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CTAP Staff rept, 11-85

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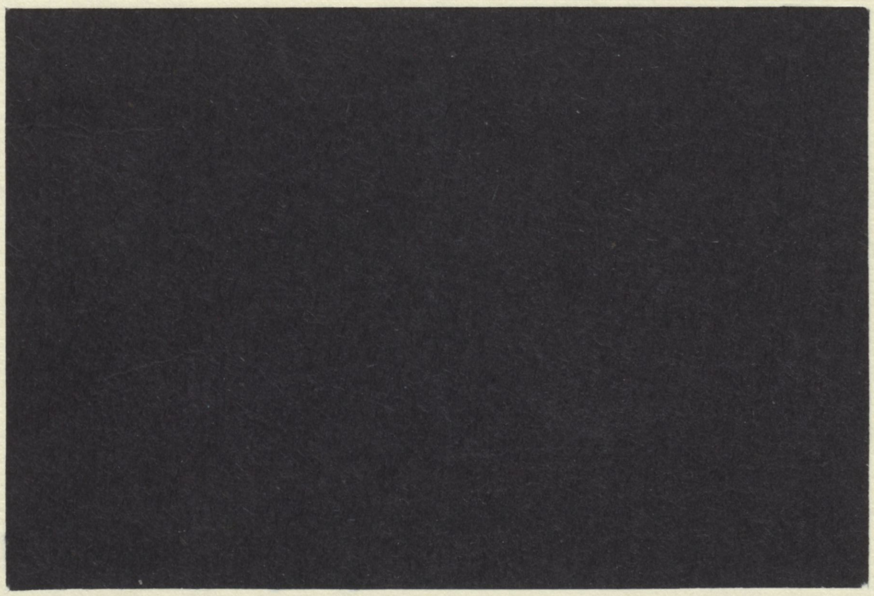

Commercial World Commodity Export Demand Equations Utilizing Real Importer Prices and Income

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CTAP Staff Report #11
July 1985

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A statistical appendix providing documentation for CTAP #11 is available from the authors upon request.

Introduction

The importance of foreign trade to US agriculture requires that commodity models for policy analysis explicitly consider the foreign sector. A number of approaches have been used to incorporate foreign demand for US exports into commodity models. These approaches range in complexity from models which treat trade exogenously to linked country market models which estimate supply and demand in each important importing or exporting region (Williams 1985).

A simplified approach to considering the foreign sector is to treat export demand as one more component of demand, estimated directly by a single equation. Such an approach permits foreign trade to be determined simultaneously with prices and the other endogenous variables in a commodity model, but it does not require the data and model complexity of a disaggregated export market model.

Using an export demand equation to model commodity trade is not without its shortcomings. Since the export demand facing the US is the difference between demand and supply in the rest of the world, an export demand equation should, in principle, include all the variables that affect supply and demand in foreign countries. Clearly, any attempt to include all relevant variables would be futile. The most that can be asked is that an export demand equation capture a few key factors affecting trade and provide reasonable estimates of key behavioral parameters.

This report will present single-equation models of world commercial export demand for wheat, corn, soybeans, soybean meal and soybean oil. The models presented here attempt to correct perceived deficiencies in earlier models, primarily by using different definitions of price and demand shift variables. It is hoped that this work will be of use to commodity modelers who like the simplicity of the aggregate export demand approach to modeling the foreign sector, but who are troubled by the problems with existing models.

The model specifications presented here represent a significant departure from past efforts, but they also borrow heavily from work done at the USDA and the University of Minnesota in the late 1970's and at the University of Missouri in recent years. Bredahl, Gallagher and Matthews (1978) provided the theoretical basis for aggregate export demand modeling. Export demand models for corn and sorghum (Bredahl, Womack and Matthews 1978) and for soybeans and soybean meal (Bredahl, Meyers, Hacklander and Breedlove Byrne 1978) were developed at the USDA, and integrated into a general crops model (Baumes and Meyers 1980).

The first section of this report briefly sketches the general form of the export demand equations and justifies the approach taken. The second section will explain how the variables utilized in the models were defined and derived. The third section presents equation results, and compares the results with those obtained when price and demand shift variables are defined differently. The final section summarizes the results and suggests how these equations could be incorporated in a commodity model. A statistical appendix, available upon request, documents the data utilized in the equations.

The General Model

The export demand equations for wheat, corn, soybeans and soymeal all take the same general form:

CXT = f(RPM, MINC, Z1, Z2...Zn), where

CXT represents total world commercial exports, defined as net exports by major exporters, minus US PL 480 exports and the total imports of the USSR and the PRC;

RPM represents the real price of the commodity faced by major importing countries, defined as the real US price multiplied by a trade-weighted real exchange rate;

MINC represents real income in importing countries, defined as a trade weighted index; and

Z1, Z2...Zn represent other export demand shift variables, such as prices of other commodities and inputs, competing supplies in importing countries, PL 480 exports, and dummy variables to account for unusual events.

The soyoil equation takes the same general form, except that, due to data limitations, the dependent variable includes exports to the USSR and PRC. Also, the lagged value of the dependent variable is one of the independent variables.

The coefficient on RPM in each equation is expected to have a negative sign. As the real importer price increases, importer quantity demanded would be expected to decrease, and importer quantity supplied would be expected to increase, thus reducing demand for imports. The coefficient on MINC is expected to be positive, assuming all the commodities under consideration are normal goods in importing countries. An increase in importer real incomes will increase demand for normal goods, thus increasing demand for imports, assuming domestic supply remains unchanged. Expected signs on other variables will be discussed when those variables are presented.

Except where explicitly stated otherwise, all prices are expressed in terms of real foreign currency units per metric ton, and all quantities are in thousands of metric tons. Variables are defined over crop years, with adjustments made when original data were defined over calendar years. Models were fit over 22 years of data, from the 1961-62 to the 1982-83 crop years. The unavailability of foreign price indices and several other variables made it impossible to extend the estimation period to the 1983-84 crop year using actual data.

Three important features of this general specification should be noted at this point:

1) The dependent variable does not include "policy exports" (PL 480 and net imports of the USSR and PRC), but it does include exports by major competitors.

Thus, these equations are not true single-equation models of export demand facing the US, but rather the commercial net import demand of importers. To derive US export demand, one needs to estimate (or make exogenous assumptions concerning) PL 480 exports, total USSR and PRC imports and exports by competitors. Although this approach may require an additional equation or two in the general commodity model, it was decided that disaggregating export demand in this manner made the problem more manageable.

2) Prices are all defined in terms of the real prices faced by importers. Unlike most previous work, this explicitly considers both exchange rates and relative rates of inflation. It does not, however, consider transportation costs and barriers to trade other than the EC threshold price of corn.

3) The principal demand shift variable in each equation is real income in importing countries. Corn, soybean and soymeal export demand equations traditionally have utilized foreign livestock production in place of this variable, since most foreign demand for these commodities is a derived demand from the livestock sector. However, in a more complete model, income is the key variable in demand growth for livestock products. Using an income variable instead of a livestock variable eliminates the need to model foreign livestock production, and allows the incorporation of information from importing regions where income data are more readily available than are estimates of livestock production. This form of demand equation is derived theoretically by combining the livestock sector and the derived feed demand. The result is a sector "equilibrium demand" in the sense of Just, Heuth and Schmitz (1982).

The Variables

The Dependent Variables

The dependent variable in each equation is CXT, world commercial exports by the major exporters. PL 480 shipments and exports to the Soviet Union and the

People's Republic of China are excluded, since they have traditionally been considered "policy" rather than "commercial" exports. Policy exports presumably are unresponsive (or, at least, less responsive) to changes in world prices, and thus are better explained outside the framework of traditional export demand models. Exports to Eastern Europe are here considered "commercial" exports, since they are thought to be more responsive to prices and other economic factors.

Commercial exports by other countries are included in the dependent variable in order to reduce aggregation problems. If, instead, a US export demand equation were estimated, other exporting countries would be grouped with importing countries or treated exogenously. It seems reasonable to assume that supply and demand response may be different in exporting and importing countries, and that aggregating across exporting and importing countries would therefore cause even more problems than already exist from aggregating across importing countries.

Wheat. As seen in Figure 1, policy wheat exports were important throughout the 1961-82 period, both for their size and their variability. It is important to note that WHECXT (commercial wheat exports) and total wheat exports sometimes moved in opposite directions. Figure 2 shows that US wheat exports generally accounted for slightly less than half of total world exports. Competitor exports are defined as net wheat exports by Canada, Australia, Argentina and the EC.

Corn. Figure 3 shows that corn policy exports only became important in the 1970s, and remained relatively less important than they were in the case of wheat. CORCXT (commercial corn exports) generally moved with total corn exports, although it was static between 1976 and 1978, while total exports increased considerably. Figure 4 shows that the US has always had a dominant position in world corn trade, although the absolute and relative importance of Argentine, Thai and South African exports has varied considerably over time.

Soybean. Nearly all soybean exports are classified as commercial, since USSR and PRC imports are small and PL 480 exports are negligible. Figure 5 shows that SOYCXT (commercial soybean exports) always moved in the same direction as total soybean exports. As seen in Figure 6, the US has also dominated world soybean trade, although Brazilian and Argentine exports did become important in the 1970s.

Soymeal. Figure 7 shows how SOMCXT (commercial soymeal exports) increased dramatically during the 1961-1983 period. USSR and PRC imports were negligible until 1980, and no PL 480 imports were recorded. As seen in Figure 8, US meal exports peaked in 1979, while Argentine and Brazilian exports have increased rapidly since 1970.

Soyoil. In the case of soyoil, data unavailability made it impossible to identify USSR and PRC imports for the entire period, so SOOCXT (commercial soyoil exports) includes USSR and PRC imports. Commercial soyoil exports increased rapidly in the 1970s, as shown in Figure 9. PL 480 exports were particularly large in the 1960s, and they remained more important for soyoil than for wheat or corn. Figure 10 shows that competitor soyoil exports (which here include all foreign exports, not just those of major exporters) increased dramatically in the 1970s, so that the US share of world soyoil exports declined precipitously.

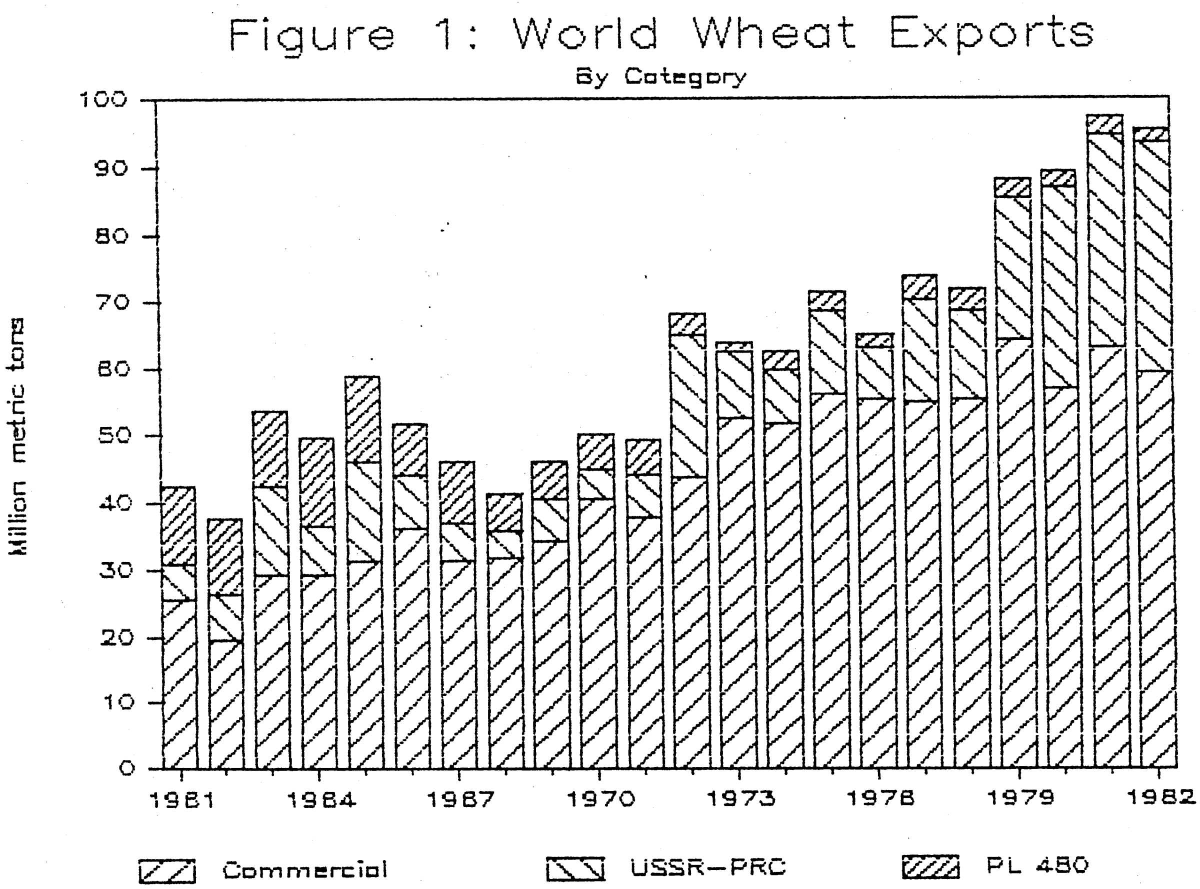


Figure 1: World Wheat Exports
By Category
Million metric tons
100
90
80
70
60
50
40
30
20
10
0
1961
1964
1967
1970
1973
1976
1979
1982
Commercial
USSR-PRC
PL 480

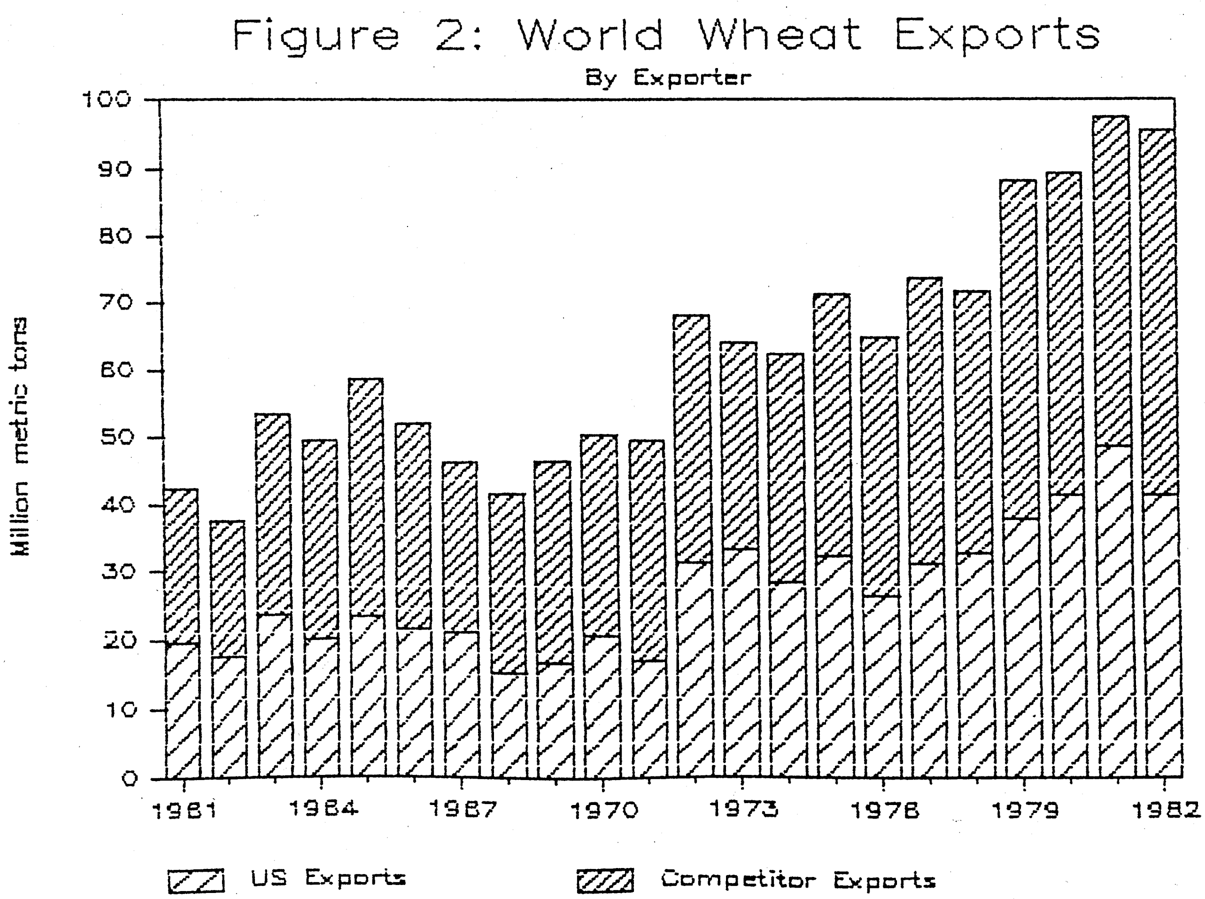


Figure 2: World Wheat Exports
By Exporter
Million metric tons
100
90
80
70
60
50
40
30
20
10
0
1961
1964
1967
1970
1973
1976
1979
1982
US Exports
Competitor Exports

Figure 3: World Corn Exports

By category

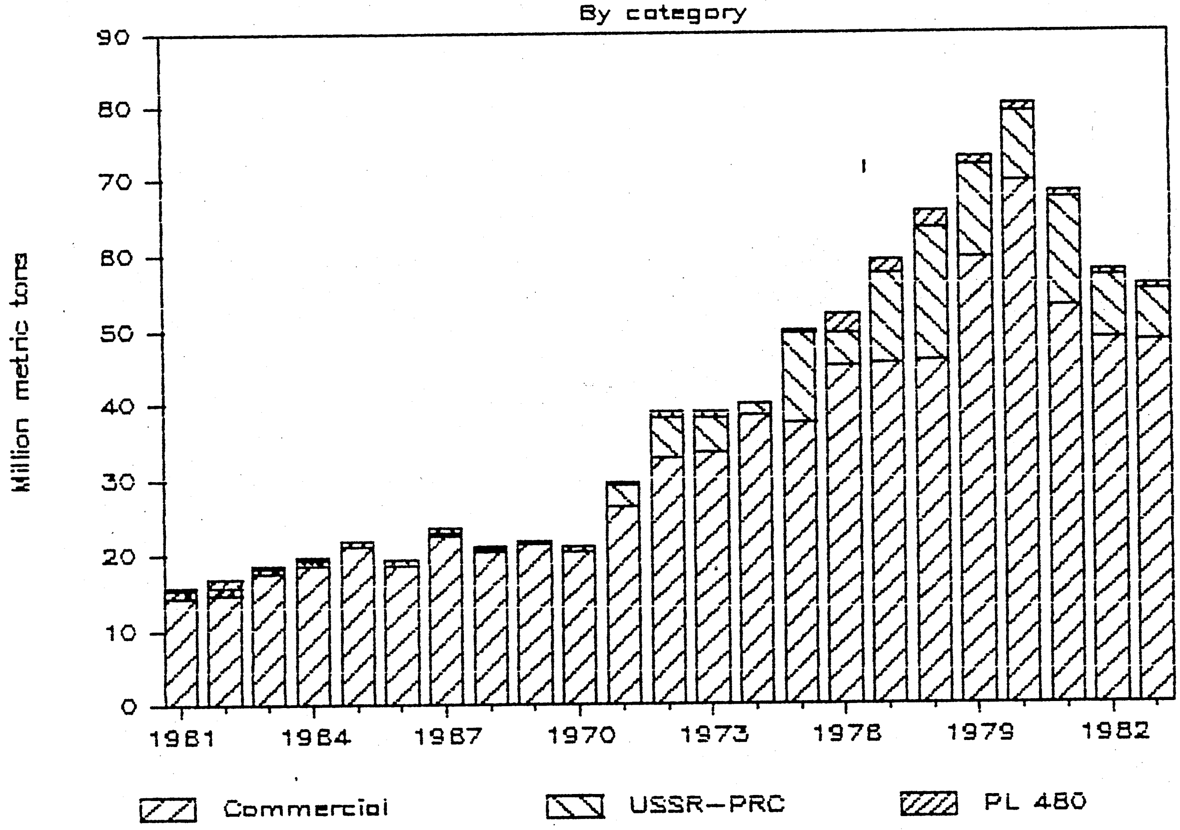
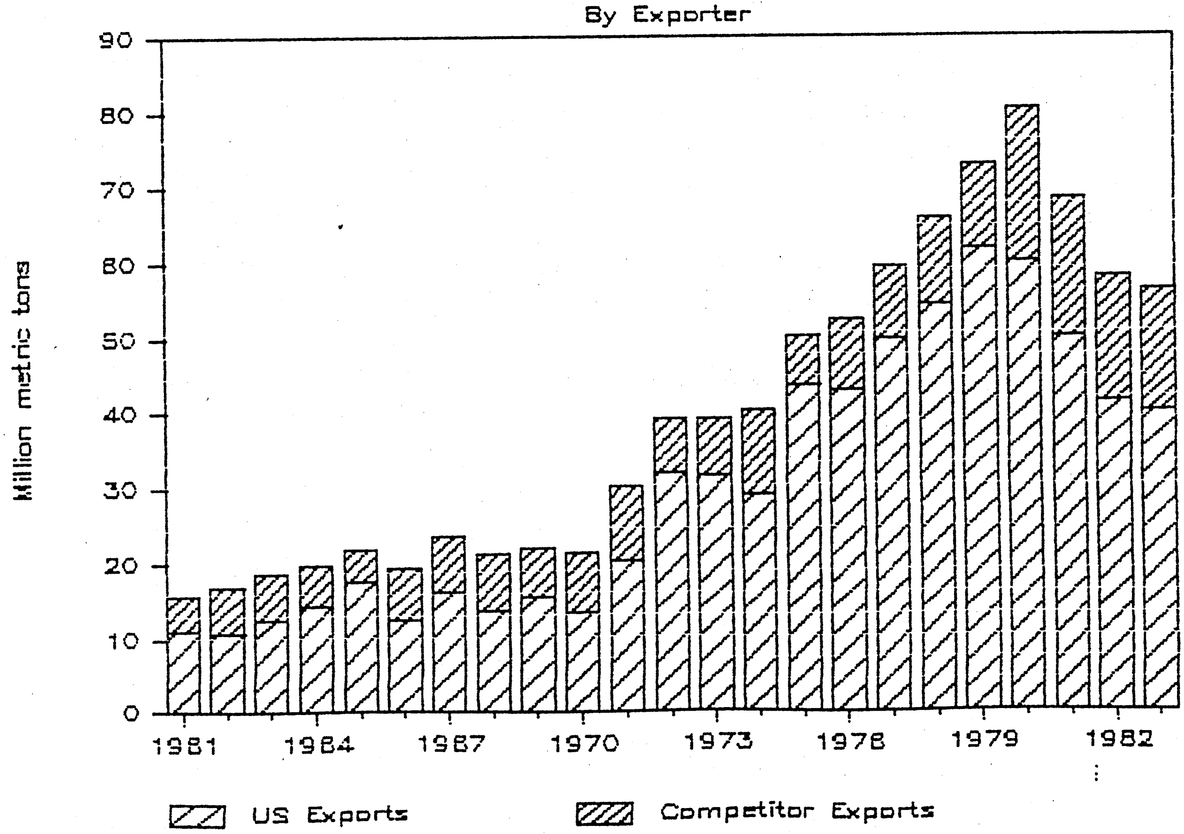


Figure 4: World Corn Exports

By Exporter



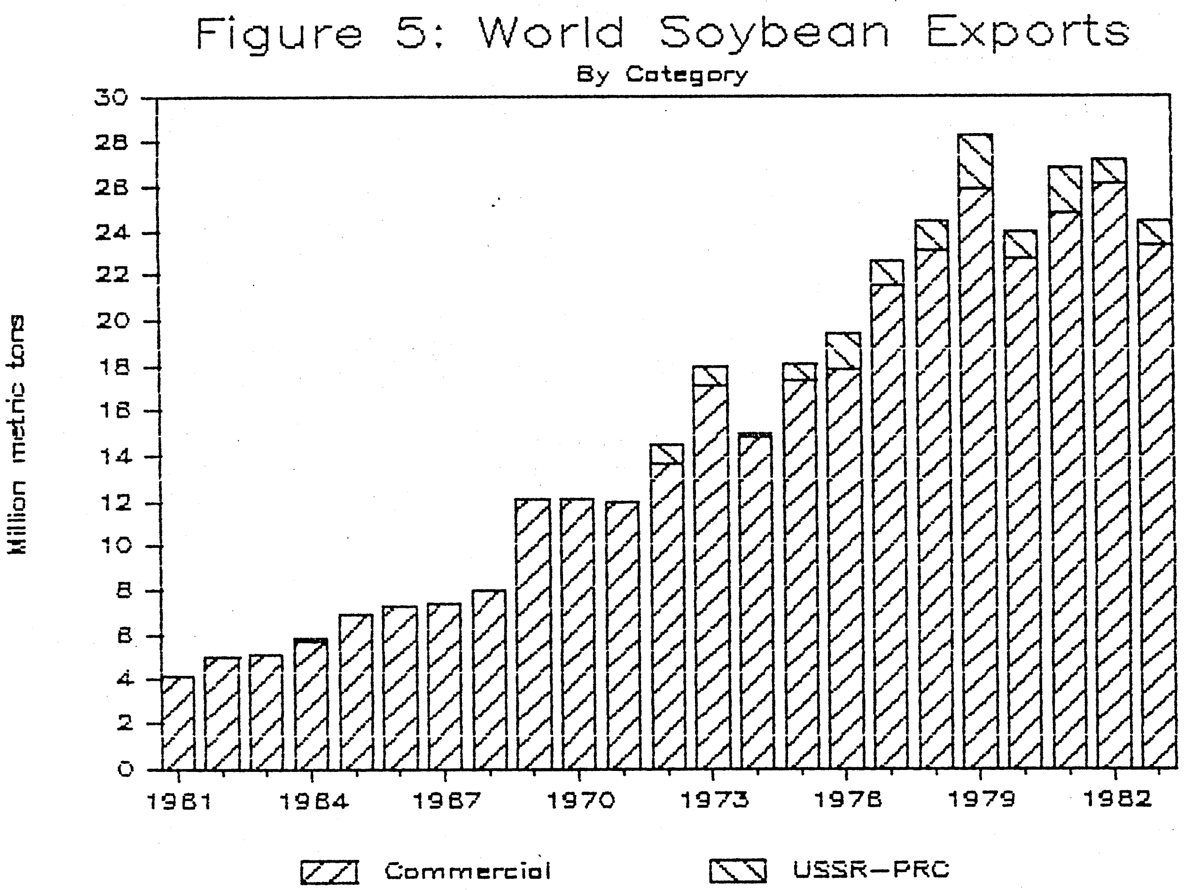


Figure 5: World Soybean Exports
By Category
Million metric tons
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
1961
1964
1967
1970
1973
1976
1979
1982
Commercial
USSR-PRC

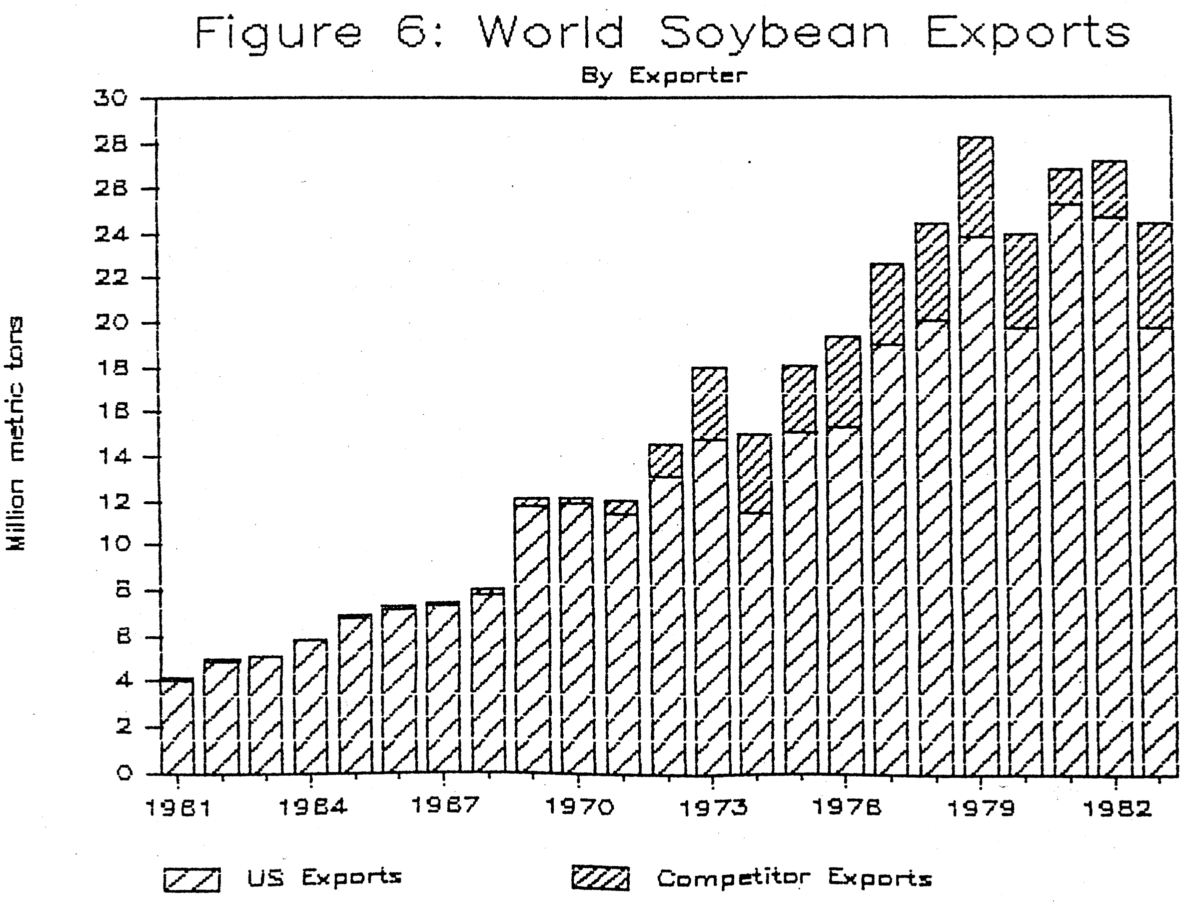


Figure 6: World Soybean Exports
By Exporter
Million metric tons
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
1961
1964
1967
1970
1973
1976
1979
1982
US Exports
Competitor Exports

Figure 7: World Soymeal Exports

By Category

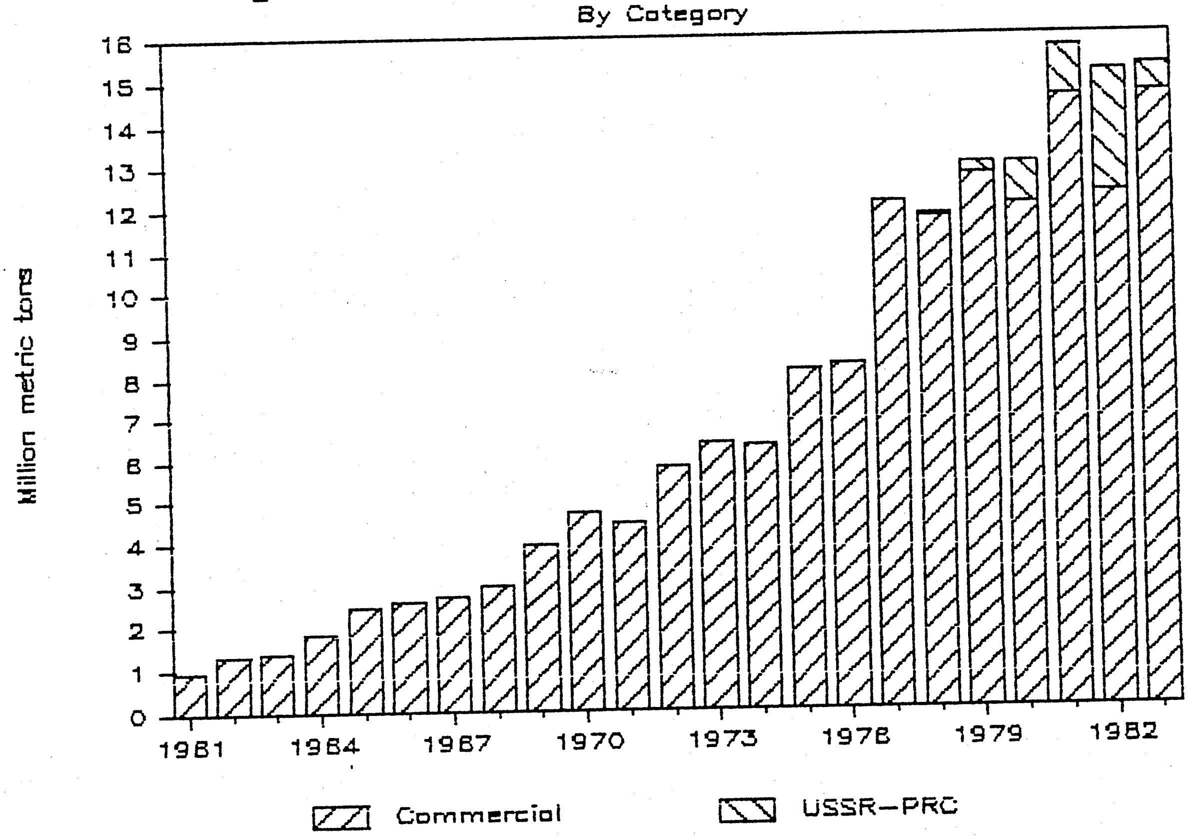


Figure 8: World Soymeal Exports

By Exporter

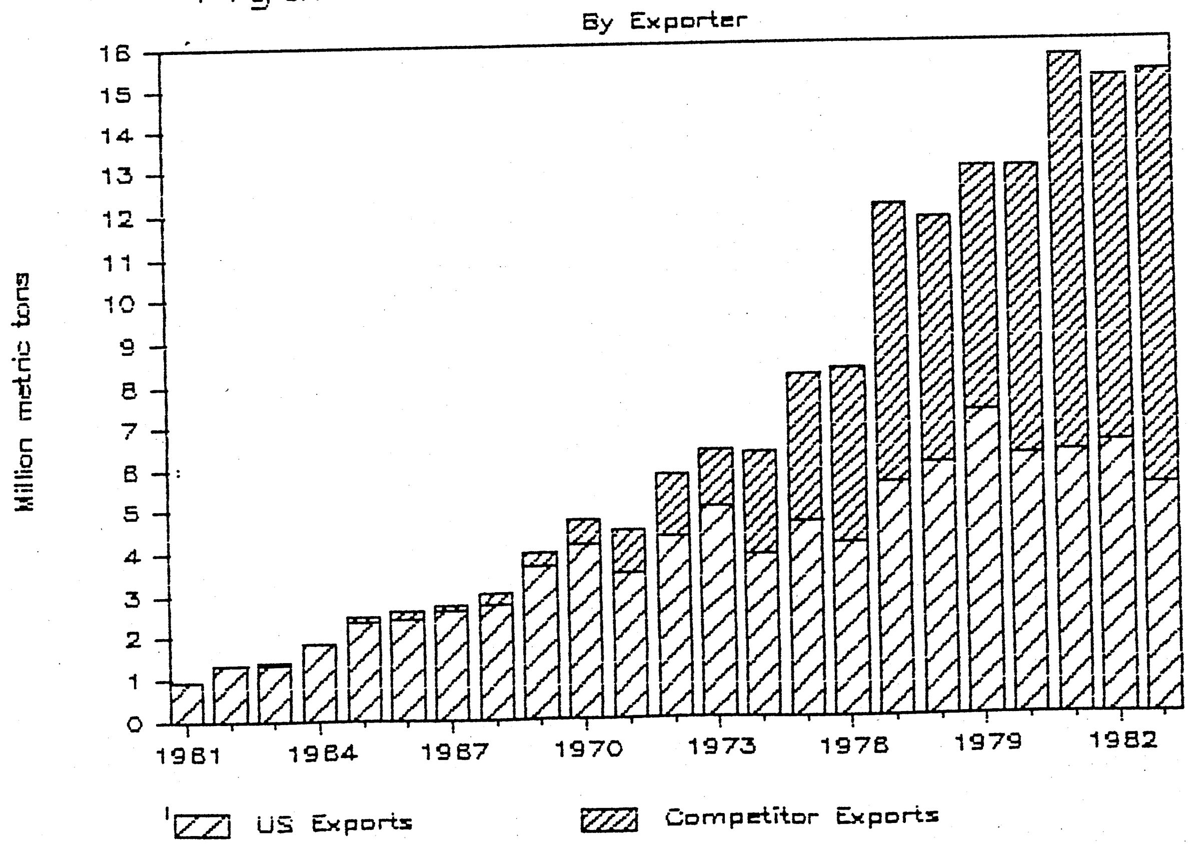


Figure 9: World Soyoil Exports

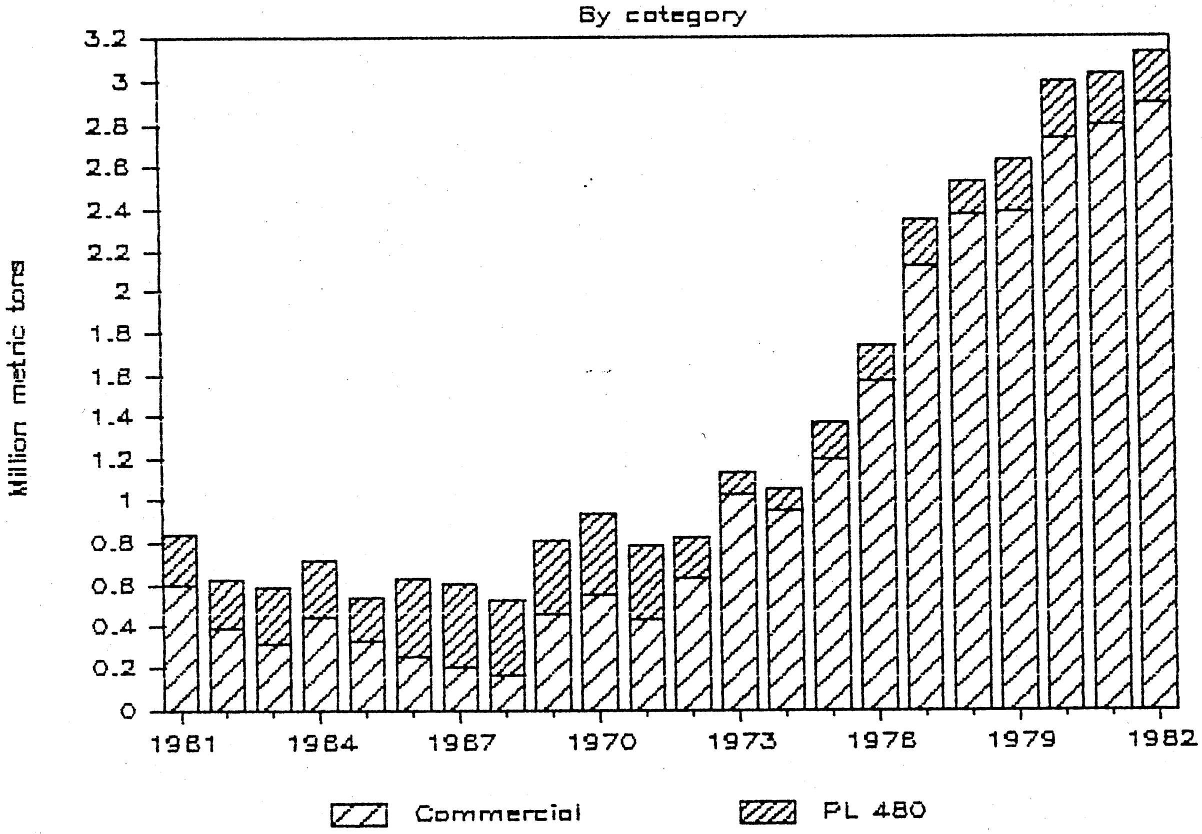
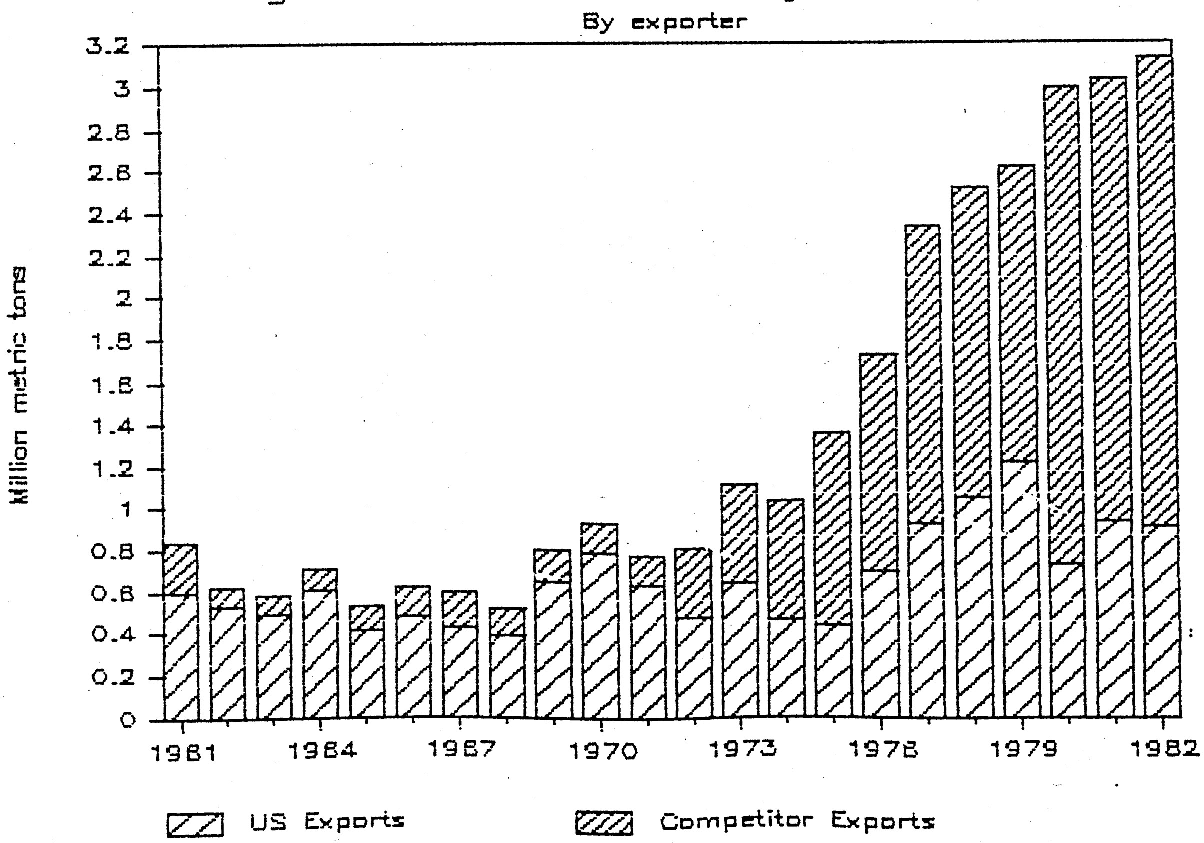


Figure 10: World Soyoil Exports



The Income Variables

As stated earlier, foreign livestock production generally has been used in previous models as the principal demand shifter in corn, soybean and soymeal export demand equations. Using real importer income instead would eliminate the need to model or take as exogenous the foreign livestock sector, and might help overcome livestock data constraints. Foreign income variables were used in wheat and soyoil export demand equations. The income variables specified here are more precise, however, in that they represent trade-weighted indices of real income in importing countries.

The first step in creating the income variables was to determine which importing countries or groups of countries to include. In the case of corn, soybeans and soymeal, commercial exports go primarily to the EC, Eastern Europe and a relatively small number of other countries. In the cases of wheat and soyoil, there are large numbers of importing countries. Since International Financial Statistics publishes indices of real income in industrial countries, oil-exporting LDCs and non-oil LDCs, those country groupings can be used to create income variables for the wheat and soyoil equations.

The second step was to determine appropriate weights for the different countries or groups of countries. It was decided to base the weights on average imports during the 1978-82 period. It might have been better to use weights which changed yearly or which were based on averages for the period as a whole, but time and data limitations led to the chosen approach. Also, it was felt that this approach would provide weights appropriate for forecasting.

Wheat. Figure 11 shows how dispersed world wheat imports were during the 1978-82 period. Other than the USSR and PRC, no single country accounted for more than 7 percent of total world imports. The wheat income variable weights listed in Table 1 were derived as follows: 1) USSR and PRC imports were subtracted from world wheat imports during the 1978-82 period; 2) imports by Eastern European countries, other industrial countries and oil-exporting LDCs were identified, and the residual was attributed to non-oil LDCs; and 3) weights summing to 1 were assigned.

Corn. As seen in Figure 12, world corn imports were much more concentrated, as 10 countries or groups of countries accounted for 81.3 percent of total imports. Table 1 lists the weights assigned when imports by the USSR, PRC and the residual "Others" are subtracted from the total.

Soybean and Soymeal. Figure 13 shows that the EC and Japan together accounted for nearly 60 percent of world soybean imports between 1978 and 1982. The EC and Eastern Europe combined for two-thirds of world soymeal imports during the same period, as shown in Figure 14. The meal equivalent of soybean and soymeal exports was distributed as shown in Figure 15. For soybeans, soymeal and meal-equivalents, weights were determined in the same manner as in the case of corn.

Soyoil. Figure 16 shows that soyoil imports were dispersed in much the same way as were wheat imports; other than India, no country accounted for more than 10 percent of total imports. The weights were determined as they were in the case of wheat.

Table 1: Income Variable Weights

	Wheat	Soyoil
Industrial Countries	0.128	0.063
Oil Exporting LDCs	0.234	0.187
Non-oil LDCs	0.545	0.678
Eastern Europe	0.093	0.072

	Corn	Soybeans	Soymeal	Soymeal Equivalents
European Community	0.231	0.543	0.593	0.562
Japan	0.290	0.197	0.021	0.130
Eastern Europe	0.149	0.031	0.344	0.150
Spain	0.107	0.136	0.015	0.090
Portugal	0.057		0.015	0.006
Mexico	0.048	0.042	0.012	0.031
Taiwan	0.060	0.051		0.031
South Korea	0.057			

Source: Appendix Table A-6.

Figure 11: Wheat Imports, 1978–82

Percent of World Total

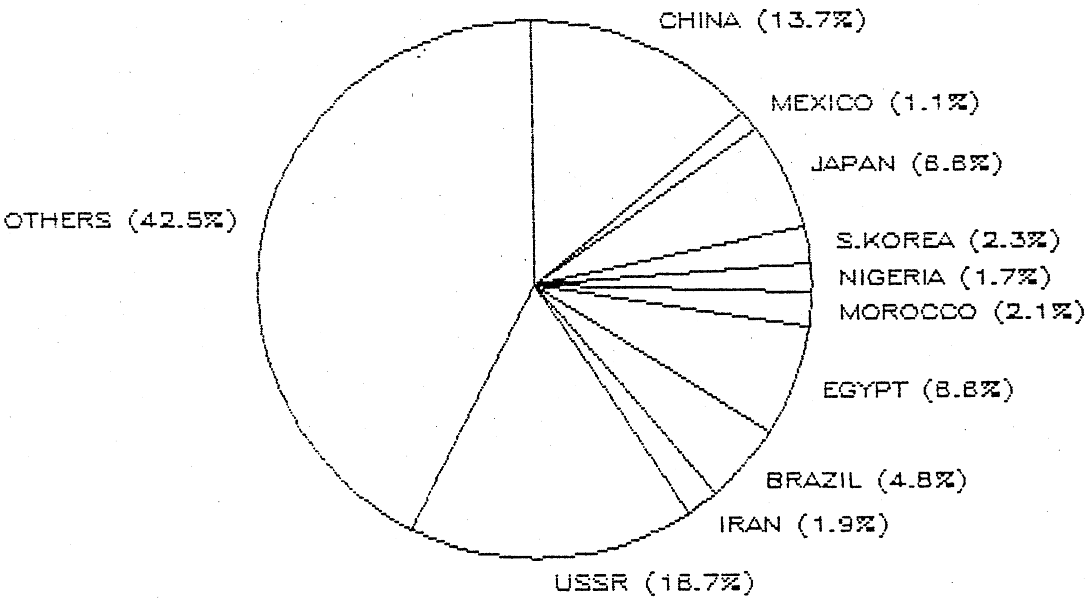


Figure 12: Corn Imports, 1978–82

Percent of World Total

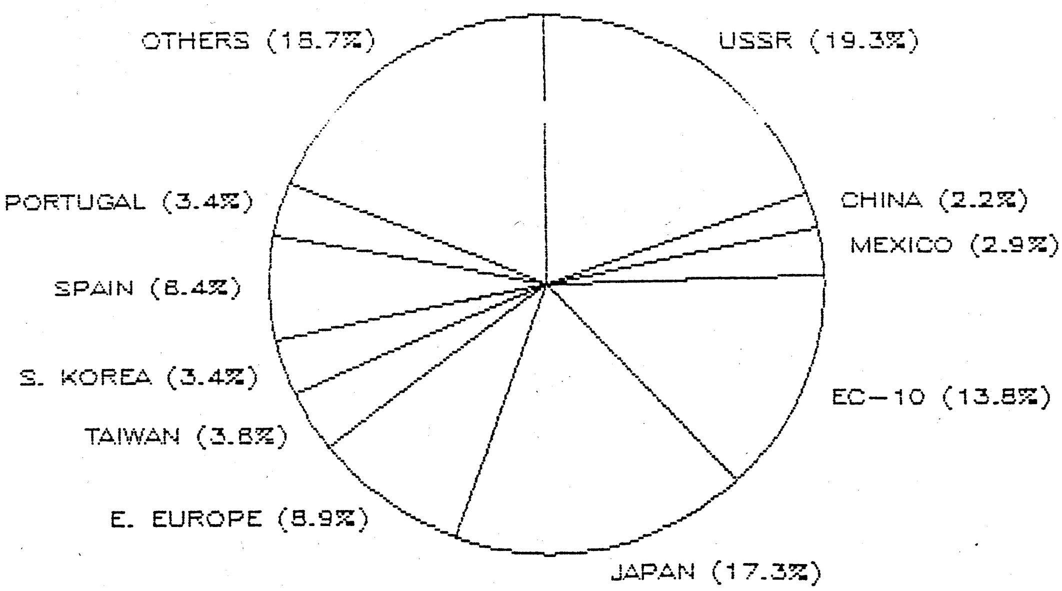


Figure 13: Soybean Imports, 1978-82

Percent of World Total

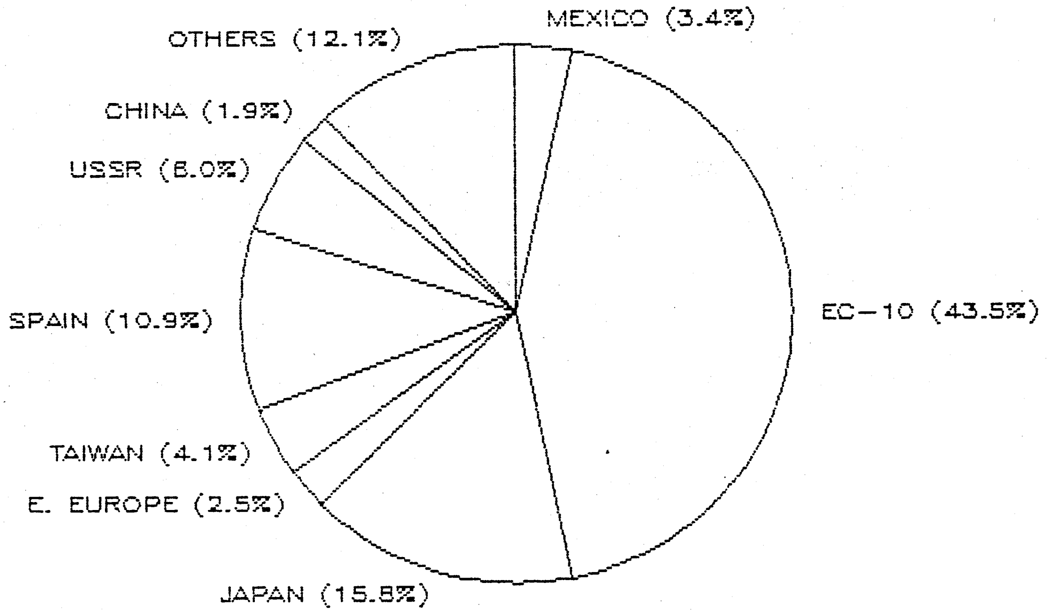


Figure 14: Soymeal Imports, 1978-82

Percent of World Total

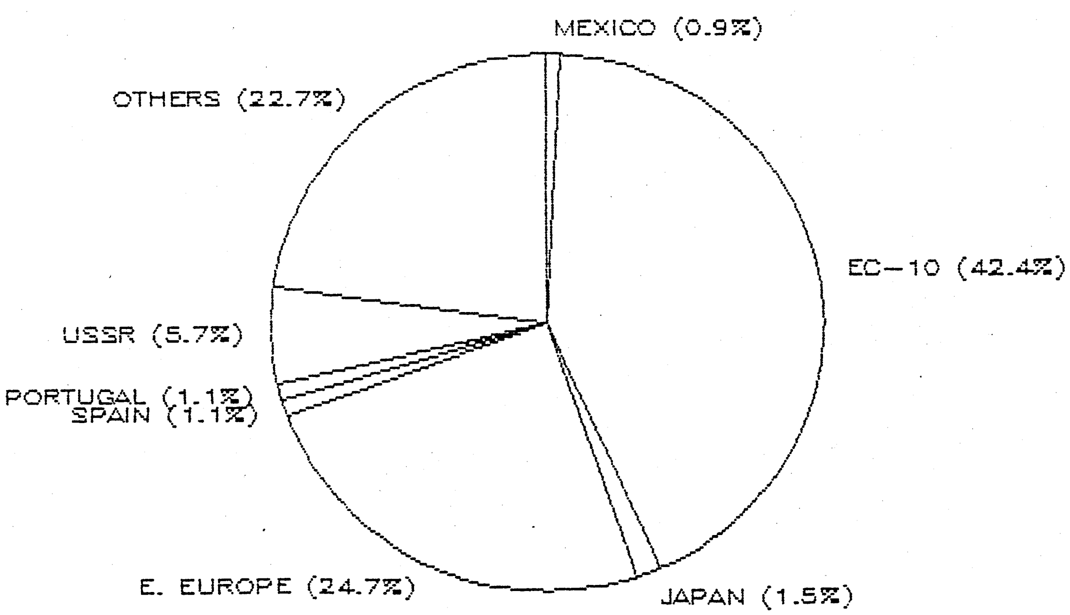


Figure 15: Meal-eq. Imports, 1978-82

Percent of World Total

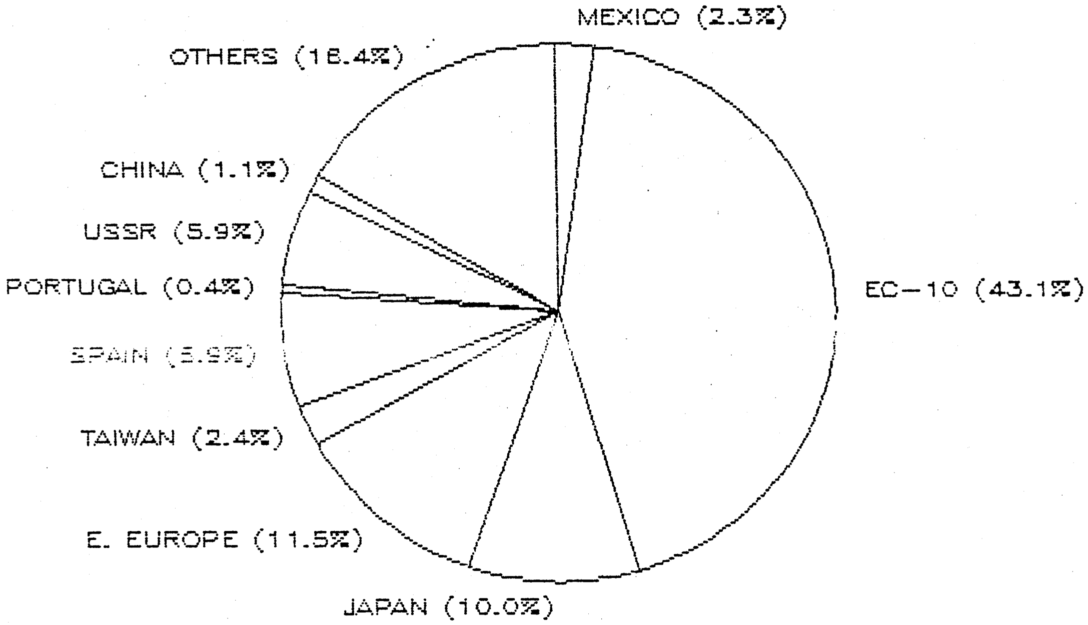
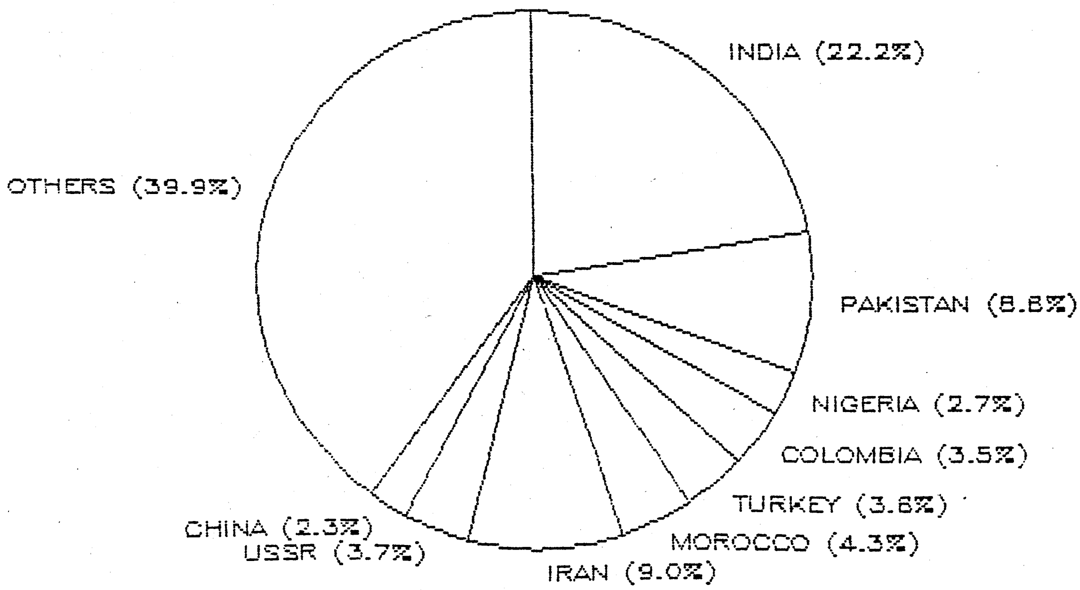


Figure 16: Soyoil Imports, 1978-82

Percent of World Total



Indices of real GDP in each of the countries were located or created, with base year 1980 set equal to 100. For most of the countries and country groupings, data were taken from International Financial Statistics, although other sources were used to create indices for Taiwan, the EC and Eastern Europe. (The country and country grouping indices are listed in Table A-7 of the statistical appendix.)

A trade-weighted index is created by multiplying each country's weight by its GDP index and summing across countries. This index is in calendar year terms, with 1980 equal to 100. To obtain a crop-year index, a weighted average is taken of the index values for the current and following years. For example, the corn income index value for the 1981-82 crop year equals .25 times the 1981 index value plus .75 times the 1982 index value (For corn, soybeans, soymeal and soyoil, the weights are .25 on the current year and .75 on the following year, reflecting an October-September crop year, while the wheat weights are each .5, reflecting a July-June year).

Figure 17 shows how WHEMINC (the index of real income in wheat-importing countries) differs from YCAPIND (a crude index of per-capita income in wheat importing countries, based on YCAPI5 in Westhoff and Meyers 1984). YCAPIND increased less rapidly than did WHEMINC in the 1960s, largely because the former is a per-capita income index. The two moved together in the 1970s.

CORMINC (the index of real income in corn-importing countries) generally moves with LIVIND (a livestock index for the EC and Japan, based on the University of Missouri variable LIVEPUJ1), as shown in Figure 18. If changes in EC and Japanese livestock production are similar to changes in livestock production in other corn-importing countries, this would indicate that the income elasticity of livestock demand is probably about 1 in corn-importing countries.

Figure 19 shows a similar picture in the case of soybeans, where SOYMINC (the index of real income in bean-importing countries) closely follows LIVIND. In the case of soybean meal, SOMMINC (the index of real income in meal-importing countries) grows slightly less rapidly than LIVIND, as seen in Figure 20. MEQMINC (the index of real income in importers of soybeans and soymeal) is very similar to the soybean income variables, since meal-equivalent export demand is dominated by soybeans (Figure 21).

SOOMINC (the index of real income in soyoil-importing countries) increased more slowly and moved less erratically than did IRESIND (an index of LDC international reserve holdings, based on IRESDEV used in Westhoff and Meyers 1984), as shown in Figure 22.

Figure 17: Wheat Demand Shift Variables

Two Alternatives

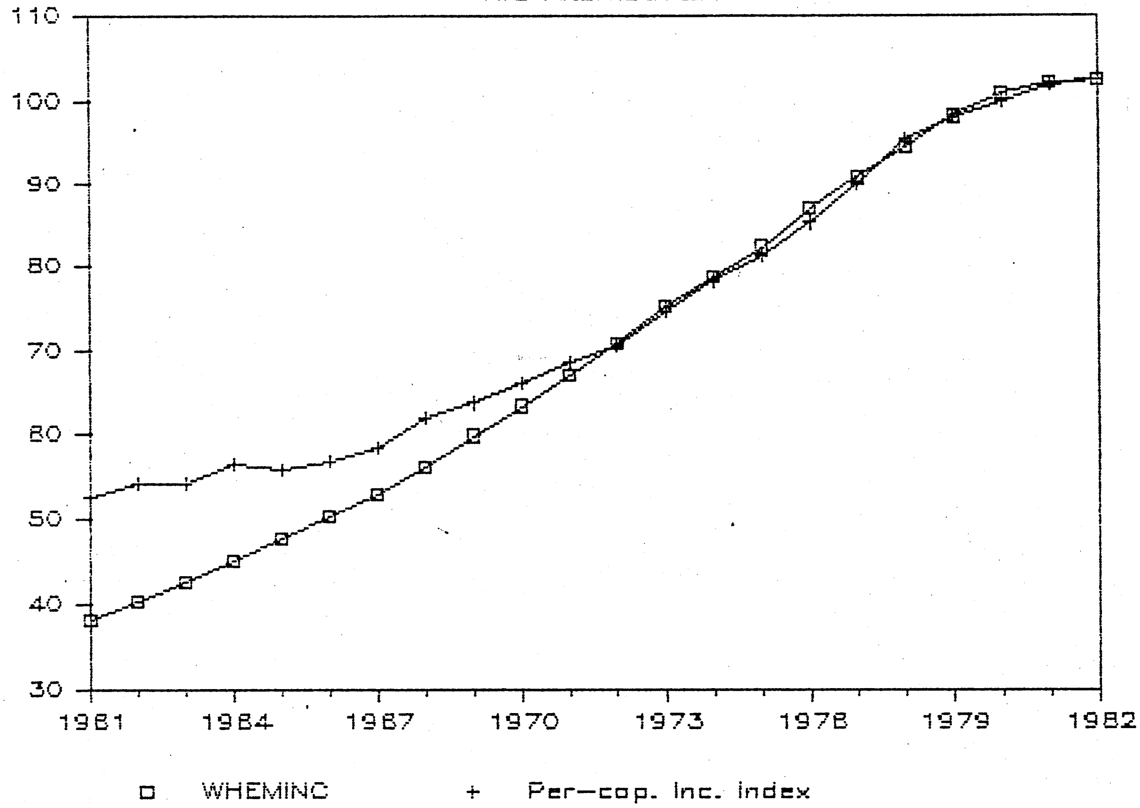


Figure 18: Corn Demand Shift Variables

Two Alternatives

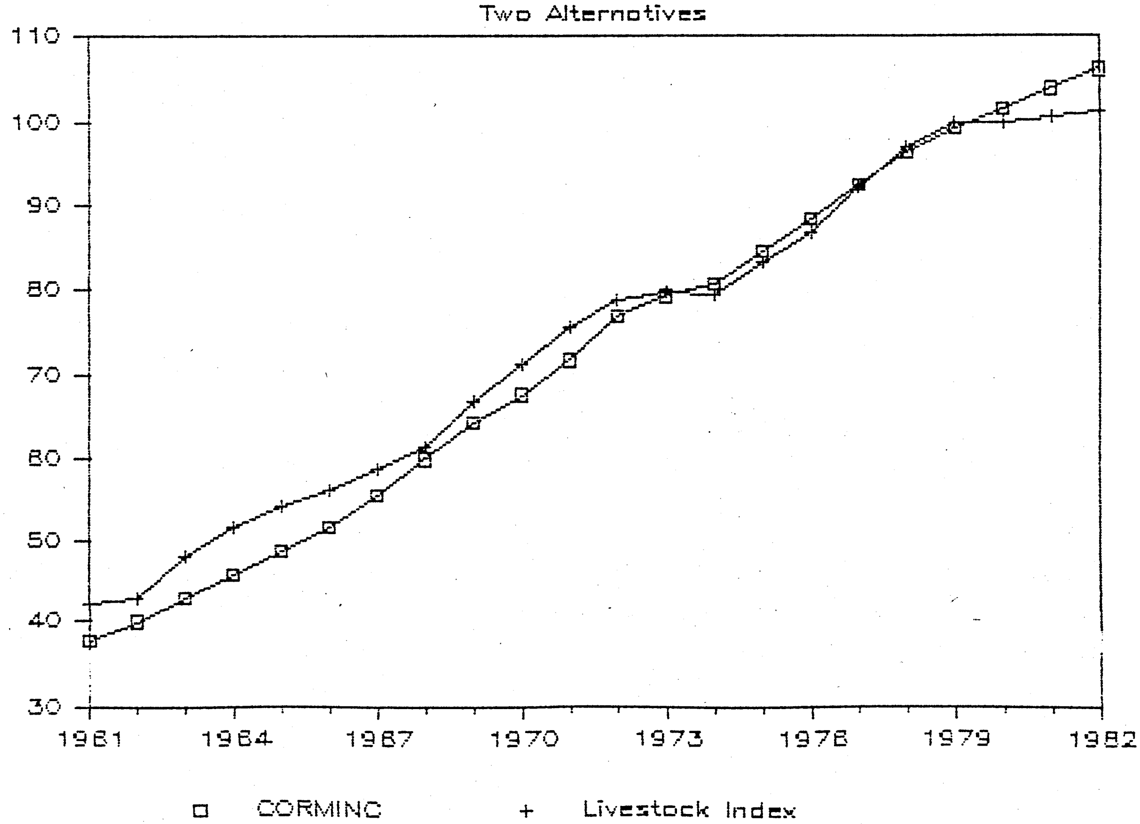


Figure 19: Bean Demand Shift Variables

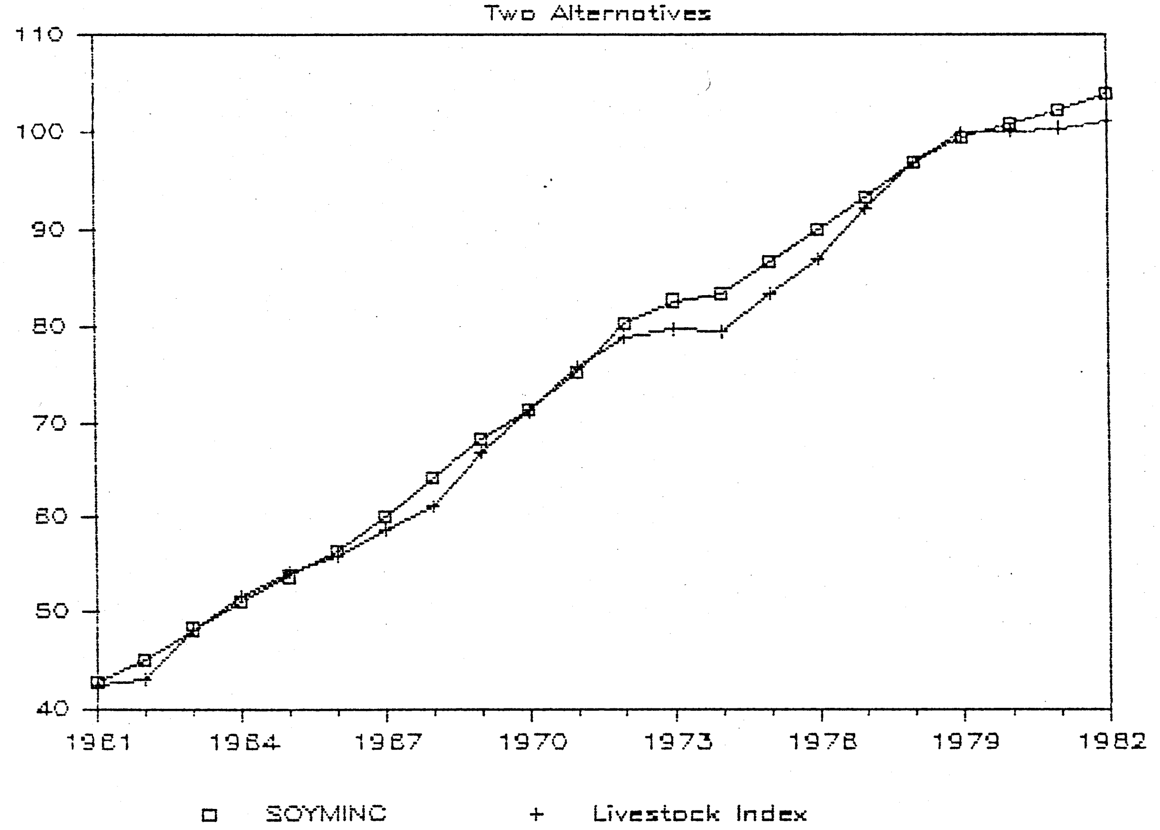


Figure 20: Meal Demand Shift Variables

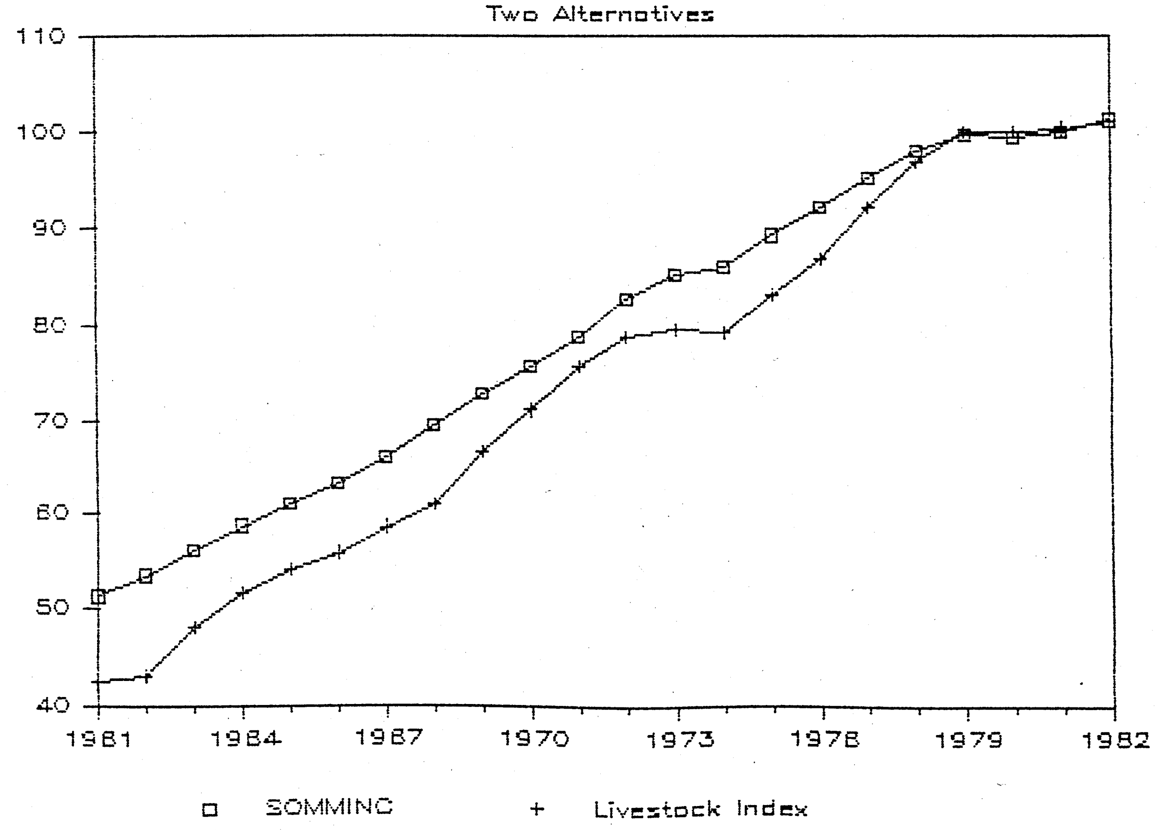


Figure 21: Meal-eq. Demand Shifter

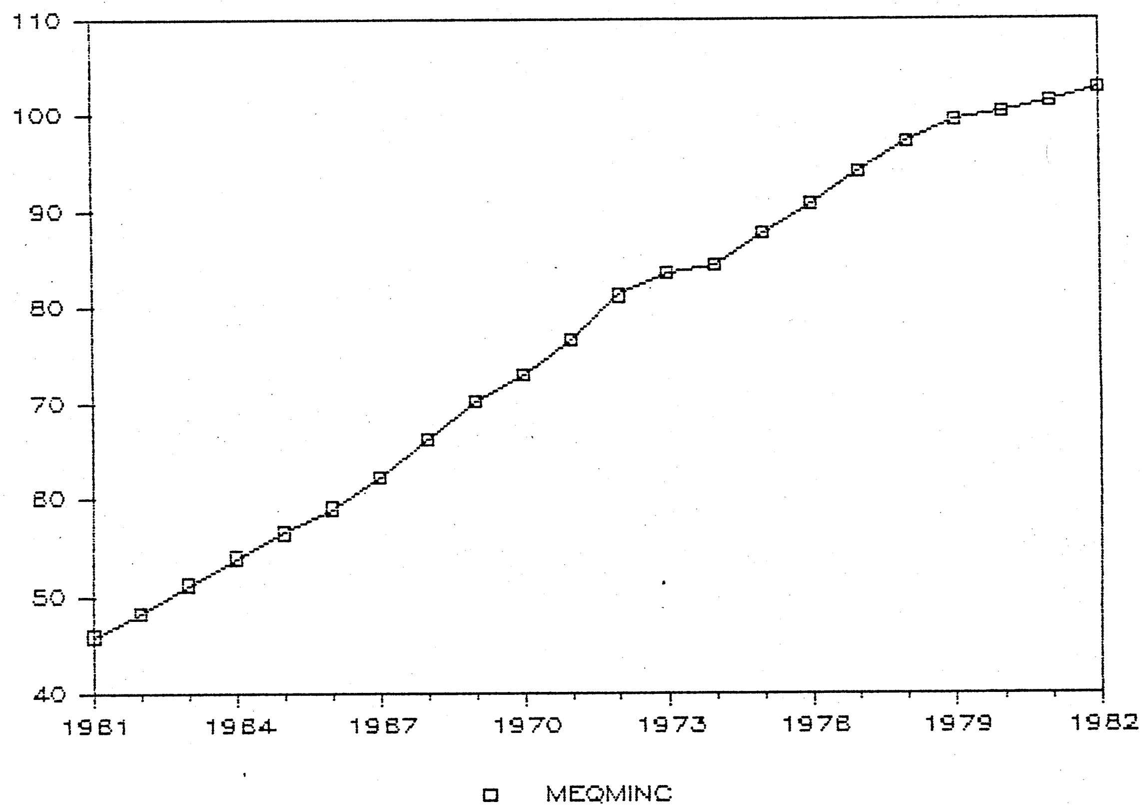
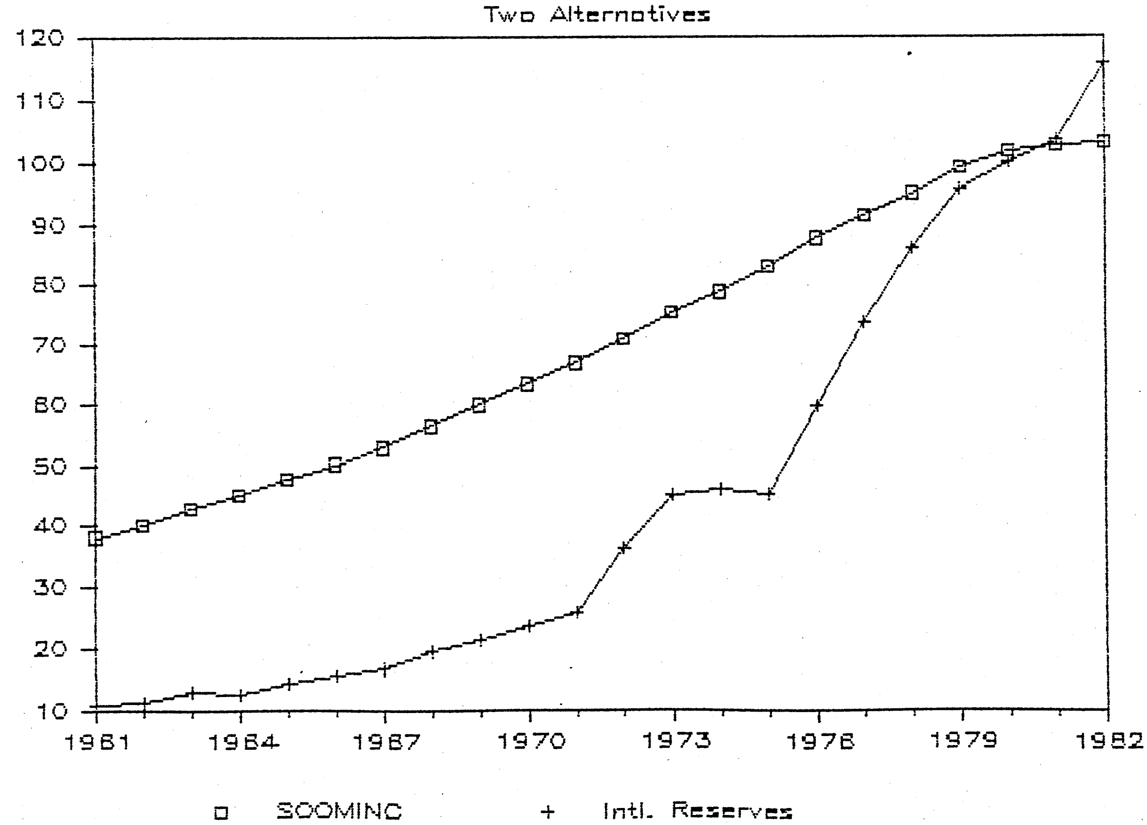


Figure 22: Oil Demand Shift Variables

Two Alternatives



The Price Variables

Defining a world price is always a problem in models of world trade. Tariffs and other trade barriers, transportation costs, and exchange rates are just some of the reasons that commodities have different real prices in different countries. Models of export demand for major agricultural commodities typically use US prices, sometimes adjusting them for changes in exchange rates or the general price level.

The price variables developed here do not consider transportation costs or trade barriers other than the EC variable levy on corn. However, they do take into account changes in exchange rates and general price levels. Thus, changes in RPM (the price variable) reflect the manner in which real prices paid for imported commodities would change in importing countries were it not for trade barriers or transportation costs.

The first steps in creating the price variables are similar to the first steps in creating the income variables. Major importing countries must be identified, and weights assigned. The weights are not identical to those in the income variables, however, due to data limitations. For example, no general price level index was available for Eastern Europe, although an income index was located. Also, no price indices exist for the country groupings in the wheat and soyoil models.

The wheat price variable weights shown in Table 2 are based on average imports during the 1978-82 period. The eight weighted countries are the largest importers for which data were available. Unfortunately, the eight countries combined account for just 27 percent of world wheat imports during the period.

The corn price variable weights are the same as the income variable weights, except Eastern Europe is not included. The same holds for the soybean, soymeal, and meal-equivalent price variable weights. Note that without Eastern Europe, the EC dominates, particularly in the case of soymeal.

As in the case of wheat, the seven weighted countries for the soyoil price variable are the largest importers for which data were available. Here, however, the coverage is much better: the seven countries account for 54 percent of soyoil imports between 1978 and 1982.

To create a real exchange rate, the nominal exchange rate (in foreign currency per dollar) must be multiplied by a US general price index divided by the country's general price index. Nominal exchange rates for importing countries are listed in Table A-10 of the statistical appendix, and price indices can be found in Table A-11 (Note that the WPI is used for some countries and the CPI for others. The CPI was used only when the WPI was unavailable). After normalizing so that 1980 equals 100, the results are the real exchange rates reported in Table A-12.

Trade-weighted real exchange rates are then computed by multiplying the weights by each country's real exchange rate. Finally, an adjustment for crop years yields the real exchange rates reported in Table A-13 of the statistical appendix. Also listed in Table A-13 is 1/SDROCT, the SDR per dollar rate adjusted so that the 1980 crop year equals 100. The SDR rate has often been used as a price deflator in export equations, since it represents a basket of currencies.

Figure 23 contrasts the real exchange rate for wheat with 1/SDROCT. Figures 24-28 do the same for corn, soybeans, soymeal, meal-equivalents and soyoil. A number of observations concerning the computed real exchange rates are in order:

1) In the cases of corn, soybeans, soymeal, and meal-equivalents, the computed real exchange rates differ little from 1/SDROCT in years after 1970. This should not be surprising, since the major importers of those commodities are the

same countries whose currencies comprise the SDR, and since relative rates of inflation have not varied greatly among those countries.

2) The real exchange rate for wheat follows 1/SDROCT less closely, and the soyoil real exchange rate is very different from 1/SDROCT. This also is not surprising, since the major importers of wheat and soyoil are developing countries, whose currencies are not included in the SDR basket of currencies. The soyoil exchange rate is so different from the SDR because of the heavy weights placed on India and Brazil, which maintained over-valued exchange rates in the 1960s.

3) The evidence indicates that real exchange rates were not constant prior to 1970, contrary to commonly held belief. In real terms, the dollar depreciated against the currencies of most important importing countries in the 1960s. In some cases, this was due to changes in nominal exchange rates. More commonly, however, nominal exchange rates were held constant, while foreign inflation rates were greater than US inflation rates. Thus, studies which imply that exchange rates only became important after 1970 fail to consider movements in real exchange rates due to differences in relative rates of inflation.

Table 2: Price Variable Weights

	Wheat	Soyoil
Japan	0.244	
Egypt	0.243	
Brazil	0.177	
S. Korea	0.083	
Mexico	0.041	
Morocco	0.077	0.079
Nigeria	0.065	0.050
Iran	0.069	0.167
India		0.411
Pakistan		0.160
Turkey		0.067
Colombia		0.065

	Corn	Soybeans	Soymeal	Soymeal Equivalents
European Community	0.272	0.560	0.904	0.661
Japan	0.340	0.203	0.032	0.153
Spain	0.126	0.141	0.023	0.106
Portugal	0.067		0.022	0.007
Mexico	0.057	0.043	0.018	0.036
Taiwan	0.071	0.052		0.037
South Korea	0.067			

Source: Appendix Table A-9.

Figure 23: Wheat Real Exchange Rate

Foreign Currency/U.S. Dollar, 1980=100

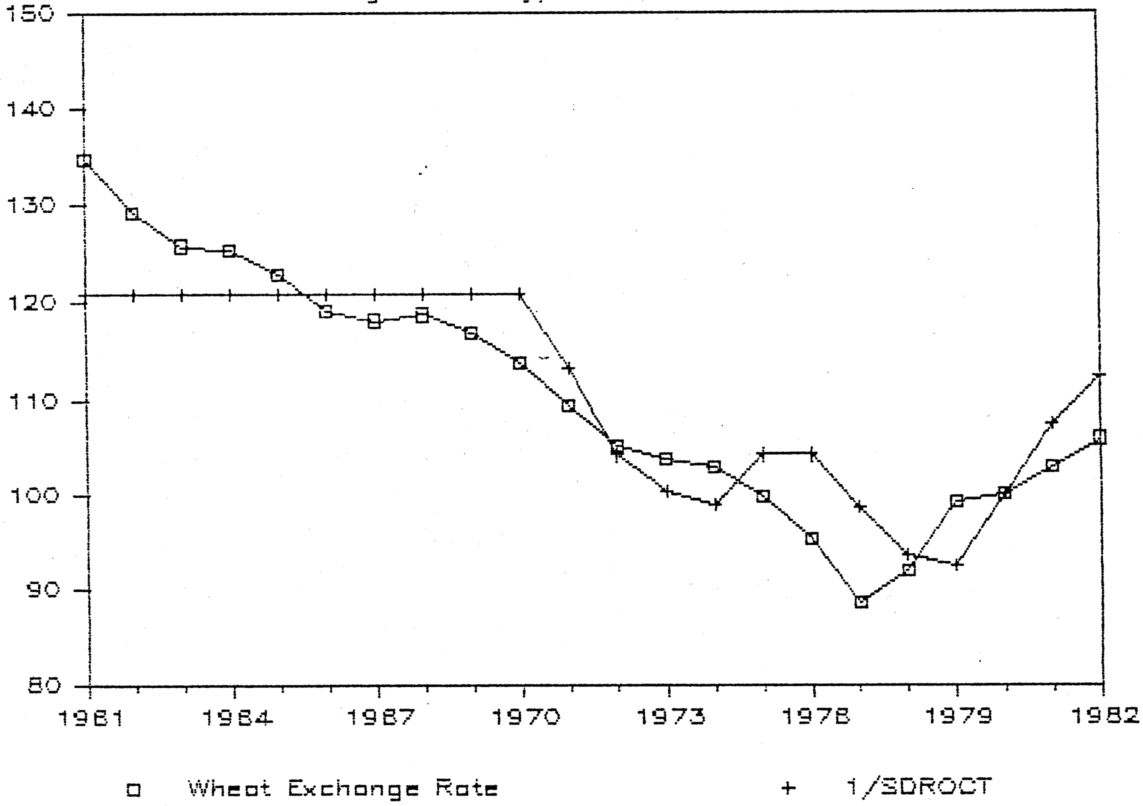


Figure 24: Corn Real Exchange Rate

Foreign Currency/U.S. Dollar, 1980=100

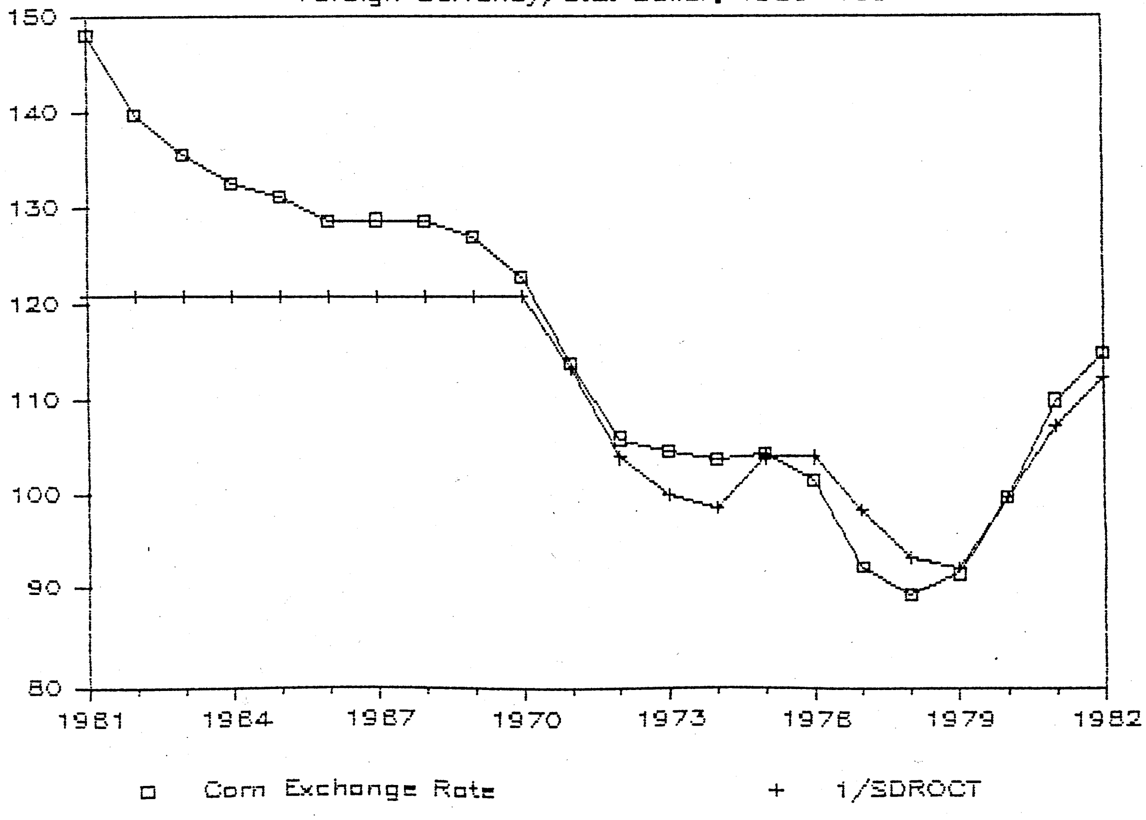


Figure 25: Soybean Real Exchange Rate

Foreign Currency/U.S. Dollar, 1980=100

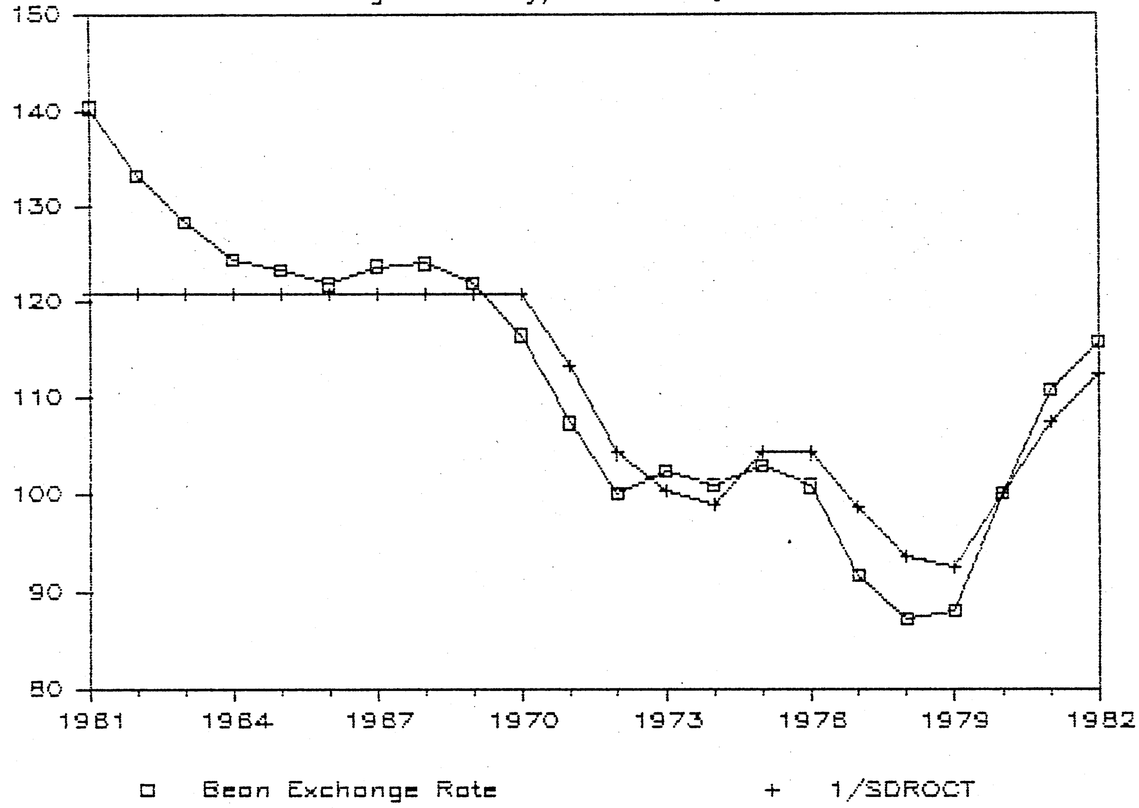


Figure 26: Soymeal Real Exchange Rate

Foreign Currency/U.S. Dollar, 1980=100

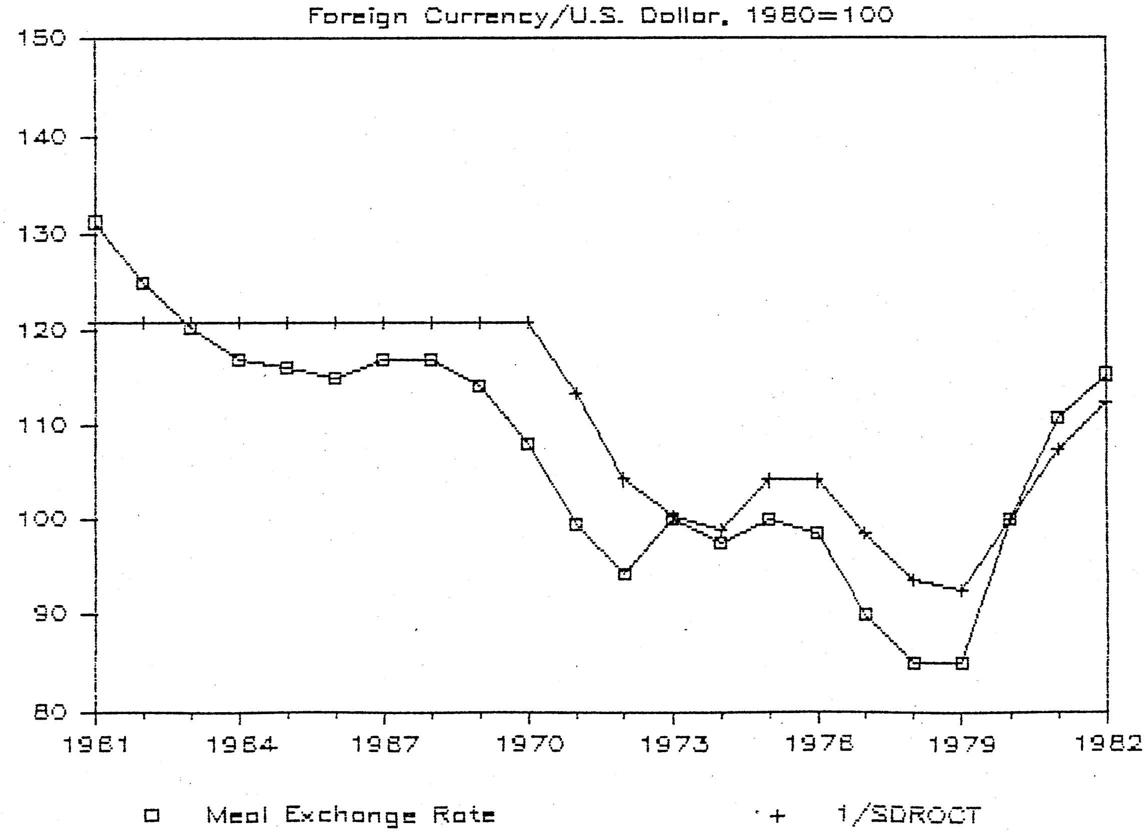


Figure 27: Meal-eq. Real Exchange Rate

Foreign Currency/U.S. Dollar, 1980=100

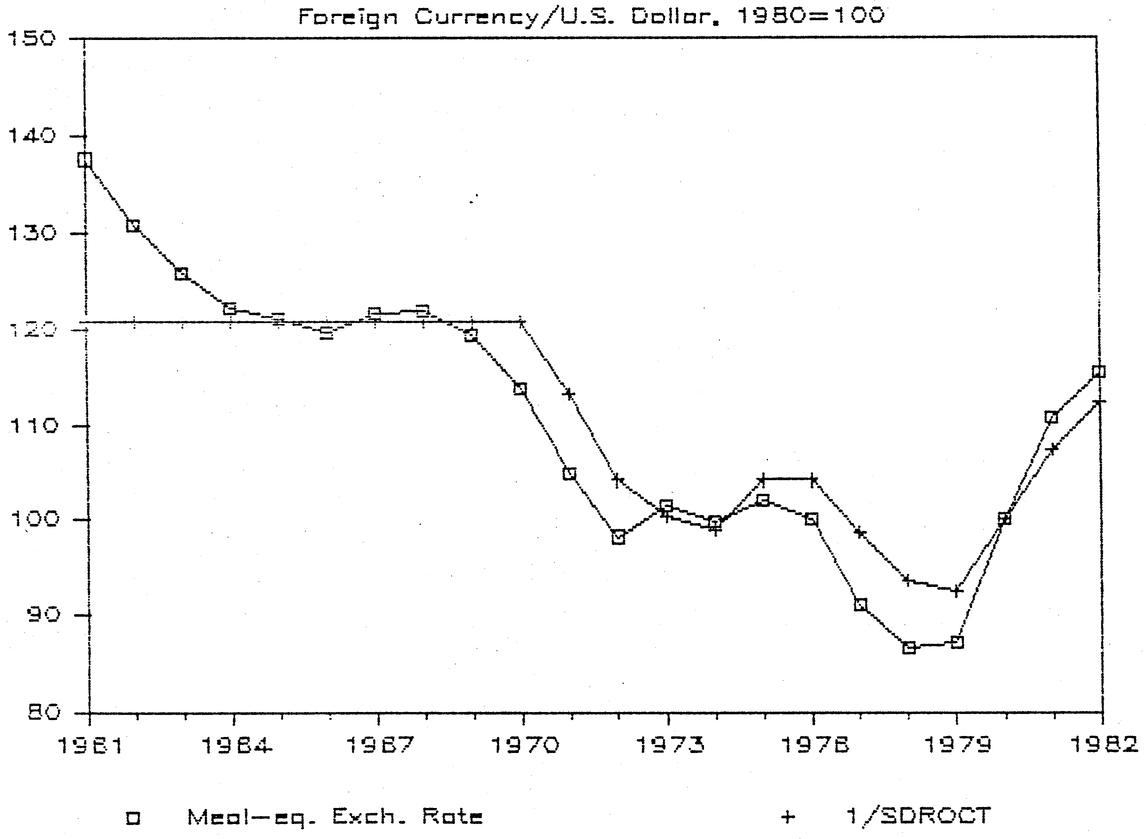
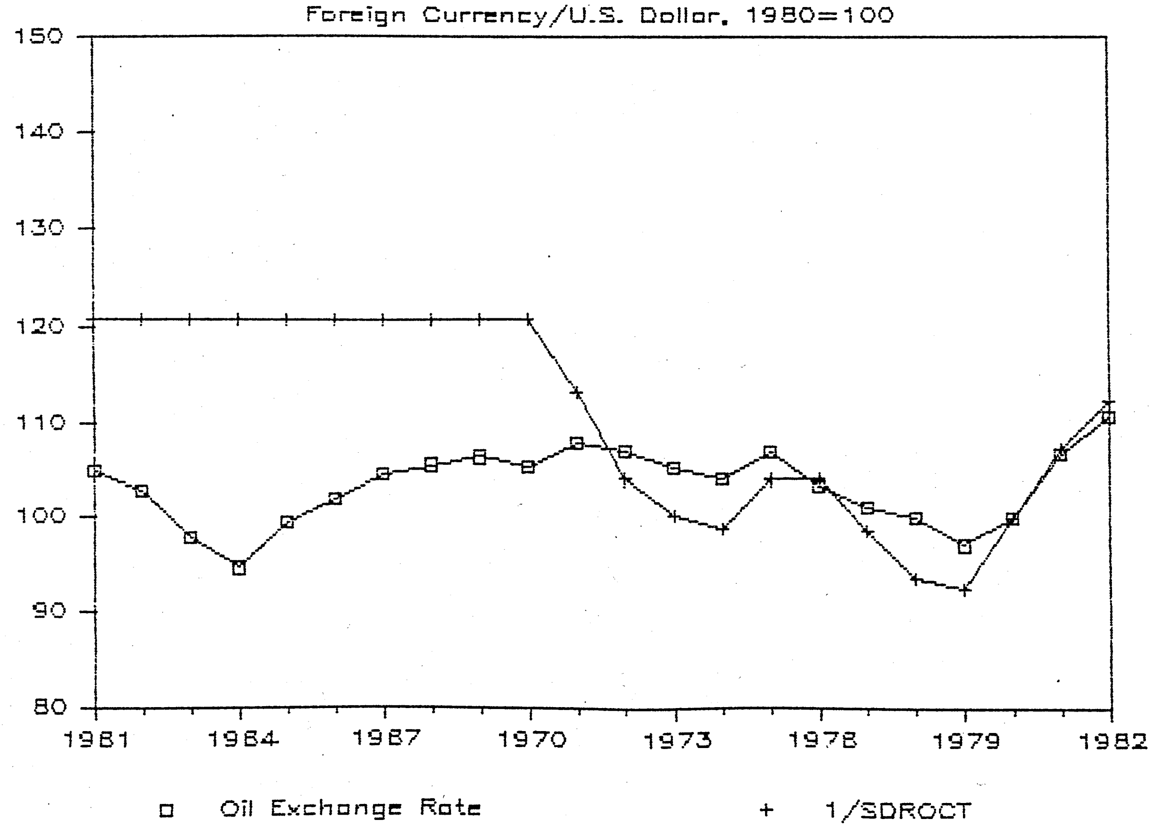


Figure 28: Oil Real Exchange Rate

Foreign Currency/U.S. Dollar, 1980=100



Real prices in importing countries are obtained by multiplying real exchange rates by real US export prices (For simplicity, export prices are defined as farm prices minus any US export subsidies). Prices, therefore, are expressed in the trade-weighted, foreign currency-equivalent of 1980 dollars (hereafter referred to as "real foreign currency units") per metric ton. The only real importer price computed differently is that for corn. The real importer corn price is a weighted average of the EC real exchange rate multiplied by the real EC threshold price of corn, and the real exchange rate for other importers multiplied by the real US price.

As an aside, it should be explained that the actual calculations were carried out in a more direct manner--the nominal US export price for each commodity was multiplied by a trade-weighted conversion index, calculated by dividing the nominal exchange rate by the price index for each country. This is possible, since the US price index is found in the denominator of the real US price and the numerator of the real exchange rate:

RPM = (US price/US WPI) * (Exchange rate * (US WPI/Foreign WPI))

= US price * Exchange rate/Foreign WPI.

Figures 29-34 show how the real importer prices calculated in this manner compare with prices often used in export demand equations--the nominal SDR price (computed by dividing the US price by the dollar per SDR rate). In each case, the real importer price is expressed in real foreign currency units per metric ton, while the alternative price is in nominal SDRs per metric ton. Since two different units are used in Figures 29-34, one should be concerned with relative movements rather than absolute levels of the variables.

There are two conceptual problems with using the nominal SDR price: first, it is a nominal price, while demand is generally considered to be a function of real prices; second, it is not the most appropriate nominal price, since the SDR rate does not weight currencies by commodity trade shares.

In general, year-to-year movements in the real importer and the nominal SDR prices are in the same direction, but the long term trends are different. Figure 29 shows that the real importer price of wheat declined until 1972, jumped in 1973 and then declined in most years thereafter. The nominal SDR price, on the other hand, was nearly as great in 1982 as in the peak year of 1974.

The case of corn is perhaps the most dramatic. Figure 30 shows that the real importer price of corn clearly declined between the 1960s and the early 1980s, even though the nominal SDR price increased over time. Figures 31-34 show similar pictures for soybeans, soymeal, meal-equivalents and soyoil. In every case, real importer prices peaked between 1972 and 1974, and then generally declined until the end of the reported period in 1982.

Figure 29: Wheat Price Variables

Two Alternatives

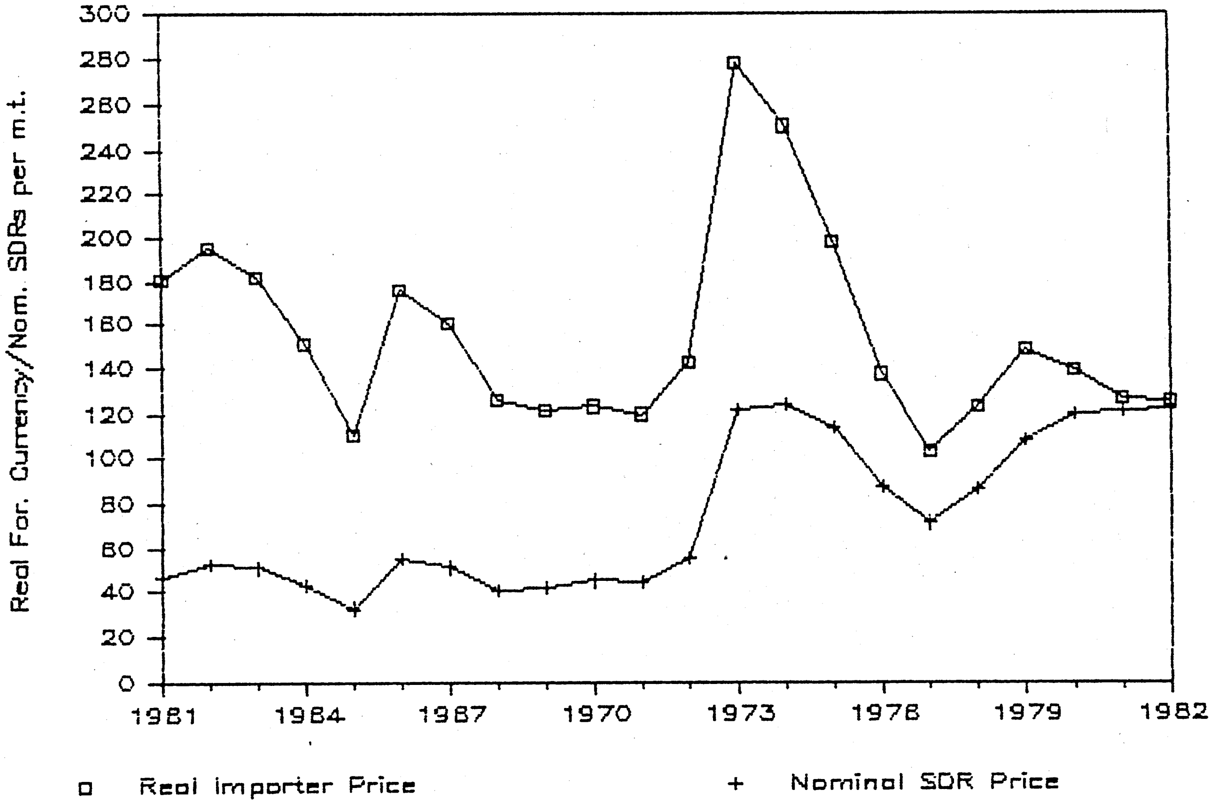


Figure 30: Corn Price Variables

Two Alternatives

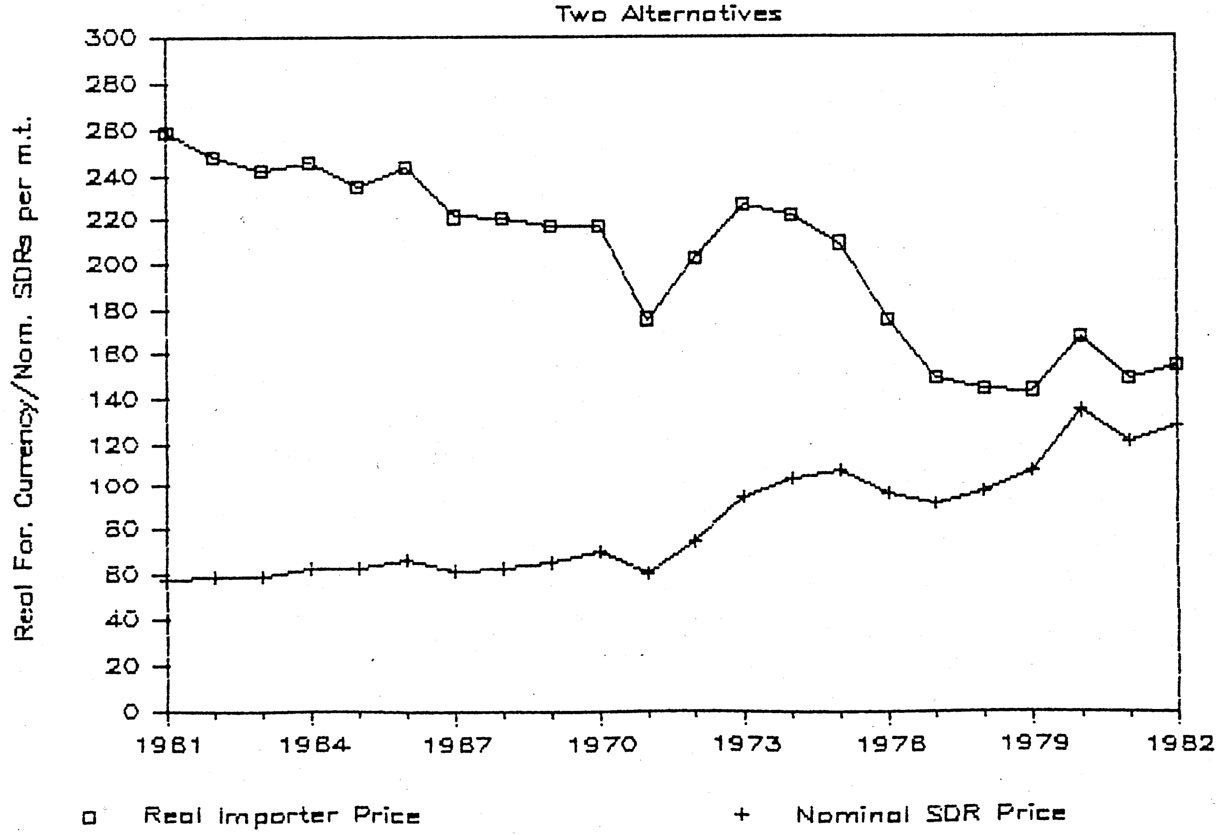


Figure 31: Soybean Price Variables

Two Alternatives

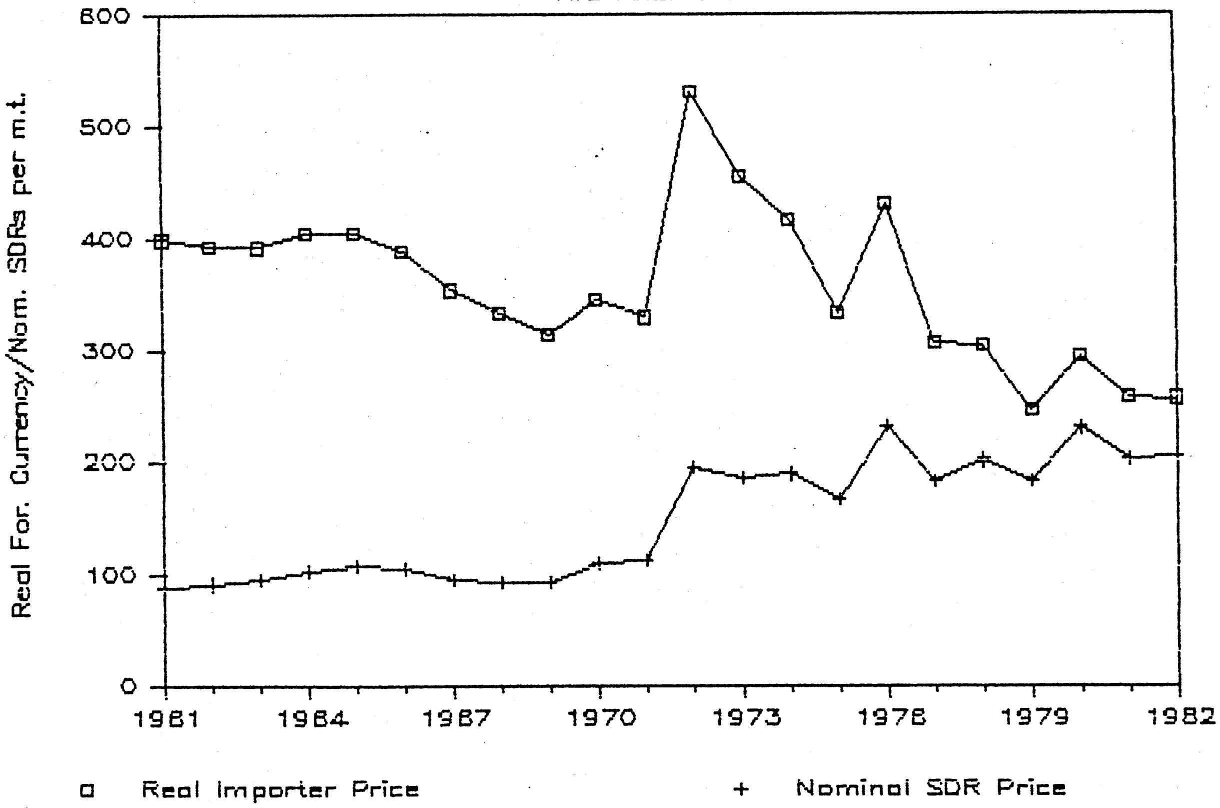


Figure 32: Soymeal Price Variables

Two Alternatives

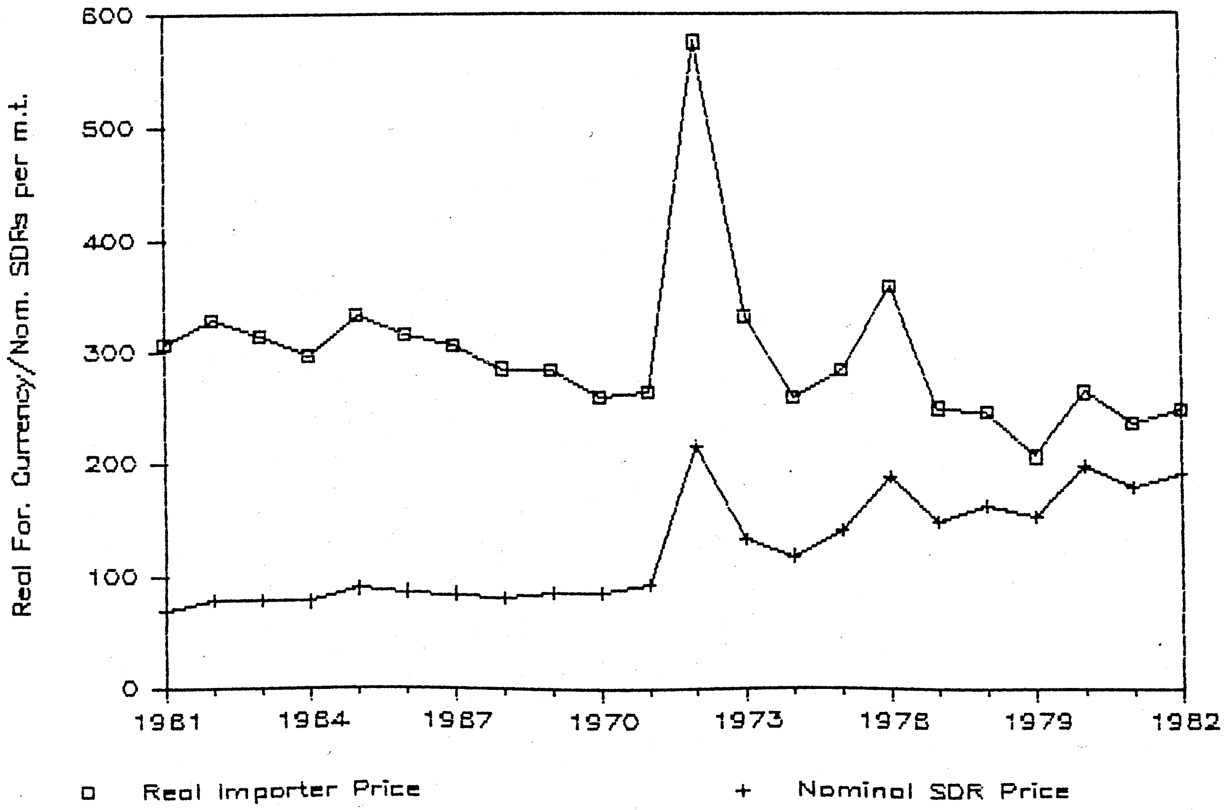


Figure 33: Meal-eq. Price Variable

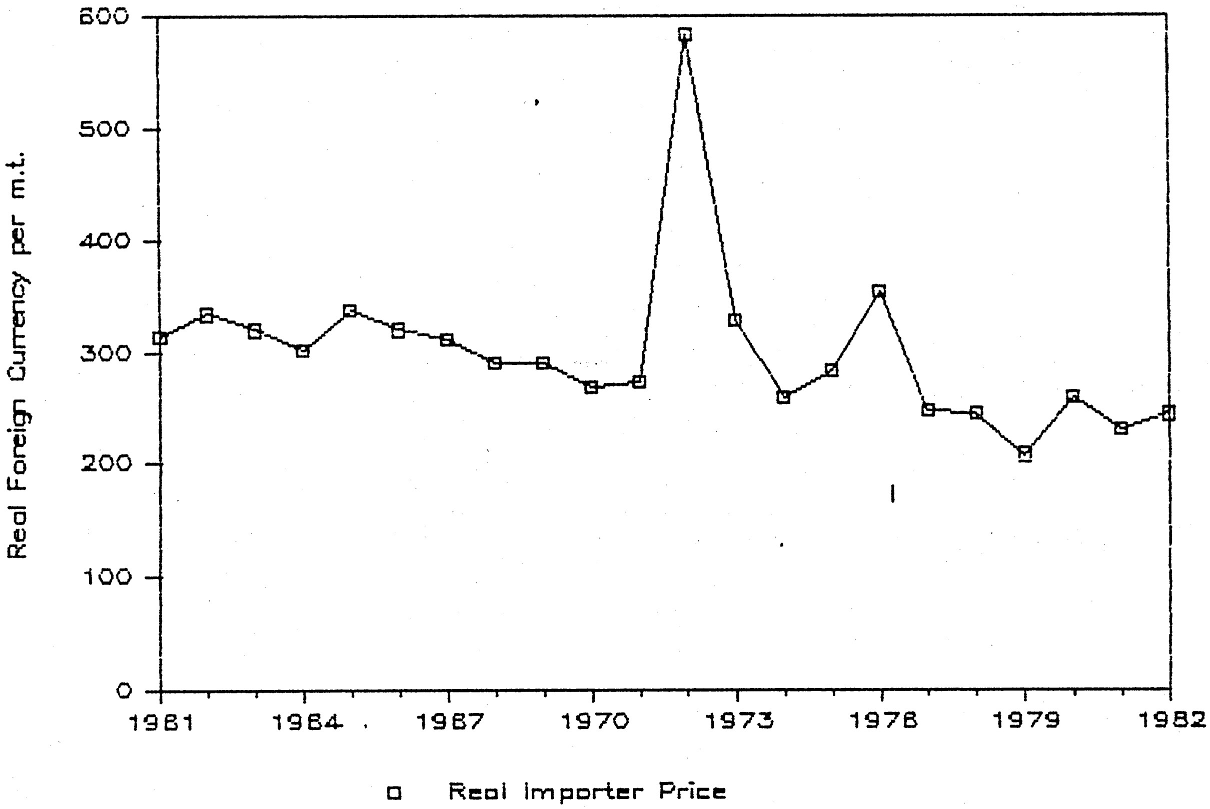
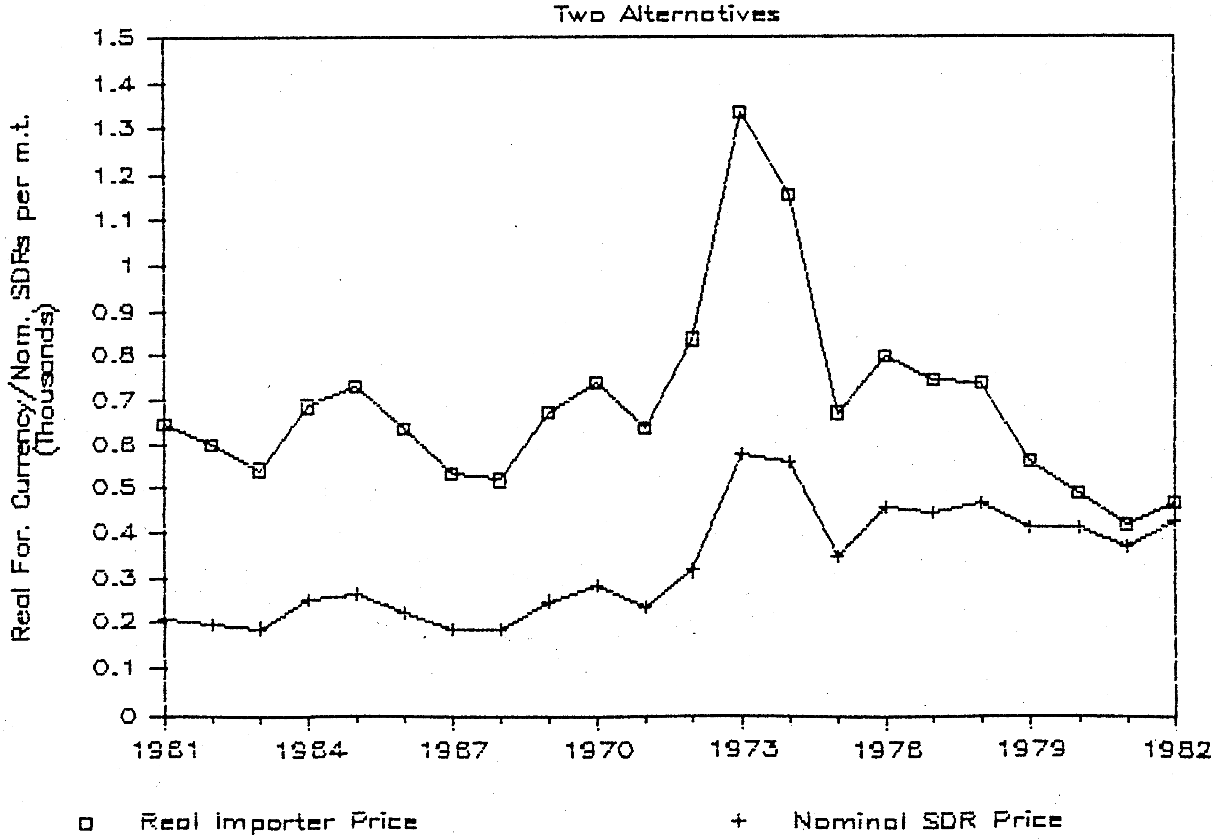


Figure 34: Soyoil Price Variables

Two Alternatives



Competing Importer Supply Variables

While it seems reasonable to assume that changes in real importer prices should affect domestic production in importing countries, it also seems likely that other factors affect domestic importer supplies. Moreover, current year production is predetermined, so it makes sense to include competing importer supplies in export demand models as a shift variable.

Including an importer supply variable seems especially appropriate for commodities like wheat and corn, where production in importing countries is significant. In the case of soybeans and soybean products, importer production is more limited, and it is more difficult to define competing importer supplies, due to the variety of available substitutes. Since importer supplies presumably are at least imperfect substitutes for imports, the expected value of the coefficient on the importer supply variables in the export equations is between 0 and -1.

Two competing importer supply variables are used in some specifications of the wheat model and one in some specifications of the corn model. These supply variables, CSPM, can be defined as production plus beginning stocks minus ending stocks in countries other than the USSR, PRC, and those that export the commodity. Strictly speaking, therefore, the variables reflect not only importer supplies, but also supplies in countries that neither import nor export the commodities.

Calculated values of WHECSPM (commercial importer domestic wheat supplies) are listed in Table 3, as are values of RICCSPM (commercial wheat importer domestic rice supplies) and CORCSPM (commercial corn importer domestic corn supplies). RICCSPM is included in some specifications of the wheat model, based on the assumption that rice can be substituted for wheat in importing country diets. Note that rice supplies are greater than wheat supplies in wheat importing countries.

Including competing importer supplies could, theoretically, reduce measured price elasticities in single-equation models of export demand. If importer supplies are included in the equation, the coefficient on the price variable will measure only the slope of the importer demand curve. This will not be equal to the slope of the importer excess demand curve, unless domestic supplies are completely price inelastic.

Due to the problems involved in including importer supplies in export demand equations, efforts were made to use other variables which would capture the same effects. In the final "selected" equations, the wheat importer supply variable is the only one which appears.

Table 3: Importer Supply Variables

	Wheat (WHECSPM)	Rice (RICCSPM)	Corn (CORCSPM)
1961	61.63	98.29	62.87
1962	67.06	97.26	65.91
1963	67.49	102.58	68.94
1964	71.29	106.40	75.39
1965	72.82	98.12	74.46
1966	71.40	100.50	84.11
1967	80.36	106.52	83.05
1968	86.47	111.45	88.93
1969	91.20	117.75	89.76
1970	89.70	121.15	95.97
1971	100.49	121.17	99.78
1972	109.64	118.01	98.56
1973	105.91	122.96	104.45
1974	106.25	122.26	102.87
1975	103.08	128.21	113.68
1976	117.65	129.82	110.05
1977	124.24	136.99	113.07
1978	130.08	142.94	116.71
1979	122.93	139.52	125.86
1980	132.09	150.86	125.39
1981	128.60	156.94	137.20
1982	139.95	153.89	134.73

Variables are defined as production plus beginning stocks minus ending stocks in non-socialist countries which do not export wheat (WHECSPM and RICCSPM) or corn (CORCSPM), in millions of metric tons.

Source: Appendix Tables A-14, A-15, and A-16.

Other Variables

This section will briefly describe other variables used in the export demand models. Values for these and variables already described can be found in Tables A-17 to A-22 of the statistical appendix, which list all the variables used in the wheat, corn, soybean, soymeal, meal-equivalents, and soyoil models.

Wheat. Four variables utilized in at least some model specifications remain to be defined:

1) WHEMGMT represents PL 480 wheat and wheat flour exports, in thousands of metric tons. It is included because it is expected that PL 480 exports displace at least some commercial exports. The coefficient on WHEMGMT in the commercial wheat export demand equation is therefore expected to take a value between 0 and -1.

2) RICRPWM is the real wheat importer price of rice, in real foreign currency units per metric ton. It is computed by multiplying the real exchange rate for wheat by the real US export price of rice. Including RICRPWM in the equation proved to be preferable to including wheat importer rice supplies as a means to capture the substitutability of rice for wheat in both consumption and production. The expected sign on RICRPWM is positive.

3) PETRPWM is the real wheat importer price of petroleum, in real foreign currency units per barrel. As the price of petroleum increases, the cost of wheat production would be expected to increase (due to higher fuel and fertilizer prices). This would shift the importer supply curve to the left, and therefore increase import demand. Also, higher petroleum prices generally increase the availability of credit from petroleum exporting countries. An increase in credit availability makes it easier for countries to finance imports. For both of these reasons, the expected sign on PETRPWM is positive.

4) D7273 is a dummy variable taking the value 1 in 1972 and 1973, and 0 otherwise. A large increase in commercial exports in 1972 and 1973 is not explained by the other variables in the model. In the selected wheat export demand equation, the increase is partially explained by other variables, and D7273 is not included in the equation.

Corn. Four additional variables are also included in some specifications of the corn export demand equation:

1) PETRPCM is the real corn importer price of petroleum, in real foreign currency units per barrel. PETRPCM is thus the same as PETRPWM, except the corn real exchange rate is used to derive PETRPCM. As in the case of wheat, higher petroleum prices would be expected to shift importer supply curves to the left and demand curves to the right, thus increasing demand for imports. The expected sign on PETRPCM is therefore positive.

2) WHERPCM is the real corn importer price of wheat, in real foreign currency units per metric ton. WHERPCM differs from WHERPM only in the real exchange rate used in its derivation. Higher wheat prices would be expected to result in some substitution of corn for wheat in food consumption and production in importing countries. Thus, the expected sign on WHERPCM is positive.

3) SOYRPCM is the real corn importer price of soybeans, in real foreign currency units per metric ton. Especially in the EC, soybean meal is considered a substitute for corn in livestock rations. Therefore, the expected sign on SOYRPCM is positive.

4) D7980 is a dummy variable taking the value 1 in 1979 and 1980, and 0 otherwise. Again, a large temporary increase in commercial exports is not explained by other variables in the model. One might argue that the US grain embargo caused a disruption of normal trading patterns in those years.

Soybeans. Two additional variables are used in some model specifications:

1) VALRPM is the real importer value of the soymeal and soyoil which can be extracted from a metric ton of soybeans, in real foreign currency units. The larger the difference between VALRPM and SOYRPM, the greater the incentive for countries to import beans and crush them domestically, rather than import soybean products. The expected sign on VALRPM is therefore positive.

2) CORRPBM is the real soybean importer price of corn in real foreign currency units per metric ton. As in the corn model, the real importer price of corn is a weighted average of the real EC threshold price and the real importer price in other importers. The weights used in the bean model reflect soybean, not corn imports, however. If corn and soybeans are substitutes in importer livestock rations, one would expect the sign on CORRPBM to be positive.

Soymeal. Four additional variables are included in some model specifications of export demand for soymeal:

1) FIMRPMM is the real soymeal importer price of fishmeal in real foreign currency units per metric ton. Since fishmeal and soymeal are substitutes in livestock rations, one would expect a positive sign on FIMRPMM in the soymeal equation.

2) CORRPMM is the real soymeal importer price of corn in real foreign currency units per metric ton, defined in a manner analagous to that of CORRPBM in the soybean model. If corn is a substitute for soymeal in feed rations in some importing countries, one would expect a positive sign on CORRPMM.

3) SOYRPMM is the real soymeal importer price of soybeans in real foreign currency units per metric ton. The higher the price of soybeans, the less the incentive to importing countries to import beans to crush themselves. Thus, the expected sign on SOYRPMM is positive.

4) D7783 is a dummy variable taking the value 1 in years after 1976 and 0 otherwise. Soymeal exports jumped in 1977, and none of the other variables explain the increase.

Soymeal Equivalents. The only additional variables utilized in specifications of the meal-equivalents export demand equations are FIMRPEM and CORRPEM. They are analagous to FIMRPMM and CORRPMM, and are expected to have positive signs in the meal-equivalents export demand equation for the same reasons.

Soyoil. Four additional variables are utilized in different specifications of the soyoil export demand equation:

1) PALRPOM is the real soyoil importer price of palm oil, in real foreign currency units per metric ton. Since palm oil and soyoil are close substitutes, one would expect a positive sign on PALRPOM in the soyoil export demand equation.

2) SOYRPOM is the real soyoil importer price of soybeans, in real foreign currency units per metric ton. The justification for including SOYRPOM in the oil equation is the same as that for including SOYRPMM in the meal equation: the higher the price of soybeans, the less the incentive to import beans rather than oil. Thus, the expected sign on SOYRPOM is positive.

3) SOOMGMT represents PL 480 exports, in thousands of metric tons. If PL 480 exports displace at least some commercial exports, one would expect the coefficient on SOOMGMT to take a value between 0 and -1.

4) SOOCXT-1 is the lagged value of the dependent variable in the soyoil commercial export demand equation. If importer production, consumption and import patterns only adjust partially from year to year, one would expect the coefficient on SOOCXT-1 to take a value between 0 and 1.

Empirical Results

Wheat

Four alternative wheat export demand models are shown in Table 4. Model 1 expresses commercial wheat export demand as a function of the prices of wheat, corn and rice, importer income and wheat supplies, and PL 480 exports. The signs on all the coefficients are those which were expected, and the fit of the model is good. The major shortcoming of the model is that the coefficients on all the price variables are not significant, perhaps due to multicollinearity. Actual and fitted values of WHECXT from Model 1 are shown in Figure 35.

Model 2 is identical to Model 1, except the rice price is replaced with wheat importer supplies of rice. Again, all the coefficients have the expected sign, and the model fit is essentially unchanged. However, the wheat price coefficient is even closer to zero, possibly due to multicollinearity.

Model 3 replaces the rice variables with a dummy variable for 1972 and 1973. As can be seen, this improves the fit of the model, but not enough to justify using a dummy variable when Models 1 and 2 perform adequately without one.

Model 4 includes the rice price and replaces the importer supply variable with the price of petroleum. The results show that the coefficients on the wheat, rice and petroleum price variables and on PL 480 exports do not have the expected sign. This would seem to indicate that importer wheat supplies are determined by more than the price of wheat and the price of petroleum. Again, multicollinearity probably is also part of the problem.

In all of the reported wheat models, the income elasticity is very large--greater than 1.3, in fact. The coefficients on importer wheat supplies and on PL 480 exports are both smaller in absolute magnitude than -1, indicating that commercial wheat imports are not a perfect subsitute for domestically-produced wheat or for PL 480 imports.

The own price elasticity of export demand is very small in each equation, and the cross price elasticities sum to more than the own price elasticity. If this is correct, it would indicate that a strengthening of the dollar would actually increase world wheat exports, since the real importer prices of corn and rice would be increased by the same proportion as the increase in the real importer price of wheat. Whether such a result is plausible is, of course, open to question.

Table 4: Wheat Export Demand Equations, fit over 1961-1982
(Dependent variable: WHECXT)

	Intercept	WHERPM	WHEMINC	CORRPWM	RICRPWM	WHECSPM	WHEMGMT
Model 1							
Coefficients	7346	-23.92	1112	51.98	7.23	-0.482	-0.315
(t-values)	(0.69)	(-0.79)	(7.16)	(1.12)	(1.12)	(-3.24)	(-0.94)
Elasticities		-0.09	1.80	0.16	0.09	-1.10	0.04
R-squared: .976	Adj. R-squared: .967	DW: 1.97					
					RICCSPM		
Model 2							
Coefficients	18721	-7.32	1179	49.77	-0.185	-0.400	-0.300
(t-values)	(1.40)	(-0.28)	(6.96)	(1.09)	(-1.41)	(-2.93)	(-0.91)
Elasticities		-0.03	1.91	0.16	-0.52	-0.91	-0.04
R-squared: .977	Adj. R-squared: .968	DW: 2.45					
					D7273		
Model 3							
Coefficients	13562	-19.58	1284	42.82	6243	-0.633	-0.199
(t-values)	(1.44)	(-0.85)	(8.54)	(1.08)	(2.73)	(-4.48)	(-0.69)
Elasticities		-0.07	2.08	0.14		-1.45	-0.03
R-squared: .983	Adj. R-squared: .976	DW: 1.98					
					RICRPWM	PETRPWM	
Model 4							
Coefficients	-25191	24.90	817	69.09	-2.82	-247	0.392
(t-values)	(-1.79)	(0.69)	(5.65)	(1.21)	(-0.37)	(-1.35)	(0.80)
Elasticities		0.09	1.32	0.22	-0.04	-0.06	0.05
R-squared: .964	Adj. R-squared: .949	DW: 2.85					

WHECXT: Commercial world wheat exports, in thousands of metric tons.
WHERPM: Real importer price of wheat, in real foreign currency units per metric ton.
WHEMINC: Real GDP index for wheat importing countries.
CORRPWM: Real wheat importer price of corn, in real foreign currency units per metric ton.
RICRPWM: Real wheat importer price of rice, in real foreign currency units per metric ton.
WHECSPM: Wheat supplies in importing countries (change in stocks plus production in non-wheat exporting countries other than USSR and PRC), in thousands of metric tons.
WHEMGMT: PL 480 wheat exports, in thousands of metric tons.
RICCSPM: Rice supplies in wheat-importing countries (change in stocks plus production in non-wheat exporting countries other than USSR and PRC), in thousands of metric tons.
D7273: Dummy variable taking the value 1 in 1972 and 1973; 0 otherwise.
PETRPWM: Real wheat importer price of petroleum, in real foreign currency units per barrel.

Figure 35: Wheat Equation 1

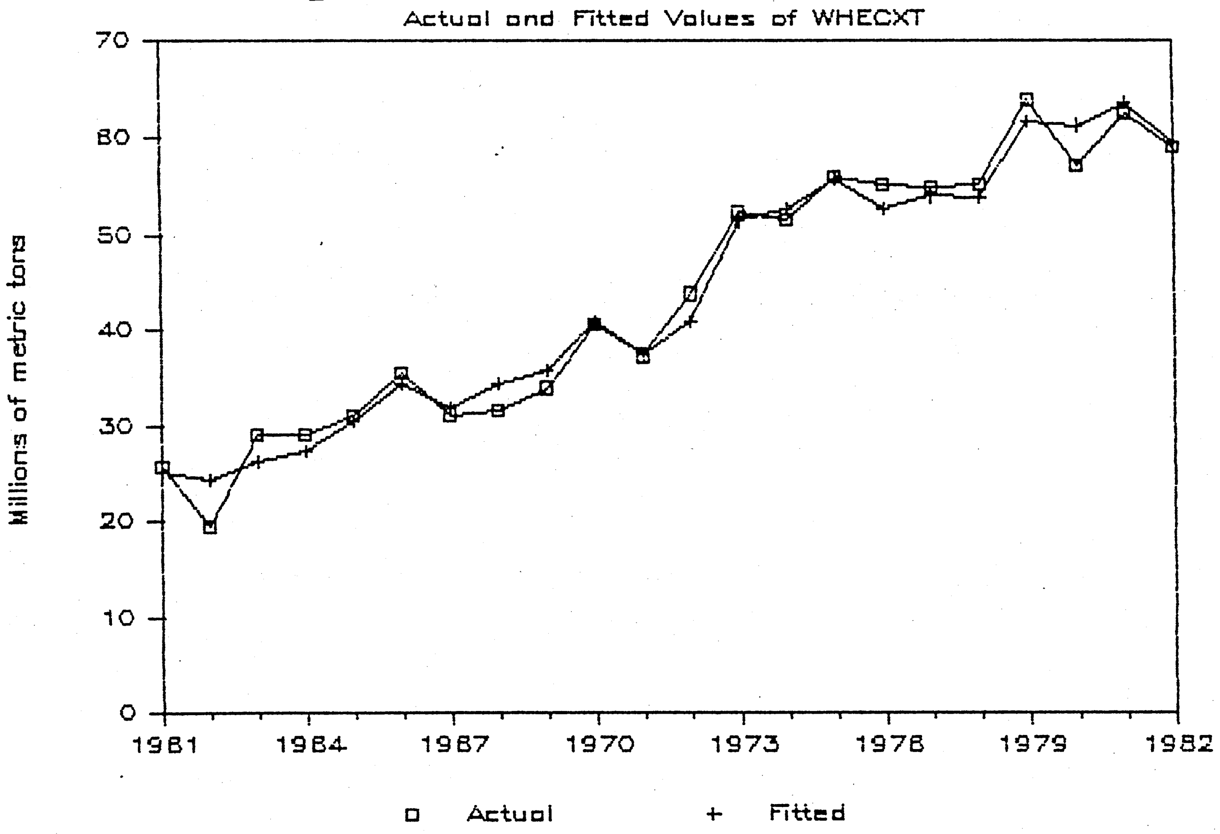
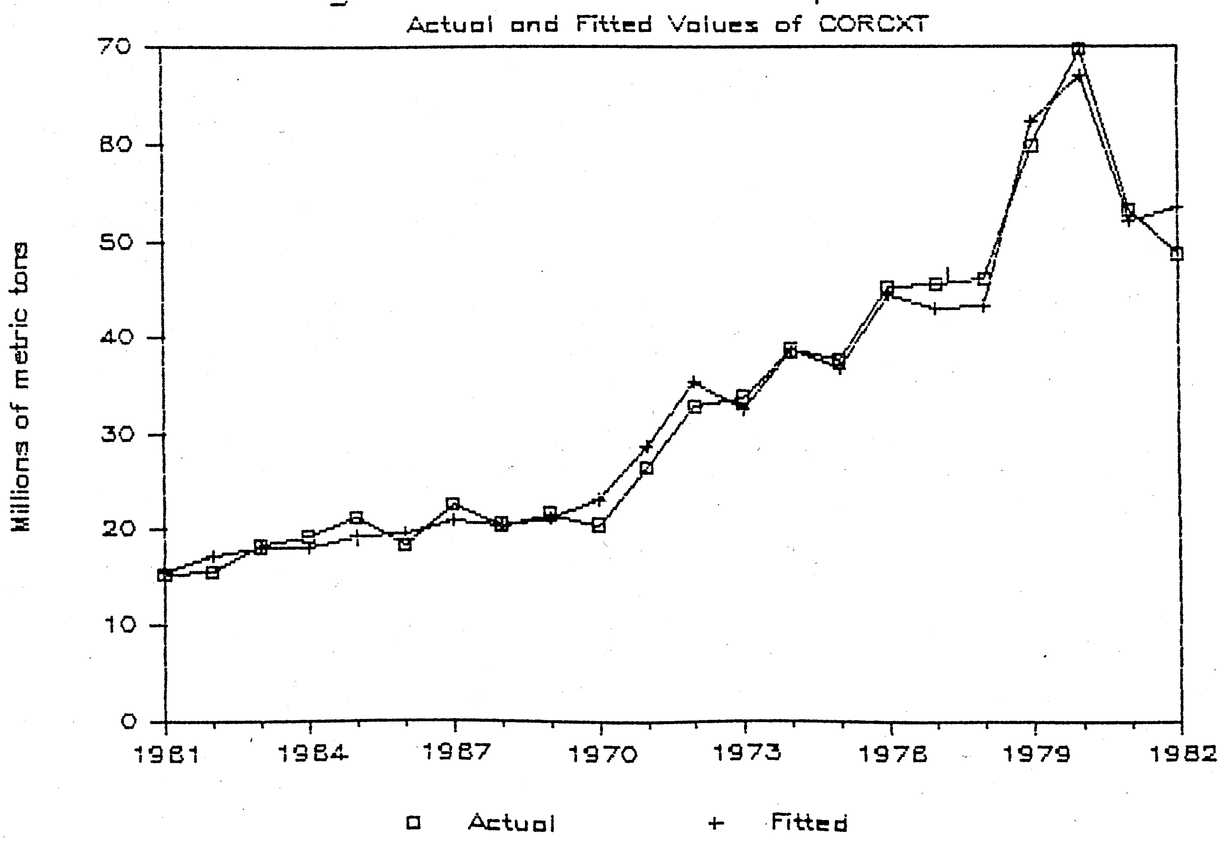


Figure 36: Corn Equation 1



Corn

Four alternative corn equation specifications are reported in Table 5. Model 1 expresses world commercial corn export demand as a function of the prices of corn, petroleum, wheat and soybeans, real importer income, and a dummy variable for 1979 and 1980. The fit is very good, all the signs are as expected, and all the variables are significant at the .05 level, with the exception of the wheat price. Actual and fitted values of CORCXT from Model 1 are shown in Figure 36.

Model 2 is identical to Model 1, except the wheat price is dropped from the equation. The only notable effect this has is that the own price elasticity is reduced by one-third.

Model 3 is the same as Model 2, except it includes importer corn supplies. Since the equation includes both the petroleum price and importer corn supplies, the measured effect of the petroleum price is not on importer production. Rather, the petroleum price variable can be seen as a proxy for international credit availability.

Model 4 shows what happens when the dummy variable for 1979 and 1980 is dropped from Model 1. All of the coefficients continue to have the expected sign, but only the petroleum price is significant at the .05 level, and the overall fit is by far the poorest of the four models. Apparently, something important occurred in 1979 and 1980 which is not being captured by the other variables in the model.

The estimated income elasticity of corn export demand is between 0.55 and 0.72 in all the equations except Model 3, where it is 1.63. In the equations with a low income elasticity, the price of petroleum is the importer supply shift variable; in Model 3, actual importer supplies are used. The sensitivity of this and other parameter estimates to model specification reduces the confidence one has in any particular estimated parameter.

In Models 1, 2, and 3, all of the price elasticities seem "reasonable," although the cross price elasticities again sum to more than the own price elasticity. As in the case of wheat, this would imply that a strengthening of the dollar would actually increase commercial corn exports. In Model 4, the own price elasticity exceeds the sum of the cross price elasticities, thus implying the expected exchange rate effect.

Table 5: Corn Export Demand Equations, fit over 1961-1982
(Dependent variable: CORCXT)

	Intercept	CORRPM	CORMINC	PETRPCM	WHERPCM	SOYRPCM	CORCSPM	D7980
Model 1								
Coefficient	12319	-113	251	554	17.5	38.8		18371
(t-values)	(0.93)	(-2.14)	(2.96)	(5.29)	(0.98)	(3.56)		(9.17)
Elasticities		-0.69	0.55	0.21	0.09	0.42		
R-squared: .983		Adj. R-squared: .977			DW: 1.78			
Model 2								
Coefficient	4750	-77	291	567		39.6		18369
(t-values)	(0.44)	(-2.03)	(3.92)	(5.47)		(3.65)		(9.18)
Elasticities		-0.47	0.63	0.22		0.42		
R-squared: .982		Adj. R-squared: .977			DW: 1.75			
Model 3								
Coefficient	10822	-54	587	567		28.7	-0.286	17836
(t-values)	(0.99)	(-1.40)	(3.00)	(5.74)		(2.32)	(-1.62)	(9.21)
Elasticities		-0.33	1.29	0.22		0.31	-0.85	
R-squared: .985		Adj. R-squared: .979			DW: 1.89			
Model 4								
Coefficient	13675	-103	332	538	17.4	18.1		
(t-values)	(0.41)	(-0.78)	(1.58)	(2.07)	(0.39)	(0.68)		
Elasticities		-0.63	0.72	0.21	0.09	0.20		
R-squared: .890		Adj. R-squared: .856			DW: 1.22			

CORCXT: Commercial world corn exports, in thousands of metric tons.
CORRPM: Real importer price of corn, in real foreign currency units per metric ton.
CORMINC: Real GDP index for corn importing countries.
PETRPCM: Real corn importer price of petroleum, in real foreign currency units per barrel.
WHERPCM: Real corn importer price of wheat, in real foreign currency units per metric ton.
SOYRPCM: Real corn importer price of soybeans, in real foreign currency units per metric ton.
CORCSPM: Corn supplies in importing countries (change in stocks plus production in non-corn exporting countries other than USSR and PRC), in thousands of metric tons.
D7980: Dummy variable taking the value 1 in 1979 and 1980; 0 otherwise.

Soybeans

The results of two soybean export demand equation specifications are shown in Table 6. In Model 1, world commercial soybean exports are expressed as a function of the prices of soybeans and soybean products, and real income in importing countries. In Model 1OLS, all of the signs are as expected and the fit is good, but autocorrelation is a serious problem. Model 1C-O uses the Cochrane-Orcutt procedure to correct for autocorrelation. The price variable coefficients are larger and more significant in Model 1C-O than in the same model estimated using OLS. Actual and fitted values of the dependent variable in Model 1C-O are shown in Figure 37.

Model 2 is identical to Model 1, except the corn price is added to the equation. If corn and soybeans are substitutes in importing countries (as indicated in Corn Models 1-4), one would expect a positive sign on the coefficient of the corn price variable. However, both Models 2OLS and 2C-O found a negative sign on CORRPBM.

The estimated coefficients on the income variable indicate that the income elasticity of export demand is between 1.39 and 1.97, with larger values occurring in equations which do not include the corn price.

The coefficients on the soybean and soybean product price variables change considerably with model specification and estimation technique, but the difference between the two remains fairly constant. If the prices of soybeans and soybean products move together, the implicit price elasticity of export demand is between -0.22 and -0.32. Since cross price elasticities sum to less than the own price elasticity, a strengthening of the dollar would result in lower exports, as one would expect.

Table 6: Soybean Export Demand Equations, fit over 1961-1982
(Dependent variable: SOYCXT)

	Intercept	SOYRPM	SOYMINC	VALRPM	CORRPBM
Model 1OLS					
Coefficients	-6910	-33.64	339	19.77	
(t-values)	(-2.33)	(-1.87)	(20.22)	(1.25)	
Elasticities		-0.85	1.81	0.53	
R-squared: .971		Adj. R-squared: .967			DW: 0.90
Model 2OLS					
Coefficients	8466	-38.41	260	26.33	-39.55
(t-values)	(0.95)	(-2.23)	(5.48)	(1.72)	(-1.79)
Elasticities		-0.98	1.39	0.71	-0.72
R-squared: .976		Adj. R-squared: .970			DW: 1.15
Model 1C-O					
Coefficients	-10133	-48.83	369	35.84	
(t-values)	(-2.90)	(-4.20)	(10.57)	(3.50)	
Elasticities		-1.24	1.97	0.97	
R-squared: .982		Adj. R-squared: .979			DW: 2.29
Rho: .634		t-value for Rho: 3.75			
Model 2C-O					
Coefficients	-2789	-51.00	329	39.35	-19.12
(t-values)	(-0.38)	(-4.32)	(6.88)	(3.65)	(-1.11)
Elasticities		-1.29	1.75	1.07	-0.35
R-squared: .984		Adj. R-squared: .979			DW: 2.33
Rho: .618		t-value for Rho: 3.60			

SOYCXT: Commercial world soybean exports, in thousands of m.t.

SOYRPM: Real importer price of soybeans, in real foreign currency units per metric ton.

SOYMINC: Real GDP index for soybean importing countries.

VALRPM: Real importer value of the soybean meal and oil in a metric ton of soybeans, in real foreign currency units.

CORRPBM: Real soybean importer price of corn, in real foreign currency units per metric ton.

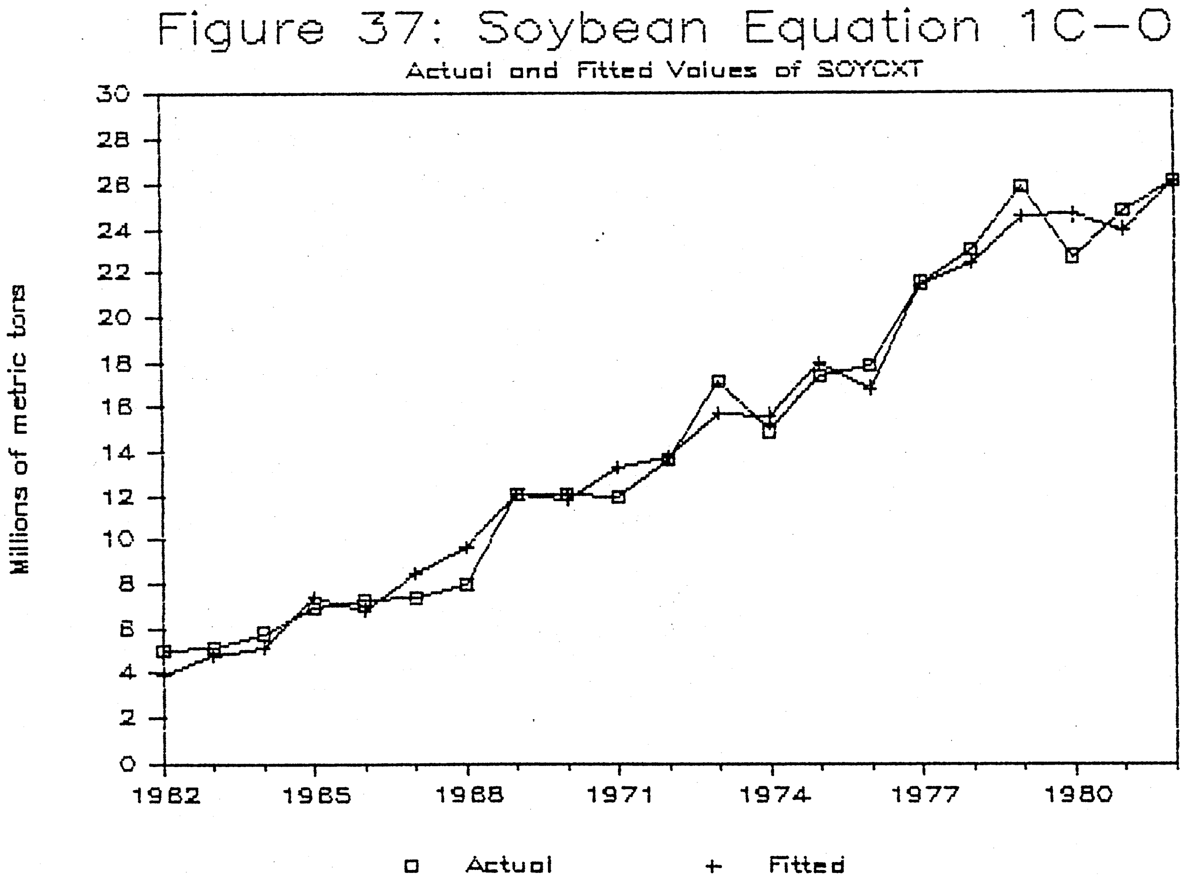


Figure 37: Soybean Equation 1C-0
Actual and Fitted Values of SOYCXT
Millions of metric tons
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1962
1965
1968
1971
1974
1977
1980
Actual
Fitted

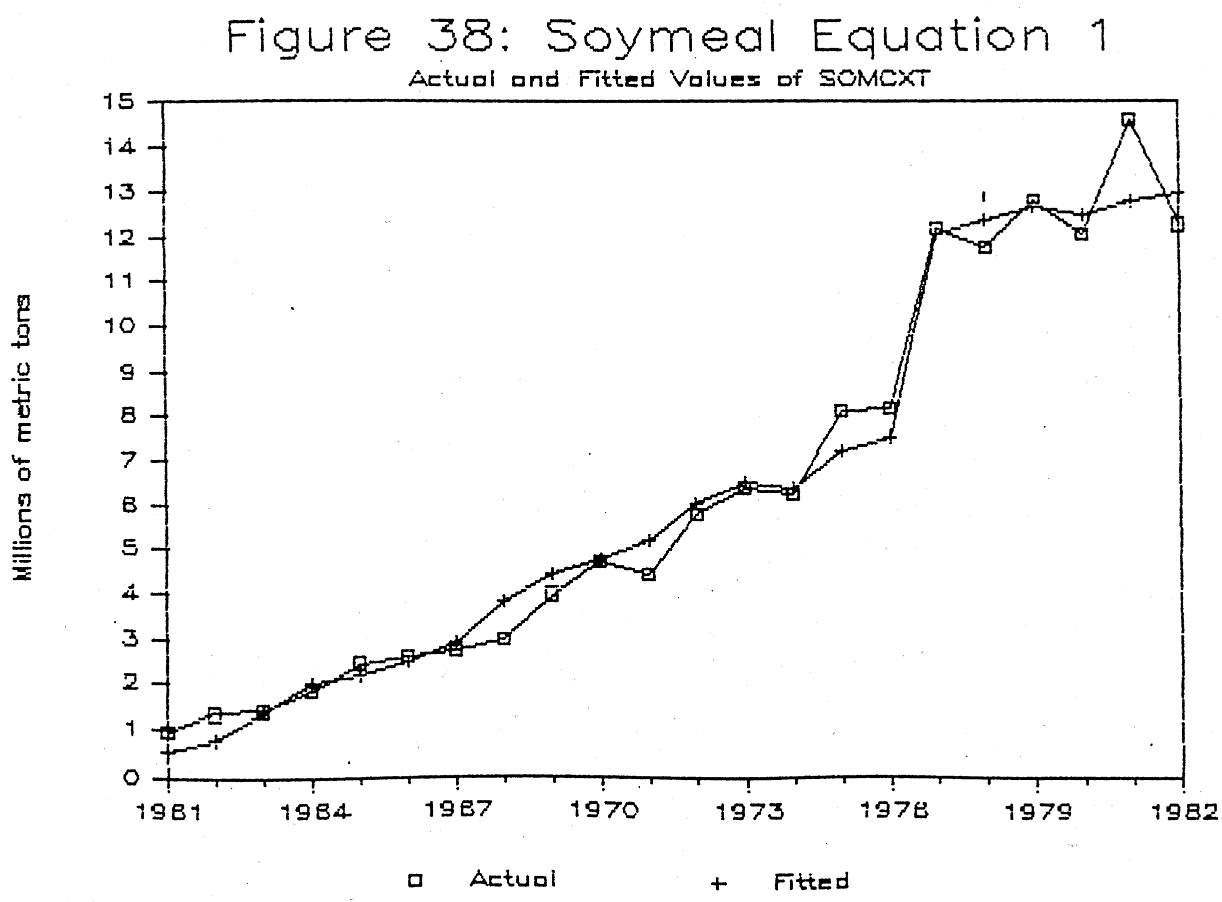


Figure 38: Soymeal Equation 1
Actual and Fitted Values of SOMCXT
Millions of metric tons
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1961
1964
1967
1970
1973
1976
1979
1982
Actual
Fitted

Soymeal

Results of four alternative specifications of the soymeal export demand equation are shown in Table 7. In Model 1 commercial soymeal export demand is expressed as a function of the prices of soymeal and fishmeal, real income in importing countries, and a dummy variable for years after 1976. All of the coefficients have the expected sign, and the fit is good, but the coefficients on the price variables are not significant. Actual and fitted values of the dependent variable in Model 1 are shown in Figure 38.

Model 2 adds the price of corn and the price of soybeans to the equation. The coefficients on both variables have the expected positive sign, but neither is significant and model fit is not improved. Model 3 deletes the soybean price from the specification in Model 2. The coefficient on the corn price variable has an unexpected negative sign.

Model 4 is the same as Model 2, except it does not include the dummy variable for years after 1976. The result is that the coefficients on the soymeal, corn and soybean price variables all have signs contrary to those expected. Thus, it would seem that demand shifted in 1977 for some reason not captured by the other variables in the model.

The income elasticity of demand is greater than 2 in all cases and is remarkably stable across equation specifications. Examining the model results, it is clear that this is because the income variable explains almost all of the upward trend in soymeal export demand.

In all of the equations, the coefficients on the price variables are small and not statistically significant. In Model 1, the own price elasticity is marginally larger than the cross price elasticity, but in Model 2, the sum of the cross price elasticities is larger. Thus, Model 1 indicates a stronger dollar would have a minor negative impact on world commercial soymeal exports, while Model 2 suggests a positive effect.

Table 7: Soymeal Export Demand Equations, fit over 1961-1982
(Dependent variable: SOMCXT)

	Intercept	SOMRPM	SOMMINC	FIMRPMM	CORRPMM	SOYRPMM	D7783
Model 1							
Coefficients	-8088	-3.78	170	1.80			3893
(t-values)	(-6.71)	(-0.69)	(12.51)	(0.81)			(7.26)
Elasticities		-0.18	2.11	0.17			
R-squared: .982		Adj. R-squared: .977		DW: 2.07			
Model 2							
Coefficients	-8913	-5.59	171	1.86	0.77	2.68	4068
(t-values)	(-1.39)	(-0.79)	(5.13)	(0.78)	(0.07)	(0.45)	(5.87)
Elasticities		-0.26	2.12	0.17	0.04	0.15	
R-squared: .982		Adj. R-squared: .975		DW: 2.21			
Model 3							
Coefficients	-7649	-3.54	170	1.73	-1.42		3810
(t-values)	(-1.58)	(-0.61)	(5.55)	(0.73)	(-0.17)		(6.62)
Elasticities		-0.17	2.11	0.16	-0.07		
R-squared: .981		Adj. R-squared: .975		DW: 2.13			
Model 4							
Coefficients	4131	6.75	166	0.28	-21.08	-17.64	
(t-values)	(0.39)	(0.57)	(2.82)	(0.07)	(-1.21)	(-2.05)	
Elasticities		0.32	2.06	0.03	-1.06	-0.99	
R-squared: .940		Adj. R-squared: .921		DW: 1.14			

SOMCXT: World commercial soymeal exports, in thousands of m.t.
SOMRPM: Real importer price of soymeal, in real foreign currency units per metric ton.
SOMMINC: Real GDP index for soymeal importing countries.
FIMRPMM: Real soymeal importer price of fishmeal, in real foreign currency units per metric ton.
CORRPMM: Real soymeal importer price of corn, in real foreign currency units per metric ton.
SOYRPMM: Real soymeal importer price of soybeans, in real foreign currency units per metric ton.
D7783: Dummy variable taking the value 1 for years after 1976; 0 otherwise.

Meal-equivalents

Meal-equivalents export demand equations were estimated to avoid the artificial separation of soybeans and soybean meal into two distinct products. Most of the countries which import soybeans do so primarily to obtain soymeal for use in livestock rations. Thus, it makes sense to specify one equation to estimate total import demand for soymeal and soybeans, and another to estimate the relative shares of each in world trade.

Table 8 shows the results of two different specifications of the meal-equivalents export demand equation. Model 1 expresses commercial export demand for meal equivalents as a function of soymeal and fishmeal prices and real income in importing countries. The results of Model 1OLS show that the coefficients have the expected signs, but the price variables are not significant and autocorrelated residuals are a problem. Model 1C-O uses the Cochrane-Orcutt method to correct for autocorrelation, and the result is larger and more significant coefficients on the price variables. Actual and fitted values of the dependent variable in Model 1C-O are shown in Figure 39.

Model 2 is identical to Model 1, except the price of corn is added to the equation. The expected sign of the coefficient on the corn price is positive, if corn and soymeal are assumed to be substitutes in livestock rations. The coefficients in Models 2OLS and 2C-O are negative, implying a complementary relationship. A similar result occurred in the soybean equations.

To determine the share of meal-equivalents traded commercially in the form of soymeal, two simple equations were estimated, and the results are reported in Table 9. In Model 1, the meal share of meal-equivalent exports is expressed as a function of the crushing margin (the real importer value of meal and oil in a metric ton of soybeans minus the real importer price of a metric ton of soybeans) and a linear trend. The coefficient on the crushing margin has the expected sign, but it is small and not significant. The actual and fitted values of the meal share of meal-equivalent exports from Model 1 are shown in Figure 40. The implicit soybean and soymeal exports from Meal-Equivalents Model 1 and Meal Share Model 1 are plotted against actual exports in Figures 41 and 42.

Model 2 expresses the meal share as a function of the crushing margin and the meal share in the previous period. Such a specification implies that meal exports can only adjust partially in a single year, and the coefficient on the lagged variable is consistent with that hypothesis. As seen in Table 6, however, Model 1 actually fits the data better.

Comparing Figures 37 and 41 and Figures 38 and 42, it appears that the meal-equivalents approach performs approximately as well as direct estimation of soybean and soymeal exports. The meal-equivalents approach may be more theoretically appealing, because it imposes an overall constraint on the trade off between meal and bean exports. However, it seems somewhat simplistic to assume the soymeal share of total soybean and soymeal exports is, essentially, increasing at a constant rate over time.

Table 8: Meal-equivalents Export Demand Equations, fit over 1961-1982
(Dependent variable: MECXT)

	Intercept	SOMRPEM	MEQMINC	FIMRPEM	CORRPEM
Model 1OLS					
Coefficients	-16504	-21.24	512	2.15	
(t-values)	(-4.08)	(-1.05)	(16.28)	(0.26)	
Elasticities		-0.36	2.22	0.07	
R-squared: .952		Adj. R-squared: .944			DW: 1.14
Model 2OLS					
Coefficients	3241	-22.09	406	3.82	-44.97
(t-values)	(0.18)	(-1.09)	(4.05)	(0.46)	(-1.11)
Elasticities		-0.37	1.76	0.13	-0.70
R-squared: .955		Adj. R-squared: .945			DW: 1.28
Model 1C-O					
Coefficients	-22679	-30.51	560	10.10	
(t-values)	(-3.76)	(-2.34)	(8.40)	(1.86)	
Elasticities		-0.52	2.43	0.34	
R-squared: .966		Adj. R-squared: .960			DW: 2.35
Rho: .606		t-value for Rho: 3.49			
Model 2C-O					
Coefficients	-10087	-31.86	491	11.89	-29.07
(t-values)	(-0.63)	(-2.42)	(4.63)	(2.05)	(-0.87)
Elasticities		-0.54	2.13	0.40	-0.45
R-squared: .968		Adj. R-squared: .960			DW: 2.30
Rho: .615		t-value for Rho: 3.58			

MECXT: Soymeal equivalent of world commercial soybean and soymeal exports, in thousands of m.t.

SOMRPEM: Real importer price of soymeal, in real foreign currency units per metric ton.

MEQMINC: Real GDP index for soybean and soymeal importing countries.

FIMRPEM: Real soybean and soymeal importer price of fishmeal, in real foreign currency units per metric ton.

CORRPEM: Real soybean and soymeal importer price of corn, in real foreign currency units per metric ton.

Table 9: Meal Share Equations, fit over 1962-1982
(Dependent variable: MEALSH)

	Intercept	CRSMAR	TREND	MEALSH-1
Model 1				
Coefficients	25.87	-0.013	0.693	
(t-values)	(23.70)	(-0.61)	(10.13)	
Elasticity		-0.01		
R-squared: .855	Adj. R-squared: .839			DW: 1.77
Model 2				
Coefficients	8.32	-0.028		0.791
(t-values)	(2.56)	(-1.17)		(8.38)
Elasticity		-0.02		
R-squared: .802	Adj. R-squared: .780			DW: 2.88

MEALSH: Soymeal share of world soybean and soymeal exports, in percent.

CRSMAR: Real importer soybean crushing margin, in real foreign currency units per metric ton.

TREND: Trend variable, taking the value 1 in 1961, 2 in 1962, etc.

MEALSH-1: The lag of MEALSH.

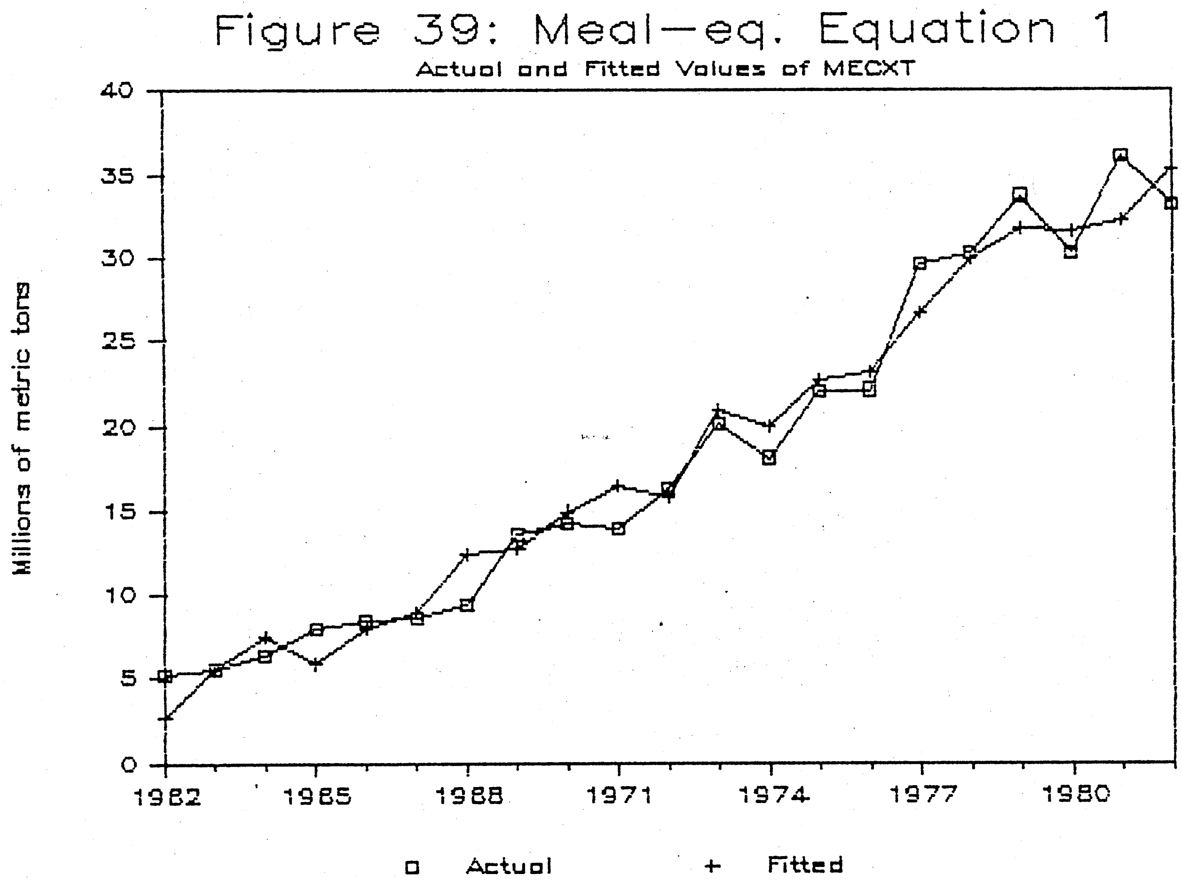


Figure 39: Meal—eq. Equation 1
Actual and Fitted Values of MECXT
Millions of metric tons
40
35
30
25
20
15
10
5
0
1962
1965
1968
1971
1974
1977
1980
Actual
Fitted

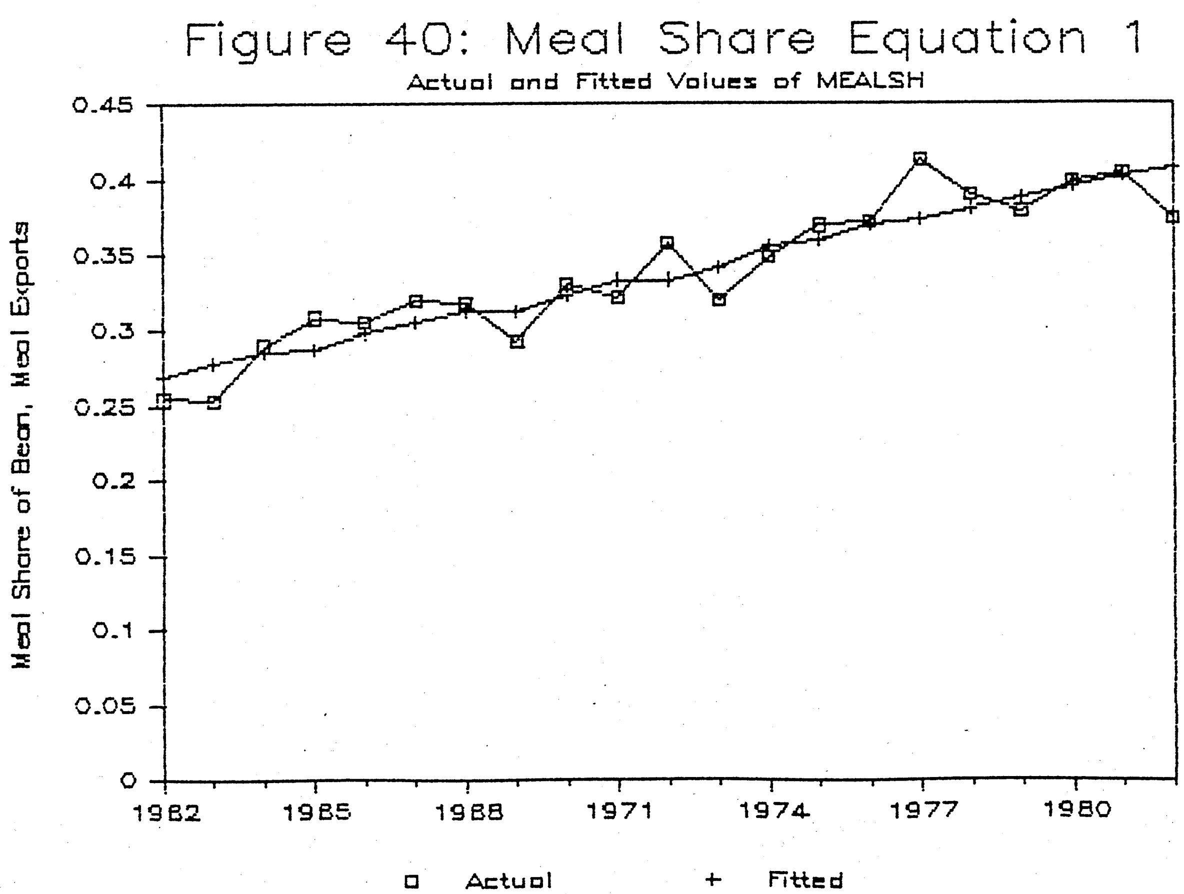


Figure 40: Meal Share Equation 1
Actual and Fitted Values of MEALSH
Meal Share of Bean, Meal Exports
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1962
1965
1968
1971
1974
1977
1980
Actual
Fitted

Figure 41: Implied Soybean Exports

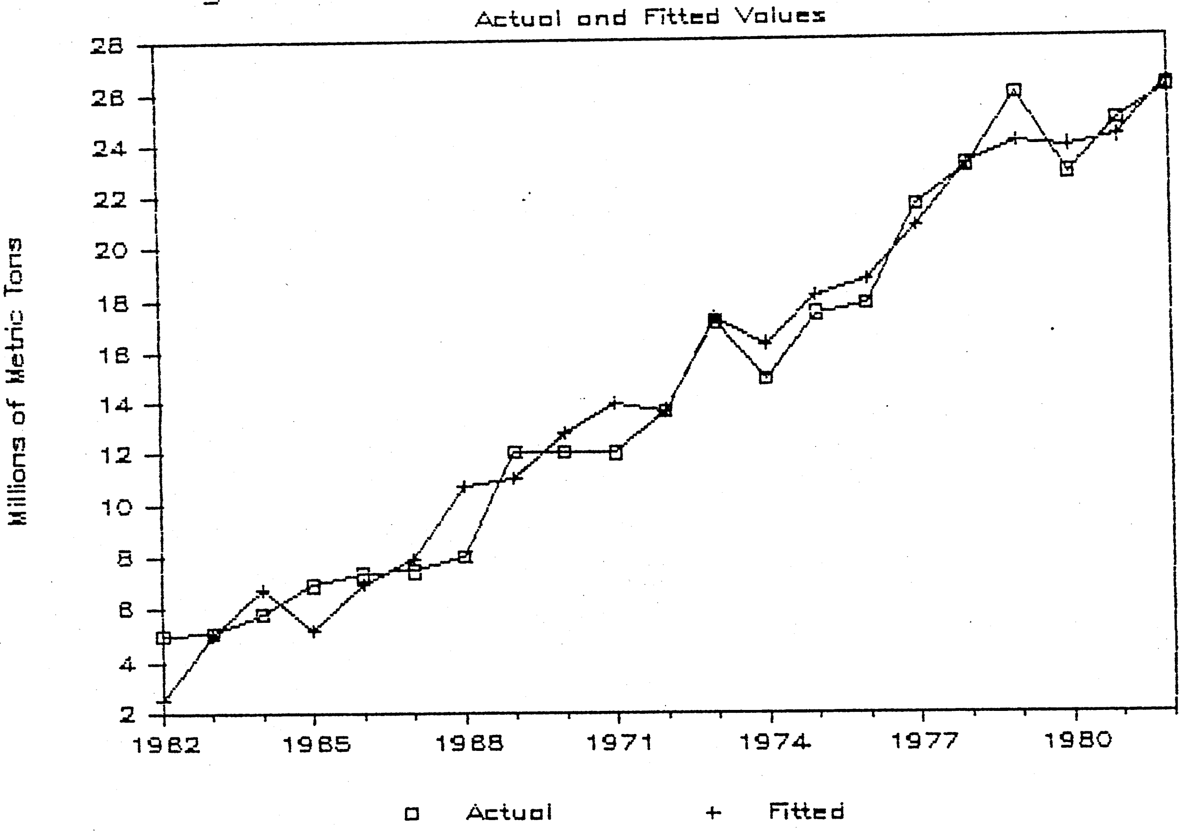
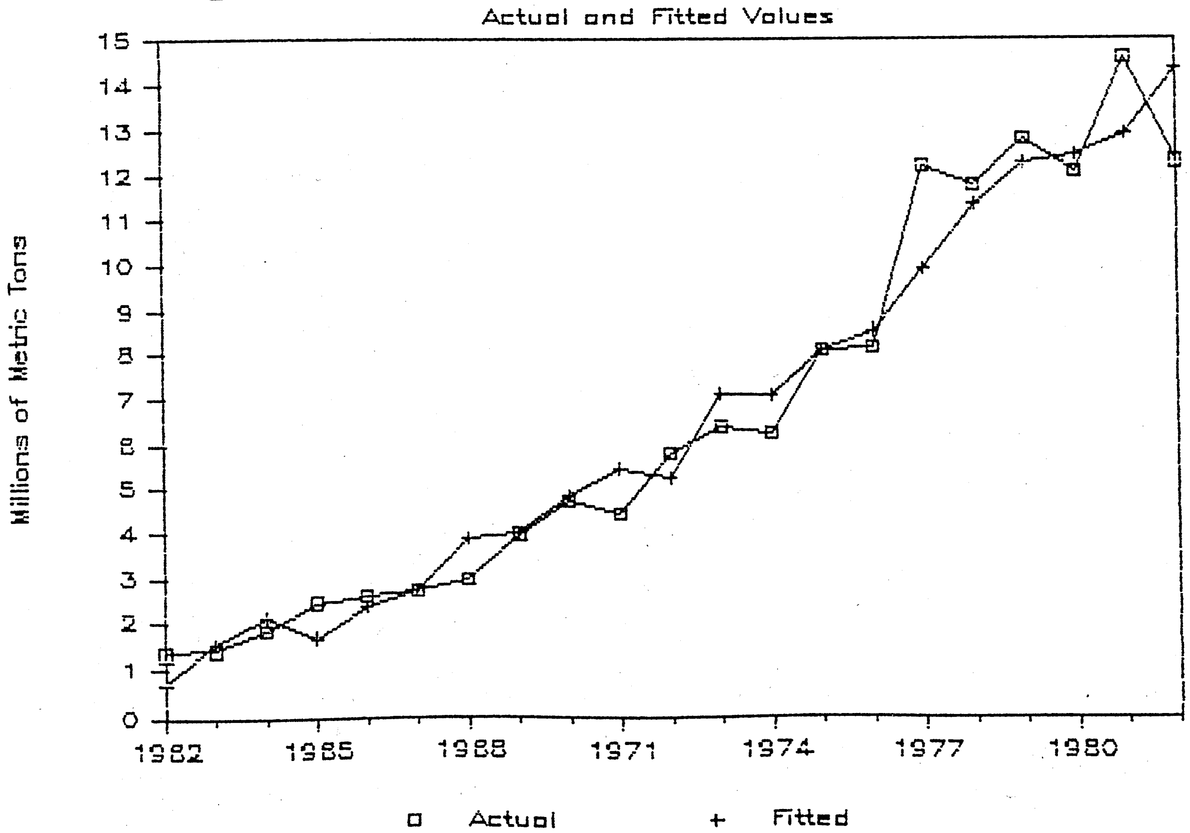


Figure 42: Implied Soymeal Exports



Soyoil

The results of four different specifications of the soyoil export demand equation are shown in Table 10. In Model 1, commercial soyoil exports are a function of the prices of soyoil and palm oil, real importer income, and commercial soyoil exports in the previous year. All of the coefficients have the expected sign and are significant at the .01 level, and the fit of the model is very good. Actual and fitted values of the dependent variable are shown in Figure 43.

Model 2 is identical to Model 1, except PL 480 exports are included as an additional variable. The coefficient on the variable is positive, however, when one would expect PL 480 exports to displace at least some commercial exports.

Model 3 adds the price of soybeans to the specification in Model 1. One would expect soybean imports to be a substitute for soyoil imports, but the computed sign on the coefficient is negative.

Model 4 shows the result when the lagged value of the dependent variable is deleted from Model 1. All of the coefficients maintain the correct signs and are all statistically significant, but the model fit is not as good. The results of Models 1 and 4 suggest that a partial adjustment model is appropriate in the case of soyoil export demand.

In the partial adjustment models (Models 1-3), the income elasticity of export demand is approximately 1, and the coefficient of the lagged dependent variable is approximately 0.7. In Model 4, the income elasticity is much greater--2.62, in fact. Without the lagged dependent variable, almost all of the general upward trend in commercial soyoil exports is explained by increases in real importer income.

Calculated price elasticities of export demand are greater in the soyoil equations than in any of the selected equations for other commodities. In large part, this appears to be due to the close substitutability of soyoil for palm oil. The cross price elasticity is greater than the own price elasticity, implying that a stronger dollar would actually increase soyoil exports.

Table 10: Soyoil Export Demand Equations, fit over 1962-1982
(Dependent variable: SOOCXT)

	Intercept	SOORPM	SOOMINC	PALRPOM	SOYRPOM	SOOMGMT	SOOCXT-1
Model 1							
Coefficients	-1179	-1.329	15.73	2.016			0.712
(t-values)	(-6.91)	(-4.07)	(5.39)	(4.75)			(9.67)
Elasticities		-0.80	0.99	1.19			
R-squared: .991		Adj. R-squared: .988			DW: 2.13		
Model 2							
Coefficients	-1244	-1.300	15.54	2.038		0.127	0.724
(t-values)	(-3.87)	(-3.63)	(5.01)	(4.56)		(0.24)	(8.16)
Elasticities		-0.78	0.97	1.20		0.03	
R-squared: .991		Adj. R-squared: .987			DW: 2.12		
Model 3							
Coefficients	-1154	-1.273	16.75	2.062	-0.454		0.686
(t-values)	(-6.61)	(-3.78)	(5.26)	(4.77)	(-0.84)		(8.49)
Elasticities		-0.76	1.05	1.22	-0.12		
R-squared: .991		Adj. R-squared: .988			DW: 2.32		
Model 4							
Coefficients	-2031	-2.807	41.83	3.093			
(t-values)	(-5.48)	(-3.83)	(14.96)	(2.98)			
Elasticities		-1.68	2.62	1.83			
R-squared: .935		Adj. R-squared: .924			DW: 1.21		

SOOCXT: World commercial soyoil exports, in thousands of m.t.

SOORPM: Real importer price of soyoil, in real foreign currency units per metric ton.

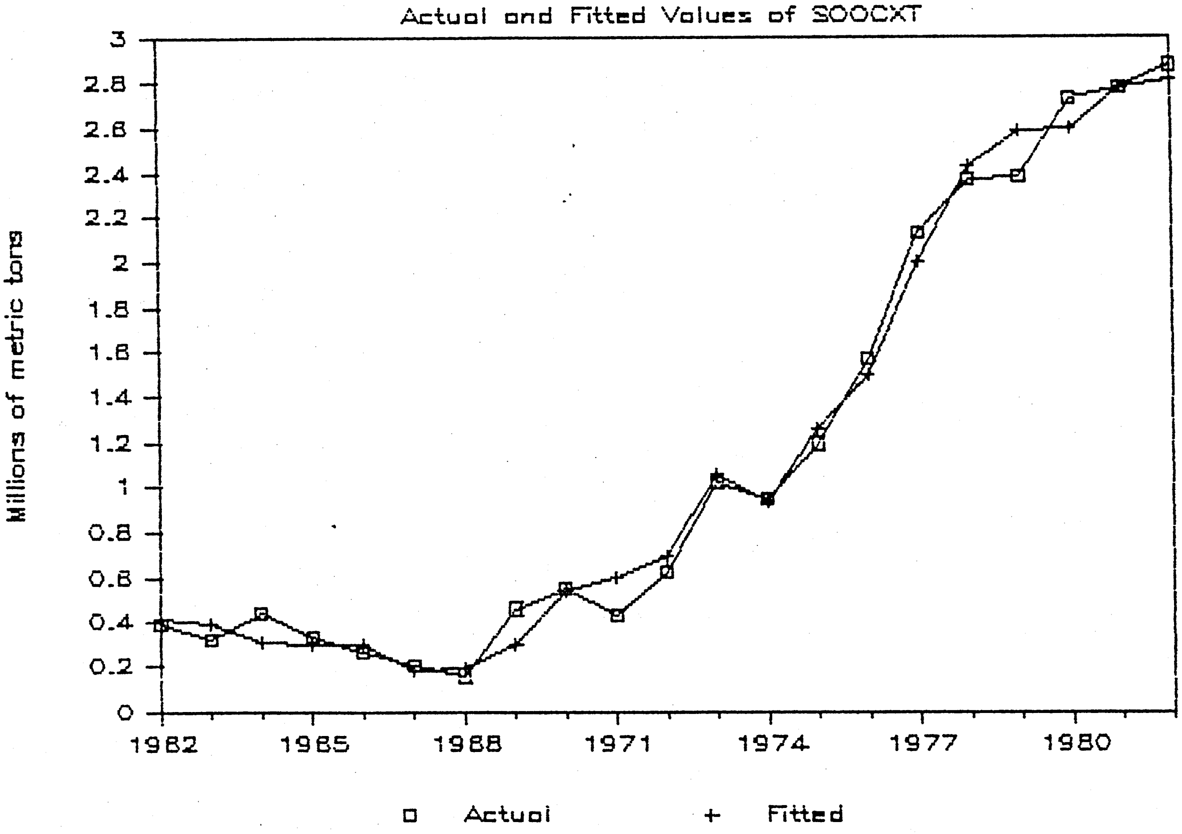
SOOMGMT: PL 480 exports, in thousands of m.t.

PALRPOM: Real soyoil importer price of palm oil, in real foreign currency units per metric ton.

SOYRPOM: Real soyoil importer price of soybeans, in real foreign currency units per metric ton.

SOOCXT-1: The lag of SOOCXT.

Figure 43: Soyoil Equation 1



Alternative Models Using Nominal SDR Prices

Since nominal SDR prices have traditionally been used in models of export demand, it seems reasonable to compare the results obtained here with those obtained using nominal SDR prices. In Tables 11-15, Model 1 is the same as that reported earlier, while Model 1A utilizes nominal SDR prices instead of real importer prices.

Using nominal SDR prices in Wheat Model 1A results in unexpected signs on the wheat and corn price variables, as seen in Table 11. Thus, the specification using real importer prices is preferred to one using nominal SDR prices.

Table 12 shows that Corn Model 1A is considerably different than Model 1. The coefficient on the wheat price has an unexpected negative sign, and the cross price elasticity with respect to soybeans is five times greater than the own price elasticity, which seems rather unlikely. Again, the model using real importer prices is preferred.

Soybean Model 1A is similar to Model 1, as seen in Table 13. However, the magnitude and significance of the coefficients on the price variables are smaller in Model 1A, and the fit is not as good. There is little statistical difference between the two equation specifications, but Model 1 is more satisfactory theoretically.

Table 14 shows that Soymeal Models 1 and 1A are also similar. Little distinguishes the two models statistically, other than a slightly larger cross price elasticity. Again, theoretical concerns are the primary reason to prefer Model 1.

Soyoil Models 1 and 1A are also quite alike, as seen in Table 15. The own price and income elasticities are less in Model 1A than in Model 1, and the cross price elasticity is greater. Although it seems unlikely that the cross price elasticity with respect to palm oil should be almost twice as large as the own price elasticity, the primary reason for preferring Model 1 is theoretical, not statistical.

Of the five models, in no case was the model using the nominal SDR price clearly superior to the model using real importer prices. Since real importer prices are more defensible theoretically, a strong case can be made for their use in models of export demand. Their only major disadvantage is the time and effort required to develop appropriate variables.

Table 11: Wheat Export Demand Equations, fit over 1961-1982
(Using alternative price and income variables)

Model 1	Intercept	WHERPM	WHEMINC	CORRPWM	RICRPWM	WHECSPM	WHEMGMT
Coefficients	7346	-23.92	1112	51.98	7.23	-0.482	-0.315
(t-values)	(0.69)	(-0.79)	(7.16)	(1.12)	(1.12)	(-3.24)	(-0.94)
Elasticities		-0.09	1.80	0.16	0.09	-1.10	0.04

R-squared: .976 Adj. R-squared: .967 DW: 1.97

Model 1A		WHEPSDR	WHEMINC	CORPSDR	RICPSDR		
Coefficients	23286	1.54	1019	-10.75	8.25	-0.502	-0.601
(t-values)	(2.94)	(0.02)	(5.02)	(-0.09)	(0.63)	(-2.84)	(-1.79)
Elasticities		0.00	1.65	-0.02	0.05	-1.15	-0.08

R-squared: .970 Adj. R-squared: .958 DW: 1.54

Model 1B		WHERPM	YCAPIND	CORRPWM	RICRPWM		
Coefficients	329	-36.69	926	81.18	5.26	-0.265	-1.293
(t-values)	(0.02)	(-0.75)	(3.92)	(1.15)	(0.54)	(-1.25)	(-2.37)
Elasticities		-0.13	1.58	0.26	0.07	-0.61	-0.17

R-squared: .948 Adj. R-squared: .927 DW: 1.64

WHECXT: Commercial world wheat exports, in thousands of metric tons.
WHERPM: Real importer price of wheat, in real foreign currency units per metric ton.
WHEMINC: Real GDP index for wheat importing countries.
CORRPWM: Real wheat importer price of corn, in real foreign currency units per metric ton.
RICRPWM: Real wheat importer price of rice, in real foreign currency units per metric ton.
WHECSPM: Wheat supplies in importing countries (change in stocks plus production in non-wheat exporting countries other than USSR and PRC), in thousands of metric tons.
WHEMGMT: PL 480 wheat exports, in thousands of metric tons.
WHEPSDR: Nominal importer price of wheat, in SDRs per m.t.
CORPSDR: Nominal wheat importer price of corn, in SDRs per m.t.
RICPSDR: Nominal wheat importer price of rice, in SDRs per m.t.
YCAPIND: Crude index of per-capita income in 5 wheat-importing countries.

Table 12: Corn Export Demand Equations, fit over 1961-1982
(Using alternative price and demand shift variables)

Model 1	Intercept	CORRPM	CORMINC	PETRPCM	WHERPCM	SOYRPCM	D7980
Coefficient	12319	-113	251	554	17.5	38.8	18371
(t-values)	(0.93)	(-2.14)	(2.96)	(5.29)	(0.98)	(3.56)	(9.17)
Elasticities		-0.69	0.55	0.21	0.09	0.42	

R-squared: .983 Adj. R-squared: .977 DW: 1.78

Model 1A		CORPSDR	CORMINC	PETPSDR	WHEPSDR	SOYPSDR	
Coefficient	-2205	-32	240	373	-0.1	110.6	17256
(t-values)	(-0.43)	(-0.22)	(3.58)	(2.15)	(-0.00)	(4.08)	(7.58)
Elasticities		-0.08	0.52	0.08	0.00	0.50	

R-squared: .983 Adj. R-squared: .977 DW: 1.92

Model 1B		CORRPM	LIVIND	PETRPCM	WHERPCM	SOYRPCM	
Coefficient	7524	-106	284	594	19.5	38.4	17853
(t-values)	(0.52)	(-1.99)	(3.04)	(6.08)	(1.12)	(3.55)	(8.89)
Elasticities		-0.65	0.63	0.23	0.10	0.41	

R-squared: .984 Adj. R-squared: .977 DW: 1.74

CORCXT: Commercial world corn exports, in thousands of metric tons.
CORRPM: Real importer price of corn, in real foreign currency units per metric ton.
CORMINC: Real GDP index for corn importing countries.
PETRPCM: Real corn importer price of petroleum, in real foreign currency units per barrel.
WHERPCM: Real corn importer price of wheat, in real foreign currency units per metric ton.
SOYRPCM: Real corn importer price of soybeans, in real foreign currency units per metric ton.
D7980: Dummy variable taking the value 1 in 1979 and 1980; 0 otherwise.
CORPSDR: Nominal importer price of corn, in SDRs per m.t.
PETPSDR: Nominal importer price of petroleum, in SDRs per barrel.
WHEPSDR: Nominal importer price of wheat, in SDRs per m.t.
SOYPSDR: Nominal importer price of soybeans, in SDRs per m.t.
LIVIND: Index of livestock production in the EC and Japan.

Table 13: Soybean Export Demand Equations, fit over 1961-1982
(Using alternative price and demand shift variables)

Model 1OLS	Intercept	SOYRPM	SOYMINC	VALRPM
Coefficients	-6910	-33.64	339	19.77
(t-values)	(-2.33)	(-1.87)	(20.22)	(1.25)
Elasticities		-0.85	1.81	0.53

R-squared: .971 Adj. R-squared: .967 DW: 0.90

Model 1A		SOYPSDR	SOYMINC	VALSDR
Coefficients	-13129	-55.10	365	50.54
(t-values)	(-9.59)	(-1.18)	(9.36)	(1.10)
Elasticities		-0.58	1.94	0.57

R-squared: .962 Adj. R-squared: .956 DW: 0.80

Model 1B		SOYRPM	LIVIND	VALRPM
Coefficients	-8265	-28.91	351	17.79
(t-values)	(-3.16)	(-1.63)	(20.65)	(1.15)
Elasticities		-0.73	1.84	0.48

R-squared: .973 Adj. R-squared: .968 DW: 0.97

SOYCXT: Commercial world soybean exports, in thousands of m.t.
SOYRPM: Real importer price of soybeans, in real foreign currency units per metric ton.
SOYMINC: Real GDP index for soybean importing countries.
VALRPM: Real importer value of the soybean meal and oil in a metric ton of soybeans, in real foreign currency units.
SOYPSDR: Nominal importer price of soybeans, in SDRs.
VALSDR: Nominal value of the meal and oil in a metric ton of beans, in SDRs.
LIVIND: Index of livestock production in the EC and Japan.

Table 14: Soymeal Export Demand Equations, fit over 1961-1982
(Using alternative price and demand shift variables)

Model 1	Intercept	SOMRPM	SOMMINC	FIMRPMM	D7783
Coefficients	-8088	-3.78	170	1.80	3893
(t-values)	(-6.71)	(-0.69)	(12.51)	(0.81)	(7.26)
Elasticities		-0.18	2.11	0.17	

R-squared: .982 Adj. R-squared: .977 DW: 2.07

Model 1A		SOMPSDR	SOMMINC	FIMPSDR	
Coefficients	7860	-9.58	161	6.50	3970
(t-values)	(-7.97)	(-0.84)	(8.82)	(1.33)	(8.41)
Elasticities		-0.19	2.00	0.26	

R-squared: .983 Adj. R-squared: .979 DW: 2.03

Model 1B		SOMRPM	LIVIND	FIMRPMM	
Coefficients	-5613	-4.44	151	1.94	3460
(t-values)	(-4.76)	(-0.73)	(11.18)	(0.79)	(5.54)
Elasticities		-0.21	1.76	0.18	

R-squared: .977 Adj. R-squared: .972 DW: 1.76

SOMCXT: World commercial soymeal exports, in thousands of m.t.
SOMRPM: Real importer price of soymeal, in real foreign currency units per metric ton.
SOMMINC: Real GDP index for soymeal importing countries.
FIMRPMM: Real soymeal importer price of fishmeal, in real foreign currency units per metric ton.
D7783: Dummy variable taking the value 1 for years after 1976; 0 otherwise.
SOMPSDR: Nominal importer price of soymeal, in SDRs.
FIMPSDR: Nominal importer price of fishmeal, in SDRs.
LIVIND: Index of livestock production in the EC and Japan.

Table 15: Soyoil Export Demand Equations, fit over 1962-1982
(Using alternative price and demand shift variables)

Model 1	Intercept	SOORPM	SOOMINC	PALRPOM	SOOCXT-1
Coefficients	-1179	-1.329	15.73	2.016	0.712
(t-values)	(-6.91)	(-4.07)	(5.39)	(4.75)	(9.67)
Elasticities		-0.80	0.99	1.19	
R-squared: .991		Adj. R-squared: .988			DW: 2.13

Model 1A		SOOPSDR	SOOMINC	PALPSDR	
Coefficients	-857	-2.652	10.53	4.587	0.580
(t-values)	(-7.63)	(-4.86)	(4.08)	(6.29)	(9.43)
Elasticities		-0.77	0.66	1.33	
R-squared: .994		Adj. R-squared: .992			DW: 2.08

Model 1B		SOORPM	IRESIND	PALRPOM	
Coefficients	-478	-0.971	18.38	1.569	0.357
(t-values)	(-3.60)	(-3.12)	(5.23)	(3.73)	(2.53)
Elasticities		-0.58	0.75	0.93	
R-squared: .990		Adj. R-squared: .988			DW: 1.72

SOOCXT: World commercial soyoil exports, in thousands of m.t.
SOORPM: Real importer price of soyoil, in real foreign currency units per metric ton.
PALRPOM: Real soyoil importer price of palm oil, in real foreign currency units per metric ton.
SOOCXT-1: The lag of SOOCXT.
SOOPSDR: Nominal importer price of soyoil, in SDRs per m.t.
PALPSDR: Nominal importer price of palm oil, in SDRs per m.t.
IRESIND: Index of international reserves held by LDCs.

Alternative Models Using Other Demand Shift Variables

As stated earlier, the real income variables developed here have certain theoretical and practical advantages over livestock and other demand shift variables. The same procedure that was used to evaluate different price definitions will be used to compare models with different definitions of the income variable. In Tables 11-15, Model 1B uses a different income variable, but is otherwise identical to Model 1.

Table 11 shows that Wheat Models 1 and 1B are fairly similar. The magnitudes of various coefficients change, but in no case does the sign on any coefficient change. Model 1B is less responsive to changes in foreign wheat supplies and has an unlikely substitution rate of -1.29 between PL 480 and commercial exports. The fit of Model 1-B is also not as good as that of Model 1. The primary reason to prefer Model 1 is theoretical, however, as YCAPIND is only a simple average of real per capita income in five wheat importing countries, while WHEMINC is a trade-weighted index of real GDP in importing regions.

Corn Models 1 and 1B are essentially indistinguishable on statistical grounds, as seen in Table 12. Coefficient values, t-statistics and model fit all are basically the same in both models. Theoretical arguments can be made in favor of either specification.

Soybean Models 1 and 1B are also difficult to distinguish on statistical grounds, as shown in Table 13. Again, coefficient values, t-statistics, and model fit are essentially the same for each model, and theoretical arguments can be made in favor of either specification.

Table 14 shows that there is also little difference between Soymeal Models 1 and 1B. The income elasticity in Model 1 is slightly less than the elasticity with respect to livestock production in Model 1B, and the fit of Model 1 is marginally better. Again, however, there is little way to distinguish the models on statistical grounds, and the use of income or livestock variables each has theoretical advantages and disadvantages.

Table 15 shows that Soyoil Models 1 and 1B are also fairly similar. Using an index of LDC international reserve holdings rather than an income variable appears to yield similar results. The only noticeable difference between the two equations is that the magnitude of the coefficient on the lagged dependent variable is less in Model 1-B. Theoretically, it seems reasonable to assume that both foreign reserve holdings and real importer incomes may affect export demand for soyoil.

In the case of all five commodities, the real income variables developed here perform as well as the traditional livestock and other demand shift variables. Except in the case of wheat, there is no strong theoretical reason to prefer the real income variables. However, the MINC variables offer some practical advantages, such as eliminating the need to model the foreign livestock sector or treat it exogenously.

Summary and Conclusions

This paper has developed an alternative approach to estimating world commercial export demand for various commodities. This section of the paper will summarize the major findings and suggest how the approach presented here could be integrated into policy models for different commodities.

Table 16 presents elasticities from various export demand equations. For each commodity, the first line presents the elasticities of export demand calculated from the results of the selected equation. The next two lines list the range of elasticities resulting from different model specifications. Four general observations are appropriate here:

1) The estimated own price elasticities indicate that world export demand for these commodities is generally inelastic. Only in the case of soybeans is the elasticity calculated from the selected equation less than -1, and even soybean export demand is inelastic if one assumes soybean and soybean product prices generally move together. These results do not necessarily imply that supply and demand are inelastic in importing countries; it may simply be that the price transmission elasticity is quite low, or that these model specifications are inadequate.

2) In the cases of wheat, soybeans and soymeal, the calculated income elasticities are quite high. One would expect the income elasticity of export demand to be greater than the income elasticity of total demand for the simple reason that export demand is less than total demand. Nevertheless, the elasticities reported here may be unrealistically high. Both incomes and exports tended to increase during the period examined, and the income variables may serve primarily to explain secular trends.

3) The computed elasticities with respect to the exchange rate appear somewhat dubious. The results of the selected wheat, corn and soyoil equations all

imply that a stronger dollar would actually increase world trade in those commodities. Even though a stronger dollar would increase the world price of each commodity, it would also raise the world price of petroleum and substitute commodities by the same percentage. In the selected equations for wheat, corn and soyoil, these substitution effects overwhelm the own-price effect.

4) As should be clear from examining the elasticity ranges, the parameters are very sensitive to changes in model specification. This implies that a number of problems remain with these models, and that the results should be treated with caution. Multicollinearity is a serious problem in a number of equations, and it is simply very difficult to determine which subset of possible variables to use in an export demand equation.

Care should be taken not to interpret the calculated elasticities of world export demand as being equal to the elasticity of export demand facing the US Even if the export supply of other countries were completely price inelastic, the elasticity of US export demand would be greater than that calculated here, since the US elasticity would be calculated over a smaller base.

Table 17 shows what the own price elasticity of commercial US export demand would be under different assumptions concerning the elasticity of export supply by competitors. Since the US share of world wheat, soymeal and soyoil trade is less than 50%, the US export demand elasticities for those commodities are very sensitive to assumptions concerning competitor export supply.

One way in which the export demand equations developed here could be incorporated into a general commodity model is as follows: One equation in the model would be the world commercial export demand equations developed here. A second equation would determine export supply by competitors in an analagous manner (i.e., using real prices in the other exporting countries and other variables which shift their domestic supply and demand curves). A third equation would estimate imports by the USSR and the PRC (or these could be taken as exogenous). Finally, a fourth equation would be an identity: total US exports equal world commercial exports plus USSR and PRC imports plus US PL 480 exports minus competitor exports.

Certainly, such an approach is not as simple as estimating a single US export demand equation, but it is also not as complicated as creating a linked regional market model. The appropriateness of such an approach would depend on time and resource availability, as well as the type of problem under consideration.

Table 16: Elasticities from selected world commercial export demand equations

	Own Price	Income	Cross Price Effects			Exchange Rate
			Corn	Rice		
Wheat #1	-0.09	1.80	0.16	0.09		0.16
Range: Low	0.09	1.32	-0.02	-0.04		0.03
High	-0.13	2.08	0.26	0.09		0.27
			Wheat	Soybean	Petroleum	
Corn #1	-0.69	0.55	0.09	0.42	0.21	0.03
Range: Low	-0.08	0.52	0.00	0.20	0.08	-0.15
High	-0.69	1.29	0.10	0.50	0.23	0.50
			Value			
Soybeans #1C-O	-1.24	1.97	0.97			-0.27
Range: Low	-0.58	1.39	0.53			-0.01
High	-1.29	1.97	1.07			-0.32
			Fishmeal			
Soymeal #1	-0.18	2.11	0.17			-0.01
Range: Low	0.32	1.76	0.03			0.10
High	-0.26	2.12	0.26			-1.73
			Fishmeal			
Meal Eq. #1C-O	-0.52	2.43	0.34			-0.18
Range: Low	-0.36	1.76	0.07			-0.18
High	-0.54	2.43	0.40			-0.94
			Palm Oil			
Soyoil #1	-0.80	0.99	1.19			0.39
Range: Low	-0.58	0.66	0.93			0.15
High	-1.68	2.62	1.83			0.56

Table 17:
U.S. Export Elasticities under Different Assumptions Concerning the Elasticity of Export Supply by Other Major Exporters

	Elast. of World Commer. Export Demand	U.S. Share of Commer. Exports	Elasticity of Commercial Export Demand Facing the U.S., Assuming the Elasticity Of Competitor Export Supply Is:				
			0.0	0.1	0.2	0.5	1.0
Wheat 1	-0.09	0.47	-0.19	-0.24	-0.30	-0.45	-0.72
Corn 1 *	-0.50	0.82	-0.61	-0.63	-0.65	-0.70	-0.79
Bean 1C-O **	-0.27	0.89	-0.30	-0.32	-0.33	-0.36	-0.42
Meal 1	-0.18	0.47	-0.39	-0.44	-0.49	-0.65	-0.92
MealEq 1C-O	-0.52	0.71	-0.73	-0.76	-0.79	-0.87	-1.01
Oil 1	-0.80	0.29	-2.81	-2.88	-2.95	-3.16	-3.52

* Assumes the EC threshold price of corn is held constant.
** Assumes soybean and soybean product prices move together.

Data Sources

The basic source for the data used in this report is the University of Missouri Agricultural Modeling Group Data Bank, as updated in November 1984. Other data sources are as follows:

1. USSR and PRC wheat imports from countries other than the US were obtained from the USDA OSF data tape.

2. Weights for the income and price variables are based on 1978-1982 imports (net in the case of the EC) as reported in USDA Foreign Agricultural Service 1982a and 1982b.

3. The income indices for countries and country groupings other than Taiwan, the EC and Eastern Europe are based on reported annual changes in GDP in IMF 1984a:120-123.

4. The income index for Taiwan was obtained from CEPD 1982.

5. The income index for the EC was based on Herlihy, et al. 1983 for years prior to 1981, and on IMF 1984a data for years after 1981.

6. The income index for Eastern Europe was obtained from Ramatu Mahama.

7. Exchange rates and price indices, other than those for Taiwan and the EC, were obtained from the IMF IFS data tape, with some updating based on IMF 1984a.

8. Exchange rates and price indices for Taiwan and the EC were based on CEPD 1982 and Herlihy et al. 1983, respectively.

9. Competing importer supply variables were derived based on data from the USDA OSF data tape.

10. Petroleum and palm oil prices were obtained from IMF 1984a.

A more complete listing of data sources, variable definitions, and variable computations is found in Appendix Table A-24.

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