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APAP Staff Papers

CALCULATING BORDER PRICES FOR GRAINS, OILSEEDS, AND OILSEED PRODUCTS

APAP Staff Paper No. 22

By Martin E. Abel
John E. Beach

July 1988

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ABSTRACT

Grain, oilseed, and oilseed product prices and ocean freight rates have exhibited large cyclical swings over time as world agriculture adjusted to either shortages or surpluses. We expect this pattern to persist in the future. Trends in these commodity prices and ocean freight rates are calculated for the period covering the 1970's and the first half of the 1980's. These trends are used to project prices and freight costs to 1990 and 1995. The analysis shows that commodity prices and freight rates in 1986 and 1987 were very depressed by historical standards and are expected to rise in subsequent years. Our projections of commodity prices to 1995 compare very favorably with those recently made by the World Bank. It is relatively easy to use projected commodity prices and ocean freight rates presented in this paper to derive border prices for individual countries.

SUMMARY

Economic analysts concerned with evaluating agricultural projects and policies in developing countries need to be able to estimate border prices in order to judge whether or not projects or policies are efficient by world market standards. However, world commodity prices are inherently unstable. One needs, therefore, to be able to develop a longer-term view about commodity price levels that is reasonable in relation to likely future market developments. One also has to be able to translate world commodity prices reported at key market locations into either cif or fob prices for a particular country.

This paper examines historical price behavior for wheat, rice, coarse grains, soybeans, soybean meal, soybean oil, and palm oil. It also projects prices to 1990 and 1995. The price projections presented in this paper are reasonably close to those recently projected by the World Bank.

In the context of longer-term cyclical movements of agricultural commodity prices, those that prevailed in 1986 and 1987 were unusually low. Prices are expected to rise from the levels that prevailed in those two years into 1995.

We have also examined the historic behavior of ocean freight rates and projected freight costs to 1990 and 1995. Projected freight rates can be used to derive border prices for a specific country from key world market price series. We have illustrated how this can be done in the case of wheat imports by Egypt and soybean oil imports by Pakistan.

Given the inherent instability in both commodity prices and ocean freight rates, the best one can do is to get a reasonable approximation of what future price levels are likely to be. Analyses of either projects or policies should be tested with respect to their sensitivity to the border prices used. If projects or policy options look promising even with a fair degree of variation in border prices, they are probably robust and deserve serious consideration. If on the other hand, the attractiveness of a project or a policy option is sensitive to small variations in border prices, the project or policy is probably of marginal value.

CALCULATING BORDER PRICES FOR GRAINS, OILSEEDS, AND OILSEED PRODUCTS

I. Introduction

This paper examines ways to derive reasonable estimates of border prices for grains, oilseeds, and oilseed products. Within a world market context, these prices represent either c.i.f. import prices or f.o.b. export prices. They are important for evaluating agricultural policies and projects in developing countries and are used to determine if a country is or can be an efficient producer by world market standards and if it is allocating agricultural resources efficiently.

Typically, analysts are interested in border prices that will reasonably approximate actual prices over an extended period of time. This is so because these prices are used to evaluate policies or investments that will influence production, consumption, and resource use for some time into the future. Deciding on a set of prices that are "reasonable" is no easy task given the inherent instability in agricultural commodity prices.

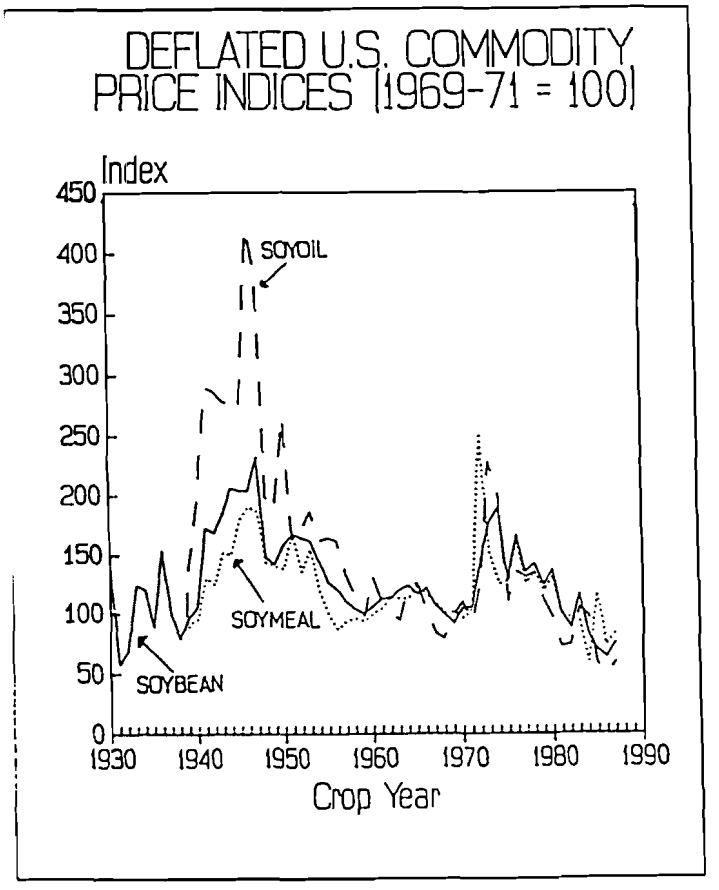
World market prices of agricultural commodities represent the combined effects on a global basis of weather and crop conditions, economic and population growth, changes in technology and productivity, national agricultural policies and the way they are implemented, exchange rates, the influence of macro-economic forces that shift resources into or out of agriculture, and, on occasion, political actions in the international arena such as wars or embargoes.

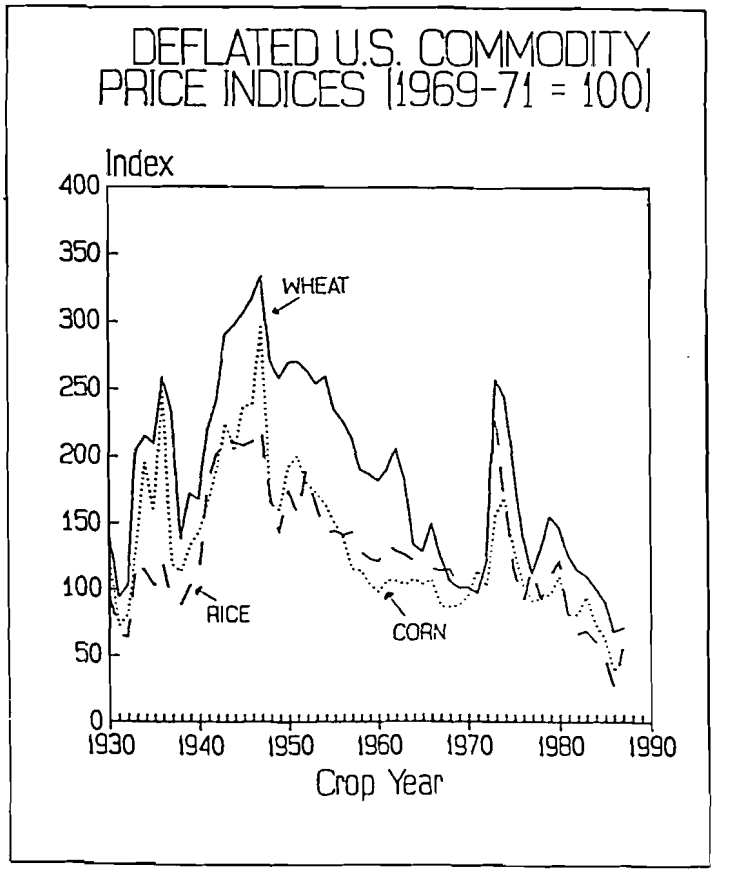
Trying to develop global economic models that capture all the major forces at work in determining longer-run commodity price levels is a hopeless task. First, the world is too complicated to be captured in models that economists are capable of constructing. Second, the underlying economic and policy structure of world agriculture is constantly changing so that any model is already outdated by the time it is completed.

We do know that world agriculture adjusts to either conditions of scarcity or surplus. Neither condition lasts for an extended period of time since prices induce adjustments in both production and consumption. Paarlberg dealt with the ability of world agriculture to adjust in an article published in the early 1980's. At the time, he challenged the then conventional view that food shortages would persist, and offered some sage advice:

> "We cannot know with accuracy the scale of agricultureal production in the years ahead. But, if we persist in public policies that price our products far above equilibrium we shall create a surplus, even though we might not have had one in the beginning. If we price them substantially and continually below the market we shall induce scarcity, even though the original scarcity may have been an illusion. These concepts become self-fulfilling."1/

We also know that the downward trend in real prices of major agricultural commodities that has persisted since the late 1940's remains in place. That trend was interrupted briefly by rising real commodity prices in the mid-1970's as shown in the following charts for U.S. prices, but that aberration did not last very long.





1/ Don Paarlberg, "The Scarcity Syndrome", AJAE, Vol. 64, No. 1, February 1982, p.114

We have no evidence to indicate that real commodity prices will not continue to decline in the future. The productivity of world agriculture is expected to continue to increase and this productivity growth will offset to some extent the influence of inflation on nominal commodity prices. But as with any trend, there can be deviations about the declining trends in real prices in the short-run. A case can be made that grain and oilseed prices were abnormally low in recent years in both nominal and real terms and that nominal prices can recover and still be consistent with a declining long-term trend in real prices. Also, one cannot rule out short-term spurts in real prices such as those experienced in the mid-1970's because of poor crops or other factors.

In this paper we discuss a relatively simple methodology for projecting future commodity prices at key market locations, provide price projections to 1990 and 1995, compare these projected prices with other available projections, provide information on ocean freight rates as well as projections of these rates, and illustrate how to derive border prices for a few countries and commodities using both commodity prices and freight rates. We also present historical data on prices and freight rates so that users of this report can update both data series as well as projected values based on them.

II. Methodology

As already discussed and as will be shown later, grain and oilseed prices are very unstable. There have been wide fluctuations in prices due to weather and crop conditions, political events, and abrupt change in national policies. There are also longer-term cyclical movements based on adjustment in production and consumption due to price changes, and uneven economic growth and developments in productivity.

We also find that ocean freight rates are generally correlated with grain and oilseed prices. This is not surprising since high commodity prices are usually associated with bouyant world trade and low prices correspond to periods of slack world trade.

The methodology used to estimate future commodity prices and freight rates is as follows:

- Longer-term series in nominal terms are smoothed using a three-year moving average to try to eliminate annual fluctuations.

- Trends are estimated statistically using these series of moving averages.

- These trends are evaluated in terms of reasonableness and their relationships to recent commodity prices and freight rates.

- Projections are made to 1990 and 1995 by extrapolating the calculated trends. These projections are discussed in relation to other projected prices that are available and what we know about key factors now driving world commodity prices.

- Finally, we combine commodity prices and ocean freight rates and derive projected border prices for a few countries and commodities in order to illustrate how the methodology can be used.

For any commodity, prices are available at several market locations in the world. At times, prices among markets move together and at times they don't because of government interventions. For example, the U.S. government has in recent years used large export subsidies for vegetable oils and wheat. As a consequence, world prices of these commodities have been sharply lower than domestic U.S. prices. Differences between domestic and world price levels may last for only a few years or may be a regular feature of domestic agricultural policy as in the case of the European Community (EC) which has consistently kept domestic grain and oilseed prices well above world market levels. Because of the problem created by subsidies, it is best not to rely on domestic prices as indicators of world prices. Rather, one will get a more accurate picture of world prices by using those prices that reflect world market transactions, and that is what we have done in the paper.

III. Price Behavior

A. Overview

The historical behavior of grain, oilseed, and oilseed product prices is shown in the charts presented below. Actual prices represented in these charts are presented in Annex A.

While price behavior in any one year differs among commodities, there is a high degree of similarity among many commodities in terms of longer-term price movements. This similarity results from world macro-economic factors and general developments in world agriculture.

The 1960's were characterized by a high degree of price stability. The lack of major movements in commodity prices during this period can be attributed to the following factors:

- The U.S. had considerable surplus agricultural production capacity measured in terms of both stock levels and a large amount of land idled under government programs. This excess capacity was used to meet surges in demand.

- World inflation rates were low and inflation was not a significant factor in increasing nominal prices.

- While world commodity trade increased in the 1960's, the levels were low compared to later years and growth in world trade was modest.

- Productivity growth in world agriculture generally was rapid enough to keep pace with growth in world demand.

- Global weather and crop conditions were generally favorable during the 1960's. There were periodic crops problems in some countries but declines in production were either absorbed domestically (e.g.. in the U.S.S.R.) or easily accommodated by existing world stocks (e.g., the severe crop problems in India during 1965 and 1966 were met by large imports that came primarily from the United States).

By comparison, prices behaved in a tumultuous manner in the 1970's. The reasons for the sharply higher and very unstable prices in this period were numerous. Some of the most important factors were:

- Severe global crop problems, particularly in 1973 and 1974.

- An acceleration in inflation through a combination of expansionary monetary and fiscal policies in a large number of countries and the petroleum price shocks in the mid-and late-1970's.

- Some major changes in food and agricultural policies around the world, the most noteworthy being a shift in the U.S.S.R. that began in 1972 to rely heavily on imports to meet growing food needs and to offset poor crops.

- Finally, a decline in the U.S. dollar during most of the 1970's helped inflate nominal commodity prices measured in dollars.

Conditions affecting commodity prices changed again in the 1980's and resulted in a rather sharp decline in prices from levels experienced in the previous decade. But there was also considerable volatility about this downward trend. Some key factors that explain behavior in the 1980-87 period include the following.

- A dramatic slowing of inflation rates from the high levels reached in the late 1970's and very early 1980's.

- A world recession in 1982.

- The emergence of serious debt problems in a number of developing countries which restricted their ability to import.

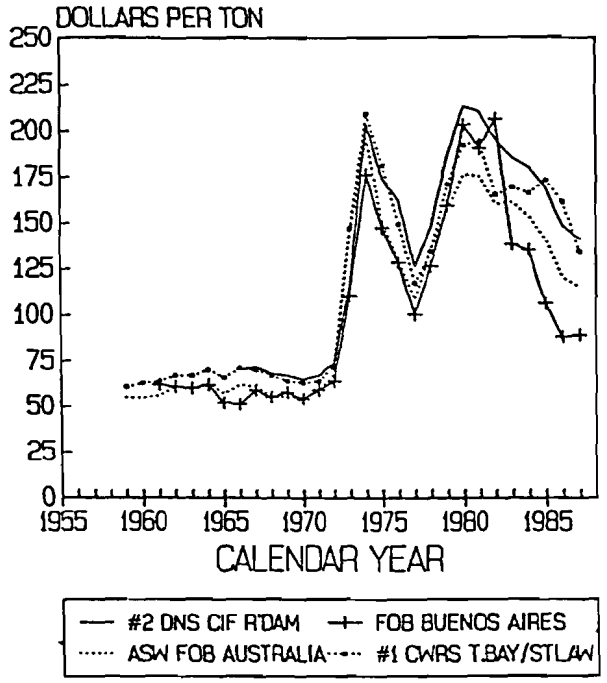
- A major expansion in world agricultural production capacity that began in the 1970's in response to the high prices of that period and that carried over into the first half of the 1980's. Major productivity gains were realized in both developed countries (e.g., the U.S. and the E.C.) and in many developing countries that reaped the fruits of the "green revolution" technology.

- An increase in the value of the U.S. dollar which helped depress nominal dollar commodity prices.

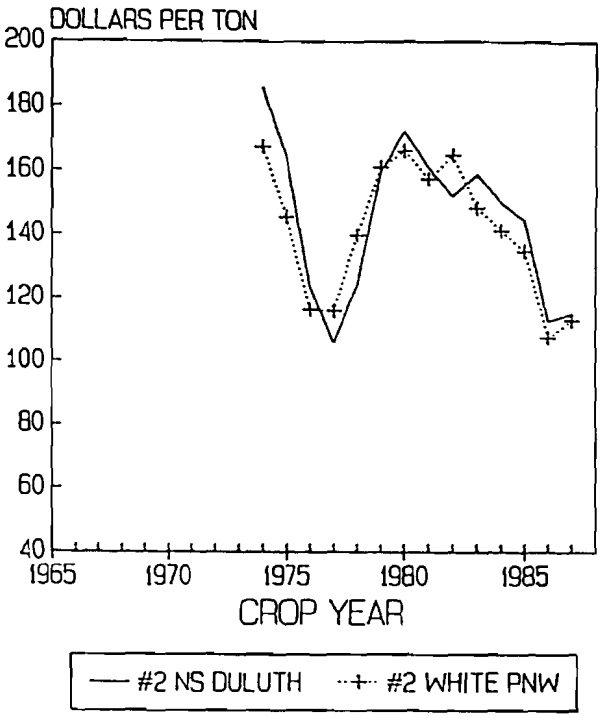
During the first half of the 1980's, the United States accumulated large surpluses due to the factors listed above. A strong dollar and and high price supports seriously eroded the competitive position of the United States in world markets and resulted in a sharp decline in U.S. exports. In response to this situation, the United States reformulated its policy in 1985 to allow market prices to decline sharply starting with 1986 crops. 2/

2/ For a discussion of these policy changes see U.S. Agricultural Policy Process and the Role of Policy Analysis, APAP Staff Paper No. 3, 1986. This paper was prepared by Abel, Daft & Earley for Abt Associates under the Agricultural Policy Analysis Project, USAID Contract No. DAN-4084-C-00-3087-00.

WORLD WHEAT PRICES



U.S. WHEAT: EXPORT PRICES



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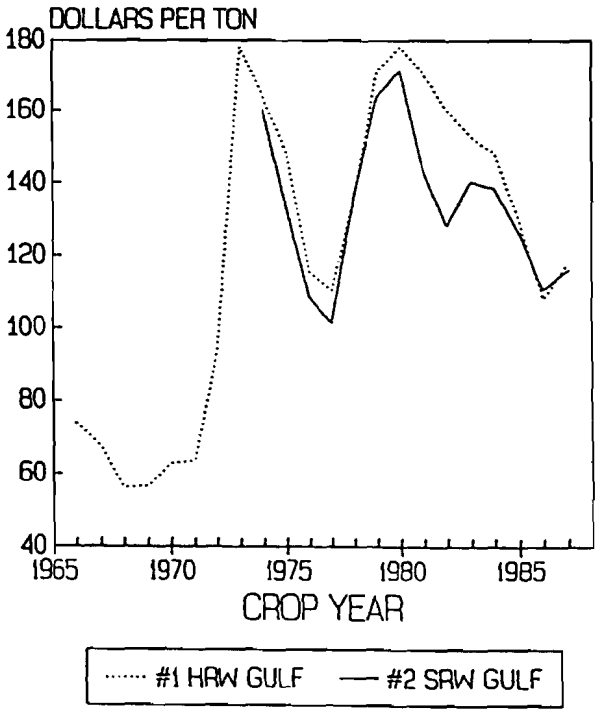
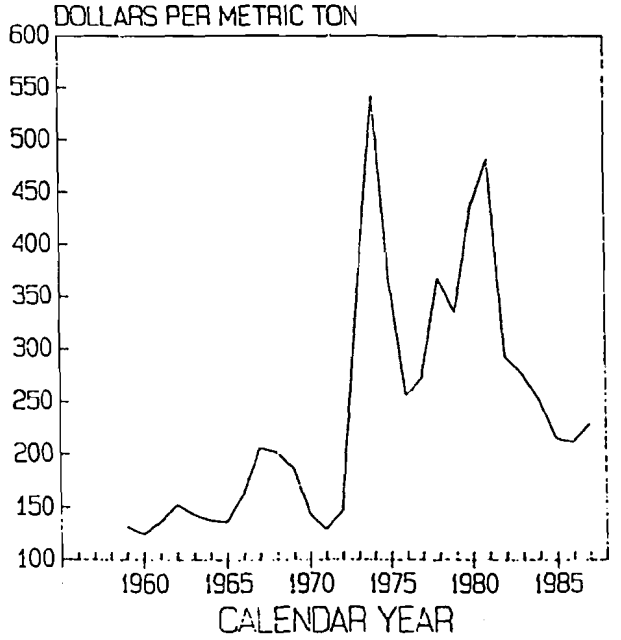
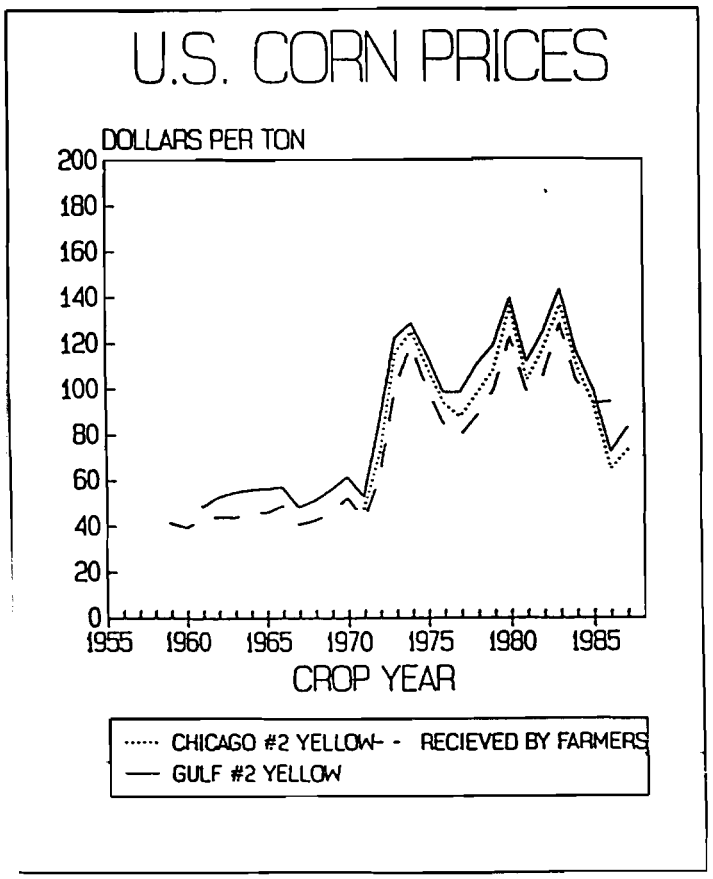
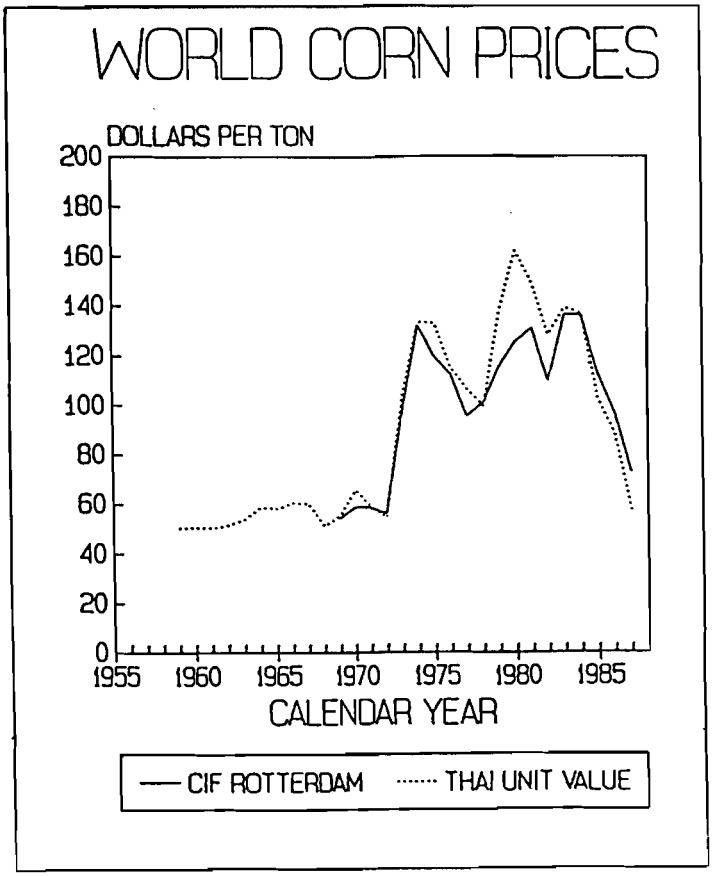
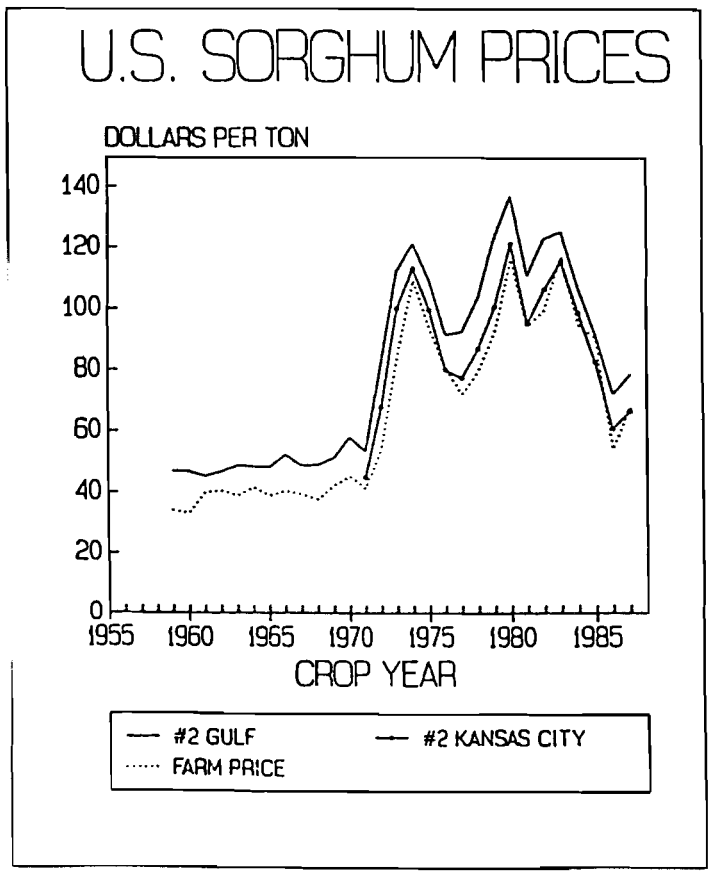


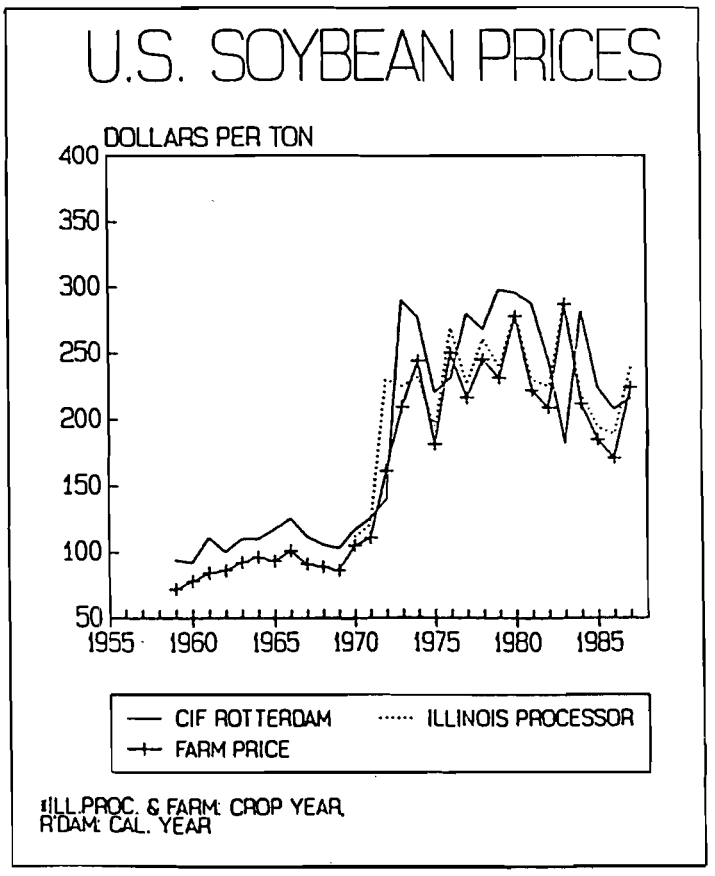
WORLD RICE PRICE
Thai 5% Broken, FOB Bangkok

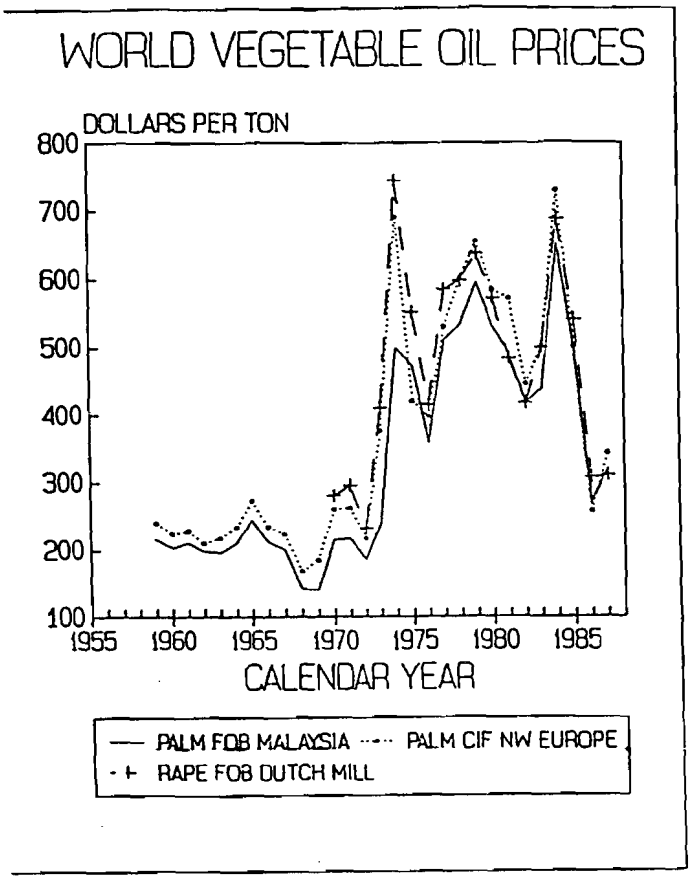


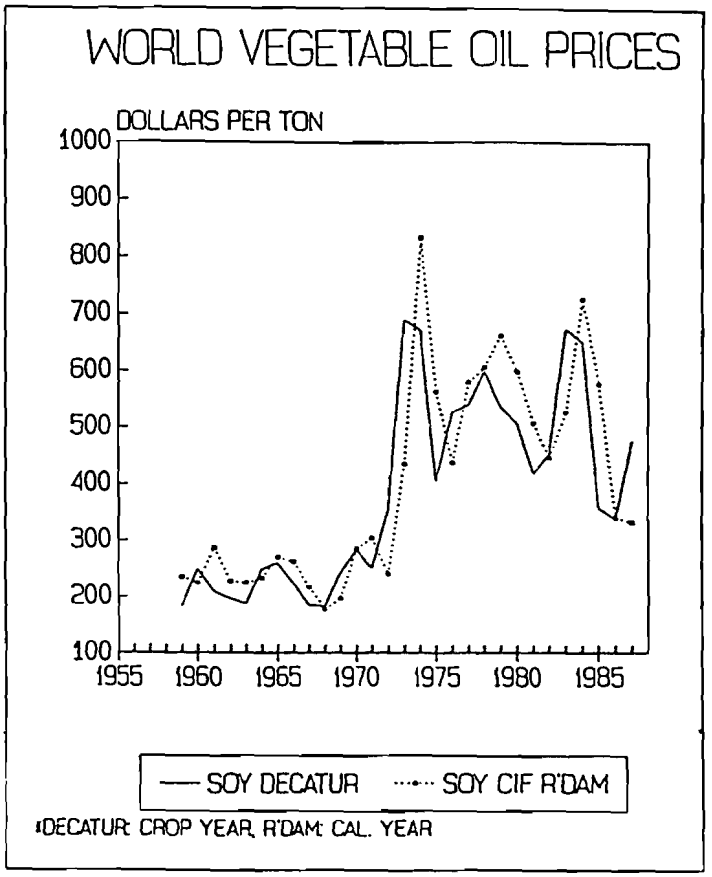

U.S. CORN PRICES
DOLLARS PER TON
200
180
160
140
120
100
80
60
40
20
0
1955
1960
1965
1970
1975
1980
1985
CROP YEAR
CHICAGO #2 YELLOW - - RECIEVED BY FARMERS
GULF #2 YELLOW

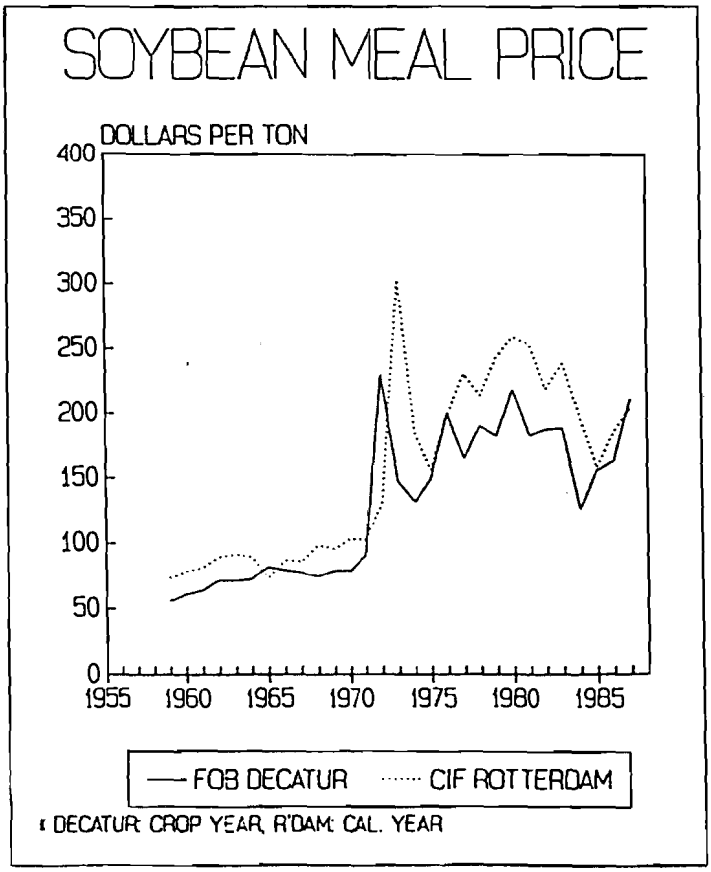

WORLD CORN PRICES
DOLLARS PER TON
200
180
160
140
120
100
80
60
40
20
0
1955
1960
1965
1970
1975
1980
1985
CALENDAR YEAR
CIF ROTTERDAM
THAI UNIT VALUE


U.S. SORGHUM PRICES
DOLLARS PER TON
140
120
100
80
60
40
20
0
1955
1960
1965
1970
1975
1980
1985
CROP YEAR
#2 GULF
#2 KANSAS CITY
FARM PRICE


U.S. SOYBEAN PRICES
DOLLARS PER TON
400
350
300
250
200
150
100
50
1955
1960
1965
1970
1975
1980
1985
CIF ROTTERDAM
ILLINOIS PROCESSOR
FARM PRICE
#ILL.PROC. & FARM: CROP YEAR,
R'DAM: CAL. YEAR


WORLD VEGETABLE OIL PRICES
DOLLARS PER TON
800
700
600
500
400
300
200
100
1955
1960
1965
1970
1975
1980
1985
CALENDAR YEAR
PALM FOB MALAYSIA
PALM CIF NW EUROPE
RAPE FOB DUTCH MILL


WORLD VEGETABLE OIL PRICES
DOLLARS PER TON
1000
900
800
700
600
500
400
300
200
100
1955
1960
1965
1970
1975
1980
1985
SOY DECATUR
SOY CIF R'DAM
*DECATUR: CROP YEAR, R'DAM: CAL. YEAR


SOYBEAN MEAL PRICE
DOLLARS PER TON
400
350
300
250
200
150
100
50
0
1955
1960
1965
1970
1975
1980
1985
FOB DECATUR
CIF ROTTERDAM
* DECATUR: CROP YEAR, R'DAM: CAL. YEAR

B. A Changing Environment

There is now fairly convincing evidence that world agricultural commodity prices are beginning to recover from the depressed levels of 1986 and 1987. There are many reasons other than weather problems in 1988 for this shift in the price outlook, just as no single factor explained price behavior in previous periods:

- World economic growth has been steady, if modest, since the early 1980's and growth in a number of Asian countries has been quite rapid. This pattern of growth is expected to continue at least for the next few years.

- There is evidence that the rate of growth in grain yields is slowing in a number of developing countries as the influence of the "green revolution" is being exhausted.

- Low prices have reduced grain production in a number of exporting countries.

- The United States has adopted policies to shrink its agricultural production capacity on a long-term basis. The Conservation Reserve Program is scheduled to idle 40-45 million acres on a long-term basis representing about 12 percent of U.S. cropland. Nearly 29 million acres have already been enrolled in this program as of May, 1988.

- A lower U.S. dollar is once again providing support to commodities priced in this currency.

An expected recovery in world commodity prices is consistent with Paarlberg's view about longer-term price movements. Just as the high prices of the 1970's stimulated policies and producer behavior around the world to expand production which in turn resulted in lower prices, the lower prices of the 1980's are bringing about adjustments in supply and demand that will lead to higher prices later on.

IV. Estimated Future Prices

As mentioned earlier, we fit trends to historical prices and project these trends into the future. Trend analysis has its pitfalls, as do other types of analyses, since the trend depends on the period from which it is derived.

A structural change in the level of commodity prices occurred between the 1960's and the 1970's and 1980's. A major reason for this change is that inflation and other economic factors forced an upward adjustment in nominal commodity prices and production cost. With these higher costs built into world agriculture, it is not realistic to expect prices to return to the low and stable levels that prevailed in the 1960's.

This point can be illustrated in another way. By almost any standard of measurement, the commodity prices realized in 1986 and 1987 were considered to be very "low", whether relative to prices in the previous 15 years or measured against production costs in most major crop producing regions of the world. Yet these prices were still above the levels of the very early 1970's and well above those that prevailed in the 1960's.

We have chosen to fit trends to the 1970-87 period believing that this period more accurately reflects current and prospective conditions than does the period of the 1960's. This period also reflects what appears to be a full historical cycle in commodity prices. The trends are fitted to a three year moving average of nominal prices in order to smooth out the influences of extreme years. We then project trend value prices to both 1990 and 1995.

But it is also useful to have a cross-check on the price projections since projected values can be sensitive to the historical period used to derive the trend. One such check is a comparison of our projected prices with those recently projected by the World Bank. 3/

Our projected prices together with those from the World Bank based on comparable price series are shown in the following table. Our projections are very close to those made by the Bank for 1995. But the Bank's 1990 prices are significantly below our trend values for that year. This comparison illustrates two points. First, world commodity prices are likely to be back on the 1970-87 trend by the mid-1990's. Second world agricultural prices will still be in the process of recovery in 1990, with prices significantly above the depressed levels of recent years but still well below where they could be by the mid-1990's.

Both we and the World Bank show a rising trend in agricultural commodity prices except in the case of rice. For rice, the World Bank has prices increasing between 1990 and 1995 while we show a slight decline. One can make arguments to support either trend. The World Bank's view of rising nominal rice prices is

3/ Half-Yearly Revision of Commodity Price Forecasts--December 1987, International Economics Department, World Bank.

consistent with the general increase in commodity prices that both they and we are projecting. On the other hand, rice is a food that consumers tend to shift away from in favor of wheat and wheat products and other grains used for animal feeding to meet increased consumption of meat and poultry as incomes rise. This was the experience of such rapidly growing economies as Japan, South Korea and Taiwan. With the strong economic growth that has occurred in Asia and that is likely to continue, rice consumption may grow only slowly, especially relative to rice production potential and this could argue for stable to slightly declining rice prices.

Our projections of oilseed and vegetable oil prices are significantly below the World Bank's projections while our projected soybean meal prices are higher. In view of the strong demand for meal and the ability of world agriculture to increase oilseed and meal production, we believe that our prices are more reasonable than the Bank's. 4/

Projected Nominal Commodity Prices

	Average	World Bank		Abel Daft & Earley	
	1985-87	1990	1995	1990	1995
	- - - - - - U.S.$/metric ton - - - - - - - - -				
Wheat 1/	157	155	199	189	206
Corn 2/	85	88	140	110	112
Sorghum 3/	80	83	133	95	110
Rice 4/	219	246	312	283	274
Soybeans 5/	216	257	307	258	265
Soybean Meal 6/	182	197	216	227	238
Soybean Oil 7/	417	451	712	506	515
Palm Oil 8/	367	443	644	506	515

1/ #1 Canadian hard red spring 13.5%, Thunder Bay
2/ #2 Yellow, FOB U.S. Gulf
3/ #2 Yellow, FOB U.S. Gulf
4/ Thailand, 5% broken
5/ U.S. soybeans, CIF Rotterdam
6/ U.S. 44%, CIF Rotterdam
7/ Dutch crude, FOB Ex-mill
8/ Malaysia, CIF N.W. Europe

4/ The World Vegetable Oil Outlook, APAP Staff Paper No. 25, April 1988, prepared for Abt Associates by Abel, Daft & Earley under the Agricultural Policy Analysis Project, USAID Contract DAN-4084-C-00-3087-00.

V. Ocean Freight Rates

A. Overview

Ocean freight rates have varied significantly over time. They are influenced by inflation as it affects all costs; fluctuations in fuel prices, a major component of shipping costs; vessel size; and shipping capacity relative to the volume of world trade. The latter is subject to cyclical fluctuations similar to those affecting world agriculture in general. Periods of tight supplies and high shipping prices such as those experienced in the 1970's usually spur new investment in ships. It is not uncommon for over-investment to occur which then creates an excess supply of shipping capacity and low prices. It may take a considerable amount of time for this excess capacity to dissipate through a combination of vessels going out of use and growth in world trade.

Vessels used to carry bulk agricultural commodities -- typically grains, oilseeds, and oilseed meals -- can also be used to carry other dry bulk cargo such as coal. Thus, world agricultural trade is only one component of the demand for shipping, although it is an important one.

There is also a wide range in vessel size. Which size vessel is used depends on a combination of the ability of ports to handle vessels of different size and the distance commodities are being shipped. Typically, large vessels have a cost advantage on long-distance routes. In any event, shipping costs per ton vary considerably by vessel size as shown below. In the tables presented later, vessels are grouped into size categories designated A,B,and C. While the vessel size range in each category varies somewhat by route, in general the size categories are as follows:

A: 10-25,000 tons
B: 25-50,000 tons
C: 50,000 tons and larger.

B. Historic Behavior of Ocean Freight Rates

The behavior of ocean freight rates for grains since 1960 is illustrated in the following table. These prices are for U.S. and Canadian wheat shipped from the St. Lawrence to Antwerp/Rotterdam/Amsterdam, referred to subsequently as the St. Lawrence-Rotterdam route. They correspond to vessel size category A.

Shipping Rates for Grain
St. Lawrence to Antwerp/Rotterdam/Amsterdam

Year	Rate	Index	Year	Rate	Index
	U.S.$/ton	1985=100		U.S.$/ton	1985=100
1960	3.70	38	1975	4.60	47
1960	4.80	49	1976	5.20	53
1962	3.30	34	1977	5.50	56
1963	4.40	45	1978	7.10	72
1964	4.20	43	1979	12.40	127
1965	4.60	47	1980	16.10	164
1966	3.60	37	9181	14.10	144
1967	4.30	44	9182	10.30	105
~~1968~~	~~3.40~~	~~35~~	~~1983~~	~~9.40~~	~~96~~
1969	4.10	42	1984	10.20	104
1970	7.00	71	1985	9.80	100
1971	3.30	34			
1972	4.10	42			
1973	13.20	135			
1974	10.20	104			

Source: World Bank

These data show that freight rates surged in the 1973-74 period and again in the 1979-81 period. Both of these surges correspond to sharp increases in petroleum prices and high levels of world grain trade as well as trade in coal and other bulk commodities. Freight rates have moderated in recent years as a result of a combination of depressed grain trade levels, lower fuel costs, and overinvestment in ships.

More detailed information on ocean freight rates by route is presented in the next table for the 1978/79-1985/86 period. These data are for wheat, but the same rates apply for other bulk grains, soybeans, and soybean meal. This information shows wide fluctuations in freight rates over time, and significant differences in shipping rates by vessel size and among ocean routes.

Ocean Freight Rates for Wheat

(July-June Year)

Destination	Source	Vessel Size 1/	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
			U.S. $/ton 2/							
East Africa	U.S. Gulf	A	21.38	42.13	49.25	43.15	35.28	37.04	38.25	37.00
	N.W. Pacific 3/	A	22.00	28.71	31.54	40.75	38.00	38.00	38.83	39.00
Bangladesh	Argentina	A	23.63	36.92	48.92	46.41	37.75	37.50	38.00	37.41
	Rotterdam	A	29.78	40.00	50.83	46.96	29.75	28.75	27.04	25.25
		B	22.13	28.00	34.38	36.50	-	-	-	-
	St. Lawrence	A	29.50	40.77	50.16	45.52	27.50	31.55	31.55	30.72
	U.S. Gulf	A	31.20	40.75	51.94	46.00	25.81	27.75	27.75	27.75
China	Argentina	A	30.38	41.31	43.35	41.19	35.05	30.00	30.79	31.67
	E. Australia	A	17.38	33.00	32.29	23.13	16.71	17.88	18.35	14.50
	St. Lawrence	A	24.06	40.36	44.28	30.85	23.42	25.00	25.00	26.23
	U.S. Gulf	A	24.06	40.10	42.58	30.33	23.99	26.60	28.03	29.00
	N.W. Pacific	A	16.88	27.98	30.54	28.83	17.75	16.00	17.87	18.75
		B	8.94	22.69	28.92	27.25	16.50	15.00	14.77	11.19
Egypt	E. Australia	A	23.67	38.88	45.83	34.83	22.80	21.92	23.29	22.00
		B	-	47.00	41.36	32.50	19.92	20.67	21.33	20.42
	Rotterdam	A	23.00	26.67	30.00	29.25	19.00	18.75	18.75	18.06
		B	15.33	20.60	25.42	19.58	13.09	13.00	13.00	12.27
	U.S. Gulf	A	23.29	35.00	39.73	26.17	18.38	21.44	23.31	21.38
		B	15.75	18.13	35.15	22.98	14.17	19.27	18.47	14.77
Rotterdam	Argentina	A	22.67	32.79	30.79	28.43	17.88	14.88	18.50	18.80
		B	18.50	26.75	30.11	24.83	16.79	12.88	11.32	8.93
	St. Lawrence	A	11.14	16.67	-	11.50	8.96	9.67	10.70	8.79
		B	9.39	16.64	16.81	10.17	7.41	7.59	9.17	7.56
		C	7.42	14.16	14.92	8.63	5.89	7.23	8.70	7.04
	U.S. Gulf	A	11.82	17.25	-	12.60	10.88	11.75	12.60	10.88
		B	9.84	17.48	18.19	10.98	7.83	9.01	10.47	8.68
		C	8.93	16.74	16.71	9.65	7.55	8.46	9.10	6.71
India (East)	E. Australia	A	23.42	40.83	40.49	30.50	24.38	22.58	22.16	20.96
		B	20.90	37.33	38.83	28.81	20.41	20.58	20.20	17.63
	Rotterdam	A	28.53	39.00	50.83	45.83	28.09	28.17	27.93	27.53
		B	21.04	27.00	34.38	35.83	-	-	-	-
	U.S. Gulf	A	33.65	52.13	62.87	46.83	30.63	29.96	29.83	30.00
		B	22.25	39.39	43.51	38.53	26.29	26.50	26.33	26.50
	N.W. Pacific	A	29.20	55.58	51.92	41.46	28.00	30.13	30.12	30.25
		B	19.85	43.58	48.17	38.13	25.17	26.75	25.16	25.25
Japan	E. Australia	A	18.05	32.63	31.46	24.67	16.98	18.21	19.14	17.48
	U.S. Gulf	A	23.00	36.17	38.42	27.38	23.41	24.42	26.08	24.63
	N.W. Pacific	A	17.79	30.25	30.68	26.85	17.69	18.27	19.41	17.50
Morocco	U.S. Gulf	A	16.08	26.48	30.67	18.83	13.54	15.21	14.81	12.88
	Rotterdam	A	13.29	18.42	25.00	24.25	14.00	13.75	13.75	9.75
Pakistan	Argentina	A	22.51	32.92	46.41	43.29	33.75	33.50	33.91	34.17
	E. Australia	A	23.63	35.90	38.60	32.12	22.08	22.50	22.91	20.38
	Rotterdam	A	27.90	39.00	50.83	45.08	27.18	27.25	28.04	26.96
	St. Lawrence	A	26.65	39.92	39.29	39.21	32.83	34.00	34.00	33.17
	U.S. Gulf	A	28.58	40.75	52.19	44.52	29.54	29.25	29.40	29.40
		B	26.22	37.17	39.19	39.31	27.37	26.50	26.50	25.17
		C	-	28.00	30.19	31.25	24.91	24.42	24.50	17.96
	N.W. Pacific	A	22.67	46.08	56.17	43.63	28.66	29.00	29.16	29.25
		B	19.74	41.92	43.32	38.00	24.58	25.00	25.00	19.25
Philippines	E. Australia	A	-	32.29	28.25	20.38	15.62	16.50	18.29	16.75
	U.S. Gulf	A	21.25	40.29	54.27	39.33	27.50	28.56	29.79	30.00
	N.W. Pacific	A	19.86	35.75	33.29	28.08	17.70	15.75	20.41	15.28

Ocean Freight Rates for Wheat (Cont'd)

(July-June Year)

Destination	Source	Vessel Size 1/	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
			U.S. $/ton 2/							
USSR										
Baltic	St. Lawrence	A	13.33	19.90	24.38	17.42	11.27	9.33	9.66	9.13
	U.S.Gulf	A	13.54	20.90	23.35	17.75	12.22	11.19	11.81	9.88
Black Sea	Argentina	A	22.10	31.66	40.67	37.77	32.50	30.46	29.25	29.71
	St. Lawrence	A	14.99	26.59	27.08	19.75	13.45	13.83	14.16	12.88
	U.S. Gulf	A	15.98	27.68	27.75	20.40	15.20	19.21	19.86	17.93
Siberia	Argentina	A	28.58	37.33	42.42	42.00	36.25	36.00	36.50	37.17
	E. Australia	A	17.35	34.04	33.58	25.13	17.00	17.42	18.87	16.21
	U.S. Gulf	A	22.17	36.17	36.35	32.04	21.50	19.00	19.00	19.00
	N.W. Pacific	A	15.25	23.33	28.50	32.00	21.50	18.00	16.41	15.25

1/ In general, vessel size categories are as follows:

A = 10-25,000 tons
B = 25-50,000 tons
C = 50,000 tons or more

2/ Long ton through May 1985, metric ton thereafter

3/ U.S. Pacific Northwest and Western Canadian ports.

Source: World Wheat Statistics, 1987, International Wheat Council, London.

Published data on freight rates for vegetable oils are not readily available. We have consulted private trade sources to obtain information for vegetable oils.

Vegetable oils are shipped in tanker-type vessels. These same ships are used to transport a variety of liquid chemicals. The size of shipment varies widely for vegetable oils. For major importers, 20,000 ton shipments are fairly common. But many countries buy smaller quantities and there are numerous shipments in the 5-10,000 ton range.

In general, freight rates for 20,000 ton shipments of vegetable oils are about the same as those for grains using vessels in the 10-25,000 ton range. For example, over the past three years rates on 20,000 ton shipments of vegetable oil from the U.S. Gulf to Pakistan averaged about $28/ton compared to grain rates of slightly over $29/ton. Similarly, rates from the U.S. Gulf to Rotterdam averaged about $12/ton, about the same as for grain. Rates for vegetable oil shipments of about 5,000 tons generally average $10-$15/ton more than those for 20,000 ton cargoes. For example, grain rates for the U.S. Gulf to Egypt on 10-25,000 ton vessels have averaged about $22/ton in recent years while rates for vegetable oils in 5-10,000 ton cargoes averaged about $33/ton.

Using this information, one can derive freight rates for vegetable oils from those presented for grains.

C. Projected Freight Rates

We use the same methodology to derive projected ocean freight rates as we used earlier for commodities. The only long historical series is the one shown earlier for grain shipments from the St.Lawrence to Rotterdam. A trend is calculated for the 1970-85 period from this series and extrapolated to 1990 and 1995.

The next question is how to translate the projected changes in freight rates in either absolute or percentage terms from, say, 1985 into changes for other routes and for different sized vessels. This is not easy to do since ocean freight rates have changed by different amounts by route and vessel size. This is illustrated in the following table where we compare average rates for the 1978/79-1980/81 period with those for the 1983/84-1985/86 period for selected routes. These data come from the previous table. There are large differences in the absolute changes among routes and vessels. Changes also vary widely in percentage terms although most fall within the 25-40 percent range.

Several factors are responsible for this diverse behavior. One is relative changes in the demand for and supply of vessels of different sizes over time. Another is that some vessels are dedicated to specific route areas (e.g. the Pacific) and there may be long lags before owners are induced to move vessels to a different part of the world. Finally, the volume of traffic on a particular route is important, especially if it is large enough to book vessels for an extended period of time. Long-term booking of vessels usually results in lower rates.

Change in Ocean Freight Rates

Destination	Source	Vessel Size	1978/79-1980/81 Average	1983/84-1985/86 Average	Absolute Change	Relative Change
			-U.S.$/metric ton-			%
East Africa	U.S. Gulf	A	37.60	37.45	- .15	-
	N.W. Pacific	A	27.40	38.60	+11.20	+41
Rotterdam	Argentina	A	28.75	17.40	-11.35	-39
		B	25.10	10.05	-15.05	-60
	St.Lawrence	A	16.00	9.70	- 6.30	-40
		B	14.30	8.10	- 6.20	-43
		C	12.15	7,65	- 4.50	-37
	U.S. Gulf	A	15.50	11.75	- 3.75	-24
		B	15.15	9.40	- 5.75	-38
		C	14.10	8.10	- 6.00	-43
Pakistan	Argentina	A	33.95	33.85	- .10	-
	E. Australia	A	32.70	21.95	-10.75	-33
	Rotterdam	A	39.25	27.40	-11.85	-30
	St.Lawrence	A	35.30	33.70	- 1.60	- 5
	U.S.Gulf	A	40.50	29.35	-11.15	-28
		B	34.20	26.05	- 8.15	-24
	N.W. Pacific	A	41.65	29.15	-12.50	-30
		B	35.00	23.10	-11.90	-34
Philippines	U.S. Gulf	A	38.60	29.45	- 9.15	-24
	N.W. Pacific	A	29.65	17.15	-12.50	-42

In deriving border prices for specific countries, one should consult with ocean freight experts on the likelihood that future freight rates on specific routes may differ from the general average or from the changes projected for our base case rates for the St. Lawrence-Rotterdam route. In general, differential movements in freight rates will not exert a large influence on derived border prices for a particular commodity/country situation. In any event, where border prices are used to analyze either policies or projects in a country, the final decision is not likely to be greatly influenced by potential differences in ocean freight rates. Where they are, one can probably consider either the policy change or the project to be of marginal value.

Our basic long-term price series for ocean freight for grains from the St. Lawrence to Antwerp/Rotterdam/Amsterdam is shown in the following two figures in terms of both U.S. dollars per ton and as an index with 1985 as the base.

Ocean freight Rate Chart

Using the methodology described earlier, projected freight rates for 1990 and 1995 are shown in the following table. These projections indicate that from 1985, rates are expected to rise by 43 percent to 1990 and 63 percent to 1995. The rates projected to 1995 would be near the high levels of 1980.

Projected Ocean Freight Rates For Grain:
Vessel Size A, St. Lawrence to Rotterdam

	1980	1985	1990	1995
U.S. dollars/ton	16.10	9.80	14.00	16.05
Index(1985=100)	164	100	143	163

VI. Derived Country - Specific Border Prices

In this section we illustrate the derivation of border prices for two commodities and two countries -- wheat to Egypt and soybean oil to Pakistan.

A. Egypt:Wheat

Egypt generally buys winter wheats, particularly soft varieties. The price of soft red winter wheat averaged $118/metric ton at the U.S. Gulf in crop year 1986/87.

For purposes of calculating border prices one can assume that prices of different types of wheat will move together over longer periods of time. Thus, we would expect the U.S. Gulf price for soft red winter wheat to increase by 51 percent between 1987 and 1995 or be at $178/metric ton in 1995. This is the same projected rate of increase as shown earlier for Canadian spring wheat.

Egypt is a major wheat importer and most wheat would be shipped on B-sized vessels in the 25-50,000 ton range. We apply the projected percentage increase in ocean freight rates of 63 percent between 1985 and 1995 to the U.S. Gulf-Egypt route for B-sized vessels to get a landed price in Egypt for U.S. soft red winter wheat. These calculations together with data for 1987 are shown in the following table.

Egypt: Derived CIF Prices for SRW Wheat

	1987	1995
	----$/metric ton-----	
U.S. Gulf Price	118	178
Freight. 1/	15	24
CIF Egypt	133	202

1/ The 1985 freight rate is used for 1987. This is a good approximation since rates have been stable over the past few years.

B. Pakistan: Soybean Oil

Pakistan is a major importer of vegetable oils. It buys substantial amounts of soybean oil from the United States and other sources, and large amounts of palm oil from Malaysia. In calculating border prices for vegetable oil, we use the Dutch soybean oil price as a proxy for all vegetable oils. Note that our projected prices for both soybean oil and palm oil in Western Europe are identical, so using soybean oil to represent all oils is probably a sound approach. Of course palm oil prices in Pakistan would be several dollar per ton lower than in Western Europe due to lower freight costs.

In the 1986/87 crop year, Dutch soybean oil prices averaged $334/metric ton. Oil prices are expected to increase by 54 percent between 1987 and 1995, so that by 1995 the price would be $515/metric ton.

Pakistant typically buys oil in 20,000 ton cargoes and we use the freight rates for this vessel size. As in the previous example, a 63 percent increase in ocean freight rates is projected to 1995.

The 1995 price of soybean oil for Pakistan is shown below together with the 1987 price.

Pakistan: Derived CIF Prices for Soybean Oil

	1987	1995
	---$/metric ton---	
Dutch	334	515
Freight 1/	27	44
CIF Pakistan	361	559

1/ The 1985 freight rate is used for 1987. This is a good approximation since rates have been stable over the past few years.

VII. Conclusions

This paper describes a relatively simple methodology for projecting world prices of grains, oilseeds, and oilseed products to be used in calculating future border prices. The projected prices generated by this methodology compare favorably with the World Bank's latest price projections.

We use this same methodology in projecting ocean freight rates which are important in translating world market prices of commodities at selected world market locations into border prices for specific countries.

Finally, we illustrate how projected commodity prices and ocean freight rates can be combined to derive border prices for specific commodity/country situations.

Commodity prices and ocean freight rates are projected to rise through to 1995 from the depressed levels of 1986 and 1987. These projected increases reflect a recovery process in world agriculture under which world demand is catching up with world production capabilities. The projected price increases are in nominal terms and are not inconsistent with declining real commodity prices.

ANNEX A

WORLD GRAIN, OILSEED, AND OILSEED PRODUCT PRICES

U. S. WHEAT PRICES RECEIVED BY FARMERS

Crop Year	Winter	Durum	Hard Spring	All Wheat
	- - - - - - - - U.S.$/metric ton - - - - - - - -			
1959				65
1960				64
1961				67
1962				75
1963				68
1964				50
1965				50
1966				60
1967				51
1968				46
1969				46
1970				49
1971	50	48	48	49
1972	63	71	69	65
1973	137	226	157	145
1974	144	219	162	150
1975	124	171	146	131
1976	100	109	98	100
1977	84	99	90	86
1978	111	108	106	109
1979	139	160	132	139
1980	134	186	145	144
1981	135	137	137	136
1982	126	125	130	127
1983	126	146	137	129
1984	122	138	130	125
1985	109	118	124	113
1986	85	99	93	89
1987 Est.	95	118	100	97

1/ Crop year begins in the year shown.

Source: Agricultural Prices, U.S. Department of Agriculture, various years.

U. S. WHEAT EXPORT PRICES

Crop Year 1/	#1 HRW Gulf	#2 SRW Gulf	#2 White PNW	#2 NS Duluth
	- - - - - - - U.S$/metric ton - - - - - -			
1960	80			
1961	83			
1962	87			
1963	83			
1964	64			
1965	67			
1966	74			
1967	68			
1968	56			
1969	57			
1970	63			
1971	64			
1972	94			
1973	178			
1974	164	160	167	186
1975	149	133	145	164
1976	115	108	116	123
1977	110	101	116	106
1978	135	136	140	124
1979	171	164	161	159
1980	178	171	166	172
1981	170	143	157	161
1982	160	128	165	152
1983	153	140	148	159
1984	148	139	141	150
1985	130	126	134	144
1986	108	111	108	113
1987 Est.	118	116	113	115

1/ Crop year begins in the year shown.

Source: Grain and Feed Market News, U.S. Department of Agriculture, various issues.

WORLD WHEAT PRICES

Calendar Year	F.O.B. Australia ASW	FOB Canada Thunder Bay #1CWRS 13.5%	CIF Rotterdam #2 14% DNS	FOB Argentina Buenos Aires
	-U.S.$/metric ton-			
1959	55	64		
1960	56	63		62
1961	55	65		61
1962	60	69		60
1963	55	73		62
1964	61	74		52
1965	57	73		51
1966	60	71	70	59
1967	61	76	72	N A
1968	58	73	68	55
1969	61	71	67	58
1970	52	60	N A	54
1971	56	74	N A	59
1972	59	79	74	64
1973	75	96	116	N A
1974	174	199	204	176
1975	168	179	174	147
1976	144	162	162	128
1977	113	116	126	100
1978	119	134	147	126
1979	142	171	186	159
1980	176	192	213	203
1981	175	194	210	190
1982	160	165	195	206
1983	161	169	185	138
1984	153	166	180	135
1985	141	173	169	106
1986	120	161	148	88
1987	115	136	141	88

Source: Economic Research Service, U.S. Department of Agriculture.

THAI RICE PRICE

Calendar Year	5% Brokens F.O.B.Bangkok (U.S. $/metric ton)
1959	132
1960	125
1961	136
1962	153
1963	143
1964	138
1965	136
1966	163
1967	206
1968	202
1969	187
1970	144
1971	129
1972	147
1973	350
1974	542
1975	363
1976	254
1977	272
1978	367
1979	334
1980	434
1981	483
1982	293
1983	277
1984	252
1985	216
1986	211
1987 Est.	229

Source: Economic Research Service, U.S. Department of Agricuture.

U. S. CORN PRICES

Crop Year 1/	U.S. #2 Yellow FOB Gulf Ports	U.S. #2 Yellow Chicago Cash	U.S. Price Received by Farmers
	-U.S.$/metric ton		
1959			41
1960			43
1961	48		44
1962	53		44
1963	55		44
1964	56		46
1965	56		46
1966	57		49
1967	48		41
1968	51		43
1969	56		46
1970	61		52
1971	53	48	43
1972	85	72	62
1973	122	116	100
1974	128	125	119
1975	115	109	100
1976	98	94	85
1977	98	88	80
1978	110	98	89
1979	119	108	99
1980	139	135	122
1981	111	104	102
1982	124	117	106
1983	143	136	128
1984	117	110	103
1985	99	93	93
1986	72	65	59
1987 Est.	83	73	70

1/ Crop year begins in the year shown.

Source: Agricultural Prices and Grain and Feed Market News, U.S. Department of Agriculture, various issues.

WORLD CORN PRICES

Calendar Year	U.S.#3 Yellow CIF Rotterdam	Thai Export Price
	U.S.$/metric ton	
1959		50
1960		50
1961		50
1962		51
1963		54
1964		58
1965		58
1966		60
1967		60
1968		51
1969	61	55
1970	71	65
1971	65	65
1972	65	59
1973	110	54
1974	149	104
1975	133	133
1976	123	133
1977	105	115
1978	114	106
1979	136	99
1980	151	137
1981	150	162
1982	122	149
1983	148	139
1984	150	137
1985	126	102
1986	101	88
1987	90	57

Source: Economic Research Service, U.S. Department of Agriculture.

U.S. SORGHUM PRICES

Crop Year 1/	Prices Received by Farmers	#2 Yellow Kansas City	U.S. #2 Yellow Gulf Ports
	- - - - - - - - - - - - - U.S.$/metric ton - - - - - - - - - - - - -		
1959	34		47
1960	33		46
1961	33		45
1962	40		46
1963	39		48
1964	41		48
1965	39		48
1966	40		52
1967	39		48
1968	37		48
1969	42		51
1970	45		57
1971	41	45	53
1972	54	67	82
1973	84	100	112
1974	109	113	121
1975	93	99	109
1976	80	80	91
1977	72	77	92
1978	79	86	103
1979	92	100	122
1980	116	121	136
1981	94	95	110
1982	99	106	122
1983	117	115	125
1984	94	98	106
1985	90	82	90
1986	54	60	71
1987 Est.	67	66	78

1/ Crop year begins in the year shown

Source: Agricultural Prices and Grain and Feed Market News, U.S. Department of Agriculture, various issues.

WORLD SOYBEAN PRICES

Calendar/Crop Year 1/	U.S. Farm Price (Crop Year)	Illinois Processor (Crop Year)	CIF Rotterdam (Calendar Year)
	U.S./metric ton		
1959	72		94
1960	78		92
1961	84		111
1962	86		100
1963	92		110
1964	96		110
1965	93		117
1966	101		126
1967	91		112
1968	89		106
1969	86		103
1970	105	112	117
1971	111	121	126
1972	161	230	140
1973	209	225	290
1974	244	232	277
1975	181	194	220
1976	250	269	231
1977	216	226	280
1978	245	261	268
1979	231	239	298
1980	278	282	296
1981	222	230	288
1982	209	225	245
1983	287	289	282
1984	212	220	282
1985	185	194	224
1986	171	189	208
1987 Est.	224	239	216

1/ Crop year begins in the year shown.

Source: Agricultural Prices and Grain and Feed Market News, U.S. Department of Agriculture, various issues.

WORLD SOYBEAN MEAL PRICES

Calendar/Crop Year 1/	U.S. Decatur (Crop Year)	U.S. Soymeal CIF Rotterdam (Calendar Year)
	U.S.$/metric ton	
1959	56	73
1960	61	78
1961	64	81
1962	71	89
1963	71	91
1964	72	89
1965	82	73
1966	79	86
1967	77	85
1968	74	98
1969	78	95
1970	78	103
1971	90	102
1972	229	129
1973	146	303
1974	131	184
1975	148	155
1976	200	198
1977	164	230
1978	190	213
1979	182	243
1980	218	259
1981	183	253
1982	187	218
1983	188	238
1984	125	197
1985	155	157
1986	162	185
1987 Est.	210	203

1/ Crop year begins in the year shown.

Source: Grain and Feed Market News, U.S. Department of Agriculture, various issues.

WORLD VEGETABLE OIL PRICES

Calendar/Crop Year 1/	U.S. Soybean Oil Decatur (Crop Year)	Soybean Oil FOB Rotterdam (Calendar Year)	Palm Oil Malaysia (Calendar Year)	Palm Oil NW Europe (Calendar Year)	Rape Oil FOB Dutch mills (Calendar Year)
	---------- U.S. $/metric ton ----------				
1959	183	235	216	240	
1960	249	224	203	224	
1961	209	287	211	228	
1962	196	227	198	210	
1963	187	224	196	218	
1964	249	233	210	234	
1965	260	270	245	273	
1966	223	262	212	234	
1967	185	217	200	223	
1968	183	178	142	168	
1969	242	197	140	185	
1970	284	286	215	260	280
1971	251	304	217	262	295
1972	355	241	185	217	232
1973	690	436	239	376	410
1974	677	832	500	691	745
1975	403	563	473	420	551
1976	527	438	357	397	415
1977	540	580	511	530	584
1978	600	607	532	600	597
1979	636	662	594	654	636
1980	500	598	530	583	571
1981	418	507	491	571	483
1982	455	447	417	445	417
1983	674	527	438	501	499
1984	651	725	651	729	687
1985	265	576	494	501	540
1986	339	342	270	257	307
1987 Est.	476	334	320	343	310

1/ Crop year begins in the year shown.

Source: Economic Research Service, U.S. Department of Agriculture.