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The World Coarse Grain Market—Government Intervention and Multilateral Policy Reform

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Abstract

The production, consumption, and trade of coarse grains have been
shaped by domestic government policies such as price and income
supports, input subsidies, and trade policies such as export
subsidies, quotas, and variable levies. Recent studies suggest
that world efficiency gains from agricultural trade reform could
be substantial. Research suggests that phasing down worldwide
government support and protection of agriculture would increase
world coarse grain trade and raise coarse grain prices. World
coarse grain production and consumption would rise slightly. The
United States and Argentina would gain most in trade as the EC-
12, Canada, and China exports contract, with the EC-12 and China
becoming net importers.

Keywords: Trade liberalization, coarse grains, policy reform,
government intervention, world trade, international markets

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Foreword

This report is a product of the trade liberalization project conducted in the Commodity Economics Division of the Economic Research Service. Eleven commodity monographs in the series "World Commodity Markets--Government Intervention and Multilateral Policy Reform" are anticipated from this study. The objectives of this series are to describe the role of individual commodities in world agricultural markets, to provide an overview of current policies for specific commodities throughout the world, and to evaluate the effects of a reduction in government supports and artificial barriers that hinder free competition among countries in the production and trade of commodities.

The monographs draw on earlier and ongoing analyses of government intervention and trade liberalization conducted by ERS in support of the Uruguay Round of multilateral trade negotiations, particularly calculations of producer and consumer subsidy equivalents and analyses of multilateral liberalizatin based on ERS's Static World Policy Simulation Model (SWOPSIM). The commodity reports build on these efforts and others in the agricultural economics profession to bring a commodity focus to ERS's work on global policy reform.

CED's study has been coordinated by Nicole Ballenger, Kate Buckley, and Joy Harwood. Pat O'Brien, Tony Grano, Mack Leath, and Bill Lin provided vision, direction, and support. Alden Manchester coordinated the outside reviews. Anticipated commodity reports and authors include:

Beef--Bill Hahn
Coarse Grains--Bengt Hyberg, Stephanie Mercier, and Lin Hoffman
Dairy--Don Blayney, Dick Fallert, and Bill Paddock
Fruits, Vegetables, Wine, and Tropical Beverages--Kate Buckley
Oilseeds--Tom Bickerton and Joe Glauber
Poultry--Bob Bishop, Stephanie Mercier, Lee Christensen, and
 Larry Witucki
Pork--Shayle Shagam
Rice--Nathan Childs
Sugar--Ron Lord and Bob Barry
Tobacco--Verner Grise
Wheat--Joy Harwood and Ken Bailey

The authors are grateful to numerous analysts in both the Agriculture and Trade Analysis (ATAD) and Commodity Economics (CED) Divisions in ERS for helpful comments, Jerry Sharples and Fred Surls of ERS and Patrick Westhoff of Iowa State for thorough critical reviews, and to Brenda Toland, Brenda Powell, Linda Hatcher and others who helped in the publication process. Information from previous ERS and OECD studies was used extensively in this report.

For a current listing of ERS work in support of the Uruguay Round, see <u>Bibliography of Research Supporting the Uruguay Round of the GATT</u>, Agriculture and Trade Analysis Division, Economic Research Service, U.S. Dept. of Agr., AGES 89-64, Dec. 1989.

Contents

Summary

Coarse grain production, consumption, and trade have increased substantially since 1960. The production and consumption of coarse grains has been strongly influenced by domestic policies such as price and income supports and input subsidies, and by trade policies such as export subsidies, quotas, and variable levies. About two-thirds of world coarse grains are used for feed, with the remainder being used for seed, industrial, and food uses. Feed use of coarse grains is more price-responsive than food, seed, and industrial uses. A region's response to trade liberalization will be heavily influenced by current agricultural policies, the change in relative prices between agricultural commodities, and the region's competitiveness in grain markets and livestock markets.

Trade liberalization is defined in this analysis as a substantial relaxation of trade barriers and price support levels by major agricultural traders. This report assumes that the major developed countries, such as the United States, the European Community (EC), Canada, Australia, and Japan, which are participating in the current round of the General Agreement on Tariffs and Trade (GATT) negotiations (called the Uruguay Round), would liberalize their domestic and trade policies by reducing the scope of the protection afforded. It also assumes that other countries which are active in the world coarse grain market, but not directly participating in the reform (such as the USSR and China), would respond to the changes in world prices caused by reform.

Coarse grain producers in the EC would respond to the elimination of high intervention prices and variable levies by substantially decreasing coarse grain production, resulting in the EC returning to a net import position for coarse grains. The EC's change from a net exporter to a net importer would be the largest response in coarse grain markets to trade liberalization. China would also move from a net exporting to a net importing position, but this change is expected to occur with or without trade liberalization. Canada would respond by reducing exports of coarse grains, though still remaining a net exporter. Australia is not expected to increase its role in world coarse grain markets because of opportunities in wheat and beef production.

It is expected that Japan would respond to trade liberalization by reducing its imports of coarse grains. The Japanese livestock sector is heavily protected and in the absence of such support would contract considerably, requiring less coarse grain imports for feeding purposes.

The United States, Argentina, and Thailand are expected to be in a position to increase production to supply the coarse grain markets opened by the departure of the exporters listed above. Thailand and Argentina have shortrun resource and infrastructural constraints on their capacity to increase production to compete fully for these markets, but these nations could expand coarse grain production to a limited extent.

In the United States, the elimination of the coarse grain program deficiency payments and support prices would lower the incentive prices farmers receive for coarse grains. This decline would make the production of alternative crops such as soybeans more attractive and open 28 million acres of land for crop production. U.S. coarse grains would be grown using less-intensive production methods. Farmers would attempt to minimize production costs by shifting to minimum cultivation methods and using less chemicals.

Planted acreage in coarse grains would be expected to increase as large amounts of land previously idled by the acreage reduction program and paid land diversion components of the coarse grain commodity program returned to crop production. The increased cropland in coarse grain production is expected to outweigh the effect of lower yields resulting from the less-intensive application of fertilizers and pesticides.

Demand for coarse grains in the United States would increase as livestock export demand increased as a result of trade liberalization. Because approximately 60 percent of the total disappearance of U.S. coarse grains is attributed to feed use, and because feed demand for coarse grains is more elastic than other domestic uses, increases in the demand for livestock products due to lower consumer prices for those products in many countries would stimulate coarse grain production. Increased export demand would also stimulate coarse grain production.

As the agricultural sector adjusted to a more market-oriented environment, the structure of U.S. agriculture would continue to change. After incentives for program crops were eliminated and income support activities ended, price variability in the domestic market would increase. Increased price variability would provide incentives for farmers to diversify their operations.

The conclusion is that U.S. coarse grain output would rise slightly to moderately as a result of trade liberalization because some of the land now in the acreage reduction and paid land diversion programs would be brought back into coarse grain production and offset the minor yield declines. Because soybeans are well suited for production in the Corn Belt, some of the acres now planted to corn and idled acres could switch from corn to soybeans. The magnitude of the increase in coarse grain production would, therefore, depend on the relationship between prices for soybeans and for corn.

As commodity programs ended, the role of the United States would change from that of storing the majority of the world's surplus coarse grains to maintaining a working supply of grain and marketing the majority of its annual production in domestic and world markets. This new position would make U.S. producers more responsive to world markets and more vulnerable to price fluctuations.

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Introduction

World production and consumption of agricultural goods are
influenced by government intervention through a broad array of
policy instruments. Government policies aim at supporting
commodity prices and farm incomes, assuring food supplies,
shaping the trade balance, and supporting other national goals
that are political in nature. The policies used have had mixed
results in meeting these goals. Moreover, they have increased
consumer and taxpayer costs, increased export subsidies and other
distorting practices, generated large commodity surpluses,
reduced world trade, and contributed to international disputes.
In recent years, government intervention has become more
intrusive in response to the market downturn of the 1980's.
Government expenditures on agricultural programs have risen
rapidly, increasing market distortion in the world agricultural
market, prompting concerns of major powers about the costs these
policies are imposing.

This report describes the functioning of the coarse grain market,
examines the effect of government intervention on the production,
consumption, and trade of coarse grains, and analyzes the coarse
grain market in an environment free of trade-distorting
agricultural policies. The effects of trade liberalization
presented here were obtained by examining qualitatively the
agricultural sectors of individual nations and the policies which
influence them. The response of the individual nations to trade
reform was examined in turn until an equilibrium was obtained.
The results were compared with those obtained from previous
research and extensively reviewed by country, commodity, and
trade analysts. In addition to this particular review process,
it should be recognized that there are alternative views on the
state of world agriculture under trade reform. Research on the
effects of liberalized trade continues, but given the complexity
of the task, a consensus may never be obtained.

This analysis examines what would happen if the major
industrialized countries participating in the GATT (General
Agreement on Tariffs and Trade) negotiations, called
industrialized market economies, removed substantial portions

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of their tariff and nontariff barriers under the trade
liberalization scenario as a result of a successful conclusion to
the Uruguay Round. Other major agricultural parties, such as
Argentina and Brazil, are members of GATT, but as less-developed
countries they may be accorded special treatment in the
agreement. These countries will not necessarily entirely remove
their support, but will nonetheless respond to the actions of
other major producers. Finally, countries such as the USSR and
China, which are not yet GATT signatories but nonetheless play
important roles in the world coarse grain market, are assumed to
continue current reforms and also respond to the changing world
market situation.

Agriculture and the GATT

GATT was negotiated at the end of World War II to provide an
international forum to promote reduced government interference in
all international trade. However, the seven rounds of
liberalization talks completed to date have focused heavily on
manufactured goods, with little attention afforded agriculture.
For the first time in history, agricultural policies are being
seriously discussed within the GATT framework. Moreover, many
governments have come to recognize that many agricultural trade
problems, such as low world prices, are deepened by domestic food
and farm policies, in addition to export subsidies or import
restrictions.

According to classical economic theory, a nation will sell goods
it can produce more cheaply than other nations and buy other
goods which can be purchased for less than it costs to produce at
home. Under these circumstances, a nation is said to have an
absolute advantage in that good which it can produce for less.

Even if a country has an absolute advantage in the production of
several goods, it could still be to a country's benefit to trade.
The theory of comparative advantage, first postulated by David
Ricardo in the early 1800's, states that, in a simple two-good
world, a country can improve welfare by shifting resources to the
production of the good it can produce at the lowest cost relative
to other countries. The increased production of this good can
then be exported in exchange for a larger quantity of the other
good than has been lost by the shift of resources. Comparative
advantage is based on the concept of "opportunity cost" within
nations, defined as the value of a reduction in the output of one
product releasing inputs necessary to increase the production of
another good. Resource allocation is at the core of this theory.
Since individual nations are endowed with different resource
bases, labor forces, climates, and technological inputs,
opportunity costs for production vary among nations. Mutually
advantageous trade can arise among nations as long as differences
in opportunity costs exist.

Policies to support agriculture tend to change the input and
output prices that would normally prevail in a free-market

economy and to distort the set of opportunity costs the farmer faces. Under such conditions, trade that would normally lead to benefits to both parties in the transaction may not occur.

The world agricultural trade environment may see substantial policy reforms. In the communique issued from Punta del Este, in September 1986 at the start of the Uruguay Round of multilateral trade negotiations, participating nations publicly stated for the first time that domestic farm programs have an important distorting effect on world agricultural trade. In deciding to form an agricultural negotiating group so early in the round, GATT members sent a sharp signal to the world about their serious intention to deal with problems caused by agricultural support and protection.

The large budget cost of commodity programs is the factor that may now override domestic considerations that in the past have led to the adoption of extensive commodity programs. In the face of mounting public debt and budget deficits in many developed countries, the billions of dollars previously devoted to supporting farm income or encouraging farm exports are now vulnerable. Most countries contemplating such cuts wish to cushion the impact on producers in some way. The anticipated increase in trade volume and potential increase in some major world commodity prices resulting from multilateral trade liberalization would alleviate adverse farm income effects, as would so-called "decoupled payments" (that is, direct payments not linked to production or marketing) that may be permitted in a free-trade environment.

The midterm ministerial review in Montreal in early December 1988 ended in a deadlock between the United States and the EC on agriculture. In the December meetings, the EC refused to accept any language in agreements implying a total elimination of trade-distorting farm programs and the United States balked at settling for anything less.

In the followup meetings in Geneva in early April 1989, the United States and the EC exhibited increased flexibility and the parties eventually reached an agreement calling for "substantial, progressive reductions in agricultural protection" in the long term, which also froze protection at current levels for 1989. A framework has thus been established for further negotiations and dialogue will continue, with high hopes for achieving substantial progress in agriculture.

Nine countries or country groups have submitted comprehensive proposals to be considered by the GATT agricultural negotiating group in the Uruguay Round. Table 1 summarizes six of these submissions. Most of the proposals are quite lengthy and complicated, and they represent a wide variety of approaches. At one end of the continuum are the proposals of the United States and the Cairns Group (Argentina, Australia, Brazil, Canada, Chile, Colombia, Fiji, Hungary, Indonesia, Malaysia, New Zealand, the Philippines, Thailand, and Uruguay) which favor largely

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Table 1--Main elements of major negotiating proposals

United States (submitted October 25, 1989)
- Replace nontariff barriers with tariff-rate quota system, to be phased down to zero or low levels over 10-year period (tariffication).
- Phase out export subsidies over 5-year period.
- Assign domestic policies to three groups: to be phased out (payments tied to output), to be disciplined (input, investment subsidies), and permitted (decoupled income support, environmental, disaster assistance, research, education).
- Treatment of less-developed countries based on development level in each.

European Community (submitted December 20, 1989)
- Reduce support and protection. Commitments would be expressed in terms of an aggregate measure.
- A form of tariffication could be accepted.
- Variable levies would be converted to fixed and variable components, fixed component reduced in line with other commitments and variable component to fluctuate according to market conditions. Deficiency payments to be included in tariffication.
- Flexibility in application of GATT rules to less-developed countries according to their actual level of development.

Cairns Group (submitted November 20, 1989)
- Prohibit measures not explicitly provided for in GATT rules (includes variable levies and quantity restraints--amounts to tariffication).
- All tariffs bound at low levels or zero.
- Prohibit new and phase out existing export subsidies.
- Reduce internal support through use of an aggregate measure of support where calculable, otherwise through commitments to reductions in support prices and budget expenditures.
- Similar internal policy categories to U.S. proposal.
- Measures in less-developed countries which encourage development to be exempt.

Japan (submitted November 27, 1989)
- Emphasizes special nature of agriculture and food security.
- Insists on countries' right to support certain level of self-sufficiency in "basic foodstuffs."
- Export subsidies should be reduced and eliminated.
- Domestic support with no (or negligible) trade-distorting effects should be permitted; other policies reduced through commitments based on an aggregate measure of support.
- Allow less-developed countries longer time frame to achieve Uruguay Round goals.

Nordic Group (submitted December 19, 1989)
- Support gradual change in level and form of border protection.
- Tariffication is among feasible alternatives.
- Most export subsidies should be eliminated. Trade-distorting domestic subsidies should be displaced.
- Objective needs of individual less-developed countries must be considered.

Net Food Importing Developing Countries
- Negotiators should consider special interests and problems of importers.
- Should continue special treatment of less-developed countries and food aid.
- Increased financial assistance should be given to food importing developing countries to compensate for post-liberalization price increases.
- Stricter discipline applied to export subsidies.

eliminating policies that distort trade. At the other end is the EC plan, which offers only minor changes in existing programs. Proposals by Japan, the Nordic countries (Finland, Iceland, Norway, and Sweden), the group of net food importing countries (Egypt, Mexico, Jamaica, and Peru), Austria, Switzerland, and South Korea advocate varying degrees of reform.

The United States submitted a proposal in October 1989 with a detailed breakdown of policies that are present in the current policy environment. Certain types of programs, including export subsidies, import quotas, variable levies, and any price support mechanisms that distort world prices, are listed as policies to be eliminated over varying lengths of time. Certain programs which are aimed at correcting market failures, such as bona fide food aid and disaster assistance and environmental goals, as well as decoupled direct payments, are designated as permissible. Policies which fall between these categories, such as input and investment subsidies that are equally available to all agricultural producers, are to be closely scrutinized and policed by GATT rules.

The EC opposes radical changes in world agricultural trade. Its proposal focuses on short-term efforts and maintenance of market shares. While promoting the aim of progressively reducing support to re-establish balanced markets, it remains opposed to distinguishing between border and domestic policies that distort trade. EC officials are concerned about the cost to European agriculture under a free-trade regime at low world prices and are reluctant to expose their agricultural sector to such pressures by complete elimination of their support policies. One urgent concern of the EC is the relative free entry of nongrain feed substitutes and protein meals into their market, which has been displacing higher priced domestic grains. The EC insists on the importance of being able to "re-balance" support and protection between such commodities.

The Nordic Group proposal also implies resistance to wholesale changes in agricultural policies. Its suggestions on trade reform are couched in terms of improving market access through reduction of tariffs, import levies, and quantitative restrictions, rather than elimination of those instruments. Priority should be placed on replacing the most trade-distorting policies with more decoupled forms of support with clearly defined objectives. They are prepared to work toward elimination of most of their export subsidies. Of the major groups submitting proposals prior to the midterm review, only the food importing group did not clarify or amplify their original position. The food importing group proposal focuses on resisting any overall price increases which would affect consumers in developing countries, though it supports "improving discipline" in the use of subsidies and elimination of policies such as quotas, voluntary export restraints, and other trade restrictive measures.

Japan is the largest single major agricultural importer to introduce a proposal to GATT. The main focus of the Japanese

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proposal is on nontrade issues, such as food security. The
Japanese prefer self-sufficiency programs for their basic
foodstuffs, rather than relying on stockpiling or stable
importation arrangements. They want to maintain use of
quantitative restrictions under Article XI for certain
circumstances. Disciplines on variable levies and minimum
support prices should be enforced, and export subsidies should be
progressively reduced and eventually eliminated. Certain
subsidies or expenditures which are devoted to improving
infrastructure and social welfare, such as those named in both
the U.S. and Cairns Group proposals, are also suggested for
exemption by Japan.

All major proposals call for harmonization of sanitary and
phytosanitary standards and ultimate elimination of
scientifically unjustified elements of sanitary and phytosanitary
regulations of traded agricultural products and for differential
treatment of developing countries, generally to be geared toward
the level of general and agricultural development currently
existing in each country. The role of an aggregate measure of
support, envisioned as substantial after the first round of
proposals, has been downplayed in the most recent set. In the
period since the midterm review ended in April 1989, several
other countries that are participants in the GATT Negotiating
Group on Agriculture have also submitted proposals. These
countries include a combined proposal by Brazil and Colombia, an
Austrian proposal, a Korean proposal, and a Swiss proposal.

Any changes in agricultural support programs that might result
from GATT negotiations scheduled to conclude in December 1990
will have a substantial impact on world coarse grain trade, since
coarse grains are both heavily traded and heavily dependent on
government support at this time.

Setting in the World Coarse Grain Market: Supply, Demand, and Trade

The coarse grain sector has been one of agriculture's fastest
growing components. Strong growth in demand for livestock
products has translated into strong growth for coarse grain--
also referred to as feed grain--production and use.

Production of world coarse grains (corn, barley, sorghum, oats,
rye, and mixed grain) rose from an average of more than 450
million metric tons in 1960-64 to an average of over 800 million
tons in 1985-89, an increase of nearly 80 percent or an annual
trend growth of 2.7 percent (table 2). In 1985, corn accounted
for about 60 percent and barley about 20 percent of total coarse
grain production. Production has dropped slightly since the
1985/86 crop year due to acreage reduction programs and drought,
mostly in the United States. About two-thirds of all coarse
grain is consumed as livestock feed. The remainder is consumed
as food, used for industrial purposes, or as seed. About 12
percent of the world's production is traded, down from the 16
percent traded during the record 1980/81 high. The destination

Table 2--Coarse grain production by selected countries or regions, 1960-89

Country	Average quantity						Average share
	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89[1]	1985-89
	Million metric tons						Percent
United States	132.4	153.8	171.1	209.2	214.1	222.7	27.8
USSR	58.1	62.9	84.5	92.0	86.8	104.0	13.0
China	40.6	51.3	60.9	74.7	86.3	90.8	11.3
EC-12	48.6	58.9	90.2	74.1	80.7	84.5	10.5
Eastern Europe	41.0	46.4	53.1	60.4	67.6	66.7	8.3
India	24.2	25.3	26.6	29.6	30.6	28.1	3.5
Brazil	10.2	12.7	15.4	17.8	22.0	25.5	3.2
Canada	12.1	15.2	20.6	20.5	23.4	23.6	2.9
Mexico	6.7	9.7	11.3	13.0	14.0	14.6	1.8
Argentina	8.3	11.5	14.6	15.1	18.8	10.7	1.3
South Africa	5.9	5.1	9.1	9.9	8.5	9.2	1.1
Nigeria	7.8	7.2	8.2	8.2	8.3	8.2	1.0
Australia	2.8	3.1	4.8	5.7	6.8	7.2	.9
Thailand	.7	1.4	2.2	2.9	4.2	4.4	.5
Subtotal	399.4	464.5	572.6	633.1	672.1	700.2	87.4
World	455.1	519.9	619.9	710.9	757.5	801.1	100.0

[1]Estimates for 1989/90 were made in October 1989.
Source: For. Agr. Serv., U.S. Dept. Agr.

of much of this coarse grain trade has shifted from Europe toward East Asia.

Nearly three-quarters of the world's coarse grains are produced in the United States, the USSR, the EC-12, China, and Eastern Europe (fig. 1).[1] While each of these regions account for a substantial portion of coarse grain production, their roles in coarse grain trade differ markedly, as do their production costs (see box). The United States has a long history of being the major exporter of coarse grains, the USSR and Eastern Europe are major importers, and the EC-12 and China shifted from net importer to net exporter status in 1985. The major exporting countries are now the United States, the EC-12, Argentina, Canada, China, Australia, Thailand, and South Africa. Major importing countries are Japan, the EC-12, USSR, South Korea, Taiwan, Eastern Europe, Saudi Arabia, Mexico, and Egypt.

Production

Producers of coarse grains can be characterized as belonging to one of two groups, major and other producers. The United States, USSR, EC-12, China, and Eastern Europe are major producers, accounting for about 72 percent of world coarse grain production. Canada, Argentina, Australia, South Africa, Nigeria, Thailand, Brazil, India, and Mexico also produce substantial quantities of coarse grains, averaging 1 to 4 percent of world coarse grain production between 1985 and 1987.

United States

The United States has long been the world's largest producer of coarse grains, producing 20 to 33 percent of world production over the past three decades. Droughts reduced U.S. production in 1983 and 1988 and acreage reduction programs have combined to reduce production through much of the 1980's, despite the stimulation to production offered by the income support programs. Hence, the U.S. share of world production has declined substantially while the shares of some of its major competitors-- notably the EC-12, China, and Thailand--have expanded. Other producers, such as Canada, Argentina, Australia, and South Africa, have maintained their shares. The United States is the world's largest corn and sorghum producer. The United States accounted for an average of 44 percent of world corn production during 1985/86-1987/88 (209 million metric tons in 1986/87, app. table 1).[2] Over the same period, the United States accounted for an average of 37 percent of world sorghum production during 1985/86-1987/88 (23.8 million metric tons in 1986/87, app.

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[1] The EC was established as an economic and customs union by the Treaty of Rome in 1957. The initial members were Belgium, France, Italy, Luxembourg, Netherlands, and West Germany. Denmark, Ireland, and the United Kingdom joined the EC in 1973. Greece joined in 1981, and Portugal and Spain joined in 1986.

[2]Production of specific feed grains are reported in appendices.

Comparison of Production and Marketing Costs for Major Exporters

A comparison of corn production and marketing costs among major exporters provides a static snapshot of each country's relative position (Ortmann, et al.). Production costs were the most important as marketing costs differed little. Variable costs were found to be larger than fixed costs in middle-income countries but fixed costs were a higher proportion of costs in the developed countries. Thailand had the lowest delivered costs (f.o.b.) for corn, followed by Argentina, the United States, South Africa, and France. These standings are subject to change and may not reflect comparative advantage in a truly free market. Given free trade, average production costs could change dramatically in some countries.

Thailand had the lowest costs of production, with yields of about 2 tons per hectare and little commercial fertilizer use. The Thai production process is labor- and animal-intensive, which differentiates Thailand.

Argentine producers use a crop-cattle rotation system and have fertile soils. Yields, increasing from 1.5 metric tons per hectare in 1960 to nearly 3 tons per hectare in 1987, are achieved with little use of high-priced fertilizers which are taxed by the Government. Export prices have periodically included a 25-percent tax that kept farm prices and land values low. Agricultural production under these conditions requires a low-cost strategy. If the Government were to remove these taxes on inputs and export prices, farmers would likely increase input use, thereby increasing output (and costs per unit), particularly if transport costs are lowered.

The delivered cost (f.o.b.) for South African corn is similar to U.S. cost. South Africa's share of the export market is small and is expected to increase little due to lack of moisture, land, and internal politics. Yield is the lowest of all major exporters at less than 2 tons.

Among major exporters, France has the highest delivered cost per ton, due mostly to its high fixed production costs. Corn production in the EC has grown rapidly in France and Italy, with yields comparable to U.S. yields. Stanton found corn production costs on large farms in France to be like costs in the United States. However, barley is the major coarse grain for the EC-12, accounting for 60 percent of production in recent years with production concentrated in the United Kingdom, West Germany, and France.

Figure 1--World coarse grain production shares

1960

Rest of world (16.1%)

Other
major
producers
(7.4%)

India
(5.3%)

Eastern
Europe
(9.6%)

United
States
(31.7%)

USSR (12.8%)

EC-12 (10.4%)   China (6.6%)

1988

Rest of world

Other
major
producers
(10.3%)

India
(4.2%)

Eastern
Europe
(8.7%)

(17.5%)

United States
(20.0%)

USSR (13.8%)

China (12.9%)

(12.5%)

EC-12
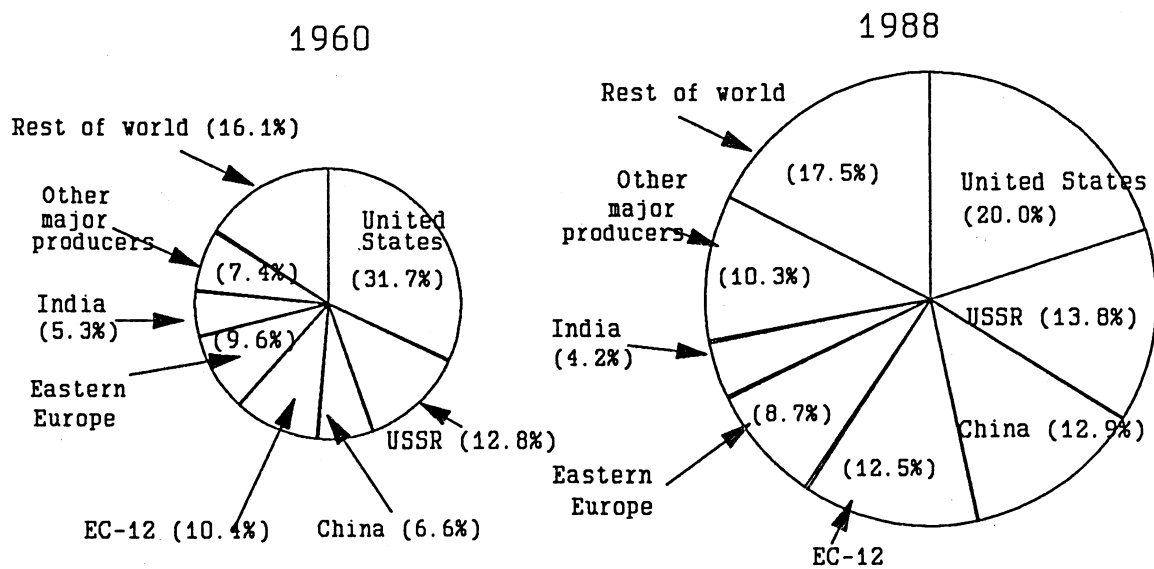
Total production:

447 million metric tons   710 million metric tons

table 3).   The United States is the fifth largest barley
producer, with output of 13.3 million metric tons in 1986/87 or
7 percent of the world total in 1985/86-1987/88 (app. table 5).
The United States is the second largest producer of oats,
accounting for an average of 13 percent of world production
during 1985-87 (5.6 million metric tons in 1986/87, app. table
7).

The United States has abundant cropland, a favorable climate, a
sophisticated technology base, a skilled agricultural labor
force, accessible capital, and a set of agricultural policies
that reduces risk in both production and prices. Moreover, the
United States is capable of expanding its coarse grain
production significantly; it has a flexible resource base as
well as considerable idled capacity that could be put into use
by changing program provisions. These characteristics suggest
that the United States could enjoy a cost advantage in the
production of coarse grains which might turn into a comparative
advantage in a free-market setting.

USSR

The USSR is the second largest producer of coarse grains in the
world and the world's largest producer of barley and oats.
During 1985-89, the USSR accounted for an average of 13 percent
of the world's coarse grain output, averaging 104.0 million
metric tons per year during 1985-89. The Soviet Union produced

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29 percent of the world's barley, averaging 52.9 million metric tons per year (app. table 5), and 43 percent of the world's oats, averaging 20.3 million metric tons per year during 1985-89 (app. table 7).

Recent attempts to increase USSR meat production and consumption have stimulated internal coarse grain production (Cook). Although Soviet coarse grain production nearly doubled between 1960 and 1987, this increase required a 19-percent increase in acres harvested (9.4 million hectares). Other major producers have realized similar production increases without increasing acreage through strong sustained increases in yields (app. tables 9 and 10). In general, corn yields have improved faster over the last few decades than yields of other coarse grains, because of genetic advances in hybrid corn varieties. The fact that the USSR specializes in oats and barley may partially account for their lagging productivity growth rates.

The USSR coarse grain sector, as well as its agriculture in general, can be characterized as having experienced slow growth and rising production costs over the past 20 years. The major objectives of recent policy reform have been to increase production growth rates through the introduction of intensive agricultural practices, improve factor productivity, encourage technological innovation, and, more recently, to reduce imports.

Analysts generally feel that the objective of increased productivity has not been met because yield growth in coarse grains lags behind that of other major producers. Many analysts of the Soviet economy view agriculture as a potential source of stronger economic growth.

China

China became the third largest producer of coarse grains following the 1978 agricultural reforms and subsequent output and productivity gains (see box). In 1985-89, China produced about 11 percent of the world's coarse grains (table 2). China is the second largest producer of corn (15 percent of world production, 1985-87, app. table 1) and also produces sorghum, millet, oats, and barley. Corn production is concentrated in the northeast and is used primarily for livestock feed.

EC-12

The fourth largest producer of coarse grains in the world is the EC-12, averaging 84.5 million metric tons per year during 1985-89. The EC-12 is the second largest producer of barley (27 percent of world production during 1985-87). In addition, corn is a major crop (5 percent of world production during 1985-87) while lesser amounts of oats and sorghum are also produced.

Coarse grain production in countries in the EC has increased steadily since the early 1960's, when the EC cereal policy was first instituted. Strong yield increases have been the dominant factor since area harvested has been fairly stable since 1960/61

(app. tables 9 and 10). Some land previously planted in oats, rye, and barley has been shifted into wheat production due to the increased profits available from wheat production under price incentives under the Common Agricultural Policy.

Eastern Europe

The Eastern European countries as a group ranked fifth in coarse grain production, with an average of 8.3 percent of the world total during 1985-89 (production averaging 67 million metric tons per year). Eastern Europe ranks third in both corn (7 percent) and barley (9 percent) production.

During the 1960's, centrally planned countries of Eastern Europe changed their main policy objective from using agriculture to support industrialization to increasing per capita livestock consumption and stabilizing retail prices. Increased investment in agriculture and large imports of agricultural commodities, particularly wheat and coarse grains, were required to accomplish these goals. By the late 1970's and early 1980's, these countries generally faced rising budgetary costs and severe balance-of-payments problems. Methods to improve agricultural efficiency in the cereal crops were sought, and the policy of subsidizing low consumer prices was reevaluated. Price reform and elimination of rigid, centralized planning were adopted as new goals with the thus far successful experiences of Hungary, Yugoslavia, and to a lesser extent China cited as models.

Other Significant Producers

Argentina, South Africa, and Thailand ranked tenth, eleventh, and fourteenth in world coarse grain production during 1985-89. Production for these countries ranged between 0.5 to 1.3 percent of world coarse grain production (4.4 to 10.7 million metric tons, 1985-89). An understanding of coarse grain production in these three nations is important because of their roles as major exporters of coarse grains.

Argentina. A temperate climate country, Argentina produces and exports many of the same crops as the United States, including corn and sorghum. The resource base and well-developed technology and human capital support a productive agricultural sector. Approximately 75 percent of Argentine agricultural production occurs on large diversified farms which produce corn, sorghum, wheat, and grass-fed beef. Crops and pastures are rotated to reduce the use of costly fertilizers and herbicides. Corn is produced at a fairly low cost, but moving grain to the ports is expensive. The remaining 25 percent of production comes from small farms which typically grow a single crop, largely for export. Production from these smaller, less-diversified farms is more responsive to world market prices than output from the larger operations (USDA, Global Review of Agricultural Policies, 1988).

Chinese Agricultural Reform

China has been engaged in serious agricultural reform since 1978, shortly after the death of Mao Zedong. This reform has consisted primarily of two initiatives, pricing reform and local production reform. In order to encourage increased grain production, the pricing system has been altered from a pure government procurement procedure in which grain prices were held artificially low to a two-tier system with a fixed amount of grain acquired by the government at a higher "fair" price, and the rest available on the open market at even higher market-clearing prices.

The second major change was the adoption of the production responsibility system, in which contracts and decisions concerning choice of crop and input use are made at the farm level and lease contract periods are lengthened. These changes combined to expand grain output an average of 9.4 percent for 1978-85, about three times higher than the growth rate of the previous three decades. Despite this phenomenal achievement, the overall increase in per capita income (both rural and urban) and the lack of investment in infrastructure have led to demands for feed grains that cannot always be met with domestic output. This has resulted in substantial imports of feed over the last decade, even while some provinces encountered problems with surpluses that had to be exported to save government storage costs. In such years, China actually was a net exporter of feed grains, though some regions were grains-deficit. It is unlikely that China will be unable to resolve these difficulties and thus will continue to both import and export substantial amounts of coarse grains.

Thailand. One of the most successful and rapidly developing countries in the world, Thailand possesses abundant natural resources, an enterprising and flexible private sector, cautious economic management, and relative political stability, all of which encourage agricultural production for export. Rice remains the leading Thai crop, currently occupying about 60 percent of the farmland. Corn (12-15 percent of total farmland), sorghum, cassava, sugar, and rubber are also important. Most farms are small and owned by the operator. Since the 1970's, Thailand's livestock sector has been marked by rapid growth in poultry, aquaculture, and swine production, and

by stagnation in the cattle industry. Thailand has the ability to expand its corn production by increasing area and the adoption of improved varieties, but potential increases would probably be utilized domestically by livestock or poultry.

South Africa. Among the significant producers, South Africa is a high-cost producer of high-quality corn. Its corn prices are generally above world market prices. Agricultural programs have contributed to the high cost of producing corn, because this domestic crop sector is insulated from the world market. In recent years, consumer prices were raised sharply in order to reduce subsidy-related expenditures. Higher prices have tended to reduce domestic consumption and so excess production is exported, but usually at a loss to the marketing board.

South Africa's coarse grain sector has been complicated by the worldwide antipathy for South Africa's apartheid system and by the severe droughts of 1983 and 1984. Six percent of the farmers own more than 50 percent of farm resources. Since they produce only 40 percent of the crop, they are not necessarily more efficient than smaller scale operations. Thus, policies appear to favor an increase in the size of farms that have already exhausted efficiencies of scale. Mechanization has been encouraged with credit assistance and diesel fuel subsidies. The severe droughts of the mid-1980's required importation of corn to ease domestic shortages.

Consumption

World coarse grain consumption rose from an average of over 450 million metric tons between 1960-64 to an average of more than 800 million tons between 1985-89, an increase of 76 percent. The United States, USSR, China, EC-12, and Eastern Europe accounted for 66 percent of the world's coarse grain consumption between 1985-89 (table 3). This percentage has decreased somewhat from the share these countries enjoyed in 1960 (see fig. 2). India, Brazil, and Nigeria, which produce most of the coarse grain they consume, each account for 1-4 percent of world coarse grain consumption. Mexico, Saudi Arabia, Venezuela, South Korea, Taiwan, Japan, Egypt, and Algeria each account for less than 3 percent of the world's coarse grain consumption, but import a significant portion for their needs.

About two-thirds of world coarse grain consumption is used for feed, with the remainder used for seed, industrial, and food uses. Feed use of coarse grains is more price-responsive than food or industrial uses. The proportion going to each use varies from country to country. For example, in 1987, India used about 90 percent of its coarse grains for human consumption, while Brazil utilized approximately 90 percent of its coarse grains for feed.

Figure 2--World coarse grain consumption shares

1960   1988

Total consumption:

438.9 million metric tons   805.3 million metric tons
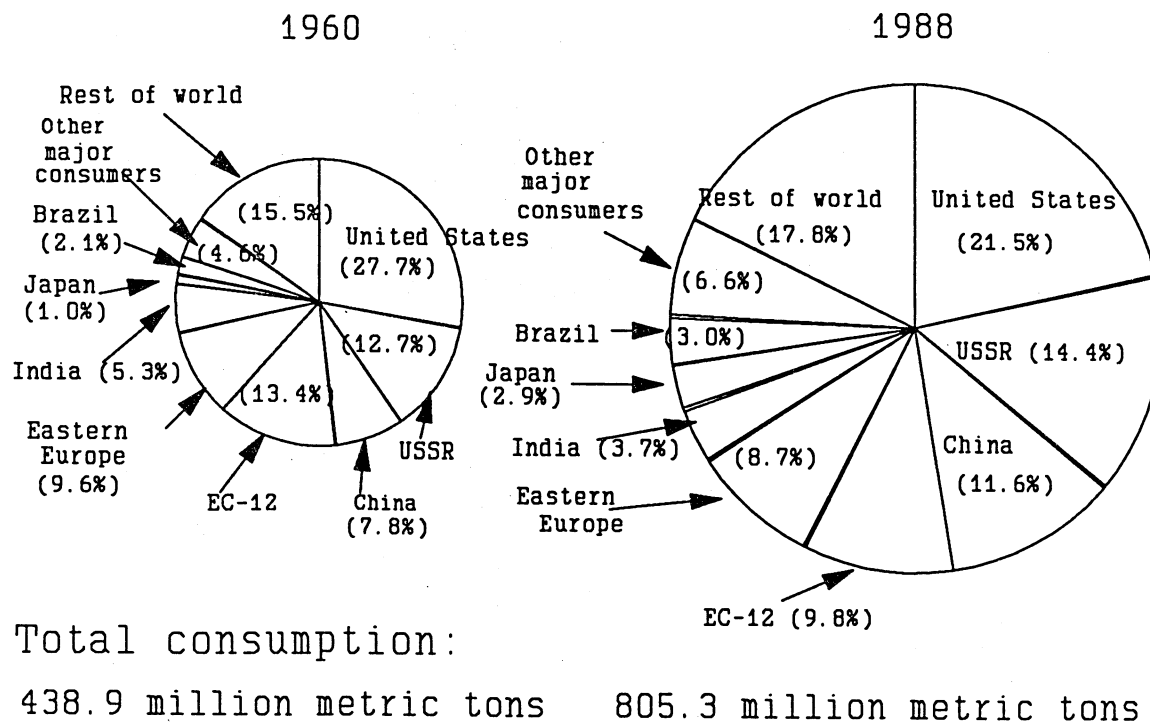
United States

The United States accounts for 22 percent of the world's coarse
grain demand. Its coarse grain consumption expanded by 50
percent between 1960 and 1987. Although the livestock industry
is still a large and stable segment of the demand for coarse
grains, growth in feed consumption has slowed while food and
industrial uses have expanded, mostly due to higher production of
HFCS (high fructose corn syrup) and corn alcohol for use in
ethanol. During 1960-87, coarse grains used for feed dropped
from 90 percent to 79 percent of total U.S. consumption due to
growth in food and industrial uses. Food, seed, and industrial
uses have accounted for more than 15 percent of total
disappearance annually since 1984 (USDA, Feed Situation and
Outlook Report).

Selected Centrally Planned Economies

The USSR, China, and Eastern Europe together account for 35
percent of the world's coarse grain consumption (1985-89). Feed
consumption of coarse grains in these centrally planned countries
has risen significantly since 1960, causing an increase in their

Table 3--Coarse grain consumption by selected countries or regions, 1960-89

Country	Average quantity						Average share
	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89[1]	1985-89
	------------------Million metric tons------------------						Percent
United States	120.4	134.8	144.8	143.9	156.4	171.7	21.4
USSR	54.5	63.1	87.4	104.2	104.8	119.2	14.8
China	40.9	50.7	58.3	73.4	86.4	90.5	11.3
EC-12	64.4	76.7	87.3	95.4	90.4	80.5	10.0
Eastern Europe	42.4	47.0	56.7	67.7	70.7	70.1	8.7
India	24.1	25.9	28.1	29.8	30.7	28.2	3.5
Brazil	9.7	12.3	15.4	18.2	22.2	25.7	3.2
Japan	5.3	8.9	12.3	16.8	19.9	22.0	2.7
Canada	11.7	14.7	17.8	17.1	18.5	19.1	2.4
Mexico	6.5	9.2	12.2	16.0	19.1	18.9	2.4
Nigeria	7.9	7.3	8.2	8.3	8.6	8.0	1.0
Argentina	4.5	5.8	7.4	6.7	7.1	6.7	.8
Saudi Arabia	.1	.1	.2	.9	4.4	6.2	.8
South Africa	4.0	5.2	6.2	7.0	7.6	7.0	.9
Egypt	2.9	3.4	3.3	4.3	5.8	6.4	.8
South Korea	1.3	1.8	2.4	3.5	4.5	6.2	.8
Taiwan	.1	.3	1.3	3.0	4.1	5.0	.6
Australia	2.0[2]	2.1	2.5	2.7	3.2	4.1	.5
Thailand		.1	.3	.7	1.2	2.3	.3
Subtotal	402.7	469.4	552.1	619.6	665.6	696.8	86.9
World	456.1	530.0	621.4	700.7	757.0	802.8	100.0

[1]Estimates for 1989/90 were made in October 1989.
[2]Less than .1 million metric tons.
Source: For. Agr. Serv., U.S. Dept. Agr.

total coarse grain consumption. The increased feed use is due to the adoption of policies designed to increase per capita meat consumption. These policies continue today although they have come into conflict with other goals such as reducing coarse grain imports and keeping hard currency reserves.

EC-12

During 1985-89, the EC-12 accounted for 10 percent of the world's coarse grain consumption. Consumption of coarse grains in the EC-12 rose significantly between 1960 and 1978, but since then consumption has gradually declined. Reasons for the decline include the use of nongrain substitutes not subject to the variable levies such as corn gluten feed and meal, oilseed meals, cassava, and other industrial byproducts. Because of the intervention prices of the EC-12's Common Agricultural Policy (CAP), wheat production has increased and wheat has become increasingly available for livestock feed (also a substitute for coarse grains) and more recently, for industrial uses such as starch production.

Other Large Consumers

While the United States, USSR, China, EC-12, and Eastern Europe account for two-thirds of the world's coarse grain consumption, a number of other countries play an important role in coarse grain markets. In 1985-89, Mexico and Brazil accounted for 2-3 percent of world consumption. Consumption in these countries has risen steadily since the late 1960's. The growth in Brazil is largely due to the expansion of their livestock sector, particularly poultry, while in Mexico it can be attributed to population growth, since corn is mostly used for food.

India accounts for 4 percent of the world's consumption (1985-89) and coarse grain consumption in India goes largely for food. Other countries such as Saudi Arabia, Venezuela, South Korea, Taiwan, Japan, and Egypt each consume between 2.7 and 0.6 percent of the world total (1985-89 average). While these figures represent relatively small shares compared to the major coarse grain consumption regions, their role is significant because they must import substantial quantities to satisfy demand. Other consuming nations shown in table 3 produce sufficient quantities to meet domestic requirements.

Stocks

The worldwide coarse grain stocks-to-use (using the ending stocks measure) ratio averaged 27 percent during 1985-89, an historically high level. The stocks-to-use ratio is defined as the quantity of coarse grains in storage at the end of the year relative to the quantity consumed. As a contrast to the 1985-89 levels, the world stocks-to-use ratio was 12 percent in 1973, its lowest point since 1960. The United States, the world's largest coarse grain stockholder, stored an average of 58 percent of the world's stocks during 1985-89 (table 4). Other major stockholders include China, the EC-12, and the USSR. Between

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Table 4--Ending stocks of coarse grain by selected countries, 1960-89

Country	Average quantity						Average share
	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89[1]	1985-89
	Million metric tons						Percent
United States	59.8	42.9	30.7	46.7	65.8	108.3	57.9
China	8.3	9.1	19.2	32.7	32.4	19.4	10.4
EC-12	6.4	6.9	7.4	8.7	8.6	13.5	13.5
USSR	6.6	6.8	6.6	4.8	4.2	11.4	6.1
Eastern Europe	1.5	1.9	1.7	3.1	4.2	5.4	2.9
Canada	4.3	5.5	6.0	6.4	5.9	5.5	2.9
Japan	.5	.7	1.3	2.1	2.1	2.4	1.3
Brazil	2.3	3.0	.8	.6	1.0	2.6	1.4
South Africa	.8	1.3	1.7	1.8	1.7	.8	.4
Mexico	.8	.8	.7	1.1	2.2	.7	.4
India	5.2	6.2	3.2	3.3	1.7	.7	.4
Argentina	.4	.3	.7	.5	.6	.5	.3
Thailand	.3	.1	.1	.1	.2	.3	.2
Australia	.3	.1	.1	.1	.2	.3	.2
Subtotal	97.5	85.6	80.2	112.0	130.8	171.8	98.3
World	103.9	90.8	87.2	123.2	142.6	187.2	100.0

[1]Estimates for 1989/90 were made in October 1989.
Source: For. Agr. Serv., U.S. Dept. Agr.

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1960-88, U.S. stocks, as a percent of world stocks, have ranged from a high of 70 percent in 1970 to a low of 23 percent in 1974. This spread is not reflected in the table because it averages the period 1970-74.

Because the United States is the world's largest holder of coarse grain stocks, it has shouldered most of the costs of holding security stocks. To mitigate these costs, the United States employs supply control policies and consumption-enhancing programs. These programs and drought conditions have combined to reduce stocks from the high levels that were present in 1986-87.

The willingness of the U.S. Government to hold grain stocks or subsidize producer stockholdings is an important feature of U.S. commodity programs. The policy is designed to help stabilize U.S coarse grain prices and facilitate exports in periods of crop failure. However, when loan rates and target prices have been set too high, production has exceeded total disappearance, and Government stocks have accumulated.

When examining world stocks, it is important to differentiate between the two general types of grain stocks: working and surplus stocks. Working stocks are pipeline stocks needed by industry to maintain uninterrupted processing. These stocks include grain in transit between producers and the intermediate and final consumers. The quantity of working stocks usually remains relatively constant from year to year. Surplus stocks are those held in excess of working stocks. These stocks (both privately and publicly held) are price-sensitive and vary considerably from year to year. Privately held stocks are generally expected to increase in value. These carryover stocks are seen as insurance against shortages.

Many countries hold some grain in working stocks, but most have domestic grain policies that discourage the holding of carryover stocks. The United States, in contrast, usually holds substantial quantities of both working and speculative stocks, primarily because of domestic agricultural policy but also, to a lesser extent, because speculation naturally occurs in a market economy.

Trade

Trade in coarse grains expanded from an average of 30.8 million metric tons between 1960-64 to 98.0 million beween 1980-84, an increase of more than 200 percent (table 5). Trade levels have increased for three major reasons: (1) population and income increased in the world, the latter especially true in the middle-income countries, (2) additional coarse grain was required to support domestic government policies designed to increase per capita meat production in developing and centrally planned countries; and (3) many importing and exporting countries changed agricultural and trade policies to encourage trade (USDA, Government Intervention in Agriculture).

Table 5--Coarse grain exports by selected countries or regions, 1960-89

| Country | Average quantity | | | | | | Average share |
	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89[1]	1985-89
	Million metric tons						Percent
United States	14.9	20.3	30.9	56.9	58.6	51.5	57.7
EC-12[2]	1.3	2.4	3.6	5.2	5.4	9.7	10.9
Argentina	3.8	5.3	7.1	8.7	11.5	5.7	6.4
Canada	1.0	1.1	3.7	4.4	5.7	5.2	5.8
China	.1	.1	.3	.2	1.3	5.1	5.7
Australia	.9	.7	2.4	3.0	3.7	3.0	3.4
Thailand	.7	1.3	1.9	2.1	3.0	2.0	2.5
South Africa	1.9	1.7	2.3	2.4	2.4	2.2	2.2
Subtotal	24.6	32.9	52.2	82.9	91.6	84.4	94.5
World	30.8	39.4	58.1	88.1	98.0	89.3	100.0

[1]Estimates for 1989/90 were made in October 1989.
[2]Excludes intra-EC exports.
Source: For. Agr. Serv., U.S. Dept. Agr.

Between 1980/81 and 1987/88, world exports of coarse grains declined 22 percent to 83.5 million metric tons. The decline can be attributed to three major factors.

First, world economic growth slowed, causing growth in consumption of livestock products and grain feeding to decline. Slower economic growth caused many importing countries to discontinue imports or, in some cases, revert to commodity exports in order to generate hard currency for debt repayment.

Second, domestic agricultural and trade policies protected farmers in importing countries from declining world prices. High U.S. support prices made it unattractive for U.S. producers to sell in the world market. Trade barriers protected foreign producers from declining world prices, but many importers could not take advantage of lower prices because of a need to service debt.

Third, interest rates and the value of the dollar increased sharply after 1980, forcing many developing and East European countries to reduce imports and use foreign exchange to service massive debt loads.

These changes in the international financial environment reduced trade. Growth in export earnings slowed for middle-income and centrally planned economies, as world trade slowed and primary product prices decreased. As the cost of transactions made in U.S. dollars increased, export earnings decreased and the cost of credit increased, resulting in a reluctance on the part of lenders to extend additional credit for developing and centrally planned economies. These factors had a negative effect on the world economy and therefore trade.

Exports

The United States, EC-12, Argentina, Canada, China, Australia, Thailand, and South Africa, accounted for an average of 95 percent of world coarse grain exports in 1985-89 (table 5). Coarse grain exports consist mostly of corn, barley, and sorghum. In 1987, corn accounted for 68 percent of all coarse grain exports, barley 19 percent, and sorghum 10 percent. Market shares for the major coarse grain exporters have changed over time. Countries that have recently increased their market shares are the EC-12 and China (fig. 3).

United States. The United States is the leading exporter of coarse grains, accounting for an average 58 percent of world coarse grain exports during 1985-89. The U.S. share of the world coarse grain market rose from 45 percent in 1960 to 71 percent in 1979, before declining to 38 percent in 1985/86. Both the farm legislation of the late 1960's and dollar devaluations in 1971 and 1973 aided U.S. export expansion in the 1970's.

Farm policies in the 1970's permitted U.S. prices to reflect world supply and demand conditions rather than domestic farm income goals. This resulted in farmers being able to quickly

Figure 3--World coarse grain export market shares

1960

Rest of world (18.1%)
Canada (4.1%)
United States (44.9%)
Thailand (2.1%)
Australia (4.5%)
Argentina (11.1%)
South Africa (4.5%)
EC-12 (10.7%)

1988

Canada (4.3%)
Thailand (3.4%)
Australia (3.4%)
China (3.7%)
Argentina (6.6%)
Rest of world (3.2%)
United States (51.0%)
EC-12 (23.6%)
South Africa (1.0%)

Total exports:

24.3 million metric tons   101 million metric tons

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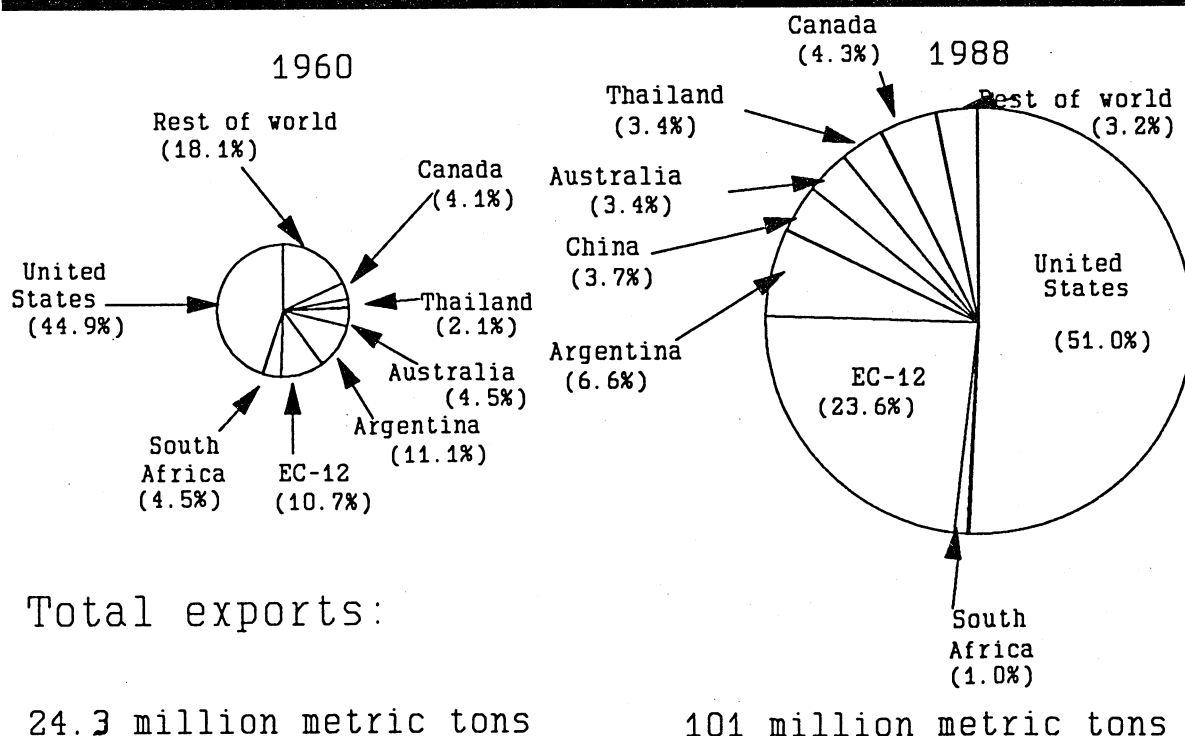
adjust production during a period when demand for coarse grains was rising rapidly. The continued weakening of the dollar in the latter part of the 1970's decreased the cost of U.S. farm products in many importing countries. The combined effect of the two policies was that the United States provided an increasing amount of coarse grain at a highly competitive price.

In the early 1980's, U.S. monetary and farm policies changed and coarse grain exports declined. The value of the dollar increased during this period, increasing the relative cost of U.S. grain to foreign buyers. In addition, U.S. commodity loan rates set by the Agricultural and Food Act of 1981 did not accurately anticipate world market conditions. Given the U.S. coarse grain storage policy and the fact that loan rates were above equilibrium world market prices, the loan rate set a floor price for coarse grains and the United States became a residual supplier to the world market. As a result, the price of U.S. grain increased relative to that of other countries, U.S. coarse grain stocks increased, and the U.S. share of the world coarse grain market decreased.

In 1985, the U.S. share of the world coarse grain market reached a low of 38 percent and the Food Security Act of 1985 was passed. One of the objectives of the 1985 Act was to enhance the competitive position of U.S. grains in world markets. To accomplish this goal, loan rates were reduced. In addition, the 1985 Act authorized the issuance of generic certificates to program participants (Glauber) in lieu of a portion of the cash

payments. These certificates could be redeemed for any grain stocks held by the Commodity Credit Corporation (CCC), producer-held grain in a 9-month regular loan, or producer-held grain in the farmer-owned reserve. U.S. grain prices adjusted to world market prices after these stocks were released upon the market. Concurrent with the enactment of the 1985 Act was a sharp decline in the value of the dollar. These changes resulted in a decrease in the price of U.S. coarse grain relative to coarse grain from other exporters. Although the U.S. market share has not reached the level obtained in 1979, it rebounded to 65 percent in 1987. Weather-related production shortfalls in competitor countries have also played a role in the rise of U.S. share of the export market.

EC-12. The Community has gained an increasing market share during the 1980's. In 1980-84, its share (excluding intra-EC-12 shipments) was 5.5 percent. By 1985-89, the EC-12 had increased its share of the world coarse grain market (excluding intra-EC-12 trade) to 10.9 percent (table 5). Although the EC-12 is the second largest exporter of coarse grains, it was a net importer prior to 1985. Consumption dropped over the last decade, imports declined, and exports increased. The EC-12 became a net exporter of coarse grains in 1985.

The primary reason for the large change in the EC-12's trade position is the Common Agricultural Policy. This policy is: (1) intervention prices to guarantee farmers high prices for their coarse grains, and (2) variable levies to tax imports so they cannot compete with domestically produced coarse grains. The combination of intervention prices and variable levies have created a situation where EC-12 farmers produce more grain than is demanded by users within the Community at the high domestic prices. The EC-12 uses export subsidies to sell the excess grain on world markets. The specific policy instruments of the Common Agricultural Policy will be discussed at greater length in the next section.

Pressure existed within the EC-12 to modify its price support and trade policies. The primary impetus for change is rising budgetary costs. In 1986, agricultural budget costs were approximately $23 billion. Although budget costs of 1988 declined from their earlier levels, costs will continue to increase if surpluses increase or world prices continue to decline as has been the long-term trend. Although there have been some reforms in the last several years, EC-12 surpluses are expected to remain large and will likely increase for some commodities, especially in the cereal crops.

Argentina. This developing country, a major exporter of corn and sorghum, is the third largest coarse grain exporter. Grain is produced at a fairly low per unit cost but the cost of transporting grain to the export points is high compared with that of competitors. In 1985-89, Argentina's share of world coarse grain markets averaged 6 percent, compared with almost 12 percent between 1980-84. The market share dropped as acreage

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shifted to other crops, and production and exports fell (app. table 13).

Current Argentine economic policies tax the agricultural sector in order to raise revenue to subsidize the manufacturing sector. The tax level is currently 30 percent for corn and sorghum. In spite of these taxes, Argentina exports more than half of its farm output. Policies that affect the agricultural sector include taxes on agricultural chemicals and past policies of deliberate exchange overvaluation that effectively taxed agricultural exports, including corn exports. Producers respond to these policies by maintaining a low-input agriculture.

Canada. The fourth largest exporter of coarse grains, Canada accounted for 6 percent of the world coarse grain export market in 1985-89 (table 5). Barley is the principal coarse grain export. Corn is grown in the eastern provinces, but little is exported because it is committed to the domestic livestock industry which is primarily located in that region. In addition, it is not cost-efficient to export corn because it is not supported by a state marketing board or by transportation subsidies.

South Africa. South African exports of coarse grains have fluctuated over the past three decades, from 100,000 to 5 million metric tons. In 1985-89, South Africa exported an average of 2 percent of the coarse grains traded, with most of its corn going to Japan, Taiwan, and other Asian countries. South Africa is generally a significant corn exporter, although during the mid-1980's a serious drought forced South Africa to import corn. During the past several years, South Africa's market share and export volume have fallen markedly due to droughts and changes in domestic production policies.

Thailand. A leading exporter of food and feed grains, Thailand is a low-cost producer of coarse grains with an adequate delivery system to its ports. Government agricultural policy goals were to maximize export earnings while providing adequate low-priced food for domestic consumers. Thai exports of corn and sorghum have generally expanded over the last few decades.

Thailand's share of the coarse grain market peaked in 1985 at 5 percent, before declining due to drought and shrinking world markets. In the EC-12, imports of Thai cassava, a low-cost feed ingredient (along with other nongrain feed substitutes) have to a large extent replaced EC-12 imports of feed grains from all export sources, including Thailand. During the 1980's, Thailand's economic growth slowed because of reduced agricultural exports (rice and corn) to developing countries.

Australia. The sixth largest exporter of coarse grains, Australia held an average market share of 3 percent in 1985-89. Australian exports of barley and sorghum have expanded over the last three decades (see table 5). Because exports account for two-thirds of the value of agricultural output, a major goal of

Australia's agricultural policy is to maintain its access to export markets.

Australian production of coarse grains, wheat, and livestock is relatively elastic. In other words, small changes in relative prices can result in substantial shifts in the amount of each commodity produced. Australia has the highest elasticity of substitution between grain production and livestock production of all the major coarse grain exporters (USDA, Global Review of Agricultural Policies, 1988). Thus, while agricultural assistance is low compared with the rest of the world, regulation is heavy, and those rules influence the crops produced.

China. China became a net exporter of corn in 1985. Presently, China exports corn to Japan and the USSR from the northeastern region of the country and sometimes imports corn in the southern provinces. This trade pattern is a result of a transportation system that inadequately links the corn producing regions with the feed deficit regions.

Imports

The major coarse grain importers are Japan, USSR, Saudi Arabia, South Korea, EC-12, Taiwan, Eastern Europe, and Mexico (table 6). These regions account for about three-fourths of the world's coarse grain imports (fig. 4).

Figure 4--World coarse grain import market shares

1960

Japan (7.9%)
Rest of world (20.1%)
Eastern Europe (7.1%)
USSR (0.8%)
EC-12 (63.2%)
South Korea (0.8%)
Eastern Europe (4.8%)

1988

Rest of world
Japan
(21.1%)
(22.9%)
Saudi Arabia (5.3%)
Mexico (4.2%)
(14.6%)
Taiwan (5.1%)
(16.6%)
South Korea (5.8%)
USSR
EC-12

Total imports:

23.9 million metric tons   99.0 million metric tons
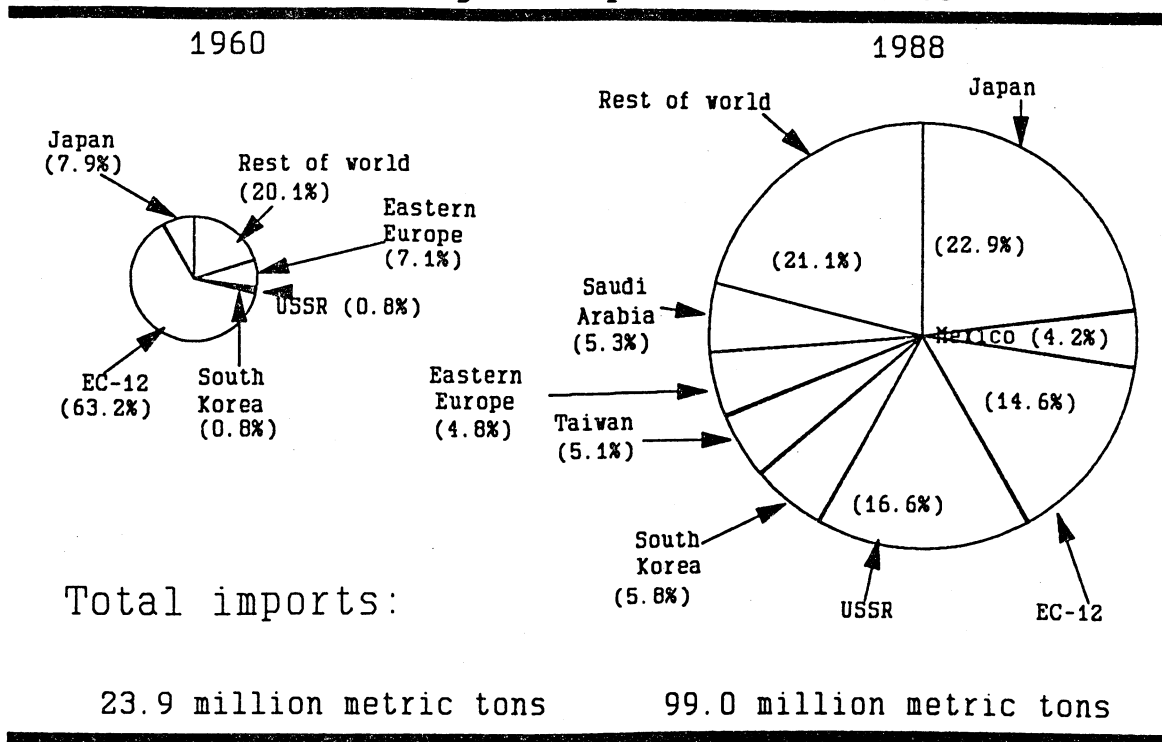
Table 6--Coarse grain imports by selected countries or regions, 1960-89

Country	Average quantity						Average share
	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89[1]	1985-89
	----------------------------Million metric tons----------------------						Percent
Japan	3.4	7.7	12.0	16.5	19.3	21.9	24.5
USSR	.1	.3	4.1	11.3	18.8	15.9	17.8
S. Arabia	.1	---[2]	.1	.7	4.4	6.6	7.4
S. Korea	.2	.2	.9	1.8	3.4	5.6	6.3
EC-12[3]	15.1	21.4	24.1	23.3	14.8	4.3	4.8
Taiwan	---[2]	.3	1.3	2.9	4.0	4.5	5.0
E. Europe	2.9	2.7	4.9	9.4	5.8	4.5	5.0
Mexico	.2	.2	1.3	3.0	5.2	4.1	4.6
Egypt	.3	.1	.2	.7	1.4	1.6	1.8
Malaysia	.1	.1	.2	.5	1.0	1.4	1.6
China	.7	---[2]	.8	1.0	1.0	.9	1.0
Algeria	---[2]	---[2]	.1	.4	.9	1.5	1.7
Venezuela	.1	.1	.5	1.1	1.6	1.2	1.3
Subtotal	23.2	33.1	50.5	72.6	81.6	74.0	82.9
World	30.8	39.4	58.1	88.1	98.0	89.3	100.0

[1]Estimates for 1989/90 were made in October 1989.
[2]Less than .1 million metric ton.
[3]Excludes intra-EC imports.
Source: For. Agr. Serv., U.S. Dept. Agr.

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<u>Japan</u>. The largest coarse grain importer, Japan averaged 22 million metric tons of imports per year (25 percent of world imports) in 1985-89. Japan requires coarse grain imports to support its livestock sector, because its scarce land base is insufficient to produce adequate grain supplies to maintain its sizable beef, poultry, and swine sectors. Less than 2 percent of Japanese coarse grain demand is supplied by domestic production.

<u>USSR and EC-12</u>. The USSR and the EC were the second and fifth largest importers of coarse grains between 1985-89. Both are major producers of coarse grains whose agricultural policies and changing behavior within the world market over the last two decades had a major impact on the world agricultural market.

<u>Saudi Arabia</u>. Saudi Arabia was the world's third largest coarse grain importer in 1985-89. Saudi Arabia is a major food importer, buying about 70 percent of its needs. Saudi Arabia imported an average of 7 percent of the world total during 1985-89 (6.6 million metric tons per year). The Saudi agricultural sector is small but growing rapidly, due to lavish production subsidies. Saudi Arabia now produces both wheat and barley at high cost. Changes in policy in the early 1980's, giving priority to livestock production through the provision of generous import subsidies, increased Saudi Arabia's demand for coarse grains in that period. These policies have resulted in Saudi Arabia becoming the world's largest barley importer, despite the elimination of import subsidies in late 1988.

<u>South Korea</u>. Despite its high level of agricultural protection aimed at promoting self-sufficiency, South Korea must import large quantities of farm products to keep the livestock, flour milling, and export-oriented textile and leather goods industries in operation. South Korea imported an average of 5.6 million metric tons of coarse grains in 1985-89. During this period, it was the fourth largest importer with a 6.3 percent market share.

<u>Taiwan</u>. Taiwan imports large quantities of coarse grains in order to support its poultry and hog operations. Taiwan was the world's sixth largest importer during 1985-89, averaging 4.5 million metric tons. Taiwan's agricultural policy has pursued a goal of increasing food security and improving the farm sector's welfare. Over the years, Taiwan's agricultural programs, beginning with land reform and followed by various rural development programs, have changed to reflect economic and social conditions.

As agriculture's contribution to the general economy has declined, Taiwanese agricultural policy has shifted from taxing producers to subsidizing them. This policy is reflected by relatively high government support levels for all major commodities. These levels are commonly expressed in terms of producer subsidy equivalents (PSE's), which consist of an aggregate measure of subsidies, direct payments, and other expenditures made for the benefit of producers of a particular commodity. These measures shall be discussed at greater length in the next chapter. The PSE's for Taiwan range from the high

end of 60-80 percent for wheat, soybeans, and sorghum to the low end of 2.1 percent for pork. The average PSE for an 11-commodity aggregate ranged from 15.1 percent in 1982 to 22.5 percent in 1986.

Eastern Europe. As a region, Eastern Europe was the seventh largest coarse grain importer in 1985-89. Because of rising budget costs, the average import level was reduced to an average of slightly over 4 million metric tons in 1985-89, down from the fourth largest importer position in 1980-84 with an import level of 5.8 million metric tons.

Mexico. As the eighth largest importer of coarse grains, Mexico imported an average of 4.1 million metric tons of coarse grains per year in 1985-89. Coarse grain trade is controlled by the government, largely through licensing requirements.

The Mexican Government is heavily involved in its agricultural and food system. Much of the focus is on the supply of corn, which figures heavily in the Mexican diet as a food staple. In addition, sorghum is a widely used feed grain in the livestock sector. Government involvement also includes investment in agricultural infrastructure, technology, input and marketing subsidies, which apply generally to all agricultural commodities, and crop price supports and retail price controls for crops. Government support to the agricultural sector, particularly for food self-sufficiency goals, has declined. Consumption subsidies have also been sharply curtailed, due to declining government oil revenues. However, tortillas have been subsidized a great deal, which supports corn consumption while meat consumption has been allowed to decline.

Changing Trade Flows

Trade flows of world coarse grain shifted significantly between 1960 and 1988, as the EC-12 and China changed from net importers to net exporters (see figs. 3 and 4) and the USSR entered the coarse grain market (tables 5 and 6). From the late 1970's to 1987, the EC-12 shifted from a net importer to a net exporter for a net trade change of approximately 20 million metric tons. The USSR increased its coarse grain imports from none in 1965 to 24 million metric tons in 1980. These changes, combined with China's entry as an exporter and the larger presence of Saudi Arabia, Egypt, and Algeria into the coarse grain import market, have led to a shift in trade focus from Western Europe to East Asia and the Middle East.

Trade flows of U.S. coarse grain also shifted significantly between 1965 and 1987 (app. table 11). In the mid-1960's and early 1970's, more than 60 percent of U.S. coarse grain exports went to the EC-12. Lesser quantities were shipped to Japan, Eastern Europe, Mexico, the Middle East, Venezuela, Taiwan, and South Korea. By the 1980's, the bulk of the U.S. trade had shifted from Europe to the East Asian countries of Japan, Taiwan, South Korea, and Malaysia. However, the USSR, Latin American, and Middle Eastern countries have also become important U.S.

clients. In all of these markets (East Asian, Middle Eastern, and Latin American), expanded U.S. sales are related to efforts to expand livestock production and increase domestic per capita meat consumption. These countries' larger livestock sectors increase the demand for coarse grains, and this generally requires larger coarse grain imports.

The same factors influencing U.S. trade patterns have also altered the trade flows of other major coarse grain exporters. Canada has experienced the same trends as the United States, with shipments to the EC-12 declining since 1960, and shipments to the USSR, Eastern Europe, and Saudi Arabia increasing (app. table 14). Canadian trade with Japan has remained relatively constant. The EC-12 was Argentina's major customer in the 1960's. By the 1980's, the EC-12 was still a major client, but coarse grain shipments to the EC-12 have declined significantly and Japan and the USSR have become major importers of Argentine coarse grain (app. table 13).

In the mid-1960's and early 1970's, Thailand shipped most of its coarse grains to Japan. In the 1980's, however, this volume declined due to Japanese concerns over Thai grain quality. Increases in Thai exports to Saudi Arabia, Malaysia, South Korea, and China more than offset the decreases in trade with Japan (app. table 17). Australia's coarse grain trade with Japan, its most important customer, has been relatively constant (app. table 15). Other important, steady customers include Saudi Arabia and Taiwan. Australian trade with the USSR has been important, but sporadic. China, Eastern Europe, and the EC-12 are small, but regular clients. Shipments from Australia to the EC-12 have declined, volume to the USSR has fluctuated, and while tonnage to China has gained it is still considered a minor customer.

The USSR, Saudi Arabia, and Eastern Europe have been the EC-12's most important coarse grain trading partners, although most EC-12 coarse grain trade takes place between members of the community (app. table 12). The volume of coarse grain trade with non-EC-12 countries has increased substantially since 1985, when the EC-12 became a net exporter. In the late 1970's, the EC-12 had imported as much as 21 million metric tons of coarse grain, while it is currently a net exporter of over 10 million tons.

Among occasional coarse grain exporters, trade flows have not changed much over time. Coarse grain exports from China have been limited but since about 1985 several million metric tons have been shipped to Japan and the USSR. South Africa traditionally ships to East Asian countries such as Japan and Taiwan (app. table 16).

Government Policies Affecting Agricultural Trade

In most countries where agriculture plays an important role, either economically or politically, the protection of agriculture has taken precedence over the desire to promote freer world trade. This section discusses both domestic and trade policies

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which combine to alter the structure of the world market in coarse grains, both directly and indirectly.

Trade Policies

Trade policies are measures that directly affect agricultural trade. Trade policies usually complement domestic agricultural programs and support domestic policy goals such as reducing surplus stocks or increasing farm income. Forms of trade policies that cause distortions in the international coarse grain market are many and varied. A summary of border policies can be found in table 7.

Tariffs and Quotas

Tariffs take several forms and most are but one component of a comprehensive system used by many importing and exporting countries to control the flow of agricultural commodities. Those countries which artificially maintain domestic prices at levels above world prices often use tariffs to keep suppliers' goods from entering their markets at prices that would undercut domestic price levels. Measures such as tariffs (as well as quotas) have the effect of reducing trade volume worldwide, since they reduce excess demand for these goods. This contraction of

Figure 5--World market in presence of a tariff or quota
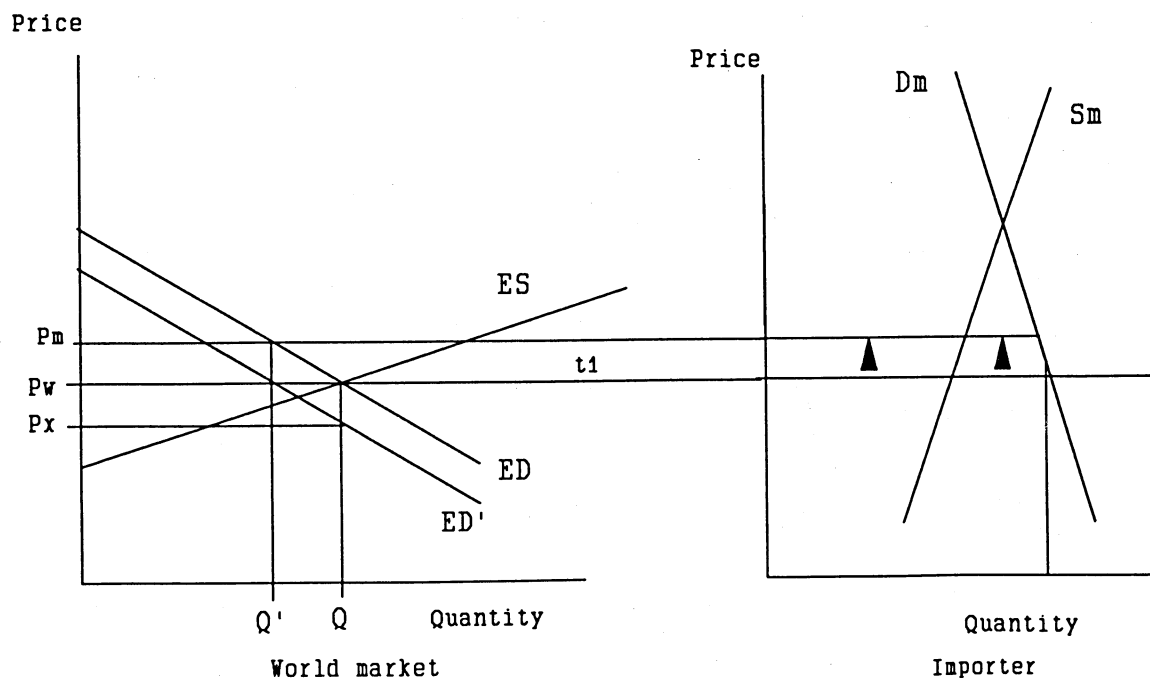
A unit tariff t^1 equal to P_m-P_w or quota Q^1 is applied to the commodity coming into the domestic market from abroad.

Table 7--Border policies recently used in world
coarse grain markets

Policy	Country	Crop coverage
Variable levy	EC-12	all coarse grains
Import tariff	Canada	corn
	Mexico	rye, barley, oats
Import quota	Taiwan	corn, sorghum
	Canada	barley, oats
	Mexico	all grains
Tariff quota	Japan	corn, nonfeed use
	S. Korea	corn, nonfeed, barley
Export tax	Argentina[1]	corn, sorghum
Food aid	United States	all surplus grains
	EC-12	all surplus grains
	Canada	all surplus grains
	Australia	all surplus grains
	Argentina	all surplus grains
Export subsidy	United States[2]	barley, corn, sorghum
	EC-12	all surplus grains
State marketing board	Canada	barley, oats
	South Africa	corn
	Argentina[3]	corn
Exchange rate policies	Argentina[3]	corn
	Brazil[3]	corn
	EC-12[4]	all grains

[1]Export tax dropped for corn and sorghum in 1987, reinstituted in 1989.
[2]Includes both Export Enhancement and Export Credit programs.
[3]In effect in early to mid-1970's, reinstated in 1989 in Argentina.
[4]Application of "green" exchange rates.
Source: USDA, Government Intervention in Agriculture.

export demand tends to reduce the price that exporters receive. This case is depicted in figure 5.[3]

However, among major participants (those that produce, export, or import large amounts of coarse grains) in the international feed grain trading market, only the EC, Canada, and Mexico apply tariffs. Unlike most other governments (except the Nordic countries), which set tariffs at a mandated single level, the Common Market varies its levy in response to changes in the c.i.f. import price for the commodity at a selected entry point. In normal practice, the price chosen is that of Rotterdam, the North Sea port, which is an important transit point for imports into the European continent. For the products covered, including feed grains, domestic users within the EC-12 must pay the grain threshold price (minimum import price for the most grain-deficient region, Duisberg, West Germany, adjusted for transportation costs) imported from outside the EC-12.

The variable levy and the tariff have different economic impacts, since world price changes affect goods covered by the latter but EC-12 commodities are insulated from world price pressures. Canada imposes a standard tariff on imported corn, and Mexico utilizes a value-added duty for rye, barley, and oats for the limited purchases by private buyers.

Import quotas or licenses restrict quantities of a particular commodity that may be imported over a certain time period, usually a year. Among major players in world agricultural trade, both Japan and Canada grant licenses or impose quotas on the importation of feed grains, specifically on barley and oats for Canada and nonfeed uses of corn for Japan. In addition, the quota is employed as a tool in enforcing state control of commodities by keeping products from other countries from entering. This usage applies in Mexico for traded agricultural goods, in South Korea for industrial uses of corn and for barley among feed grains, and in Taiwan for corn and sorghum.

Industrial corn imports in Japan and South Korea are regulated with tariff quotas. Up to a certain level of imports, one tariff rate is charged; any imports purchased above that level are charged at a higher tariff rate. This instrument enables a

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[3] In the short term, the Stolper-Samuelson theory shows that since the domestic prices of importables are maintained at high levels, resources are diverted toward production of importables away from exportables, and relative input prices of the factor used most intensively in the import-competing sector tend to rise. The higher output prices tend to harm consumers and help producers. In the long run, the countries' terms of trade are improved, but not enough to offset the cost of the tariff.

government to discourage imports above a certain level, without entirely prohibiting such imports.[4]

Export Taxes and Subsidies

Export taxes are often used by countries exporting primary goods in order to generate government revenue and redistribute income from producers to consumers. They tend to discourage domestic production of the taxed good, reallocate resources between crops or out of agriculture into the industrial sector, and reallocate supplies of the taxed commodity to the domestic market from the export market. The revenue generated is sometimes used to finance consumer subsidies or other urban projects. Such taxes are common in developing countries and are important for feed grains in Argentina. The export tax is often used in preference to other methods of taxation because products passing through government-controlled ports are easier to monitor than personal income or domestic sales.

Export subsidies encourage domestic production by raising the internal price above world prices, thereby having the opposite effect as export taxes. Export subsidies can be applied to a wide class of commodities and all potential buyers, or can be targeted for specific goods to only some buyers. The implications of an export subsidy can be seen in figure 6.[5]

Most export subsidy plans currently in use are targeted. Nations using targeted export subsidies include the EC-12 and the United States. This category includes food aid and targeted market expansion schemes such as export credit subsidies and credit guarantees, export bonus schemes, and export payment-in-kind (PIK) programs.[6]

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[4] Under textbook market conditions, a tariff of t^1 equal to (P_m - P_w in fig. 5) has an equivalent effect on supply and demand conditions as a quota which restricts imports to the point where the last unit is sold at $p+t^1$. The only difference would be to whom the quota rent or tariff revenue is allocated, otherwise welfare costs are equivalent. However, in agricultural markets the excess supply elasticity is usually low (inelastic), which makes it difficult to limit imports of goods by use of a tariff.

[5] In general, the introduction of a uniform export subsidy causes an increase in the welfare of domestic producers and of foreign consumers, and a decline in the welfare of domestic consumers and foreign producers. The total gain in welfare is exceeded by the total loss, the difference is paid for by taxpayers in the subsidizing country.

[6] These programs can potentially be designed to take advantage of the fact that import demand elasticities differ among potential customers. The effect of the targeted export subsidy on the subsidizer's net welfare is ambiguous, but such policies can be used as strategic policies to increase market share, particularly when facing a very price-responsive competitor.

Figure 6--World market in presence of an export subsidy
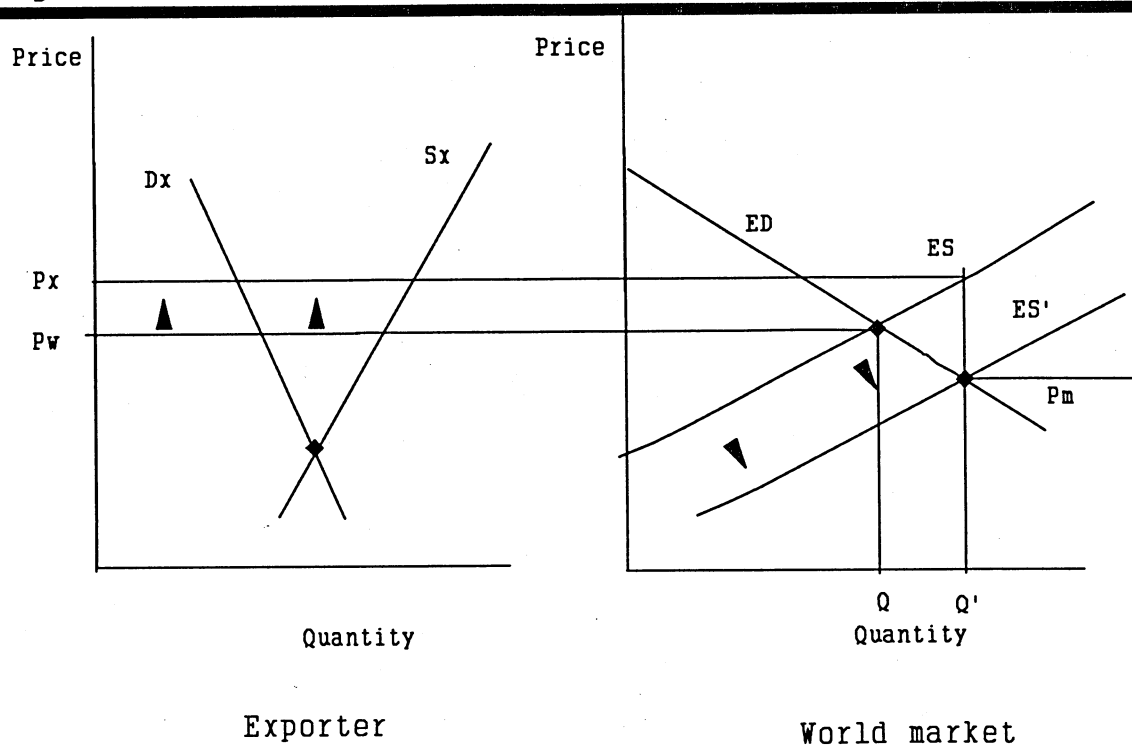
In a hypothetical two-country model, an export subsidy is perceived by importers as a right-ward shift in the exporter's excess supply curve (ES to ES'), which lowers the price to the rest of the world.

Food aid is a component of commodity programs in most major feed grain exporting countries. Grain, primarily from surplus stocks, is shipped to developing countries either at no cost to the recipient or at highly concessional long-term credit terms. Some shipments are composed of regularly allocated aid and some are designated for emergency relief. Most U.S. aid is transmitted under the auspices of the Agricultural Trade Development and Assistance Act of 1954, known as PL-480. Other exporters engage in direct food aid but in nearly all cases the grain sent is derived primarily from surplus stocks. The top five donors of feed grain through food aid programs in the world are major commercial feed grain exporters: the United States, the EC-12, Canada, Australia, and Argentina.

The 1985 Act, under which U.S. agricultural commodity programs will operate through the 1990 crops, authorized the Secretary of Agriculture to utilize any one of a number of export assistance programs to attempt to combat EC export subsidies and recapture feed grain market shares lost in the early 1980's. An export enhancement program (EEP) employing bonuses in the form of certificates for government-held stocks has been used in the United States since mid-1985. The only coarse grains exported

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under this program are barley and sorghum. But, barley exported under EEP auspices was nearly the entire total exported during 1988/89. In this program, grain trading firms negotiate contracts with the targeted importer, then submit bids to the U.S. Department of Agriculture (USDA) for approval. The contracts which contain the lowest bonus, i.e. amount over and above the prevailing world price, are accepted by USDA. The company transfers the grain to the importer at the agreed-upon price and receives the bonus from the CCC in the form of generic certificates. These certificates can be exchanged for any grain in the stocks, and the grain is sold or used by the firm redeeming it.

Another U.S. program in use to counter EC subsidies and encourage exports is the export credit guarantee program, in which the Government guarantees credit of 6 months to 10 years duration extended to importing countries for the purchase of U.S. agricultural products. In the 1988 and 1989 fiscal years, these programs were allocated a budget of $5 billion each year. In 1987, they helped importers of U.S. coarse grains to buy 6 million metric tons of corn, 67,000 metric tons of barley, and 706,000 metric tons of sorghum.

The EC-12 also employs export subsidies as part of its Common Agricultural Policy. Its restitution payments bridge the gap between supported internal EC-12 prices and lower world prices. In general, prices at typical export markets, marketing costs, and other expenses are considered when fixing restitution levels for exported goods. The EC-12 has been a consistent exporter of barley for feed purposes, using these subsidies, and in recent years increased its corn exports to the point where exports and imports are near balanced. For this reason, the EC-12 is a net coarse grain exporter.

Marketing boards in exporting countries often subsidize as well. When boards receive a higher price than their output would otherwise bring on the world market they are receiving a subsidy, though it may be otherwise accounted for. They pool the revenue from sales of the output both at home and abroad and allocate the receipts to producers who participate. This implicit subsidizing can happen when producers are permitted to keep the initial payment even if the final transaction price falls short of the initial payment rate. The government can also contribute funds to the share of revenue from exports, in which case they are in effect subsidizing all output. Among major feed grain exporters, this method of subsidization applies to Canada for barley and oats, South Africa for corn, and Argentina for corn in the early to mid-1970's.

Exchange Rates

Another border measure used by governments to control trade flows is the management of exchange rates. This type of intervention takes three forms: (1) multiple exchange rate systems, (2) deliberate exchange rate overvaluation or undervaluation, and (3) the "green" exchange rates used in the EC-12 Common

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Agricultural Policy. All these instruments force a wedge between domestic and external prices, without being as conspicuous as tariffs or quotas.[7]

Multiple exchange rate systems are usually operated to maintain a fixed rate of exchange for certain types of export arrangements. In other transactions in these countries, the exchange rate is allowed to fluctuate according to market forces. Among major players in the grain market, only Argentina has used this instrument. Argentina maintains a minimum trading price, below which exporters are not permitted to trade. The exporters must convert their foreign exchange earnings to domestic currency at the official rate, so they may suffer exchange losses if the market rate varies. Brazil has also used this policy to promote export of soybean products while discouraging export of the raw beans. Exchange rates were established by the government according to rules prescribing the percent of trade operations negotiated in each market.

Deliberate exchange rate overvaluation (or undervaluation) is utilized to discourage (encourage) exports of all kinds without applying a direct export tax (subsidy). Overvaluation tends to make exportable products less attractive to potential import customers by raising the relative price they would face. Such an action in effect shifts the excess demand curve leftward for goods that the country would normally export, while only minimally affecting internal supply and demand curves in those goods. Economic theory suggests that the overvaluation of exchange rates behaves as an implicit export tax (Schuh).

Overvaluation tends to affect all external trade, not simply one sector of an economy. Deliberate manipulation of the exchange rate away from par value distorts the terms-of-trade for all goods which would be traded in the absence of such intervention. In the past, among major players in the feed grain market, Argentina, Brazil, and Mexico have engaged in explicit currency overvaluation in order to hold down domestic prices of exportable goods by restricting exports.

The final policy instrument in use which affects the border prices of traded goods is the so-called "green" exchange rate employed by the EC in order to prevent market exchange rate movements from affecting farm support prices. The relevant administered prices (target, intervention, and threshold) are established by the EC-12 Agricultural Commission and denominated in European Currency Units, an artificial combination of EC-12

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[7] For the sake of reference, depreciation and devaluation are interchangeable terms, both meaning a decline in the value of a currency. Overvaluation is generally a deliberate government policy.

member currencies. These prices are then translated into national currency values by using special exchange rates called "green" rates that differ from market exchange rates for all EC-12 countries except Denmark.

Prices are equalized at national borders in both intra-EC-12 and extra-EC-12 trade by a system of border taxes and subsidies. These taxes (for countries with appreciating currencies) or subsidies (for countries with depreciating currencies) called monetary compensatory amounts are added for extra-EC-12 imports. If these monetary compensatory amounts were not in place, in theory, farm support rates would be relatively lower in nations with weaker currencies and relatively higher in nations with stronger currencies, which would partially defeat the purpose of the creation of the Economic Community. However, since the monetary compensatory amounts are established bureaucratically rather than by the market, some countries enjoy favorable green rates consistently, despite fluctuations in exchange rates.

Domestic Policies Affecting Trade of Coarse Grains

A discussion of government policies that affect trade would not be complete without including domestic agricultural policies. Domestic agricultural policies can indirectly affect the level of trade by shifting a particular country's excess supply or demand curve. Policies that promote domestic production can increase an exporting country's surpluses or reduce an importing country's excess demand. The consequences of either situation when conducted by large countries (defined as countries whose actions can affect the world market) is a decrease in world prices which affects other nations. The extent to which a domestic policy affects trade depends on three general factors: (1) the program's size, (2) the magnitude of a country's supply and demand elasticities, and (3) how policy is administered and operated with other policies. Often domestic agricultural policies have been found to be greater hindrances to trade than trade policies themselves (USDA, 1986).

A nation's agricultural trade policy is often an offshoot of its domestic agricultural policy. This section examines the domestic policies that affect coarse grain trade. The policies have been grouped into six basic categories: price supports, supply controls, income supports, input subsidies, marketing subsidies, and long-term programs for research and infrastructure (table 8). Brief descriptions of how they affect trade and of the major countries' policies are provided. Finally, measures of the levels of government support to coarse grain producers through domestic and trade policies are presented.

Price Support Policies

Policies that affect commodity prices include pricing policies of some state marketing agencies, other price support programs, marketing loans, multi-tiered pricing systems, and price stabilization programs. These policies are designed to increase the price received by producers, often through government

Table 8--Domestic policies used in the world coarse grain market

Policy	Country	Crop coverage
Price support:		
Variable levies, intervention stocks	EC-12	coarse grains
State boards	Japan	barley
	South Korea	corn, barley
	South Africa	corn
	Taiwan	corn, sorghum
	Canada	barley
	Australia	barley
Gov't. price guarantee	Mexico	corn
Deficiency payments, loan rates, FOR	United States	corn, sorghum, barley, oats
Supply control:		
Acreage restrictions	United States	coarse grains
Voluntary set-aside	EC-12	barley, corn
Income support:		
Taxation breaks	Australia	barley
	United States	coarse grains
Agr. stabilization payments	Canada	corn, barley, oats
Corn competitive pricing policy	Canada	barley, oats, rye
Pool deficit	Canada	barley, oats
Diversion payments	United States	coarse grains
Input subsidies:		
Fertilizer	Australia	barley
	Mexico	corn
	Nigeria	corn
	South Africa	corn
Interest concessions	Australia	barley
	Canada	rye, corn
Rural adjustment scheme	Australia	barley
Short-term credit	Brazil	corn
	Mexico	corn
	Nigeria	corn
	South Africa	corn
	United States	coarse grains
Fuel subsidy	Canada	barley, oats, rye
	Mexico	corn
	United States	coarse grains
Lime and fertilizer subsidies	Canada	barley, oats
Agr. mechanization	South Korea	corn, barley

Table 8--Domestic policies used in the world coarse grain market--Continued

Policy	Country	Crop coverage
Crop insurance	Canada	coarse grains
	Japan	barley
	Mexico	corn
	United States	coarse grains
Inputs assistance	Japan	barley
	Mexico	corn
	South Korea	barley
Infrastructure dev.	South Korea	barley
	Taiwan	corn, sorghum
Farm management improvement	Taiwan	corn, sorghum
Production improvement	Taiwan	corn, sorghum
Land improvement	United States	coarse grains
Market subsidies:		
Export incentives	Australia	barley
Marketing credit	Brazil	corn
Transportation subsidy	Canada	coarse grains
	South Africa	corn
	United States	corn, sorghum barley, oats
Inspection services	Canada	barley, oats rye, corn
	United States	corn, sorghum barley, oats
Feed freight	Canada	corn
Marketing/promotion	Canada	barley, oats rye, corn
Marketing system improvement	Taiwan	corn, sorghum
Structural reform:		
Research	Australia	barley
	Brazil	corn
Research and advisory	Canada	barley, oats rye, corn
Structural improvements	EC-12	barley, oats
Infrastructural development	Canada	coarse grains
	Taiwan	corn, sorghum
Agr. development	South Korea	barley
Research, processing, marketing, pest and disease control, advisory	United States	coarse grains
Regional or national programs	United States	coarse grains
	EC-12	
	Canada	

purchases. The net trade effect of price support programs depends on how the government disposes of the agricultural commodities. If the government stores or exports the excess commodity, the domestic market price will tend to increase over what it would be without such price stabilization programs. The effect of price support programs is transmitted to the world market as changes in the excess supply and demand of grain on the world market. Excess supply is increased and excess demand is decreased, resulting in lower world market prices than would occur in a free trade environment.

Most countries offer some form of minimum price support for coarse grain production. The United States offers nonrecourse price support loans. The EC-12 provides an intervention (guaranteed minimum) price support. Both of these supports are maintained through governmental acquisition of excess production. Other major exporters such as Canada, South Africa, and Australia have some form of marketing board. Some of the major importers such as Japan, Taiwan, and South Korea also have state-controlled marketing boards. The centrally planned countries generally administer prices through government agencies.

An important feature of price support programs in exporting nations is how governments handle the excess stocks generated by the supported program price. Generally, the government acquires the excess production and needs to either store the commodity or dispose of it on either the domestic or world market. Most countries hold some grain in working stocks (stocks present within the marketing channel), but domestic grain policies for most nations discourage the holding of carryover stocks (those stocks held off the market), to avoid assuming the burden of storage costs. The United States usually holds substantial quantities of both working and carryover stocks. Exporting countries that do not hold carryover stocks use their trade policies to assist exports of the excess grain generated with price supports. In large country cases, this would exert downward pressure on the world market price. The United States, which holds substantial carryover stocks, has tended to support the world market price above the price that would prevail if these stocks were released onto the market. However, in the last few years, the United States has encouraged exports of surplus commodities in order to reduce government stockholding costs.

Under the U.S. price support program, the Government purchases commodities under the nonrecourse loan program. Under this program, the Government, in effect, loans money to farmers with stored grain as collateral, with the farmer forfeiting the grain if failing to repay the loan (if market prices are still low when the loan period is over). The loan rate is established by law. Until the enactment of the 1985 Act authorized the use of generic commodity certificates, loan rates acted as a price floor for commodity prices. Without generic certificates, if the loan rate is set above the equilibrium world price, Government-owned grain stocks accumulate through farmer forfeiture of loans, causing world prices to rise toward the loan rate. U.S. competitiveness in exports declines as a result, and U.S. Government stockholding

costs rise. With generic certificates, government stocks are used for payment of some government commodity program obligations, world excess supply increases, and world market prices drop.

The EC-12's Common Agricultural Policy provides a minimum price for domestic coarse grain producers. The Common Agricultural Policy sets intervention prices that are higher than world market prices, which affects domestic market prices, and maintains higher prices through variable import levies which protect internal prices from fluctuations in the world market. This trade instrument was discussed above. Because domestic prices are insulated from world prices, EC-12 producers can sell domestically their grain at the EC-12 market price. Intervention agencies purchase the excess production at the intervention price discounted 6 percent for the buying-in level. The grain purchased by these agencies is then stored, sold on the domestic market, or disposed of in international markets without affecting EC-12 domestic prices. In recent years, the EC-12 has increasingly relied on export subsidies to support domestic market prices.

Canada, Australia, and South Africa use marketing boards, which offer minimum prices to producers (barley for Canada and Australia, corn for South Africa). Producers are paid the guaranteed price upon the delivery of their grain to their marketing board. If the world price is below the minimum producer price paid when the grain is sold on the world market, the government pays the difference to the marketing board. This payment is called a pool deficit. If the world price is above the minimum price, the difference, less transportation and handling charges, is paid to producers.

Because they are major food and feed importers, Japan, South Korea, and Taiwan are concerned about food security, by which they generally mean the maintenance of a secure and stable food supply. These countries strive to meet this and other agricultural policy goals by stimulating domestic agricultural production. Agricultural production is encouraged through a state agricultural board which offers producers prices well above the world level. These boards differ from those discussed above only in their role as primary government agent for purchasing imported grain. Domestic consumption is consequently curtailed by maintaining high internal food prices and using restrictive border measures, such as import tariffs and quotas, to protect these prices.

Supply Control Policies

Supply control programs are used to offset the supply-stimulating effects of price and income support programs and to reduce government expenditures. The United States is the only country that has implemented major supply control measures for feed grains, although the EC-12 introduced a voluntary program for the 1989 crop year, the scope of which will vary among member nations. The EC-12 also instituted a stabilizer program--a

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system of co-responsibility levies--at the beginning of the 1988/89 marketing year.

U.S. agricultural policy requires program participants to comply with acreage reduction or paid land diversion requirements in order to receive price and income support payments and program benefits. These requirements call for participants to remove a portion of their crop acreage from production. The acreage removed must be devoted to conservation uses. Three types of voluntary acreage reduction programs have been used: (1) diversion for cash, (2) diversion as a condition for eligibility to receive benefits from the government program, and (3) diversion for payment-in-kind (PIK). In 1987, 29 million acres of coarse grain cropland were removed from agricultural production.

The European set-aside is not the same policy instrument as the acreage reduction program in the United States because the European version is a voluntary program for farmers, not a requirement for payment participation. Farmers are entitled to receive financial compensation for the loss of income resulting from the set-aside (at least 20 percent of the arable land) for a period of 5 years. The program must be available to farmers in all EC-12 countries, but the compensation varies between members.

The EC-12 stabilizer program consists of automatic cuts for grain support prices triggered when production exceeds a "maximum guaranteed quantity" of 160 million tons for wheat and coarse grains, for the 1988/89 through 1990/91 marketing years. At the start of each marketing year, producers are charged a "co-responsibility levy" or production tax of 3 percent. This charge is in addition to the basic 3 percent levy producers have paid since 1985. If grain production is estimated by the European Commission at less than the ceiling, the new levy will be refunded in full. If production exceeds the ceiling by less than 3 percent, the levy will be partially refunded. Price cuts due to this new levy have not to this point significantly affected the large EC-12 grain surpluses, because the price cuts have been offset to some extent by improved yields and currency adjustments.

Income Support Policies

Income support policies link program payments to agricultural production in order to increase farm income. These policies include diversion payments, deficiency payments, crop insurance and disaster payments, and income tax concessions. Income support policies affect trade because increasing producer net returns by linking program payments to production stimulates production, thereby lowering import demand or increasing excess supply. The United States and Canada are the major coarse grain exporters that use direct income support measures. Other countries with similar income policies are listed in table 8.

The United States uses a target price to establish a guaranteed producer price for grains. Participating producers receive the

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difference between the target price and the announced loan rate or a season average producer price, whichever is higher. This is referred to as the deficiency payment rate. The deficiency payment rate times the permitted acreage times the established program yield equals the deficiency payment.[8] The effect of target prices on crop production differs from that of loan rates because deficiency payments to producers are based on historic crop yields, so producers receive no immediate benefit from the target price for increasing yields. The entire crop can receive the loan rate, if turned over to the CCC. As long as farmers believe that Congress will continue to freeze program yields, marginal input decisions affecting crop yield will not be affected by changes in target price, but by market price changes.

Canada possesses an income stabilization program designed to protect producers from large changes in prices. The program pays producers when their cash flow falls below a 5-year average. This program was authorized by the Western Grain Stabilization Act in 1976 and applies to producers in the Western Prairie Provinces.[9] Producers and the Canadian Government provide funding for the program.

Input Subsidies

Input subsidies reduce the cost of producing agricultural commodities. They include subsidies on purchased inputs such as fuel, fertilizer, seed, pesticides, and irrigation. Concessionary interest rates, credit guarantees, concessionary taxes on agricultural land, storage cost subsidies, and labor subsidies can also be categorized as input subsidies. Input subsidies encourage greater use of subsidized factors of production by reducing the cost of these inputs to producers. This effect in turn lowers import demand or raises exportable surpluses.

Input subsidies are widely used by governments to stimulate production. The inputs subsidized and the form of the subsidies differ throughout the world (see table 8). The United States subsidizes farm credit, irrigation, grain storage, transportation, and tax liability. Canada provides special interest rates, fuel subsidies, and transportation subsidies to barley through its wheat board. Japan provides input assistance and crop insurance to its producers. Other countries, such as Australia and South Africa, subsidize fertilizer use.

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[8] There is usually a voluntary acreage diversion program, and often a paid land diversion program, required for income support eligibility, so the permitted acreage is less than the farmer's total base acreage.

[9] Alberta, Manitoba, and Saskatchewan.

Marketing Subsidies

Marketing subsidies can lower marketing costs and increase producer income. Such cuts in marketing costs in turn tend to increase production, although some varieties of these subsidies may increase wholesalers' income rather than producers'. These subsidies include marketing credits, as well as processing, transportation, inspection, and sales promotion subsidies by governments.

Two prime examples of marketing subsidies are the U.S. upkeep of the inland waterway system and Canadian transport subsidies. While transportation subsidies are an important form of agricultural support in Canada, most countries rely more heavily on other forms such as price and income support and input subsidies to protect their agricultural sector.

Long-Term Structural Measures

Long-term structural measures include agricultural research, advisory or extension services, and rural development programs. In the short run, these measures have less trade-distorting effects than do the other domestic policy categories. However, in the longer run, these investments can expand production substantially and help to lower costs of production. This is regarded by many economists as efficiency enhancing rather than production and trade distorting. Popular forms of long-term structural support in many countries are research and education (see table 8).

Justifications for Agricultural Policies

In the past, agricultural trade has enjoyed a unique near-immunity to attacks on protectionism. This status is only now beginning to break down. The security of that position has been due to a combination of the lack of transparency of the protection that occurs through domestic support programs and the vast array of economic and noneconomic arguments mustered by governments for retaining those policies. It has been publicly acknowledged only recently that domestic farm programs have an adverse effect on world agricultural trade.

The motives often cited for the preservation of farm programs in developed economies are complex, but fall into three basic interrelated categories: (1) food security, (2) the explicit protection of domestic producers, and (3) price and income stabilization. Less-developed countries and centrally planned economies have other goals as well.

Developed Countries

Food security is an issue that mixes elements of politics and basic economics. Food security typically means a reluctance to rely on foreign suppliers to make up for shortfalls in domestic production of staple crops. This condition can stem from historical preferences for self-sufficiency due to past shortages

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(resulting from wars, disease, embargoes, droughts, etc.) or an aversion to depending on potentially unfriendly nations for maintaining normal food supplies. Protecting agriculture under the guise of food security as a policy dates back to the English Corn Laws of the early 19th century, which protected the English farm sector from cheap food imports. These severe laws were repealed in 1846 under the united assault of British industrialists and consumers.

The protection of domestic producers is common in developed countries and has been increasing over the last couple of decades. The rapid growth in productivity in the agricultural sector, due to technological breakthroughs like hybrid crop varieties, irrigation, and effective fertilizers and pesticides, have far outstripped productivity gains in the industrial sector. Given the low elasticity of domestic demand for food products, these factors have led to a clear trend of declining real agricultural prices. Faced with this situation, domestic producers have sought and received considerable protection in the form of domestic price support programs and border measures.

This insulation of farmers against market forces has political and social roots as well. While agricultural producers and those engaged in agriculturally related activities are only a small fraction of the population of most developed economies, it is quite customary for producer groups, which are concentrated, to wield more political power in national legislatures than consumer groups, which are much less organized. This is especially true for price support programs which have little apparent cost for consumers. Payments for price support programs are lumped with education and social programs in the form of budget expenditures for entitlements, which are paid for by general tax revenues. These producer groups are further concentrated geographically, which gives elected representatives from those regions a further incentive to maintain protection for their farmer constituents.

An additional factor which enters into the process is the public's perception of the value of the rural lifestyle and the family farm. This preference causes widespread popular backing for "maintaining the family farm" even though nonagricultural businesses of similar size have no similar base of support. These noneconomic factors are quite intangible but have in the past effectively offset economic arguments for making agriculture confront market forces.

The final category of reasons for protecting agriculture is the stabilization of farm prices and/or income. The aim to stabilize prices that is explicit in the loan rate/nonrecourse loan portion of the United States coarse grain program is somewhat more palatable to the general public than is income stabilization, which is viewed as a form of welfare payment by many. In fact, in the United States at least, the more direct the income supplementation to farmers (i.e., not tied to output, performance, etc.), the less agreeably such a policy is usually regarded by the electorate (Cochrane).

Economic arguments do exist for the implementation of price stabilization. In the face of distorted markets and aversion to risk among producers and consumers, excessive price instability causes efficiency losses which could be recouped from price stabilization. Within developed countries, price stabilization schemes often have multiple objectives. These include raising average prices and incomes of producers, improving export market access by assuring a reliable supply, reducing the risks faced by producers and consumers, and stabilization of the macroeconomy.

The avowed purpose of price stabilization is to reduce the variability of product prices faced by producers and consumers. This approach attacks only one facet of a farmer's uncertainty; the farmer must also deal with yield variability, input price variability, and uncertainty about marketing strategies. Reduction of price risk and, indirectly, income risk may enable the farmer to increase production of a risky crop or utilize a risky technique that may enhance income in the short run. However, longrun market adjustments may occur which both eliminate those income gains and increase the cost of the program, such as farmers engaging in strategic behavior to maximize program payments rather than to minimize their costs.

The impact of price stabilization on consumers depends on the source of the variability. If variability stems from the supply side, stabilization would help the consumer. If it is derived from income variability, on the demand side, stabilization would harm the consumer. However, consumer price variability in general is lower than producer price instability, because the basic commodity cost (farm-gate price) is only a fraction of the price the consumer encounters. Thus, it is not important to the average consumer whether the instability is generated on the supply or demand side, because the consequences of price stabilization at the producer level would not be large in either case (Just, Hueth, and Schmitz).

Stabilizing agricultural prices can play a role in stabilizing the entire economy in developed and developing countries in which the agricultural sector is a large component of the economy. This reason is not valid for countries or regions like the United States or the EC-12, in which agricultural income is only a small fraction of gross national product, but is potentially applicable in countries with a large stake in the agricultural export market. Fluctuating commodity prices in such a country would cause large swings in farm income and thus farm employment, which would be disruptive. Stabilizing prices could reduce these problems, but so could other solutions, such as all countries dropping trade barriers, which might be less costly in the long run.

Less-Developed Countries

Less-developed countries attach much importance to the programs affecting their agricultural production, some of which may have been used to protect agriculture, while others were initiated to help urban consumers. Many policies are in place which tend to

protect agriculture, to attain some or all of the following objectives: (1) an adequate and stable food supply (food security), (2) stable prices, and (3) increased farm income. Other policies are in use to explicitly or implicitly tax agricultural producers for the assistance of other segments of the economy. Reasons cited for the implementation of these programs include hunger and malnutrition, national security, relieving pressure on foreign exchange, and keeping a strong agricultural sector in order to achieve economic development.

Food security as a justification often results from a combination of economic and political motivation for protectionism in less-developed countries. Some less-developed countries have been relatively poor in foreign currency and are unable to import large amounts of food to feed their populace, so they seek to nurture their agricultural sector through output and input subsidization and protection from outside competition. Grain policies in India and Brazil are examples of this type of policy. Forms of protection are often in place because these countries are uncertain of the motives of developed exporters or are unwilling to rely on uncertain world agricultural markets for their food supply.

On the other hand, other policy goals have the effect of hampering agricultural production. These include raising government revenue and maintaining a cheap domestic food supply. Some developing countries have a fairly productive agricultural sector but impose export or producer taxes, overvalued currency, a two-tiered pricing system, or an overall import substitution strategy in order to provide cheap food to consumers or divert resources out of agriculture into the industrial sector. This is often a tool in promoting growth in the industrial sector but distorts resource allocation in the entire economy. Such a strategy in the long run often creates a shortage of domestically produced food and eventually may force the government to encourage or even subsidize certain types of agricultural imports.

Centrally Planned Economies

The objectives of agricultural policies of centrally planned economies are difficult to compare to market economies, because both production and prices are planned at a government level. Inconvertible currencies, closed markets, and internally administered prices make it difficult to determine the value of their agricultural output relative to the world market.

Agriculture is generally adversely affected by administered prices. Conditions such as weather, climate, topography, and soil fertility vary widely among agricultural areas within a single country, making central administration difficult. The transmission of price signals, which reflect relative scarcities between output and input markets to producers, is vitally important to the efficiency of the agricultural sector.

Economic reforms which promote decentralization were undertaken by China in the late 1970's. Its output of agricultural commodities greatly expanded in the early 1980's. Since the mid-1980's, however, grain production has fallen short of the country's target levels due to low contract prices and the government's inability to pay farmers cash for their grain. Other socialist countries in Eastern Europe have also instituted greater decentralization which has resulted in increased agricultural production. The USSR has resisted such a change but now is beginning to consider following suit, with the advent of Gorbachev's proposed *perestroika* or economic restructuring.

Policies of the centrally planned countries have appeared to increase their demand for U.S. exports in the past decade (Cook). Whether this export demand will continue depends upon the evolution of their domestic and trade policies and on their progress in increasing agricultural efficiency and growth.

Extent of Trade Protection

Substantial barriers to trade exist in the world feed grain market. Because of the complex forms of this protection, it is difficult to quantify and compare protection across countries. Previous studies devoted much effort to a simple classification of governmental measures which affect production, imports, and exports. Early GATT negotiation rounds arrived at the following five categories: (1) government participation in trade, (2) customs and administrative entry procedures, (3) industrial health and safety standards, and packaging, labeling, and marketing regulations, (4) specific limits on imports and exports, and (5) restraints on trade by price mechanisms. Out of the GATT summaries, it was possible to derive import restrictions by country and general product category, but levels of protection could not really be compared on such a basis (Hillman).

Protection of agriculture is extensive in the countries that are major players in feed grain trade. This is important not only because coarse grains are a large component of world agricultural trade, but because linkages between feed grains and food grains, oilseeds, and livestock cause the effects of feed grain protection to be felt throughout the entire agricultural sector. To determine the impacts of proposed trade liberalization on feed grains, it is necessary to be able to compare these levels of protection, particularly across countries. Several alternative measures have been devised, whose coverage and consistency has become more complete since the need for them was first recognized.

The first empirical measures of protection levels were developed by economists in the mid-1960's (Balassa, 1965). They were called nominal (or explicit) and effective (or implicit) rates of protection. The effective rate takes into account the fact that inputs into the final product are also subject to tariffs. The

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nominal rate of protection is defined as

$$N_i = T_i / P_i,$$

in which T_i is the country's tariff level on the ith good, and P_i is the border price. The effective rate of protection is defined as

$$E_{ij} = \frac{W_{ij}}{\dfrac{S_{ij}}{(1 + N_{ij})} - \dfrac{M_{ijk}}{(1 + G_{ijk})}}$$

where W_{ij} = domestic value-added of factor costs of ith good, S_{ij} = value of ith good, M_{ijk} = value of kth input in production of the ith good, N_{ij} = <u>ad valorem</u> tariff equivalent on good i, and G_{ijk} = tariff rate on k^{th} input used in production of ith good.

These concepts have been useful for assessing protection levels in the industrial sector but neglect important dimensions of agricultural protection by considering only border measures. In response to a clear need for a more complete indicator of levels of protection in agriculture, producer and consumer subsidy equivalents (PSE's, CSE's) were developed by Timothy Josling (Josling and Tangerman). PSE's and CSE's are representations of the level of government assistance for producers and consumers of a particular commodity. These measures account for non-border policies such as domestic price support and input subsidy programs, which are important in agriculture and not counted in nominal rates of protection and effective rates of protection.

PSE's and CSE's measure and compare the level of protection of agricultural products (USDA, <u>Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture</u>, 1988). The PSE includes (1) components based on price wedges, induced by border measures and price support programs, (2) budgetary data such as direct payments, and extension and research expenditures, and (3) various input subsidies. Budget expenditures are allocated to commodities by share of value in production if commodity breakdowns are not available, and then aggregated with the items based on price wedges for a total per metric ton of production. The measure that is usually reported as the PSE is the value of government support per unit as a percentage of producer price. The PSE and CSE commodity coverage is quite thorough for the OECD countries and is rapidly expanding for less-developed countries and centrally planned economies, where adequate data are lacking. The coverage for feed grains is quite good.

Such measures have gained wider attention since the commencement of the latest round of GATT negotiations in Uruguay in late 1986. Most of the tabled proposals for agriculture call for the use of an aggregate measure of support as a tool for negotiating or

monitoring reductions in the levels of agricultural protection. A measure like the PSE is mentioned in five of the seven initial proposals, though they differ in how to apply it and what types of programs ought to be included. Most proposals favor a measurement or monitoring role. This would imply that negotiators would still have to directly confront specific programs in the actual bargaining sessions.

PSE's for 1984-86 indicate a distinct increase in the level of protection afforded most major agricultural commodities. PSE levels for major traded coarse grains rose consistently for most major players in the market. The exceptions were Argentina and Australia, where PSE's fell, and Mexico and Taiwan, where the corn PSE's stayed fairly constant while the sorghum PSE's rose. The exact breakdown of these PSE's are shown in table 9.

Seven of the 11 reported PSE's are for developed countries. In several of these countries, a considerable portion of the increase in protection level between 1984-86 occurred due to changes in exchange rates and price levels. The highest levels of protection for feed grains (in 1986) were offered by the EC-12 (for corn), Japan (for barley), South Korea (both corn and barley), the United States (for barley), and Taiwan (for sorghum). The lowest levels of protection were provided by Argentina (which effectively taxes its sorghum producers), Australia (for barley), Canada (for oats and corn), and Taiwan (for corn).

The countries for which feed grain PSE's have been calculated employ somewhat different policy mixtures in order to protect their producers. A breakdown of the major policy instruments (in terms of their contribution to the total PSE) for corn and barley is shown in table 10. In the cases of the United States, Canada, Mexico, South Africa, and South Korea, price and income stabilization programs dominated. For the EC-12, Argentina, Japan, Brazil, and Taiwan, trade policy and state control programs were the major source of producer support. In Australia, the only programs for a mostly unsubsidized commodity are research and minor tax concessions. The only policies in use among major countries which tend to tax feed grain producers are the exchange rate policies in Argentina and Brazil and the export taxes and producer levies in Brazil, Argentina, and the EC-12.

Economists from both the United States and abroad have criticized the PSE/CSE concept for a number of reasons. The critiques fall into two basic categories: (1) inability to distinguish between effects on production and trade of removing very different types of programs, such as input subsidies and export subsidies, and (2) inclusion of measures which may affect production, such as research expenditures, but have a minimal distorting impact on trade (Jabara, 1988).

Table 9--Producer subsidy equivalents (PSE) for
coarse grains, 1984-86

Country	Crop	1984	1985	1986
		PSE (percent)		
Argentina[1]	Corn	-25.0	-8.8	11.8
	Sorghum	-67.3	-30.4	-16.1
Australia	Barley	2.5	3.2	2.6
Brazil[1]	Corn	-23.5	11.6	58.5
Canada	Barley	27.2	45.4	61.0
	Oats	8.5	12.6	23.2
	Rye	28.8	23.8	63.1
	Corn	8.0	9.8	21.4
EC-10[2]	Barley	1.6	9.7	39.2
	Corn	12.0	65.5	115.5
Japan	Barley	91.9	98.4	103.7
Mexico[3]	Corn	50.9	50.0	N.A.
	Sorghum	32.7	42.5	N.A.
South Africa	Corn	42.7	53.4	54.2
South Korea	Corn	53.6	61.6	70.9
	Barley	61.7	64.5	74.8
Taiwan	Corn	9.8	10.2	10.3
	Sorghum	69.9	70.9	78.2
United States	Corn	15.5	19.7	49.5
	Sorghum	19.5	22.5	49.2
	Barley	13.7	27.4	76.3
	Oats	5.8	8.0	15.8

[1]In Argentina and Brazil, a negative PSE indicates that the agricultural commodity is effectively taxed rather than subsidized.

[2]PSE calculated for EC before entry of Portugal and Spain.

[3]No PSE for 1986 for Mexico was available at this time.

Source: Econ. Res. Serv., U.S. Dept. Agr.

Hertel examined the impacts from removing different types of agricultural subsidies from a nation's farm program. The impact of a given level of subsidy on production and trade can vary, depending on the type of subsidy. In general, both input subsidies and output subsidies tend to encourage additional output. However, the former is apt to influence the input mixture used in production, while an output subsidy tends to increase farmland value. Export subsidies distort trade more than equivalent output subsidies. Examining equal expenditures on output and export subsidies, Hertel found that export subsidies would increase exports about 300 percent more than an equivalent expenditure on output subsidies. The cost of export subsidies falls on domestic consumers, who pay higher prices than they would under an output subsidy program. Thus, if GATT negotiations result in mandated cuts in support as measured by PSE's, then governments could juggle program mixtures and have quite different impacts on world production and trade. If GATT members wish to impose limitations on such program switching, any agreement must also require accompanying budgetary reductions or eliminate whole classes of policy instruments.

The second major criticism concerns the policy composition currently included in calculated PSE's. The PSE includes programs such as research and extension, meat and food inspection services, and rural development schemes that affect productivity and efficiency but are not typically perceived as having adverse effects on world trade. On the other hand, the currently available PSE's do not attempt to measure the effects on producers of supply controls, such as the U.S. acreage reduction program, or food aid programs, such as PL-480, which could indeed alter world trade and production.

Some economists believe that countries which engage in supply control, particularly the United States, ought to be credited in negotiations for restraining production of certain commodities. This position is expressed by EC negotiators in the agricultural talks, though not by U.S. representatives. However, such constraints are not directly accounted for within the PSE. Further, issues such as an appropriate world reference price, lack of strict comparability of PSE's among countries, and exchange rate fluctuations make the use of the PSE as a negotiating tool difficult. Difficulties with data and lack of trained statistical manpower make timely calculation of updated PSE's a task that is nearly impossible for many countries. However, choosing a single year's estimates as the definitive measure of protection would be an inadequate indicator of true protection levels. Some compromise in dealing with these two problems must be arrived at.

Alternatives and adjustments to PSE's have been suggested both within academic circles and in tabled trade liberalization proposals. Alternative measures include the Australian price adjustment gap, the Canadian trade distorting equivalent, and the EC-12 supply management unit, which all are designed to redress many of the above-mentioned weaknesses (McClatchy). Such

Table 10--Policy components of PSE's for coarse grains
in order of magnitude, 1986

Country	Corn	Barley
Argentina[1]	Export tax (-) Exchange rate (-)	
Australia		Research (+) Tax concessions (+)
Brazil	Marketing intervention (+) Production credit (+) Domestic taxes (-) Exchange rate (-)	
Canada[2]	Coarse grain stabilization (+) Western grain stabilization (+) Crop insurance (+) Provincial programs (+)	Transport subsidy (+) Pool deficit (+)
EC-12	Variable levies (+) Producer levy (-)	Variable levies (+) Producer levy (-)
Japan	Riceland diversion (+)	State board (+) Inputs assistance (+)
Mexico[1]	Price support and licensing (+) Credit (+) Exchange rate (+)	
South Africa	Price subsidization (+) Overvaluation (+) Credit subsidy (+)	
South Korea	Price stabilization (+) Agr. mechanization (+)	Price stabilization (+) Agr. development (+)
Taiwan[1]	State board (+) Production (+) Infrastructural development (+)	
United States[1,2]	Deficiency payments (+) Loan forfeiture (+) Commodity loans (+) Storage payments (+)	Price support policy (+) Deficiency payments (+) Commodity loans (+) Storage payments (+)

Note: Direction of influence on producers in parentheses.
[1] Same policy set for sorghum as for corn.
[2] Same policy set for oats as for barley, except oats not eligible for export enhancement program in the United States.

indicators have not been published for serious comparisons with PSE's/CSE's.

The exact character of the aggregate support measure to be used will depend greatly on the purpose for which it is designated. There are several roles which an aggregate measure could conceivably fill in a GATT agricultural treaty. These functions include use to monitor countries' progress in adhering to agreements, to determine credit and/or debits for past policy actions, to trigger elimination of certain policy instruments, or to bind GATT members to specific commitments on support levels. With a more precise focus on policy categories in the most recent set of proposals, the role of an aggregate measure of support seems to have been de-emphasized. It remains possible that some measure will be used as a measurement tool in the GATT negotiations, since such a clause appears in most of the proposals, but many issues will have to be resolved before a gauge of protection satisfactory for GATT purposes is available.

Future Coarse Grain Markets Under Trade Liberalization

If trade reforms are agreed upon, their implementation would take place over a number of years, and the adjustments to the new policy environment would interact with market developments driven by other factors. In order to provide a reasonable portrayal of future markets under a reformed trading environment, a discussion of coarse grain markets needs to include both the changes resulting from an elimination of trade-distorting policies and the developments in the market resulting from other forces. For this reason, the description of the changes in the coarse grain market will first examine the changes resulting from trade liberalization. This analysis will be followed by a description of agricultural reforms in centrally planned economies and other market developments.

Trade liberalization will be defined in this analysis as the elimination by the seven industrialized market economies of all tariff and nontariff barriers, subsidies, price and income supports, and commodity stabilization programs that affect trade.[10] In this analysis, the coarse grain market after trade liberalization is compared with a normal year of production and consumption under the current set of agricultural policies, in which output, prices, and exchange rates are at or near their trend levels. This analysis depends crucially on the assumption

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[10] These industrialized market economies are the United States, the EC, Canada, Japan, Australia, New Zealand, and other Western European countries.

that, if large stocks of coarse grains exist, they would be released onto the market in an orderly manner.[11]

The definition of trade liberalization used was selected both because industrialized market economies' agricultural policies are responsible for most of the distortion in agricultural trade and because most of the proposals in the Uruguay Round (see table 1) include special exemptions for less-developed nations. China, the USSR, Argentina, South Africa, Taiwan, South Korea, Saudi Arabia, Mexico, Brazil, and other countries that are not developed play a significant role in the coarse grain market. The effect of trade liberalization on each of these nations would depend on whether it participates in the liberalization of agricultural markets. The effect of trade liberalization on such individual nations will be examined by assuming that each alone joins the developed countries in eliminating trade-distorting policies. Significant differences between a nation's reaction to trade liberalization with and without its participation will be noted. Several nations, such as the USSR and China, are not expected to undertake trade reform, so the discussion of the effects of trade reform on these countries will examine only their adjustments to changes in the coarse grain market resulting from liberalization by the industrialized countries. The effects of agricultural reform in centrally planned economies and other market developments not directly related with trade reform on the coarse grain markets will then be discussed in the next section.

Full trade liberalization of agriculture by the seven industrialized market economies or regions would have a significant effect on the world coarse grain market. World trade in coarse grains would likely rise, while world coarse grain prices would likely rise slightly to moderately. The stability of world prices in the new trading environment is uncertain due to two conflicting factors. On the one hand, coarse grain prices in individual countries which use agricultural programs to stabilize domestic prices would become less stable due to the removal of domestic price support measures, but these domestic instabilities would tend to offset each other as more open trade tended to smooth out local disruptions due to shortfalls in production. On the other hand, some major producers, such as the United States, employ extensive commodity stockholding as part of their grain policy. These stocks would likely be greatly reduced in scope with trade liberalization. In their absence, prices in those countries would become more variable and, as they are major players, this could destabilize world prices.

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[11] After the drought of 1988, the stocks held by the United States were drastically reduced. However, given current agricultural policies, large stocks of coarse grains are frequently observed. The orderly disposal of large stocks would have a slight depressing effect on prices. If, however, several billion bushels of coarse grains were suddenly placed on the world market, there would be a drastic decline in prices until the excess supply was exhausted and the market was able to adjust and reach a longrun equilibrium.

Production and exports would increase for countries such as Argentina and the United States which are able to expand production while maintaining a low cost of production. In Australia and Thailand, production and exports could increase, but alternative opportunities in livestock and food grain production are expected to reduce the likelihood of greatly increased coarse grain exports. Trade patterns would change as the EC-12 became a major net importer, and the exporting roles of Canada and China would diminish greatly. The United States would solidify its position as the major producer and exporter in the world coarse grain market.

This section presents the likely adjustment of coarse grain markets after full trade liberalization. The section first provides a general overview of the economics of trade liberalization. Then the adjustments in coarse grain production, consumption, and trade for major participants in world coarse grain markets are discussed. Following this discussion, the effect of agricultural reforms in centrally planned economies and other market developments on coarse grain markets, the likely shifts in trade flows, prices and stocks, and the long- and short-term adjustments of the major producers will be examined. This work is the not the output of a specific large-scale model, though results from such models are referred to when appropriate.

Economics of Trade Liberalization

This section will describe the motivation for eliminating domestic agricultural policies. This description will be followed by an illustration of the changes in world coarse grain markets that would likely occur if the current policies were eliminated.

Before proceeding further, trade liberalization needs to be defined more explicitly. For the United States, trade liberalization would mean the elimination of loan rates, deficiency payments, acreage set-asides, paid land diversions, export subsidies, and storage subsidies. Examples of policies in other countries that would be eliminated by trade liberalization are: intervention prices, variable levies, exchange rate policies, and export subsidies for all coarse grains in the EC-12; import tariffs on corn, import quotas for oats and barley, state marketing boards and transportation subsidies for barley in Canada; state controls, input assistance, and tariff quotas on nonfeed corn in Japan; and input subsidies and taxation concessions in Australia.

The removal of these agricultural programs would result in the reduction, if not elimination, of distortions in agricultural commodity markets and permit market prices to provide producers and consumers with more accurate information on the relative value of goods. The use of market prices rather than government incentives to allocate resources results in a movement toward a free trade environment and more efficient decisions.

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Under free trade, farmers observe the price available for different agricultural inputs and commodities and then decide the amount of each commodity to produce. Farmers also use market prices to determine the appropriate combination of inputs to use to produce those crops. Profit-maximizing farmers will choose to produce at the point where the marginal value of production (the market price times the marginal product) attributable to the last unit of an input applied equals the cost of that unit of input. In an undistorted market, the price of both the crop produced and the inputs used accurately reflect the demand for these goods, permitting farmers and consumers to make decisions that optimize their respective profits and utility. If the free trade environment applied to all producers, there would be one market price that would prevail.[12]

Current agricultural policies, such as price supports, subsidies, tariffs, or similar programs, affect prices so that these prices no longer clearly reflect the market demand for a commodity. The prices instead reflect the market demand as seen through the distortion introduced by the policy. This situation can be illustrated more easily by using a price support policy as an example. When a price support policy is used and the price is artificially supported above market prices, farmers no longer respond to the market price but instead to the support price. This response results in farmers increasing the amount of the commodity they would produce and the amount of inputs they would use to produce it. In addition, unless there is a policy that also subsidizes consumption, the quantity of the commodity consumed decreases. The distortion is passed onto the world market because the price support increases production and reduces consumption in the country employing the subsidy, causing the country to offer more (buy less) grain on the world market.[13] The additional excess grain (or reduced excess demand) on the market serves to reduce the world price, increasing the difference between the domestic and world market price. Because the world price is less than the support price in the subsidizing country, the country would need to impose some form of border restriction to prevent arbitragers from purchasing grain on the world market and selling it at a lower price to consumers in the subsidizing country.

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[12] Claiming there would be one world market price is an oversimplification. In fact, a different farmgate price would apply to different farmers because the cost of transporting and handling the commodity to the market will vary depending on the location of the farm.

[13] A country using price supports could choose to store the grain for a while, but without some kind of production control policy the country's storage capacity would eventually be exhausted (or bankrupt the treasury).

The effects of trade liberalization can be viewed as the reverse of the distortion described above. There would be movement away from separate protected national prices toward a single world market price which would affect producers and consumers in all nations. Border measures inhibiting agricultural trade would be removed, permitting arbitrage to assure an efficient market. There are two qualifications to this analogy: (1) instead of removing one policy, the many policies discussed would be removed; and (2) rather than examining one nation, the changes in seven major agricultural producing and consuming economies are being examined.

To discuss the general effects of trade liberalization in a systematic way, the effects on producers, consumers, and world trade will be discussed in order. While these sectors are discussed separately, it is important to recognize that, because the different sectors are interdependent, the effects of liberalizing world agricultural trade would occur simultaneously. Movement from the current set of agricultural policies to a new trade environment would result in producers and consumers reacting to the new set of policies and interacting with one another. This study examines these responses to trade liberalization by examining the individual national responses iteratively until an equilibrium is reached. In this process, the producers' response to current world prices is examined, the consumer responses are then examined and a new world price is estimated, the producers' response is then estimated to this new price, and so on until a market-clearing price is determined. Figure 7 summarizes the factors leading to changes in production, consumption, prices, and trade in the world coarse grain market.

This process differs only by degree between unilateral liberalization and multilateral trade liberalization. In unilateral liberalization, one country eliminates its agricultural policies, causing its consumers and producers to make substantial adjustments for the new policy environment. In this situation, domestic consumers and producers bear most of the adjustment costs. The rest of the world also responds, but this adjustment is usually minor compared with domestic adjustments. In multinational trade liberalization, producers and consumers in all countries concerned need to adjust to new policy environments and therefore share the adjustment costs. Under a multilateral trade liberalization scenario, the adjustment cost borne by any single industrialized market economy is less than or equal to the adjustment costs that country would bear under unilateral liberalization (Roningen and Dixit; Tyers and Anderson). The result is larger overall social gains from multinational trade liberalization. No GATT participant has proposed unilateral trade liberalization.

Producers

The elimination of current agricultural policies would mean that producers would face lower incentive prices in the United States and the EC-12 and lower farmgate prices in Canada. In the United States and EC-12, the lower incentive prices would be due to the

Figure 7--Net changes in world coarse grain markets

| Production (3-6%) | Consumption (4-8%) | World prices (5-10%) | Exports (5-10%) |
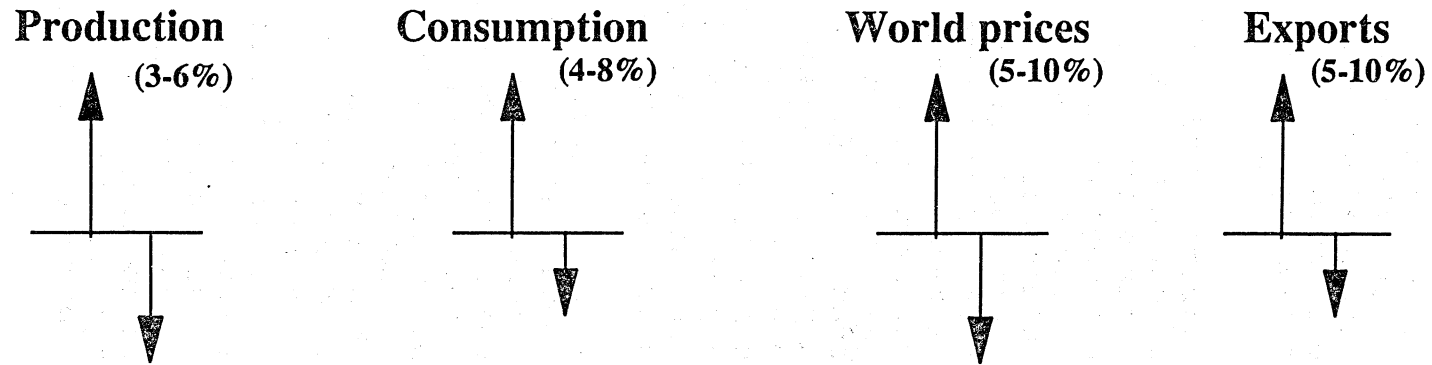
Factors leading to an increase (left arrow)

- Production on set-aside land in the United States
- Increased production in Thailand and Argentina in response to higher world prices

- Increased livestock production
- Decreased consumer coarse grain prices in EC, Japan, and South Korea, due to end of domestic price controls
- Decreased world feed-food grain price ratio

- Loss of price and income supports in developed countries
- Removal of import barriers
- Reduced use of nongrain feed ingredients
- Increased livestock production
- Removal of world export subsidies

- Increased U.S. and Argentine exports
- Increased EC, USSR, and Chinese imports

Factors leading to a decrease (right arrow)

- Decreased production in the EC and Japan
- Shifts between production of corn and other crops

- Increased corn-soybean price ratio

- Decreased EC, Canadian, and Chinese exports

- Decreased EC, Canadian, and Chinese exports
- Decreased South Korean and Japanese imports

removal of target and intervention prices. In Canada, lower farmgate prices would result because elimination of transportation subsidies would mean the state marketing boards would have less net revenue after selling the grain due to increased costs for transportation. Holding all other variables constant, these lower incentive prices would tend to reduce the production of coarse grains.

Of course, all other factors are not held constant. The ending of support prices would change the relative incentive price between competing crops as market forces rather than as legislation or regulations determining the appropriate price relationships. In the United States, for example, the incentives provided by the 1985 Act for corn production provide a disincentive for soybean production. Without the commodity programs of the 1985 Act, soybean production would expand because the producer price for soybeans would rise relative to the producer price for corn.

As farmers worldwide adjusted to the new free trade environment, they would examine the new commodity market prices and alter their production practices in response to these changes. If coarse grain prices for producers increase relative to prices for other commodities and coarse grain production was still profitable, then one would expect coarse grain output to rise.

Another factor that could lead to an increase in global coarse grain production is the removal of supply control policies. The termination of the U.S. acreage reduction program in 1988 would have released for production 28 million acres of land that had a history of coarse grain production. The increase in acreage available for coarse grain production would tend to increase coarse grain production, although historically, when set-aside acreage requirements have been reduced, the increase in harvested acres has been less than the increase in available acres. Of course, in the past, land coming back into production out of set-aside was not planted to soybeans or other competing crops.

Trade liberalization would also remove input subsidies. As described earlier, these subsidies tend to increase production by lowering the cost of inputs. Input subsidies increase commodity production because: (1) lower input costs increase the amount of the input used, raising yields, and (2) lower production costs and higher yields make agricultural production profitable in areas that would not be farmed without the subsidy. The increased use of inputs such as pesticides, fertilizer, and irrigation also tend to increase environmental degradation (Runge; Young; Hyberg and Mercier, "Decoupling Agricultural and Environmental Policy: Opportunities for Trade Negotiations?"; and Ribaudo). Eliminating input subsidies would lower coarse grain production but could improve environmental quality as a result.

Consumers

The industrialized market economies tend to support agricultural production at the expense of consumers or taxpayers (USDA, Global Review of Agricultural Policies; 1988). Increased producer prices are generally maintained through support prices and acreage reduction and/or border measures which prevent the importation of lower priced commodities from competing nations. Both measures increase the consumer price for agricultural goods. Trade liberalization would remove the producer supports, thereby reducing the cost of agricultural goods for the industrialized market economies. Because two-thirds of coarse grains produced are consumed by livestock, changes in coarse grain prices would primarily affect the livestock sector.[14]

The elimination of subsidies and other producer supports would reduce government expenditures and therefore either reduce the tax burden for consumers, or permit the government to provide new services. If one assumes that the tax burden was reduced, or the government provides services that substitute for those previously purchased by consumers, then consumer welfare would increase in those countries that have producer subsidies.[15]

Perhaps the largest effect of trade liberalization is the reallocation of resources between agriculture and other economic sectors. This reallocation can be discussed using the results of other studies, but is beyond the scope of this study.[16] Because agriculture is frequently subsidized at the expense of other economic sectors, resources such as investment capital, land, and

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[14] Because some countries now permit coarse grain imports at world market prices (which because of subsidized exports are lower than would be expected in a free trade environment), it would be incorrect to state without further support that livestock demand for coarse grains would increase in a free trade world, all other things being equal.

[15] This discussion expressly considers industrialized market economies. If less-developed countries were included in the discussion, a number of qualifying statements would need to be added. This is particularly true when discussing the effect of eliminating agricultural subsidies on consumers. In some less-developed countries, consumers are sold grain at subsidized prices and producers are paid below market prices. Removing such a policy would have the opposite effect of those discussed above.

[16] Economywide effects of trade liberalization presented here pertain to industrialized market economies and not to less-developed countries. The reason is that the developed countries tend to tax other manufacturing sectors to support agriculture, while less-developed countries tend to tax agriculture to subsidize the urban economic sectors. A number of the references cited discuss this point.

labor that could be more efficiently utilized in another sector
have been diverted into agriculture. Removal of the agricultural
subsidies would reduce these distortions between sectors in the
same way that they are reduced within the agricultural sector.
This action would permit a more efficient allocation of resources
between economic sectors and permit the entire economy to operate
more efficiently (Balassa, 1988; Krissoff and Ballenger; Kilkenny
and Robinson, and Johnson, 1988).

Trade

The effect of trade liberalization on the amount of world trade
overall or in any one sector is ambiguous without a detailed
examination of the policy changes. This ambiguity results
because trade is a function of excess demand and excess supply,
which in turn depend on the response of producers and consumers
to the new policy environment. What can be said without an
examination of the individual policies is that world gross
national product would increase as a result of trade
liberalization and the removal of trade-distorting policies would
provide an opportunity to increase trade.

Several studies have examined agricultural trade under trade
liberalization. These analyses have reached surprisingly
consistent conclusions with regard to world trade in agriculture.
The analyses conclude that the volume and value of agricultural
trade would increase if the current set of trade-distorting
policies were eliminated (Tyers and Anderson, 1986 and 1987;
Roningen and Dixit).

Changes in Production and Trade for Major Coarse Grain Exporters

Trade liberalization would affect world production as program
changes or adjustments to the new trading environment were made
in the major exporting countries, including the United States,
the EC-12, Argentina, Thailand, China, Australia, Canada, and
South Africa. The United States, as both the single largest
producer of coarse grains and the operator of one of the most
complex sets of commodity programs affecting these crops, would
be the source of much of the change occurring in world coarse
grain production. Other countries are also substantial producers
of coarse grains (such as the USSR and Eastern Europe) but do not
play important roles as exporters in the market. The market role
of the EC-12, even though currently a major producer, will be
discussed in a later section on consumption.

United States

In the United States, total coarse grain trade and production
after trade liberalization would depend on how the changes in
different components of the commodity program interact with
global agricultural policy changes. Price and income support
programs provide above-market target prices and nonrecourse
commodity loans. These supports create incentives for farmers to
produce coarse grains, while the acreage reduction program and
paid land diversions are designed to take land out of production

and reduce output.[17] Further complicating the analysis is the change in cross-commodity production incentives. In the absence of commodity programs, incentives for the production of coarse grains and alternative crops such as soybeans would be altered, leading to some movement of acreage previously in coarse grain production into the production of soybeans and other nonprogram crops. Figure 8 summarizes the factors causing change in the U.S. coarse grain market.

Coarse grain output in the United States would probably rise slightly to moderately as a result of trade liberalization. This increase would occur because most of land now in acreage diversion programs would be brought back into coarse grain production, offsetting decreases in average coarse grain yields.[18] Because soybeans are the main cropping alternative to corn, the magnitude of the increase in coarse grain production would strongly depend on the net returns available from the two crops which, in turn, would depend on the relative world market prices for corn and soybeans. Changes in livestock demand for coarse grains would also be a major determinant of changes in coarse grain production.

The demand for coarse grains would likely increase somewhat as livestock production expands in response to the higher livestock export demand resulting from trade liberalization (Hahn; Shagam; Bishop and others; Blayney and others). Food, seed, and industrial use of coarse grains, mainly of corn, is less price responsive (more price inelastic) than feed use and would change little. Sugar prices are not expected to fall sufficiently under trade liberalization to reduce domestic demand for corn for high fructose corn syrup (HFCS) (Barry and Lord).

Price and income support programs. Under full trade liberalization and an end to U.S. policies, deficiency payments and nonrecourse loans would end, and U.S. producers would make production decisions on the basis of market prices, reducing the production incentive. With producers no longer eligible to receive target prices (usually well above the world market price), they would have an incentive to reduce both the intensity of coarse grain production and the acreage planted to coarse

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[17] Base acreage restrictions may also be reducing coarse grain production, but the effect is ambiguous. On one hand, the base acreage restriction, through the commodity program requirements, discourages farmers from planting more than the permitted acreage into feed grains. On the other hand, the planting of alternative crops, such as soybeans, on the base acreage is discouraged because the commodity programs make maintaining the corn acreage base desirable.

[18] This conclusion is supported by work by Tyers and Anderson (1986) and Parikh and others, who estimated the United States would increase coarse grain production if agricultural markets were liberalized. Roningen and Dixit, however, concluded that U.S. production of coarse grains would decrease.

Figure 8--Net changes in the U.S. coarse grain market

| Production (4-8%) | Consumption (3-5%) | Producer prices (5-10%) | Exports (8-13%) |
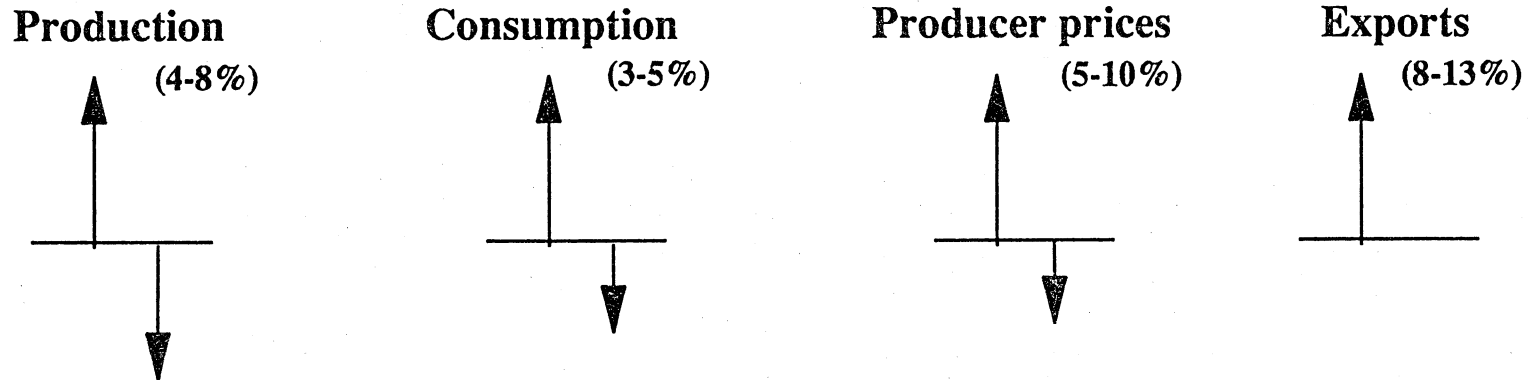
Factors leading to an increase (left arrow)

- Production on set-aside land

- Increased demand for livestock production in the world market

- Increased livestock production

- Moderate increase in world prices

- Increased U.S. production
- Decreased EC, Canadian, and Chinese exports
- Increased EC, USSR, and Chinese imports

Factors leading to a decrease (right arrow)

- Shifts from corn to soybean production
- Decrease in average corn yield
- Lower producer incentive prices

- Increased corn-soybean price ratio

- Loss of target price support
- Loss of loan rate support

grains. Under acreage reduction and paid land diversion programs contained in the current farm program, participating farmers are required to reduce their cropland planted to coarse grains. Because the incentive prices offered by the program are considerably higher than market prices, farmers have a strong inducement to participate in the program. As a result of the higher program prices and the restrictions on planted acreage, farmers have an incentive to use more inputs, such as fertilizers, pesticides, and machinery, to increase production and maximize profits. Imputed rent for land and machinery would fall, as implicit rents from program payments are removed.

In the absence of a land constraint, U.S. agriculture should become less input-intensive. Decreased coarse grain production costs and lower coarse grain crop yields are expected. A new combination of inputs would be used, changing coarse grain output. Agronomic evidence suggests that a reduction in fertilizer applications would not significantly lower crop yields on a large portion of the acreage now in production (Madden, National Research Council).[19] In addition, there is reason to believe that much of the coarse grain production has reached the point at which additional inputs yield decreasing marginal returns. Thus, cutting back on the application of these inputs would reduce output, but the proportional reduction would be less than the input reductions.

Removal of acreage restrictions. Cropland, idled by acreage reduction requirements of the feed grain and paid land diversion programs, would mostly return to production, counteracting the effect of lower input use on coarse grain production. Because the idled land is generally less productive than land now in crop production, average coarse grain yields would decrease relative to current trend yields.[20] Some of the idled acres would be switched to other crops, such as soybeans in the Corn Belt and Lake States regions. The least productive fraction of the

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[19] The evidence for coarse grain yield response to reduced fertilizer application is from a sizable number of individual farm reports and, therefore, must be considered anecdotal in nature. The number of reports lends credibility to the hypothesis that support prices, risk aversion, and/or information costs (Simon) interact to induce farmers to apply fertilizers at levels beyond the point where a biological response can normally be expected.

[20] The average yields would unambiguously decrease if the agricultural programs were ended within 1 year, but if the end of the programs were implemented through a phased reduction then the yields must be compared to trend yields. In this case, yields could actually be increasing over time though they would be less than the yields existing with the set-aside programs in place. For the purposes of this analysis, a decrease in yields refers to a decrease relative to trend yields.

acreage reduction program and paid land diversion acreage would go into grazing or other less intensive uses such as timber.

In 1988, 28 million acres of land previously planted in coarse grains were idled by the annual acreage diversion programs. With 80.3 million acres of coarse grains harvested in 1988, this idled acreage accounts for 26 percent of the land available for coarse grain production. Much of the increased coarse grain production would occur in the Corn Belt (corn and sorghum) and Lake States (corn) regions, because these regions contain 50 percent of the land retired by commodity programs and the land in these regions is generally highly productive. In percentage terms, the increases would not be as large as in some other regions because of the large magnitude of coarse grain production in the Corn Belt and Lake States. The Northern (corn, sorghum, and barley) and Southern (corn and sorghum) Plains regions would also contribute substantially to the increased production of coarse grains. In percentage terms, this increase might exceed increases in the Corn Belt and Lake States, although not in terms of output. The Delta States would contribute to the expansion to a lesser extent with increased production of corn and sorghum.

Cross-commodity relationships. Farmers produce crops that offer the greatest returns. Thus, they examine commodity prices when determining which crop to produce. Because the commodity programs offer price signals that differ from market prices, the programs alter the relative incentives to farmers for the production of different crops. Soybean production is the major alternative to coarse grain production. Because the soil and climatic requirements for corn and soybeans are similar, much of the land now in corn production is also well suited for soybean production. In the United States, soybeans are not covered under most of the major commodity program provisions (except the nonrecourse loan rate, which is almost always below market price) and the program crops' incentive prices and cross-commodity acreage restrictions have combined to discourage the planting of soybeans and favor coarse grain production.

The relative shares of the idled land that returned to coarse grain and soybean production would depend on the changes of relative output prices and on the changes in farming practices in each crop. It is apparent that the amount of fertilizer applied to corn in less intensive cultivation practices would be reduced. But much of the fertilizer used on corn is nitrogen, which is not necessary for soybean cultivation. Hence, costs of production would go down for both crops (machine costs, implicit land rental, etc.), but less for soybeans. On the other hand, the producer incentive price would decline less (and could rise) for soybeans than for corn, because soybean prices currently receive only minimal support. Given the large amount of land currently idled, there would be room for increased production of both corn and soybeans in the United States. Corn-soybean rotations might increase in the absence of base restrictions that reduce soybean acreage, allowing an increase in the production of both corn and soybeans (Bickerton and Glauber).

Although the United States was the source of more than half of the world's coarse grain exports in 1987, the actions of other coarse grain producing nations (particularly the EC-12) would also have a substantial effect on the world coarse grain market. Corn exports are taxed in Argentina, both directly with an export tax and indirectly through a dual exchange rate policy.[21] Barley receives low levels of protection in Australia and a transportation subsidy in Canada. In each of these countries, the overriding factor determining production changes following liberalization is the change in the relationship between prices of competing commodities.

Wheat and livestock are major alternatives to coarse grains in Canada, Argentina, and Australia. In Argentina, soybeans are also a major alternative to corn and sorghum, while in Canada, rapeseed is an alterative to barley. If coarse grain prices weakened relative to wheat and livestock prices as expected then coarse grain farmers with land capable of supporting such activities would have an incentive to reduce coarse grain production. An expected increase in coarse grain prices relative to soybean prices would increase the incentive to produce coarse grains in Argentina.

Argentina

As a major producer for export, Argentina would respond to both increased world coarse grain prices and changes in the relative price of coarse grains. If Argentina participated in trade liberalization, its response to a higher relative price for coarse grains would be conditioned by the removal of the taxes on agricultural exports and the fact that the large diversified farms will respond differently than the smaller single crop farms. The removal of the export tax on coarse grains and soybeans and the dual exchange rate policy would increase the price farmers receive for coarse grains over and above the expected increase in world coarse grain prices. In addition, Argentina currently has lower production costs than other major producers because agricultural policies such as the export tax and high transportation costs result in reduced land rents and less intensive production practices. These factors suggest an increase in Argentine coarse grain production and exports are likely under trade reform.

However, because most additional coarse grain production would occur away from ports, high transportation costs would tend to limit the extent of the increase. Small farms now producing soybeans might shift to corn if the decrease in soybean prices

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[21] Argentina is not included in the earlier definition of trade liberalization. But in the current round of the GATT negotiations, Argentina has advocated movement to a free market in agricultural trade. For this reason, Argentine trade policies are discussed. It should be noted that Argentina had removed the direct export tax in 1985 but reinstated it in March 1989.

relative to corn prices is large enough. While some smaller
farms might respond to the relatively larger increase in wheat
prices by shifting some production from coarse grains, large
diversified farms account for 75 percent of Argentina's
agricultural production. These larger farms would respond to
increased world coarse grain prices by undertaking low-cost
measures such as using improved seed to both increase yields and
expand the area planted in coarse grains. If Argentina continues
to tax producers, production and exports would still be likely to
increase under trade liberalization, but the increase would not
be as large.

Canada

For Canada, the loss of transportation subsidies and the
decreased price for coarse grains relative to wheat and livestock
would lead to a reduction in coarse grain exports. The loss of
transportation subsidies for barley exports would, for most
sections of the country, make barley production for domestic
livestock feeding more attractive than selling it on world
markets. Exports would therefore be likely to decline,
decreasing the opportunity cost of domestic consumption and
leading to an increase in domestic consumption.

Australia

Australia would likely respond to the higher relative price of
wheat and livestock resulting from trade liberalization by
shifting some resources from barley production to wheat and
livestock production. This shift could reduce coarse grain
production in spite of rising world coarse grain prices. While
Australia would still continue to export barley, it might do so
at a lower level.

Thailand

Corn is a major export product for Thailand. Thailand's
agriculture is market-oriented. Corn acreage in Thailand is
flexible, having decreased about 20 percent since 1985 in
response to lower world prices and drought conditions. Thus,
given good weather, Thailand could expand corn production if
world coarse grain prices increase. Thailand now exports
substantial quantities of cassava (8 million tons in 1988), a
nongrain feed ingredient, the bulk of which goes to the EC-12
(Food and Agriculture Organization). This trade could disappear
under liberalization because feed substitutes such as cassava
would lose their advantage over coarse grains in the EC-12 under
more open market conditions. A possible result of the loss of
cassava export markets would be the displacement of corn by
cassava in Thailand's livestock sector. If corn were displaced
in the Thai livestock sector, Thailand's ability to export corn
would increase. However, a rapidly expanding poultry sector is
expected to increase Thailand's domestic demand for coarse grain,
which would reduce Thailand's ability to capture a larger portion
of world export markets. To assure expansion of its export
markets, Thailand would need to improve corn quality.

South Africa

If South Africa participated in agricultural policy reform by extending its current reduction in subsidies to a total elimination of producer subsidies, corn production would continue its current decline and corn exports would cease in most years, except possibly to nearby African states. Corn exports would become infrequent, because without subsidies the producer uncertainty associated with the highly variable South African weather would increase. This would tend to decrease production. Some exports outside the African continent might take place irregularly after bumper crops. If South Africa did not participate in trade reform, it would likely continue to be a significant but inconsistent exporter. By raising world prices, industrialized market economy trade reform would reduce the South African program costs.

China

As the second largest coarse grain producer, China would likely continue to emphasize domestic livestock feeding to increase the standard of living of its population. China's consumption pattern is changing, as livestock consumption increases due to an expansion in per capita income. China's response to trade liberalization would depend on the producers' access to world markets and prices. Given the Chinese government's control over prices and trade, recent movement toward agricultural reform, and its recent overtures toward GATT, producer access to market incentives is uncertain. The higher world prices would create an incentive for both increased production and exports, but cropland constraints, inadequate transportation, and domestic priorities constrain China's ability to respond to these incentives.

Changes in Consumption and Trade for Major Coarse Grain Importers

The largest consumers of coarse grains in the world include the United States, the USSR, China, the EC-12, Japan, Eastern Europe, Mexico, South Korea, Saudi Arabia, and Taiwan. The coarse grain demands of these regions would change if their agricultural programs were eliminated and world coarse grain prices increased in response. Little change is expected in global consumption levels, as increased demand from a rising world population and increased livestock production offset the effects of increased world prices. However, traded grain should account for a higher percentage of world consumption. The changes that would occur in production and consumption in the USSR and the EC-12 are expected to dominate the new import demand picture.

The USSR and Eastern Europe

If Soviet and Eastern European agriculture maintained its current structure, coarse grain imports would likely stay large. The Soviet Union would continue to contribute the most volatility to the world coarse grain market, having utilized between 100-120 million metric tons a year during the 1980's. At present, the

Soviets depend on imports to make up for their frequent shortfalls in grain availability induced by variable weather conditions, poor incentives, and inefficient production and post-harvest technology. Since 1972, when the USSR first ventured onto the international agricultural market, its coarse grain imports have ranged from 2.7 million metric tons in 1974 to more than 26 million metric tons in both 1981 and 1984.

The probable response of the USSR and Eastern Europe to changing prices resulting from trade liberalization would be to increase coarse grain demand. The USSR and Eastern European countries now import large amounts of wheat and corn for feeding livestock. An increase in the food/coarse grain price ratio would be likely because USSR and Eastern European wheat imports have been heavily subsidized by the EC-12 and the United States (in response to EC subsidies) in the last few years. These subsidies have lowered both the world wheat price and the USSR and Eastern European import price to the disadvantage of the less subsidized coarse grains. Because sales of coarse grains have been less subsidized than wheat sales, wheat prices would rise relative to feed grain prices as trade liberalization leads industrialized nations to remove subsidies. A relative increase in the food/coarse grain price ratio with trade liberalization would suggest a demand shift toward more coarse grains. A shift of this nature has recently been observed as the USSR and Eastern Europe have increased corn purchases in 1988/89 in response to an increase in the relative price of wheat. Reductions in the availability of feed quality wheat from the EC will also play an important role.

EC-12

Over the last decade, the movement of the EC-12 from a net importer to a net exporter of coarse grains has been the most significant development in the world coarse grain market. This shift has accounted for a change of approximately 24 million metric tons in its coarse grain trade flow and represents a quarter of current world coarse grain trade. This area accounted for 4-5 percent of total coarse grain trade in 1987.

European production of coarse grains under less subsidized conditions (1960's and 1970's) strongly suggests that much of European coarse grain production would not be competitive with other producers under the market conditions that would exist in the absence of the high intervention prices of the Common Agricultural Policy. It is likely that, without the high coarse grain intervention prices, land would shift from coarse grain production into other uses, and yields would decrease as input use (particularly fertilizer) decreased. Therefore, EC-12 coarse grain production would likely decline under trade liberalization. Coarse grain demand (currently 80-90 million metric tons per year) would increase 10-15 million tons as the elimination of variable levies made the use of nongrain feed ingredients such as cassava and industrial byproducts less attractive economically. These expected developments would lead to the EC-12 becoming a net importer of coarse grains.

Japan

Japan, another substantial consumer of coarse grains, imports nearly all of its coarse grains. The change in the level of feed demand under trade liberalization would depend heavily on the reduction of domestic production of beef and dairy products that would result from the removal of stringent meat and dairy import barriers. The decrease in Japanese coarse grain demand following the bilateral liberalization of beef trade with the United States offers a preview for the likely effect of trade liberalization. Reduced beef, dairy, and pork production would not be offset by potential increases in poultry production, suggesting that Japanese demand for coarse grains would decrease moderately, causing imports to fall (Hahn; Bishop and others; Blayney and others; and Shagam).

Other Importers

South Korea, Taiwan, and Saudi Arabia each import substantial quantities of coarse grains, but are minor consumers in comparison to countries already discussed. All three have consumed, on average, 4.5-7.5 million metric tons over the last decade, nearly all of which was imported. Each of the three countries would respond differently to trade liberalization.

South Korea has highly protected coarse grain and beef sectors. If South Korea liberalized along with the industrialized market economies, coarse grain imports would be affected by several contrasting effects: (1) the removal of protection for the domestic beef industry which would likely decrease coarse grain demand in the short run, (2) the decreased coarse grain production resulting from the loss of subsidies for coarse grains, and (3) the potential for increased consumer meat demand due to lower food prices and growing income levels. Because it is likely that the effect of decreased demand would outweigh the effect of decreased production and increased meat demand, South Korean imports of coarse grains are likely to decrease in a free trade environment. If South Korea did not liberalize, the increased world price also would cause decreased imports.

In Taiwan, the cost of producing coarse grains is higher than the world price level. In addition, Taiwan exports pork products from its efficient hog sector, has little government intervention in the coarse grain market, and does not have the resources to expand its coarse grain sector. These factors suggest that, if Taiwan participated in trade reform, it would expand its hog sector and increase consumption and imports of coarse grains to support this expansion. Even if Taiwan did not participate in liberalization, it is likely that coarse grain imports would increase to support an expansion of pork exports to Japan.

The response of Saudi Arabia, a key participant in the barley market, to industrialized market economy trade liberalization is difficult to determine. Increased world coarse grain prices and elimination of the U.S. export enhancement program would force them to pay higher prices but not reduce demand. However,

because Saudi Arabia's reactions to the world market are influenced by its wealth and its complex political situation, domestic policies to increase self-sufficiency, and nonparticipation in the GATT, any projections of Saudi response to trade liberalization are uncertain. If Saudi Arabia were also to liberalize, it would be unlikely to produce any coarse grain.

Mexico's response to trade liberalization would depend heavily on its participation in liberalization. If Mexico did not eliminate its production and consumption subsidies, the costs of such programs would rise as Mexico's population and world coarse grain prices increased, increasing the consumer subsidies burden on the Mexican budget. If Mexico did withdraw its support from producers and consumers of agricultural products, the government would experience considerable budget savings, but Mexican consumers would face higher prices for tortillas, a corn-based food staple, and Mexico's corn producers would probably face lower prices. This suggests that it is unlikely that Mexico would willingly lower its own trade barriers.

Other Market Developments

Trade reform under discussion would take place against a backdrop of continuing market changes that would occur with or without the elimination of agricultural subsidies. To place the effect of trade reforms in perspective, these dynamic changes need to be considered. Agricultural reforms in centrally planned economies, particularly significant participants in the coarse grain market such as China and the USSR, Third World debt problems, and the expansion of competing agricultural sectors each will alter the world coarse grain market in the foreseeable future.

This section will discuss only likely changes that could have a major affect on world coarse grain markets. Unfortunately, this means that little will be said about potential developments in less-developed countries, because the net effect of rapid population growth, resource development, capital acquisition, and debt constraints on coarse grain markets is uncertain. This is a major shortcoming of this analysis and would be a fruitful area for further work.

Agricultural reform in centrally planned economies is expected to have a substantial effect on world markets with or without the occurrence of trade liberalization. These reforms are anticipated because the centrally planned economies are seeking to eliminate the inefficiencies that are rampant in the state farm system to permit a greater response to consumer demand for domestic meat supplies and other agricultural products.

In 1978, China instituted agricultural reforms which resulted in a rapid increase in agricultural production. These reforms made two major policy changes of interest:

(1) China introduced greater market orientation in the movement of grain from the farm level to the consumer. This was done by improving the price incentive structure

and reducing the portion of grain that is directly procured by the government.

    (2) China increased the individual farmer's responsibility for production and input allocation decisionmaking, moving away from centralized production planning.

These reforms have resulted in a substantial expansion in Chinese agricultural production between 1978-85, during which time China became a net exporter of grains to the rest of the world. Since 1985, the boom in grain production has stalled somewhat due to weather and liquidity problems and the appearance of inflation in the Chinese economy.

China will likely continue to emphasize domestic livestock feeding to increase the standard of living of its population. This emphasis on livestock production is expected to continue with or without trade liberalization. China's consumption pattern is changing, as livestock consumption increases due to an expansion in per capita income. Increased amounts of both domestic and imported grain are expected to be used to meet the growing demand for meat and dairy products. Eventually, this policy is expected to move China from its position as a net corn exporting nation to a position of zero net trader or net importer. Recent political upheaval and foreign exchange shortages are expected to retard the planned expansion in meat consumption. Thus, while trade liberalization is unlikely to significantly change China's role in world grain markets, China's actions independent of trade reform would change and influence the adjustment of other parties in the world coarse grain market.

If recent proposals for agricultural reform in the USSR are successfully implemented, Soviet agricultural productivity could increase 5-10 percent over the next decade, and demand for protein feed (oilseed meal) could displace some of the import demand for feed grains in the mixed feed ration (Moore). However, if per capita consumption of meat expands as anticipated, then overall feed grain demand is also likely to increase. Similar developments are expected to also occur in some Eastern European countries, such as Poland and Hungary. However, their agricultural economies are not as closely linked to the world market as are those of China and the USSR.

The worldwide bout with inflation in the late 1970's, followed by the lengthy recession of the early 1980's, had a catastrophic effect on the debt structure of much of the developing world. High nominal interest rates charged primarily by commercial banks made debt-servicing costs expensive. The growth slowdown which ensued had a strong effect on less-developed countries, cutting both domestic production growth and export income as developed countries curtailed their imports of agricultural products.

Thus, less-developed countries over the last few years have been faced with large debt-servicing burdens and lagging economic growth with which to meet those payments. Those countries which depend heavily on exports of agricultural goods, such as Brazil

and Argentina, have encouraged agricultural exports in order to boost national income, while at the same time taxing those exports, either explicitly or implicitly, in order to provide needed government revenue. Additionally, those nations which might normally be prime import customers of grains exported by industrialized countries, such as Latin American importers, have had to decrease their import demand for coarse grains due to the constraints on hard currency created by large interest payments.

The greatest potential for growth in world coarse grain demand is in the less-developed world, particularly in regions like Northern Africa and the Middle East. The impact of trade liberalization on these areas would depend (1) on the extent to which less-developed countries participated in agricultural policy reform, (2) the increase in coarse grain prices, and (3) nonagricultural developments, such as debt relief, economic growth, and oil prices. Trade reform would increase less-developed countries' access to industrialized markets. Such access could help less-developed economies by encouraging growth and providing hard currency to meet their debts (Krissoff and Ballenger). If these countries continued to subsidize coarse grain imports for domestic consumption by expanding livestock industries and debt constraints do not restrict purchases, then grain imports by North Africa and the Middle East would continue the upward trend of the 1980's.

Finally, expansion in agricultural products competing directly with coarse grain production or exports will have a dynamic impact on the world coarse grain market. For example, the growth in livestock exports in countries like Thailand (poultry) and Canada (beef) will tend to cut back coarse grains that would otherwise be available for export. As modern livestock production and processing technology (particularly poultry) becomes available in other parts of the world, countries also could expand their domestic production of livestock, particularly if domestic per capita income is also increasing. In nations which are already substantial coarse grain producers, supplies could increasingly be consumed in domestic feed use. In countries like Taiwan, which are efficient livestock producers but import most of their coarse grain, enlargement of livestock production capacities would require more coarse grain imports.

All of these dynamic factors would interact with the price and trade flow changes induced by trade policy reform, and could combine to create a new trading environment in which a larger portion of grain produced would be traded on the world market.

Trade Flows After Trade Liberalization

Coarse grain trade would increase slightly to moderately under trade liberalization.[22] The greatest pressure for an increase in

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[22] Roningen and Dixit found that trade liberalization resulted in a slight decrease in world coarse grain trade.

world trade would occur because the EC-12 would shift from a major net exporter of coarse grains to a substantial net importer. The increase in trade resulting from changes in the EC-12 trade position would be offset somewhat by lower Canadian exports and lower Japanese imports. Modifying the shifts in the EC-12, Canada, and Japan are numerous feedback effects from changes in relative commodity prices that would result from trade liberalization. These effects are difficult to categorize and will be discussed on a country-by-country basis.

The changes in coarse grain markets that would stem from trade liberalization would be influenced by the market adjustments that would occur without world trade policy reform. In particular, the expected increase in Soviet Union and Eastern Europe coarse grain demand and China's move from a net exporting position to a zero net trade position (or possibly net importer) would stimulate coarse grain trade.[23]

Four nations are in a position to increase production of coarse grains to supply expanded import demand: Argentina, Thailand, and the United States.[24] It is expected that the coarse grain exporters would have an advantage in filling additional import demand in markets they already serve. In general, this suggests that the United States and Argentina might supply some of the markets previously supplied by Canada. China would be likely to continue to export coarse grains to Japan and the Soviet Union, but Thailand might move to export more grain to China.

The largest adjustment to a free trade environment would occur in the EC-12. The reduction in the incentive price for coarse grain production would cause production in the EC-12 to decrease. While livestock production might contract somewhat, the quantity of coarse grains demanded is likely to substantially exceed production. This increased excess demand would occur because reduced coarse grain production would lower domestic supply, while the removal of incentives for using nongrain feed ingredients would increase domestic demand for coarse grain.

Because the United States and Argentina currently export coarse grains to the EC-12, these nations would be the most likely to satisfy the increased European demand for coarse grains. In addition, the EC-12 has been exporting 3 million metric tons of coarse grains to the USSR and Eastern Europe in recent years. The United States and Argentina would be the producers most

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[23] The change in China's trade position would increase trade because part of the shift in net trade would result from an increase in imports.

[24] If South Africa did not liberalize, it could alter its policies to increase coarse grain production, but its international political position and Japan's reduction of feed grain demand make it unlikely South Africa would increase exports outside of Africa.

likely to capture this market as EC-12 production declined. The United States and Argentina are also in a position to meet any increased coarse grain demand that may arise in the USSR and Eastern Europe.

Because of an inadequate transportation system and a desire on the part of provincial governments to acquire hard currency, China exports coarse grains from the northern provinces to Japan and the USSR and imports small amounts of coarse grains to southern provinces from Australia, Thailand, and the United States. In recent years, exports have exceeded imports, but in the future, higher livestock production is expected to require more coarse grain imports. Exports to Japan and the USSR from China are expected to gradually decline, but Thailand and the United States can be expected to increase coarse grain exports to China in order to fill the increasing livestock feed demand.

Other Pacific Rim nations are likely to retain their positions as net importers or exporters. While Japan, Taiwan, and South Korea would adjust to the new trade environment by altering their consumption and trade of coarse grains, they are likely to continue to import coarse grains from the United States, Thailand, and Australia. Because of its longstanding trade relationship with these nations, the United States is expected to remain the primary source of Japanese, Taiwanese, and South Korean coarse grains, with Thailand, Australia, and China supplying most of the remaining grain. Australia is likely to remain a net exporter, but because Australian coarse grain production is expected to remain constant or decline, Australia is not expected to capture additional coarse grain markets.

Price Stability and Stocks After Trade Liberalization

In order to determine world market prices that might result from total trade liberalization, overall supply and demand changes must be examined. Aggregating over all the national supply and demand changes discussed above, excess coarse grain trade demand would increase as the EC-12 decreases output and becomes a net importer. Excess coarse grain supply would also increase, largely because much of the U.S. set-aside acreage is likely to return to coarse grain production. Because this supply increase is expected to be less than the increased demand, the new equilibrium would lead to an increase in world prices.[25] While

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[25] The short-term change in prices would depend on whether excessive grain stocks exist. If excessive stocks of grain exist when trade liberalization is implemented, then prices could temporarily decrease. However, in the long run, prices are likely to rise due to the fundamental change in the supply and demand characteristics of the coarse grain market under liberalization. Empirical estimates of the change in coarse grain prices range from a decrease of 3 percent (OECD) to an increase of 11 percent (Roningen and Dixit; Parikh and others). Tyers and Anderson (1986, 1987) estimated an increase in world coarse grain prices of 1 to 3 percent.

world market prices would be above the level observed in a year with normal production and consumption patterns, prices paid by many consumers and received by producers in the liberalizing countries would be lower due to the removal of internal price supports.

After liberalization, prices facing producers and consumers would begin to converge to determine the world market price, maintaining marketing and transportation margins, as the price wedges are removed and government intervention ends. Marketing and transportation margins would continue to introduce some regional differences to producer and consumer prices. The prices faced by consumers and producers in major participating countries such as the United States, the EC-12, and Japan, where prices are supported by commodity programs, would fluctuate more as the world market opens up. However, world market prices would become more stable as agricultural goods move more freely and policies that tend to add to international price instability, such as domestic price supports and variable levies, are eliminated (Tyers and Anderson, 1987). However, not all research supports this particular result.

National stockholding policies would change as domestic price stabilization policies were eliminated. Working stocks would be held to smooth temporal and regional differences between production and consumption and private storage would increase as speculative opportunities expanded in the absence of large government-controlled grain reserves. The elimination of national reserves could remove one element currently adding stability to coarse grain markets. Tyers and Anderson (1987) found that the elimination of U.S. grain storage programs would increase the coefficient of variation for world coarse grain prices. However, they also found that the elimination of all agricultural policies would increase price stability in the world market.

Shortrun and Longrun Adjustments in Agricultural Trade[26]

In the short run, farmers would change their production practices in response to changes in output and input prices that would immediately follow the removal of price subsidies and program

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[26] In this discussion, shortrun agricultural trade adjustments will be those adjustments that occur immediately after the participating nations have ended subsidies and shifted production through the reallocation of mobile resources. This adjustment process permits farmers to alter their planting decisions, fertilizer applications, and labor inputs, but does not permit the reallocation of land and investment in new technologies and capital. The longrun adjustment in agricultural trade permits reallocation of land, and investment in new capital, but does not consider the effect of potential new technology on agricultural production.

restrictions. Many of these cross-commodity adjustments require little new investment and could be made in a single crop year, although it could take many years for world markets to stabilize and for relative prices to reflect an equilibrium. Examples of these changes include new feed rations for livestock and new crop rotation patterns.

The cross-commodity relationships that would dominate the world coarse grain sector reflect the relative scarcity of productive land. There are three agricultural commodities, or commodity groups, that compete with coarse grains for arable land: wheat, soybeans and other oilseeds, and livestock. As stated previously, in Argentina, Australia, and Canada, the major alternatives to producing coarse grains (barley for Australia and Canada and corn and sorghum for Argentina) are wheat and livestock. Soybean production is also a major alternative to coarse grain production in Argentina. Increased wheat production due to a likely increase in wheat prices relative to coarse grain prices, would limit the increase in coarse grain production in Argentina, and reduce coarse grain production in Canada and Australia.

As discussed earlier, soybean production is the major alternative to coarse grain production in the United States. However, in several regions, wheat and coarse grains are the primary crop alternatives. In the Northern Plains, Durum and spring wheat are probable alternatives for production of barley and oats. In the Central and Southern Plains, winter wheat is the major crop alternative to sorghum. Coarse grain production could increase somewhat at the expense of winter wheat if the wheat export market becomes less attractive due to the loss of export subsidies.

Production of soybeans and other oilseeds, such as rapeseed, is in many areas the major substitute for coarse grain production. Generally (the EC-12 is an exception), oilseeds are less subject to government intervention than other major agricultural commodities and therefore receive less government support (USDA, Estimates of Producer and Consumer Subsidy Equivalents, 1988). Among the major soybean exporters, production is subsidized at relatively low levels in the United States and Brazil, and subject to export taxes in Argentina and Brazil.[27]

In the United States, soybeans are not covered under most of the major commodity program provisions (except nonrecourse loans). Incentive prices and cross-commodity acreage restrictions for other commodities have combined to discourage the planting of soybeans (Hyberg and Mercier, "Gainers and Losers from U.S. Commodity Programs..."). If trade liberalization occurs, U.S. coarse grain production would lose its favorable treatment with respect to oilseed production, the producer price of coarse

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[27] Raw soybeans are taxed in Brazil and Argentina to encourage the export of soymeal and other processed goods. Agricultural goods are also taxed through unfavorable official exchange rates.

grains relative to oilseeds would decline, and some land would move into oilseed production, thus limiting the increase in coarse grain production.

The volume of increased oilseed production would depend on changes in relative prices, which would determine the composition of the feed ration to be fed to livestock in a liberalized world. If oilseed prices go up relative to corn prices, then increased corn in the feed ration would be desired. If oilseed prices go down relative to corn prices, then the proportion of corn would stay the same or decline. In the first case, oilseed consumption would expand only modestly, while in the second, it would increase significantly.

The shortrun response of an individual country or country group depends on the specific circumstances. In the EC-12, some substitution in crop production is possible because while both the heavily protected oilseed and coarse grain sectors would lose government subsidies, EC-12 rapeseed and barley production will remain competitive in some areas. Nonetheless, the size of both sectors is expected to diminish. The removal of Japanese subsidies would result in a sharp contraction in coarse grain production. However, the coarse grain produced in Japan accounts for only a small portion of domestic consumption. In the short term, the contraction in these countries would result from movement of land from coarse grains into alternative crops and pasture and the reduction of fertilizer applications in coarse grain production. In Argentina and Brazil, on the other hand, coarse grain and oilseed production now compete on equal terms, so changes in production would depend on the change in their relative world market prices. Currently, slack resources in Argentina and Brazil are constrained by infrastructural deficiencies, so a limited scope exists for substantial increases in production of either corn or soybeans. In the United States, coarse grain production would be less attractive relative to oilseed production, but in the short run, the large amount of land returning to production from the acreage diversion programs would permit an increase in the production of both oilseeds and coarse grains. In Canada, production of rapeseed would increase if producers move more toward cattle feedlot operations (as is likely) instead of finishing their livestock on the farm.

In Australia and parts of Argentina and Canada, wheat and livestock production are the major substitutes for coarse grain production. In these areas, the change in production with trade liberalization would depend on the change in relative producer prices. Because world beef and wheat production is heavily protected, world prices for these commodities would be likely to rise if production and export subsidies were removed. For this reason, it is likely that wheat and beef production would expand in Australia, Argentina, and Canada if an agreement can be obtained regarding agricultural trade reform (Harwood and Bailey; Blayney and others; Hahn).

At present, lower quality wheat (and rice in Japan) is fed to livestock in areas where wheat is surplus or sufficient hard

currency is not available to purchase adequate coarse grains, for example, in the USSR. However, in a free trade environment, wheat and rice would probably have lower feed value per dollar than coarse grains, and feed use of food grains might be less widespread.

Changes in coarse grain output and prices that would occur with liberalization depend in large part on changes in livestock output and price, because other uses of coarse grains are highly price inelastic. Removal of livestock trade barriers would lead to lower domestic meat prices, increased meat consumption, and decreased production in a number of countries. The resulting higher livestock import demand would stimulate livestock production elsewhere, increasing coarse grain demand in countries expanding livestock production. In some countries, domestic feed costs would decrease following liberalization of coarse grain policies. This would stimulate livestock production, which has a positive feedback on the grain sector. Shifts in demand away from beef and toward pork could also increase coarse grain demand, because hogs do not have grass-feeding as a normal part of their diets. A shift toward poultry consumption would have a mixed effect because, while poultry cannot feed on grass, oilseed meal accounts for a larger portion of poultry's feed ration.

The longrun realignment in agricultural trade is expected to be broader, affecting more sectors of the economy, than the shortrun adjustment. The elimination of input subsidies will remove distortions, causing economically rational but inefficient use of inputs in agricultural production. As world agricultural producers shift their farming operations to respond to input prices rather than subsidies and to world market prices for agricultural commodities rather than subsidized prices, the agricultural sector is expected to become more efficient.

The longrun U.S. response to trade liberalization would likely be a continuation of the shortrun movement to less intensive agriculture. The structure of the U.S. agricultural sector would change, as farm operations adjust to world market prices. Farmers would respond to less stable domestic prices by further diversifying their farms. Agricultural diversification would take several forms. Crops which do not now receive program support could receive more attention and livestock operations could be increasingly integrated into the farm operation. Crops such as triticale (a wheat-rye hybrid grain), kenaf (a fiber plant), jojoba (an oilseed), and crambe (a herb) which are currently considered rather exotic could become commercially important. The appeal of the choices would depend on farm location, available natural resources, and market accessibility. In areas where productivity is relatively low, less intensive agriculture and the absence of program support could require a larger land base to sustain a profitable farm, such as the western Great Plains.

A farmer's shift from current agricultural production practices to less intensive, more diversified production would demand increased farm management skills and time. Planning requirements

would necessarily increase. The managerial abilities of the farmer would affect the diversification decisions and the success of the adjustment process.

The long-term adjustments in the EC-12 and Japan would result in the aggregation of smaller farms and concentration of capital investment, both in areas of agricultural production where these countries are competitive and in nonagricultural production. This set of factors suggests that the EC-12 would concentrate its efforts in wheat, dairy, and hog production, while Japan would move toward a smaller agricultural sector with the poultry and horticultural sectors becoming relatively more important.

In the long term, Argentina and Brazil have the potential to make infrastructural investments in transportation, flood control, and land drainage, thus allowing a substantial expansion of coarse grain production. However, these countries need to resolve current problems with inflation, national budgets, and excessive debt before undertaking major infrastructural change.

It is difficult to predict the full extent of agricultural modifications, because in the long term the adjustment to agricultural reform would involve all sectors of the world economy. Empirical evidence does suggest several long-term macroeconomic changes that could result from trade reform. The results from several studies indicate that, if industrialized market economy subsidies to agricultural production were removed, agricultural land values would decline and capital and labor would shift from agriculture to other economic sectors (Parikh and others; Johnson, 1988). This reallocation of resources would result in an increase in world GNP and consumer welfare and a decrease in producer welfare. The increase in consumer welfare would be sufficient to compensate producers for their losses and still leave consumers better off (Parikh and others; Roningen and Dixit).

In the short run, the lack of excess capacity in the rest of the world would leave the United States as the supplier of much of the coarse grains required to meet the expected increase in demand resulting from the removal of trade barriers in the world coarse grain market. The magnitude of the increased demand would depend on progress in eliminating hoof-and-mouth disease and on individual nations' preferences between raising their own livestock or importing livestock products. With trade reform completed, the United States would be likely to move to an even more dominant role as a producer and exporter of coarse grains. In the longer run, Argentina could expand its productive capacity and move to compete with the United States for world markets.

As commodity programs are ended, the role of the United States would change from that of holding the majority of the world's grain stocks to maintaining a working supply of grain and marketing the majority of its annual production in both domestic and world markets. This new position would make U.S. producers both more responsive to world markets and more vulnerable to price fluctuations.

The Effects of Trade Liberalization on Coarse Grain Markets

Reduced EC-12 coarse grain production would be the most significant response to trade liberalization. This reduction would occur because trade reform would eliminate both the high support prices presently offered to farmers and the variable levies which limit coarse grain imports. The elimination of these trade distortions would: (1) lower producer incentive prices, causing farmers to shift land into other areas of production, (2) lower yields by reducing inputs used in coarse grain production, (3) increase EC-12 demand for coarse grains by removing the variable levies and decreasing the coarse grain price for domestic consumers, (4) increase livestock demand for coarse grains by removing the current relative cost advantage of nongrain feeds, and (5) increase imports of coarse grains from low-cost exporting nations. Both the decreased coarse grain production area and the reduced yields would be significant, resulting in much lower EC-12 coarse grain production. The result of the decreased supply and increased demand would be the EC-12's shift from a net exporter to net importer of coarse grains.

Producers in the United States and Argentina would be expected to respond to trade reform by increasing coarse grain production. U.S. farmers would increase coarse grain production because the large amount of crop acreage previously removed from production by commodity program requirements would be available for production. This increase in coarse grain production would be tempered by a decrease in producer incentive prices resulting from the elimination of price and income supports, and an increase in the relative producer incentive prices for wheat and soybeans. The decreased producer incentive prices and the lower quality of the land entering production would result in a decrease in average yields. However, the expected increase in land producing coarse grains should be sufficient to assure an increase in coarse grain production. U.S. coarse grain trade would be likely to increase as the EC-12 surrenders markets and increases imports.

Argentine producers would be affected by the likely increase in world coarse grain prices and excess demand resulting from liberalized trade. Argentine farmers would respond to increased world coarse grain prices by increasing production. Argentina would therefore be expected to increase coarse grain exports. The increase in coarse grain production and trade would be magnified by a likely decrease in relative soybean prices, but would be tempered by an expected increase in relative wheat and livestock prices. The increase in Argentina's production and trade of coarse grains would be amplified if Argentina participated in trade reform and ended its dual exchange rate policy and intermittent use of export taxes.

Canada and Australia would respond to trade liberalization by shifting land now in the production of coarse grains into wheat and livestock production. Thus, they would reduce exports. This shift would be largely driven by the effects of trade reform on

other agricultural sectors, lowering the price of coarse grains relative to wheat and livestock. In Canada, the changes resulting from the adjustment in the relative prices would be reinforced by the loss of transportation subsidies for coarse grains, causing an increase in the consumption of Canadian barley by the domestic livestock sector. The reduced barley production in Canada and Australia would lead to reduced coarse grain exports.

Japan would respond to the trade reforms by decreasing subsidies for livestock production, resulting in decreased domestic demand and lower coarse grain imports. Thailand does not have substantial barriers to agricultural trade and has low cost, efficient coarse grain producers. Therefore, Thai coarse grain production could increase rapidly in response to increased world coarse grain prices. Without the anticipated increase in Thai poultry production, this increase in coarse grain production would suggest substantially increased exports. However, with the anticipated rapid expansion of the Thai poultry sector, exports would not increase as significantly.

Taiwan and South Korea would be strongly influenced by trade reforms, even though Taiwan (as a non-GATT member) would not necessarily take part in these reforms. Because both countries import substantial quantities of coarse grains, the expected increase in world coarse grain prices would affect domestic demand. Taiwan, however, would be likely to expand its pork production to supply Japanese markets opened by the reforms. The expanded pork production would be likely to increase coarse grain imports in spite of increased prices. South Korea would be likely to decrease coarse grain imports without government incentives for increasing livestock production.

Trade reform would result in significant changes in coarse grain markets. Increased U.S. and Argentine coarse grain production and trade, reduced EC-12 production and trade, and shifting Canadian and Australian production would be the likely results of the liberalization of world agricultural trade. The United States is likely to move to an even more dominant role as a producer and exporter of coarse grains.

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Appendix table 1--Production and consumption in the world corn market, by major country

Country	1960/61	1970/71	1980/81	1985/86	1986/87	1987/88	1988/89	Average 1985-87
	- - - - - - - Million metric tons- - - - - - - - - - - -							Percent
Production:								
United States	92.2	105.5	168.6	225.5	209.6	179.6	125.0	43.7
China	14.3	33.0	62.6	63.8	70.9	79.8	75.0	15.3
Eastern Europe	17.5	20.7	30.6	30.6	38.9	30.0	27.1	7.1
EC-12	8.4	15.7	20.3	25.7	25.2	25.9	28.5	5.5
Brazil	9.0	14.1	22.6	21.0	26.5	24.7	24.0	5.1
USSR	9.8	9.4	9.5	14.4	12.5	14.8	16.0	3.0
Mexico	5.4	8.9	10.4	10.5	10.0	9.9	10.1	2.2
Argentina	4.9	9.9	12.9	12.4	9.3	9.0	4.7	2.2
South Africa	5.3	8.6	14.7	8.1	7.2	7.1	11.0	1.6
Thailand	.5	1.9	3.2	5.4	4.3	2.7	4.3	.9
Subtotal	167.3	227.7	355.4	417.4	414.4	383.5	325.7	86.6
Other	26.0	40.6	53.3	62.4	63.3	64.1	67.4	13.5
Total	193.3	268.3	408.7	479.8	477.7	447.6	393.1	100.0
Consumption:								
United States	86.5	101.4	123.8	133.5	150.0	151.6	133.5	32.3
China	16.3	30.8	66.8	65.7	73.2	74.6	74.4	15.8
EC-12	16.4	28.4	37.1	29.5	28.9	27.4	29.6	6.4
USSR	9.6	9.4	21.3	24.8	19.6	22.1	35.4	5.0
Japan	1.8	5.3	13.7	14.4	15.5	16.6	16.6	3.4
Subtotal	130.6	175.3	262.7	267.9	287.2	292.3	289.5	62.9
Other	64.4	94.3	153.0	157.3	173.1	170.2	170.8	37.1
Total	195.0	269.6	415.7	425.2	460.3	462.5	460.3	100.0

Source: For. Agr. Serv., U.S. Dept. Agr. World Grain Situation and Outlook. FG 4-89, Apr. 1989.

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Appendix table 2--Trade in the world corn market, by major country

Country	1960/61	1970/71	1980/81	1985/86	1986/87	1987/88	1988/89	Average 1985-87
	- - - - - - - - -Million metric tons- - - - - - - - - - -							Percent
Exports:								
United States	6.3	13.1	59.8	31.5	39.4	44.5	53.4	68.6
Argentina	1.9	5.3	9.0	7.4	4.0	3.7	2.2	9.1
China	0	0	.1	6.4	3.8	4.1	4.0	8.6
Thailand	.5	1.7	2.1	3.8	2.6	.8	1.9	4.3
South Africa	1.0	.9	4.1	1.5	2.6	.8	2.0	2.9
Subtotal	9.7	21.0	75.1	50.6	52.4	53.9	63.5	93.5
Other	2.9	9.1	7.7	3.9	4.0	3.0	3.4	6.5
Total	12.6	30.1	82.8	54.5	56.4	56.9	66.9	100.0
Imports:								
Japan	1.7	5.2	13.9	14.6	16.1	16.7	16.5	28.2
USSR	.1	.3	15.1	10.3	7.6	8.1	19.2	15.5
South Korea	0	.4	2.3	3.6	4.6	5.1	6.2	7.9
EC-12	8.4	17.7	22.7	4.8	2.8	3.3	3.0	6.5
Taiwan	0	.6	2.6	3.1	3.5	4.0	4.1	6.3
Mexico	0	.5	3.8	1.7	3.4	3.2	3.3	4.9
Eastern Europe	.6	1.5	7.6	2.2	1.7	2.1	2.3	3.6
China	0	0	.8	.4	1.6	.2	.1	1.3
Subtotal	10.8	26.2	68.8	40.7	41.3	42.7	54.7	74.2
Other	2.0	2.9	14.1	13.8	15.1	14.2	12.2	25.7
Total	12.8	29.1	82.9	54.5	56.4	56.9	66.9	100.0

Source: For. Agr. Serv., U.S. Dept. Agr. <u>World Grain Situation and Outlook</u>. FG 4-89, Apr. 1989.

Appendix table 3--Production and consumption in the world sorghum market, by major country

Country	1960/61	1970/71	1980/81	1985/86	1986/87	1987/88	1988/89	Average 1985-87
	- - - - - - - - - -Million metric tons- - - - - - - - -							Percent
Production:								
United States	15.7	17.4	14.7	28.5	23.8	18.8	14.7	37.0
India	9.8	8.1	10.4	10.2	8.9	9.5	11.5	15.1
China	4.6	8.2	6.8	5.6	5.4	5.4	5.3	8.7
Mexico	.2	2.4	3.8	3.7	4.3	4.0	3.7	6.4
Argentina	1.3	4.7	7.1	4.2	3.1	3.0	1.5	5.4
Nigeria	4.0	4.1	3.8	3.5	3.6	2.9	3.5	5.2
Sudan	1.1	1.5	2.1	3.6	3.4	1.3	4.0	4.2
Australia	.2	1.3	1.2	1.4	1.4	1.4	1.2	2.2
South Africa	.3	.6	.5	.4	.5	.5	.4	.7
Thailand	0	.1	.4	.3	.3	.2	.3	.4
Subtotal	37.2	48.4	50.8	61.4	54.7	47.0	46.1	85.4
Other	3.6	6.7	8.5	8.9	9.8	9.0	10.2	14.6
Total	40.8	55.1	59.3	70.3	64.5	56.0	56.3	100.0
Consumption:								
United States	10.9	17.6	8.5	17.6	13.9	15.0	13.6	25.1
China	5.2	7.7	7.0	5.8	5.5	5.5	4.8	9.1
Mexico	.2	2.2	5.2	5.7	5.1	4.8	5.0	8.4
Japan	.1	4.1	3.3	5.0	4.2	3.8	4.1	7.0
USSR	0	0	2.8	.6	.1	0	1.1	.4
Subtotal	16.4	31.6	26.8	34.7	28.8	29.1	28.6	50.1
Other	21.6	27.0	31.0	30.3	31.5	30.2	32.8	49.9
Total	38.0	58.6	57.8	65.0	60.3	59.3	61.4	100.0

Source: For. Agr. Serv., U.S. Dept. Agr. World Grain Situation and Outlook. FG 4-89, Apr. 1989.

Appendix table 4--Trade in the world sorghum market, by major country

Country	1960/61	1970/71	1980/81	1985/86	1986/87	1987/88	1988/89	Average 1985-87
			-Million metric tons-					Percent
Exports:								
United States	2.2	4.2	7.6	4.1	5.1	6.1	8.1	61.8
Argentina	.2	2.0	4.9	2.2	1.0	1.2	.6	17.5
Australia	0	.5	.5	1.1	.6	.6	.6	9.2
Subtotal	2.4	6.7	13.0	7.4	6.7	7.9	9.3	88.4
Other	.3	.7	1.1	1.3	1.3	.3	1.3	11.6
Total	2.7	7.4	14.1	8.7	8.0	8.2	10.6	100.0
Imports:								
Japan	.1	4.2	3.0	5.1	4.2	3.9	4.1	52.9
Venezuela	0	.3	.5	.8	.8	1.7	1.6	13.3
Mexico	0	0	3.2	.6	.8	.9	1.6	9.3
Taiwan	0	0	.7	.8	.8	.3	.2	7.6
Israel	.2	.5	.5	.5	.2	.4	.4	4.4
Saudi Arabia	0	0	.7	.2	.1	.1	0	1.6
South Korea	0	0	0	.3	0	0	.6	1.1
USSR	0	0	4.0	.1	.1	0	1.2	.8
Subtotal	.3	5.0	12.6	8.4	7.0	7.3	9.7	91.0
Other	2.3	2.2	1.6	.3	1.0	.9	.9	9.0
Total	2.6	7.2	14.2	8.7	8.0	8.2	10.6	100.0

Source: For. Agr. Serv., U.S. Dept. Agr. World Grain Situation and Outlook. FG 4-89, Apr. 1989.

Appendix table 5--Production and consumption in the world barley market, by major country

Country	1960/61	1970/71	1980/81	1985/86	1986/87	1987/88	1988/89	Average 1985-87
	- - - - - - - - - - - -Million metric tons- - - - - - - - -							Percent
Production:								
USSR	16.0	38.2	43.5	46.5	53.9	58.4	44.5	29.3
EC-12	19.3	35.0	50.1	51.5	46.8	46.8	50.5	26.8
Eastern Europe	6.9	9.0	16.6	16.4	16.9	16.3	16.2	9.2
Canada	4.2	8.9	11.3	12.4	14.6	14.0	10.1	7.6
United States	9.3	9.1	7.9	12.9	13.3	11.5	6.3	7.0
China	5.6	7.5	6.8	6.2	5.6	6.0	6.3	3.3
Australia	1.5	2.4	2.7	4.9	3.6	3.5	3.3	2.2
Subtotal	62.8	110.1	138.9	150.8	154.7	156.5	137.2	85.4
Other	19.5	15.9	24.3	27.2	27.7	24.1	28.8	14.6
Total	82.3	126.0	163.2	178.0	182.4	180.6	166.0	100.0
Consumption:								
USSR	15.4	37.6	47.6	48.6	56.6	60.9	47.8	31.1
EC-12	20.8	34.5	45.2	41.8	40.5	40.6	41.9	23.1
Eastern Europe	7.4	11.4	18.3	18.6	18.9	18.1	18.9	10.4
United States	8.1	9.3	7.6	10.9	10.3	9.4	8.4	5.7
Subtotal	51.7	92.8	118.7	119.9	126.3	129.0	117.0	70.4
Other	31.2	37.3	44.9	52.8	51.8	53.4	52.9	29.6
Total	82.9	130.1	163.6	172.7	178.1	182.4	169.9	100.0

Source: For. Agr. Serv., U.S. Dept. Agr. World Grain Situation and Outlook. FG 4-89, Apr. 1989.

Appendix table 6--Trade in the world barley market, by major country

Country	1960/61	1970/71	1980/81	1985/86	1986/87	1987/88	1988/89	Average 1985-87
	- - - - - - - - - - - - - -Million metric tons - - - - - - - - - -							Percent
Exports:								
EC-12	1.4	3.1	9.1	7.3	6.2	7.0	10.0	39.0
Canada	.8	3.8	4.0	4.8	6.0	3.4	3.5	26.6
Australia	.8	1.1	1.5	3.7	2.2	1.7	1.3	14.2
United States	1.8	1.8	1.8	.8	3.0	2.9	1.0	12.9
Subtotal	4.8	9.8	16.4	16.6	17.4	15.0	15.8	92.7
Other	3.0	3.5	3.1	2.6	4.1	3.9	2.4	7.3
Total	7.8	13.3	19.5	19.2	21.5	18.9	18.2	100.0
Imports:								
Saudi Arabia	0	0	1.8	6.6	9.0	4.5	4.0	37.5
USSR	0	0	4.0	2.9	3.0	2.4	3.4	15.7
Eastern Europe	.5	1.3	2.1	3.3	1.3	1.9	2.4	12.3
Japan	0	.9	1.5	1.5	1.2	1.3	1.2	7.6
EC-12	3.5	6.4	4.5	.1	.1	.5	.4	1.4
Subtotal	4.0	8.6	13.9	14.4	14.6	10.6	11.4	74.5
Other	2.0	2.2	3.2	4.0	3.9	5.4	5.8	25.5
Total	6.0	10.8	17.1	18.4	18.5	16.0	17.2	100.0

Source: For. Agr. Serv., U.S. Dept. Agr. World Grain Situation and Outlook. FG 4-89, Apr. 1989.

Appendix table 7--Production and consumption in the world oats market, by major country

Country	1960/61	1970/71	1980/81	1985/86	1986/87	1987/88	1988/89	Average 1985-87
	- - - - - - - - - - - - -Million metric tons- - - - - - - - -							Percent
Production:								
USSR	12.0	14.2	15.5	20.5	21.9	18.5	15.3	43.4
United States	16.7	13.3	6.7	7.6	5.6	5.4	3.2	13.2
EC-12	10.1	8.1	7.6	7.4	5.6	5.3	5.5	13.0
Canada	6.1	5.4	3.0	2.7	3.3	3.0	3.0	6.4
Poland	2.8	3.2	2.2	2.7	2.5	2.4	2.2	5.4
Australia	1.4	1.6	1.1	1.3	1.6	1.7	1.8	3.3
Sweden	1.2	1.7	1.6	1.7	1.5	1.4	1.3	3.3
Finland	1.1	1.3	1.3	1.2	1.2	.8	.9	2.3
China	.6	.8	.7	.7	.6	.6	.7	1.4
Subtotal	52.0	49.6	39.7	45.8	43.8	39.1	33.9	91.6
Other	5.5	3.9	3.8	3.9	3.7	4.2	3.6	8.4
Total	57.5	53.5	43.5	49.7	47.5	43.3	37.5	100.0
Consumption:								
USSR	11.9	14.2	15.5	20.7	21.9	18.6	15.4	43.3
United States	15.5	12.7	7.3	7.9	6.8	6.4	4.4	14.9
EC-12	10.8	9.1	7.7	7.7	5.8	5.4	5.5	13.3
Canada	5.3	5.6	3.1	2.5	2.8	2.8	2.8	5.8
Poland	2.8	3.3	2.3	2.7	2.5	2.4	2.4	5.4
Australia	1.0	.8	1.2	1.2	1.2	1.3	1.4	2.6
Sweden	1.1	1.3	1.3	1.2	1.2	1.2	1.1	2.6
Finland	1.1	1.3	1.3	1.1	1.0	.8	.8	2.0
China	.7	.8	.7	.8	.7	.6	.7	1.5
Subtotal	50.8	49.1	40.4	45.8	43.9	39.5	34.5	91.3
Other	5.4	4.1	4.1	4.2	4.1	4.0	3.6	8.7
Total	56.2	53.2	44.5	50.0	48.0	43.5	38.1	100.0

Source: For. Agr. Serv., U.S. Dept. Agr. World Grain Situation and Outlook. FG 4-89, Apr. 1989.

Appendix table 8--Trade in the world oats market, by major country

Country	1960/61	1970/71	1980/81	1985/86	1986/87	1987/88	1988/89	Average 1985-87
	- - - - - - - - - - - -Million metric tons- - - - - - - -							Percent
Exports:								
Sweden	0.0	0.3	0.3	0.5	0.3	0.2	0.2	23.8
EC-12	.1	.3	.3	.4	.3	.3	.2	23.8
Canada	0	.2	.1	.1	.3	.3	.6	16.7
Australia	.3	.6	.2	.1	.2	.2	.5	11.9
Argentina	.2	.2	.1	0	0	.3	.1	7.1
Finland	0	.1	0	.2	.1	0	0	7.1
Subtotal	.6	1.7	1.0	1.3	1.2	1.3	1.6	90.5
Other	.6	.2	.3	.1	.2	.1	.1	9.5
Total	1.2	1.9	1.3	1.4	1.4	1.4	1.7	100.0
Imports:								
United States	0	0	0	.5	.5	.7	.9	41.3
EC-12	.9	1.3	.5	.4	.3	.4	.3	26.7
Japan	0	.2	.2	.1	.1	.1	.1	7.4
Switzerland	.2	.2	.1	.1	.1	.1	.1	7.4
USSR	0	0	0	.2	0	.1	.1	7.0
East Germany	0	.1	0	.1	0	0	.1	2.4
Subtotal	1.1	1.8	.8	1.4	1.0	1.4	1.6	92.2
Other	0	0	0	0	.2	.1	0	7.8
Total	1.1	1.8	.8	1.4	1.2	1.5	1.6	100.0

Source: For. Agr. Serv., U.S. Dept. Agr. World Grain Situation and Outlook. FG 4-89, Apr. 1989.

Appendix table 9--Coarse grain acreage harvested by selected countries

Country	1960/61	1970/71	1980/81	1985/86	1986/87	1987/88	1988/89[1]	Average 1985-87
	- - - - - - - - - - - - - - - -Million hectares- - - - - - - - - - - -							Percent share
USSR	50.1	46.6	57.9	58.5	58.6	59.5	57.0	17.8
India	45.1	46.2	41.5	39.4	39.6	35.8	39.9	11.7
United States	52.3	40.7	41.3	45.5	41.5	35.4	32.0	11.1
China	33.9	35.1	31.7	27.0	27.9	28.8	28.0	8.6
EC-12	19.4	21.0	21.3	20.3	19.7	19.1	19.4	5.9
Eastern Europe	23.1	19.1	19.2	18.6	18.6	18.1	18.5	5.6
Brazil	7.0	10.7	13.1	13.0	14.0	13.1	12.9	4.1
Mexico	5.9	9.2	9.6	7.8	7.7	7.8	7.8	2.4
Canada	7.6	8.4	8.0	7.9	7.8	8.0	7.2	2.3
Argentina	5.7	7.5	6.4	5.6	4.5	4.4	4.8	1.4
Australia	2.9	4.3	4.3	5.2	4.3	4.6	4.8	1.4
South Africa	5.2	5.5	5.0	4.9	4.9	4.5	4.4	1.4
Thailand	.3	.9	1.7	2.5	2.0	2.0	2.1	.6
Subtotal	258.5	255.2	261.0	256.2	251.1	241.1	238.8	74.3
Total	320.0	327.0	342.0	341.0	336.0	324.0	323.0	100.0

[1] Estimates for 1988/89 were made in November 1988.
Source: For. Agr. Serv., U.S. Dept. Agr.

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Appendix table 10--Coarse grain yields by selected countries and world totals

Country	1960/61	1970/71	1975/76	1980/81	1985/86	1986/87	1987/88	1988/89[1]
				Metric tons per hectare				
United States	2.72	3.59	4.35	4.80	6.04	6.09	6.10	4.44
EC-12	2.39	2.92	4.26	3.87	4.36	4.13	4.31	4.58
Eastern Europe	1.86	2.29	3.03	3.24	3.53	3.97	3.56	3.35
China	.87	1.66	2.14	2.60	3.05	3.14	3.36	3.28
Canada	1.64	2.31	2.33	2.77	3.01	3.26	3.20	2.66
Argentina	1.48	2.10	2.11	3.28	3.12	2.88	2.98	2.94
USSR	1.15	1.65	1.13	1.39	1.71	1.81	1.91	1.72
Mexico	1.00	1.25	1.39	1.54	1.88	1.93	1.87	1.89
Brazil	1.30	1.34	1.60	1.76	1.67	1.95	1.88	1.75
South Africa	1.11	1.71	1.40	3.07	1.79	1.61	1.73	2.02
Thailand	1.91	2.35	2.09	2.11	2.26	2.25	1.51	2.55
Australia	1.15	1.29	1.43	1.21	1.51	1.56	1.48	1.54
India	.53	.66	.69	.69	.66	.67	.64	.75
Total	1.40	1.74	1.90	2.14	2.47	2.48	2.45	2.20

[1] Estimates for 1988/89 were made in November 1988.
Source: For. Agr. Serv., U.S. Dept. Agr.

Appendix table 11--United States coarse grain shipments by
selected importing countries

Importer	1965	1970	1975	1980	1985	1986	1987
			Million metric tons				
Japan	4.0	6.4	7.4	15.0	12.9	10.8	14.5
EC-12	12.6	7.8	18.2	16.1	5.2	2.3	2.1
USSR	0	0	3.2	4.0	12.0	2.4	4.9
Saudi Arabia	*	*	*	*	.4	1.3	2.4
South Korea	*	.3	.5	2.1	1.7	1.4	4.2
Taiwan	0	0	.7	2.2	3.0	3.0	3.3
Eastern Europe	.4	.4	2.1	6.7	.8	.7	.9
Mexico	.2	.5	2.1	7.1	3.1	1.8	3.8
Egypt	.1	*	.5	.9	1.4	1.6	1.4
China	0	0	0	1.6	0	.1	1.2
Venezuela	.1	.2	.4	1.1	1.4	.6	.9
Algeria	0	*	.1	.1	.5	.4	.9

*Less than 100,000 metric tons.
Source: For. Agr. Serv., U.S. Dept. Agr.

Appendix table 12--EC-12 coarse grain shipments by selected
importing countries, selected calendar years

Importer	1965	1970	1975	1980	1985	1986	1987
	Million metric tons						
Japan	0.0	0.1	*	*	*	0.1	0.3
EC-12	3.6	6.3	9.9	9.6	10.8	13.1	12.2
USSR	*	*	.3	.2	2.6	1.4	2.1
Saudi Arabia	0	*	*	.8	1.9	3.1	2.2
Eastern Europe	*	1.1	.6	1.8	.9	.8	.7
Egypt	*	0	*	*	*	0	.2
Algeria	*	*	*	.2	.3	0	.1

*Less than 100,000 metric tons.
Source: For. Agr. Serv., U.S. Dept. Agr.

Appendix table 13--Argentine coarse grain shipments by
importing countries, selected calendar years

Importer	1965	1970	1975	1980	1985	1986	1987
	Million metric tons						
Japan	0.1	1.8	0.7	*	1.9	2.8	N.A.
EC-12	3.4	5.3	2.9	.5	2.2	1.0	N.A.
USSR	*	*	.5	4.5	3.5	.4	N.A.
Saudi Arabia	*	0	0	0	*	.1	N.A.
South Korea	0	0	0	0	0	.2	N.A.
Taiwan	0	*	*	0	.1	.2	N.A.
Eastern Europe	.1	0	.1	*	.1	.4	N.A.
Mexico	*	*	1.2	0	.6	.5	N.A.
Egypt	0	0	0	0	.4	.4	N.A.
Malaysia	0	0	0	0	*	.1	N.A.
China	.1	*	.1	0	0	*	N.A.
Algeria	0	0	0	0	.1	.4	N.A.

N.A. = Not available.
*Less than 100,000 metric tons.
Source: For. Agr. Serv., U.S. Dept. Agr.

Appendix table 14--Canada coarse grain shipments by importing countries, selected calendar years

Importer	1965	1970	1975	1980	1985	1986	1987
			Million metric tons				
Japan	N.A.	0.7	1.0	0.7	1.1	0.9	0.8
EC-12	N.A.	1.9	.9	.7	.2	.2	.3
USSR	N.A.	0	.6	1.6	.2	2.1	.8
Saudi Arabia	N.A.	0	0	*	.4	.9	2.1
Taiwan	N.A.	.1	*	*	0	0	.1
Eastern Europe	N.A.	.2	.5	.2	.6	1.4	.3
China	N.A.	0	0	0	0	.3	.3
Algeria	N.A.	0	*	.1	0	*	*

N.A. = Not available.
*Less than 100,000 metric tons.
Source: For. Agr. Serv., U.S. Dept. Agr.

Appendix table 15--Australia coarse grain shipments by importing countries, selected calendar years

Importer	1965	1970	1975	1980	1985	1986	1987
			Million metric tons				
Japan	N.A.	0.5	1.7	1.2	1.8	1.6	1.2
EC-12	N.A.	.5	.2	.1	*	*	.1
USSR	N.A.	0	.1	1.2	1.1	0	0
Saudi Arabia	N.A.	*	*	.3	2.9	1.6	.6
South Korea	N.A.	0	.3	0	*	*	*
Taiwan	N.A.	.2	.2	.4	.5	.4	.4
Malaysia	N.A.	*	*	*	.1	*	*
China	N.A.	0	0	*	*	*	.2

N.A. = Not available.
*Less than 100,000 metric tons.
Source: For. Agr. Serv., U.S. Dept. Agr.

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Appendix table 16--South Africa coarse grain shipments by importing countries, selected calendar years

Importer	1965	1970	1975	1980	1985	1986	1987
	Million metric tons						
Japan	*	0.5	1.0	0.9	0.1	1.3	1.7
EC-12	0.4	.4	1.4	.4	.1	.1	.1
Taiwan	0	*	.5	.5	N.A.	N.A.	N.A.
Venezuela	0	*	.1	.2	*	N.A.	N.A.

N.A. = Not available.
*Less than 100,000 metric tons.
Source: For. Agr. Serv., U.S. Dept. Agr.

Appendix table 17--Thailand coarse grain shipments by importing countries, selected calendar years

Importer	1965	1970	1975	1980	1985	1986	1987
	Million metric Tons						
Japan	0.6	0.7	0.9	0.1	*	0.1	N.A.
USSR	0	0	0	.3	0.0	0	N.A.
Saudi Arabia	*	*	.1	.3	.4	.4	N.A.
South Korea	0	0	.1	*	.5	1.1	N.A.
Taiwan	*	.5	.2	.2	.1	.2	N.A.
Egypt	0	0	0	0	0	.1	N.A.
Malaysia	0	.1	0	.4	.9	.9	N.A.
China	0	0	0	.1	.1	.6	N.A.

N.A. = Not available.
*Less than 100,000 metric tons.
Source: For. Agr. Serv., U.S. Dept. Agr.

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