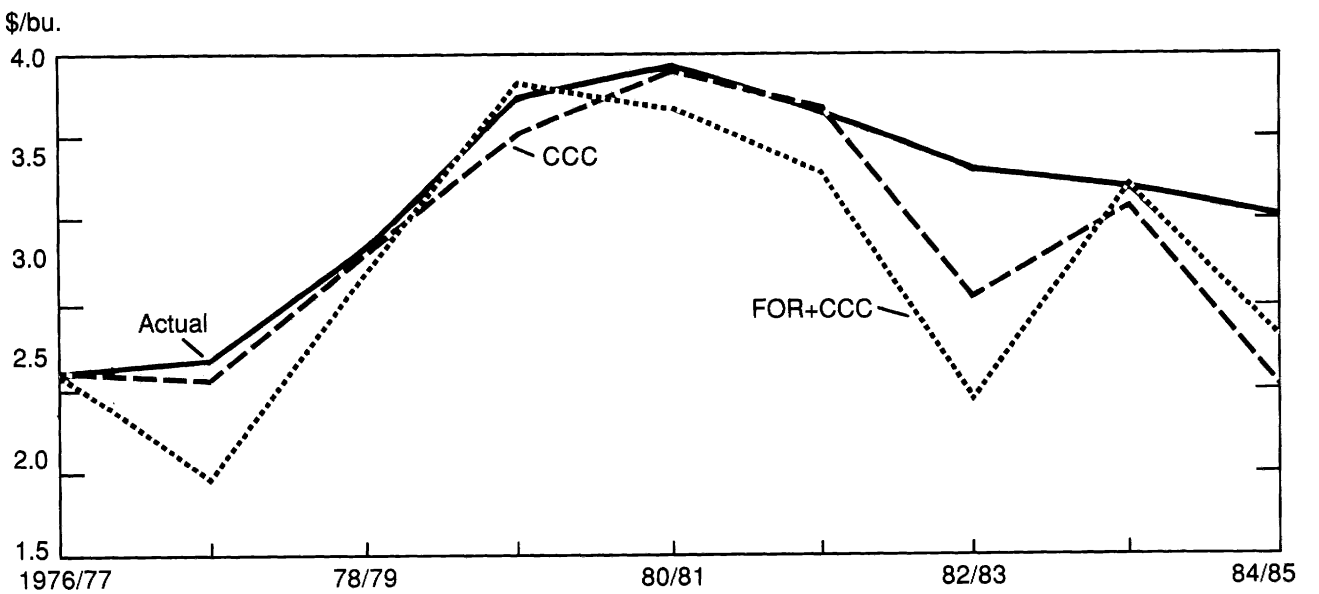
Effects of surplus disposal of corn on U.S. supply, use, stocks, and prices are presented in table 19.5. On average, over the 8-year period, the release of only CCC stocks reduces total ending stocks by nearly 15 percent and increases exports by about the same percentage. Subsidies and CCC stocks disposal have no significant effect on domestic prices except in 1983/84 when the domestic price under the CCC stocks disposal program is 15 percent lower than the actual domestic price. There was no export subsidy in 1984; increased production from removing PIK exceeded the reduction in stocks.

Required subsidies in the CCC case ranged from zero to over $22 per ton in 1984/85. Effects of disposal of both CCC and FOR stocks are naturally larger. Release of more stocks in the foreign market reduces total ending stocks by an average of 52 percent and increases exports an average of 20 percent. The larger volume of stocks sold requires subsidies of more than $20 per ton in 3 of the last 4 years and an average annual subsidy equivalent to more than 10 percent of the farm price over the period.

Effects of disposal of U.S. surplus corn stocks on net feed grain exports by major exporters is presented in table 19.6. Average net exports by Argentina, Australia, Canada, and Thailand decline. Loss of feed grain exports by these countries has been captured by the United States. As with wheat, the United States gains much more from increased imports than from reductions in competitors' exports. On average, increased trade accounts for nearly 90 percent of the U.S. export increases. Average U.S. trade share gain is 3 percentage points in the CCC case and 3.7 percentage points in the FOR + CCC case.

Figure 19.3

U.S. Export Prices for Wheat by Surplus Disposal Model



Crop years. Models assume low elasticity levels. Sources: *(1, 2, 3).*

The stocks disposal program generally increases net imports by major importers (table 19.7). The 2 years when imports decline, 1980/81 and 1983/84, were drought years in the U.S. Corn Belt. In these years, under the FOR + CCC case, prices in the United States and abroad were higher under the subsidy program because there were lower carryover stocks to buffer production shortfalls. Net imports by importers increased by an average of 8 percent in the CCC stock disposal case and 10.9 percent in the FOR + CCC case. In years with larger subsidies, 1982/83 and 1984/85, total net imports increased by 27 and 19 percent for the CCC case and 32 and 21 percent for the FOR + CCC case. Imports of the EC and the USSR are invariant to price because of their price insulation from world markets. The EC automatically increases its import levies when world market prices decline. Since the EC was a net importer of feed grains in all but the last year of this period, there is an increase in its import levy revenues for 7 years and an increase in export subsidy costs for 1984/85. Net revenue gain to the EC is $16 million and $260 million in the two cases.

As is the case with wheat, the stock disposal export subsidy program causes world market prices to be more unstable and generally lower than U.S. prices (fig. 19.4). Moreover, the larger disposal program (FOR + CCC) creates a greater degree of instability in world markets. Annual subsidy costs range from zero to over $1.7 billion and average about $400 million for the CCC case and $740 million for the FOR + CCC case (table 19.8). When adjustments are made for storage savings and net sales revenue, average annual costs are reduced by about $110 million and $260 million for the two cases. Taking account of the CCC

Table 19.4--Effects of surplus wheat stocks disposal on prices, subsidy, and program cost

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
				Dollars per bushel					
Actual:									
U.S. gulf price	3.16	3.83	4.74	4.95	4.65	4.32	4.19	4.04	
U.S. farm price	2.33	2.98	3.78	3.91	3.65	3.55	3.53	3.38	3.39
9-month loan rate	2.25	2.35	2.50	3.00	3.20	3.55	3.65	3.30	2.98
Reserve loan	2.25	2.35	2.50	3.30	3.50	4.00	3.65	3.30	3.11
CCC disposal:									
U.S. farm price	2.33	2.98	3.78	3.91	3.68	3.55	3.43	3.40	3.38
Subsidy	.10	.02	.22	.05	0	.77	0	1.02	.27
U.S. price subsidy	2.23	2.96	3.56	3.86	3.68	2.78	3.43	2.38	3.11
				Million dollars					
Change in cost--									
Subsidy expenditure	120.39	19.67	315.66	77.76	0	1,402.89	0	1,971.66	488.50
Storage cost 1/	-12.76	-13.53	-49.76	-52.87	-50.44	-50.92	-50.34	-100.19	-47.60
Net sales less 2/	-3.85	-1.85	-174.88	-10.71	0	0	0	-18.21	-26.19
CCC inventory value 3/	0	0	0	0	0	0	0	1,247.00	155.96
Net cost	103.78	4.29	91.02	14.18	-50.44	1,351.97	-50.34	3,100.25	570.67
PIK cost 4/	0	0	0	0	0	389.10	1,836.40	248.60	309.26
				Dollars per bushel					
FOR + CCC disposal:									
U.S. farm price	2.33	2.98	3.87	3.91	3.65	3.55	3.53	3.40	3.40
Subsidy	.70	.15	0	.27	.35	1.38	0	.74	.45
U.S. price subsidy	1.63	2.83	3.87	3.64	3.30	2.17	3.53	2.66	2.95
				Million dollars					
Change in cost--									
Subsidy expenditure	951.69	195.83	0	444.19	665.82	3,033.59	0	1,340.76	828.98
Storage cost 1/	-102.73	-117.43	-103.80	-148.30	-199.32	-332.03	-312.17	-319.57	-204.42
Net sales loss 2/	-30.88	-34.93	-528.53	-106.11	-30.22	224.67	0	-18.27	-65.54
CCC inventory value 3/	0	0	0	0	0	0	0	1,247.00	155.96
Net cost	818.08	43.47	-632.33	189.78	436.29	2,926.22	-312.17	2,249.91	714.99
PIK cost 4/	0	0	0	0	0	389.10	1,836.40	248.60	309.26

1/ Cost of CCC storage and FOR storage payments (FOR + CCC case only).
2/ Acquisition cost of stocks minus the value of stock sales.
3/ Value of CCC stocks held at the end of 1984/85 if there is no disposal program.
4/ Value of PIK entitlements to producers.

inventory value loss in 1984/85, the estimated net cost for the 8-year period is nearly $3 billion for the CCC case and $4.4 billion for the FOR + CCC case.

In comparison, value of PIK entitlements to feed grain producers over the 1982/83-1984/85 period is $5.6 billion. This is about equivalent to $700 million per year over the 8-year period. Thus, for feed grains, the export subsidy surplus disposal scheme appears to be less costly than the PIK program by $146 million to $330 million per year.

Export Volume and Value

The combined effect of the stocks disposal program is to increase export volume and value in most years. Export volume for wheat and corn is higher than actual levels nearly every year in both scenarios (fig. 19.5). The largest effects are from 1981/82 onward, a period when stocks accumulated rapidly. For the 8-year period, export volume for wheat and corn is 12 percent higher in the CCC case and 18 percent higher in the FOR + CCC case. Export values do not increase as much as

Table 19.5--Effects of surplus corn stocks disposal on U.S. supply, use, stocks, and prices

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
					Million tons				
Actual:									
Production	165.24	184.62	201.38	168.64	206.23	209.18	106.05	194.93	179.53
Beginning stocks	22.51	28.22	33.12	41.07	26.26	55.22	79.25	18.37	38.00
Domestic use	110.09	125.56	131.64	123.63	127.32	137.65	119.56	131.53	125.87
Exports	49.48	54.18	61.80	59.82	49.96	47.50	47.37	46.69	52.10
Ending stocks	28.22	33.12	41.07	26.26	55.22	79.25	18.37	35.08	39.57
CCC	.30	2.47	6.33	5.88	7.46	28.81	5.11	6.10	7.81
FOR	7.80	13.35	15.72	4.57	32.37	38.30	10.80	11.10	16.75
					Dollars per ton				
Price	79.52	88.58	99.21	122.43	98.42	106.29	127.95	103.14	103.19
					Million tons				
CCC disposal, change from actual:									
Production	0	0	0	0	.08	.03	50.55	8.97	7.45
Beginning stocks	0	-.25	-2.08	-5.32	-5.05	-6.27	-26.90	4.32	-5.19
Domestic use	0	0	0	-.11	0	0	3.97	0	.48
Exports	.25	1.82	3.24	-.15	1.30	20.66	15.35	18.42	7.61
Ending stocks	-.25	-2.08	-5.32	-5.05	-6.27	-26.90	4.32	-5.13	-5.83
CCC	-.30	-2.47	-6.33	-5.88	-7.46	-28.81	-5.11	-6.10	-7.81
FOR	0	0	0	0	0	0	0	0	0
					Dollars per ton				
Price	.01	-.03	.01	.66	-.01	.01	-20.22	.02	0
Subsidy	.39	1.57	3.15	0	2.36	20.08	0	22.05	6.30
					Million tons				
FOR + CCC disposal, change from actual:									
Production	0	0	0	0	1.18	.44	50.65	11.34	7.95
Beginning stocks	0	-6.80	-13.30	-18.53	-10.48	-33.49	-59.10	-8.15	-18.73
Domestic use	0	0	0	-1.81	0	0	-.57	0	-.30
Exports	6.80	6.50	5.23	-6.24	24.19	26.05	.27	17.65	10.06
Ending stocks	-6.80	-13.30	-18.53	-10.48	-33.49	-59.10	-8.15	-14.46	-20.54
CCC	-.30	-2.47	-6.33	-5.88	-7.46	-28.81	-5.11	-6.10	-7.81
FOR	-7.80	-13.35	-15.72	-4.57	-32.37	-38.30	-10.80	-11.10	-16.75
					Dollars per ton				
Price	0	-.01	.02	10.49	-.02	0	2.92	.01	1.68
Subsidy	7.48	4.72	4.33	0	23.23	22.05	0	24.01	10.63

volume, since world prices are lower in most years (fig. 19.6). Since wheat import demand is inelastic and corn import demand is elastic in the model, wheat export values are actually declining while corn and total export values are increasing. Total export value over the 8-year period increases by 2.5 to 3.0 percent in the two cases as the increase in the value of corn exports offsets the lower wheat export value.

New Program Cost

When the wheat and corn net program costs are aggregated, they range from -$100 million to $5.1 billion and average $940 million in the CCC case. These same costs range from -$600 million to $4.2 billion and average $1.3 billion in the FOR + CCC case (fig. 19.7). If the net costs of wheat and corn including PIK are

Table 19.6--Effects of surplus corn stocks disposal on net exports by exporters and the U.S. market share

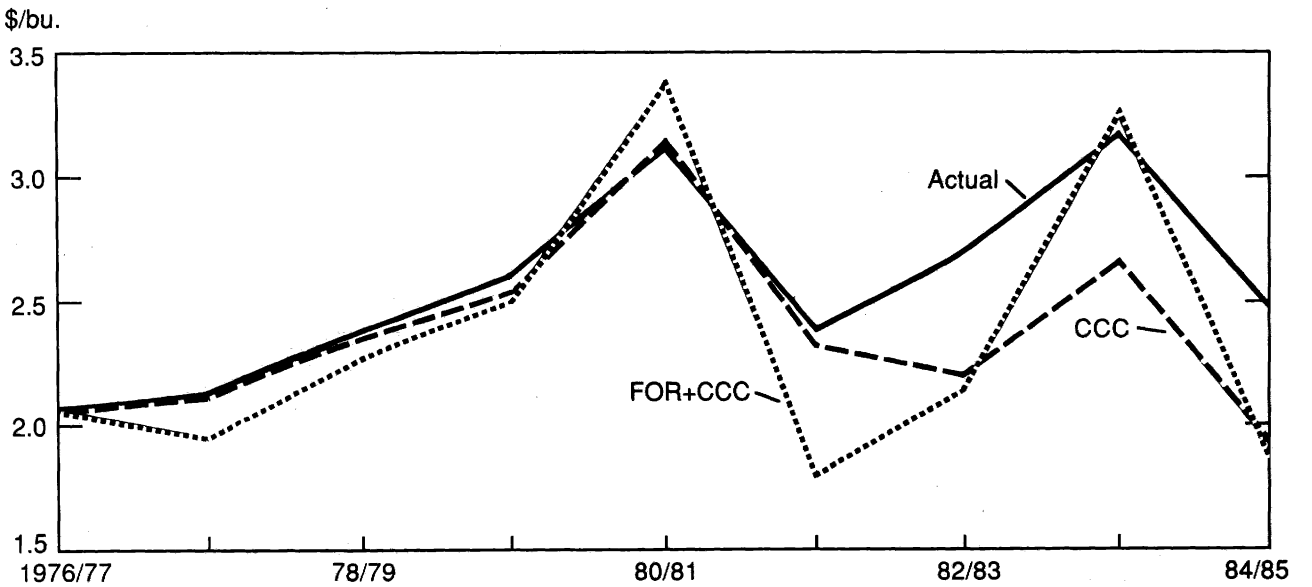
Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
					Million tons				
Actual:									
Argentina	11.15	10.02	5.13	13.88	10.14	11.41	10.67	10.42	10.35
Canada	3.65	3.21	3.64	3.35	6.62	5.80	6.61	3.22	4.51
Australia	1.56	3.24	3.89	2.84	3.38	1.24	5.75	6.66	3.57
Thailand	1.32	2.25	2.34	2.40	3.51	2.33	3.11	3.35	2.58
South Africa	3.34	2.51	3.72	4.93	4.57	-2.33	.80	.97	2.31
Total non-U.S.	21.02	21.23	18.72	27.40	28.22	18.45	26.94	24.62	23.33
United States	55.99	59.94	71.07	69.21	58.40	54.00	55.80	55.50	59.99
					Percent				
Export share	72.70	73.85	79.15	71.64	67.42	74.53	67.44	69.27	72.00
					Million tons				
Total	77.01	81.17	89.79	96.61	86.62	72.45	82.74	80.12	83.31
CCC disposal, change from actual:									
Argentina	0	-.02	-.03	-.02	-.03	-.28	-.37	-.48	-.15
Canada	0	-.05	-.17	-.24	.04	-.31	-1.08	-1.99	-.48
Australia	-.01	-.04	-.08	-.03	-.05	-.30	-.49	-.64	-.20
Thailand	0	-.01	-.02	-.03	0	-.04	-.15	-.15	-.05
South Africa	0	0	0	0	0	0	0	0	0
Total non-U.S.	-.01	-.11	-.30	-.32	-.04	-.92	-2.10	-3.26	-.88
United States	.25	1.82	3.24	-.15	1.30	20.66	15.35	18.42	7.61
					Percent				
Export share	.13	.91	1.10	.20	.59	6.21	6.59	8.29	3.00
					Million tons				
Total	.24	1.71	2.94	-.47	1.25	19.74	13.26	15.16	6.73
FOR + CCC disposal, change from actual:									
Argentina	-.10	-.11	-.08	.04	-.29	-.48	-.21	-.34	-.20
Canada	-.07	-.78	-.46	-.29	.68	-2.03	-1.08	-.03	-.51
Australia	-.15	-.21	-.22	.05	-.27	-.42	-.27	-.50	-.25
Thailand	-.01	-.08	-.05	-.03	.06	-.17	-.14	-.01	-.05
South Africa	0	0	0	0	0	0	0	0	0
Total non-U.S.	-.33	-1.19	-.81	-.23	.18	-3.10	-1.70	-.89	-1.01
United States	6.80	6.50	5.23	-6.24	24.19	26.05	.27	17.65	10.06
					Percent				
Export share	2.51	2.98	1.84	-1.78	6.99	9.38	1.52	6.23	3.71
					Million tons				
Total	6.48	5.31	4.43	-6.48	24.37	22.95	-1.44	16.76	9.05

Table 19.7--Effects of surplus corn stocks disposal on net imports by exporters

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
					Million tons				
Actual:									
EC	11.67	11.16	9.30	6.56	5.45	1.79	1.24	-4.04	5.39
Japan	16.95	17.87	18.89	18.86	18.32	18.70	20.51	20.41	18.81
Spain	5.70	4.76	5.90	3.72	7.79	6.72	4.80	3.42	5.35
USSR	10.71	8.90	18.40	18.00	25.50	11.30	11.50	27.00	16.41
Eastern Europe	5.36	7.11	6.83	9.76	4.85	.78	.97	.58	4.53
High-income East Asia	3.53	4.30	5.41	6.79	7.88	9.23	8.69	8.72	6.82
Rest of world	23.09	27.07	25.06	32.92	16.83	23.93	35.03	24.03	26.00
Total	77.01	81.17	89.79	96.61	86.62	72.45	82.74	80.12	83.31
CCC disposal, change from actual:									
EC	0	0	0	0	0	0	0	0	0
Japan	.01	.04	.07	-.01	.02	.37	.41	.39	.16
Spain	0	.01	.02	0	.02	.17	.17	.18	.07
USSR	0	0	0	0	0	0	0	0	0
Eastern Europe	.10	.94	1.73	-.22	.62	3.22	1.32	1.37	1.14
High-income East Asia	.01	.07	.10	-.02	.09	1.23	.79	1.13	.43
Rest of world	.12	.65	1.02	-.23	.50	14.74	10.57	12.08	4.93
Total	.24	1.71	2.94	-.47	1.25	19.74	13.26	15.16	6.73
FOR + CCC disposal, change from actual:									
EC	0	0	0	0	0	0	0	0	0
Japan	.19	.14	.07	-.19	.34	.52	-.04	.32	.17
Spain	.07	.04	.03	-.06	.17	.19	-.02	.20	.08
USSR	0	0	0	0	0	0	0	0	0
Eastern Europe	3.01	2.98	2.66	-2.75	15.25	3.93	-.10	1.60	3.32
High-income East Asia	.25	.20	.15	-.26	1.15	1.39	-.10	1.24	.50
Rest of world	2.95	1.94	1.52	-3.21	7.45	16.91	-1.18	13.40	4.97
Total	6.48	5.31	4.43	-6.48	24.37	22.95	-1.44	16.76	9.05

Figure 19.4

U.S. Export Prices for Corn by Surplus Disposal Method



Crop years. Models assume low elasticity levels. Sources: *(1, 2, 3).*

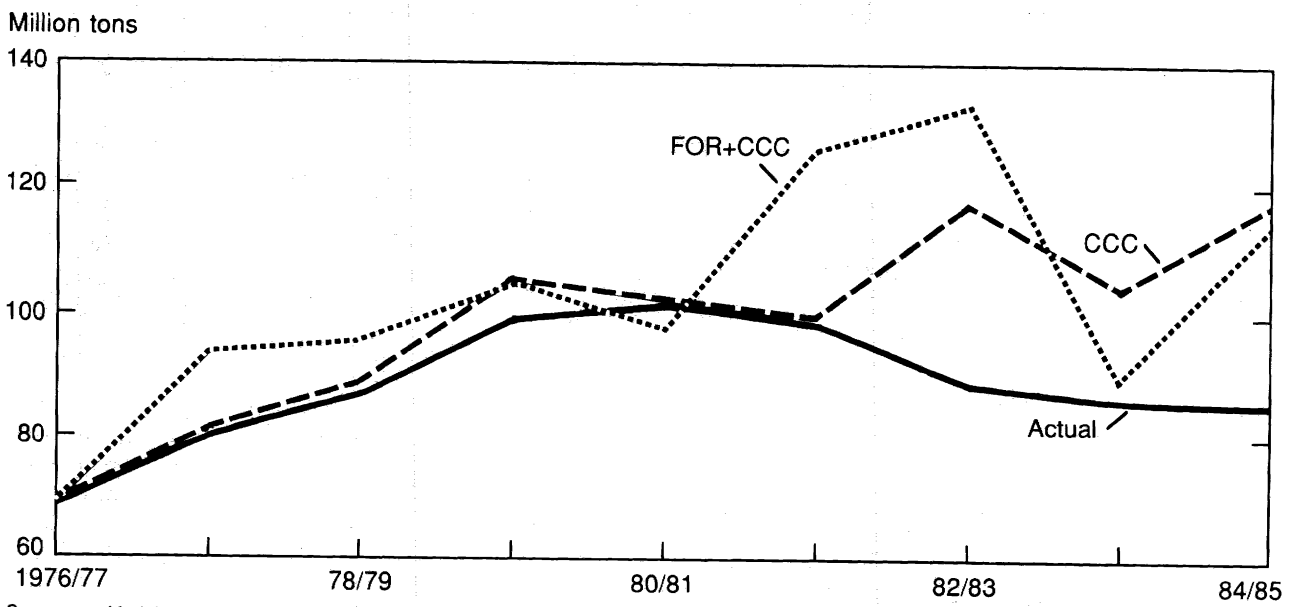
Table 19.8--Effects of surplus corn stocks disposal on prices, subsidy, and program cost

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
				Dollars per bushel					
Actual:									
U.S. gulf price	2.63	2.88	3.11	3.62	2.88	3.20	3.67	2.98	3.12
U.S. farm price	2.02	2.25	2.52	3.11	2.50	2.70	3.25	2.62	2.62
9-month loan rate	2.00	2.00	2.10	2.25	2.40	2.55	2.65	2.55	2.31
Reserve loan	2.25	2.35	2.50	2.25	2.55	2.90	2.65	2.55	2.50
CCC disposal:									
U.S. farm price	2.02	2.25	2.52	3.13	2.50	2.70	2.74	2.62	2.56
Subsidy	.01	.04	.08	0	.06	.51	0	.56	.16
U.S. price subsidy	2.01	2.21	2.44	3.13	2.44	2.19	2.74	2.06	2.40
				Million dollars					
Change in cost--									
Subsidy expenditure	16.41	96.61	194.80	0	111.99	1,366.24	0	1,442.11	403.52
Storage cost 1/	-3.10	-25.78	-66.01	-61.35	-77.86	-300.59	-53.27	-63.60	-81.44
Net sales loss 2/	-.24	-21.34	-63.80	0	-6.21	-126.30	0	-2.74	-27.58
CCC inventory value 3/	0	0	0	0	0	0	0	612.00	76.55
Net cost	13.07	49.48	65.00	-61.35	27.92	939.34	-53.27	1,987.77	371.05
PIK cost 4/	0	0	0	0	0	14.20	5,218.60	362.70	699.44
				Dollars per bushel					
FOR + CCC disposal:									
U.S. farm price	2.02	2.25	2.52	3.38	2.50	2.70	3.32	2.62	2.66
Subsidy	.19	.12	.11	0	.59	.56	0	.61	.27
U.S. price subsidy	1.83	2.13	2.41	3.38	1.91	2.14	3.32	2.01	2.39
				Million dollars					
Change in cost--									
Subsidy expenditure	421.85	296.41	293.61	0	1,719.90	1,627.67	0	1,535.15	736.82
Storage cost 1/	-84.43	-165.07	-229.97	-109.05	-415.57	-700.18	-165.89	-179.41	-256.20
Net sales loss 2/	70.36	.55	-65.76	0	49.12	-79.28	0	-3.58	-3.57
CCC inventory cost 3/	0	0	0	0	0	0	0	612.00	76.55
Net cost	407.78	131.88	-2.13	-109.05	1,353.45	848.00	-165.89	1,964.16	553.60
PIK cost 4/	0	0	0	0	0	14.20	5,218.60	362.70	699.44

1/ Cost of CCC storage and FOR storage payments.
2/ Acquisition cost of stocks minus the value of stock sales.
3/ Value of CCC stocks held at the end of 1984/85 if there is no disposal program.
4/ Value of PIK entitlements to producers.

Figure 19.5

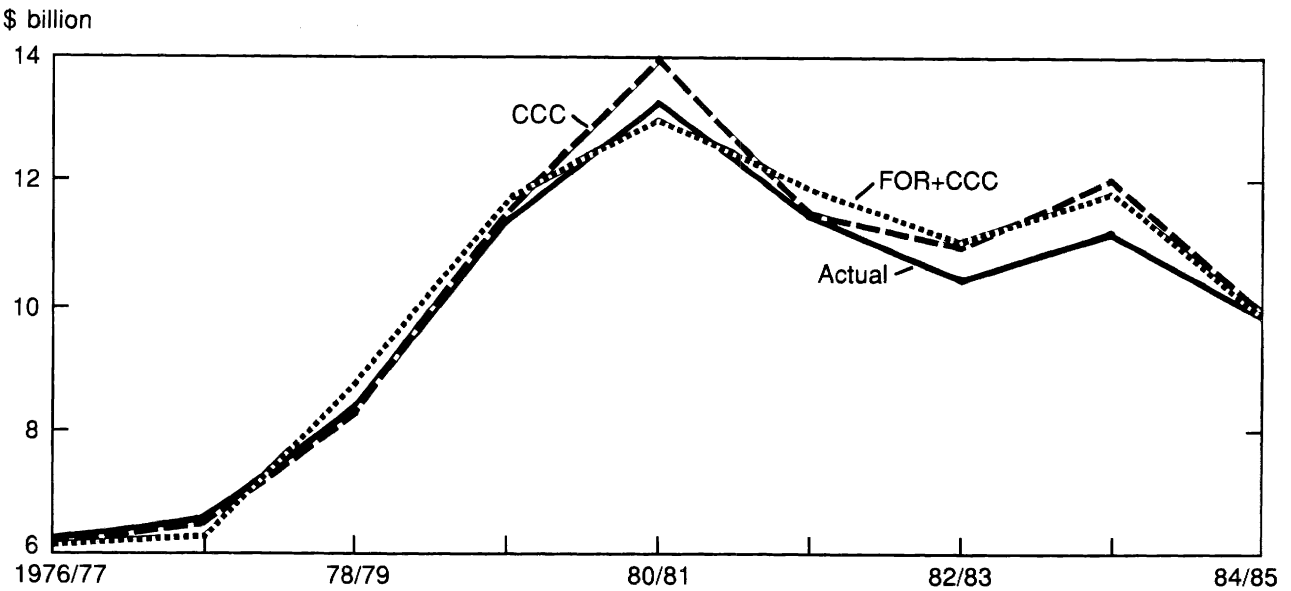
U.S. Export Volume by Surplus Disposal Model



Crop years. Models assume low elasticity levels. Volume is for wheat and corn combined. Sources: *(1, 2, 3).*

Figure 19.6

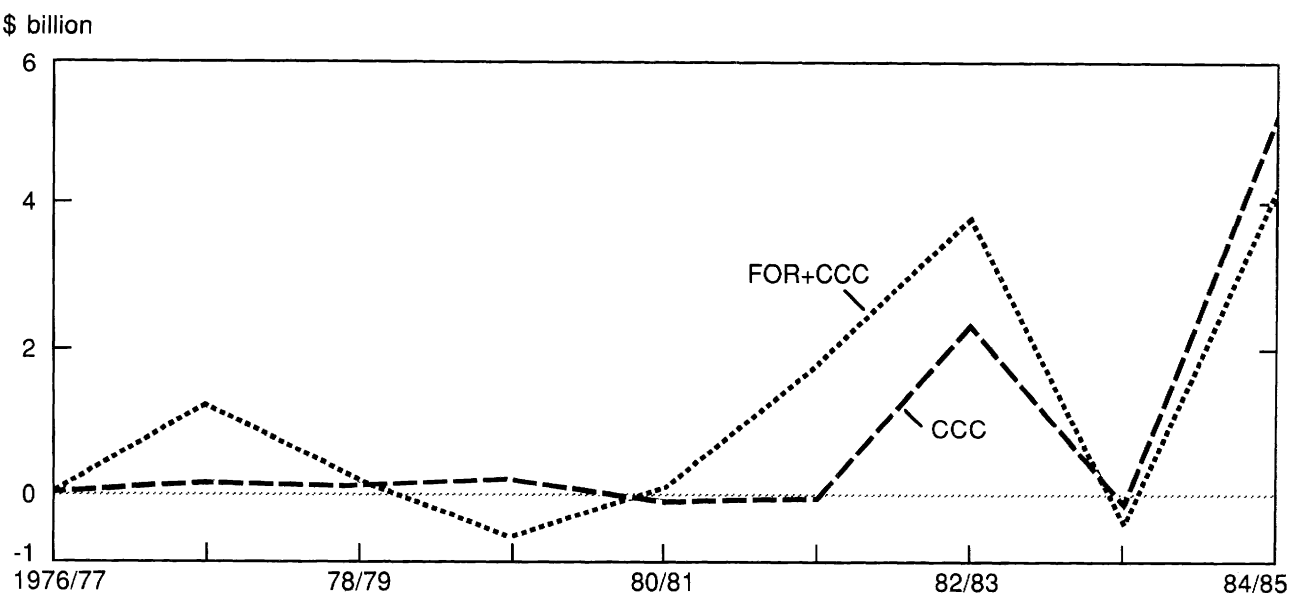
Market Value of U.S. Exports by Surplus Disposal Model



Crop years. Models assume low elasticity levels. Volume is for wheat and corn combined. Sources: *(1, 2, 3)*.

Figure 19.7

Net U.S. Cost of Subsidies by Surplus Disposal Model



Crop years. Models assume low elasticity levels and no payment in kind. Sources: *(1, 2, 3)*.

combined, the PIK savings almost exactly offset the export subsidy costs for the CCC case. In the FOR + CCC case, the aggregated net costs of subsidies adjusted for PIK savings are about $260 million above current program costs per year or $2.1 billion over the 8-year period.

Net Farm Income

Before 1983/84, there was not enough change in prices or production in the surplus disposal alternatives to significantly affect net farm income. The only exception was the 1980/81 FOR + CCC scenario for corn. Because all reserve stocks were depleted in the previous years under this scenario, the drought in 1980/81 raised prices $0.27 per bushel above the actual level that year. Thus, the value of corn production in 1980/81 would have been about $1.8 billion higher under the FOR + CCC case (table 19.9). Since there would have been no effect on payments or expenses, net farm income would have increased by the same amount.

The removal of the PIK acreage diversion program in 1983/84 and 1984/85 has significantly affected production, prices, payments, and production expenses for both wheat and corn. In the 1983/84 CCC case, the increase in production is partly offset by the decline in corn prices, and the increased value of production is over $5.6 billion (table 19.9). There are no CCC stocks left to dispose of, and the increase in production is nearly twice as large as the decline in beginning stocks, so corn price falls about $0.50 per bushel (see table 19.5). The price falls below the target price, so nearly $1 billion in deficiency payment is required. The loss in the PIK payments of over $7 billion more than offsets increased receipts, leaving total receipts slightly lower than the actual 1983/84 values. Further, the additional acreage planted and harvested increases variable production expenses by over $3 billion, leaving net farm income nearly $3.6 billion lower.

The FOR + CCC case is quite similar for 1983/84, except that prices do not decline. Thus, value of production increases more than $7 billion (there are no deficiency payments), but total receipts do not increase enough to cover the increase in variable production expenses. As a result, net farm income falls by about $2.9 billion. It is clear that, given the opportunity to plant, producers cannot generate profits equal to what was offered by the PIK program. This result is consistent with the generally accepted view that the 1983/84 PIK program offered generous payments per idled acre.

The PIK program in 1984/85 was less generous and was offered only on wheat. In both cases evaluated here, profits from increased plantings in 1984/85 exceed losses in PIK payments, so net farm income increases. For the 8-year period of analysis there is an estimated loss of net farm income of $3 billion in the CCC disposal case and less than $500 million in the FOR + CCC case.

SENSITIVITY OF RESULTS TO IMPORT ELASTICITIES

The analysis was repeated using import demand elasticities which imply a greater response of exports to changes in prices. A change in elasticities has a major effect on the foreign market price and subsidy costs. Since a given amount of surplus grain moves in export markets, a more elastic import demand means that a smaller subsidy is required to export the same quantity, leading to lower costs of achieving the same objectives.

The change in the subsidy rates for wheat and corn can be seen in figures 19.8 and 19.9. The subsidy rate is equal to the difference between actual prices and the simulated prices over the historical period. Price movements under the high elasticity assumption are also more variable than actual prices, but they are not as variable or as low as those estimated with the lower elasticities. There is a bigger reduction in export subsidies with wheat, because the change in the import elasticity was proportionately larger. On average, export subsidies were 11-16 cents per bushel ($4 to $6 per ton) lower for wheat and 4-5 cents per bushel ($1.60 to $2 per ton) lower for corn (app. tables 19.10 and 19.11).

The market value of exports is also expected to be higher when the import elasticity is higher because the same increase in exports can be achieved with a smaller reduction in the export

price. Figure 19.10 compares the value of exports under the two alternative elasticities. Most of the gain in export value occurs in 1982 and 1984, when the export subsidies were relatively large. For the 8-year period of the program, the value of corn and wheat exports was $2.7 billion or 3.2 percent higher under the high elasticity assumption.

Achieving the same expansion in exports with a smaller subsidy naturally reduces the estimated program costs (fig. 19.11). Where both FOR and CCC stocks are sold, the net cost without PIK rises to a peak of over $4 billion in 1984/85 and averages $1.3 billion per year compared with a peak of over $3 billion and an average of $0.8 billion per year under the high elasticity assumption. Again in 1984/85, the estimated cost is $2.3 billion using the model elasticities and $1.4 billion using the high elasticity assumptions. Over the 8-year period, the estimated costs are $4.7 billion lower with the higher elasticities. Thus, if exports respond as readily to price changes as is assumed in the high elasticity scenarios, export subsidy programs turn out to be less costly than PIK for both wheat and corn.

As indicated earlier, some analysts would argue that actual import demand elasticities are smaller than those in the FAPRI model. The cost estimates are quite sensitive to the level of the import demand elasticities. Thus, if import demand elasticities were smaller than those in the model, the cost of the subsidy program would be higher than what was estimated with the FAPRI model. Clearly, one of the uncertainties of initiating a subsidy program is the uncertainty about the import response to lower prices.

SUMMARY AND CONCLUSIONS

This chapter has evaluated a program where the U.S. Government disposed of commodities held in public stocks. We did not consider whether the Government should or should not hold or encourage farmers to hold reserve stocks or what the optimum level of such reserve stocks should be. This study was conducted under two cases, one in which there are no Government-owned stocks carried from year to year and another in which there are no Government-owned or -controlled stocks of any kind carried from one year to the next. In the latter case, all carryover stocks would be privately owned and controlled.

A surplus disposal-export subsidy approach over the past 8 years would have created much greater variability in world market prices and would have driven those prices substantially lower than they were during the 1980's. The increase in U.S. exports and U.S. market share that results from this policy comes primarily from increases in foreign demand at the lower prices and to a lesser extent from declines in the exports of competitors.

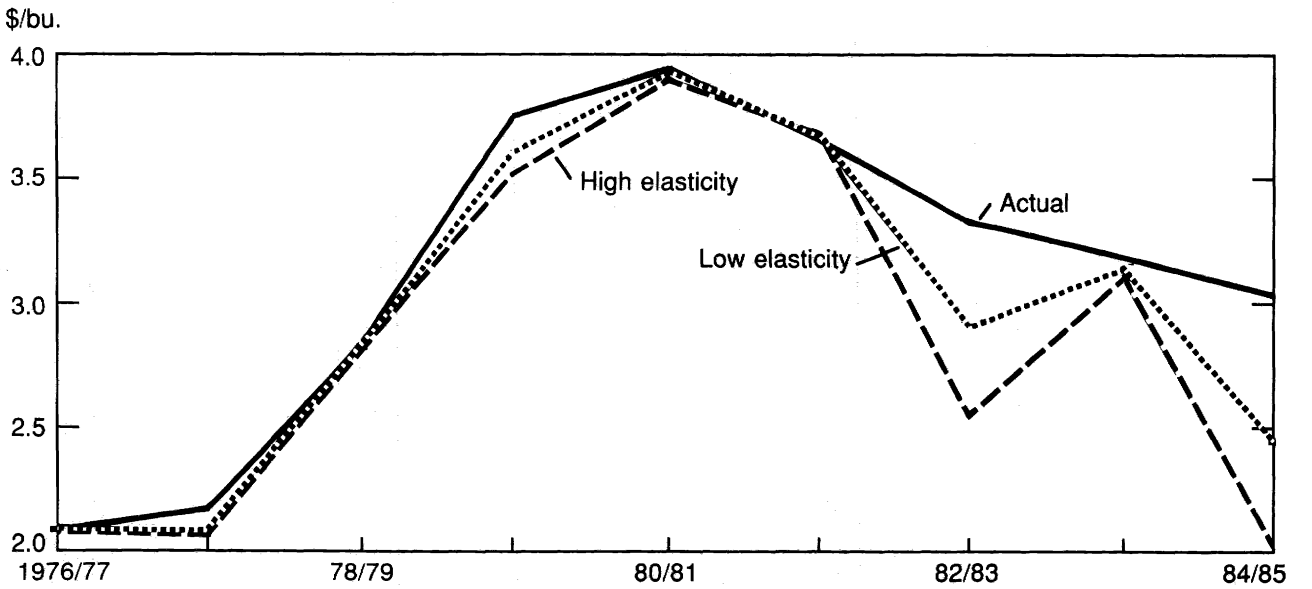
Costs of operating this type of program for wheat and corn alone reached several billion

Table 19.9--Effects of surplus corn and wheat stocks disposal on net farm income

Item	1980/81	1983/84	1984/85	Total
		Million dollars		
CCC disposal:				
Value of production 1/	0	5,655	1,750	7,100
Deficiency payments	0	960	0	960
PIK payments	0	-7,055	-610	-7,665
Total receipts	0	-440	1,140	700
Production expenses	0	3,153	629	3,782
Net farm income	0	-3,593	511	-3,082
FOR + CCC disposal, change from actual:				
Value of production 1/	1,770	7,350	2,070	11,190
Deficiency payments	0	0	0	0
PIK payments	0	-7,055	-610	-7,665
Total receipts	1,770	295	1,460	3,525
Production expenses	0	3,160	777	3,937
Net farm income	1,770	-2,865	683	-412

Figure 19.8

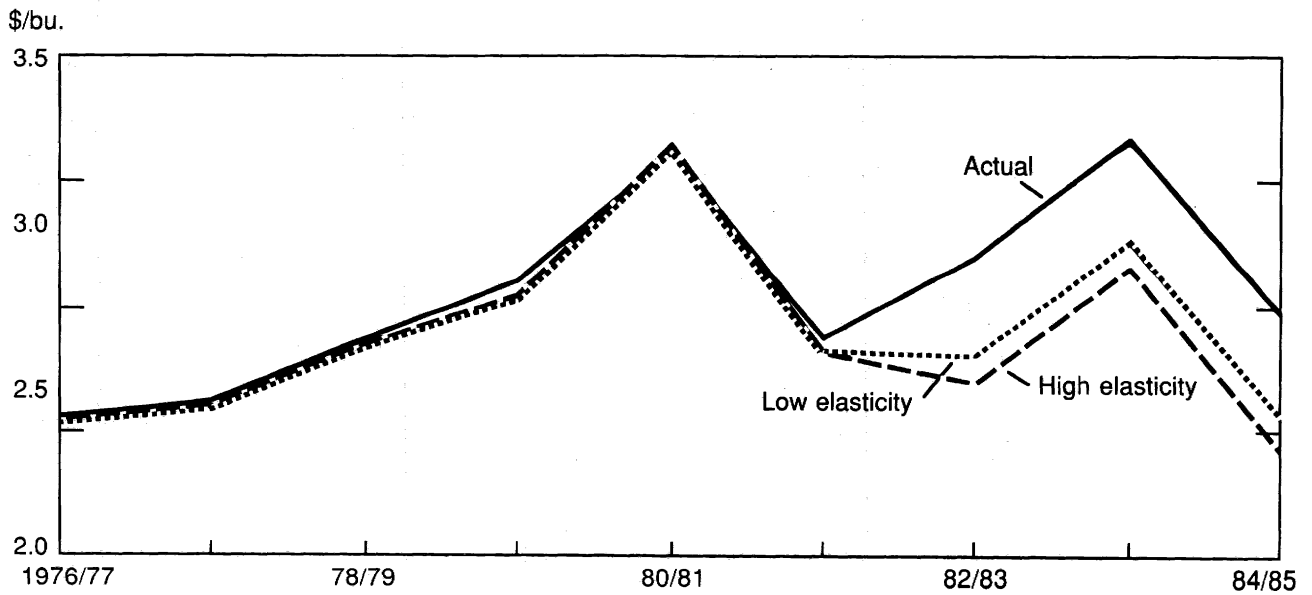
U.S. Export Prices for Wheat Under CCC Model by Elasticity Level



Crop years. Sources: *(1, 2, 3).*

Figure 19.9

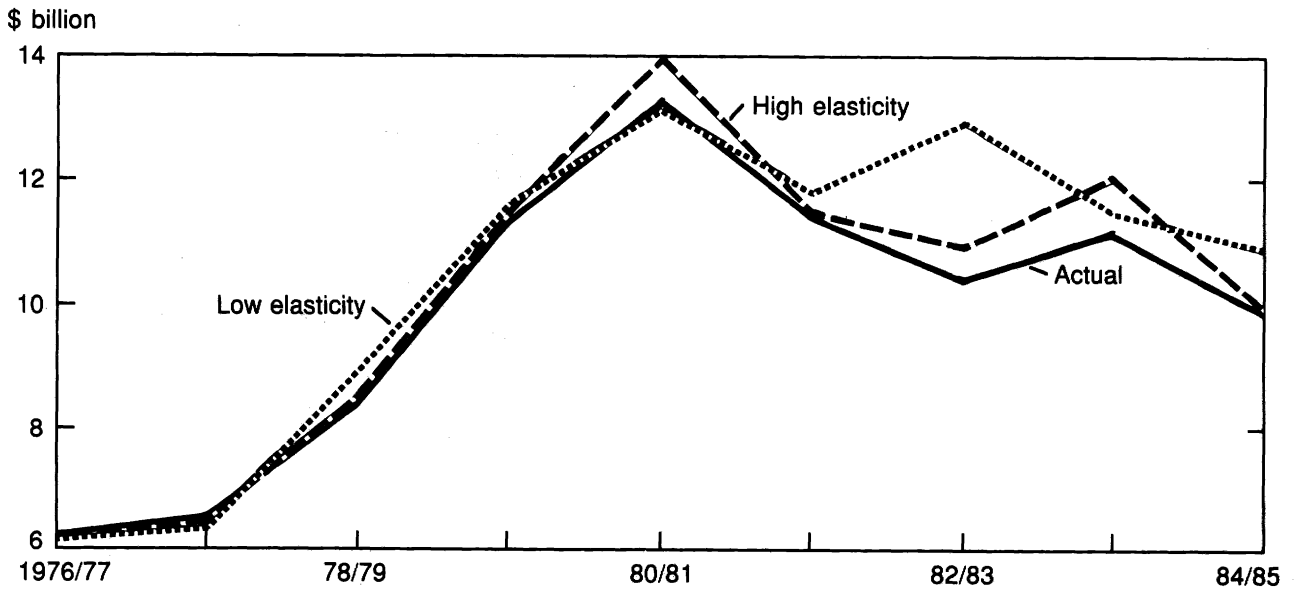
U.S. Export Prices for Corn Under CCC Model by Elasticity Level



Crop years. Sources: *(1, 2, 3).*

Figure 19.10

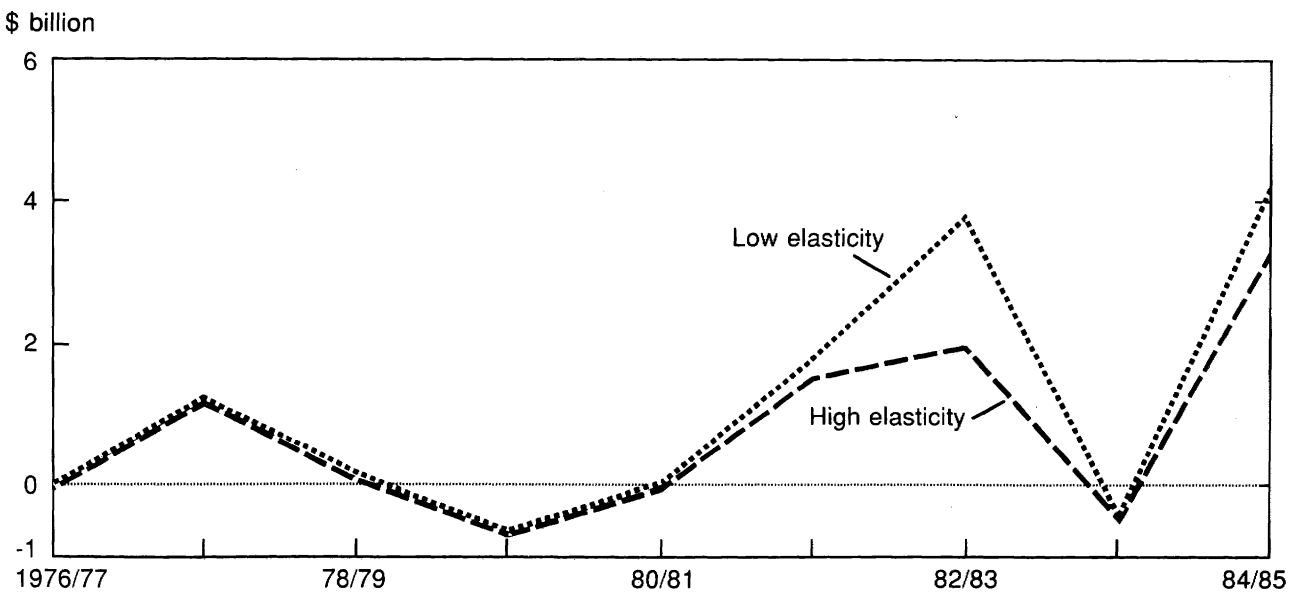
Market Value of U.S. Exports Under CCC Model by Elasticity Level



Crop years. Value is for wheat and corn combined. Sources: *(1, 2, 3)*.

Figure 19.11

Net U.S. Cost of Subsidies Under FOR + CCC Model by Elasticity Level



Crop years. Model assumes no payment in kind. Sources: *(1, 2, 3)*.

dollars in some years. Taking into account the savings on storage costs and the gains from sales revenue in some years, the estimated costs for the CCC stocks disposal over the 8 years was $7.5 billion, and the estimated cost for disposal of both CCC and FOR stocks was over $10 billion (table 19.10). Actual costs of the PIK program can be considered as a savings in this analysis, since a PIK program would not have been necessary with surplus stocks disposal. In comparison to the estimated costs of the subsidy programs, the value of PIK entitlements to wheat and corn producers was about $8 billion, which is slightly above the cost of the subsidy program for CCC stocks only and $2 billion below the cost of the FOR + CCC case. Other program costs, such as deficiency payments, were not affected by this program, since it was designed to hold U.S. prices at the historic levels.

Estimated costs of the subsidy program are sensitive to the assumed import demand elasticities. When higher elasticities are assumed, estimated costs decline by $2.5-$3.5 billion. Both cost estimates under high elasticities are below cost of PIK.

Design of the subsidy program requires that a domestic price objective be set. For this analysis, actual historical market prices were chosen as the policy price objective. If a similar program were implemented, one program parameter would be a price objective for the commodities affected. In many respects, this would be similar to the EC export restitution program where the export subsidy varies based on the difference between a fixed domestic price and a variable international price. In this analysis, the larger costs occurred during years when there was an exceptionally good crop. There were no subsidies in the drought years. As is the case with the EC export subsidy program, this program would add more instability to U.S. exports and world market prices while stabilizing domestic prices.

Table 19.10--Estimated cost levels for the export disposal scenarios with PIK cost comparison

Item	Model elasticities	Higher elasticities
	Billion dollars	
Change in cost:		
CCC case	7.5	5.1
FOR + CCC case	10.1	6.7
PIK cost	8.1	8.1

REFERENCES

(1) Bahrenian, Aniss, S. Devadoss, and William H. Meyers. *FAPRI Trade Model for Feed Grains: Specification, Estimation, and Validation.* CARD Staff Report 86-SR1. Iowa State Univ., Center for Agr. and Rural Dev., Jan. 1986.

(2) Devadoss, S., Michael Helmar, and William H. Meyers. *FAPRI Trade Model for the Wheat Sector: Specification, Estimation, and Validation.* CARD Staff Report 86-SR3. Iowa State Univ., Center for Agr. and Rural Dev., Jan. 1986.

(3) Meyers, William H., Michael Helmar, and S. Devadoss. *FAPRI Trade Model for the Soybean Sector: Specification, Estimation, and Validation.* CARD Staff Report 86-SR2. Iowa State Univ., Center for Agr. and Rural Dev., Jan. 1986.

APPENDIX

CARD/FAPRI MODEL: STRUCTURE, ASSUMPTIONS, AND ALTERNATIVE SIMULATION

The components of the CARD/FAPRI Regional Trade Model are shown in the following equations:

Equations

(1) $EDT = \sum_{i=1}^{n} DM_i - \sum_{i=1}^{n} SM_i = \sum_{i=1}^{n} f_i(P_i, X_i) - \sum_{i=1}^{n} h_i(P_i, Z_i)$ $\quad i = 1,...,n$ Importers

(2) $ESO = \sum_{i=1}^{m} SX_j - \sum_{i=1}^{m} DX_j = \sum_{i=1}^{m} h_j(P_j, Z_j) - \sum_{i=1}^{m} f_j(P_j, X_j)$ $\quad j = 1,...,m$ Exporters

(3) $ESUS = h_u(P_u, Z_u) - f_u(P_u, X_u)$ $\quad u$ = U.S.., United States Exports

(4) $ESUS = EST - ESO$ World Market Equilibrium

(5) $P_i = P_u e_i + M_i$ $\quad i = 1,...,n$

(6) $P_j = P_u e_j + M_j$ $\quad j = 1,...,m$

where

DM = importer demand

DX = exporter demand

e = exchange rate

M = trade margin (transport cost, tariff, subsidy, etc.)

P = domestic prices

SM = importer supply

SX = exporter supply

X = vector of demand shifters

Z = vector of supply shifters

In most instances, the supply and demand relationships f_i and h_i are the estimated equations in the model. In a few instances net trade equations are estimated directly. The tables that follow outline the structural components of the model and report the estimated price and income elasticities. The functional form is generally linear.

Appendix table 19.1--Price elasticities of supply and demand for soybean trade model

Item	Elasticity with respect to--				
	Soybean price	Soymeal price	Soyoil price	Value of meal and oil	Corn price
United States:					
Production	0.71				
Soybean crush	-2.08			1.96	
Soybean stocks	-.69				
Soymeal demand		-0.41			0.19
Soyoil demand			-0.45		
Soyoil stocks			-.13		
Brazil:					
Production	.08				
Soybean crush	-.50			1.00	
Soymeal demand		-.34			-.21
Argentina:					
Production	.27				
Soybean crush	-2.26			2.50	
Soymeal demand		-.18			
EC:					
Soybean crush	-1.91			1.99	
Soymeal demand		-.27			.25
Spain:					
Soybean crush	-4.87			5.05	
Soymeal demand		-.32			.44
Japan:					
Soybean crush	-.26			2.16	
Soymeal demand		-.07			
Eastern Europe:					
Soybean crush	-2.20			1.84	
Rest of world:					
Soymeal demand		-.30			

Appendix table 19.2--Price transmission elasticities of soybean and soymeal prices of other regions with respect to U.S. soybean and soymeal prices

Regions	Soybean price	Soymeal price
Brazil	1.80	1/1.00
Argentina	.97	.96
EC	.90	.88
Spain	.86	.84
Japan	.91	.53
Eastern Europe	.88	.88
Rest of world	--	1.00

1/ The domestic soymeal price is subject to government control and hence does not respond to U.S. soymeal price. The U.S. soymeal price is used for the Brazil soymeal export price and thus price transmission elasticity is 1.

Appendix table 19.3--Summary of estimated domestic supply and demand elasticities from the wheat trade model

Item	Elasticities of--					
	Wheat price	Barley price	Sorghum price	Rice price	Soymeal price	Corn price
United States:						
Production	0.20					
Food demand	-.14					0.55
Feed demand	-3.01		1.17			
Stock demand	-.28					
Canada:						
Production	.38	-0.30				
Feed demand	-.12					
Stock demand	-.28					
Australia:						
Production	.01	-.63				
Stock demand	-.43					
Argentina:						
Production	.50					
Food demand	-.16					
EC:						
Production	.66					
Feed demand	-3.11	6.04			0.08	
India:						
Production	.44		-.04			
Food demand,	-.45			0.48		.73
Japan total use	-.12					.22
USSR food demand						.23
China total use						.59
Eastern Europe total use						.28

Appendix table 19.4--Price transmission elasticities of wheat prices of other regions with respect to world prices 1/

Regions	U.S. wheat gulf port prices
Canada wheat export prices	1.13
Australia wheat export prices	.97
Argentina wheat farm price	.28
Japan wheat resale price	.28

1/ Price transmission elasticities for other regions--EC, India, and centrally planned economies--are zero.

Appendix table 19.5--Summary of estimated production elasticities from the feed grains model

Country	Elasticities of--						
	Corn price	Sorghum price	Barley price	Wheat price	Soybean price	Cassava price	Rice price
U.S. corn	0.07				-0.13		
Canada:							
Barley			0.74	-0.47			
Corn	.26				-.20		
Australia barley			.34	-.29			
Argentina:							
Sorghum		0.10					
Corn	1.10	-.97					
Thailand corn and sorghum	.30					-0.06	-0.28
EC:							
Corn	.39						
Barley			.70				

Appendix table 19.6--Summary of estimated domestic demand elasticities from the feed grain model

Country	Elasticities of--							
	Corn price	Sorghum price	Barley price	Soymeal price	Wheat price	Cassava price	Livestock product price	Income
United States:								
Corn food	-0.18							
Corn stock	-.19			0.18	0.20		0.13	
Corn stock	-.67							
Canada barley and corn total use		-0.08	0.14	.05			.25	
Australia:								
Corn total use	-.14	.14						
Sorghum total use	.98	-3.17						
Thailand corn and sorghum total use	-.14					0.14	.25	
South Africa feed grain net imports								2.00
EC:								
Corn feed	-.05			.05				.88
Corn food	-.70							
Barley feed			-.26	.02				.06
Barley food			-.39					
Spain corn	-.21							
USSR feed grain total use								.37
Japan:								
Corn and sorghum total use	-.20			.16				
Corn and sorghum stock	-.46	-.45					.95	

Appendix table 19.7--Price transmission elasticities of feed grain prices with respect to U.S. feed grain prices

Country	Elasticities of U.S. corn price	U.S. barley price	U.S. sorghum price
Canada:			
Barley		0.84	
Corn	0.96		
Australia:			
Barley		1.12	
Argentina:			
Corn	1.10		
Sorghum			1.14
Thailand:			
Corn	1.12		
South Africa:			
feed grain	0	0	0
EC:			
Corn	0		
Barley		0	
Spain corn	.75		
USSR feed grain	0	0	0
Japan corn	.97		

Appendix table 19.8--Computation of price and income elasticities for net import demand in selected regions not included in the econometric model

Region	Imports (1)	Consumption (2)	(2)/(1)	$\frac{(2)-(1)}{(1)}$	n Income elasticity	$n \times \frac{(2)}{(1)}$ Adusted income elasticity	e_d Demand elasticity	e_s Supply elasticity	e_i Price elasticity	Import elasticity 1/
					1,000 tons					
Wheat:										
North Africa and Middle East 2/	20,026	48,098	2.41	1.41	0.35	0.84	-0.2	0.2	0.4	-0.306
Other West Europe	220	9,268	42.13	41.13	.15	6.32	-.2	.2	.3	-4.163
Other Asia 3/	12,328	28,505	2.31	1.31	.40	.93	-.5	.2	.2	-.362
Other S. America 4/	8,312	12,016	1.45	.45	.25	.36	-.2	.2	.5	-.378
Rest of world 5/	10,136	54,939	5.42	4.42	.40	2.17	-.7	.2	.3	-1.170
Feed grains:										
High-income East Asia	8,263	9,513	1.15	.15	.45	.52	-.7	.2	.6	-.502
East Europe	3,390	70,891	20.91	19.91	.35	7.32	-.3	.2	.5	-5.128
Rest of world 5/	24,543	173,197	7.06	6.06	.40	2.82	-.5	.2	.4	-1.659
Soymeal:										
China	475	1,019	2.15		.40	.86				
USSR	1,211	2,358	2.00		.30	.58				
Rest of world 5/	8,200	14,920	1.82	.820	.40	.73	-.3	.2	.5	-.355
Soybean:										
China	569	8,775	15.43		.20	3.09				
USSR	1,269	1,785	1.41		.30	.42				

1/ Computed as $e_d e_i \frac{(2)}{(1)} - e_s e_i \frac{(2)-(1)}{(1)}$.
2/ Excludes Egypt.
3/ Excludes India.
4/ Excludes Central America.
5/ Includes all countries and regions not listed in appendix tables 19.1 to 19.8.

Appendix table 19.9--Variable cost of production used for the minimum export price rule

Year	Wheat	Corn
	Dollars per bushel	
1970	0.64	0.46
1971	.67	.48
1972	.72	.52
1973	.82	.59
1974	.94	.67
1975	1.03	.74
1976	1.10	.79
1977	1.16	.83
1978	1.25	.90
1979	1.42	1.02
1980	1.60	1.15
1981	1.73	1.25
1982	1.82	1.31
1982/84 and 1983	1.85	1.33
1984	1.90	1.36

Source: ERS/USDA. The 1982/84 average is the average variable cost of production for the United States. Other years are computed by using the producer price index to adjust from year to year.

Appendix Table 19.10--Effects of surplus wheat stocks disposal on prices, subsidy, and program costs (high elasticity)

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
				Dollars per bushel					
Actual:									
U.S. gulf price	3.16	3.83	4.74	4.95	4.65	4.32	4.19	4.03	4.23
U.S. farm price	2.33	2.98	3.78	3.91	3.65	3.55	3.53	3.38	3.39
9-month loan rate	2.25	2.35	2.50	3.00	3.20	3.55	3.65	3.30	2.98
Reserve loan	2.25	2.35	2.50	3.30	3.50	4.00	3.65	3.30	3.11
CCC disposal:									
U.S. farm price	2.33	2.98	3.78	3.91	3.67	3.55	3.48	3.38	3.38
Subsidy	.10	.01	.13	.02	0	.42	0	.58	.16
U.S. price subsidy	2.23	2.97	3.65	3.89	3.67	3.13	3.48	2.80	3.23
				Million dollars					
Change in cost--									
Subsidy expenditure	114.79	10.92	190.41	36.05	0	770.28	0	1,133.52	282.00
Storage cost 1/	-12.76	-13.53	-49.76	-52.87	-50.44	-50.92	-50.34	-100.19	-47.60
Net sale loss 2/	-3.86	-1.85	-174.93	-10.70	0	0	0	-15.06	-25.80
CCC inventory value 3/	0	0	0	0	0	0	0	1,247.00	155.96
Net cost	98.18	-4.47	-34.28	-27.52	-50.44	719.35	-50.34	1,018.27	208.93
PIK cost 4/	0	0	0	0	0	389.10	1,836.40	248.60	309.26
				Dollars per bushel					
FOR + CCC disposal:									
U.S. farm prices	2.33	2.98	3.85	3.91	3.65	3.55	3.54	3.38	3.40
Subsidy	.68	.09	0	.17	.20	.72	0	.45	.29
U.S. price subsidy	1.65	2.89	3.85	3.74	3.45	2.83	3.54	2.93	3.11
				Million dollars					
Change in cost--									
Subsidy expenditure	932.71	110.97	0	282.88	388.98	1,608.13	0	826.10	518.72
Storage cost 1/	-102.73	-117.43	-103.80	-148.30	-199.32	-332.03	-312.17	-319.57	-204.42
Net sales loss 2/	-30.92	-34.98	-525.60	-105.94	-30.34	224.54	0	-15.04	-64.79
CCC inventory value 3/	0	0	0	0	0	0	0	1,247.00	155.96
Net cost	799.06	-41.44	-629.39	28.65	159.32	1,500.63	-312.17	1,738.48	405.47
PIK cost 4/	0	0	0	0	0	389.10	1,836.40	248.60	309.26

1/ Cost of CCC storage and FOR storage payments.
2/ Acquisition cost of stocks minus the value of stock sales.
3/ Value of CCC stocks held at the end of 1984/85 if there is no disposal program.
4/ Value of PIK entitlements to producers.

Appendix table 19.11--Effects of surplus corn stocks disposal on prices, subsidy, and program costs (high elasticity)

Item	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1977-84 average
					Dollars per bushel				
Actual:									
U.S. gulf price	2.63	2.88	3.11	3.62	2.88	3.20	3.67	2.98	3.12
U.S. farm price	2.02	2.25	2.52	3.11	2.50	2.70	3.25	2.62	2.62
9-month loan rate	2.00	2.00	2.10	2.25	2.40	2.55	2.65	2.55	2.31
Reserve loan	2.25	2.35	2.50	2.25	2.55	2.90	2.65	2.55	2.50
CCC disposal:									
U.S. farm price	2.02	2.25	2.52	3.13	2.50	2.70	2.84	2.62	2.57
Subsidy	.01	.04	.07	0	.05	.40	0	.42	.12
U.S. price subsidy	2.01	2.21	2.45	3.13	2.45	2.30	2.84	2.20	2.45
					Million dollars				
Change in cost--									
Subsidy expenditure	13.67	84.29	174.63	0	93.81	1,061.86	0	1,065.36	311.70
Storage cost 1/	-3.10	-25.78	-66.01	-61.35	-77.86	-300.59	-53.27	-63.60	-81.44
Net sales loss 2/	-0.23	-21.42	-63.74	0	-6.26	-126.14	0	-2.71	-27.56
CCC inventory value 3/	0	0	0	0	0	0	0	612.00	76.55
Net cost	10.35	37.09	44.88	-61.35	9.70	635.12	-53.27	1,711.05	278.25
PIK cost 4/	0	0	0	0	0	14.20	5,218.60	362.70	699.44
					Dollars per bushel				
FOR + CCC disposal									
U.S. farm price	2.02	2.25	2.52	3.35	2.50	2.70	3.34	2.62	2.66
Subsidy	.16	.11	.10	0	.54	.43	0	.44	.22
U.S. price subsidy	1.86	2.14	2.42	3.35	1.96	2.27	3.34	2.18	2.44
					Million dollars				
Change in cost--									
Subsidy expenditure	361.87	256.68	255.05	0	1,568.86	1,231.63	0	1,103.41	597.19
Storage cost 1/	-84.43	-165.07	-229.97	-109.05	-415.57	-700.18	-165.89	-179.41	-256.20
Net sales loss 2/	70.53	.33	-65.67	0	48.50	-78.96	0	-3.54	-3.60
CCC inventory value 3/	0	0	0	0	0	0	0	612.00	76.55
Net cost	348.02	91.94	-40.59	-109.05	1,201.79	452.49	-165.89	1,532.46	413.90
PIK cost 4/	0	0	0	0	0	14.20	5,218.60	362.70	699.44

1/ Cost of CCC storage and FOR storage payments.
2/ Acquisition cost of stocks minus the value of stock sales.
3/ Value of CCC stocks held at the end of 1984/85 if there is no disposal program.
4/ Value of PIK entitlements to producers.

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CHAPTER 20

EMPIRICAL MODELING OF SURPLUS DISPOSAL PROGRAMS*

This chapter examines what would happen if the Commodity Credit Corporation (CCC) reduced stocks and promoted exports more aggressively than in the last decade. While the United States apparently could dispose of all public stocks by subsidizing grain exports in world markets, costs of such programs are large. Targeting export subsidies to specific buyers raises export revenues and farm income more than does a global disposal program because a targeted export subsidy can exploit differences in price responsiveness among countries.

This analysis determines the price impacts, export increases, and costs associated with three general programs. Other versions of export disposal programs may be modeled as various forms of these general programs. The program scenarios analyzed are: (1) A uniform, global export subsidy to dispose of public stocks in the export market, (2) a program designed to maximize farm income by allowing the United States to select the optimal pattern of targeted export subsidies, and (3) a program to dispose of public stocks of wheat and coarse grains in world markets using targeted export subsidies. Although both scenarios 2 and 3 use targeted export subsidies, their objectives differ. Scenario 2 is solely concerned with farm income, while scenario 3 also has a stocks disposal target. Some actual CCC authorizations fit this generic analysis better than others, but overall the effects identified hold for all export disposal programs.

MODELING APPROACHES

The alternative CCC program scenarios can be analyzed by the same spatial equilibrium and price discrimination models used to analyze the 1980 U.S. suspension of grain sales to the USSR.[1]

The spatial equilibrium model assumes that wheat and coarse grains are homogeneous commodities traded in a competitive environment. Nations are spatially separated and price differences reflect differences in transportation costs and policy intervention. Policies in the spatial equilibrium model are treated exogenously. The model determines trade flows on the basis of differences in transportation costs.

The spatial equilibrium model provides an underlying structure for the price discrimination model. Because the spatial equilibrium model is designed to explain bilateral trade flows, modifications allow the model to target policies to specific buyers. The spatial equilibrium model assumes competitive conduct, while the price discrimination model assumes imperfectly competitive markets. This transformation is accomplished by adding an objective function which represents U.S. welfare and buyer-specific, endogenous policy instruments: The targeted export subsidies. In effect, the United States is given the market power to set policies to maximize its welfare (given by the objective function) by exploiting the elasticity of excess demand of the various buyers.

Analysis of targeted export subsidies shows that, while a global export subsidy is welfare-reducing, targeted export subsidies can benefit a nation. This result is obtained for several reasons. If the targeted country is relatively price- and income-sensitive, then the exporting country can potentially increase its welfare by adopting discriminatory subsidies to exploit differences in substitution and income effects among countries: A form of price discrimination. As discussed in Chapter 18, the more price-responsive an importer is, the greater is the increase in demand as a consequence of receiving a subsidy. Targeting countries where income rather than substitution effects are large ensures that welfare gains in one commodity are not matched by losses in the substitute commodity. Differences in behavior are important because

*Contributors to this chapter were Philip C. Abbott and Philip Paarlberg.

[1]A detailed discussion of these models is found in the appendix to Chapter 11.

achieving a welfare gain requires implicit taxation. Targeted subsidies accomplish this by raising demand in income and hence price-elastic markets and by increasing border prices thus generating implicit taxes in markets which are less price-responsive and which receive lower or no subsidies.

Market sharing and transportation costs are also critical. An exporting country can exploit the import demand elasticity of a market it does not supply because of relatively high transportation costs by subsidizing a market shared with an exporter who does supply that market. Further, an exporting country can exploit the export supply elasticity of a competitor by subsidizing shared markets even if the import demand elasticity of the shared market is zero.

The exploitation of exporter response to price is an important and unique component of this model. Many economists argue that some exporter responses to border price changes are greater than most importer responses. Thus, if the United States subsidizes a market which is price-inelastic, it may be driving down the export supply of a competitor. This mechanism is particularly important when export subsidies are used to increase U.S. market shares and drive out competitors in the price elastic markets. Unless the larger, less elastic markets are also subsidized, competitors may simply replace the market share taken by the United States through its program of targeted subsidies in the larger, unsubsidized market.

Hence, targeted subsidies can be used both to gain market access and to defend markets against competitors. A complete general equilibrium and partial equilibrium development of the price discrimination model is presented by Abbott, Paarlberg, and Sharples, who demonstrate these results in considerably greater detail *(1)*.[2]

EMPIRICAL IMPLEMENTATION OF ALTERNATIVE APPROACHES

Three scenarios are analyzed. The first scenario estimates effects of a uniform, global export subsidy program that achieves U.S. stock disposal targets while maximizing farm income, less subsidy costs. This scenario assumes that one objective of U.S. policy is to eliminate U.S. public wheat and coarse grain stocks by exporting an additional 12 million tons of wheat and exporting an additional 20 million tons of coarse grains.

The second scenario estimates impacts of a program to maximize U.S. farm income, less subsidy costs, using export subsidies that are targeted to individual buyers. This scenario does not include a surplus stocks disposal target. Given the farm income objective, the problem is to determine the levels and pattern of export subsidies. Effects on prices and export volume for wheat and coarse grains vary according to the levels chosen. Abbott, Paarlberg, and Sharples demonstrate that results obtained by maximizing farm income and by maximizing export revenue are similar *(1)*. Therefore, we consider only the former in this analysis.

The third scenario estimates the pattern and level of targeted subsidies necessary for the United States to dispose of all CCC and farmer-owned reserve (FOR) stocks of wheat and coarse grains in world markets while keeping farm income net of subsidy cost as high as possible.

The price discrimination model is used for all program scenarios in the analysis. The scenario in which the United States adopts a pattern of targeted export subsidies to maximize farm income without the stocks disposal targets (scenario 2) is the most similar to the pure price discrimination model. The United States is assumed to select a pattern of targeted export subsidies which maximizes farm income less subsidy costs. An individual country can have several possible objectives: Maximization of economic surplus, export revenue, export volume, or farm income (net of subsidy costs). Picking the objective that is most appropriate for selecting the optimal targeted subsidies is difficult and requires knowledge of policymaker behavior and preferences. This analysis assumes that U.S. agricultural policymakers are solely concerned with farm income versus subsidy costs. The optimal pattern of subsidies is determined by the elasticity of import demand exhibited by the different importers and by the elasticity of

[2]Italicized numbers in parentheses refer to items in the References section at the end of this chapter.

export supply for major competitors supplying that import market. The more elastic a country's import demand function, the larger a subsidy received *(1)*. The subsidies are also larger where the United States faces competition from other exporting countries *(1)*. An additional assumption introduced into the model is that no trade flow is taxed; that is, all subsidies are positive. The model is not a strictly classic price discrimination model because export taxes are not considered. Export taxes are not considered because neither the CCC nor the U.S. Government have the authority to impose direct export taxes, and because, by offering different subsidies to different countries, some nations face an implicit tax because they receive a smaller subsidy. Thus, implicit taxes arise due to different subsidy levels.

Scenarios 1 and 3, in which surplus stocks are reduced with a uniform, global export subsidy and with a targeted subsidy policy, are similar. Both assume that the CCC wishes to dispose of a specific quantity of wheat and coarse grains in world markets. Scenario 1 assumes that the disposal is accomplished with a uniform, global subsidy and determines the subsidy necessary to meet the stock disposal targets while maximizing farm income less subsidy costs. Scenario 3 determines the optimal pattern of targeted subsidies which must be paid by the CCC to meet the stock disposal targets while maximizing farm income less subsidy costs.

The subsidy scheme in Chapter 19 was a uniform global subsidy. While those results are most directly comparable to scenario 1, the quantity of grain disposed of differs. As in that chapter, the disposal scheme was begun prior to 1980, and surplus stocks had already disappeared by 1980. That chapter employed a multi-year dynamic analysis, while scenario 1 uses comparative static analysis for a convenient, representative base year.

For scenarios 1 and 3, surplus stocks must be defined. In this analysis, surplus stocks are assumed to be CCC and FOR stocks held in 1979/80. Under this definition, 12 million tons of wheat and 20 million tons of coarse grain are forced onto world markets either with a uniform or targeted export subsidy.

Implementing these scenarios is difficult. The U.S. objective is to find a set of subsidies which maximizes farm income less subsidy costs at the same time that all of surplus tonnages are disposed of in the export market. The difficulty occurs because fixing the export levels at base quantity plus the stock release creates a perfectly inelastic U.S. export supply function. With the U.S. domestic price, the world price, and the subsidies as the solution variables, the optimization algorithm cannot find a solution when the export level is fixed. To resolve this difficulty, the U.S. export supply function for each type of grain is shifted rightward by the amount of the surplus stocks disposal. The model then determines optimal subsidies and border prices, given this excess supply shift. Thus, the model is forced to balance the increase in farm income and subsidy costs in determining the optimal subsidies. The global, uniform export subsidy is found by adding a constraint that all subsidies are identical. The U.S. domestic price less the subsidy to the individual importer determines the price that a buyer must pay (exclusive of transportation charges) for U.S. wheat and coarse grains. The problem with this approach is that the solution values for U.S. exports do not exactly equal the base trade level plus the stock disposal because the shifted U.S. export supply function retains its slope, which means supply is not fixed but instead responds to the border (world) price.

IMPACT OF U.S. SURPLUS STOCKS DISPOSAL PROGRAM

Despite a large number of possible specific programs, we analyze three generic programs because other versions of export disposal programs may be modeled as various forms of these general programs.

Scenario 1: A Uniform, Global U.S. Export Subsidy

The first scenario considers consequences of the United States adopting a program offering a uniform export subsidy to all buyers to dispose of surplus public stocks of wheat and coarse grains that were on hand at the end of the 1979/80 crop year (table 20.1). The export subsidy is $59.22 per ton for wheat and $32.55 per ton for coarse grains. The subsidy policy

introduces a wedge between the internal U.S. price and the export price. Domestic U.S. wheat price rises to $174.88 per ton, compared with a base price of $173.88 per ton, while the U.S. export price falls to $115.17 per ton. Similar changes in U.S. coarse grain prices occur as the U.S. domestic price remains at around $130 per ton and the export price falls to $97.66 per ton.

Total U.S. wheat exports rise from 35.9 million tons without the subsidy to 48 million tons with the subsidy. U.S. coarse grain exports rise from 63.5 million tons to 83.5 million tons with the export subsidy. The U.S. subsidy policy not only expands purchases by countries supplied in the base solution but also allows the United States to expand into markets which are not supplied in the base solution. In the case of wheat, the United States gains additional markets in Africa and in South Asia. For coarse grains, markets gained are in North Africa, the Middle East, Other Southeast Asia, and China. For both wheat and coarse grains, U.S. exports to the USSR cannot expand despite the export subsidy because of the sales limits imposed by the embargo.

Table 20.1--Scenario 1: A uniform, global export subsidy by the United States on U.S. wheat and coarse grain exports

Country/region	Wheat		Coarse grains	
	Base	Global subsidy disposal	Base	Global subsidy disposal
		Dollars per ton		
U.S. price (domestic)	173.88	174.88	130.26	130.20
Subsidy	0	59.22	0	32.55
U.S. price (export)	173.88	115.17	0	97.66
		Million tons		
EC	4.897	4.897	11.978	12.663
Other Western Europe	1.711	1.993	7.758	11.271
Japan	3.486	3.551	17.488	19.619
South Africa	.009	.017	2/	2/
Eastern Europe	4.153	5.002	6.678	10.241
USSR	1.800	1.800	6.200	6.200
China	6.798	8.690	0	1.838
Mexico	.750	1.035	7.233	8.744
Other Central America	2.064	2.135	.842	.966
Brazil	4.259	4.381	1.100	2.152
Venezuela	.731	.810	1.174	1.362
Other South America	3.060	3.340	1.567	1.927
Sub-Sahara	0	.825	0	0
Nigeria	0	.346	0	0
Egypt	1.500	4.475	0	0
North Africa	0	.832	0	.557
India	0	0	0	0
Other South Asia	0	0	0	0
Indonesia	0	.995	0	.050
Thailand	0	.187	2/	2/
Other Southeast Asia	.178	1.492	0	1.338
East Asia	.500	0	.750	2.885
Middle East	0	1.193	0	.891
Rest of world	0	0	.773	.794
Total	35.896	48.000	63.543	83.500

1/ This policy uses a uniform export subsidy to dispose of surplus wheat and coarse grains stocks in world markets. For wheat this means twelve million tons of wheat stocks are exported, while 20 million tons of coarse grains are exported.
2/ Not applicable. This country is an exporter of coarse grains.

Scenario 1, the global, uniform subsidy program, was also solved using the Armington model described in Chapter 11 (not shown). That Armington model is identical to the spatial equilibrium model, except that trade flows are no longer determined by a cost-minimizing algorithm, which reflects the operation of a perfectly competitive market. Rather, the Armington model reflects the rigidities in adjustments of trade flow patterns to border price changes due to existing marketing relationships, bilateral agreements, differences in quality, characteristics of the commodity, and other factors. Given these rigidities in trade flow patterns, it is expected that larger subsidies would be required to accomplish the same magnitude of stock disposal. Empirical results bear out this expectation. For wheat, a subsidy of $63.91 per ton, which is $4.69 per ton greater than that found for the spatial equilibrium model, was needed to dispose of the 12 million tons of surplus stocks. Export disposal of 20 million tons of coarse grains required a $42.65 per ton subsidy, $10.10 per ton greater than the subsidy found for the spatial equilibrium model. While subsidy costs for this scenario are commensurately higher than those for scenario 1, export revenue and farm income are nearly identical because the U.S. internal price is the same.

Scenarios 2 and 3: Price and Subsidy Patterns When Targeted

Table 20.2 shows the U.S. price and export subsidies required in the targeted subsidy scenarios compared with the uniform, global subsidy. If the United States were to adopt a policy of targeted subsidies to maximize U.S. farm income, the U.S. prices for both wheat and coarse grains would rise because exports are increased, which reduces supplies available to the domestic market. The U.S. wheat price rises from $173.88 to $178.22 per ton, while the U.S. coarse grain price rises from $130.26 to $158.44 per ton. Virtually every buyer receives some subsidy in this scenario. Smaller subsidies occur because of the low elasticity compared with coarse grain. Thus, except for a few countries, effectiveness of subsidies in the wheat market is limited. The large subsidy for South Africa occurs because that country is a marginal importer with an extremely price-sensitive demand. The smallest export subsidies are given to developed country markets in Europe and Japan which are relatively insensitive to price changes. Centrally planned countries receive subsidies of between $6.50 and $8.70 per ton. Large subsidies for China and Eastern Europe reflect foreign exchange limitations which can be relieved by the subsidy. The USSR is subsidized to defend U.S. market share against Canadian sales. Countries in North Africa and Asia receive the largest subsidies because these developing countries are relatively responsive to price changes and because the United States faces competition from Canada and Australia.

The export subsidies offered by the United States for coarse grains are considerably larger, in excess of $50 per ton. As with wheat, the pattern of the subsidies reflects the price-responsiveness of import demand. The subsidies offered to the EC, Japan, Eastern Europe, China, and Latin America range from $49.17 to $57.07 per ton. Markets with more price-responsiveness due to policies or foreign exchange difficulties and markets where the United States faces competition from other suppliers receive export subsidies in the $60- to $70-per-ton range.

For the stocks disposal program scenario (Scenario 3), the targeted export subsidies needed to export an additional 12 million tons of wheat and 20 million tons of coarse grains are large. This program adds supplies to the market; hence, world prices fall. The U.S. wheat price falls to a maximum of $119.61 per ton to the least preferred buyers, the European countries and Latin American countries, and the coarse grain price falls to a maximum of $105.45 per ton to Mexico and Other Central America. Except for India, Other South Asia, and the Middle East, all wheat buyers receive a subsidy. The smallest subsidy offered is $59.22 per ton, and the largest is $79.38 per ton. The wheat subsidies necessary to achieve stock disposal (scenario 3) show a large increase over the scenario with no disposal objective (scenario 2). In comparison, a much smaller increase in subsidies is needed in the coarse grain market. This is a result of the low elasticity of the wheat market compared with coarse grains (-1.2 for wheat versus -1.6 for coarse grains). In the coarse grain market, the targeted subsidies necessary to export an additional 20 million tons do not greatly differ

Table 20.2--Three scenarios: A U.S. targeted subsidy scheme and CCC surplus stocks disposal programs 1/, 2/

Country/region	Wheat			Coarse grains		
	Global subsidy disposal	Targeted subsidy	Targeted subsidy disposal	Global subsidy disposal	Targeted subsidy	Targeted subsidy disposal
			U.S. dollars per ton			
U.S. price 3/	174.88	178.22	178.83	130.20	158.44	138.00
U.S. subsidy:						
EC	59.22	1.10	59.22	32.55	51.07	35.93
Other West Europe	59.22	2.00	59.22	32.55	70.22	69.56
Japan	59.22	3.90	61.19	32.55	54.27	35.33
South Africa	59.22	49.61	79.38	32.55	4/	4/
Eastern Europe	59.22	6.70	63.92	32.55	54.77	39.63
USSR	59.22	5.60	59.22	32.55	0	36.27
China	59.22	8.70	65.92	32.55	54.77	43.93
Mexico	59.22	6.47	59.22	32.55	46.77	32.55
Other Central America	59.22	0	59.22	32.55	49.17	59.10
Brazil	59.22	1.10	59.22	32.55	58.27	41.47
Venezuela	59.22	0	59.22	32.55	53.47	38.33
Other South America	59.22	0	59.22	32.55	57.07	40.27
Sub-Sahara	59.22	0	69.82	32.55	0	0
Nigeria	59.22	0	69.82	32.55	0	0
Egypt	59.22	0	69.42	32.55	0	0
North Africa	59.22	13.60	70.82	32.55	68.47	0
India	59.22	0	0	32.55	0	0
Other South Asia	59.22	0	0	32.55	0	0
Indonesia	59.22	10.50	67.72	32.55	60.87	41.47
Thailand	59.22	10.50	67.72	32.55	4/	4/
Other Southeast Asia	59.22	9.50	66.72	32.55	71.50	78.85
East Asia	59.22	0	71.92	32.55	65.27	50.13
Middle East	59.22	13.60	0	32.55	0	53.33
Rest of world	59.22	5.42	62.82	32.55	57.67	42.53

1/ The disposal program scenario assumes that the United States subsidizes sales of all CCC and FOR wheat and coarse grains. For wheat, this means around 12 million tons are dumped in world markets. For coarse grains, the program dumps around 20 million tons in world markets.
2/ A subsidy of zero is reported for countries which do not purchase U.S. grain.
3/ Base U.S. prices are $173.88 per ton for wheat and $130.26 per ton for coarse grains.
4/ Not applicable. This country is an exporter of coarse grains.

from those for the other two scenarios because the coarse grain market is modeled as being relatively elastic. The largest subsidy is offered to Other Southeast Asia, $78.85 per ton. The smallest subsidies are given to Mexico, Japan, and Venezuela, between $32.55 and $38.33 per ton.

The Targeted Programs on Exports

Impacts of the two targeted policies on U.S. export volume are presented in table 20.3. Scenario 2, where the United States offers targeted export subsidies to maximize U.S. farm income without a stocks disposal objective, shows U.S. wheat exports rising from 35.9 million tons to 36.8 million tons. With targeted export subsidies (scenario 3), U.S. coarse grain exports increase from 63.5 million tons to 84.8 million tons. This increase in exports of coarse grains is nearly as great as the increase under the stocks disposal scenario. The large increase for coarse grains compared with wheat reflects the assumption of greater elasticity in the world coarse grain market due to the larger proportion of coarse grains used in livestock feed.

The largest increases occur in Other Southeast Asia, Indonesia, Thailand for wheat only,

North Africa, and the Middle East. For coarse grains, the subsidies encourage additional purchases by Latin American countries. Despite the subsidies, developed countries do not increase purchases of wheat greatly. Other Western Europe reduces imports from the United States slightly as world price adjustments result in a higher net price for that region. The developed countries do increase imports of U.S. coarse grains in response to the subsidy program, but wheat purchases remain about the same. Purchases of U.S. coarse grains by Eastern Europe and China increase significantly, but few gains are shown in the wheat market.

In the surplus stocks disposal scheme, U.S. wheat exports rise to 48.9 million tons. While Eastern Europe and China increase U.S. wheat imports, the disposal program allows the United States to gain access to wheat markets in Sub-Sahara, Nigeria, and East Asia. Exports to many markets, such as Egypt, North Africa, Indonesia, and Southeast Asia also expand.

While the surplus stocks disposal program greatly expands U.S. coarse grain exports to 89.3 million tons, the expansion above the level shown for the targeted subsidy scenario is not as great as for wheat because the coarse grain market is assumed to be more elastic. The only new market gained is in the Middle East, but all buyers increase their purchases of U.S. coarse grains. Other Western Europe in particular shows a large expansion, almost 7 million tons above the base level. Other developed countries also expand purchases, but by much less. Compared with the first scenario, China does not purchase additional

Table 20.3--Scenarios 2 and 3: U.S. wheat and coarse grain exports by region with the U.S. targeted subsidy and surplus stocks disposal program

Country/region	Wheat			Coarse grains		
	Base	Targeted subsidy	Targeted subsidy disposal	Base	Targeted subsidy	Targeted subsidy disposal
			Million tons			
EC	4.897	4.897	4.897	11.978	12.460	12.574
Other West Europe	1.711	1.701	1.974	7.758	12.298	14.449
Japan	3.486	3.486	3.549	17.488	19.194	19.302
South Africa	.009	.015	.019	0	0	0
Eastern Europe	4.153	4.185	5.012	6.678	9.934	10.214
USSR	1.800	1.800	1.800	6.200	6.200	6.200
China	6.798	6.942	8.776	0	1.838	1.838
Mexico	.750	.761	1.016	7.233	8.098	8.393
Other Central America	2.064	2.058	2.130	.842	.922	.937
Brazil	4.259	4.252	4.373	1.100	2.130	2.164
Venezuela	.731	.725	.805	1.174	1.320	1.351
Other South America	3.060	3.039	3.320	1.567	1.886	1.928
Sub-Sahara	0	0	1.068	0	0	0
Nigeria	0	0	.328	0	0	0
Egypt	1.500	0	4.499	0	0	0
North Africa	0	.236	2.236	0	2.507	0
India	0	0	0	0	0	0
Other South Asia	0	0	0	0	0	0
Indonesia	0	.797	1.003	0	.050	.050
Thailand	0	.164	.188	0	0	0
Other Southeast Asia	.178	1.350	1.502	0	1.474	1.735
Eastern Asia	.500	0	.402	.750	3.666	3.882
Middle East	0	.362	0	0	0	3.529
Rest of world	0	0	0	.773	.794	.794
Total	35.896	36.770	48.896	63.543	84.771	89.340

1/ The U.S. surplus stock disposal scheme assumes that the United States dumps around 12 million tons of wheat and 20 million tons of coarse grains in world markets.

quantities under the disposal program, but Eastern Europe does increase imports from the United States. Most developing countries also expand purchases.

Export Revenue and Farm Income

The three U.S. policies discussed result in greatly different export earnings for the United States (table 20.4). Compared with the base export earnings, export revenue is higher for the two targeted scenarios and lower for the global subsidy disposal scenario. Without the U.S. policy, export revenue for wheat exports is $6.24 billion and U.S. coarse grain exports earn $8.28 billion. The uniform global export subsidy scenario yields only $5.53 billion and $8.15 billion in export earnings for wheat and coarse grains. The global subsidy disposal program costs the U.S. Government $2.84 billion for wheat and $2.72 billion for coarse grains.

In the targeted export subsidy scenario, the United States increases export revenues compared with the base solution. The export earnings for wheat rise to $6.36 billion, with subsidy costs of $0.19 billion. The earnings for U.S. coarse grain exports are also higher, $8.95 billion. The export subsidies for coarse grains are costly, $4.48 billion. As shown in table 20.3, this policy does not achieve the increase in wheat exports shown in the disposal scenarios.

The surplus stocks disposal scenario results in larger export revenues compared with the base scenario. For wheat and coarse grains, export earnings are $8.48 billion and $10.76 billion. The disposal program costs the U.S. Government $3.1 billion in the wheat market and $3.94 billion in the coarse grain market.

Value of production or farm income for the different scenarios is also shown in table 20.4. Farm income for wheat producers is higher when the programs are in effect than in the base case. The largest increase in wheat producers' income occurs when targeted subsidies are used to reduce stocks by 12 million tons. The level of farm income in the targeted subsidy scenario is nearly as great as in the targeted subsidy disposal scenario. The income of wheat producers in the global subsidy disposal is roughly the same as in the base solution. Income for coarse grain producers is also above the base level for the targeted subsidy scenarios. The global subsidy disposal scenario causes a slight decline in income to

Table 20.4--Impacts of subsidy programs on U.S. export earnings from wheat and coarse grain exports

Item	Base	Global subsidy disposal 1/	Targeted subsidy 2/	Targeted subsidy disposal 1/
		Billion dollars		
Wheat:				
Export revenue	6.24	5.53	6.36	8.48
Subsidy costs	0	2.84	.19	3.10
Farm income	11.48	11.58	11.75	12.79
Farm income less subsidy costs 3/	11.48	8.74	11.56	9.69
Coarse grains:				
Export revenue	8.28	8.15	8.95	10.76
Subsidy costs	0	2.72	4.48	3.94
Farm income	31.09	31.08	37.81	32.94
Farm income less subsidy costs 3/	31.09	28.36	33.34	29.00

1/ These scenarios assume that the United States disposes of all surplus stocks of wheat and coarse grains.
2/ This scenario assumes the United States adopts a farm income-maximizing pattern of targeted export subsidies.
3/ This is the objective function for the model.

coarse grain producers. The largest farm income is reported for the targeted subsidy scenario because the policy increases exports nearly as much as the disposal scenario. For wheat, the targeted subsidy policy is not nearly as effective at increasing exports.

The model objective is to maximize farm income less subsidy costs. These results are also shown in table 20.4. Compared with the base level of farm income, only results for the targeted subsidy scenario are greater. This must be true, otherwise no subsidies would be adopted. The results for the other scenarios are below both the targeted subsidy and the base scenarios because the disposal target introduces an additional restriction on U.S. behavior. The objective function value (farm income less subsidy costs) for the global subsidy disposal scenario is below that for the targeted disposal scenario because the constraint requiring all subsidies to be equal is added.

One goal of the CCC disposal programs discussed in Chapter 17 is to reduce storage charges on stocks. Assuming storage costs of 26.5 cents per bushel for both wheat and coarse grains, if 12 million tons of wheat stocks and 20 million tons of coarse grain stocks are exported, the CCC saves $325 million of storage costs. Since the increase in exports is less in the targeted subsidy scenario, the storage cost savings are lower, around $230 million, assuming all of the increased exports are from public stocks.

CONCLUSION

The consequences of U.S. policies designed to reduce U.S. public grain stocks by expanding U.S. exports are analyzed in this chapter. While the United States apparently could dispose of all public stocks by subsidizing grain exports in world markets, the costs of such programs are large. For example, the model results suggest that disposal of 12 million tons of wheat using a global, uniform subsidy program would cost $2.84 billion, and the disposal of 20 million tons of coarse grains with the same program would cost $2.72 billion. The analysis shows that targeting export subsidies to specific buyers is superior to a global disposal program in terms of export revenue and farm income. For wheat, net farm income (farm income less subsidy cost) is $0.95 billion greater using targeted subsidies rather than a global subsidy to achieve the stocks disposal goal, and net export revenue (export revenue less subsidy cost) for the targeted subsidy program is $2.95 billion higher. For coarse grains, in the same comparison of targeted and global subsidies, net farm income is $0.64 billion greater, while net export revenue is $1.29 billion higher. This occurs because the targeted export subsidy can exploit differences in price-responsiveness among countries. Nations with more price sensitivity receive larger subsidies.

The level of U.S. exports is lower if the targeted subsidy is directed to a maximum income level than if there is a stocks disposal target. In the case of coarse grains, the export quantity difference is slight, while for wheat it is quite large because of the smaller import demand elasticity compared with the import demand elasticity of the coarse grain market. Compared with the program of disposing of a fixed quantity of stocks, the targeted export subsidy yields a greater net benefit; net farm income is $2.82 billion greater for wheat and $4.98 billion greater for coarse grains. In the coarse grain market, the targeted export subsidy program obtains nearly as large an increase in exports as the surplus stock disposal program. While the subsidy cost is greater, so is the increase in farm income. When the surplus disposal objective takes precedence over income after cost considerations, the surplus disposal program is more effective at exporting wheat. These increased exports are obtained at a much greater cost, however, which results in a net loss to the United States. Targeted and global subsidies as modeled here to achieve the surplus disposal objective have differing effects on the magnitude and distribution of benefits and losses.

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CHAPTER 21

POLICY RESPONSE TO U.S. COMPETITIVENESS

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CHAPTER 21

POLICY RESPONSE TO U. S. COMPETITIVENESS*

The quantitative analysis portions of our study assume that competitor countries will match U.S. prices if the United States decides to subsidize its exports. This assumption is well documented in the interviews we conducted in connection with country policy responses. U.S. export subsidies could elicit two types of response from competitor countries. The first is a possible change in stockholding behavior; the second, a possible change in production levels.

We see no increase in the willingness or ability of our competitors to hold stocks. Stocks held by other exporters, except for the European Community (EC), either have been, or have become, nonprice-responsive (stockholding decisions are made independently of international market prices) and will likely remain so for at least the next several years. The EC has no short-term budget constraints and will meet our prices with their own subsidies at whatever level necessary to be competitive.

Longer term production level changes will depend on the direction and magnitude of change in international market prices and the extent to which those changes are transmitted to domestic producers. For Australia and Canada, the full effect of an international price change is passed to domestic producers. For Argentina, the effect is also fully transmitted, but with an export tax that reduces producer prices. For the EC, the Common Agricultural Policy (CAP) levy system protects domestic producers from any short-term price transmission from the international market. However, in the longer term, international market pressures could cause reassessment and change in the CAP. In the medium to longer term, if world prices remain depressed, production in competitor countries is likely to adjust downward. But any adjustment is likely to be slow and relatively small since, in most cases, alternative production opportunities are limited.

In the short term, competitors are likely to meet U.S. export prices at whatever level necessary to maintain volume flows into world markets. Specific reasons for short- and long-term export market behavior vary with each competitor country. This chapter presents the rationale for the actions which could be expected from each of the competing exporters.

ARGENTINA

Argentina has traditionally exported surplus commodities (produced in excess of domestic consumption requirements) as quickly as possible regardless of the international market price because Argentina has no storage capacity to hold stocks longer than needed to move a commodity into export channels. The storage capacity used during the wheat harvest must be cleared by the time the corn crop is ready for harvest. Similarly, the corn must be moved out of storage to make room for the soybean harvest. Argentina is not likely to increase storage capacity since the quantity they export is not large enough to affect world market prices and because the cost of holding commodities is high.

Argentina also needs the foreign exchange. Argentina's external debt stood at $46 billion in 1984, about $11 billion owed to U. S. banks alone. Argentina must export as much as possible to make debt service payments. Argentina's agriculture bears the brunt of this export pressure since agricultural commodities normally account for around two-thirds (72 percent in 1984) of total Argentine exports. In 1984, wheat exports accounted for about 16 percent of Argentine agricultural exports.

Debt service burdens also severely restrict Argentina's ability to import. Thus, with imports of both investment goods and investment capital sharply curtailed, Argentina has even less incentive to improve agricultural stockholding capacity.

Argentina overvalues its currency in foreign exchange markets; its official exchange rate is higher than the market or curb rate. This

*The principal contributor to this chapter was George E. Rossmiller.

currency overvaluation, which in early 1986 was in the range of 10-12 percent, operates as an export tax on all exports, including agricultural exports. Thus, producers receive a lower price than they would if the currency were valued at the free market rate.

Finally, Argentina imposes a direct export tax on agricultural exports that passes straight to producers. This tax is levied on the export price, and in April 1986 was 16.5 percent for wheat, 22.5 percent for corn, and 23.5 percent for soybeans, *ad valorem* rate. These rates include what amounts to a 1.5-percent checkoff to finance agricultural research. The export tax for the 1987 wheat crop has been set at 6.5 percent, and the plan is for export taxes for all agricultural products for 1987 to average 15 percent. As in the past, differential rates will be set with the taxes on raw products higher than those on processed products.

In addition, some observers estimated that inefficiencies in the Argentine marketing infrastructure cost producers another 15 percent. Given the poor state of Argentina's economy and the likelihood that economic stress will continue for the next several years, major improvement in the transporting, handling, and marketing infrastructure is not likely. For the same reasons, export taxes are expected to remain in force in the short term but will be reduced over time until phased out entirely. Over the long term, Argentina has the capability of becoming much more competitive with the United States in world grain markets, but the export tax and the infrastructural constraints seriously impair its ability to respond to U.S. subsidies in the near term.

AUSTRALIA

Australia's role in international commodity markets has traditionally been as a somewhat price-responsive seller. In the past, Australia has increased stockholding to a limited extent when international prices were low and reduced stocks as prices strengthened. But, as was explained in Chapter 15, the Australian Wheat Board was forced to reappraise and alter its operating methods in the 1980's.

The Wheat Board's methods of providing initial payments to producers had been disrupting the domestic economy. (See Chapter 15 for details.) Hence the Wheat Board had to enter the international capital markets to finance the initial payments. The board quickly came to appreciate the time value of money and the high cost associated with holding stocks. Further, when no discernable market effect occurred as a result of its shipping less than "normal" quantities of grain due to the drought of 1980, the board decided that the reverse would also hold. Thus, with stockholding costs high and no market advantage to be gained from holding stocks, Australia became a nonprice-responsive seller in the world market once the wheat crop was harvested.

Finally, in the longer term, lower world prices would likely adjust production and export levels downward. The degree of adjustment, however, is limited by the lack of Australia's wheat growing areas. Sheep production is the primary alternative. Large declines in wheat prices relative to lamb and wool prices would be necessary to stimulate a large reduction in wheat acreage. Wheat production would likely be adjusted through reduced applications of variable inputs such as fertilizer and chemicals. Persistent low world prices would likely lower farm incomes and reduce land values.

CANADA

During rapid worldwide growth of agricultural exports in the 1970's, Canadian export growth was constrained by the capacity of the rail transportation system and west coast port capacity. In the late 1970's, new capital investment significantly improved the Prairie Province rail branch line network. West coast port capacity was expanded. The Canadian Wheat Board and the Provincial governments of Alberta and Saskatchewan invested in 3,000 covered hopper cars that began to roll in late 1979. Grain acreage increased by 6 million acres between 1977 and 1981. Thus, Canada was poised to expand exports significantly just when the world economic downturn occurred, beginning in late 1981.

To stress its commitment as a reliable supplier, the Canadian Wheat Board negotiated long-term supply agreements now covering 80-90 percent of Canada's wheat export sales.

Canadian Wheat Board and Government policy is to maximize export sales in the context of increasing production from both increasing acreage and yields. The Canadian reaction to the lower loan rates of the 1985 U.S. farm legislation is instructive, since the lower loan rates have the same international impact as an export subsidy. In response to lower U.S. loan rates, the Canadian Wheat Board lowered initial prices by 19 percent for 1986; producer planting intentions still rose, albeit slightly.

In the Prairie Provinces, as in the U.S. Northern Plains, alternative production choices are limited almost entirely to wheat or barley. Canada, like Argentina and Australia, has no choice, at least in the short run, but to meet world market prices whether they fall due to lower U.S. loan rates or because the United States chooses to directly subsidize exports.

The short-term effect of lower loan rates or a U.S. export subsidy would be lower prices to Canadian producers leading to lower farm incomes. The Western Grain Stabilization Program could be used to offset lower incomes due to declines in prices. In addition, the initial payment from that program is a Canadian policy instrument and the Government could choose to maintain prices above world prices by indemnifying farmers with the difference out of the general treasury.

In the longer term, if the Canadian Government chose not to support farm incomes, land values could be expected to fall, lowering production costs and maintaining competitiveness. But the debate in Canada on whether to convert to a deficiency payment system may be accelerated by any U.S. price reduction action. The issue of whether Canadian farmers should be guaranteed a target price (with the difference between the target price and the world price being made up by a deficiency payment) is becoming an increasingly popular political issue in western Canada. Given the current strength of the Conservatives in western Canada, if prices continue to drop in world markets, an income policy response is likely. If target prices were initiated, greater price stability would likely significantly increase fertilizer and chemical applications and therefore increase yields. Further, the high-yielding varieties that can increase yields by 30-35 percent over currently used Marquis varieties, with some decline in quality, would be adopted at a higher rate given higher and more stable prices. In this situation, unless supply controls were imposed, Canadian production and exports would increase.

Finally, the Canadian Wheat Board is completely flexible on individual sales and thus is capable of quickly and easily meeting lower U.S. prices whether from lower loan rates or either general or targeted subsidized sales on a market-by-market basis. Therefore, while the Canadian situation and response may be somewhat more complex than that of either Argentina or Australia, the result in the short term is the same: Lower U.S. prices will be met and export sales will be maintained.

EUROPEAN COMMUNITY

The EC's CAP provides high and stable prices to producers through a system of levies that tax imports the difference between the world market price and the internal price. With no or minimal production controls, the high stable prices have called forth surplus production. The EC moves this surplus into the world market through a system of export restitutions or export subsidies, paid for by the EC budget. The EC share of the world wheat market presently stands at 16 percent, on an increasing trend.

The U.S. Food Security Act of 1985, with its lower loan rates, has strongly influenced the outcome of the CAP price-setting round of talks by EC agricultural ministers for 1986/87. Ministers froze prices in European Currency Units (ECU), although manipulations of Green Rates allow modest price increases for some countries. Discussion concerning possible need for strict EC supply controls is intensifying. The dairy quota was installed without major political fallout; discussion has now turned to grains.

In the short term, the EC will not allow the United States to undercut EC prices in world markets. The EC can set export restitutions quickly and easily market-by-market to remain competitive. The overwhelming attitude throughout the European interviews was that

there is no budget constraint. The view predominates that the combination of lower U.S. loan rates and the export enhancement program (BICEP) is predatory and directed totally toward the EC. While the EC budget cannot carry over a deficit from one year to the next, supplemental monies can be appropriated when the EC is confronted by "extraordinary" circumstances. The lower U. S. loan rates, coupled with a declining dollar, exacerbated by BICEP, have constituted an "extraordinary" circumstance, and the EC has initiated a supplemental appropriation to cover the added export subsidy required to keep its foreign markets.

In the longer term, the trend in the evolution of the CAP will be shaped by economic factors and pressures but the speed will be dictated by political forces. European interviews suggested that the CAP will not be changed in response to short-term financial pressures. The EC always has recourse to special supplements to the budget, and the possibility always exists to raise the value-added tax contribution for financing the agricultural program. Individual member governments also have the option, and are exercising it, to supplement benefits provided to producers by the CAP out of their own treasuries. For example, it was pointed out that the Germans do not focus on farm markets but rather on farm incomes. They are expected to compensate farmers for recent price declines with direct income payments.

The EC response to lower U.S. loan rates or export subsidies, like that for other competitors, is that it will match U.S. prices to maintain market share in the short term and will only gradually adjust policy to control production increases as economic pressures become irresistible in the longer term. In any case, EC export volumes are not likely to decline.

BRAZIL

The Brazilian policy agenda is dominated by the need to maintain a reasonable price for consumers in the domestic vegetable oil market. Brazil increased soybean production during the late 1970's and early 1980's to the extent that it can export some oil that is produced over and above domestic requirements. Brazilian crushing capacity has grown well beyond that necessary for domestic needs. And while Brazilian domestic demand for oil consumes 80-90 percent of the oil produced in the present annual soybean crush, only about 25-30 percent of the soymeal, produced as a joint product with the oil, is used domestically.

Under these conditions, the expected Brazilian reaction to lower U.S. loan rates or a U.S. export subsidy on soybeans and products, in the short term, is to sell excess supplies into the world market regardless of the level of international prices. In the longer term, Brazilian soybean production could be expected to adjust downward to just meet domestic oil consumption requirements. Excess soymeal would be exported at whatever price it would command in the international market.

Resources shifted out of soybean production would likely be used to produce import substitution food crops (such as tree fruits) presently imported at relatively high cost. Thus, while Brazil may adjust more to lower international prices than other competitors, they will not be driven from the world market.

CONCLUSIONS

In the short term, competitor response to lower U.S. prices in the international market would be to meet or even undercut U.S. export prices and to maintain volume flows into world markets. If lower prices were to persist, competitors would adjust their production and exports downward, but not as quickly nor as far as some might expect.

Adjustment would be sticky and slow for several reasons. First, most competitors have few production alternatives for resources committed to agriculture, particularly land. Sustained lower prices would, of course, lower farm incomes and eventually reduce land values, which in turn would reduce production costs and thus maintain competitiveness.

Second, lower prices would also cause producers to reduce use of variable inputs such as fertilizer and chemicals, which, in turn, would reduce output. Partially offsetting the effect of reduced use of variable inputs would be the introduction of improved technology that

increases yields and/or reduces labor requirements.

Third, competitor countries might introduce policy measures to offset or ease adjustment to lower prices. Canada could move toward an income support system, perhaps a deficiency payment scheme. Argentina could reduce the overvaluation of its currency and reduce further or eliminate export taxes on agriculture products. And within the EC, some national governments have shown a willingness to provide supplemental support to their own producers when they perceive EC support to be inadequate.

Finally, until importing countries are able to restore their economies to health, demand response to lower prices is likely to be weak. While export volume may increase slightly, export revenue most certainly will fall.

CHAPTER 22

SURPLUS DISPOSAL AND EXPORT SUBSIDIES: THE SPECIAL CASE OF DAIRY EXPORTS DISPOSAL

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CHAPTER 22

SURPLUS DISPOSAL AND EXPORT SUBSIDIES: THE SPECIAL CASE OF DAIRY EXPORTS DISPOSAL*

Surpluses of U.S. dairy products have risen rapidly in recent years as increased milk production has outpaced commercial demand. Removal of the surplus dairy products has generally been through CCC domestic programs and the buildup of stocks rather than through exports. This chapter examines whether dairy stocks accumulated under U.S. farm programs could have been exported onto world markets if they had been priced competitively. We attempt to estimate the possible budget costs of such surplus disposal onto export markets, compared with actual program costs.

Dairy surplus disposal is somewhat different from that of other products such as grains and oilseeds. The world market onto which surplus U.S. dairy products could have been sold is generally considered to be a "thin" market. A small proportion of dairy production enters world trade, in part reflecting transport costs and the perishability of the fresh product. A handful of countries has specialized in exporting dairy products, particularly butter, cheese, and milk powder, and these products find a regular market in a limited number of importing regions. Dairy imports often are seen as a threat to domestic dairy interests and are regulated. Thus, exporting substantial quantities of dairy products might be difficult without considerably disrupting world markets. This chapter examines whether additional U.S. exports would have been large enough to cause such a disruption.

METHODS USED IN STUDY

Our first task was to assemble a consistent set of quantity data for stocks and flows of dairy products over the study period, 1970-85. These provided the basic information necessary to understand the actual historical situation and to serve as the basis from which the alternative hypotheses could be constructed and analyzed.

The main hypothesis we explored was that program costs could have been less if the Commodity Credit Corporation (CCC) had moved surplus dairy goods onto the international market in recent years, rather than building stocks to current levels. The counterfactual scenarios we analyzed assumed that the CCC ended its stock-carrying program in a particular year without relinquishing its responsibility for price support purchases of milk products and for domestic donations programs. Once the stocks were liquidated, the CCC was deemed not to hold stocks thereafter. Surpluses of acquisitions over domestic disposals were put onto export markets with a subsidy representing the gap between domestic and world market prices. If acquisitions did not cover planned domestic disposals, the latter were reduced according to priorities embodied in legislation (details are given in the "Options for Surplus Disposal on Foreign Markets" section).

The degree of success of such a program depends on the program starting date. A large stock liquidation could have devastated prices in a thin market, resulting in large program costs in the beginning year. On the other hand, a program beginning in a year when stocks were low, prices were high, or import demand was particularly strong may have had a minimal effect on export prices. In the latter scenario, one might expect substantial benefits from initiating the stock disposal plan because it would have involved less write-down on inventory at the time of sale and would have had lower transport, processing, handling, storage, and administrative costs in all subsequent years.

With the above as a guide, two scenarios were chosen for detailed investigation. The first forced disposal of all CCC stocks in fiscal year 1974, a year in which CCC stocks of butter, cheese, and nonfat dry milk were low. The second forced the stock disposal in fiscal 1981,

*Contributors to this chapter were Tim Josling and Steve Neff.

a year in which CCC stocks were large and growing.

This analysis hinges on answers to two questions:

- At what price could CCC stocks have been sold on the international market?
- What is the appropriate price at which to value unsold CCC inventories?

The potential for U.S. dairy exports to significantly influence the world price makes it difficult to accurately predict price effects of the stock disposal. Given this difficulty, this chapter identifies the extremes of the range of price possibilities. The low end of the range assumes disposal on a donation basis; that is, that there are no buyers and the CCC must therefore give away the stocks as food aid. The upper end of the range is represented by the assumption that the surplus stocks could be sold without causing a fall in the world price; the prices received by non-European exporters are used for this purpose. (Later discussion will clarify why European countries are excluded from this price calculation.) In between these two extremes is the possibility that the United States could have sold at a relatively low price to certain countries that appear to buy at prices below normal world levels. This price is represented by the lowest average price paid by any region in the world each year.

The question of inventory valuation is almost as important as that of world price in a situation where stocks have been growing. Program costs are made up of profits and losses from acquisitions and sales and changes in inventory. Inventory changes are important because the two counterfactual scenarios show no stocks at the end of the study period. Since stocks are an asset which can be sold to offset program costs, comparing trading profits with that of the actual situation will overstate the actual costs of stock disposal. In order to ensure comparability among scenarios, inventory valuation adjustments are included as a separate item of cost or credit to the program each year. A number of prices could be used to estimate this asset value change.

The CCC values stocks at acquisition prices, which are much higher than the prices at which they are eventually sold. A second approach is to value stocks at the current world price. A third is to charge the dairy program the full acquisition cost for the stocks at the time of purchase, carry the stocks at zero value, and treat all sales as a recovery of costs. This approach is equivalent to assuming that all stocks will be donated to domestic and foreign aid programs. This chapter compares all three inventory valuation methods.

U.S. MARKET BALANCE FOR MILK

We can see the scope of the dairy surplus problem and how it has arisen by reviewing the U.S. market balance for milk and milk products. U.S. milk production has been steadily rising since 1970. Domestic consumption has failed to keep up with this growth, leading to the removal of substantial quantities of surplus milk products from the market. Table 22.1 shows the market balance for 1970-85. Production rose from 117 billion pounds in 1970 to 144 billion pounds in 1985. Farm use, including milk for calf-feeding, has been stable for the last decade at about 2 percent of milk production, giving a total marketed volume of 141 billion pounds of milk in 1985. Imports, particularly of cheese, rose in the early 1970's, and have stabilized at around 2.5 billion pounds of milk equivalent. (Milk products have been converted to milk equivalent on the basis of their milk-fat content). Domestic consumption and commercial exports together have risen from 109 billion pounds to 131 billion pounds over the past 15 years, leaving the residual, the amount of milk removed from the marketplace under Government programs, to fluctuate between 1.2 billion pounds in 1976 to 16.8 billion pounds in 1983.

This picture of CCC purchases as a residual to remove production fluctuations is confirmed by examining the year-to-year changes in these variables. Nearly 75 percent of the annual changes in production over the past 15 years have been reflected in changes in net removals, 18 percent in consumption changes, 5 percent in stocks by private companies, and only 3 percent in changes in private international trade. Foreign trade has apparently not been a

Table 22.1--Balance sheet for milk production and consumption, United States, whole milk-equivalent basis

Year	Milk production	Farm use	Marketings	Opening commercial stocks	Imports	Total supply	Closing commercial stocks	Net removals	Commercial disappearance
				Billion pounds					
1970	117.0	4.1	113.0	3.8	1.9	118.7	3.7	5.8	109.2
1971	118.5	3.8	114.7	3.7	1.3	119.7	3.6	7.3	108.9
1972	119.9	3.5	116.4	3.6	1.7	121.6	3.5	5.3	112.8
1973	115.6	3.3	112.3	3.5	3.9	119.7	4.7	2.2	112.8
1974	115.6	3.2	112.4	4.7	2.9	120.0	5.6	1.3	113.1
1975	115.4	3.1	112.3	5.6	1.7	119.6	3.7	2.0	113.8
1976	120.2	3.0	117.2	3.7	1.9	122.9	5.3	1.2	116.3
1977	122.7	2.8	119.8	5.3	2.0	127.1	4.9	6.1	116.1
1978	121.5	2.7	118.8	4.9	2.3	126.0	4.5	2.7	118.8
1979	123.4	2.5	120.9	4.5	2.3	127.7	5.4	2.1	120.2
1980	128.5	2.3	126.2	5.4	2.1	133.7	5.8	8.8	119.1
1981	133.0	2.3	130.7	5.8	2.3	138.8	5.4	12.9	120.5
1982	135.8	2.3	133.5	5.4	2.5	141.3	4.6	14.3	122.4
1983	139.7	2.4	137.3	4.6	2.6	144.5	5.2	16.8	122.5
1984	135.4	3.1	132.4	5.2	2.7	140.3	4.9	8.6	126.8
1985	143.7	2.6	141.1	4.9	2.8	148.8	4.6	13.2	131.0

Source: (5).

major stablizing factor on the domestic dairy market.

These net removals from the domestic market are subsequently channeled into domestic food programs, subsidized exports, overseas aid, and stock accumulation. Commercial stocks of dairy products, at about 5 percent of production, are fairly large but do not vary much from year to year. By contrast, public stocks, which were relatively low until 1976, have become substantial. In 1981, the public stocks of dairy products increased by nearly 6 million pounds of milk-equivalent, and rose in each of the next 2 years.

Dairy product exports have not been significant over most of the period since 1975. However, exports were important in 1971 when shipments rose briefly to above 2 billion pounds, and again in 1981 and 1982 when private exports increased to over 3 billion pounds annually. Since 1983, concessional exports have also increased. At other times, the United States has not been a major exporter of milk products, despite the domestic surplus.

The market balance picture is further clarified by shifting the focus from the aggregate measure of milk-equivalent to markets for individual milk products. Among these products, butter, cheese, and nonfat dry milk are purchased by the CCC at fixed prices in order to support the price of milk. Each product has its own domestic and world market characteristics.

Table 22.2 shows the balance sheet for these three milk products. Total supply, made up of production, imports, and opening stocks (both private and public) goes to either private (direct) use or to CCC acquisition. Private use can be for consumption, export, or closing stocks, while CCC acquisition goes to disposals or CCC ending stocks. The difference between CCC acquisition and CCC disposals must therefore equal the buildup or rundown of CCC stocks. Total exports and total consumption will be larger than private exports and consumption by the amount of foreign and domestic CCC disposals.

Cheese production has increased considerably over the past 15 years, in contrast to that of butter and nonfat dry milk. Cheese is also the only one of the three products to be imported to any significant extent, except in the early 1970's, when some butter and skim milk were imported into the United States in response to a drop in production at a time of domestic price controls. Both public and private stocks of butter have risen in recent years, but to a much smaller extent than stocks of cheese and nonfat dry milk. Acquisitions of cheese and

Table 22.2--Market balance for milk products, United States, fiscal years

Product/year	Total production	Total imports	Opening stocks, private	Opening stocks, CCC	Total supply	Private direct use	Private closing stocks	Private consumption	Private exports	CCC total acquisitions	CCC total disposals	CCC ending stocks
						1,000 tons						
Butter:												
1970-73 average	489.0	7.0	47.0	113.7	656.5	449.9	43.0	386.4	20.0	92.9	110.3	96.3
1974-76 average	442.0	1.0	18.0	26.4	486.7	441.7	16.0	423.7	2.0	18.6	33.4	11.6
1977-80 average	478.0	1.0	70.0	67.9	616.4	469.9	99.0	369.2	2.0	78.6	44.5	102.0
1980/81	557.0	1.0	138.0	136.2	832.2	535.9	195.0	286.9	54.0	160.1	69.6	226.8
1981/82	570.0	1.0	195.0	226.8	992.8	595.7	212.0	315.7	68.0	170.3	158.8	238.3
1982/83	589.0	1.0	212.0	238.3	1,040.3	625.2	227.0	364.2	34.0	176.8	151.0	264.1
1983/84	500.0	1.0	227.0	264.1	992.1	631.5	135.0	445.5	51.0	96.5	106.9	253.7
1984/85	563.0	1.0	135.0	253.7	952.7	616.3	109.0	459.3	48.0	82.7	202.6	133.8
Cheese:												
1970-73 average	1,119.0	80.0	144.0	8.7	1,351.2	1,324.3	149.0	1,163.0	13.0	18.2	21.1	5.8
1974-76 average	1,371.0	106.0	183.0	1.9	1,662.6	1,639.4	202.0	1,422.1	16.0	21.2	21.3	1.9
1977-80 average	1,653.0	106.0	219.0	16.8	1,994.6	1,908.0	243.0	1,648.8	16.0	69.5	43.8	42.5
1980/81	1,940.0	112.0	313.0	102.8	2,467.8	2,120.6	443.0	1,671.6	6.0	244.4	66.3	281.0
1981/82	2,060.0	122.0	443.0	281.0	2,906.0	2,352.7	483.0	1,851.7	18.0	272.3	124.3	429.0
1982/83	2,186.0	130.0	483.0	429.0	3,228.0	2,425.3	574.0	1,834.3	17.0	373.7	289.8	512.9
1983/84	2,120.0	139.0	574.0	512.9	3,345.9	2,529.9	482.0	2,030.9	17.0	303.1	297.0	519.0
1984/85	2,295.0	135.0	482.0	519.0	3,431.0	2,646.3	454.0	2,174.3	18.0	265.7	405.2	379.4
Nonfat dry milk:												
1970-73 average	567.0	31.0	55.0	138.8	792.0	527.3	38.0	358.8	130.0	126.0	189.8	74.9
1974-76 average	445.0	18.0	126.0	65.3	653.6	447.6	188.0	217.6	42.0	140.8	63.0	130.7
1977-80 average	464.0	1.0	253.0	259.8	978.0	560.1	265.0	191.6	104.0	158.2	129.1	288.8
1980/81	596.0	1.0	266.0	312.9	1,175.9	546.3	404.0	-12.7	155.0	316.7	227.6	402.0
1981/82	635.0	1.0	404.0	402.0	1,442.0	650.6	581.0	-74.4	144.0	389.4	172.2	619.2
1982/83	680.0	1.0	581.0	619.2	1,881.2	837.3	633.0	-84.7	289.0	424.7	246.1	797.8
1983/84	527.0	1.0	633.0	797.8	1,958.8	830.3	559.0	-26.7	298.0	330.7	372.6	755.9
1984/85	640.0	1.0	559.0	755.9	1,955.9	885.3	504.0	31.3	350.0	314.7	413.9	656.8

Source: CCC data.

milk powder are also running considerably higher than those of butter, in part reflecting higher storage and handling costs for butter.

U.S. Trade in Dairy Products

The United States has been a net exporter of butter, with virtually no imports except in 1973 (the year after the domestic price controls stimulated exports). The United States recently has exported about 50,000 tons of butter, or about 4 percent of the non-intra-European Community (EC) world trade volume.

The picture is different for cheese. Imports of specialty cheeses, mainly from Europe, have risen steadily. Exports have been less dynamic, having peaked in 1979 and now having fallen well below 1 percent of production. American-type cheese has not found the same expanded demand abroad as has overseas cheese in the United States.

Nonfat dry milk differs from the other two commodities in having a much more limited home market. In 1985, over half of production was exported. This mirrored the situation in the early 1970's, when exports exceeded domestic use. Dried skim milk has a limited use in the food industry, but it is a convenient protein source for animal feed. However, since it is expensive, relative to other such protein sources, it is not competitive in feed rations.

Destination of U.S. exports of dairy products is shown in table 22.3. Butter exports under concessional terms, in recent years, have gone predominantly to countries such as Egypt and Poland which were large recipients of aid. There also were some extraordinary sales of butter to New Zealand and to Europe from 1981-83, as part of an agreement to avoid market disruption. This butter was sold to the New Zealand Government which transported some to Europe for processing to butter oil. Final destination of this sale is uncertain.

Cheese exports also follow the aid pattern, as does much of the dried milk. No developing country purchased a substantial quantity of cheese. The developing country markets for milk powder include Mexico and Brazil; in addition, a market has arisen in Spain though that country's entry in the EC could prevent further development of sales. No other developed country buys significant quantities of U.S. milk powder.

Table 22.3--U.S. exports of milk products and exports to selected destination

Product/destination	1981	1982	1983	1984	1985
			1,000 tons		
Butter:					
Total	53,582	62,678	27,577	44,178	29,965
Egypt	0	0	2,950	18,760	17,340
Mexico	65	36	616	1,885	10,933
Poland	28,247	13,347	13,426	19,620	280
Bel-Luxemburg	9,819	14,416	9,390	0	0
New Zealand	14,799	33,560	805	0	0
Nonfat dry milk:					
Total	112,706	126,412	234,796	267,083	304,920
Mexico	206	8,595	88,047	31,458	33,540
Ethiopia	1,965	1,970	4,453	7,752	26,290
Brazil	697	738	656	17,345	25,638
Egypt	8,039	17,749	11,931	18,836	19,471
Chile	1,312	452	1,644	8,064	16,864
Poland	26,896	9,100	21,685	8,680	5,664
India	3,821	101	2,184	25,609	451
Spain	0	0	9	0	44,815
Cheese:					
Total	5,731	17,958	17,447	16,731	15,692
Poland	0	12,302	6,543	1,723	0

Source: (5).

CCC PURCHASES

The CCC buys dairy products, primarily butter, cheese, and nonfat dry milk, at announced prices, in order to put a floor under the price of manufacturing milk. This action is designed to support raw milk prices received by the farmer. Over the past 15 years, these purchases have varied widely depending upon the state of the market. CCC butter purchases have ranged from 0.3 percent of the total production in 1976 to over 30 percent in 1970 (see fig. 22.1 and app. table 22.1).

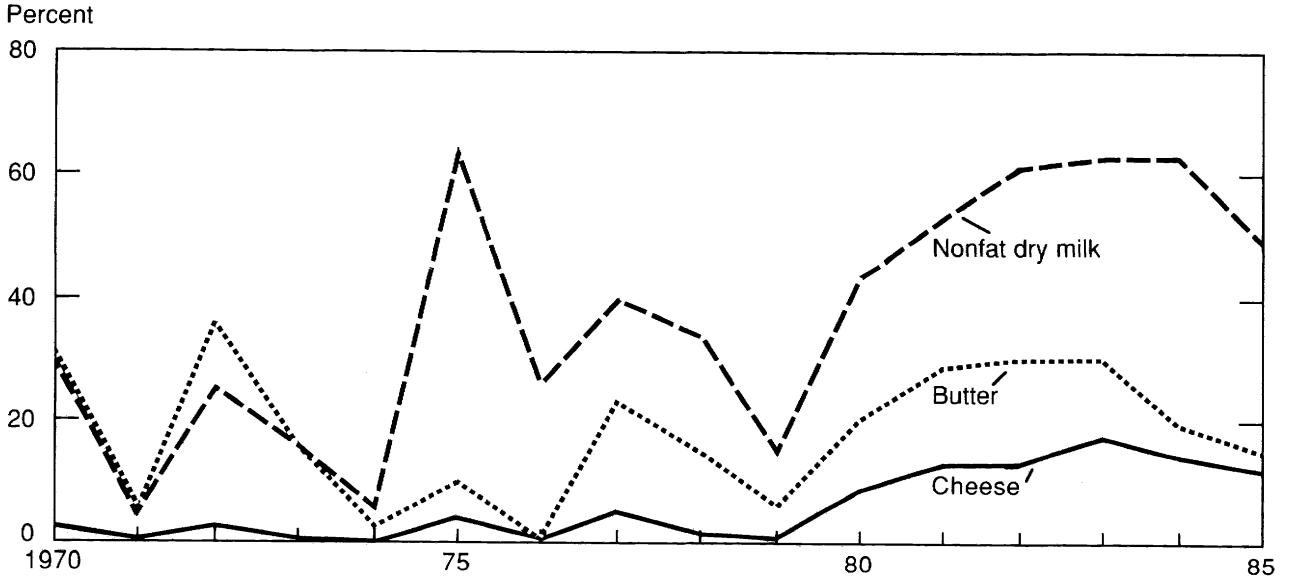
Little total cheese production was purchased before 1980. Since then, over 10 percent has been taken off the market. The situation for nonfat dry milk has varied considerably from year to year. In 5 of the past 15 years, CCC purchases represented over half of the total U.S. market. These purchases are placed on both the domestic market and abroad, some through private companies (commercial sales), and the rest through Government agencies. Until 1981, export sales of CCC butter have been relatively minor, except for 1971-72, when nearly 60,000 tons were exported at a time of domestic price controls. For cheese, the picture is even clearer. No CCC stocks were exported until 1982. By contrast, nonfat dry milk disposals have included a significant export trade under both commercial and concessional terms.

Commodities are purchased at support prices to firm the market and then sold under the programs listed above. In any year, difference between purchases and disposals leads to a rundown or a buildup of stocks. Figure 22.2 and appendix table 22.2 show the balance of acquisition and disposal for fiscal years 1970-85. This figure varies significantly from year to year, indicating some degree of independence between farm support measures (acquisition of dairy products to place a floor under the market) and consumer measures (disposal of those products to welfare programs and as overseas aid). The programs do tend, however, to respond to the same stimuli (fluctuations in domestic production), albeit with different lags and intensities.

The major buildup of inventories of all three dairy products in the early 1980's is very clear

Figure 22.1

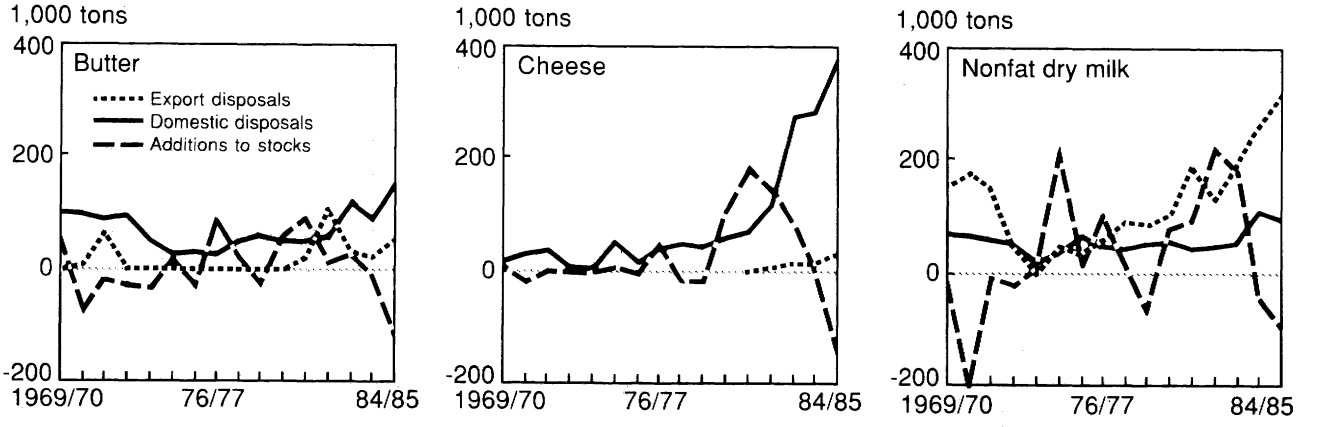
CCC Purchases of Milk Products as a Percentage of Production



Source: Table 22.5.

Figure 22.2

CCC Export and Domestic Disposal of Milk Products and Additives to Stocks



Fiscal years. Source: Table 22.2

from the tables. The butter and nonfat dry milk situation resembled that of the early 1970's. Stock accumulation was even more significant in the 1980's for cheese, where such stocks had been low in most years since 1970.

Increased purchases of dairy products, not fully matched by the expansion of disposal programs, led to an increase in CCC costs. Figure 22.3 and appendix table 22.3 show the evolution of Government spending on dairy programs during 1970-85. Net support purchase expenditures, the cost of buying, storing, and handling surplus commodities less the payments made by private firms on any commercial sales, increased markedly in 1979 and have stayed high since that time. In addition to this expenditure on purchases, subsidies are given in other ways to stimulate consumption, in particular the school lunch program and the special milk program. Export assistance programs, other than those already mentioned, were a significant cost item only in the early 1970's.

THE WORLD DAIRY MARKET

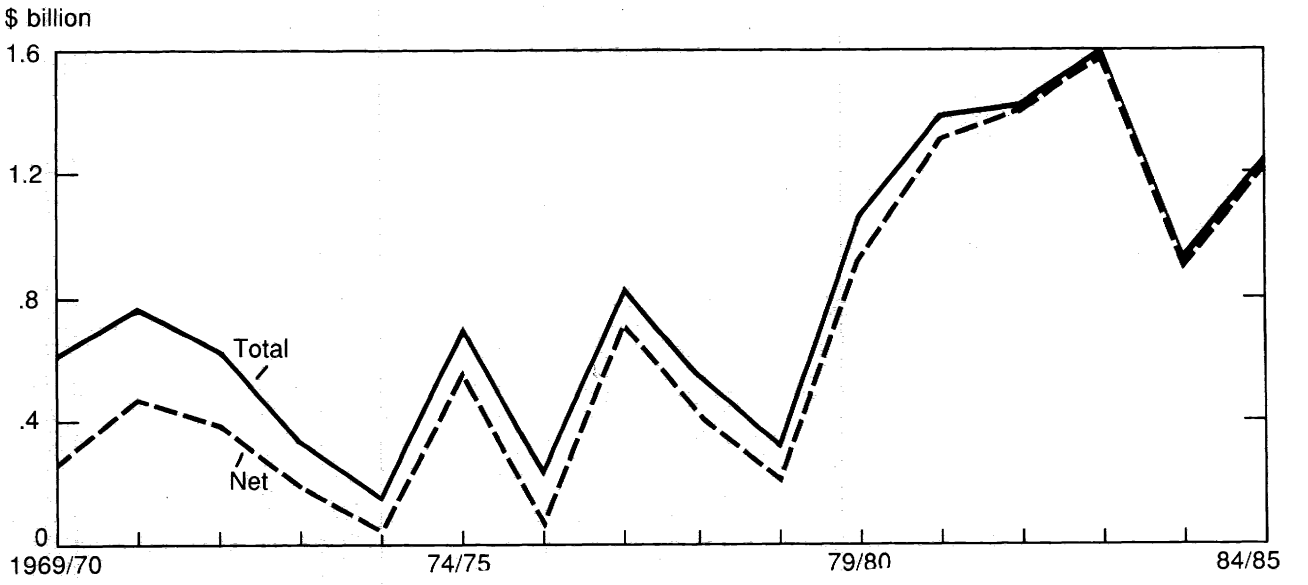
To dispose of additional dairy products on world markets there must be buyers willing to purchase the commodities. Cost of such disposal depends on both the potential market and also upon the willingness of other suppliers to allow their market shares and export volume to decline.

The largest milk producing regions are in northern Europe and North America. Table 22.4 illustrates distribution of milk production (excluding that from sheep and goats) in recent years. The USSR and the EC each account for almost 25 percent of world production. The United States and Canada account for almost 18 percent of world milk production. India, Brazil, and Mexico are the only developing countries among the top 20 milk producers. Distribution of milk consumption is remarkably similar to that of production. New Zealand and Australia are the only countries that appear to produce primarily for export.

Production of milk products has risen steadily in recent years in most countries, outpacing growth in milk production. This reflects both the strong demand for milk products as incomes rise (as opposed to that for liquid milk which does not respond to income increases) and the widespread conversion of surplus milk to milk products. Table 22.5 shows this emergence of world surpluses in the form of milk products. Butter stocks rose sharply in 1983; a similar trend was evident in cheese. Milk powder stocks peaked in 1983, and stayed at over one-third of annual production for the next 2 years.

Figure 22.3

Government Expenditures on Dairy Support Programs



Fiscal years. Real 1977 dollars. Source: Table 22.5.

Table 22.4--Cow's milk production by country, selected years

Country	1970	Share	1975	Share	1980	Share	1985	Share
	1,000 tons	*Percent*	*1,000 tons*	*Percent*	*1,000 tons*	*Percent*	*1,000 tons*	*Percent*
USSR	83,016	24.7	90,800	25.1	90,900	23.6	100,000	24.0
United States	53,054	15.8	52,312	14.5	58,298	15.1	64,973	15.6
France	27,276	8.1	29,686	8.2	26,859	7.0	27,043	6.5
Fed Rep Germany	21,856	6.5	21,604	6.0	24,778	6.4	25,000	6.0
India	7,630	2.3	9,600	2.7	13,500	3.5	18,500	4.4
Poland	14,934	4.4	16,359	4.5	16,494	4.3	16,291	3.9
United Kingdom	12,873	3.8	13,909	3.9	15,958	4.1	15,900	3.8
Netherlands	8,239	2.5	10,221	2.8	11,785	3.1	12,325	3.0
Brazil	6,492	1.9	8,849	2.4	10,265	2.7	10,400	2.5
Italy	8,225	2.4	9,559	2.6	10,749	2.8	10,100	2.4
Dem Rep Germany	7,091	2.1	8,095	2.2	8,321	2.2	8,800	2.1
Canada	8,307	2.5	7,744	2.1	7,855	2.0	8,200	2.0
New Zealand	5,991	1.8	5,090	1.4	6,833	1.8	7,766	1.9
Japan	4,761	1.4	4,961	1.4	6,505	1.7	7,350	1.8
Mexico	5,030	1.5	5,930	1.6	6,742	1.7	6,920	1.7
Spain	4,322	1.3	4,984	1.4	5,871	1.5	6,400	1.5
Australia	7,731	2.3	6,670	1.8	5,562	1.4	6,217	1.5
Ireland	3,162	.9	3,689	1.0	4,859	1.3	6,000	1.4
Argentina	4,134	1.2	5,646	1.6	5,301	1.4	5,600	1.3
Denmark	4,480	1.3	4,918	1.4	5,117	1.3	5,090	1.2
Total, above	298,604	88.9	320,626	88.8	342,552	88.8	368,875	88.6
World total	335,758	100.0	361,239	100.0	385,964	100.0	416,558	100.0

Source: (5).

World trade in dairy products represents only a small percentage of total milk production but a significant proportion of the production of milk products. Butter's export share has been around 19 percent of world production for the past few years, up from 18 percent in 1970. Some 13 percent of world cheese production was exported in 1970; by 1985 the proportion had reached 18 percent. Dried milk has the most significant share of world trade, with 39 percent of production exported in 1970 and 52 percent in 1985.

Trade levels of the significant exporting regions for the three main milk products are shown in table 22.6. The table includes trade among EC-member countries. The EC emerges as the dominant exporting region of all three commodities. Oceania, the second largest exporting region for butter, and the EC account for 85 percent of butter exports. Other countries in Western Europe contribute significantly to world cheese exports. Together with the EC, Australia, and New Zealand, they make up 94 percent of world cheese sales. The United States is significant only as an exporter of nonfat dry milk, with North America, Oceania, and the EC accounting for 94 percent of world exports.

The EC dominates world import markets for the three commodities, nearly as much as it does for exports. Regional import patterns are shown in table 22.7. Among other regions important as import markets, the USSR has developed as the largest single destination for butter. North America and Asia (largely Japan) are the main buyers of cheese. And, South America (including Central America) and Asia have emerged as major buyers of nonfat dry milk.

The importance of the EC in both imports and exports highlights a special feature of world dairy markets. Under EC rules, farm products flow between member states with no border taxes, other than those designed to reflect exchange rate movements. Imports from outside the EC have difficulty competing with internal production, except where the EC has committed itself to certain quantitites of purchases as in the case of New Zealand. Intra-EC trade accounts for up to 33 percent of world trade (table 22.8). To countries outside the EC, this trade appears more domestic than international and is sometimes excluded from world trade totals. In the present context, this is appropriate because trade among EC countries takes place under different terms than that between EC members and third countries. Although any country can compete for a share in such import markets, the fact that the rules governing trade into the EC markets are differentiated by import source

Table 22.5--World stocks relative to world production

Calendar year	Butter			Cheese			Dried skim milk		
	World production	Ending stocks	Stocks as percentage of production	World production	Ending stocks	Stocks as percentage of production	World production	Ending stocks	Stocks as percentage of production
	--1,000 tons--		Percent	--1,000 tons--		Percent	--1,000 tons--		Percent
1970	5,065	412	8.1	5,388	543	10.1	2,958	380	12.8
1971	5,042	306	6.1	5,747	572	10.0	2,975	252	8.5
1972	5,376	565	10.5	6,178	686	11.1	2,369	541	16.1
1973	5,490	441	8.0	6,374	686	10.7	3,409	613	18.0
1974	5,455	369	6.8	6,756	791	11.7	3,520	928	26.4
1975	5,722	493	8.6	6,525	851	13.0	3,806	1,879	49.4
1976	6,001	600	10.0	7,040	985	14.0	3,834	1,924	50.2
1977	6,197	674	10.9	7,211	980	13.6	3,818	1,610	42.2
1978	6,103	864	14.2	7,529	980	13.0	3,904	1,307	33.5
1979	6,148	793	12.9	7,915	1,113	14.1	3,770	790	21.0
1980	6,182	650	10.5	8,126	1,204	14.8	3,862	868	22.5
1981	6,062	628	10.4	8,379	1,320	15.8	3,955	1,150	29.1
1982	6,361	946	14.9	8,805	1,434	15.8	4,257	1,599	37.6
1983	6,876	1,464	21.3	9,070	1,559	17.2	4,692	1,945	41.5
1984	6,759	1,663	24.6	9,218	1,468	15.9	4,332	1,573	36.3
1985	6,718	1,765	26.3	9,500	1,462	15.4	4,285	1,381	32.2

NA = Not available.

Source: USDA, FAS, Dairy, livestock, and poultry data.

influences net returns of the seller and the ease of access. Regional shares of both the total and the "non-intra-EC" world market are shown in figures 22.4, 22.5, and 22.6 and in appendix tables 22.4 and 22.5.

The possibility of expanding exports of surplus dairy products hinges on the extent to which markets will absorb the extra product. This in turn depends on the policy environment in the potential importing country and on the reaction of other exporters.

Any U.S. benefits from expanding exports by expansion by disposing of U.S. Government stocks on the international market depends on such policy reactions and how they influence the world price. U.S. benefits also depend on the Government's ability to sell its stocks without disrupting U.S. commercial exports. This might be accomplished by selling into markets where U.S. commercial traders are not currently selling, for instance.

WORLD MARKET PRICES FOR DAIRY PRODUCTS

We need to estimate world prices in order to determine the budget of disposing of surplus CCC stocks by selling them abroad. Implicit average world prices for dairy products can be obtained by calculating the ratio of value relative to quantity for total world imports and exports. For all three commodities, average world prices fluctuated around a rising trend during the 1970's, then declined in the early 1980's (fig. 22.7). The average price hides considerable differences among regions. In order to calculate the likely price at which the United States could sell additional products, we

Table 22.8--Dairy exports level, by region and product

Product/region	Average 1970-73	Average 1974-76	Average 1977-79	1980	1981	1982	1983	1984	1985
					1,000 tons				
Butter:									
North America	21	4	2	0	54	68	38	51	49
EC (total) 1/	490	626	748	980	929	889	753	800	796
Other Western Europe	39	34	30	24	34	30	54	45	40
Eastern Europe	17	29	13	18	13	64	76	84	85
Oceania	273	234	232	255	214	235	251	245	281
Soviet Union	33	18	18	18	13	15	17	17	18
World total*	879	948	1,056	1,319	1,271	1,312	1,197	1,244	1,269
Cheese:									
North America	25	18	16	9	11	23	21	22	26
South America	5	11	13	4	2	7	7	5	5
EC 1/	519	714	869	996	1,128	1,078	1,098	1,271	1,258
Other Western Europe	117	135	160	167	169	167	161	176	176
Eastern Europe	16	19	58	121	117	67	79	71	70
Oceania	126	106	120	130	129	138	129	151	153
World total*	814	1,011	1,245	1,435	1,565	1,484	1,501	1,701	1,693
Nonfat dry milk:									
North America	235	109	222	191	217	263	371	379	439
South America	5	15	6	0	0	7	7	0	0
EC (total) 1/	630	675	1,205	1,142	930	1,022	1,278	1,464	1,229
Other Western Europe	24	40	32	34	57	46	66	64	54
Eastern Europe	1	16	32	29	6	11	44	61	60
Oceania	204	245	266	184	175	164	260	296	360
World total*	1,098	1,100	1,757	1,580	1,385	1,513	2,034	2,282	2,156

* Regions may not add to total due to exclusion of regions with negligible trade.
1/ Intra-EC trade included.

Source: (5).

need to look beyond world prices to the average import price level of particular regions (app. table 22.6). The USSR typically establishes floor prices for butter and cheese, even though it makes only small purchases of cheese. The USSR average purchase price is only rarely above the world average for these commodities. Lowest regional price for nonfat dry milk is the North and Central American region, reflecting considerable purchases by Mexico at relatively low prices.

These import prices are usually well below domestic support price levels in the United States and the EC. The level of support prices for milk in the United States and the EC is shown in table 22.9, together with that for New Zealand, a country which gives relatively little subsidy to move dairy products onto world markets. High U.S. and EC milk prices are maintained by high milk product prices. Comparisons between the U.S. and EC support levels have been dominated in recent years by exchange rate movements, but the table shows butter prices generally higher in the EC and nonfat dry milk prices higher in the United States. (Cheese is generally not supported at a fixed price in the EC, although imports are controlled.)

Table 22.7--Dairy imports level, by region and product

Product/region	Average 1970-73	Average 1974-76	Average 1977-79	1980	1981	1982	1983	1984	1985
				1,000 tons					
Butter:									
North America	18	10	2	1	1	1	7	4	14
South America	22	17	21	24	22	7	3	0	1
EC 1/	519	673	581	587	669	653	574	529	565
Other Western Europe	23	21	20	22	20	24	15	13	12
Eastern Europe	50	31	25	34	87	50	40	38	21
Asia	13	26	16	12	13	22	3	23	4
USSR	60	11	96	249	215	151	203	198	200
World total*	879	948	1,056	1,319	1,271	1,312	1,197	1,244	1,269
Cheese:									
North America	98	130	129	127	135	143	155	162	168
South America	2	7	17	16	23	10	6	7	6
EC 1/	527	621	723	758	854	861	869	929	1,017
Other Western Europe	51	62	74	68	66	64	65	75	81
Eastern Europe	12	10	13	14	15	31	21	16	15
Asia	36	50	70	75	71	74	72	79	82
Oceania	7	8	11	12	13	17	20	22	23
USSR	18	9	6	13	22	11	15	16	16
World total*	814	1,011	1,245	1,435	1,565	1,484	1,501	1,701	1,693
Nonfat dry milk:									
North America	82	72	71	178	171	98	123	101	146
South America	51	54	71	117	52	49	90	80	94
EC 1/	407	476	705	551	447	697	1,081	1,144	923
Other Western Europe	29	27	68	41	24	33	20	22	31
Eastern Europe	2	4	13	22	6	11	15	16	16
Asia	92	94	152	138	122	157	100	159	119
USSR	23	24	36	70	77	90	47	57	60
World total*	1,098	1,100	1,757	1,580	1,385	1,513	2,034	2,282	2,156

* Regions may not add to total due to exclusion of regions with negligible trade.
1/ Intra-EC trade included.

Source: (5).

Table 22.8--Intra-EC trade relative to world trade in dairy products

Product/trade	1979	1980	1981	1982	1983	1984	1985
				1,000 tons			
Butter:							
EC imports--							
Total	585	587	669	653	574	529	565
Excluding intra-EC	122	106	113	122	109	94	84
EC exports--							
Total	893	980	920	889	753	800	796
Excluding intra-EC	428	493	396	346	278	304	315
World trade--							
Total	1,213	1,319	1,271	1,312	1,197	1,244	1,269
Excluding intra-EC	748	832	747	769	722	748	788
Cheese:							
EC imports--							
Total	786	758	854	861	869	929	1,017
Excluding intra-EC	77	92	102	98	103	99	102
EC exports--							
Total	966	996	1,128	1,078	1,098	1,271	1,258
Excluding intra-EC	264	327	365	351	350	442	376
World trade--							
Total	1,388	1,435	1,565	1,484	1,501	1,701	1,693
Excluding intra-EC	686	766	802	757	753	872	811
Nonfat dry milk:							
EC imports--							
Total	742	551	447	697	1,081	1,144	923
Excluding intra-EC	7	2	8	1	1	0	0
EC exports--							
Total	1,435	1,142	930	1,022	1,278	1,464	1,229
Excluding intra-EC	666	578	433	341	216	314	333
World trade--							
Total	1,825	1,580	1,385	1,513	2,034	2,282	2,156
Excluding intra-EC	1,056	1,016	888	832	972	1,132	1,260

Source: (5).

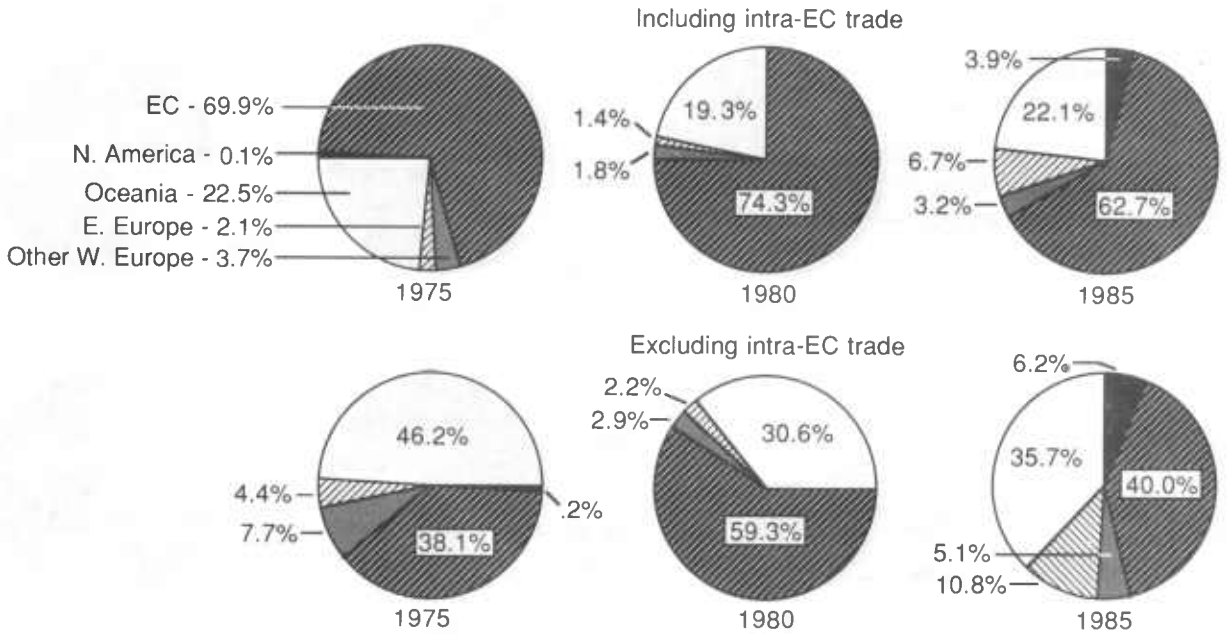
Table 22.9--Comparative domestic nominal and real prices of milk and dairy products, selected countries

Product/country	Average 1970-73	Average 1974-76	Average 1977-79	1980	1981	1982	1983	1984	1985
					1977 dollars per ton				
Milk:									
EC	180.6	238.2	249.4	202.8	166.0	154.1	130.7	107.4	118.7
New Zealand	71.7	93.7	70.0	71.6	69.5	75.4	69.1	54.0	
United States	151.8	163.9	188.4	193.4	192.5	181.6	175.7	163.1	151.9
Butter:									
EC	2,983.7	3,310.7	3,511.1	2,807.9	2,299.5	2,124.3	1,801.1	1,322.3	1,411.6
United States	2,236.7	1,683.1	2,143.8	2,247.2	2,234.0	2,106.6	2,038.3	1,893.5	1,787.0
Cheese:									
United States	1,693.0	1,818.8	2,055.9	2,079.0	2,050.3	1,933.5	1,870.7	1,743.4	1,621.6
Nonfat dry milk:									
EC	882.4	1,414.2	1,427.9	1,170.1	958.2	888.3	753.1	686.1	784.4
United States	918.3	1,319.1	1,415.3	1,406.2	1,381.5	1,302.8	1,260.5	1,176.9	1,079.1

Source: USDA, FAO, and European Commission statistics.

Figure 22.4

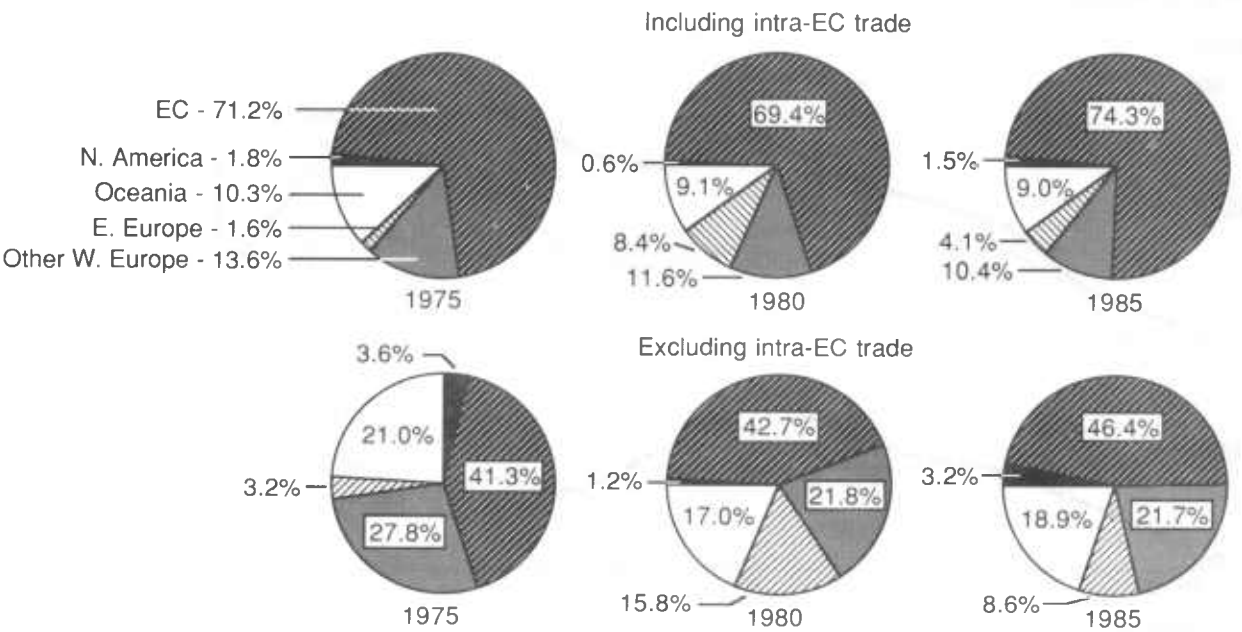
Export Shares for Butter



Sources: Appendix tables 22.4 and 22.5.

Figure 22.5

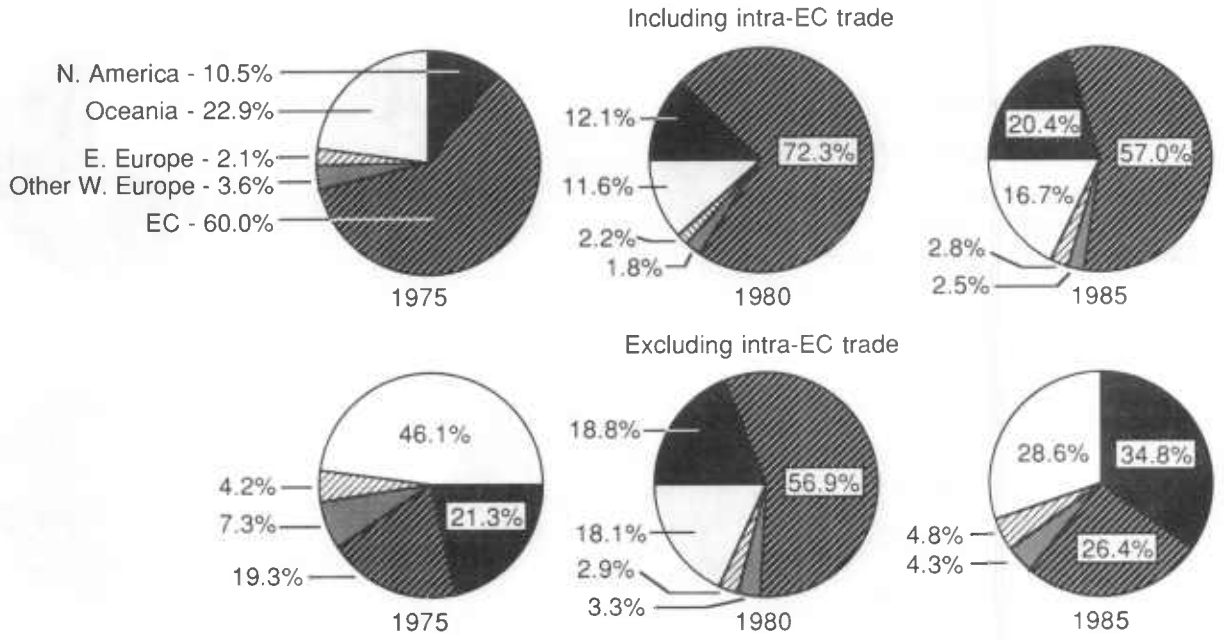
Export Shares for Cheese



Sources: Appendix tables 22.4 and 22.5.

Figure 22.6

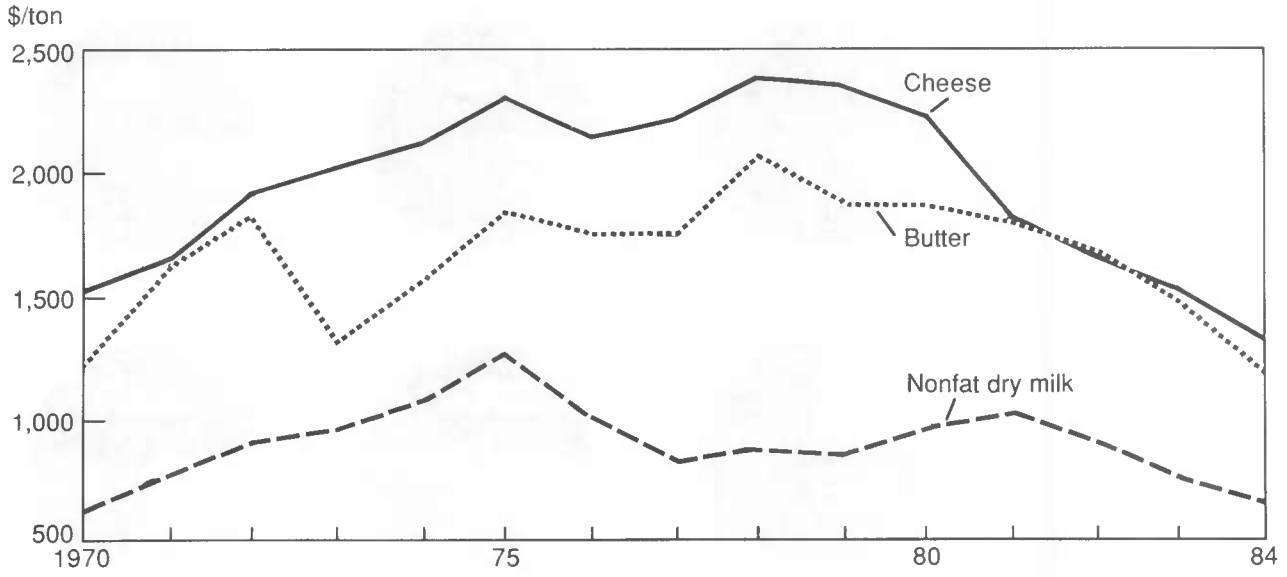
Export Shares for Nonfat Dry Milk



Sources: Appendix tables 22.4 and 22.5.

Figure 22.7

World Prices



1977 dollars. Source: Table 22.6.

OPTIONS FOR SURPLUS DISPOSAL ON FOREIGN MARKETS

To explore the extent to which surpluses could have been placed on world markets rather than being stored, we needed to explicitly state what alternative or counterfactual situations are hypothesized. In particular, given the variability of stock levels in the past, it was necessary to indicate when a no-stock policy was assumed to have begun. We explored two hypotheses in an attempt to indicate the magnitude of extra exports that would have been necessary to keep CCC stocks from accumulating. These two hypotheses, described below, were intended to represent the extreme cases of beginning the export disposal program when stocks are at a low point and when stocks were at a high point.

Situation 1

Stocks held by the CCC were assumed to have been at actual levels in 1970 and in subsequent years until 1973. At that time it would have been relatively easy to implement a zero-stocks policy. In 1974 for butter and cheese and 1973 for nonfat dry milk, the actual CCC ending stocks were reduced to near zero. We assumed that all stocks were sold by the end of the 1973/74 fiscal year and that they were not accumulated after 1974. We must distinguish between two types of disposals: Those that actually occurred, including domestic and foreign disposals under existing programs, and those additional disposals on export markets that would have occurred to reduce surpluses to zero under the proposed program. To determine the allocation of acquisitions relative to actual and proposed disposals, we said any acquisitions in excess of actual disposals increased export disposals. If acquisitions in any year were less than total (actual) disposals, then actual disposals were reduced according to priorities embodied in current legislation. The order of reduction was noncommercial export sales first, then commercial export sales, and then domestic dollar sales. If any further reduction in disposals was required, then the level of domestic donations was reduced. In practice, the CCC has the authorization to purchase dairy products and could maintain many of these domestic programs in the absence of surplus stocks.

Situation 2

Stocks held by the CCC were assumed to have been at actual levels in all years up to 1980. At that time, stocks were relatively high, and consequently the task of reducing those stocks by exporting them would have been more difficult. We assumed that all dairy stocks were reduced to zero by the end of the 1980/81 fiscal year and not rebuilt. As with Situation 1, the level of acquisitions was not varied, but the level of disposals in the period after stocks had been liquidated was adjusted to equal acquisitions. If a surplus of CCC dairy stocks was indicated, then that surplus was exported, with whatever subsidy necessary to make those products competitive. If acquisitions fell short of that required to maintain actual disposal levels, then these disposals were deemed to have been reduced according to the hierarchy of uses described in Situation 1.

These two hypotheses on stock levels define different market balances for the milk products. These hypothetical balances are given in table 22.10. Each stock level decision in turn implies a surplus which has to be removed, or a deficit which has to be absorbed, relative to actual levels. Appendix tables 22.7 and 22.8 show the distribution of this surplus or deficit among export outlets and domestic programs.

Option Results

The first hypothetical situation, that no stocks were accumulated after 1974 (Situation 1), would have implied additional exports of butter in 8 years out of 16, and an actual reduction in disposal programs in the other 8 years. There would have been extra cheese exports also in 8 years over roughly the same periods, and exports of nonfat dry milk would have increased in 9 years. In Situation 2, where CCC stock accumulation was assumed to have ended in 1980/81, considerable additional exports would have been necessary at that time.

Effect on total exports of these alternatives can be seen in appendix tables 22.7 and 22.8. The "new" export level includes the addition to exports implied by the decision not to accumulate CCC stocks. If stocks had been

Table 22.10--Comparison of actual and hypothetical CCC stocks and disposal positions

Product/ year	Actual				Situation 1 1/	Situation 2 2/
	CCC opening stocks	CCC ending stocks	CCC total acquisitions	CCC total disposals	CCC total disposals	CCC total disposals
			1,000 tons			
Butter:						
1969/70	113.9	170.3	156.5	100.0	100.0	100.0
1970/71	170.3	95.0	23.0	98.3	98.3	98.3
1971/72	95.0	75.6	126.3	145.7	145.7	145.7
1972/73	75.6	44.3	65.7	97.0	97.0	97.0
1973/74	44.3	8.1	11.6	47.8	55.9	47.8
1974/75	8.1	26.8	42.9	24.2	42.9	24.2
1975/76	26.8	0	1.3	28.1	1.3	28.1
1976/77	0	86.4	112.4	26.1	112.4	26.1
1977/78	86.4	106.4	66.7	46.6	66.7	46.6
1978/79	106.4	79.0	28.0	55.4	28.0	55.4
1979/80	79.0	136.2	107.1	49.9	107.1	49.9
1980/81	136.2	226.8	160.1	69.6	160.1	296.4
1981/82	226.8	238.3	170.3	158.8	170.3	170.3
1982/83	238.3	264.1	176.8	151.0	176.8	176.8
1983/84	264.1	253.7	96.5	106.9	96.5	96.5
1984/85	253.7	133.8	82.7	202.6	82.7	82.7
Cheese:						
1969/70	11.6	21.8	27.8	17.6	17.6	17.6
1970/71	21.8	1.1	5.6	26.3	26.3	26.3
1971/72	1.1	.1	33.3	34.3	34.3	34.3
1972/73	.1	.1	6.2	6.2	6.2	6.2
1973/74	.1	.1	1.9	1.9	2.0	1.9
1974/75	.1	5.5	53.9	48.5	53.9	48.5
1975/76	5.5	.0	7.9	13.4	7.9	13.4
1976/77	0	41.8	77.4	35.6	77.4	35.6
1977/78	41.8	23.9	24.8	42.7	24.8	42.7
1978/79	23.9	1.7	16.7	38.9	16.7	38.9
1979/80	1.7	102.8	159.1	57.9	159.1	57.9
1980/81	102.8	281.0	244.4	66.3	244.4	347.3
1981/82	281.0	429.0	272.3	124.3	272.3	272.3
1982/83	429.0	512.9	373.7	289.8	373.7	373.7
1983/84	512.9	519.0	303.1	297.0	303.1	303.1
1984/85	519.0	379.4	265.7	405.2	265.7	265.7
Nonfat dry milk:						
1969/70	255.6	238.2	203.2	220.6	220.6	220.6
1970/71	238.2	35.6	35.6	238.2	238.2	238.2
1971/72	35.6	25.6	199.0	209.0	209.0	209.0
1972/73	25.6	.3	66.1	91.4	91.4	91.4
1973/74	.3	10.8	27.0	16.4	27.3	16.4
1974/75	10.8	184.7	285.2	76.2	285.2	111.3
1975/76	184.7	196.7	110.2	96.3	110.2	98.2
1976/77	196.7	296.4	201.0	101.3	201.0	101.3
1977/78	296.4	306.9	140.9	130.3	140.9	130.3
1978/79	306.9	239.2	63.6	131.3	63.6	131.3
1979/80	239.2	312.9	227.3	153.6	227.3	153.6
1980/81	312.9	402.0	316.7	227.6	316.7	629.6
1981/82	402.0	619.2	389.4	172.2	389.4	389.4
1982/83	619.2	797.8	424.7	246.1	424.7	424.7
1983/84	797.8	755.9	330.7	372.6	330.7	330.7
1984/85	755.9	656.8	314.7	413.9	314.7	314.7

1/ Situation 1 begins 1973/74.
2/ Situation 2 begins 1980/81.

Source: CCC data and assumptions described in text.

liquidated in 1974, the United States would have been a major butter exporter in 1977 and 1980 and would have increased considerably its market share in 1981 (app. table 22.7). The United States would have entered the cheese export market as a large supplier in 1977 and over 1980-83. The United States would have increased its share of world nonfat dry milk exports in 1975, 1977, and 1980 and exported record levels in 1981-83. The price at which such exports could have been sold would have depended on existence of markets able to absorb the extra trade and upon reactions of other exporters.

For Situation 2, CCC disposal of stocks beginning in 1981 would have dramatically affected market shares in that year. U.S. exports would have constituted 24 percent of total world exports and 41 percent of world trade excluding intra-EC trade flows. The share of the world cheese market accounted for by U.S. exports would have been 28 percent overall and 36 percent of non-intra-EC trade. The United States would have been attempting to sell 54 percent of total and 84 percent of non-intra-EC world milk powder exports, versus 25 percent and 39 percent in the actual case. With the United States more than doubling its market share, markets would likely have had difficulty absorbing these extra exports, and the reaction of other exporters would have been crucial.

Domestic programs could not have been maintained, in general, in the absence of CCC stocks. Under the hypothesis that no stocks were released in 1974 (Situation 1), significant domestic program cuts would have been needed in 1976, 1979, and 1985 for butter, and in 1976, 1978, 1979, and 1985 for cheese. However, if the full programs had been maintained, market prices may have been raised. Sales by the CCC on the domestic market, authorized when market prices rise above 110 percent of the support levels, would have occurred less frequently, particularly in the 1970's. Overseas export disposal under P.L. 480 and through bilateral deals would have been cut, under the assumptions of no CCC stocks in 1984/85 for butter, 1985 for cheese, and 1979 and 1985 for nonfat dry milk. In years of extra products for disposal, these concessional exports may, of course, have been increased.

THE COST OF SURPLUS DISPOSAL

The additional dairy products identified in the last section could have been moved onto world markets, albeit with the aid of a subsidy. The cost of the dairy program would have been less by the saved storage cost and greater by the subsidy cost. Any capital gains and losses actually incurred by the CCC on its stock operations would have been foregone or avoided. Appendix table 22.9 shows actual budget costs reconstructed from the quantities of dairy products purchased by the CCC and the sales to both domestic and foreign markets, excluding donations which were assumed to yield no revenue. Average cost of purchases per unit and of domestic sales per unit were calculated from CCC financial accounts. Per-unit return on foreign sales is taken as the average non-EC export price. Storage costs and costs of transporting, packaging, and handling were also from CCC records. Prices were deflated, as were storage and other costs, to a 1977 basis using a consumer price index. Budget costs ranged in this calculation from a low of $127 million for all three products in fiscal year 1974 to a high of $1,719 million in fiscal year 1985. Average budget cost over the 16 years was $578 million at 1977 prices.

Revenue from foreign and domestic sales of CCC products varied as did the storage cost. Other costs were assumed to be invariate with respect to stock levels (though in practice some part of the transporting, processing, and handling costs incurred by the CCC were related to storage levels). An inventory value adjustment was made in each year to correct for different levels of inventory carried into and out of the period. These inventories are valued at cost in appendix table 22.9, thus probably understating the true costs in the actual case relative to the various no-stock scenarios.

Significance of the valuation of the change in stocks can be seen in appendix table 22.10. In addition to acquisition cost valuation, opening and closing inventories were valued at three price levels representing their returns on export markets. These three world prices included the average revenue earned by non-EC exporters, the import price in the lowest price region, and a "floor" price calculated by extrapolating the

International Dairy Agreement price minimum and the current apparent price levels for EC exports to third countries backwards to previous years. Inventories were also valued at zero, representing the option of disposal as donations or noncommercial transactions. The change in inventory valuation could be added to the trading profit or loss to give program costs for any particular year.

The net budget cost under the three different stock scenarios is reproduced in table 22.11. Average program costs were generally higher under the no-stock situations, with the lower cost alternative the one that eliminates stocks in 1974. Much of the apparent benefit of the actual situation, however, came from valuing stocks at acquisition cost. The average cost of the actual scenario was somewhat greater if a zero value was put on stocks. If stocks were worthless, eliminating them was less expensive than keeping them.

Again, a key variable in estimating budget costs is the world price level, which determined the needed export subsidy. Calculations in the first column of table 22.11 assumed the United States would receive the average world price for non-EC exported products. This is clearly an optimistic assumption. The actual price may well be below that average. There are several reasons for such a difference between average price and U.S. export price. First, the United States would have represented a major part of the world market, and in particular the non-EC market, in several years (table 22.12). Under such conditions, U.S. exports would have depressed world prices. This large country effect, the influence on world prices of domestic policy developments, is difficult to estimate with confidence because it requires accurate knowledge of the price response of both importers and exporters. These responses in turn are influenced by the reactions of governments in those countries as well as of private individuals. In addition to the effect through market prices, there is another large country effect in terms of the direct reaction of other governments to U.S. policy changes. This reaction can vary from accommodation of such changes to confrontation.

A second reason for a difference between average non-EC world price and the U.S. export price relates to quality and homogeneity. This is particularly a problem for cheese. Much of the world's cheese trade is in specific cheeses carrying a locational label which entices consumers from lower priced domestic varieties. This cheese trade has the effect of raising average prices. If the United States is exporting block cheese that competes with New Zealand and European cheddar and Edam-type cheeses, then the price may well be lower.

For all these reasons it is useful to recalculate the budget costs with other levels of world price. For the first case, as stated above, we assumed that the United States would have received the average price received by non-European exporting countries. A second price level, the "low region" price, is that paid by the residual buyer (the USSR in most years for butter and cheese, and Mexico for nonfat dry milk). Since even this price may be optimistic for additional exports (and since there is some evidence that these reported prices are substantially above the amount actually paid for dairy products from storage), an alternative valuation of zero (donation basis) was used to give an upper bound to disposal costs. Table 22.11 combines these three price levels with three alternative inventory valuations and three policy scenarios. The detailed annual costs by commodity are given in appendix tables 22.11-22.14.

Table 22.11 shows that program costs vary with world prices and with inventory valuation procedures, as is to be expected. Relative size of these effects is somewhat surprising. The "world price" effect, the difference in average program costs with different world price assumptions, is rather modest, $37-$40 million extra if CCC exports move into aid channels rather than being added to commercial exports and receiving the average world export price level. This effect is steady over all inventory valuation scenarios and, more surprisingly, is not influenced by the choice of when to liquidate stocks. By contrast, "inventory value" effect is a pivotal factor in calculating program cost as it changes ordering of alternatives. Actual policies look more expensive as the price on accumulated inventories is lowered. The two stock-liquidation policies (1974 when stocks were low, and 1981 when stocks were high) are less costly when inventories are valued at zero.

Table 22.11--Comparison of average budget cost by commodity under alternative CCC stock policies

Product	Acquisition price for inventories			World price for inventories			Donation basis for inventories		
	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis
				Million 1977 dollars					
Actual CCC stock levels:									
Butter	178	179	197	176	178	196	182	183	201
Cheese	196	196	197	217	218	219	245	245	246
Nonfat dry milk	204	203	222	219	218	237	244	243	262
Total	578	579	617	612	614	651	670	671	709
CCC stocks sold in 1974:									
Butter	195	197	214	190	191	208	181	182	199
Cheese	242	242	243	241	242	243	205	241	242
Nonfat dry milk	255	254	273	250	249	268	239	238	257
Total	693	694	731	681	682	718	661	662	698
CCC stocks sold in 1981:									
Butter	194	195	212	192	193	210	180	181	198
Cheese	242	242	243	240	240	214	241	241	242
Nonfat dry milk	254	254	272	251	250	269	241	240	259
Total	690	691	728	683	683	720	662	663	699

Table 22.12--Implied U.S. share of world market under alternative stock policies, levels

Product/ year	Actual CCC stock policy		CCC stocks sold in 1974		CCC stocks sold in 1981		U.S. share increase over actual			
	Percentage of trade		Percentage of trade		Percentage of trade		1974 disposal program		1981 disposal program	
	World total	Non-intra-EC	World total	Non-intra-EC	World total	Non-intra-EC	World total	Non-intra-EC	World total	Non-intra-EC
					Percent					
Butter:										
1972/73	0.9	1.4	0.9	1.4	0.9	1.4	0	0	0	0
1973/74	.3	.6	.3	.6	.3	.6	0	0	0	0
1974/75	.1	.2	.1	.2	.1	.2	0	0	0	0
1975/76	.2	.4	.2	.4	.2	.4	0	0	0	0
1976/77	.2	.3	8.8	14.2	.2	.3	8.6	13.9	0	0
1977/78	.2	.3	2.3	3.8	.2	.3	2.1	3.4	0	0
1978/79	.2	.3	.2	.3	.2	.3	0	0	0	0
1979/80	0	0	4.3	6.9	0	0	4.3	6.9	0	0
1980/81	6.0	10.3	13.2	22.4	23.9	40.6	7.1	12.1	17.8	30.4
1981/82	13.0	22.2	13.9	23.7	13.9	23.7	0.9	1.5	.9	1.5
1982/83	5.6	9.3	7.8	12.9	7.8	12.9	2.2	3.6	2.2	3.6
1983/84	5.8	9.6	5.8	9.6	5.8	9.6	0	0	0	0
1984/85	7.8	12.6	7.8	12.6	7.8	12.6	0	0	0	0
Cheese:										
1972/73	1.5	3.4	1.5	3.4	1.5	3.4	0	0	0	0
1973/74	1.6	3.2	1.6	3.2	1.6	3.2	0	0	0	0
1974/75	1.6	3.2	1.6	3.2	1.6	3.2	0	0	0	0
1975/76	1.5	2.9	1.5	2.9	1.5	2.9	0	0	0	0
1976/77	1.5	2.9	5.1	9.9	1.5	2.9	3.6	7.1	0	0
1977/78	1.7	3.4	1.7	3.4	1.7	3.4	0	0	0	0
1978/79	1.5	3.1	1.5	3.1	1.5	3.1	0	0	0	0
1979/80	.4	.8	7.5	14.0	.4	.8	7.0	13.2	0	0
1980/81	.4	.7	11.8	23.0	18.3	35.8	11.4	22.2	18.0	35.0
1981/82	1.6	3.1	11.6	22.7	11.6	22.7	10.0	19.6	10.0	19.6
1982/83	2.1	4.2	7.7	15.4	7.7	15.4	5.6	11.1	5.6	11.1
1983/84	1.9	3.8	2.3	4.5	2.3	4.5	.4	.7	.4	.7
1984/85	2.8	5.8	2.8	5.8	2.8	5.8	0	0	0	0
Nonfat dry milk:										
1972/73	5.1	8.5	5.1	8.5	5.1	8.5	0	0	0	0
1973/74	1.1	1.7	2.0	3.2	1.1	1.7	.9	1.5	0	0
1974/75	14.7	29.6	33.8	68.1	14.7	29.6	19.1	38.5	0	0
1975/76	7.8	14.1	8.7	15.8	7.8	14.1	1.0	1.7	0	0
1976/77	7.9	12.2	13.9	21.5	7.9	12.2	6.0	9.3	0	0
1977/78	11.9	22.5	12.5	23.6	11.9	22.5	.6	1.1	0	0
1978/79	9.4	16.3	9.4	16.3	9.4	16.3	0	0	0	0
1979/80	14.7	22.8	19.3	30.0	14.7	22.8	4.7	7.3	0	0
1980/81	24.7	38.5	31.1	48.5	53.7	83.8	6.4	10.0	29.0	45.3
1981/82	18.0	32.8	32.4	58.9	32.4	58.9	14.4	26.1	14.4	26.1
1982/83	23.7	49.7	32.5	68.0	32.5	68.0	8.8	18.4	8.8	18.4
1983/84	24.5	49.4	24.5	49.4	24.5	49.4	0	0	0	0
1984/85	31.1	53.2	31.1	53.2	31.1	53.2	0	0	0	0

The difference between liquidating stocks in 1974 as opposed to 1981 is less striking than might be imagined. The main difference between the two scenarios is the sudden increase in exports in the year when the decision was taken. The final effect, averaged over 16 years, looks small and can even be offset by other factors. For the initial year, the stocks disposal program would have been more costly by up to $34 million in 1974 if stocks had been reduced in that year (depending on the export price) and in 1981 by as much as $1.5 billion (app. table 22.14). But, overall, the average program cost is marginally less with the continuation of stocks over 1974-81.

Determining which price level would have been obtained for these extra exports is more a matter of judgment than science. As indicated before, the world market is strongly influenced by government policies both constraining imports and subsidizing exports. For the United States to "join in" this activity would clearly have major effects on decisions of others. It is possible that in 1974 a change in U.S. policy could have been accomplished without undue disruption of markets. EC and New Zealand policies were changing as a result of UK accession to the Common Market (taking with it a history of considerable dairy imports). Third-world countries were rethinking their food policies and livestock producing countries were searching for animal feed ingredients other than fishmeal and grain. In addition, the USSR market was opening up to western trade and the United States might have been able to take some of the market for butter that went to the EC countries. A zero-stock policy at that time might have had the effect of establishing a higher level of U.S. exports.

By 1981 the situation was different. The stock levels were much higher in both the EC and the United States. From 1981 to 1983, the EC built up stocks of butter by 740,000 tons and of skim milk powder by 551,000 tons. The United States and New Zealand also built up stocks of butter (by 32,000 and 10,000 tons) and of nonfat dry milk (by 233,000 and 19,000 tons). Had the United States chosen to unload stocks on the world market, it is quite possible that other major exporters would have followed suit. Under such circumstances, the world price would have collapsed. In the short run, this would have implied a near-zero return on additional exports. In the longer run, pressures on EC finances may have altered the agricultural policy stance in the Common Market.

The year 1981 would have been a difficult year to change policy. Had some way been found to dispose of the accumulated stocks, then the situation would have improved in subsequent years. In 1982 and 1983, the United States would not have had appreciably more butter to sell, and it is therefore reasonable to expect the price to have stayed at about the USSR import price level. A large buildup of stocks in 1983 in the EC, generally considered to be related to domestic budget pressures rather than world market conditions, would have helped with U.S. surplus disposal.

The United States would have had considerable difficulty selling cheese in the world market in 1980-83. Japan's market was flat and the USSR was not supporting the price to the same extent as in the butter market. It is likely that the extra cheese could only have been sold at a lower price than the average (at $1,500-$1,700 per ton). At this price, quantity demanded could perhaps have risen to absorb U.S. exports. It is always possible, though not necessarily desirable, that some reduction in U.S. cheese imports could have been encouraged by policy to avoid the need to export so large a quantity.

The situation is also discouraging for additional U.S. nonfat dry milk exports. In 1980 and 1981, extra U.S. sales might have been possible at about the Mexican import price ($988 and $1,284 per ton, respectively). The USSR, in fact, paid somewhat more for milk powder in those years. In 1981, prices firmed (as in the butter market) as a result of EC and New Zealand stock buildup. Extra U.S. sales at that time could have shaken the implicit coordination of the two largest exporters in their attempt to firm world prices. In 1982, the EC and New Zealand stock buildup increased, and the Mexican (and other middle income) markets were weakened by debt problems. The price may well have dropped dramatically in that year if the United States had exported an extra 217,000 tons. The minimum price under the International Dairy Agreement ($600 per ton) might have been put to the test. But, over time, it is also possible

that a more regular export availability of nonfat dry milk from the United States would cultivate some additional Asian markets.

CONCLUSION

Costs for the dairy price support program in recent years have been high by historical standards. This chapter has attempted to determine whether program costs could have been lower if the CCC had disposed of its stocks on export markets and thereafter made acquisitions surplus to domestic program needs available to foreign buyers at competitive prices.

We conclude based on the analysis presented in this chapter that exporting excess milk products in the year in which they are purchased has limited potential for reducing dairy program costs. Under most scenarios, such schemes would have cost more than the current practice of storing such products for later disposal. Trading gains made by holding stocks for a time can outweigh storage cost savings resulting from immediate sale.

We have assumed that domestic prices were held constant and that domestic donation programs were maintained insofar as commodity surpluses existed. Clearly the program costs would have been lower if either less milk products had been purchased, or had been purchased at a lower price, or if less had been given away at home. But within the above constraints, it is not apparent that the dairy programs would have been significantly less stable in the absence of yearend CCC stocks. Domestic prices would have been higher if the lack of CCC stocks would have encouraged private stocks to increase, but this would have been only a one-time effect in the period of stock buildup.

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Appendix table 22.1--CCC purchases as a percentage of production of total

Fiscal year	Butter	Cheese	Nonfat dry milk
		Percent	
1970	30.1	2.8	31.0
1971	4.4	.5	5.5
1972	25.3	2.8	35.9
1973	15.8	.5	15.9
1974	2.7	.1	5.8
1975	9.6	4.2	63.2
1976	.3	.5	26.2
1977	22.8	5.1	40.0
1978	14.8	1.6	33.8
1979	6.3	1.0	15.4
1980	20.6	8.8	43.2
1981	28.7	12.6	53.1
1982	29.9	13.2	61.3
1983	30.0	17.1	62.5
1984	19.3	14.3	62.8
1985	14.7	11.6	49.2

Source: Calculated from CCC data.

Appendix table 22.2--Disposal of CCC removals from domestic market

Product/ year	CCC export disposals					CCC domestic disposals					Acquisitions minus disposals
	Total exports	Sales for dollars	P.L. 480 Title II	Foreign donations	Agency transfer	Total disposals	Sales for dollars	Domestic donations	Agency transfer	Other	
					1,000 tons						
Butter:											
1969/70	0.4	0	0	0	0.4	99.6	0.1	54.6	44.9	0	56.4
1970/71	5.1	4.4	0	0	.7	93.1	0	51.2	41.9	0	-75.3
1971/72	59.9	58.8	0	0	1.0	85.9	1.7	53.7	30.3	.1	-19.4
1972/73	1.3	.4	0	0	.9	95.7	10.9	84.5	0	.3	-31.3
1973/74	0	0	0	0	0	47.8	.3	47.4	0	.1	-36.2
1974/75	0	0	0	0	0	24.2	1.2	23.0	0	.1	18.7
1975/76	0	0	0	0	0	28.1	10.7	17.4	0	.1	-26.8
1976/77	0	0	0	0	0	26.1	0	2.2	23.8	0	86.3
1977/78	0	0	0	0	0	46.6	4.1	16.1	26.4	0	20.0
1978/79	0	0	0	0	0	55.4	8.1	22.6	24.7	.1	-27.4
1979/80	.1	0	0	0	.1	49.8	.5	19.6	29.6	.1	57.2
1980/81	22.6	22.2	0	0	.4	47.0	0	57.7	-10.9	.1	90.5
1981/82	102.8	101.5	.7	0	.6	56.0	3.3	52.5	0	.1	11.6
1982/83	33.2	18.6	13.6	.3	.7	117.8	.1	117.6	0	.2	25.8
1983/84	20.8	13.4	3.1	3.8	.6	86.1	2.1	83.7	0	.3	-10.4
1984/85	51.0	17.3	.7	32.8	.2	151.6	.5	150.9	0	.1	-119.9
Cheese:											
1969/70	0	0	0	0	0	17.6	0	7.7	9.9	0	10.2
1970/71	0	0	0	0	0	26.3	0	22.9	3.4	0	-20.7
1971/72	0	0	0	0	0	34.3	0	34.3	0	0	-1.0
1972/73	0	0	0	0	0	6.2	0	6.2	0	0	0
1973/74	0	0	0	0	0	1.9	0	1.9	0	0	0
1974/75	0	0	0	0	0	48.5	0	48.5	0	.1	5.4
1975/76	0	0	0	0	0	13.4	0	13.3	0	0	-5.4
1976/77	0	0	0	0	0	35.6	0	3.3	32.3	0	41.8
1977/78	0	0	0	0	0	42.7	1.9	11.9	28.7	.2	-17.9
1978/79	0	0	0	0	0	38.9	.4	7.8	30.8	-.1	-22.2
1979/80	0	0	0	0	0	57.9	.1	28.8	28.9	.1	101.1
1980/81	0	0	0	0	0	66.3	3.0	61.6	3.1	-1.4	178.2
1981/82	5.7	5.7	0	0	0	118.6	4.6	111.1	.8	2.2	148.1
1982/83	14.9	5.4	8.9	.3	.3	274.9	4.3	269.6	0	1.1	83.9
1983/84	15.9	4.9	4.6	5.9	.4	281.1	16.4	263.4	0	1.4	6.0
1984/85	29.2	1.7	1.4	25.4	.7	376.0	17.5	357.8	0	.8	-139.5
Nonfat dry milk:											
1969/70	153.8	21.2	132.6	0	0	66.8	4.4	41.1	21.3	0	-17.4
1970/71	172.9	31.5	141.4	0	0	65.3	.2	61.0	4.1	0	-202.6
1971/72	152.5	37.1	115.4	0	0	56.4	0	56.2	0	.2	-10.0
1972/73	44.8	19.1	25.7	0	0	46.6	6.1	40.5	0	.1	-25.3
1973/74	0	0	0	0	0	16.4	0	16.4	0	0	10.5
1974/75	44.3	0	44.3	0	0	31.9	0	30.8	0	1.0	209.0
1975/76	34.5	0	34.5	0	0	61.8	41.4	19.2	0	1.1	13.9
1976/77	57.6	0	57.4	0	.2	43.7	28.1	2.4	8.9	4.3	99.7
1977/78	89.4	18.1	68.2	0	3.1	40.9	15.6	5.9	18.4	1.0	10.5
1978/79	83.1	14.0	65.5	0	3.5	48.2	26.0	5.7	15.7	.8	-67.7
1979/80	100.5	37.8	58.5	0	4.2	53.1	32.3	5.8	13.9	1.0	73.7
1980/81	186.8	83.5	99.2	0	4.1	40.8	23.5	20.0	-3.3	.7	89.1
1981/82	128.8	50.1	74.3	0	4.3	43.4	24.4	17.0	1.1	.9	217.2
1982/83	193.7	47.0	142.5	1.6	2.6	52.4	18.8	31.9	1.3	.3	178.6
1983/84	261.7	30.4	147.1	81.2	3.0	110.9	63.2	45.4	.1	2.2	-41.8
1984/85	320.9	46.4	145.1	125.2	4.2	93.0	28.9	64.1	0	0	-99.2

Source: CCC data.

Appendix table 22.3--Net Government expenditures on dairy support programs

Year 1/	Net support purchases 2/	School lunch/ welfare 3/	Export assist-ance 4/	Special milk program 5/	Total expen-diture	Real net support purchases	Real school lunch/ welfare	Real export assist-ance	Real special milk program	Real total expen-diture
					Million dollars					
1969/70	168.6	114.9	7.4	102.9	393.8	263.0	179.3	11.5	160.5	614.4
1970/71	315.4	94.8	11.6	91.8	513.6	472.2	141.9	17.4	137.4	768.9
1971/72	267.0	63.9	7.3	93.6	431.8	387.0	92.6	10.6	135.7	625.8
1972/73	135.8	15.5	1.5	90.8	243.6	185.3	21.1	2.0	123.9	332.3
1973/74	31.4	39.5	0	50.2	121.1	38.6	48.5	0	61.7	148.8
1974/75	485.8	10.3	0	122.9	619.0	547.1	11.6	0	138.4	697.1
1975/76	69.6	6.9	0	144.0	220.5	74.1	7.3	0	153.4	234.8
1976/77	709.8	4.5	0	109.7	824.0	709.8	4.5	0	109.7	824.0
1977/78	446.4	5.0	0	137.8	589.2	414.5	4.6	0	127.9	547.1
1978/79	244.3	6.3	0	134.1	384.7	203.9	5.3	0	111.9	321.1
1979/80	1,274.0	5.8	0	159.9	1,439.7	936.8	4.3	0	117.6	1,058.6
1980/81	1,967.2	7.5	0	104.4	2,079.1	1,311.5	5.0	0	69.6	1,386.1
1981/82	2,231.3	7.9	0	22.9	2,262.1	1,400.7	5.0	0	14.4	1,420.0
1982/83	2,592.0	8.4	0	14.9	2,615.3	1,576.6	5.1	0	9.1	1,590.8
1983/84	1,558.1	9.4	0	16.0	1,583.5	909.0	5.5	0	9.3	923.9
1984/85	2,168.8	16.2	0	16.0	2,201.0	1,221.9	9.1	0	9.0	1,240.0

1/ Fiscal year begins July 1 through 1975-76; Oct. 1 thereafter.
2/ CCC support purchases and related costs (for processing, packaging, transporting, and storing) dairy products, less sales to commercial buyers for domestic use and for export, U.S. military agencies, foreign government and private welfare agencies, and Section 32 programs.
3/ Expenditures of Section 32 funds to buy dairy products in the market and from CCC for school lunch and welfare uses. Purchases of dairy products at market prices under Section 709 of the Food and Agriculture Act of 1965 and under Sec. 4(a) of the Agriculture and Consumer Protection Act of 1973, for domestic school lunch and welfare uses.
4/ Value of payment-in-kind certificates issued by CCC on exports of nonfat dry milk, butter, and other high milkfat products, and CCC cost of exports under Title I, P.L. 480 of dairy products not originating in CCC stocks.
5/ Expenditures under the program to increase milk consumption by children in schools, child-care centers, and similar institutions.

Source: USDA, Agricultural Stabilization and Conservation Service.

Appendix table 22.4--World dairy exports including intra-EC trade, share by region and product

Product/country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
							Percent						
Butter:													
North America	0.7	0.3	0.1	0.8	0.4	0.3	0	0	4.2	5.2	3.2	4.1	3.9
EC	68.9	66.4	69.9	62.3	67.8	70.7	73.6	74.3	72.4	67.8	62.9	64.3	62.7
Other Western Europe	2.2	3.6	3.7	3.4	3.4	2.8	2.5	1.8	2.7	2.3	4.5	3.6	3.2
Eastern Europe	2.5	4.9	2.1	1.9	1.0	1.2	1.5	1.4	1.0	4.9	6.3	6.8	6.7
Oceania	23.2	22.5	22.5	28.8	24.6	22.2	19.5	19.3	16.8	17.9	21.0	19.7	22.1
Cheese:													
North America	2.1	2.1	1.8	1.6	1.6	1.9	.6	.6	.7	1.5	1.4	1.3	1.5
EC	67.0	70.6	71.2	70.0	69.0	70.9	69.6	69.4	72.1	72.6	73.2	74.7	74.3
Other Western Europe	13.8	13.3	13.6	13.1	13.6	13.3	11.9	11.6	10.8	11.3	10.7	10.3	10.4
Eastern Europe	2.0	1.8	1.6	2.2	2.1	2.3	8.8	8.4	7.5	4.5	5.3	4.2	4.1
Oceania	13.5	11.0	10.3	10.3	11.4	9.6	8.2	9.1	8.2	9.3	8.6	8.9	9.0
Nonfat dry milk:													
North America	11.4	6.3	10.5	12.7	14.4	13.9	9.7	12.1	15.7	17.4	18.2	16.6	20.4
EC	66.5	62.6	60.0	61.4	56.8	69.4	78.6	72.3	67.1	67.5	62.8	64.2	57.0
Other Western Europe	2.4	2.8	3.6	4.4	2.5	1.7	1.2	2.2	4.1	3.0	3.2	2.8	2.5
Eastern Europe	.2	.4	2.1	2.0	2.3	1.5	1.8	1.8	.4	.7	2.2	2.7	2.8
Oceania	18.8	27.4	22.9	17.3	24.4	13.1	8.7	11.6	12.6	10.8	12.8	13.0	16.7

Source: (5).

Appendix table 22.5--World dairy exports excluding intra-EC trade, share by region and product

Product/country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
							Percent						
Butter:													
North America	1.2	0.6	0.2	1.6	0.6	0.5	0	0	7.2	8.8	5.3	6.8	6.2
EC	50.0	31.2	38.1	25.6	47.9	52.1	57.2	59.3	53.0	45.0	38.5	40.6	40.0
Other Western Europe	3.6	7.3	7.7	6.6	5.5	4.6	4.0	2.9	4.6	3.9	7.5	6.0	5.1
Eastern Europe	4.0	10.1	4.4	3.8	1.6	1.9	2.4	2.2	1.7	8.3	10.5	11.2	10.8
Oceania	37.3	46.1	46.2	56.9	39.8	36.2	31.7	30.6	28.6	30.6	34.8	32.8	35.7
Cheese													
North America	4.6	4.0	3.6	3.3	3.2	3.7	1.2	1.2	1.4	3.0	2.8	2.5	3.2
EC	27.8	42.6	41.3	39.7	39.2	41.5	38.5	42.7	45.5	46.4	46.5	50.7	46.4
Other Western Europe	30.2	25.9	27.8	26.3	26.7	26.8	24.1	21.8	21.1	22.1	21.4	20.2	21.7
Eastern Europe	4.3	3.6	3.2	4.4	4.1	4.6	17.8	15.8	14.6	8.9	10.5	8.1	8.6
Oceania	29.5	21.5	21.0	20.7	22.3	19.3	16.6	17.0	16.1	18.2	17.1	17.3	18.9
Nonfat dry milk													
North America	19.0	10.2	21.3	23.0	22.3	26.4	16.8	18.8	24.4	31.6	38.2	33.5	34.8
EC	44.3	38.9	19.3	29.9	33.1	42.1	63.1	56.9	48.8	41.0	22.2	27.7	26.4
Other Western Europe	4.0	4.6	7.3	7.9	3.9	3.3	2.1	3.3	6.4	5.5	6.8	5.7	4.3
Eastern Europe	.3	.7	4.2	3.6	3.5	2.9	3.0	2.9	.7	1.3	4.5	5.4	4.8
Oceania	31.2	44.7	46.1	31.4	37.7	24.9	15.1	18.1	19.7	19.7	26.7	26.1	28.6

Source: (5).

Appendix table 22.8--Average implied nominal and real price levels of imports by region

Product/region	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
								Dollars per ton							
Butter:															
World	779	1,079	1,262	968	1,281	1,631	1,656	1,746	2,219	2,242	2,532	2,692	2,679	2,445	2,032
North and Central America	752	901	1,261	1,154	1,270	1,355	1,404	1,333	1,498	1,703	1,732	2,167	2,003	1,873	1,853
South America	477	772	1,312	1,054	1,302	1,495	1,280	1,341	1,513	1,778	1,826	2,434	2,456	2,203	2,153
Asia	525	805	1,023	973	1,200	1,283	1,409	1,449	1,684	1,827	2,153	2,373	2,487	2,143	1,928
Europe	854	1,157	1,307	1,113	1,313	1,725	1,778	2,005	2,602	2,843	3,267	3,001	3,030	2,798	2,301
USSR	843	922	900	511	912	998	1,043	898	1,192	1,206	1,661	2,331	2,253	2,074	1,408
Cheese:															
World	970	1,104	1,317	1,484	1,737	2,054	2,013	2,219	2,574	2,805	3,044	2,743	2,644	2,512	2,280
North and Central America	1,102	1,175	1,333	1,423	1,666	1,997	2,146	2,204	2,372	2,566	2,859	2,955	2,998	2,898	2,697
South America	873	1,029	1,013	1,351	1,397	1,805	1,398	1,822	2,087	2,101	2,352	2,080	1,848	2,752	2,890
Asia	620	683	898	999	1,225	1,509	1,373	1,449	1,678	1,853	1,961	1,917	1,872	1,800	1,621
Europe	1,000	1,162	1,379	1,577	1,852	2,172	2,147	2,415	2,883	3,178	3,471	3,024	2,883	2,705	2,456
Oceania	992	1,149	1,362	1,492	1,791	2,052	2,034	2,039	2,231	2,366	2,836	2,947	2,819	2,700	2,630
USSR	597	561	648	723	781	1,471	1,423	1,502	1,622	1,638	1,703	1,505	1,715	1,750	1,548
Nonfat dry milk:															
World	392	509	629	700	881	1,126	949	822	932	1,031	1,302	1,543	1,447	1,242	1,116
North and Central America	363	531	681	690	897	1,077	784	724	778	875	988	1,284	1,255	1,164	1,012
South America	521	562	728	802	893	1,058	787	819	956	1,014	1,210	1,572	1,534	1,356	1,330
Asia	439	554	707	793	974	1,187	928	870	949	1,106	1,408	1,800	1,685	1,601	1,436
Europe	319	432	530	616	769	1,056	979	754	904	986	1,360	1,362	1,257	935	827
USSR	441	461	740	746	831	915	882	826	922	949	1,113	1,428	1,497	1,420	1,039
								1977 dollars per ton							
Butter:															
World	1,215	1,615	1,828	1,321	1,573	1,836	1,763	1,746	2,061	1,872	1,862	1,795	1,682	1,487	1,186
North and Central America	1,173	1,350	1,828	1,575	1,560	1,526	1,495	1,333	1,390	1,422	1,273	1,445	1,257	1,139	1,081
South America	745	1,156	1,901	1,437	1,599	1,683	1,363	1,341	1,405	1,485	1,342	1,622	1,542	1,340	1,256
Asia	819	1,204	1,482	1,328	1,474	1,445	1,501	1,449	1,563	1,525	1,583	1,582	1,561	1,303	1,125
Europe	1,332	1,732	1,895	1,518	1,612	1,942	1,893	2,005	2,416	2,373	2,402	2,001	1,902	1,702	1,343
USSR	1,315	1,380	1,305	697	1,121	1,123	1,111	898	1,107	1,006	1,222	1,554	1,414	1,262	822
Cheese:															
World	1,513	1,653	1,909	2,025	2,133	2,314	2,144	2,219	2,390	2,341	2,238	1,829	1,660	1,528	1,330
North and Central America	1,719	1,759	1,932	1,942	2,046	2,249	2,286	2,204	2,202	2,142	2,103	1,970	1,882	1,763	1,573
South America	1,362	1,540	1,467	1,843	1,716	2,032	1,488	1,822	1,938	1,754	1,730	1,387	1,160	1,674	1,686
Asia	967	1,023	1,301	1,363	1,505	1,699	1,462	1,449	1,558	1,546	1,442	1,278	1,175	1,095	946
Europe	1,561	1,740	1,998	2,152	2,275	2,446	2,287	2,415	2,677	2,653	2,552	2,016	1,810	1,645	1,433
Oceania	1,547	1,720	1,974	2,035	2,200	2,311	2,166	2,039	2,072	1,975	2,085	1,965	1,770	1,642	1,535
USSR	931	840	940	986	960	1,657	1,516	1,502	1,506	1,367	1,252	1,003	1,077	1,064	903
Nonfat dry milk:															
World	611	762	912	956	1,083	1,268	1,010	822	865	861	957	1,028	908	756	651
North and Central America	566	795	987	941	1,102	1,213	835	724	723	731	726	856	788	708	591
South America	813	841	1,056	1,095	1,097	1,192	838	819	888	847	890	1,048	963	825	776
Asia	685	829	1,025	1,082	1,196	1,337	988	870	881	924	1,035	1,200	1,058	974	838
Europe	498	647	768	840	945	1,189	1,043	754	839	823	1,000	908	789	569	482
USSR	688	690	1,073	1,018	1,021	1,030	939	826	856	792	819	952	939	864	606

Source: (2)

Appendix table 22.7--Simulated disposition of surplus or coverage of deficit assuming all CCC stocks sold in 1974 (Situation 1)

Product/ year	Surplus(+) or deficit(-)	Addition to exports	Reduction in CCC sales	Total exports	New export level	Foreign dona- tions	New foreign donations	CCC export sales	New export sales	Domestic dollar sales	New domestic sales	Domestic dona- tions	New domestic donations
						1,000 tons							
Butter:													
1969/70	0	0	0	4.4	4.4	0.4	0.4	0	0	0.1	0.1	99.5	99.5
1970/71	0	0	0	50.1	50.1	.7	.7	4.4	4.4	0	0	93.1	93.1
1971/72	0	0	0	83.9	83.9	1.0	1.0	58.8	58.8	1.7	1.7	84.2	84.2
1972/73	0	0	0	9.3	9.3	.9	.9	.4	.4	10.9	10.9	84.7	84.7
1973/74	8.1	8.1	0	3.0	11.1	0	0	0	0	.3	.3	47.6	47.6
1974/75	18.7	18.7	0	1.0	19.7	0	0	0	0	1.2	1.2	23.1	23.1
1975/76	-26.8	0	26.8	2.0	2.0	0	0	0	0	10.7	0	17.4	1.3
1976/77	86.3	86.3	0	2.0	88.3	0	0	0	0	0	0	26.1	26.1
1977/78	20	20	0	2.0	22.0	0	0	0	0	4.1	4.1	42.5	42.5
1978/79	-27.4	0	27.4	2.0	2.0	0	0	0	0	8.1	0	47.3	28.0
1979/80	57.2	57.2	0	.1	57.4	.1	.1	0	0	.5	.5	49.3	49.3
1980/81	90.5	90.5	0	76.6	167.2	.4	.4	22.2	22.2	0	0	46.9	46.9
1981/82	11.6	11.6	0	170.8	182.4	1.3	1.3	101.5	101.5	3.3	3.3	52.6	52.6
1982/83	25.8	25.8	0	67.2	92.9	14.5	14.5	18.6	18.6	.1	.1	117.8	117.8
1983/84	-10.4	0	10.4	71.8	71.8	7.4	0	13.4	10.4	2.1	2.1	84.0	84.0
1984/85	-119.9	0	119.9	99.0	99.0	33.7	0	17.3	0	.5	0	151.1	82.7
Cheese:													
1969/70	0	0	0	10	10	0	0	0	0	0	0	17.6	17.6
1970/71	0	0	0	13.0	13.0	0	0	0	0	0	0	26.3	26.3
1971/72	0	0	0	14.0	14.0	0	0	0	0	0	0	34.3	34.3
1972/73	0	0	0	14.0	14.0	0	0	0	0	0	0	6.2	6.2
1973/74	.1	.1	0	16.0	16.1	0	0	0	0	0	0	1.9	1.9
1974/75	5.4	5.4	0	15.0	20.4	0	0	0	0	0	0	48.5	48.5
1975/76	-5.4	0	5.4	16.0	16.0	0	0	0	0	0	0	13.3	7.9
1976/77	41.8	41.8	0	17.0	58.8	0	0	0	0	0	0	35.6	35.6
1977/78	-17.9	0	17.9	20.0	20.0	0	0	0	0	1.9	0	40.8	24.8
1978/79	-22.2	0	22.2	21.0	21.0	0	0	0	0	.4	0	38.5	16.7
1979/80	101.1	101.1	0	6.0	107.1	0	0	0	0	.1	.1	57.8	57.8
1980/81	178.2	178.2	0	6.0	184.2	0	0	0	0	3.0	3.0	63.3	63.3
1981/82	148.1	148.1	0	23.7	171.8	0	0	5.7	5.7	4.6	4.6	114.0	114.0
1982/83	83.9	83.9	0	31.9	115.7	9.5	9.5	5.4	5.4	4.3	4.3	270.7	270.7
1983/84	6.0	6.0	0	32.9	38.9	11.0	11.0	4.9	4.9	16.4	16.4	264.8	264.8
1984/85	-139.5	0	139.5	47.2	47.2	27.5	0	1.7	0	17.5	0	358.6	265.7
Nonfat dry milk:													
1969/70	0	0	0	349.8	349.8	132.6	132.6	21.2	21.2	4.4	4.4	62.4	62.4
1970/71	0	0	0	342.9	342.9	141.4	141.4	31.5	31.5	.2	.2	65.2	65.2
1971/72	0	0	0	290.5	290.5	115.4	115.4	37.1	37.1	0	0	56.4	56.4
1972/73	0	0	0	61.8	61.8	25.7	25.7	19.1	19.1	6.1	6.1	40.6	40.6
1973/74	10.8	10.8	0	12.0	22.8	0	0	0	0	0	0	16.4	16.4
1974/75	209.0	209.0	0	98.3	307.3	44.3	44.3	0	0	0	0	31.9	31.9
1975/76	13.9	13.9	0	95.5	109.4	34.5	34.5	0	0	41.4	41.4	20.4	20.4
1976/77	99.7	99.7	0	131.6	231.3	57.6	57.6	0	0	28.1	28.1	15.5	15.5
1977/78	10.5	10.5	0	211.4	221.9	71.3	71.3	18.1	18.1	15.6	15.6	25.3	25.3
1978/79	-67.7	0	67.7	172.1	172.1	69.1	1.4	14.0	14.0	26.0	26.0	22.2	22.2
1979/80	73.7	73.7	0	231.5	305.2	62.7	62.7	37.8	37.8	32.3	32.3	20.8	20.8
1980/81	89.1	89.1	0	341.8	430.9	103.3	103.3	83.5	83.5	23.5	23.5	17.3	17.3
1981/82	217.2	217.2	0	272.8	490.0	78.6	78.6	50.1	50.1	24.4	24.4	19.0	19.0
1982/83	178.6	178.6	0	482.7	661.3	146.7	146.7	47.0	47.0	18.8	18.8	33.6	33.6
1983/84	-41.8	0	41.8	559.7	559.7	231.3	189.5	30.4	30.4	63.2	63.2	47.7	47.7
1984/85	-99.2	0	99.2	670.9	670.9	274.5	175.3	46.4	46.4	28.9	28.9	64.1	64.1

Source: Calculations based on other tables.

Appendix Table 22.8--Simulated disposition of surplus or coverage of deficit assuming all CCC stocks sold in 1981 (Situation 2)

Product/ year	Surplus(+) or deficit(-)	Addition to exports	Reduction in CCC sales	Total exports	New export level	Foreign dona- tions	New foreign donations	CCC export sales	New export sales	Domestic dollar sales	New domestic sales	Domestic dona- tions	New domestic donations
						1,000 tons							
Butter:													
1969/70	0	0	0	4.4	4.4	0.4	0.4	0	0	0.1	0.1	99.5	99.5
1970/71	0	0	0	50.1	50.1	.7	.7	4.4	4.4	0	0	93.1	93.1
1971/72	0	0	0	83.9	83.9	1.0	1.0	58.8	58.8	1.7	1.7	84.2	84.2
1972/73	0	0	0	9.3	9.3	.9	.9	.4	.4	10.9	10.9	84.7	84.7
1973/74	0	0	0	3.0	3.0	0	0	0	0	.3	.3	47.6	47.6
1974/75	0	0	0	1.0	1.0	0	0	0	0	1.2	1.2	23.1	23.1
1975/76	0	0	0	2.0	2.0	0	0	0	0	10.7	10.7	17.4	17.4
1976/77	0	0	0	2.0	2.0	0	0	0	0	0	0	26.1	26.1
1977/78	0	0	0	2.0	2.0	0	0	0	0	4.1	4.1	42.5	42.5
1978/79	0	0	0	2.0	2.0	0	0	0	0	8.1	8.1	47.3	47.3
1979/80	0	0	0	.1	.1	.1	.1	0	0	.5	.5	49.3	49.3
1980/81	226.8	226.8	0	76.6	303.4	.4	.4	22.2	22.2	0	0	46.9	46.9
1981/82	11.6	11.6	0	170.8	182.4	1.3	1.3	101.5	101.5	3.3	3.3	52.6	52.6
1982/83	25.8	25.8	0	67.2	92.9	14.5	14.5	18.6	18.6	.1	.1	117.8	117.8
1983/84	-10.4	0	10.4	71.8	71.8	7.4	0	13.4	10.4	2.1	2.1	84.0	84.0
1984/85	-119.9	0	119.9	99.0	99.0	33.7	0	17.3	0	.5	0	151.1	82.7
Cheese:													
1969/70	0	0	0	10.0	10.0	0	0	0	0	0	0	17.6	17.6
1970/71	0	0	0	13.0	13.0	0	0	0	0	0	0	26.3	26.3
1971/72	0	0	0	14.0	14.0	0	0	0	0	0	0	34.3	34.3
1972/73	0	0	0	14.0	14.0	0	0	0	0	0	0	6.2	6.2
1973/74	0	0	0	16.0	16.0	0	0	0	0	0	0	1.9	1.9
1974/75	0	0	0	15.0	15.0	0	0	0	0	0	0	48.5	48.5
1975/76	0	0	0	16.0	16.0	0	0	0	0	0	0	13.3	13.3
1976/77	0	0	0	17.0	17.0	0	0	0	0	0	0	35.6	35.6
1977/78	0	0	0	20.0	20.0	0	0	0	0	1.9	1.9	40.8	40.8
1978/79	0	0	0	21.0	21.0	0	0	0	0	.4	.4	38.5	38.5
1979/80	0	0	0	6.0	6.0	0	0	0	0	.1	.1	57.8	57.8
1980/81	281.0	281.0	0	6.0	287.0	0	0	0	0	3.0	3.0	63.3	63.3
1981/82	148.1	148.1	0	23.7	171.8	0	0	5.7	5.7	4.6	4.6	114.0	114.0
1982/83	83.9	83.9	0	31.9	115.7	9.5	9.5	5.4	5.4	4.3	4.3	270.7	270.7
1983/84	6.0	6.0	0	32.9	38.9	11.0	11.0	4.9	4.9	16.4	16.4	264.8	264.8
1984/85	-139.5	0	139.5	47.2	47.2	27.5	0	1.7	0	17.5	0	358.6	265.7
Nonfat dry milk:													
1969/70	0	0	0	349.8	349.8	132.6	132.6	21.2	21.2	4.4	4.4	62.4	62.4
1970/71	0	0	0	342.9	342.9	141.4	141.4	31.5	31.5	.2	.2	65.2	65.2
1971/72	0	0	0	290.5	290.5	115.4	115.4	37.1	37.1	0	0	56.4	56.4
1972/73	0	0	0	61.8	61.8	25.7	25.7	19.1	19.1	6.1	6.1	40.6	40.6
1973/74	0	0	0	12.0	12.0	0	0	0	0	0	0	16.4	16.4
1974/75	35.1	35.1	0	98.3	133.5	44.3	44.3	0	0	0	0	31.9	31.9
1975/76	1.9	1.9	0	95.5	97.4	34.5	34.5	0	0	41.4	41.4	20.4	20.4
1976/77	0	0	0	131.6	131.6	57.6	57.6	0	0	28.1	28.1	15.5	15.5
1977/78	0	0	0	211.4	211.4	71.3	71.3	18.1	18.1	15.6	15.6	25.3	25.3
1978/79	0	0	0	172.1	172.1	69.1	69.1	14.0	14.0	26.0	26.0	22.2	22.2
1979/80	0	0	0	231.5	231.5	62.7	62.7	37.8	37.8	32.3	32.3	20.8	20.8
1980/81	402.0	402.0	0	341.8	743.8	103.3	103.3	83.5	83.5	23.5	23.5	17.3	17.3
1981/82	217.2	217.2	0	272.8	490.0	78.6	78.6	50.1	50.1	24.4	24.4	19.0	19.0
1982/83	178.6	178.6	0	482.7	661.3	146.7	146.7	47.0	47.0	18.8	18.8	33.6	33.6
1983/84	-41.8	0	41.8	559.7	559.7	231.3	189.5	30.4	30.4	63.2	63.2	47.7	47.7
1984/85	-99.2	0	99.2	670.9	670.9	274.5	175.3	46.4	46.4	28.9	28.9	64.1	64.1

Source: Calculations based on other tables.

Appendix table 22.9--Budget cost of surplus disposal, based on actual CCC stock levels and acquisition cost value on inventories

Product/ year	Cost of purchases per unit	Sales revenue: Domestic per unit	Sales revenue: Foreign per unit	Total purchases	Sales quantity: Domestic	Sales quantity: Foreign	Sales revenue: Domestic total	Sales revenue: Foreign total	Total outlay	Total receipts	Storage cost	Other cost	Inventory value adjustment	Net budget cost
	----- Dollars per ton -----			------- 1,000 tons -------			---------- 1,000 dollars ----------							
Butter:														
1969/70	2,381.8	2,563.9	1,019	156.5	0.1	0	192	0	372,658	192	4,974	10,000	134,424	253,016
1970/71	2,350.8	1,650.1	1,088	23.0	0	4.4	3	4,804	53,994	4,807	4,876	10,271	(177,050)	241,383
1971/72	2,230.1	2,028.6	1,604	126.3	1.7	58.8	3,390	94,402	281,610	97,792	4,845	7,699	(43,341)	239,702
1972/73	2,089.4	2,104.5	1,401	65.7	10.9	.4	22,988	538	137,272	23,526	3,326	0,581	(65,369)	193,023
1973/74	1,852.9	1,698.2	1,257	11.6	.3	0	473	0	21,519	473	404	5,162	(67,107)	93,720
1974/75	1,646.6	1,690.7	1,249	42.9	1.2	0	1,962	0	70,670	1,962	592	2,773	30,797	41,276
1975/76	1,651.8	1,879.3	1,150	1.3	10.7	0	20,150	0	2,230	20,150	342	986	(44,253)	27,660
1976/77	2,094.1	1,714.7	1,196	112.4	0	0	0	0	235,410	0	2,274	4,195	180,851	61,028
1977/78	2,047.7	2,389.1	1,287	66.7	4.1	0	9,811	0	136,493	9,811	5,480	4,342	41,024	95,480
1978/79	1,928.6	2,244.5	1,283	28.0	8.1	0	18,152	0	54,081	18,152	4,160	3,764	(52,805)	96,657
1979/80	1,959.3	1,534.9	1,153	107.1	.5	0	694	0	209,899	694	4,778	7,916	112,137	109,762
1980/81	2,002.3	1,111.1	1,225	160.1	0	22.2	50	27,229	320,617	27,280	10,011	10,995	181,302	133,041
1981/82	1,951.0	676.2	1,315	170.3	3.3	101.5	2,239	133,464	332,297	135,703	11,772	10,445	22,538	196,272
1982/83	2,037.9	1,639.0	1,171	176.8	.1	18.6	161	21,819	360,255	21,979	12,759	39,273	52,501	337,806
1983/84	1,937.5	1,904.8	1,044	96.5	2.1	13.4	4,001	13,949	187,005	17,950	11,313	58,422	(20,150)	258,940
1984/85	1,872.6	1,595.3	1,000	82.7	.5	17.3	863	17,260	154,798	18,122	6,335	98,590	(224,553)	466,154
Cheese:														
1969/70	1,811.2	2,340.1	970	27.8	0	0	0	0	50,290	0	502	1,500	18,469	33,822
1970/71	1,880.9	2,245.5	1,036	5.6	0	0	0	0	10,569	0	69	1,918	(38,922)	51,478
1971/72	1,902.9	2,173.9	1,329	33.3	0	0	0	0	63,457	0	81	1,730	(1,886)	67,154
1972/73	1,829.6	2,046.4	1,435	6.2	0	0	0	0	11,308	0	4	368	(53)	11,734
1973/74	2,333.3	1,842.8	1,521	1.9	0	0	0	0	4,430	0	0	14	20	4,424
1974/75	1,906.0	1,689.2	1,402	53.9	0	0	0	0	102,722	0	32	2,410	10,221	94,943
1975/76	2,072.1	2,147.4	1,307	7.9	0	0	80	0	16,430	80	131	711	(11,268)	28,461
1976/77	2,107.9	2,487.2	1,262	77.4	0	0	43	0	163,107	43	671	3,324	88,016	79,043
1977/78	2,117.4	2,302.2	1,377	24.8	1.9	0	4,481	0	52,522	4,481	1,254	9,631	(37,969)	96,895
1978/79	2,079.2	1,941.5	1,355	16.7	.4	0	848	0	34,791	848	286	2,693	(46,130)	83,052
1979/80	2,136.9	2,270.6	1,374	159.1	.1	0	290	0	339,918	290	1,466	7,132	216,106	132,12
1980/81	2,059.1	2,139.6	1,383	244.4	3.0	0	6,405	0	503,324	6,405	8,321	21,983	366,878	160,344
1981/82	1,956.7	1,358.5	1,332	272.3	4.6	5.7	6,224	7,581	532,894	13,804	16,218	26,112	289,717	271,702
1982/83	1,973.3	1,627.3	1,263	373.7	4.3	5.4	6,819	6,821	737,337	13,740	23,332	47,355	165,530	628,754
1983/84	1,881.7	1,792.8	1,141	303.1	16.4	4.9	29,352	5,635	570,301	34,987	24,167	64,275	11,366	612,391
1984/85	1,825.5	1,601.6	1,000	265.7	17.5	1.7	28,008	1,662	485,062	29,669	19,070	53,530	(254,708)	782,700
Nonfat dry milk:														
1969/70	843.2	548.8	530	203.2	4.4	21.2	2,421	11,240	171,346	13,661	4,938	5,000	(14,668)	182,292
1970/71	1,006.7	579.5	635	35.6	.2	31.5	88	19,982	35,799	20,070	720	7,639	(203,981)	228,069
1971/72	1,100.6	1,150.2	797	199.0	0	37.1	13	29,578	219,004	29,591	743	6,023	(10,975)	207,156
1972/73	1,065.0	1,052.9	843	66.1	6.1	19.1	6,392	16,084	70,396	22,476	333	3,572	(26,938)	78,763
1973/74	1,698.5	614.3	907	27.0	0	0	0	0	45,796	0	45	1,362	17,887	29,317
1974/75	1,447.9	1,423.0	1,081	285.2	0	0	53	0	412,938	53	2,723	5,422	251,717	169,313
1975/76	1,404.3	1,381.2	740	110.2	41.4	0	57,216	0	154,716	57,216	6,140	3,230	16,785	90,084
1976/77	1,376.9	1,254.6	598	201.0	28.1	0	35,309	0	276,766	35,309	4,743	10,971	137,287	119,884
1977/78	1,357.4	579.3	583	140.9	15.6	18.1	9,046	10,575	191,200	19,621	5,960	9,278	14,261	172,556
1978/79	1,267.2	510.5	564	63.6	26.0	14.0	13,270	7,909	80,554	21,179	4,199	20,956	(85,771)	170,300
1979/80	1,236.1	746.5	606	227.3	32.3	37.8	24,083	22,914	280,934	46,998	3,925	20,985	91,115	167,731
1980/81	1,282.7	738.3	729	316.7	23.5	83.5	17,314	60,898	406,196	78,212	5,730	16,487	114,246	235,955
1981/82	1,278.2	418.6	707	389.4	24.4	50.1	10,196	35,436	497,736	45,632	8,454	16,933	277,666	199,825
1982/83	1,274.7	691.9	616	424.7	18.8	47.0	13,027	28,982	541,369	42,008	12,090	20,838	227,643	304,645
1983/84	1,215.7	588.2	515	330.7	63.2	30.4	37,146	15,650	402,047	52,797	10,788	23,998	(50,858)	434,894
1984/85	1,160.9	524.5	600	314.7	28.9	46.4	15,134	27,868	365,360	43,002	9,391	23,003	(115,141)	469,893

Note: Values in parentheses indicate reductions in inventory values.

Source: Calculations based on other tables.

Appendix table 22.10--Inventory valuations and total budget cost of CCC stocks under various methods

Product/ year	CCC opening stock	CCC closing stock	Changes in inventory value when valued at-- Acquisition average cost	World low price	Region price	Price floor	Donation basis	Budget cost including inventories valued at-- Acquisition average cost	World low price	Region price	Price floor	Donation basis
	--- 1,000 tons ---		---------- 1,000 dollars ----------									
Butter:												
1969/70	113.9	170.3	134,424	57,495	41,999	40,293	0	253,016	329,945	345,441	347,147	387,440
1970/71	170.3	95.0	-177,050	-81,967	-87,041	-83,506	0	241,383	146,300	151,374	147,839	64,333
1971/72	95.0	75.6	-43,341	-31,179	-25,349	-24,320	0	239,702	227,541	221,710	22,081	196,361
1972/73	75.6	44.3	-65,369	-43,834	-21,810	-20,925	0	193,023	171,487	149,464	148,578	127,654
1973/74	44.3	8.1	-67,107	-45,517	-40,578	-38,930	0	93,720	72,129	67,190	65,543	26,613
1974/75	8.1	26.8	30,797	23,358	21,021	20,167	0	41,276	48,715	51,053	51,906	72,073
1975/76	26.8	0	-44,253	-30,813	-29,757	-28,549	0	27,660	14,220	13,165	11,956	(16,592)
1976/77	0	86.4	180,851	103,288	77,552	74,403	0	61,028	138,591	164,327	167,476	241,879
1977/78	86.4	106.4	41,024	25,783	22,174	21,273	0	95,480	110,721	114,330	115,231	136,504
1978/79	106.4	79.0	-52,805	-35,127	-27,562	-29,711	0	96,657	78,980	71,415	73,563	43,852
1979/80	79.0	136.2	112,137	65,985	69,899	67,332	0	109,762	155,914	152,001	154,568	221,900
1980/81	136.2	226.8	181,302	110,891	130,812	120,731	0	133,041	203,452	183,531	193,612	314,343
1981/82	226.8	238.3	22,538	15,193	14,525	14,866	0	196,272	203,572	204,285	203,898	218,811
1982/83	238.3	264.1	52,501	30,165	29,350	25,856	0	337,806	359,347	360,957	363,656	390,307
1983/84	264.1	253.7	-20,150	-10,855	-8,543	-7,585	0	258,940	249,484	247,333	246,213	238,790
1984/85	253.7	133.8	-224,553	-119,917	-83,942	-65,870	0	466,154	361,483	325,542	307,436	241,601
Cheese:												
1969/70	11.6	21.8	18,469	9,895	9,497	7,912	0	33,822	42,396	42,794	44,380	52,291
1970/71	21.8	1.1	-38,922	-21,437	-17,378	-14,477	0	51,478	33,992	29,934	27,033	12,556
1971/72	1.1	.1	-1,886	-1,317	-931	-775	0	67,154	66,586	66,199	66,044	65,269
1972/73	.1	.1	-53	-42	-29	-24	0	11,734	11,723	11,709	11,705	11,681
1973/74	.1	.1	20	13	8	7	0	4,424	4,431	4,436	4,437	4,444
1974/75	.1	5.5	10,221	7,518	8,883	7,400	0	94,943	97,645	96,280	97,763	105,163
1975/76	5.5	.0	-11,268	-7,106	-7,952	-6,624	0	28,461	24,379	25,144	23,897	17,193
1976/77	0	41.8	88,016	52,695	60,504	50,402	0	79,043	114,314	106,556	116,608	167,059
1977/78	41.8	23.9	-37,969	-24,692	-27,006	-22,497	0	96,895	88,060	85,933	85,865	58,927
1978/79	23.9	1.7	-46,130	-30,057	-30,334	-21,297	0	83,052	64,048	67,257	55,289	36,922
1979/80	1.7	102.8	216,106	138,980	126,636	105,964	0	132,120	208,544	221,589	241,560	348,225
1980/81	102.8	281.0	366,878	246,359	178,770	190,055	0	160,344	286,995	348,452	343,299	527,222
1981/82	281.0	429.0	289,717	197,229	159,400	158,006	0	271,702	373,928	402,019	413,150	561,419
1982/83	429.0	512.9	165,530	105,979	89,294	66,333	0	628,754	687,400	704,990	727,047	794,284
1983/84	512.9	519.0	11,366	6,889	5,455	3,612	0	612,391	637,564	618,301	640,841	623,757
1984/85	519.0	379.4	-254,708	-139,526	-118,597	-88,432	0	782,700	665,800	646,590	614,706	527,993
Nonfat dry milk:												
1969/70	255.6	238.2	-14,668	-9,227	-8,657	-6,937	0	182,292	190,512	176,281	188,221	167,624
1970/71	238.2	35.6	-203,981	-128,615	-131,042	-105,001	0	228,069	152,558	155,130	128,944	24,088
1971/72	35.6	25.6	-10,975	-7,949	-7,660	-6,138	0	207,156	206,469	203,840	204,658	196,180
1972/73	25.6	.3	-26,938	-21,325	-21,256	-17,032	0	78,763	62,962	73,081	58,669	51,825
1973/74	.3	10.8	17,887	9,548	9,949	7,972	0	29,317	-1,225	37,255	351	47,204
1974/75	10.8	184.7	251,717	187,947	179,137	143,539	0	169,313	202,486	241,893	246,894	421,030
1975/76	184.7	196.7	16,785	8,847	9,980	7,997	0	90,084	155,239	96,890	156,089	106,870
1976/77	196.7	296.4	137,287	59,627	72,190	57,845	0	119,884	231,481	184,981	233,263	257,171
1977/78	296.4	306.9	14,261	6,126	7,589	6,081	0	172,556	175,309	179,228	175,354	186,817
1978/79	306.9	239.2	-85,771	-38,195	-49,438	-37,856	0	170,300	127,915	133,968	127,576	84,529
1979/80	239.2	312.9	91,115	44,660	53,548	54,199	0	167,731	236,474	205,298	226,935	258,846
1980/81	312.9	402.0	114,246	64,959	76,240	60,861	0	235,955	331,651	273,961	335,748	350,201
1981/82	402.0	619.2	277,666	153,549	171,140	122,730	0	199,825	327,272	306,351	358,090	477,491
1982/83	619.2	797.8	227,643	110,045	101,572	77,673	0	304,645	393,521	430,717	425,893	532,288
1983/84	797.8	755.9	-50,858	-21,528	-20,186	-15,133	0	434,894	416,324	404,222	409,929	384,036
1984/85	755.9	656.8	-115,141	-59,510	-42,153	-33,527	0	469,893	414,895	396,905	388,912	354,752

Note: Values in parenthesis indicate reductions in inventory value.
Source: Calculations based on other tables.

Appendix table 22.11--Comparison of total budget cost calculations under alternative CCC stock inventory valuations and world prices by commodity

Product/ year	Acquisition price for inventories			World price for inventories			Donation basis for inventories		
	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis
				1,000 1977 dollars					
Butter:									
1969/70	253,016	253,016	253,016	345,441	345,441	345,441	387,440	387,440	387,440
1970/71	241,383	241,085	246,187	151,374	151,077	156,178	64,333	64,036	69,137
1971/72	239,702	257,354	334,104	221,710	239,363	316,112	196,361	214,013	290,763
1972/73	193,023	193,293	193,561	149,464	149,734	150,002	127,654	127,924	128,192
1973/74	93,720	93,720	93,720	67,190	67,190	67,190	26,613	26,613	26,613
1974/75	41,276	41,276	41,276	51,053	51,053	51,053	72,073	72,073	72,073
1975/76	27,660	27,660	27,660	13,165	13,165	13,165	(16,592)	(16,592)	(16,592)
1976/77	61,028	61,028	61,028	164,327	164,327	164,327	241,879	241,879	241,879
1977/78	95,480	95,480	95,480	114,330	114,330	114,330	136,504	136,504	136,504
1978/79	96,657	96,657	96,657	71,415	71,415	71,415	43,852	43,852	43,852
1979/80	109,762	109,762	109,762	152,001	152,001	152,001	221,900	221,900	221,900
1980/81	133,041	128,150	160,270	183,531	178,640	210,761	314,343	309,451	341,572
1981/82	196,272	202,133	329,736	204,285	210,146	337,749	218,811	224,672	352,275
1982/83	337,806	338,396	359,625	360,957	361,546	382,776	390,307	390,896	412,126
1983/84	258,940	261,910	272,889	247,333	250,304	261,282	238,790	241,760	252,739
1984/85	466,154	471,332	483,414	325,542	330,720	342,802	241,601	246,779	258,860
Average	177,808	179,516	197,399	176,445	178,153	196,037	181,617	183,325	201,208
Cheese:									
1969/70	33,822	33,822	33,822	42,794	42,794	42,794	52,291	52,291	52,291
1970/71	51,478	51,478	51,478	29,934	29,934	29,934	12,556	12,556	12,556
1971/72	67,154	67,154	67,154	66,199	66,199	66,199	65,269	65,269	65,269
1972/73	11,734	11,734	11,734	11,709	11,709	11,709	11,681	11,681	11,681
1973/74	4,424	4,424	4,424	4,436	4,436	4,436	4,444	4,444	4,444
1974/75	94,943	94,943	94,943	96,280	96,280	96,280	105,163	105,163	105,163
1975/76	28,461	28,461	28,461	25,144	25,144	25,144	17,193	17,193	17,193
1976/77	79,043	79,043	79,043	106,556	106,556	106,556	167,059	167,059	167,059
1977/78	96,895	96,895	96,895	85,933	85,933	85,933	58,927	58,927	58,927
1978/79	83,052	83,052	83,052	67,257	67,257	67,257	36,922	36,922	36,922
1979/80	132,120	132,120	132,120	221,589	221,589	221,589	348,225	348,225	348,225
1980/81	160,344	160,344	160,344	348,452	348,452	348,452	527,222	527,222	527,222
1981/82	271,702	273,156	279,283	402,019	403,473	409,600	561,419	562,873	569,000
1982/83	628,754	629,828	635,575	704,990	706,064	711,811	794,284	795,358	801,105
1983/84	612,391	613,564	618,026	618,301	619,474	623,936	623,757	624,930	629,391
1984/85	782,700	782,950	784,362	646,590	646,839	648,251	527,993	528,242	529,654
Average	196,189	196,436	197,545	217,386	217,633	218,743	244,650	244,897	246,006
Nonfat dry milk:									
1969/70	182,292	182,986	193,531	176,281	176,975	187,520	167,624	168,318	178,863
1970/71	228,069	227,692	248,051	155,130	154,753	175,112	24,088	23,711	44,070
1971/72	207,156	208,231	236,733	203,840	204,916	233,418	196,180	197,256	225,758
1972/73	78,763	78,815	94,847	73,081	73,133	89,165	51,825	51,877	67,909
1973/74	29,317	29,317	29,317	37,255	37,255	37,255	47,204	47,204	47,204
1974/75	169,313	169,313	169,313	241,893	241,893	241,893	421,030	421,030	421,030
1975/76	90,084	90,084	90,084	96,890	96,890	96,890	106,870	106,870	106,870
1976/77	119,884	119,884	119,884	184,981	184,981	184,981	257,171	257,171	257,171
1977/78	172,556	170,030	183,131	179,228	176,702	189,802	186,817	184,291	197,392
1978/79	170,300	167,972	178,209	133,968	131,639	141,876	84,529	82,201	92,438
1979/80	167,731	163,170	190,645	205,298	200,737	228,212	258,846	254,286	281,761
1980/81	235,955	225,379	296,853	273,961	263,385	334,859	350,201	339,625	411,099
1981/82	199,825	195,765	235,261	306,351	302,291	341,787	477,491	473,431	512,927
1982/83	304,645	306,876	333,626	430,717	432,948	459,698	532,288	534,520	561,270
1983/84	434,894	435,870	450,545	404,222	405,198	419,872	384,036	385,012	399,687
1984/85	469,893	478,021	497,761	396,905	405,033	424,772	354,752	362,880	382,620
Average	203,792	203,088	221,737	218,750	218,046	236,695	243,810	243,105	261,754

Note: Values in parenthesis indicate a net return rather than a net cost.
Source: Calculations based on other tables.

Appendix table 22.12--Comparison of budget cost under alternative CCC inventory valuations and world prices, assuming stock policies ended in 1974

Product/ year	Acquisition price for inventories			World price for inventories			Donation basis for inventories		
	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis
					1,000 1977 dollars				
Butter:									
1969/70	253,016	253,016	253,016	345,441	345,441	345,441	387,440	387,440	387,440
1970/71	241,383	241,085	246,187	151,374	151,077	156,178	64,333	64,036	69,137
1971/72	239,702	257,354	334,104	221,710	239,363	316,112	196,361	214,013	290,763
1972/73	193,023	193,293	193,561	149,464	149,734	150,002	127,654	127,924	128,192
1973/74	108,640	108,640	108,640	76,188	76,188	76,188	26,550	26,550	26,550
1974/75	71,481	71,481	71,481	71,481	71,481	71,481	71,481	71,481	71,481
1975/76	3,216	3,216	3,216	3,216	3,216	3,216	3,216	3,216	3,216
1976/77	239,584	239,584	239,584	239,584	239,584	239,584	239,584	239,584	239,584
1977/78	131,023	131,023	131,023	131,023	131,023	131,023	131,023	131,023	131,023
1978/79	57,844	57,844	57,844	57,844	57,844	57,844	57,844	57,844	57,844
1979/80	217,121	217,121	217,121	217,121	217,121	217,121	217,121	217,121	217,121
1980/81	304,332	299,440	331,561	304,332	299,440	331,561	304,332	299,440	331,561
1981/82	207,039	212,900	340,503	207,039	212,900	340,503	207,039	212,900	340,503
1982/83	377,549	378,138	399,367	377,549	378,138	399,367	377,549	378,138	399,367
1983/84	230,588	232,896	241,426	230,588	232,896	241,426	230,588	232,896	241,426
1984/85	253,388	253,388	253,388	253,388	253,388	253,388	253,388	253,388	253,388
Average	195,558	196,901	213,876	189,834	191,177	208,152	180,969	182,312	199,287
Cheese:									
1969/70	33,822	33,822	33,822	42,794	42,794	42,794	52,291	52,291	52,291
1970/71	51,478	51,478	51,478	29,934	29,934	29,934	12,556	12,556	12,556
1971/72	67,154	67,154	67,154	66,199	66,199	66,199	65,269	65,269	65,269
1972/73	11,734	11,734	11,734	11,709	11,709	11,709	11,681	11,681	11,681
1973/74	4,696	4,696	4,696	4,548	4,548	4,548	4,444	4,444	4,444
1974/75	105,132	105,132	105,132	105,132	105,132	105,132	105,132	105,132	105,132
1975/76	17,142	17,142	17,142	17,142	17,142	17,142	17,142	17,142	17,142
1976/77	166,387	166,387	166,387	166,387	166,387	166,387	166,387	166,387	166,387
1977/78	62,153	62,153	62,153	62,153	62,153	62,153	62,153	62,153	62,153
1978/79	37,484	37,484	37,484	37,484	37,484	37,484	37,484	37,484	37,484
1979/80	346,759	346,759	346,759	346,759	346,759	346,759	346,759	346,759	346,759
1980/81	518,901	518,901	518,901	518,901	518,901	518,901	518,901	518,901	518,901
1981/82	545,201	546,655	552,782	545,201	546,655	552,782	545,201	546,655	552,782
1982/83	770,952	772,026	777,773	770,952	772,026	777,773	770,952	772,026	777,773
1983/84	599,590	600,763	605,224	599,590	600,763	605,224	599,590	600,763	605,224
1984/85	538,592	538,592	538,592	538,592	538,592	538,592	538,592	538,592	538,592
Average	242,324	242,555	243,576	241,467	241,699	242,720	240,908	241,140	242,161
Nonfat dry milk:									
1969/70	182,292	182,986	193,531	176,281	176,975	187,520	167,624	168,318	178,863
1970/71	228,069	227,692	248,051	155,130	154,753	175,112	24,088	23,711	44,070
1971/72	207,156	208,231	236,733	203,840	204,916	233,418	196,180	197,256	225,758
1972/73	78,763	78,815	94,847	73,081	73,133	89,165	51,825	51,877	67,909
1973/74	47,700	47,700	47,700	47,460	47,460	47,460	47,160	47,160	47,160
1974/75	418,307	418,307	418,307	418,307	418,307	418,307	418,307	418,307	418,307
1975/76	100,730	100,730	100,730	100,730	100,730	100,730	100,730	100,730	100,730
1976/77	252,428	252,428	252,428	252,428	252,428	252,428	252,428	252,428	252,428
1977/78	180,857	178,331	191,431	180,857	178,331	191,431	180,857	178,331	191,431
1978/79	80,331	78,002	88,239	80,331	78,002	88,239	80,331	78,002	88,239
1979/80	254,921	250,361	277,836	254,921	250,361	277,836	254,921	250,361	277,836
1980/81	344,471	333,895	405,369	344,471	333,895	405,369	344,471	333,895	405,369
1981/82	469,037	464,977	504,473	469,037	464,977	504,473	469,037	464,977	504,473
1982/83	520,198	522,430	549,180	520,198	522,430	549,180	520,198	522,430	549,180
1983/84	373,248	374,224	388,899	373,248	374,224	388,899	373,248	374,224	388,899
1984/85	345,361	353,489	373,229	345,361	353,489	373,229	345,361	353,489	373,229
Average	255,242	254,537	273,187	249,730	249,026	267,675	239,173	238,469	257,118

Source: Calculations based on other tables.

Appendix table 22.13--Comparison of budget cost under alternative CCC stock inventory valuations and world prices, assuming stock policies ended in 1981

Product/ year	Acquisition price for inventories			World price for inventories			Donation basis for inventories		
	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis
				1,000 1977 dollars					
Butter:									
1969/70	253,016	253,016	253,016	345,441	345,441	345,441	387,440	387,440	387,440
1970/71	241,383	241,085	246,187	151,374	151,077	156,178	64,333	64,036	69,137
1971/72	239,702	257,354	334,104	221,710	239,363	316,112	196,361	214,013	290,763
1972/73	193,023	193,293	193,561	149,464	149,734	150,002	127,654	127,924	128,192
1973/74	93,720	93,720	93,720	67,190	67,190	67,190	26,613	26,613	26,613
1974/75	41,276	41,276	41,276	51,053	51,053	51,053	72,073	72,073	72,073
1975/76	27,660	27,660	27,660	13,165	13,165	13,165	(16,592)	(16,592)	(16,592)
1976/77	61,028	61,028	61,028	164,327	164,327	164,327	241,879	241,879	241,879
1977/78	95,480	95,480	95,480	114,330	114,330	114,330	136,504	136,504	136,504
1978/79	96,657	96,657	96,657	71,415	71,415	71,415	43,852	43,852	43,852
1979/80	109,762	109,762	109,762	152,001	152,001	152,001	221,900	221,900	221,900
1980/81	580,895	576,003	608,124	504,922	500,030	532,151	308,089	303,197	335,318
1981/82	207,039	212,900	340,503	207,039	212,900	340,503	207,039	212,900	340,503
1982/83	377,549	378,138	399,367	377,549	378,138	399,367	377,549	378,138	399,367
1983/84	230,588	232,896	241,426	230,588	232,896	241,426	230,588	232,896	241,426
1984/85	253,388	253,388	253,388	253,388	253,388	253,388	253,388	253,388	253,388
Average	193,885	195,229	212,204	192,185	193,528	210,503	179,917	181,260	198,235
Cheese:									
1969/70	33,822	33,822	33,822	42,794	42,794	42,794	52,291	52,291	52,291
1970/71	51,478	51,478	51,478	29,934	29,934	29,934	12,556	12,556	12,556
1971/72	67,154	67,154	67,154	66,199	66,199	66,199	65,269	65,269	65,269
1972/73	11,734	11,734	11,734	11,709	11,709	11,709	11,681	11,681	11,681
1973/74	4,424	4,424	4,424	4,436	4,436	4,436	4,444	4,444	4,444
1974/75	94,943	94,943	94,943	96,280	96,280	96,280	105,163	105,163	105,163
1975/76	28,461	28,461	28,461	25,144	25,144	25,144	17,193	17,193	17,193
1976/77	79,043	79,043	79,043	106,556	106,556	106,556	167,059	167,059	167,059
1977/78	96,895	96,895	96,895	85,933	85,933	85,933	58,927	58,927	58,927
1978/79	83,052	83,052	83,052	67,257	67,257	67,257	36,922	36,922	36,922
1979/80	132,120	132,120	132,120	221,589	221,589	221,589	348,225	348,225	348,225
1980/81	732,820	732,820	732,820	624,281	624,281	624,281	521,130	521,130	521,130
1981/82	545,201	546,655	552,782	545,201	546,655	552,782	545,201	546,655	552,782
1982/83	770,952	772,026	777,773	770,952	772,026	777,773	770,952	772,026	777,773
1983/84	599,590	600,763	605,224	599,590	600,763	605,224	599,590	600,763	605,224
1984/85	538,592	538,592	538,592	538,592	538,592	538,592	538,592	538,592	538,592
Average	241,893	242,124	243,145	239,778	240,009	241,030	240,950	241,181	242,202
Nonfat dry milk:									
1969/70	182,292	182,986	193,531	176,281	176,975	187,520	167,624	168,318	178,863
1970/71	228,069	227,692	248,051	155,130	154,753	175,112	24,088	23,711	44,070
1971/72	207,156	208,231	236,733	203,840	204,916	233,418	196,180	197,256	225,758
1972/73	78,763	78,815	94,847	73,081	73,133	89,165	51,825	51,877	67,909
1973/74	29,317	29,317	29,317	37,255	37,255	37,255	47,204	47,204	47,204
1974/75	169,313	169,313	169,313	241,893	241,893	241,893	421,030	421,030	421,030
1975/76	90,084	90,084	90,084	96,890	96,890	96,890	106,870	106,870	106,870
1976/77	119,884	119,884	119,884	184,981	184,981	184,981	257,171	257,171	257,171
1977/78	172,556	170,030	183,131	179,228	176,702	189,802	186,817	184,291	197,392
1978/79	170,300	167,972	178,209	133,968	131,639	141,876	84,529	82,201	92,438
1979/80	167,731	163,170	190,645	205,298	200,737	228,212	258,846	254,286	281,761
1980/81	748,330	737,754	809,228	614,814	604,238	675,712	346,979	336,403	407,877
1981/82	469,037	464,977	504,473	469,037	464,977	504,473	469,037	464,977	504,473
1982/83	520,198	522,430	549,180	520,198	522,430	549,180	520,198	522,430	549,180
1983/84	373,248	374,224	388,899	373,248	374,224	388,899	373,248	374,224	388,899
1984/85	345,361	353,489	373,229	345,361	353,489	373,229	345,361	353,489	373,229
Average	254,478	253,773	272,422	250,656	249,952	268,601	241,063	240,359	259,008

Note: Values in parentheses indicate a net return rather than a net cost.
Source: Calculations based on other tables.

Appendix table 22.14--Comparison of total budget cost calculations under alternative CCC stock inventory valuations and world prices, 1970-85

Stocks/year	Acquisition price for inventories			World price for inventories			Donation basis for inventories		
	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis	Non-European export price	Low region price	Donation basis
				1,000 1977 dollars					
Actual CCC stock levels:									
1969/70	469,130	469,824	480,370	564,516	565,211	575,756	607,355	608,050	618,595
1970/71	520,930	520,256	545,716	336,438	335,764	361,225	100,977	100,303	125,763
1971/72	514,012	532,740	637,992	491,750	510,478	615,730	457,810	476,538	581,790
1972/73	283,520	283,843	300,142	234,255	234,577	250,877	191,160	191,482	207,782
1973/74	127,461	127,461	127,461	108,881	108,881	108,881	78,260	78,260	78,260
1974/75	305,532	305,532	305,532	389,226	389,226	389,226	598,266	598,266	598,266
1975/76	146,206	146,206	146,206	135,199	135,199	135,199	107,470	107,470	107,470
1976/77	259,956	259,956	259,956	455,864	455,864	455,864	666,109	666,109	666,109
1977/78	364,932	362,406	375,506	379,491	376,965	390,065	382,247	379,722	392,822
1978/79	350,009	347,681	357,918	272,639	270,311	280,548	165,304	162,976	173,213
1979/80	409,613	405,052	432,527	578,888	574,327	601,802	828,971	824,411	851,886
1980/81	529,341	513,873	617,468	805,944	790,476	894,071	1,191,766	1,176,299	1,279,894
1981/82	667,799	671,055	844,281	912,655	915,910	1,089,136	1,257,721	1,260,976	1,434,202
1982/83	1,271,206	1,275,100	1,328,827	1,496,664	1,500,559	1,554,285	1,716,880	1,720,775	1,774,501
1983/84	1,306,225	1,311,345	1,341,459	1,269,856	1,274,976	1,305,091	1,246,582	1,251,702	1,281,816
1984/85	1,718,747	1,732,302	1,765,536	1,369,037	1,382,592	1,415,826	1,124,345	1,137,900	1,171,134
Average	577,789	579,039	616,681	612,581	613,832	651,474	670,077	671,327	708,969
CCC stocks sold in 1974:									
1969/70	469,130	469,824	480,370	564,516	565,211	575,756	607,355	608,050	618,595
1970/71	520,930	520,256	545,716	336,438	335,764	361,225	100,977	100,303	125,763
1971/72	514,012	532,740	637,992	491,750	510,478	615,730	457,810	476,538	581,790
1972/73	283,520	283,843	300,142	234,255	234,577	250,877	191,160	191,482	207,782
1973/74	161,036	161,036	161,036	128,195	128,195	128,195	78,153	78,153	78,153
1974/75	594,920	594,920	594,920	594,920	594,920	594,920	594,920	594,920	594,920
1975/76	121,088	121,088	121,088	121,088	121,088	121,088	121,088	121,088	121,088
1976/77	658,399	658,399	658,399	658,399	658,399	658,399	658,399	658,399	658,399
1977/78	374,033	371,508	384,608	374,033	371,508	384,608	374,033	371,508	384,608
1978/79	175,659	173,331	183,568	175,659	173,331	183,568	175,659	173,331	183,568
1979/80	818,801	814,241	841,716	818,801	814,241	841,716	818,801	814,241	841,716
1980/81	1,167,704	1,152,236	1,255,831	1,167,704	1,152,236	1,255,831	1,167,704	1,152,236	1,255,831
1981/82	1,221,277	1,224,533	1,397,759	1,221,277	1,224,533	1,397,759	1,221,277	1,224,533	1,397,759
1982/83	1,668,699	1,672,594	1,726,320	1,668,699	1,672,594	1,726,320	1,668,699	1,672,594	1,726,320
1983/84	1,203,426	1,207,884	1,235,549	1,203,426	1,207,884	1,235,549	1,203,426	1,207,884	1,235,549
1984/85	1,137,341	1,145,469	1,165,209	1,137,341	1,145,469	1,165,209	1,137,341	1,145,469	1,165,209
Average	693,123	693,994	730,639	681,031	681,902	718,547	661,050	661,920	698,566
CCC stocks sold in 1981:									
1969/70	469,130	469,824	480,370	564,516	565,211	575,756	607,355	608,050	618,595
1970/71	520,930	520,256	545,716	336,438	335,764	361,225	100,977	100,303	125,763
1971/72	514,012	532,740	637,992	491,750	510,478	615,730	457,810	476,538	581,790
1972/73	283,520	283,843	300,142	234,255	234,577	250,877	191,160	191,482	207,782
1973/74	127,461	127,461	127,461	108,881	108,881	108,881	78,260	78,260	78,260
1974/75	305,532	305,532	305,532	389,226	389,226	389,226	598,266	598,266	598,266
1975/76	146,206	146,206	146,206	135,199	135,199	135,199	107,470	107,470	107,470
1976/77	259,956	259,956	259,956	455,864	455,864	455,864	666,109	666,109	666,109
1977/78	364,932	362,406	375,506	379,491	376,965	390,065	382,247	379,722	392,822
1978/79	350,009	347,681	357,918	272,639	270,311	280,548	165,304	162,976	173,213
1979/80	409,613	405,052	432,527	578,888	574,327	601,802	828,971	824,411	851,886
1980/81	2,062,045	2,046,577	2,150,172	1,744,017	1,728,549	1,832,144	1,176,158	1,160,730	1,264,325
1981/82	1,221,277	1,224,533	1,397,759	1,221,277	1,224,533	1,397,759	1,221,277	1,224,533	1,397,759
1982/83	1,668,699	1,672,594	1,726,320	1,668,699	1,672,594	1,726,320	1,668,699	1,672,594	1,726,320
1983/84	1,203,426	1,207,884	1,235,549	1,203,426	1,207,884	1,235,549	1,203,426	1,207,884	1,235,549
1984/85	1,137,341	1,145,469	1,165,209	1,137,341	1,145,469	1,165,209	1,137,341	1,145,469	1,165,209
Average	690,256	691,126	727,771	682,619	683,489	720,135	661,930	662,800	699,445

Source: Calculations based on other tables.

CHAPTER 23

FEASIBILITY OF SURPLUS DISPOSAL AND EXPORT SUBSIDY

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CHAPTER 23

FEASIBILITY OF SURPLUS DISPOSAL AND EXPORT SUBSIDY*

Our study mandate stated that U.S. farm producers experienced losses as a result of embargoes and "the failure to offer for sale on world markets commodities surplus to domestic needs at competitive prices." Thus, Part III investigates what might have happened if the United States had pursued a policy of surplus stocks disposal in foreign markets.

ADEQUACY OF CURRENT LAW GOVERNING EXPORT MARKET DISPOSAL

The hypothesis was that the United States had not been sufficiently aggressive in disposing of surplus stocks over the last decade. For this reason, Chapter 17 reviewed U.S. programs, regulations, and rules associated with agricultural exports. There were two purposes. One was to ascertain whether U.S. officials could have been more aggressive within existing law; the other to summarize how widely Government programs were used to further exports.

We concluded that existing law provided legislative authorities which officials could have used to dispose of a greater volume of surplus agricultural commodity stocks, particularly those owned by the Commodity Credit Corporation (CCC). Between 1982 and 1984, a longstanding authority allowing the CCC to price inventories competitively in foreign markets was removed, but the authority was not being used when removed and was not used when reinstated. Other alternatives were available which would have permitted more aggressive Government aid to exports during this brief period. They were direct credit, loan guarantees, donations, export subsidies, and payment-in-kind (PIK) enhancements.

PERSPECTIVES FROM THEORY

Chapter 18 developed the theoretical framework used to analyze surplus stock disposal. That chapter began with the simplest form of export subsidy, a uniform, global subsidy, and introduced complications such as subsidies targeted to individual buyers, retaliation by competitors, and introduction of domestic U.S. commodity programs. We then analyzed income transfer and demand expansion programs.

Several important conclusions emerged from the theoretical frameworks. The traditional model of an export subsidy showed that if competitors do not retaliate, an export subsidy expands exports by lowering border prices. To meet additional demand for exports, domestic prices in the subsidizing country must rise. The size of these shifts depends critically on the elasticity of the import demand function confronted by the country in world markets. The more elastic the import demand function, the greater the expansion in exports and the more the internal price rises. If the import demand is elastic, then export revenues rise. A subsidy in the presence of an inelastic import demand lowers export revenue.

We also concluded that a global, uniform subsidy's effects on prices change the sector's income distribution. Higher prices benefit producers, but also increase consumer expenditures. Taxpayers pay for the subsidy, part of which is a transfer to domestic producers and part of which is an income transfer to foreign consumers. The subsidizing country as a whole loses welfare due to the subsidy.

We analyzed targeted export subsidies because many CCC export programs are buyer specific. These subsidies should be given to nations with relatively elastic demands. Such subsidies can also be used to defend or capture market share from competitors. Finally, in contrast to the global subsidy, targeted subsidies can be used to increase social welfare of the subsidizing country.

In the models which analyze income transfer programs, such as P.L. 480, two parameters

*The contributor to this chapter was Milton H. Ericksen.

are critical. The first is the income effect which consists of the income elasticity and the budget share. If these are small, as appears to be the case for grains, then transfer programs have limited effects. The second critical parameter measures additionality. Most CCC income transfer programs include the restriction that shipments are to be fully additional to commercial sales. This restriction is costly to receiving nations and they have the incentive to avoid the restriction. Hence, most aid shipments are not fully additional.

We examined effects of U.S. domestic commodity programs in an open economy framework. These policies are critical to the surplus disposal issue. Loan rates and land retirement programs have implicit export tax effects. Target prices have implicit export subsidy effects. Loan rates encourage the accumulation of surpluses which overhang the market, but at the same time, contribute to market price stability.

Chapter 18 integrates the models containing U.S. domestic commodity programs with the export subsidy analysis to form the conceptual framework upon which our empirical models of surplus stock disposal are based. This framework showed that an export subsidy can be effective at avoiding stock increases, but that foreign consumers benefit at the expense of U.S. taxpayers.

The final set of frameworks discussed in Chapter 18 concerns retaliation by competitors and buyers. We show that retaliation can undo many of the gains of the subsidy program, or raise costs of export subsidies.

IMPLICATIONS FROM THE ANALYSES

Our purpose here is not to repeat results of earlier chapters dealing with analyses. Rather, we have used the information and results from those chapters to examine repercussions of a shift in U.S. policy from reliance on stockholding to reliance on surplus stocks disposal as a way to maintain domestic commodity prices and farm income.

The United States operates concessional programs to provide commodities that can be either consumed directly or processed into food. These programs are directed to both domestic and foreign consumers who do not have the ability to pay. Foreign aid is made available principally under P.L. 480. Given the magnitudes of surplus stocks disposal to be considered in the study and given previous research that suggests low additionality for food aid exports, the study team saw no significant opportunities for additional disposal through food aid. Therefore, this was not an alternative evaluated here.

The current price and income support programs, which include loan rates, target price-deficiency payments, and land idling, were treated as part of the underlying structure in both Chapters 19 and 20, which analyzed the general subsidy and the targeted subsidy, respectively. For the simulations, only the 1983 and 1984 PIK component of the acreage program and the reserve program were eliminated. The land reserve and subsidy programs attack the surplus problem from different perspectives. A subsidy program incurs a cost to dispose of excess production, while a land idling program incurs a cost for preventing production. We will address relative costs later in this chapter.

General Subsidy

Chapter 19 analyzes a general subsidy program operated continuously from 1977/78 through 1984/85. The Government paid a subsidy that was sufficient to encourage, in one case, enough additional foreign buying to dispose of CCC inventories and in another case, CCC plus farmer-owned reserve (FOR) inventories. Subsidizing is analogous to selling CCC inventories or combined CCC and FOR inventories on the foreign market at reduced prices. The subsidy scenarios evaluated were designed to maintain the level of domestic prices at the loan rate or above.

The analysis presented in Chapter 19 showed an important effect of stocks disposal. If surplus stocks are sold competitively rather than stored, there is a greater chance of a positive income effect in subsequent years whenever a poor harvest or unexpected surge in demand occurs. A poor harvest combined with an absence of buffer stocks results in higher prices and higher net income. An offsetting impact results, however, because the

livestock sector may be made worse off from higher feed prices. In the aggregate, we would expect the higher crop prices to more than offset the added costs to livestock producers. What the crop sector has gained is more than what the livestock sector has lost.

Government price support programs tended to protect farmer incomes from the consequences of low prices. In these scenarios, stocks disposal and export subsidies were used in place of stockholding policies to implement these programs. As prices were generally low relative to farm program objectives, disposing of CCC and FOR inventories improved domestic prices and farm income in only one year, 1980/81. Improvement resulted from the fact that there were no stocks to buffer a short crop in 1980. However, the study assumption to eliminate the PIK part of the 1983 and 1984 commodity programs resulted in a loss of farm income in 1983. Over the study period, the income loss in 1983 exceeded income gains from higher prices in 1980 and 1984. Average farm income over the period thus was lower under the stock disposal program.

When stocks are exported with a subsidy, world prices are lower and more variable. This result was shown to be true for most years included in the Chapter 19 simulation. Thus, the strategy to export surpluses creates additional price variability in world markets. The analysis shows that surplus disposal can lead to increased domestic price variability because the economy loses the buffering effect of large stocks. If the United States as a large trader pursued competitive pricing of surplus stocks, world markets would also vary more unless other countries changed stockholding policies.

Buyers' responsiveness in relation to price or, put another way, the level of import demand elasticities is the critical parameter affecting the study team's final results. Throughout the study, this concept has been stressed. Import demand elasticity measures potential economic response to lower prices assuming that other countries leave their policies unchanged. A more elastic import demand means that a smaller subsidy is required to dispose of the same quantity (table 23.1). A higher elasticity also means that the world market experiences less price variability. The measured value of the elasticity in relation to whether it is greater than or less than -1.0 is also critical.

If market demand is elastic, meaning that a given percentage change in price results in a greater percentage change in the quantity imported, a price cut will result in greater total revenue for a commodity whose price is reduced. If the market demand is inelastic, meaning that a percentage change in price results in a smaller percentage change in imports, a price cut will reduce revenue. Elasticities of import demand applicable to this study indicate that the demand for wheat was inelastic in the regional econometric trade model under the lower elasticity scenario and only slightly elastic under the higher elasticity scenario. The demand for corn (coarse grains) was elastic for all of the scenarios; the elasticity for corn was greater than for wheat. Because the demand for corn was more responsive than for wheat, the subsidy program performs better for corn. The most obvious causal explanation is that the per-ton cost of achieving disposal of surplus corn stocks was less than for wheat even though a larger tonnage of corn moved into the export market. Under the lower elasticity scenario, the highest subsidy cost per additional ton of corn disposed equaled $86.98 compared with the highest cost for wheat at $161.02 (table 23.1). Under the higher elasticity scenarios, costs per additional ton were lower.

In Chapter 19, the general export subsidy discriminated between U.S. consumers and foreign buyers and was costly to the Government. We showed that the United States could have disposed of surplus stocks in the export market. If subsidized disposal had been limited to CCC-owned inventories, total Government program costs (assuming no PIK) would not have changed significantly. However, net farm income would have decreased by $3.1 billion over the 8 years. If the United States had carried out a more aggressive disposal effort that included FOR inventories, the Government would have incurred an added cost of $2.6 billion, but net farm income would have eroded by less than $500 million over the 8 years.

The timing of the commencement of the subsidy disposal scheme can greatly affect this evaluation, particularly the extent of

Table 23.1--Subsidy rate and cost comparisons using alternative elasticities and a regional econometric trade model 1/

Item	Unit	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Wheat:									
Lower elasticity--									
Increase in exports	*Mil. tons*	6.43	2.59	0.01	2.87	4.23	18.84	2.20	10.72
Total exports	*Mil. tons*	37.03	35.09	37.43	44.07	53.43	59.91	41.08	49.47
Subsidy rate	*Dol./ton*	25.72	5.51	0	9.92	12.86	50.71	0	27.19
Total subsidy cost	*Mil. dol.*	951.69	195.83	0	444.19	665.82	3,033.59	0	1,340.76
Cost per additional ton of exports	*Dol./ton*	147.90	75.61	NA	154.77	157.40	161.02	NA	125.07
U.S. historical farm price	*Dol./ton*	85.81	109.50	133.89	143.67	134.11	130.44	129.71	124.19
Higher elasticity--									
Increase in exports	*Mil. tons*	6.47	2.73	-.33	3.12	4.26	19.77	1.10	11.03
Total exports	*Mil. tons*	37.07	35.23	37.09	44.32	52.46	60.84	39.99	49.78
Subsidy rate	*Dol./ton*	24.99	3.31	0	6.25	7.35	26.46	0	16.53
Total subsidy cost	*Mil. dol.*	932.71	110.97	0	282.88	388.98	1,608.13	0	826.10
Cost per additional ton of exports	*Dol./ton*	144.16	40.65	0	90.67	91.31	81.34	0	74.90
Corn:									
Lower elasticity--									
Increase in exports	*Mil. tons*	6.80	6.50	5.23	-6.24	24.19	26.05	.27	17.65
Total exports	*Mil. tons*	56.28	60.68	87.03	53.58	74.15	73.55	47.64	64.34
Subsidy rate	*Dol./ton*	7.48	4.72	4.33	0	23.23	22.05	0	24.01
Total subsidy cost	*Mil. dol.*	421.85	296.41	293.61	0	1,719.90	1,627.67	0	1,535.15
Cost per additional ton of exports	*Dol./ton*	62.04	45.60	56.14	NA	71.10	62.48	NA	86.98
U.S. historical farm price	*Dol./ton*	79.52	88.58	99.21	122.43	98.42	106.29	127.95	103.14
Higher elasticity--									
Increase in exports	*Mil. tons*	6.80	6.50	5.23	-6.62	22.98	26.00	.47	17.61
Total exports	*Mil. tons*	56.28	60.68	67.03	53.20	72.94	73.50	47.84	64.30
Subsidy rate	*Dol./ton*	6.30	4.33	3.94	0	20.47	16.93	0	17.32
Total subsidy cost	*Mil. dol.*	361.87	256.68	255.05	0	1,495.61	1,235.55	0	1,103.97
Cost per additional ton of exports	*Dol./ton*	53.22	39.49	48.77	0	65.08	47.52	0	62.29

NA = Not available.

1/ All comparisons are for disposal of CCC and FOR stocks.

Government costs. These estimates are conditional on starting in 1974, a year with low stocks. If such a program were begun now when stocks are large, the Government program costs would be much greater.

We must consider another factor. Under current conditions, the United States holds large commodity inventories. Comparatively, under the subsidy program with an objective to dispose of surplus stocks, inventories are smaller at the end of the period. The general subsidy strategy did not improve farm income nor did it reduce Government cost for wheat despite savings obtained from not having to operate the PIK program. If, in appraising merits of a subsidy program, PIK program savings are taken into account, we show that a subsidy reduced the corn program cost. Value of the inventory, therefore, must be considered in evaluating total costs and benefits of a stock disposal strategy.

Whether current stocks are a liability or an asset is an open question. The answer depends heavily on global weather patterns in the immediate future. An immediate crop failure could make surplus stocks a valuable asset. Or, continued large crops could make surplus buildups a growing liability because of carrying costs and spoilage. If current stocks are an asset, then the cost of a subsidy program is greater. If today's stockpiles are a liability, then the subsidized cost of stocks disposal would be lower.

Targeted Subsidized Disposal

The analysis presented in Chapter 19, which looks at the merits of surplus disposals achieved through competitive pricing, does not explore all potential strategies. Chapter 20 analyzes what happens when the dimensions of discrimination among foreign buyers and discrimination against domestic consumers are added to the equation. As Part I points out, an analysis of individual buyers (countries or regions) that includes different prices among foreign buyers required a spatial equilibrium simulation model. This model, which includes trade flows, can then be transformed to include price discrimination. The spatial model available to us was limited to an analysis of conditions during a single year; we selected 1980. We also used this model to conduct an analysis of a general export subsidy and compared the general export subsidy results with those of the targeted subsidy. Chapter 20 results for the year 1980, however, cannot be compared with the Chapter 19 analysis for 1980 because the latter was begun in 1977. That fact altered the quantity of stocks carried over to the 1980 crop year.

If the United States employs targeted subsidies, it can use its market power to set policies that maximize national well-being. For example, it can exploit the elasticity of import demand shown by different buyers. Moreover, it can use targeted subsidies to gain market access and to defend markets against competitors. In Chapter 20, we adopted an objective to make farm income minus the subsidy cost as high as possible by targeting subsidies. The more elastic or responsive a country's import demand, the larger the subsidy directed to that country. However, to maximize farm income minus the subsidy cost, the amount of the surplus stocks moved into the market must remain variable. It is also possible to dispose of a specified level of stocks by targeting subsidies, but the subsidy cost increases sharply so that farm income minus the subsidy is less than when a variable amount of disposal is permitted.

Chapter 20 analyzed three subsidy strategies that yield important insights when compared. The three strategies are a global subsidy with a disposal target, a targeted subsidy with no disposal level requirement, and a targeted subsidy with a disposal level requirement. The targeted subsidy scheme with no disposal level requirement results in the greatest value (domestic plus export) of 1980/81 wheat and coarse grains sales when the subsidy cost is subtracted (table 20.4). Thus, the analysis presented in Chapter 20 shows the possibility of increasing farm income net of subsidy costs by implementing a targeted subsidy that discriminates among foreign buyers. When the additional restriction of a stocks disposal target is added, an equivalent gain in farm income net of subsidy costs cannot be realized. With targeted subsidies, farm sales revenue is either roughly the same or above the no-subsidy value. Overall, the United States fares better under both the fixed and variable level of disposal quantities with a targeted subsidy. A targeted subsidy yields superior results

compared with a global subsidy. However, even in these scenarios, Government costs are still high.

The targeted subsidy program, which aims to maximize crop value minus the subsidy cost, increased wheat exports by only a small amount while the surplus disposal program nearly achieved its disposal goal for coarse grains. As Chapter 20 explains, the discrepancy resulted from a lower value of the wheat import demand elasticity compared with the coarse grain import demand elasticity. Surplus wheat stocks were left in inventory, leading to a stock overhang in subsequent crop years. Stock overhangs open up the possibility that a targeted subsidy with no disposal requirement may be of limited benefit if the import demand elasticities for the surplus commodity were small and particularly if they were inelastic.

The largest subsidies under a targeted subsidy scheme with no disposal requirement are given to the countries or regions with the largest import demand elasticities and to countries in which the United States shares the market with other exporters. For wheat, the largest increases in U.S. exports take place in Other Southeast Asia, Indonesia, Thailand, North Africa, and the Middle East. For coarse grains, the subsidies encourage additional purchases by countries in Latin America, Eastern Europe, and China. Subsidies to other regions exploit the price responsiveness of competing exporters.

When we add the disposal requirement to the targeted subsidy scheme, the United States gains access to wheat markets in Sub-Sahara Africa, Nigeria, and East Asia. Exports to Egypt, North Africa, Indonesia, and Southeast Asia expand as well. While U.S. coarse grain exports expand substantially in current markets, the strategy opens up a new market for coarse grains in the Middle East. Other Western Europe shows a large expansion because the subsidy together with a lower U.S. border price substantially lowers the price to the Other Western European countries.

Implementing a targeted subsidy program depends on the exporting nation's knowledge of the price responsiveness, or elasticity, of each importing nation and export competitor countries. It requires a willingness to use that information to provide an individualized subsidy to each country on the basis of the responsiveness. If this information is available, targeted subsidies can improve U.S. welfare although they can be costly. The analysis suggests that such a policy is more effective in highly elastic markets, such as the market for coarse grains, than in the wheat market. To achieve a welfare gain, the United States could consider subsidizing other commodities that elicit a relatively elastic response. Again, effectiveness of a targeted subsidies program depends on responses of competing exporters. Retaliation by competitors can substantially reduce the impact of a targeted subsidy program. Should the targeted subsidies program alter policy in these countries, the effect can be still further reduced.

Subsidized Dairy Surplus Disposal

Disposing of dairy surplus, as Chapter 22 relates, differs from that of other commodities. The world market for dairy products is thin, and only a small proportion of dairy products enter world trade, reflecting significant transportation costs and perishability of fresh dairy products. However, a significant proportion of processed or manufactured milk products does enter world trade. For example, over half of the nonfat dry milk produced enters international markets.

A small number of countries, particularly New Zealand and Australia, specialize in the export of dairy products though only a limited number of regions regularly import the goods. If intra-EC trade is counted in world trade, the EC countries constitute a large import market. Protection, via EC policy, limits access to that market. However, the USSR is the largest importer of butter; North America and Japan are the main buyers of cheese; and Central America, South America, and Asia are major importers of nonfat dry milk. Because countries often view imports as threats to their domestic dairy interests, they tend to restrict imports.

The intra-EC trade, which accounts for one-third of world trade, constitutes a special feature of world dairy trade. While this trade could be looked on as a domestic flow, it can also be regarded as international trade because

other countries can compete for a share of these markets. Also, the trade is based on differentiated products, particularly cheeses, making market entry difficult for generic products.

EC policy allows member countries to enter EC markets duty free, while the threshold price and variable levy force external competitors to supply this market at higher prices.

An important consideration in the case of surplus dairy disposal is whether U.S. surpluses could, in fact, be disposed of in the world marketplace. We conclude that the United States could subsidize exports and, in all likelihood, dispose of surplus stocks of processed dairy products. A one-time disposal when stocks were at peak levels from cumulative acquisitions could present a problem. A major consideration would be the stock level in the year in which policymakers made a policy change.

Annual export of surplus CCC dairy product inventories, particularly those of butter and cheese, would reduce the supplies available for domestic and foreign concessional disposals in years when acquisitions fall short of planned disposals. An alternative to cutting back concessional disposals would be to buy on the commercial market as a way to rebuild inventories when CCC stocks diminish. This action would result in competition with the commercial market and higher domestic market prices. In Chapter 22, we allowed reductions in concessional disposals rather than make market purchases meet concessional use. If the United States made market purchases, it would increase the cost of the surplus disposal program. The policy would also tend to increase milk prices to consumers. In this case, the added cost would be transferred from taxpayers to producers.

Disposing of surplus dairy product stocks on the export market at whatever price they would bring is shown to be more costly during the study period than the actual practice of allowing surplus stocks to accumulate with periodic drawdowns. One factor favoring stock accumulations during that period was a trend of rising world prices that did not reverse itself until the 1980's. While the analysis indicated the feasibility of exporting the surplus quantities, it also showed that substantial world market price declines would be necessary to sell the products in world markets. Because the United States now maintains the highest milk prices among major world producers, the difference between CCC acquisitions and competitive sales of CCC surpluses in world markets can be substantial. Because the United States figures prominently in the world market, sales to dispose of its surplus inventory (such as nonfat dry milk for which its stocks constitute a significant share of world trade) would force world prices down. That action would make the margin between U.S. domestic prices and disposal prices even greater than observed historical differences.

WOULD U.S. FARM PRODUCERS BENEFIT FROM SUBSIDIES?

Did U.S. farm producers suffer losses because of the Government's failure to sell surplus commodities at competitive prices? The answer is conditional. If, during the last decade, the CCC would have sold its accumulated inventories of grain and dairy products each year at whatever price it would have taken to make a sale, the result would have been a lower world price. U.S. farm producers would not have gained financially in any year in which sales took place. The only time that farm producers would gain would be in those years in which subsidized sales did not take place and in which domestic market prices exceeded target prices. This situation could take place if disposals depleted surplus stocks in previous years so that they no longer act as a buffer against a crop shortfall. The analysis presented in Chapter 19 identified 1980/81 as an example of such a case. As long as prices stay below target prices, a price increase simply reduces the deficiency payment. Government costs may decline, but producer income remains largely unaffected. As long as world prices remain below the U.S. target price and while the Government continues to pay storage on FOR inventories, grain-related farm income is insensitive to both market price and shortrun quantity changes in foreign markets.

If instead of selling at competitive prices on world markets, the CCC had discriminated among importers with targeted subsidies solely on the basis of their market responsiveness, it would have had an opportunity to wring added

value from the marketplace. This action could prompt an increase in producer income exceeding the cost of the subsidy to taxpayers (table 20.4). Opportunities would be greater for corn (coarse grains) than for wheat. To be most effective, however, this policy would have to permit variable disposal levels. From the standpoint of the rest of the world, a targeted subsidy would be destabilizing to world market relationships and could be expected to generate a response from competing exporters and nontargeted importers. (Chapter 21 focuses on the issue of other country responses.)

A final observation relates to the cost of disposing of additional quantities in the export market. Tables 23.1 and 23.2 show the per-ton cost of the additional grain export disposal. Cost exceeds the prevailing farm price in several instances. These data suggest that subsidizing or competitive pricing would cost more than it would cost to rent the land and keep it idle or to buy the commodity from the farmer and destroy the grain.

For equal quantities of disposal, the spatial equilibrium model applied in Chapter 20 resulted in a higher subsidy cost. There is a technical explanation for this difference: The spatial model operated linearly, resulting in variable elasticities, while the econometric model used in Chapter 19 included constant elasticities for some regions of the world. The difference suggests that the costs of a subsidy program, or competitive selling for that matter, would be hard to predict in an applied way because the costs are sensitive to the assumptions used in analyzing the alternative. However, the estimates do yield a likely range that would apply if a subsidy program were used.

WOULD U.S. TAXPAYERS BENEFIT FROM SUBSIDIES?

During the study period, farmers had limited opportunities to benefit from export disposal. Opportunities were particularly limited for wheat. However, what about the taxpayer? The analysis presented in Chapter 19 yielded the most information on this topic. If we assume that surplus inventories represent a positive value rather than a cost and if we also assume that the cost of PIK could have been avoided by using a subsidy scheme, then the results suggest that taxpayer costs would have been lower by operating a subsidy program for corn. Taxpayer costs would have been higher, however, under a subsidy program for wheat (tables 19.4 and 19.8 and appendix tables 19.10 and 19.11) and for dairy products. These results depend on the magnitude of stocks on hand and the price responsiveness of international market demand, which determine how large subsidies must be to dispose of existing stocks.

A WIDER PERSPECTIVE ON SUBSIDIES

If the question of surplus disposal through competitive marketing losses is posed in the

Table 23.2--Subsidy rate and cost comparisons using higher elasticity and spatial equilibrium price discrimination model, 1980/81

Item	Unit	Global subsidy	Targeted subsidy for income	Targeted subsidy for disposal
Wheat:				
Increase in exports	*Mil. tons*	12.10	0.87	13.00
Total exports	*Mil. tons*	48.00	36.77	48.90
Subsidy rate	*Dol./ton*	59.22	5.17	63.40
Total subsidy cost	*Mil. dol.*	2,840.00	190.00	3,100.00
Cost per additional ton of exports	*Dol./ton*	234.71	218.39	238.46
Corn:				
Increase in exports	*Mil. tons*	19.96	21.23	25.80
Total exports	*Mil. tons*	83.50	84.77	89.34
Subsidy rate	*Dol./ton*	32.55	52.85	44.10
Total subsidy cost	*Mil. dol.*	2,720.00	4,480.00	3,940.00
Cost per additional ton of exports	*Dol./ton*	136.27	211.02	152.71

absence of a specific historical period, then a different kind of appraisal and a different perspective would have to be considered. The commodity programs prevailing for half a century have given farmers an alternative to offering their commodities for sale at competitive market prices in years of surplus. The CCC, through the nonrecourse loan rate, becomes the buyer with the highest bid. Since the United States is a large producer and trader, competitors have found that the U.S. loan rate made an ideal point on which to base pricing. The rate served as a reliable reference point for setting prices because the U.S. commodity program functioned as a price floor. Further, U.S. policy is largely predictable. Its predictability arises from the fact that policy is translated into announced provisions and the provisions are carried out as announced regardless of cost.

Given the nature of the U.S. programs and markets, the lack of competitive pricing on the part of the CCC in the United States did not result in losses to U.S. farm producers. There is stronger evidence that taxpayer costs may have been higher than they would have been under surplus disposal, however. Moreover, the failure to market what was produced at harvest time (less that maintained as working and speculative stocks) allowed the rest of the world to gain some distinct advantages. For instance, importers subject to variable production had access to stockpiles without having to hold stocks within their borders. Exporters with marketing boards had a predictable basing point for pricing. The EC had a source of imports and a price basing point. Comprehensive surplus disposal of the type evaluated here would upset these arrangements and practices. The international agricultural commodities market would have to establish new marketing arrangements and practices if the United States sold surplus stocks competitively.

U.S. farm producers can gain if they can sell the same quantity at a higher price or if they sell a larger quantity at the same or even lower price. The profit position can be retained as long as net revenue increases, which has been possible only under a discriminatory pricing scheme during the last decade. Competitive pricing could lead to such gains if it caused other countries to cut down production, to increase stockholding, or to introduce production controls.

Once a surplus is produced, buyers learn of the excess supplies. From the seller's standpoint, it is unclear whether to sell for less or bide time and store stocks in hopes of future opportunities. What is clear is that policymakers react to the behavior of other market participants. It has been easy to predict how the United States makes its policies and responds to market conditions. If the United States marketed more competitively, other countries would have to adjust. In the short run, the study's analysis showed that more competitive marketing was not a superior alternative to current programs. In the longer run, however, more competitive marketing via export surplus disposal could lead to policy changes in other countries. It is an open question whether, on balance, these policy changes would improve or weaken the competitive position of the United States in world grain markets.

PART IV

MACROECONOMIC EFFECTS

Parts II and III examined specific issues of embargoes and export subsidies using actual macroeconomic conditions as given parameters. This approach would be perfectly acceptable if macroeconmic conditions had been stable in 1970-84. But they were not. Macroeconomic conditions prevailing in the late 1970's (declining dollar, rapid growth in GNP and exports, high rates of inflation, and negative real interest rates) began to reverse in 1980 and continued worsening through 1984. This dramatic reversal occurred almost simultaneously with the 1980 Soviet embargo and coincided with the rapid buildup of stocks in the 1980's. We were concerned that, by taking rapidly changing macroeconomic conditions as given in our analysis, we could not easily disentangle embargo effects from other effects.

We were specifically interested in knowing how much the rise in the dollar, the rise in real interest rates, and U.S. and global recession may have contributed to the difficulties of U.S. agriculture in the 1980's. To test the proposition that changes in macroeconomic conditions were a potentially significant contributor to agriculture's difficulties, we constructed an alternative macroeconomic scenario and tested its effect on U.S. agriculture in the 1980's. Note that this alternative set of assumptions about macroeconomic conditions is only one of many that we could have chosen, and we do not argue that it is the most likely or that it would have persisted over the entire period. We simply wanted to test the sensitivity of our agricultural sector impact analysis to macro conditions. We assumed that the macroeconmic conditions prevailing in 1979/80 persisted through the 1980's. We then reran one of our national models (FAPRI) to simulate farm prices and incomes under this alternative scenario. Part IV reports results of that simulation. Results strongly suggest that macroeconomic conditions greatly affect the health of U.S. agriculture.

CHAPTER 24

EFFECTS OF AN ALTERNATIVE MACROECONOMIC SCENARIO ON THE U.S. AGRICULTURAL SECTOR

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CHAPTER 24

EFFECTS OF AN ALTERNATIVE MACROECONOMIC SCENARIO ON THE U.S. AGRICULTURAL SECTOR*

Agricultural trade problems have received increased attention in the United States for the last few years. The reason is obvious. After a decade during which agricultural export values grew from $8 billion annually to a peak of nearly $44 billion in 1981, export quantities and values have fallen substantially. USDA projects $29 billion in farm exports in 1985. Exports have often been a major force in U.S. agricultural prosperity and distress. Thus, export growth is often seen as a solution to the dismal state of the farm economy. But, poor export performance is only one of many complex factors contributing to agricultural distress. Many of these factors are related to macroeconomic policies and conditions *(5, 6, 9)*.[1]

Empirical studies have verified links between macroeconomic policies and conditions and U.S. agriculture. Chambers and Just *(2)* estimated the impact of money supply changes on commodity markets. Devadoss, Meyers, and Starleaf *(4)* found that the U.S. contractionary monetary policy of the early 1980's put upward pressure on exchange rates and interest rates and hurt the farm economy. In a related study, Starleaf, Meyers, and Womack *(10)* presented evidence that the real income of U.S. farmers has generally increased during economic expansion and declined during economic contraction. Meyers, Thamodaran, and Helmar *(7)* found that stagnant income growth in foreign countries and appreciation of the U.S. dollar hurt U.S. agricultural exports.

Major elements of changes in the macroeconomic environment from the 1970's to the 1980's are noted in table 24.1. Economic policies that successfully wrung inflation out of the U.S. economy also slowed economic growth here and in many foreign countries. U.S. inflation rates fell more rapidly than interest rates, causing real interest rates to rise. The 1981 tax cut reduced Government revenues without an associated cutback in Government expenditures, causing the Federal budget deficit to increase rapidly and real interest rates to rise further. As foreign investors bought dollars to invest in the United States and earn high returns, the dollar appreciated and made U.S. exports more costly abroad. The resulting decline in exports relative to imports substantially increased the current account deficit. The world economic slowdown in the early 1980's, high real interest rates, and an appreciating dollar contributed to debt crises in many developing countries. Public and private debt disbursements to these countries declined, and debt repayments increased until net debt transfers became negative.

All these factors helped to substantially reduce U.S. agricultural exports from the 1981 peak. In addition to weak foreign and domestic demand, U.S. bumper crops in 1981 and 1982 set the stage for a substantial decline in farm prices, incomes, and land values. Commodity programs designed to protect farm prices and income absorbed substantial amounts of the growing surplus by building stocks and reducing acreage planted. Program costs rose to nearly three times the expenditure level of the 1970's.

Reversal of conditions existing in the 1970's could hardly have been more complete. Exchange rate changes and export declines were casualties rather than causes of this turnaround. Macroeconomic policies and conditions have been major elements in this reversal. Large negative impacts of the changed macroeconomic conditions on agriculture are widely acknowledged. This analysis provides a quantitative evaluation of the impact of the changing macroeconomic environment on agricultural markets and trade.

ANALYTICAL METHOD

The adverse macroeconomic environment of the 1980's is hypothesized to substantially affect commodity markets. What might have happened had the 1970's macroeconomic

*Contributors to this chapter were William H. Meyers, Michael Helmar, S. Devadoss, David Blandford, and Robert E. Young II.

[1]Italicized numbers in parentheses cite sources listed in the References section at the end of this chapter.

conditions continued into 1980-84? This entails a hypothetical 1980-84 scenario in which U.S. and foreign economic growth rates are higher and the U.S. dollar remains at 1979's favorable exchange rate levels. This alternative scenario is compared with a baseline scenario that represents actual conditions during the period.

The crop sector analysis is illustrated in figure 24.1. The actual price and quantity levels for the period are represented by P_0 (price), D_0 (domestic demand), S_0 (domestic supply), and X_0 (exports). Higher income growth rates would shift domestic demand to the right (1), resulting in a leftward shift of export supply (4). But import demand also shifts to the right as indicated by (2). Preserving the lower 1979 exchange rates would make it possible for importers to buy more with one unit of their currency, which would increase import demand as in (3). All these changes would generate a new price and quantity solution at P_1, D_1, S_1, and X_1. Foreign price PF may also rise but not as much as the U.S. price. Exports and domestic consumption may go up or down depending on size of the demand shifts relative to price change. Our analysis later indicates that U.S. consumption decreases and exports increase. Export value in U.S. dollars would increase from P_0X_0 to P_1X_1, and production value would increase from P_0S_0 to P_1S_1. Higher prices probably would reduce substantially farm program costs.

The U.S. livestock sector analysis is illustrated in figure 24.2. Actual price and quantity levels for the period are represented by PL_0 (price) and QL_0 (quantity supplied and consumed). Assumed higher U.S. income growth for the macroeconomic alternative increases demand for livestock products (1). As result of the crop sector changes, feed prices increase and shift livestock supply to the left (2). An unambiguous effect of these changes is a

Table 24.1--The 1980's economic environment compared with that of the 1970's

Item	1970's	1980-84
	Percent	
Argentina's real GDP growth rate	2.70	-1.32
Brazil's real income growth rate	5.72	1.44
Canada's real GDP growth rate	4.50	1.52
Eastern Europe's real GDP growth rate	4.10	2.48
EC's real GDP growth rate	3.10	.94
Japan's real GDP growth rate	4.90	4.36
USSR's real income growth rate	3.00	.02
Spain's real GDP growth rate	3.98	1.16
Thailand's real GDP growth rate	7.06	2.04
U.S. real GNP growth rate	2.90	1.80
U.S. inflation rate	5 to 10	3 to 5
U.S. real interest rate	-1 to 3	5 to 9
	Billion 1980 dollars	
U.S. budget deficit range	15 to 115	66 to 158
U.S. current account range	-20 to 8	2 to -81
	Percent	
U.S. exchange rate change	(1969-80) = -29	(1980-84) = 58
	Billion dollars	
Net debt transfers to developing countries	(1978-81) = 30/yr.	(1982-83) = -2/yr.
U.S. agricultural export changes	(1971-81) = 35.8	(1981-85) = -12.6
	Billion 1983 dollars	
U.S. agricultural program costs	(1971-81) = 5/yr.	(1982-85) = 14/yr.

Figure 24.1

U.S. Agricultural Market Under Alternative Economic Conditions

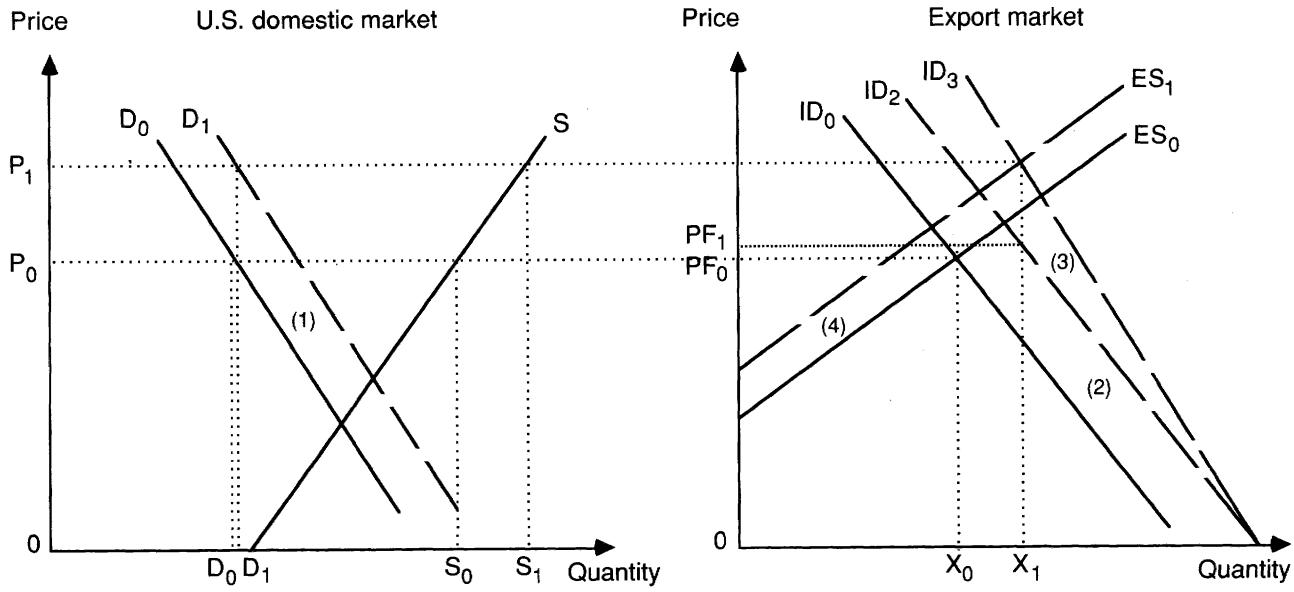
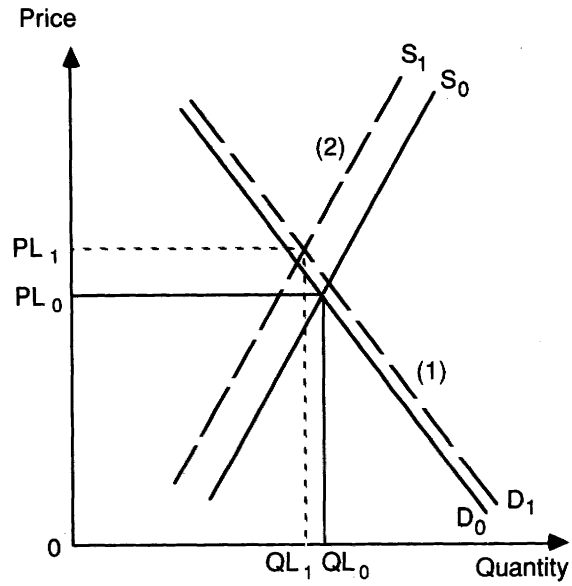


Figure 24.2

U.S. Livestock Sector Under Alternative Economic Conditions



livestock price increase from PL_0 to PL_1. Whether the quantity supplied increases or decreases depends on the relative magnitudes of the demand and supply shifts. Our analysis later indicates that livestock supply declines as shown here. This decline dampens the U.S. crop demand shift (1) in figure 24.1.

We primarily conducted the analysis with an econometric regional trade model developed by the Food and Agricultural Policy Research Institute (FAPRI) at Iowa State University *(1, 3, 8)*. The model includes wheat, coarse grains, soybeans, and soymeal, and explicitly incorporates exchange rates and price transmission relationships between countries and regions. Basic elements of this nonspatial equilibrium supply and demand model are described in Chapter 19. We used an econometric model of the U.S. livestock sector developed by FAPRI at the University of Missouri-Columbia to evaluate interaction between crops and livestock.

Assumptions for the Alternative Macroeconomic Scenario

The baseline scenario was simulated through the 1984/85 crop year using actual levels of all exogenous variables. Predetermined variables in the model were dynamically determined in the model simulation. The alternative scenario continued macroeconomic conditions of the 1970's into the 1980's. Variables most affected by macroeconomic conditions were income levels, inflation rates, and exchange rates. Other macroeconomic variables with minor roles in the model were U.S. real interest rate, Argentine budget deficit, and international reserves of developing countries. Because the foreign livestock sector was exogenous to the model, livestock variables were linked to income levels to capture effects of income growth changes on livestock product demand.

The general approach to generating assumptions for the alternative scenario is given next to each variable listed below, and plots of the actual data are compared with values under the alternative scenario in figures 24.3-24.6:

- Income growth—1970's trend.
- Inflation rates—1970's trend.
- Exchange rate—constant real exchange rate at 1979 level.

Economic growth rates in the 1980's are considerably lower in the United States and in many foreign countries than those in the 1970's (table 24.1). This slower growth is attributed primarily to the macroeconomic policies of various countries, especially the United States, in the 1980's and, to a lesser degree, to the oil price shocks of the late 1970's. Because incomes of most of the countries grew in the 1970's, we assumed that income growth rates in the 1980-84 alternative scenario also grew (fig. 24.3).

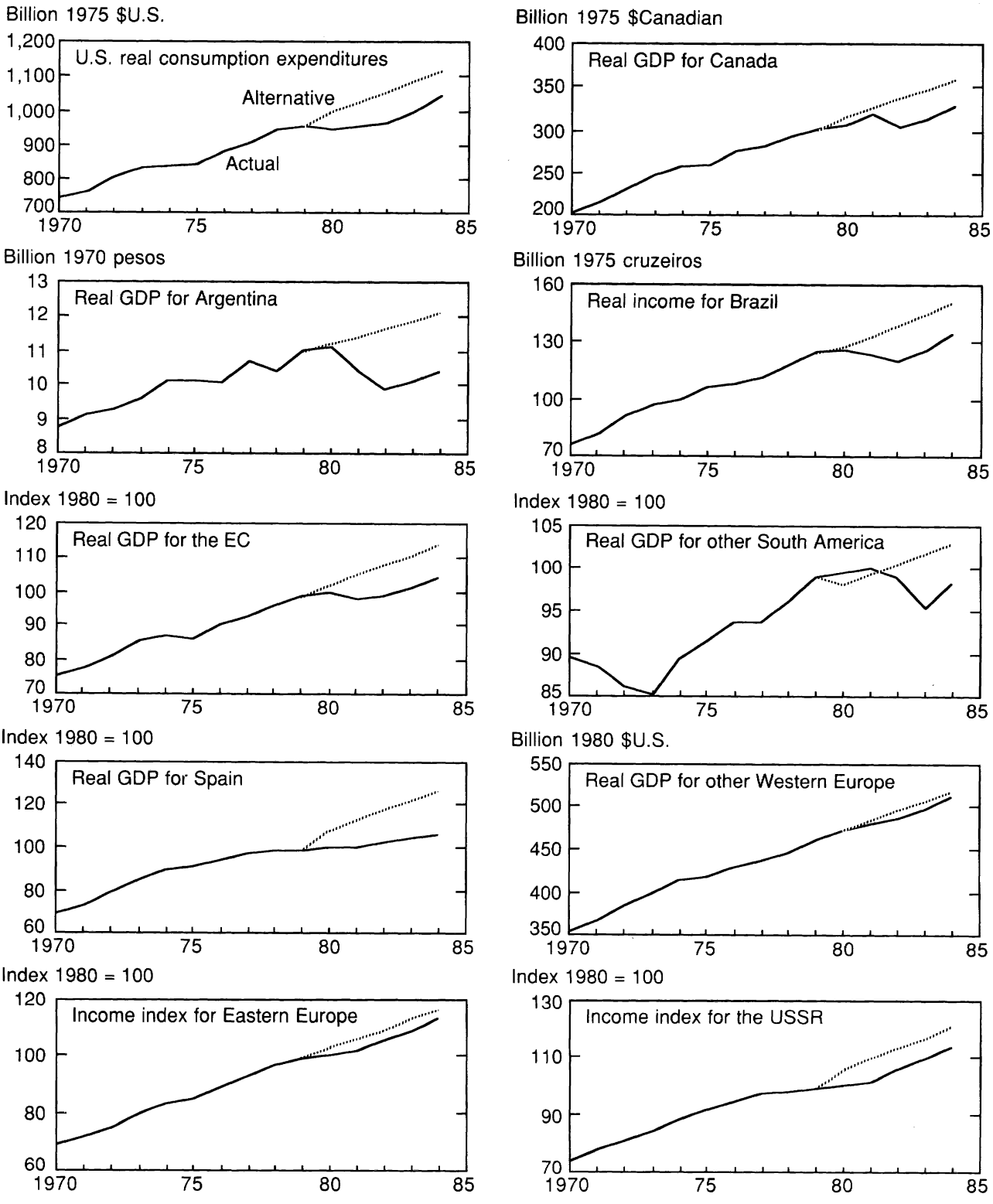
For most countries, inflation rates in the first year or two of the 1980's exceeded inflation rates in the 1970's as a result of the oil price shocks in the late 1970's. Inflation rates declined subsequently because of contractionary macroeconomic policies of various countries. Argentina's inflation skyrocketed in 1983 and 1984 because of its expansionary monetary policy and huge budget deficit. Inflation rates for the 1980-84 alternative scenario were assumed to continue their 1970's trend (fig. 24.4).

Real exchange rates in the alternative scenario were assumed to continue at 1979's rates. This meant that the U.S. exchange rate relative to each of the foreign currencies would change only in the amount needed to offset differing rates of inflation. This was equivalent to maintaining purchasing power parity at the 1979 level. This assumption was actually somewhat less favorable than exchange rates in the 1970's, when real exchange rates of many foreign currencies for the dollar declined (fig. 24.5).

Real U.S. interest rates have increased significantly in the 1980's. Real interest rates in the alternative scenario were maintained at a longrun rate of 3 percent. Argentina's budget deficit has increased rapidly in the 1980's. The budget deficit in the alternative scenario remained at its 1980 level. International reserves of developing countries in the 1980's were assumed to follow their trends of the 1970's.

Figure 24.3

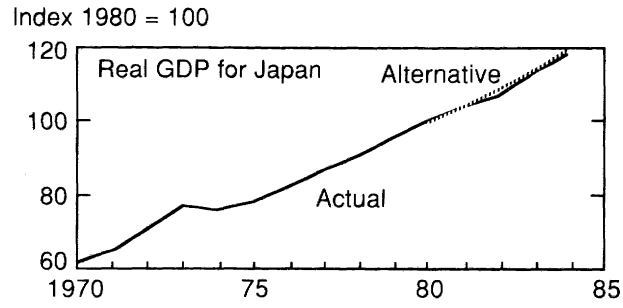
Income Levels Under Alternative Economic Conditions

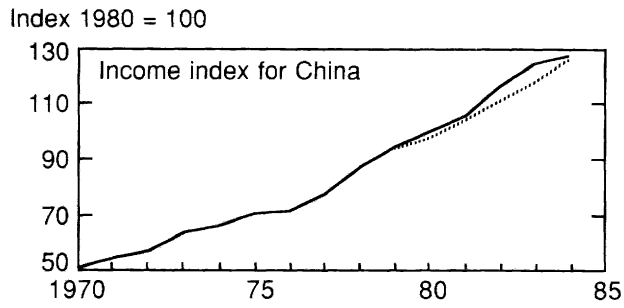


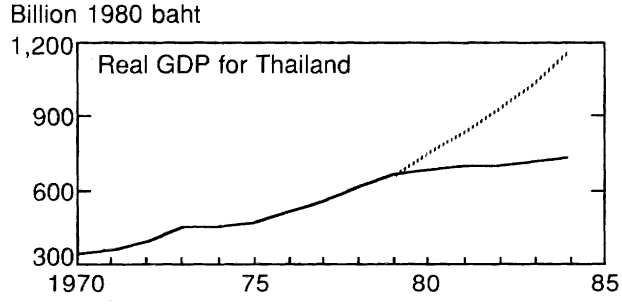
Sources: *(1, 3, 8)*.

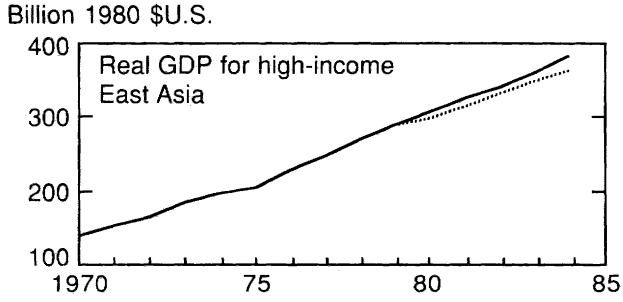
Figure 24.3

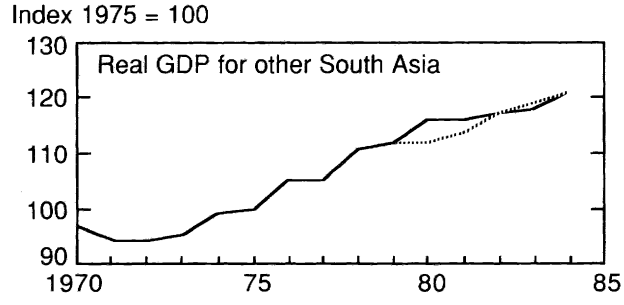
Income Levels Under Alternative Economic Conditions, continued

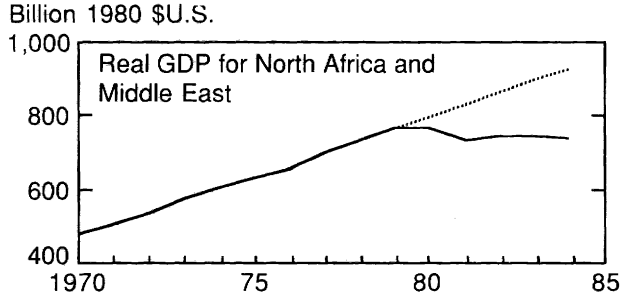


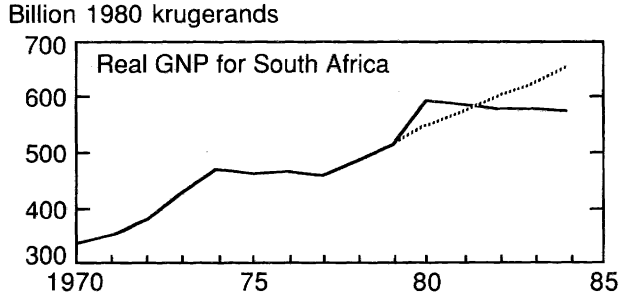


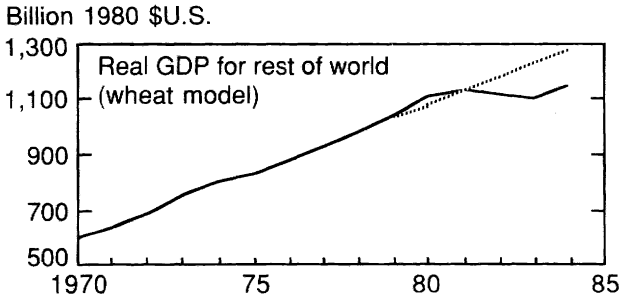


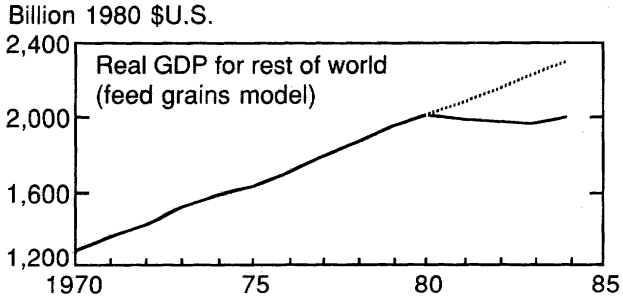


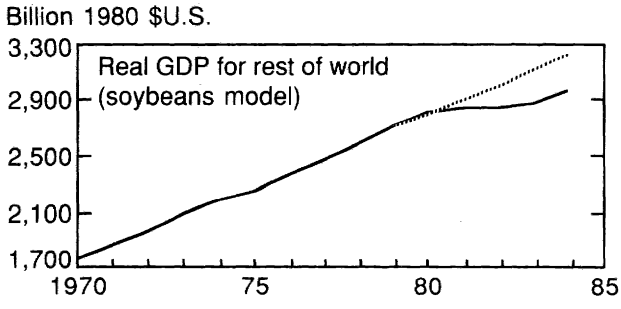








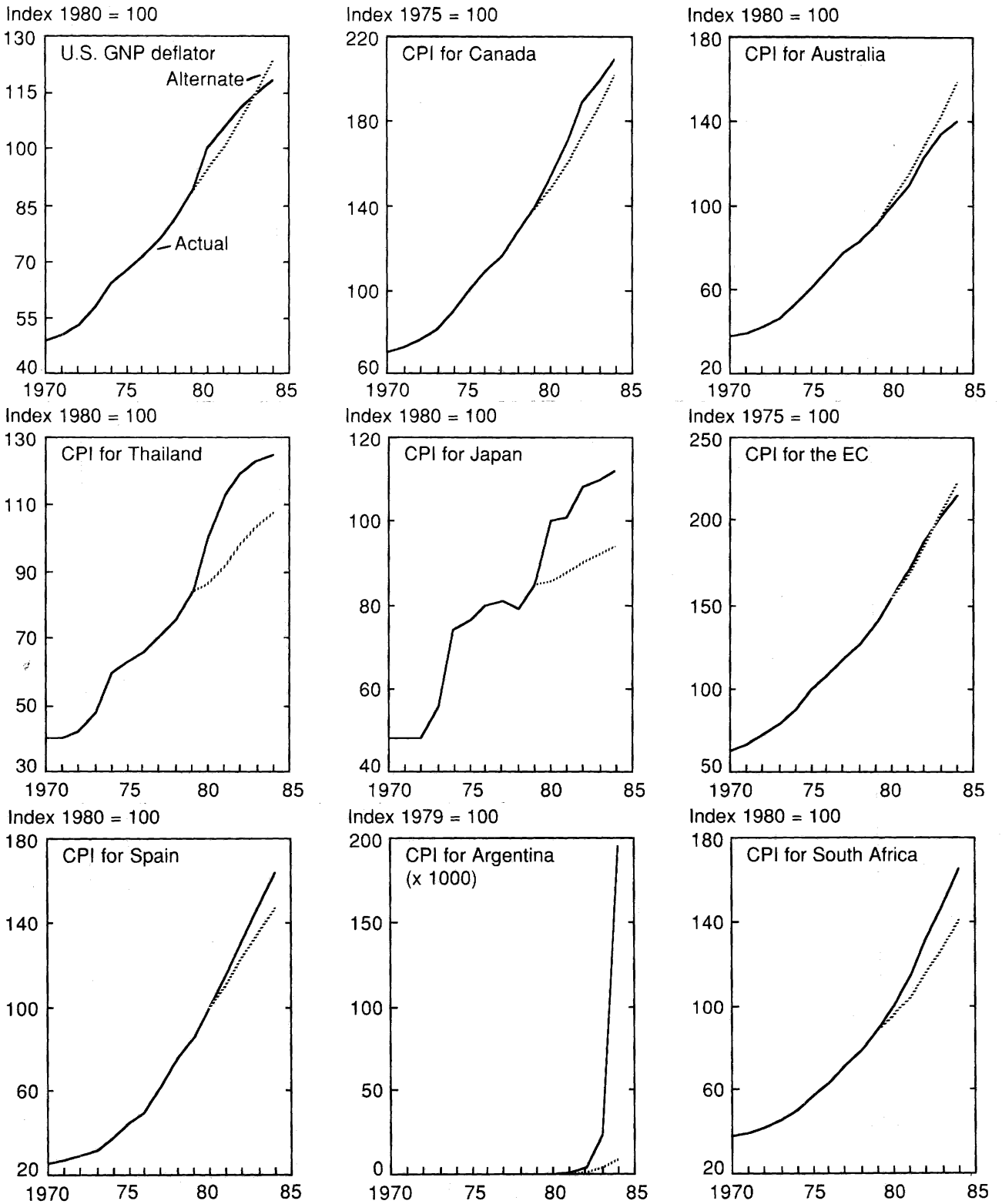




Sources: *(1, 3, 8)*.

Figure 24.4

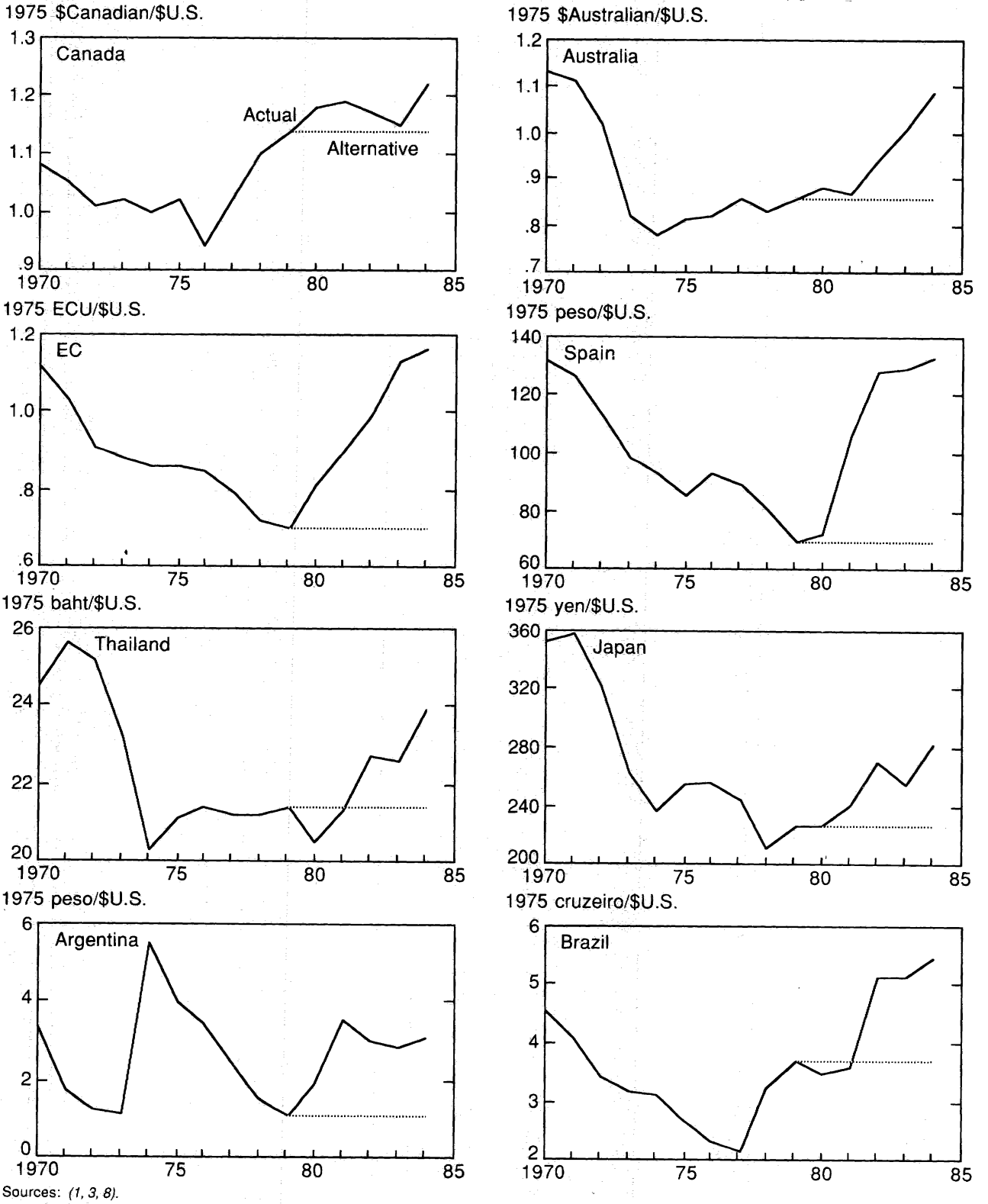
Inflation Rates Under Alternative Economic Conditions



Sources: *(1, 3, 8).*

Figure 24.5

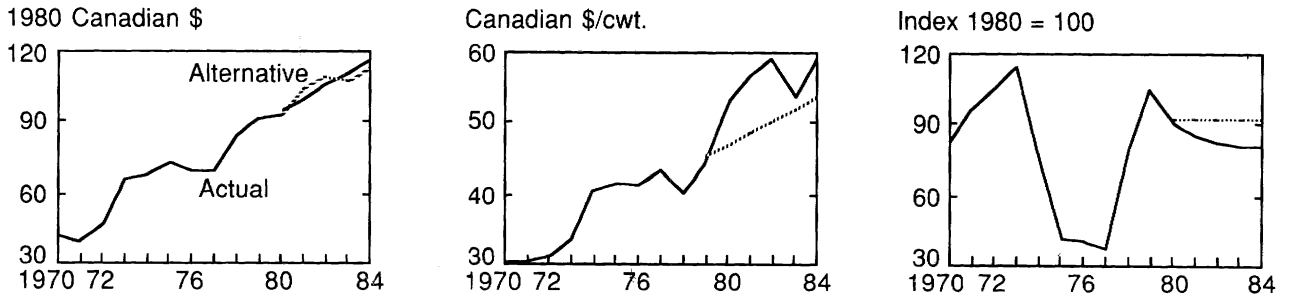
Real Exchange Rates Under Alternative Economic Conditions



Sources: *(1, 3, 8).*

Figure 24.6

Livestock Product Prices Under Alternative Economic Conditions



Sources: *(1, 3, 8)*.

Analytical Procedure and U.S. Policy Adjustments

The difference between the baseline scenario and the alternative scenario for 1980-84 is an estimate of the dynamic effects of the changed macroeconomic environment over the 5 years. Several steps were involved in generating this scenario:

- The alternative assumptions were imposed on the individual commodity trade models and the U.S. livestock model, and new equilibrium supply, demand, price, and trade results were estimated.

- To incorporate the cross-commodity interaction among these commodities, we passed the new price estimates between the crops models until a new cross-commodity equilibrium was generated.

- To incorporate the cross-commodity interaction between U.S. feed and livestock, we passed the new crop and livestock prices and livestock animal unit indices between the crop and livestock models until a new cross-commodity equilibrium was generated.

- Commodity program provisions were adjusted according to the new market prices. If market prices were above release prices for wheat and corn, wheat and corn were removed from the farmer-owned grain reserve (FOR) until either market prices declined to release price levels or the FOR stocks were exhausted, whichever came first. If the stocks were exhausted and market prices were still above release prices, then CCC-owned stocks were released until market prices declined to Government release price levels. FOR stock accumulations were also adjusted for changing prices. If market prices in a year before an actual paid diversion or PIK program were 10 cents a bushel below target prices, the paid diversion or PIK program was eliminated.

- This process continued until all models were in equilibrium and policy conditions were satisfied. Results indicate the PIK program and all paid diversions were unnecessary for wheat and corn, and substantial quantities of FOR and Government stocks were released to the market.

Evaluation Results

We present effects of macroeconomic conditions on wheat, corn, and soybeans; on major countries and regions that trade these commodities; on the farm industry; and on Government programs. Effects on the farm industry were measured by acreage planted, crop production value, agricultural export value, cash receipts from crops and livestock, and net farm income. Effects on Government programs are measured by Government stock levels and the cost of commodity programs. For crop years 1981/82 to 1984/85, we

averaged all the measures and compared the difference between the alternative scenario and the baseline scenario. Yearly data are presented here in tables and figures.

Wheat

The more favorable macroeconomic assumptions of the alternative scenario increased estimated U.S. wheat exports nearly 18 percent for the last 4 years of the period (table 24.2). Wheat feed demand also rose in some years because of wheat's more favorable price relative to coarse grains, but the net effect was a slight decline in wheat feeding over the 4-year period. The stronger import demand reduced carryover stocks, increased prices nearly 20 percent, and increased wheat supply an average of nearly 5 percent each year. Estimated wheat supply actually declined in the first 2 years because the decline in beginning stocks was greater than the increase in production. Planted acreage increased in the last 2 years due to the absence of PIK and paid diversion programs.

Projected total net exports of major exporting countries increased an average of 2.5 percent, but the U.S. market share gained at the expense of the European Community (EC) and Argentina (table 24.3). Higher income growth rates assumed in the EC and Argentina boosted domestic consumption and reduced wheat available for export. The estimated U.S. market share, instead of falling 12 percent in 1981-84, maintained a level equal to or greater than the actual share in 1979/80.

Higher wheat prices of the alternative scenario in some cases offset higher income growth in the import markets (table 24.4). China's imports declined the most because income growth in the alternative scenario was lower than actual income growth. Income effects

Table 24.2--Effects of an alternative scenario on U.S. domestic supply and use of wheat, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Supply	83.23	89.35	102.71	106.79	107.09	108.70	106.32
Domestic use	21.31	21.31	23.05	24.71	30.24	31.38	27.35
Exports	37.42	41.20	48.20	41.07	38.89	38.75	41.73
Ending stocks	24.50	26.84	31.46	41.01	37.96	38.57	37.25
				Dollars per ton			
Price	138.89	143.67	134.11	130.44	129.71	124.19	129.61
				Million tons			
Alternative conditions:							
Supply	83.23	89.35	99.05	105.65	116.10	125.13	111.48
Domestic use	21.31	21.39	21.24	24.99	30.64	31.48	27.09
Exports	37.42	44.10	50.40	47.92	45.46	51.79	48.89
Ending stocks	24.50	23.86	27.41	32.74	40.00	41.86	35.50
				Dollars per ton			
Price	138.89	139.63	157.80	154.59	163.75	144.08	155.06
				Percent			
Percentage change:							
Supply	0	0	-3.56	-1.07	8.41	15.11	4.72
Domestic use	0	.38	-7.85	1.13	1.32	.32	-1.27
Exports	0	7.04	4.56	16.68	16.89	33.65	17.95
Ending stocks	0	-11.10	-12.87	-20.17	5.37	8.53	-4.78
				Dollars per ton			
Price	0	-2.81	17.66	18.51	26.24	16.02	19.61

dominated price effects in the USSR, Eastern Europe, Africa and the Middle East, and Other Western Europe. Net imports in other regions either declined or slightly increased.

Corn

Estimated U.S. corn exports during the last 4 years of the period under the alternative scenario increased an average of 35 percent over actual levels (table 24.5). Ending stocks fell more than 36 percent from actual levels, and simulated prices on average increased nearly 16 percent. The larger stock decline for corn compared with that for wheat was due to significantly lower corn release prices for the FOR and Government stocks relative to loan rates. Total availability increased more than 1 percent on average during the period because the increase in production more than offset the lower level of available stocks. Projected feed demand rose despite higher prices because more rapid U.S. income growth expanded demand for meat products.

Table 24.3--Effects of an alternative scenario on net wheat exports by major exporters, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Canada	15.00	17.00	17.60	21.40	21.80	19.40	20.05
Australia	15.00	10.60	11.00	8.10	10.60	15.30	11.25
EC	5.10	10.20	10.80	11.70	11.80	15.30	12.40
Argentina	4.80	3.90	4.30	7.50	9.70	8.00	7.38
Total non-U.S.	39.90	41.70	43.70	48.70	53.90	58.00	51.08
United States	37.42	41.20	48.20	41.07	38.89	38.75	41.73
				Percent			
Export share	48.40	49.70	52.45	45.75	41.91	40.05	45.04
				Million tons			
World total	77.32	82.90	91.90	89.77	92.79	96.75	92.80
Alternative conditions:							
Canada	15.00	17.00	18.17	22.59	23.42	20.39	21.14
Australia	15.00	10.56	11.23	7.98	10.63	14.83	11.17
EC	5.10	10.02	9.49	7.41	7.00	11.11	8.75
Argentina	4.80	3.80	3.14	4.68	7.53	5.60	5.24
Total non-U.S.	39.90	41.38	42.03	42.66	48.58	51.93	46.30
United States	37.42	44.10	50.40	47.92	45.46	51.79	48.89
				Percent			
Export share	48.40	51.59	54.53	52.90	48.34	49.93	51.43
				Million tons			
World total	77.32	85.48	92.43	90.58	94.04	103.72	95.19
				Percent			
Percentage change:							
Canada	0	0	3.24	5.56	7.43	5.10	5.33
Australia	0	-.38	2.09	-1.48	.28	-3.07	-.54
EC	0	-1.76	-12.13	-36.67	-40.68	-27.39	-29.21
Argentina	0	-2.56	-26.98	-37.60	-22.37	-30.00	-29.24
Total non-U.S.	0	-.77	-3.82	-12.40	-9.87	-10.47	-9.14
United States	0	7.04	4.56	16.68	16.89	33.65	17.95
Export share	0	3.81	3.96	15.64	15.34	24.67	14.90
				Million tons			
World total	0	3.11	.58	.90	1.35	7.20	2.51

Estimated net world corn exports increased an average of 15 percent for the period, exceeding those of wheat because income elasticity for feed grains was larger (table 24.6). U.S. market share also gained because of higher incomes and increased consumption in other exporting countries. The projected U.S. share remained on average near the actual peak of 1979/80, instead of declining 10 percent. Thus, market shares of other exporters fell.

The EC, Spain, and the USSR accounted for most of the 15-percent growth in imports (table 24.7). Higher prices dominated the effect of higher income growth in other regions. The EC, instead of moving from a net importer of 11 million tons in 1979/80 to a net exporter in 1984/85, remained a net importer of an estimated 9 million tons. Because the EC's internal prices are fixed, neither its internal prices nor its income growth were dampened by increased international prices.

Soybeans

Estimated U.S. soybean exports under the alternative scenario increased an average of over 20 percent in the 4-year period (table 24.8). Part of the increased volume was drawn from domestic crushing use and stocks, but a larger amount came from an increase of more than 4 percent in domestic supplies. Increased

Table 24.4--Effects of an alternative scenario on net wheat imports by major importers, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Japan	5.49	5.70	5.60	5.80	5.90	5.60	5.73
India	-.48	0	2.26	2.39	2.50	.15	1.83
USSR	11.60	15.50	19.00	19.70	20.00	27.10	21.45
China	8.90	13.80	13.20	13.00	9.60	7.40	10.80
Eastern Europe	5.00	3.40	4.30	2.20	1.50	-1.50	1.63
Africa & Middle East	17.08	17.04	18.27	16.99	22.85	24.99	20.78
Other Asia	12.56	11.19	11.17	12.09	12.98	14.21	12.61
Other Latin America	8.54	7.57	8.30	8.19	8.52	8.97	8.50
Other Western Europe	1.28	.45	1.29	-.52	.34	-.46	.16
Rest of world	7.35	8.25	8.51	9.93	8.60	10.29	9.33
Total	77.32	82.90	91.90	89.77	92.79	96.75	92.80
Alternative conditions:							
Japan	5.49	5.71	5.60	5.84	5.95	5.66	5.76
India	-.48	0	2.26	2.39	2.50	.15	1.83
USSR	11.60	18.29	22.98	23.40	23.67	30.55	25.15
China	8.90	12.72	12.36	10.90	6.85	6.94	9.26
Eastern Europe	5.00	3.83	4.61	2.61	1.91	-1.14	2.00
Africa & Middle East	17.08	17.73	19.19	18.27	24.80	28.89	22.79
Other Asia	12.56	11.15	10.44	11.48	12.57	14.10	12.15
Other Latin America	8.54	7.65	7.83	7.70	7.79	8.53	7.96
Other Western Europe	1.28	.41	.57	-.98	.05	-.94	-.33
Rest of world	7.35	8.00	6.60	8.98	7.95	10.97	8.63
Total	77.32	85.49	92.44	90.59	94.04	103.71	95.20
				Percent			
Percentage change:							
Japan	0	.18	0	.69	.85	1.07	.65
India	0	0	0	0	0	0	0
USSR	0	18.00	20.95	18.78	18.35	12.73	17.70
China	0	-7.83	-6.36	-16.15	-28.65	-6.22	-14.34
Eastern Europe	0	12.65	7.21	18.64	27.33	-24.00	7.29
Africa & Middle East	0	4.05	5.04	7.53	8.53	15.61	9.18
Other Asia	0	-.36	-6.54	-5.05	-3.16	-.77	-3.88
Other Latin America	0	1.06	-5.66	-5.98	-8.57	-4.91	-6.28
Other Western Europe	0	-8.89	-55.81	88.46	-85.29	104.35	12.93
Rest of world	0	-3.03	-22.44	-9.57	-7.56	6.61	-8.24
Total	0	3.12	.59	.91	1.35	7.19	2.51

import demand drove up estimated prices for the period an average of nearly 20 percent.

Estimated soybean exports of all major exporting countries increased nearly 13 percent on average during the period (table 24.9). Exports in Brazil and Argentina declined due to increased domestic use. Brazilian soybean exports dropped to nearly half actual levels, but most of Brazil's exports were in soymeal. The U.S. export share gained on average 5 percent. The share during the last 2 years gained over 7 and 10 percent.

Developed countries accounted for most of the import growth (table 24.10). Europe, Japan, and the USSR increased imports, with the EC the major growth area in volume. Higher prices choked off increased soybean demand in the rest of the world.

Industry Performance Measures

Higher prices and the removal of PIK and paid diversion programs under the alternative scenario increased acreage planted in all three crops over actual levels, especially during the last 2 years of the period (table 24.11 and fig. 24.7). The largest increases were during the PIK year for wheat and corn (1983/84) and the following year for wheat when there had been a large paid diversion program. Planted acreage looked much like that of the mid-1970's.

Higher prices and more acreage planted increased crop production value an average 30 percent over the last 4 years (table 24.12 and fig. 24.7). Production value for corn gained over $5 billion per year, and that for wheat and

Table 24.5--Effects of an alternative scenario on U.S. domestic supply and use of corn, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Supply	234.51	209.71	232.50	264.40	185.30	213.30	223.88
Domestic use	131.64	123.63	127.32	137.65	119.56	131.53	129.02
Exports	61.80	59.82	49.96	47.50	47.37	46.69	47.88
Ending stocks	41.07	26.26	55.22	79.25	18.37	35.08	46.98
				Dollars per ton			
Price	99.21	122.43	98.42	106.29	129.91	104.33	109.74
				Million tons			
Alternative conditions:							
Supply	234.51	209.71	229.63	246.24	200.97	223.72	225.14
Domestic use	131.64	120.97	130.26	138.60	124.16	129.78	130.70
Exports	61.80	65.53	58.50	62.11	65.99	71.30	64.48
Ending stocks	41.07	23.21	40.87	45.53	10.82	22.64	29.97
				Dollars per ton			
Price	99.21	126.90	105.01	125.60	157.53	121.79	127.48
				Percent			
Percentage change:							
Supply	0	0	-1.23	-6.87	8.46	4.88	1.31
Domestic use	0	-2.15	2.31	.69	3.85	-1.33	1.38
Exports	0	9.55	17.09	30.76	39.31	52.71	34.97
Ending stocks	0	-11.61	-25.99	-42.55	-41.10	-35.46	-36.27
				Dollars per ton			
Price	0	3.65	6.70	18.17	21.26	16.74	15.71

soybeans each rose over $3 billion a year. Wheat production values gained slightly more in percentage terms than the other two crops because of larger acreage gains in wheat.

Estimated export values gained nearly 50 percent for the three commodities during the last 4 years of the period because of the increased volume and price levels of the alternative scenario (table 24.13 and fig. 24.7). Corn and soybeans gained relatively more than wheat because world income boosted demand for these commodities more.

The alternative scenario's effect on net farm income was derived from a standard farm sector balance sheet. Because these balance sheets usually are based on calendar years, this analysis covers calendar years 1981-84. Increases in cash marketing receipts from actual levels ranged from about $1.3 billion in 1981 to over $15 billion in 1984 under the

Table 24.8--Effects of an alternative scenario on net feed grain exports by major exporters, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Argentina	5.13	13.88	10.14	11.41	10.67	10.42	10.66
Canada	3.64	3.35	6.62	5.80	6.61	3.22	5.56
Australia	3.89	2.84	3.38	1.24	5.75	6.66	4.26
Thailand	2.34	2.40	3.51	2.33	3.11	3.35	3.08
South Africa	3.72	4.93	4.57	-2.33	.80	.97	1.00
Total non-U.S.	18.72	27.40	28.22	18.45	26.94	24.62	24.56
United States	71.07	69.21	58.40	54.00	55.80	55.50	55.93
				Percent			
Export share	79.15	71.64	67.42	74.53	67.44	69.27	69.67
				Million tons			
World total	89.79	96.61	86.62	72.45	82.74	80.12	80.48
Alternative conditions:							
Argentina	5.13	13.66	9.37	6.98	7.23	6.29	7.47
Canada	3.64	2.96	6.62	4.65	6.96	1.89	5.03
Australia	3.89	2.89	3.53	1.57	6.10	6.79	4.50
Thailand	2.34	2.30	3.18	1.80	2.36	2.41	2.44
South Africa	3.72	5.34	4.72	-2.54	.32	.20	.68
Total non-U.S.	18.72	27.15	27.42	12.46	22.97	17.58	20.11
United States	71.07	74.92	66.94	68.61	74.42	80.11	72.52
				Percent			
Export share	79.15	73.40	70.94	84.63	76.41	82.00	78.50
				Million tons			
World total	89.79	102.07	94.36	81.07	97.39	97.69	92.63
				Percent			
Percentage change:							
Argentina	0	-1.59	-7.59	-38.83	-32.24	-39.64	-29.57
Canada	0	-11.64	0	-19.83	5.30	-41.30	-13.96
Australia	0	1.76	4.44	26.61	6.09	1.95	9.77
Thailand	0	-4.17	-9.40	-22.75	-24.12	-28.06	-21.08
South Africa	0	8.32	3.28	9.01	-60.00	-79.38	-31.77
Total non-U.S.	0	-.91	-2.83	-32.47	-14.74	-28.59	-19.66
United States	0	8.25	14.62	27.06	33.37	44.34	29.85
Export share	0	2.46	5.22	13.55	13.31	18.38	12.61
World total	0	5.65	8.94	11.90	17.71	21.93	15.12

alternative scenario (table 24.14). Most of these increases came from crop marketings because livestock receipts declined slightly in the first 2 years and increased slightly in the last 2 years. Because of higher feed prices, the livestock industry suffered a net loss over the period. Cash receipts were slightly lower, and production expenses were higher.

Government payments to producers for target price support, paid diversion (including PIK), and disaster relief fell $900 million and $1.4 billion from actual in the first 2 years. Payments in the last 2 years fell $7 billion and $6 billion. The large reduction in payments the last 2 years reflected removal of the PIK program. Increases in total receipts from actual levels ranged from $500 million to $10.6 billion, an average of $5.1 billion per year.

Production expenses were influenced by changing macroeconomic assumptions and increased crop area planted and harvested. Estimated expenses changed less than 1 percent in the first 2 years but rose sharply in the last 2 years when planted area rose 12-27 percent over actual levels. Inventory increased in most years under the alternative scenario, especially in 1983, because the changed commodity market conditions meant farmers did not place much grain and soybeans under loan.

Changes in receipts, expenses, and inventories under the alternative scenario increased net farm income $2.9-$4.5 billion in the first 2 years and reduced it $1.4-$2.3 billion in the last 2 years (fig. 24.8). Over the 4-year period, net farm income rose an average $1 billion per year. However, the reduction in net farm income in the last 2 years resulting from the more favorable macroeconomic alternative is largely the result of the PIK program. Foregone PIK payments of $6-$7 billion the last 2 years apparently exceeded profits farmers could have earned under the alternative macroeconomic conditions by putting land into production.

Table 24.7--Effects of an alternative scenario on net feed grain imports by major importers, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
EC	9.30	6.56	5.45	1.79	1.24	-4.04	1.11
Japan	18.89	18.86	18.32	18.70	20.51	20.41	19.49
Spain	5.90	3.72	7.79	6.72	4.80	3.42	5.68
USSR	18.40	18.00	25.50	11.30	11.50	27.00	18.83
Eastern Europe	8.80	9.76	4.85	.78	.97	.58	1.80
High-income East Asia	6.18	6.79	7.88	9.23	8.69	8.72	8.63
Rest of world	22.32	32.92	16.83	23.93	35.03	24.03	24.96
Total	89.79	96.61	86.62	72.45	82.74	80.12	80.48
Alternative conditions:							
EC	9.30	6.79	10.14	10.11	10.92	6.36	9.38
Japan	18.89	18.83	18.44	19.09	20.94	20.72	19.80
Spain	5.90	4.03	8.66	7.95	6.33	5.27	7.05
USSR	18.40	19.87	28.16	13.79	15.19	29.79	21.73
Eastern Europe	8.80	12.34	4.54	.13	.48	.33	1.37
High-income East Asia	6.18	6.77	7.47	8.25	7.73	7.85	7.83
Rest of world	22.32	33.44	16.96	21.80	35.80	27.39	25.49
Total	89.79	102.07	94.37	81.12	97.39	97.71	92.65
				Percent			
Percentage change:							
EC	0	3.51	86.06	464.80	780.65	-257.43	268.52
Japan	0	-.16	.66	2.09	2.10	1.52	1.59
Spain	0	8.33	11.17	18.30	31.88	54.09	28.86
USSR	0	10.39	10.43	22.04	32.09	10.33	18.72
Eastern Europe	0	26.43	-6.39	-83.33	-50.52	-43.10	-45.84
High-income East Asia	0	-.29	-5.20	-10.62	-11.05	-9.98	-9.21
Rest of world	0	1.58	.77	-8.90	2.20	13.98	2.01
Total	0	5.65	8.95	11.97	7.71	21.95	15.14

Government Stocks and Costs

The estimated higher prices of the macroeconomic alternative made possible the release of some Government and FOR stocks during the period of analysis. Relatively few FOR stocks and no Government stocks of wheat were released (table 24.15). In contrast, FOR corn stocks were completely emptied in 3 of the 5 years, and Government corn stocks were emptied in the last 2 years. The difference between the two commodities was that the release price for corn was not as high relative to the loan rate as it was for wheat. The very small amounts of Government soybean stocks were also emptied during this period.

Lower stock levels, elimination of PIK and paid diversion programs, and reduction or elimination of deficiency payments in many years substantially reduced Government program costs during this period (fig. 24.9). Costs in fiscal years 1982/83 to 1984/85 were 43-54 percent lower, and average savings over the last 4 years were more than $7 billion annually. More detail on these estimated cost reductions is provided in table 24.16. Deficiency and diversion payments were eliminated completely in the first 5 years and reduced over 70 percent in fiscal year 1984/85. PIK payments for acreage reduction were also eliminated. Net loan activity costs declined because when market prices were higher, fewer loans were taken and a higher proportion was repaid. The lower FOR and Government stock levels also meant lower storage costs and producer storage payments. These estimated savings are probably conservative because estimating interest cost savings was not possible.

Table 24.8--Effects of an alternative scenario on U.S. domestic supply and use of soybeans, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Supply	66.30	58.68	62.65	66.54	53.90	55.43	59.63
Domestic use	32.72	30.45	30.44	32.53	28.91	30.55	30.61
Exports	23.82	19.71	25.28	24.63	20.21	16.28	21.60
Ending stocks	9.76	8.52	6.93	9.38	4.78	8.60	7.42
				Dollars per ton			
Price	230.75	278.15	221.93	209.07	286.97	213.11	232.77
				Million tons			
Alternative conditions:							
Supply	66.30	58.68	60.33	68.50	57.55	61.72	62.03
Domestic use	32.72	30.37	27.83	32.60	25.00	31.15	29.14
Exports	23.82	21.15	26.83	27.90	26.03	21.78	25.63
Ending stocks	9.76	7.16	5.68	8.00	6.52	8.79	7.25
				Dollars per ton			
Price	230.75	276.68	271.16	252.80	355.31	237.36	279.16
				Percent			
Percentage change:							
Supply	0	0	-3.70	2.94	6.77	11.35	4.34
Domestic use	0	-.27	-8.59	.23	-13.54	1.97	-4.98
Exports	0	7.31	6.12	13.26	28.82	33.76	20.49
Ending stocks	0	-15.96	-18.03	-14.75	36.39	2.21	1.46
				Dollars per ton			
Price	0	-.53	22.18	20.92	23.82	11.38	19.57

CONCLUSIONS

Continuation of the 1970's macroeconomic environment would have substantially increased domestic and foreign demand for wheat, corn, and soybeans. Combined effects of the high rates of demand growth were so strong as to empty FOR and Government corn stocks in 3 of the 5 years of the analysis. FOR wheat stocks declined slightly, and Government soybean stocks were eliminated. PIK and paid diversion programs were no longer needed in the 1980's, resulting in additional substantial savings to the Government.

Under this hypothetical scenario, export values would have continued to grow during the period, although not as rapidly as in the 1970's (fig. 24.7). We cannot speculate as to how this hypothetical macroeconomic environment could have been brought about during the 1980's or even whether it would have been possible. However, we conclude from the results that the change in the macroeconomic environment that did take place in the 1980's significantly depressed the U.S. agricultural sector. Slower income growth in developed and developing countries stunted growth in demand for all three commodities, and the stronger U.S. dollar made U.S. products less competitive with other exporters.

These results provide quantitative evidence to support what many economists, legislators, and

Table 24.9--Effects of an alternative scenario on net soybean exports by major exporters, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Brazil	1.06	0.56	-0.37	1.23	1.59	3.10	1.39
Argentina	2.73	2.19	1.88	1.42	2.97	3.29	2.39
China	-.60	-.40	-.38	.29	.73	1.05	.42
Total non-U.S.	3.19	2.35	1.13	2.94	5.29	7.44	4.20
United States	23.82	19.71	25.28	24.63	20.21	16.28	21.60
				Percent			
Export share	88.19	89.35	95.72	89.34	79.25	68.63	83.24
				Million tons			
World total	27.01	22.06	26.41	27.57	25.50	23.72	25.80
Alternative conditions:							
Brazil	1.06	.59	-.13	1.06	.40	1.50	.71
Argentina	2.73	2.19	1.88	1.35	2.65	3.19	2.27
China	-.60	-.37	-.36	.32	.86	1.08	.48
Total non-U.S.	3.19	2.41	1.39	2.73	3.91	5.77	3.45
United States	23.82	21.16	26.83	27.88	26.04	21.80	25.64
				Percent			
Export share	88.19	89.81	95.11	91.38	86.57	79.14	88.05
				Million tons			
World total	27.01	23.57	28.22	30.61	29.95	27.57	29.09
				Percent			
Percentage change:							
Brazil	0	5.36	-64.86	-13.82	-74.84	-51.61	-51.29
Argentina	0	0	0	-4.93	-10.77	-3.04	-4.69
China	0	-7.50	-5.26	10.34	17.81	2.86	6.44
Total non-U.S.	0	2.55	23.01	-7.14	-26.09	-22.45	-8.17
United States	0	7.36	6.13	13.20	28.85	33.91	20.52
Export share	0	.52	-.64	2.29	9.23	15.30	6.55
World total	0	6.84	6.85	11.03	17.45	16.23	12.89

farm leaders have suggested: The performance of the U.S. agricultural sector depends heavily upon the performance of U.S. and international macroeconomies. This analysis concludes that the unfavorable macroeconomic environment in the 1980's substantially reduced the volume and value of exports and the level of farm prices. Because commodity programs are designed to reduce price and income risks for farmers, the general economic deterioration substantially increased Government costs associated with loan programs, income payments, and stock disposal through PIK. Thus, in this analysis, the effect on Government cost was much larger than on net farm income. Government programs absorbed much of the market impact of the unfavorable macroeconomic conditions.

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Table 24.10--Effects of an alternative scenario on net soybean imports by major importers, fiscal years

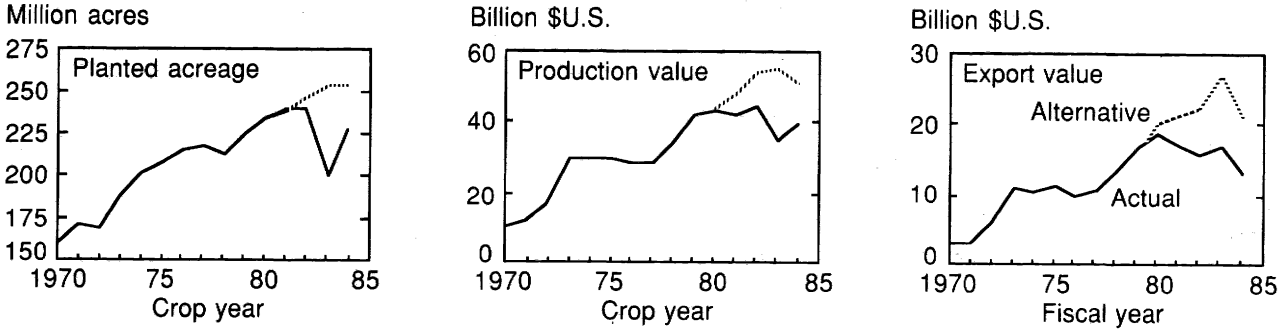
Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
EC	11.98	10.01	12.35	11.89	9.69	9.81	10.94
Spain	3.10	2.79	3.20	3.04	2.60	2.00	2.71
Japan	4.40	4.21	4.49	4.87	4.73	4.61	4.68
Eastern Europe	.85	.52	.48	.78	.84	.59	.67
USSR	1.47	1.39	1.48	1.05	.95	.85	1.08
Rest of world	5.21	3.14	4.41	5.94	6.69	5.86	5.73
Total	27.01	22.06	26.41	27.57	25.50	23.72	25.80
Alternative conditions:							
EC	11.98	10.92	13.84	14.17	12.72	12.29	13.26
Spain	3.10	3.26	3.67	4.07	4.09	3.13	3.74
Japan	4.40	4.25	4.52	4.91	4.84	4.72	4.75
Eastern Europe	.85	.58	.55	.85	1.19	.85	.86
USSR	1.47	1.43	1.52	1.08	.98	.87	1.11
Rest of world	5.21	3.15	4.10	5.52	6.15	5.70	5.37
Total	27.01	23.59	28.20	30.60	29.97	27.56	29.08
				Percent			
Percentage change:							
EC	0	9.09	12.06	19.18	31.27	25.28	21.95
Spain	0	16.85	14.69	33.88	57.31	56.50	40.59
Japan	0	.95	.67	.82	2.33	2.39	1.55
Eastern Europe	0	11.54	14.58	8.97	41.67	44.07	27.32
USSR	0	2.88	2.70	2.86	3.16	2.35	2.77
Rest of world	0	.32	-7.03	-7.07	-8.07	-2.73	-6.23
Total	0	6.94	6.78	10.99	17.53	16.19	12.87

Table 24.11--Effects of an alternative scenario on planted U.S. acreage of wheat, corn, and soybeans, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Wheat	71.6	80.6	88.9	87.4	76.4	79.2	83.0
Corn	81.4	84.0	84.1	81.9	60.2	80.5	76.7
Soybeans	71.6	69.9	67.5	70.9	63.8	67.7	67.5
Total	224.6	234.5	240.5	240.2	200.4	227.4	227.1
Alternative conditions:							
Wheat	71.6	80.6	88.1	90.7	97.9	96.3	93.27
Corn	81.4	84.0	84.2	80.8	85.3	84.5	83.70
Soybeans	71.6	69.9	66.4	74.7	71.0	73.8	71.48
Total	224.6	234.5	238.7	246.2	254.2	254.6	248.44
				Percent			
Percentage change:							
Wheat	0	0	-.9	3.8	28.1	21.6	13.15
Corn	0	0	.1	-1.3	41.7	5.0	11.36
Soybeans	0	0	-1.6	5.4	11.3	9.0	6.01
Total	0	0	-.7	2.5	26.8	12.0	10.14

Figure 24.7

Wheat, Corn, and Soybeans Under Alternative Economic Conditions



Sources: *(1, 3, 8)*

Table 24.12--Effects of an alternative scenario on U.S. production value of wheat, corn, and soybeans, fiscal years

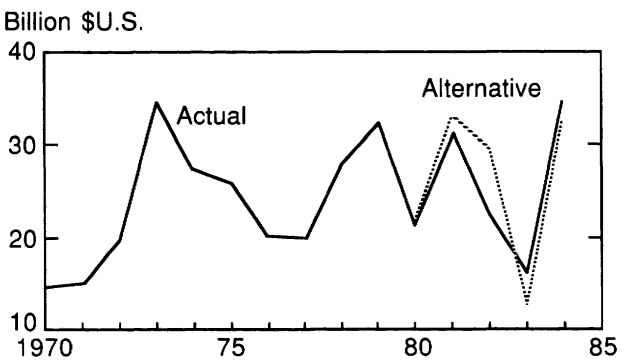
Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Wheat	8,070	9,310	10,160	9,822	8,548	8,768	9,326
Corn	19,979	20,647	20,297	22,234	13,777	20,337	19,161
Soybeans	14,199	13,611	12,013	12,461	12,777	10,794	12,011
Total	42,247	43,567	42,476	44,517	35,102	39,898	40,498
Alternative conditions:							
Wheat	8,070	9,028	11,930	12,098	13,449	12,143	12,405
Corn	19,979	21,395	21,661	25,962	24,292	25,876	24,448
Soybeans	14,199	13,542	14,407	15,839	17,570	13,114	15,233
Total	42,247	43,965	47,998	53,898	55,310	51,134	52,085
				Percent			
Percentage change:							
Wheat	0	-3.0	17.4	23.2	57.3	38.5	34.1
Corn	0	3.6	6.7	16.8	76.3	27.2	31.8
Soybeans	0	-.5	19.9	27.1	37.5	21.5	26.5
Total	0	.9	13.0	21.1	57.6	28.2	30.0

Table 24.13--Effects of an alternative scenario on U.S. export values of wheat, corn, and soybeans, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million tons			
Actual conditions:							
Wheat	5,197	5,919	6,464	5,357	5,044	4,812	5,420
Corn	6,131	7,324	4,917	5,049	6,154	4,871	5,248
Soybeans	5,496	5,482	5,610	5,149	5,800	3,469	5,007
Total	16,825	18,725	16,992	15,555	16,998	13,153	15,674
Alternative conditions:							
Wheat	5,197	6,144	7,996	7,366	7,391	7,487	7,560
Corn	6,131	8,281	6,099	7,767	10,353	8,646	8,216
Soybeans	5,496	5,860	7,301	6,994	9,213	5,163	7,168
Total	16,825	20,285	21,396	22,127	26,957	21,296	22,944
				Percent			
Percentage change:							
Wheat	0	3.8	23.7	37.5	46.5	55.6	40.8
Corn	0	13.1	24.0	53.8	68.2	77.5	55.9
Soybeans	0	6.9	30.1	35.8	58.9	48.8	43.4
Total	0	8.3	25.9	42.2	58.6	61.9	47.2

Figure 24.8

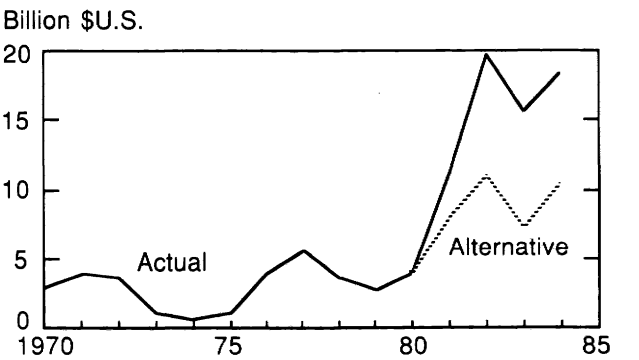
U.S. Farm Income Under Alternative Economic Conditions



Calendar years. Sources: *(1, 3, 8).*

Figure 24.9

U.S. Government Expenditures Under Alternative Economic Conditions



Fiscal years. Sources: *(1, 3, 8).*

Table 24.14--Effects of an alternative scenario on U.S. cash receipts, production expenses, and net farm income

Item	1981	1982	1983	1984	1981-84 average
			Billion dollars		
Actual conditions:					
Cash receipts					
Crops	72.9	72.7	66.8	69.1	70.4
Livestock	69.2	70.3	69.4	72.7	70.4
Total	142.1	143.0	136.2	141.8	140.8
Government payments	1.9	3.5	9.3	8.4	5.8
Receipts before invoice change	160.2	163.0	161.2	166.2	162.6
Production expenses	136.1	136.9	135.6	139.5	137.0
Net income before invoice change	24.1	26.1	25.6	26.7	25.6
Value of invoice change	5.8	-1.4	-10.6	7.8	.4
Net farm income	29.9	24.7	15.0	34.5	26.2
Alternative conditions (change from actual):					
Cash receipts--					
Crops	2.0	4.7	12.3	14.8	8.5
Livestock	-.7	-.6	.3	.5	-.1
Total	1.3	4.1	12.6	15.3	8.3
Government payments	-.9	-1.4	-7.1	-6.0	-3.9
Receipts before invoice change	.5	3.0	6.1	10.6	5.1
Production expenses	-1.6	-1.4	12.0	11.4	5.1
Net income before invoice change	2.1	4.3	-5.9	.8	.3
Value of invoice change	.8	.2	3.6	-.6	1.0
Net farm income	2.9	4.5	-2.3	-1.4	.9
			Percent		
Percentage change over actual:					
Cash receipts--					
Crops	2.74	6.46	18.41	21.42	12.26
Livestock	-1.01	-.85	.43	.69	-.19
Total	.91	2.87	9.25	10.79	5.96
Government payments	-47.37	-40.00	-76.34	-71.43	-58.79
Receipts before invoice change	.31	1.84	3.78	6.37	3.08
Production expenses	-1.18	-1.02	8.85	8.17	3.72
Net income before invoice change	8.71	16.48	-23.05	3.00	1.17
Value of invoice change	13.79	-14.29	-33.96	-7.69	-10.38
Net farm income	9.70	18.22	-15.33	-4.06	3.44

Table 24.15--Effects of an alternative scenario on U.S. Government stocks of wheat, corn, and soybeans, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million bushels			
Actual conditions:							
Wheat--							
FOR	260	360	560	1,060	1,010	654	821
CCC	188	200	190	192	188	378	237
Corn--							
FOR	619	180	1,274	1,508	425	437	911
CCC	249	232	294	1,134	201	240	467
Soybeans--							
CCC	0	0	3	21	0	32	14
Alternative conditions:							
Wheat--							
FOR	260	360	370	853	857	654	684
CCC	188	200	190	192	188	378	237
Corn--							
FOR	619	0	671	865	0	0	384
CCC	249	232	232	232	0	0	116
Soybeans--							
CCC	0	0	0	0	0	0	0
				Percent			
Percentage change:							
Wheat--							
FOR	0	.1	-33.9	-19.6	-15.1	0	-17.2
CCC	0	0	0	0	0	0	0
Corn--							
FOR	0	-100.0	-47.3	-42.6	-100.0	-100.0	-72.5
CCC	0	.2	-21.0	79.5	-100.0	-100.0	-75.1
Soybeans--							
CCC	0	0	-100.0	-100.0	0	-100.0	-75.0

Table 24.16--CCC outlay changes for wheat, feed grain, and soybean programs under an alternative scenario, fiscal years

Item	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1981-84 average
				Million dollars			
Direct payments 1/	-136	0	-696	-2,268	-1,522	-3,873	-2,090
PIK program 2/	0	0	0	-403	-7,055	-611	-2,017
Loan programs 3/	0	-23	-2,665	-6,232	148	-3,331	-3,020
Total	-136	-23	-3,361	-8,903	-8,429	-7,815	-7,127

1/ Deficiency and diversion payments.
2/ PIK payments.
3/ Loans and purchases less repayments and sales plus storage and handling plus FOR storage payments.