

**Baseline Projections, Yield Impacts and Trade
Liberalization Impacts for Soybeans, Wheat,
and Feed Grains: A FAPRI Trade Model Analysis**

by

William H. Meyers, S. Devadoss, and Michael Helmar*

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* Authors are Professor, Post-doctoral Research Associate, and Research Associate, Trade and Agricultural Policy Section, Center for Agricultural and Rural Development, Iowa State University, Ames, Iowa. The authors gratefully acknowledge Judith Gildner for editorial assistance and Pat Westhoff for review comments.

Introduction

The FAPRI models were developed to quantify trade and policy interactions among the major importing and exporting regions of the world. They are intended primarily for use in making intermediate-term projections and conducting policy impact analysis. Thus, they are relatively small, partial equilibrium models but incorporate the most basic supply, demand, price, and policy variables in these sectors.

A dynamic nonspatial equilibrium approach is used for these trade models. Net imports and exports are determined in the model but not trade flows between specific regions. The net demands of importers (EDT) less the net supplies of other exporters (ESO) is the net excess demand facing the U.S. market (EDN). The necessary components of this model are detailed in the following equations:

$$\begin{aligned}
 (1) \quad EDT &= \sum DM_i - \sum SM_i = \sum f_i(P_i, X_i) - \sum h_i(P_i, Z_i) && i = 1, \dots, n \text{ Importers} \\
 (2) \quad ESO &= \sum SX_j - \sum DX_j = \sum h_j(P_j, Z_j) - \sum f_j(P_j, X_j) && j = 1, \dots, m \text{ Exporters} \\
 (3) \quad ESUS &= h_u(P_u, Z_u) - f_u(P_u, X_u) && \text{United States Exports} \\
 (4) \quad ESUS &= EDT - ESO && \text{World Market Equilibrium} \\
 (5) \quad P_i &= P_u e_i + M_i && i = 1, \dots, n \\
 (6) \quad P_j &= P_u e_j + M_j && j = 1, \dots, m
 \end{aligned}$$

where

DM = importer demand
 DX = exporter demand
 e = exchange rate
 M = trade margin (transport cost, tariff, subsidy, etc.)
 P = domestic price
 SM = importer supply
 SX = exporter supply
 X = vector of demand shifters
 Z = vector of supply shifters

A descriptive econometric approach is employed in the structural specification, so there are few constraints imposed in estimation of the models. The functional form is generally linear. In most regions the internal supply and demand functions are the structural components. Detailed validation statistics for each model have been reported in the documentation reports (1, 2, and 3).

Baseline Projections

The projections of some important macroeconomic variables, such as gross national products of different regions, exchange rates, and interest rates, were obtained from Wharton Econometric Forecasting Associates. They imply that the U.S. dollar will depreciate slowly and slow economic growth in the United States will continue. Most of the Latin American economies will experience recovery; and East Asian countries such as South Korea, Taiwan, and Singapore will have high economic growth.

Any long-term outlook of world commodity markets requires some explicit assumptions about farm policies, especially U.S. farm policies. While several options are considered for the new farm bill, we are assuming that a program will be adopted that will allow prices to fall below current loan rates. Support prices and acreage reduction programs will continue to exist.

The baseline projections for some key variables of the soybean sector are reported in Table 1. U.S. soybean production shows a sharp decline from 57.6 million MT (MMT) in 1985/86 to 52.9 MMT in 1986/87, a decrease of 8.2 percent, mainly due to acreage reduction. Crush is expected to increase slowly from 29.3 MMT in 1985/86 to 31.0 MMT in 1989/90. U.S. soybean exports and projected to grow during this period, reflecting the effects of the weak dollar and decline in the U.S. prices.

TABLE 1. SOYBEAN BASELINE FORECAST AND IMPACT % CHANGES

YEAR	1985/86	1986/87	1987/88	1988/89	1989/90
=====					
UNITED STATES	(THOUSAND METRIC TONS)				
BEAN PRODUCTION (BASE)	57643	52907	51873	52526	53043
1-YR YIELD IMPACT (%)	-5.0	2.6	0.1	-0.6	-0.3
5-YR YIELD IMPACT (%)	-5.0	-2.3	-2.9	-3.1	-3.3
TRADE IMPACT (%)	0.0	-1.2	-2.7	-3.8	-4.3
END STOCKS (BASE)	16139	16819	15241	13336	11839
1-YR YIELD IMPACT (%)	-4.4	-0.1	0.3	-0.2	-0.3
5-YR YIELD IMPACT (%)	-4.4	-4.1	-4.1	-4.8	-5.6
TRADE IMPACT (%)	0.8	1.1	1.0	0.5	0.0
CRUSH (BASE)	29338	30264	30808	30917	31026
1-YR YIELD IMPACT (%)	-1.7	1.7	0.0	-0.2	0.0
5-YR YIELD IMPACT (%)	-1.7	0.0	0.0	-0.2	-0.2
TRADE IMPACT (%)	0.4	0.1	0.0	0.0	0.2
BEAN EXPORTS (BASE)	18289	19486	20221	21038	21065
1-YR YIELD IMPACT (%)	-9.1	0.9	0.0	-1.0	-0.7
5-YR YIELD IMPACT (%)	-9.1	-7.0	-6.3	-6.9	-7.4
TRADE IMPACT (%)	-1.4	-3.8	-6.8	-9.2	-10.8
MEAL EXPORTS (BASE)	4568	5270	5478	6008	6425
1-YR YIELD IMPACT (%)	7.1	2.7	-0.7	0.1	0.5
5-YR YIELD IMPACT (%)	7.1	8.4	6.9	6.4	6.8
TRADE IMPACT (%)	-5.4	-8.7	-9.6	-6.6	-4.4
	(DOLLARS/BUSHEL)				
BEAN FARM PRICE (BASE)	5.29	5.15	5.24	5.34	5.65
1-YR YIELD IMPACT (%)	11.0	-5.6	-0.5	-0.8	0.5
5-YR YIELD IMPACT (%)	11.0	5.2	4.4	5.4	5.8
TRADE IMPACT (%)	-4.2	-5.1	-4.7	-3.2	-2.5
	(DOLLARS/SHORT TON)				
MEAL PRICE (DECATUR) (BASE)	133	140	142	145	156
1-YR YIELD IMPACT (%)	14.5	-5.0	-0.7	0.8	0.7
5-YR YIELD IMPACT (%)	14.5	8.2	7.0	7.9	8.4
TRADE IMPACT (%)	-6.9	-9.4	-9.8	-7.5	-5.8
	(MILLION DOLLARS)				
VALUE BEAN EXPORTS (BASE)	3737	3879	4099	4338	4601
1-YR YIELD IMPACT (%)	0.7	-4.8	-0.6	-0.3	-0.2
5-YR YIELD IMPACT (%)	0.7	-2.2	-2.2	-1.9	-2.0
TRADE IMPACT (%)	-5.4	-8.7	-11.2	-12.1	-134.1
VALUE MEAL EXPORTS (BASE)	671	812	866	962	1104
1-YR YIELD IMPACT (%)	22.8	-2.5	-1.5	0.8	1.2
5-YR YIELD IMPACT (%)	22.8	17.2	14.4	14.8	15.8
TRADE IMPACT (%)	-11.9	-17.3	-18.4	-13.5	-10.0
=====					

TABLE 1. SOYBEAN BASELINE FORECAST AND IMPACT % CHANGES

YEAR	1985/86	1986/87	1987/88	1988/89	1989/90
=====					
(THOUSAND METRIC TONS)					
BRAZIL					
BEAN EXPORTS (BASE)	2578	2534	2451	2441	2525
1-YR YIELD IMPACT (%)	7.8	0.6	2.4	3.9	1.2
5-YR YIELD IMPACT (%)	7.8	6.1	7.0	9.3	8.4
TRADE IMPACT (%)	19.7	30.9	38.9	43.5	44.4
MEAL EXPORTS (BASE)	7860	7846	7917	7992	7964
1-YR YIELD IMPACT (%)	-2.0	0.6	0.2	0.0	-0.1
5-YR YIELD IMPACT (%)	-2.0	-0.8	-0.4	-0.4	-0.5
TRADE IMPACT (%)	-5.5	-8.0	-9.3	-9.6	-9.7
ARGENTINA					
BEAN EXPORTS (BASE)	2917	2976	2908	2810	2663
1-YR YIELD IMPACT (%)	1.3	1.1	1.5	1.9	1.1
5-YR YIELD IMPACT (%)	1.3	2.1	3.0	4.2	4.5
TRADE IMPACT (%)	0.0	0.1	0.2	0.0	0.0
MEAL EXPORTS (BASE)	2736	3042	3193	3328	3438
1-YR YIELD IMPACT (%)	-0.9	-0.1	-0.1	-0.1	-0.1
5-YR YIELD IMPACT (%)	-0.9	-0.8	-0.6	-0.5	-0.5
TRADE IMPACT (%)	-0.1	-0.1	-1.0	-1.2	-1.4
WORLD					
BEAN NET IMPORTS (BASE)	23780	25003	25581	26289	26254
1-YR YIELD IMPACT (%)	-6.0	0.9	0.4	-0.3	-0.3
5-YR YIELD IMPACT (%)	-6.0	-4.6	-4.0	-4.2	-4.7
TRADE IMPACT (%)	1.0	0.2	-1.6	-3.3	-4.4
MEAL NET IMPORTS (BASE)	15164	16158	16628	17328	17827
1-YR YIELD IMPACT (%)	0.9	1.1	-0.1	0.0	0.1
5-YR YIELD IMPACT (%)	0.9	2.2	2.0	2.0	2.1
TRADE IMPACT (%)	-4.5	-6.8	-7.8	-7.0	-6.2
=====					

Brazilian soybean production is projected to increase 6 percent, as Brazil is expected to experience substantial competition from the United States as a result of the lower dollar value and reduced prices. Brazilian crush demand hovers around 13.3 MMT. Argentina soybean production is projected to increase from 7 MMT in 1985/86 to 7.7 MMT in 1988/89 due to increases in area harvested. Soybean crush is projected to increase, while exports decline slowly to 2.7 MMT in 1989/90.

The crush demand in the EC remains stable over the projection period. The crush and import demands of Spain show modest increases over the projection period. The Japanese crush demand increased from 4 MMT in 1985/86 to 4.6 MMT in 1989/90, a 15 percent increase, and soybean imports increase accordingly. World trade of soybeans is expected to continue increasing as developing countries as they attempt to improve diets with meat and poultry.

U.S. soymeal utilization projections remain stable, except for the last two years of the projection period. A modest decline in utilization is expected in 1988/89 and 1989/90 in response to higher prices. Exports of soymeal are expected to expand sharply from 4.6 MMT in 1985/86 to 6.4 MMT in 1989/90.

Brazilian domestic use of soymeal increases from 2.2 MMT in 1985/86 to 2.7 MMT in 1989/90, while Brazilian exports remain stable. Argentine soymeal exports increase rapidly as Argentine crush expands.

Over the projection period, EC domestic consumption of meal increases from 15.0 MMT in 1985/86 to 16.3 MMT 1989/90, and the net imports of soymeal increase significantly. World trade of meal is expected to increase from 15.2 MMT to 17.8 MMT.

Wheat Baseline Projections

Wheat trade is the largest in the international trade markets of grains, with nearly 94 million metric tons of net trade in 1983/84. The U.S., Canada, Australia, and EC are the major exporters of wheat. The major importing countries are the U.S.S.R., China, Japan, and middle eastern countries. The baseline projections from 1985/86 to 1989/90 are reported in Table 2.

The projections show U.S. production increasing from 66.9 MMT in 1985/86 to 69.5 MMT in 1989/90 with U.S. exports growing. The increased exports are due to a weaker dollar and lower U.S. price resulting from an anticipated reduction in support prices from the new farm bill. The wheat price in 1983/84 was \$137.9 per MT and is projected to be \$112.8 per MT in 1989/90, a decrease of 18.2 percent. This decline in the wheat price leads to stock accumulation and increased domestic use in the projection period.

Canada produced 20.8 MMT in 1985/86, and production increases over the projection period. Canadian exports for the last three years of the projection period hover around 19.2 MMT. Canadian wheat prices, similar to U.S. wheat prices, decline from 1985/86 to 1987/88 and surge in 1989/90. Net exports for Australia are fairly stable. Production increases from 17.7 MMT in 1985/86 to 19.3 MMT in 1986/87.

EC production projections show a modest increase in wheat production from 68.6 MMT in 1985/86 to 70.1 MMT in 1989/90. EC exports exhibit a positive trend, increasing from 13.7 MMT to 15.3 MMT, an increase of 11.7 percent. This increase in EC exports may be attributed to the fact that the EC heavily subsidizes the wheat exports.

Indian production and food use have increased significantly over the projection period. In fact, the green revolution in the Indian agriculture has caused that country to become a net exporter in recent years.

TABLE 2. WHEAT BASELINE FORECAST AND IMPACT % CHANGES

YEAR	1985/86	1986/87	1987/88	1988/89	1989/90
=====					
UNITED STATES	(MILLION METRIC TONS)				
PRODUCTION (BASE)	66.76	68.71	68.96	68.25	69.32
1-YR YIELD IMPACT (%)	-5.0	1.1	1.9	0.2	-1.0
5-YR YIELD IMPACT (%)	-5.0	-3.9	-2.1	-1.6	-2.5
TRADE IMPACT (%)	0.0	2.3	5.1	7.6	9.0
END STOCKS (BASE)	46.07	53.44	57.17	56.08	54.01
1-YR YIELD IMPACT (%)	-5.5	-1.1	1.4	1.0	-0.3
5-YR YIELD IMPACT (%)	-5.5	-6.0	-4.4	-3.1	-3.2
TRADE IMPACT (%)	-2.8	-3.4	-3.3	-2.7	-1.4
FEED USE (BASE)	7.27	7.24	8.52	9.44	8.82
1-YR YIELD IMPACT (%)	-9.0	-12.8	3.5	6.3	1.5
5-YR YIELD IMPACT (%)	-9.0	-22.0	-15.9	-8.1	-6.2
TRADE IMPACT (%)	-19.3	-34.5	-39.9	-39.2	-39.0
EXPORTS (BASE)	31.95	33.18	35.54	38.46	40.9
1-YR YIELD IMPACT (%)	-0.4	-0.8	-0.9	-0.8	-0.1
5-YR YIELD IMPACT (%)	-0.4	-1.3	-2.2	-2.9	-2.9
TRADE IMPACT (%)	8.5	13.9	20.0	22.4	22.2
FARM PRICE (BASE)	3.09	2.9	2.72	2.8	3.07
1-YR YIELD IMPACT (%)	4.9	9.3	-2.6	-5.4	-1.0
5-YR YIELD IMPACT (%)	4.9	13.1	11.8	6.4	4.2
TRADE IMPACT (%)	10.7	20.7	30.1	31.8	26.8
VALUE OF EXPORTS (BASE)	3628	3535	3552	3956	4614
1-YR YIELD IMPACT (%)	4.4	8.4	-3.5	-6.1	-1.1
5-YR YIELD IMPACT (%)	4.4	11.7	9.4	3.4	1.2
TRADE IMPACT (%)	20.0	37.2	60.0	61.3	54.9
VALUE OF PRODUCTION (BASE)	7579	7322	6892	7022	7819
1-YR YIELD IMPACT (%)	-0.4	10.5	-0.7	-5.2	-1.9
5-YR YIELD IMPACT (%)	-0.4	8.7	9.4	4.7	1.6
TRADE IMPACT (%)	10.9	23.5	36.8	42.2	34.9
=====					

TABLE 2. WHEAT BASELINE FORECAST AND IMPACT % CHANGES

YEAR	1985/86	1986/87	1987/88	1988/89	1989/90
=====					
(MILLION METRIC TONS)					
CANADA					
EXPORTS (BASE)	17.12	18.35	19.15	19.23	19.28
1-YR YIELD IMPACT (%)	0.5	1.5	2.1	1.7	0.1
5-YR YIELD IMPACT (%)	0.5	2.0	4.1	5.9	6.2
TRADE IMPACT (%)	0.2	0.9	1.5	2.3	2.9
AUSTRALIA					
EXPORTS (BASE)	15.53	15.7	16.23	16.06	15.93
1-YR YIELD IMPACT (%)	0.2	0.1	-0.3	-0.1	0.1
5-YR YIELD IMPACT (%)	0.2	0.3	0.0	-0.1	0.0
TRADE IMPACT (%)	0.5	0.4	0.4	0.2	0.1
WORLD					
NET IMPORTS (BASE)	85.92	90.06	93.99	97.23	99.34
1-YR YIELD IMPACT (%)	0.0	0.0	0.0	0.0	0.0
5-YR YIELD IMPACT (%)	0.0	0.0	0.0	0.0	0.0
TRADE IMPACT (%)	0.6	1.2	1.6	2.2	2.3
=====					

Japan's net import hovers around 5.3 MMT. The Soviet Union is expected to increase its wheat imports about 5.6 percent from 1985/86 to 1989/90. World trade will increase from 84.7 MMT in 1985/86 to 98.1 MMT in 1989/90, a 12.6 percent increase. This increase in trade is largely attributed to a declining trend in the wheat price.

Feed Grains Baseline Projections

Table 3 summarizes the projected results of the feed grains model. The feed grains model comprises corn, sorghum, barley, and oats. The major crops of different regions are selected for reporting the projection results. For net trade, however, the projected values of total feed grains are presented.

U.S. corn production is expected to decline by 7.7 percent from 219.6 MMT in 1985/86 to 202.8 MMT in 1989/90. This production decline is due mainly to acreage reduction. The decline in prices results in increased demand for corn food and feed use and for exports over the projection period.

For Canada, corn and barley are modeled. Both corn and barley production show modest increases over the projection period. Canadian domestic consumption of corn and barley together increase from 13.8 MMT in 1985/86 to 15.1 MMT in 1989/90. Canadian feed grain exports increase from 8.5 MMT in 1985/86 to 9.9 MMT in 1989/90, a 16.7 percent increase.

Barley is the major commodity modeled for Australia. Barley production in Australia shows a modest declining trend, whereas consumption exhibits a modest increasing trend. Net exports of feed grains are projected to decline from 3.2 MMT in 1985/86 to 2.7 MMT in 1989/90, a 15.6 percent decrease.

For Argentina, corn and sorghum are modeled as an aggregate. Production, consumption, and net exports of corn and sorghum together increase over the projection period. As in the case of Argentina, corn and sorghum in Thailand are modeled together. Domestic consumption of corn and sorghum in Thailand

TABLE 3. FEED GRAINS BASELINE FORECAST AND IMPACT % CHANGES

YEAR	1985/86	1986/87	1987/88	1988/89	1989/90
=====					
UNITED STATES	(MILLION METRIC TONS)				
PRODUCTION (BASE)	219.6	204.2	203.3	202.2	202.8
1-YR YIELD IMPACT (%)	-4.9	0.3	0.1	0.0	0.0
5-YR YIELD IMPACT (%)	-4.9	-4.0	-3.8	-3.8	-3.8
TRADE IMPACT (%)	0.0	0.0	0.1	0.2	0.2
END STOCKS (BASE)	74.9	84.1	92.5	100.1	101.8
1-YR YIELD IMPACT (%)	-4.1	0.0	0.1	0.5	0.0
5-YR YIELD IMPACT (%)	-4.1	-2.9	-2.4	-2.1	-2.2
TRADE IMPACT (%)	-0.6	-1.2	-1.4	-1.3	-1.2
FEED USE (BASE)	106.9	114.7	115.3	113.1	117.9
1-YR YIELD IMPACT (%)	-5.5	0.0	0.2	0.1	0.0
5-YR YIELD IMPACT (%)	-5.5	-4.1	-3.8	-3.9	-3.7
TRADE IMPACT (%)	-0.8	-1.7	-2.1	-2.4	-2.0
FOOD USE (BASE)	22.6	23.6	24.5	25.3	26
1-YR YIELD IMPACT (%)	-1.9	0.0	0.1	0.0	0.0
5-YR YIELD IMPACT (%)	-1.9	-1.4	-1.2	-1.2	-1.1
TRADE IMPACT (%)	-0.3	-0.6	-0.7	-0.7	-0.6
EXPORTS (BASE)	53.8	56.8	55.2	56.3	57.2
1-YR YIELD IMPACT (%)	-2.6	-4.7	-0.2	0.0	0.0
5-YR YIELD IMPACT (%)	-2.6	-6.6	-5.8	-5.5	-5.3
TRADE IMPACT (%)	2.7	4.7	5.6	5.9	4.9
FARM PRICE (BASE)	2.48	2.22	2.09	2.15	2.31
1-YR YIELD IMPACT (%)	24.3	-0.2	-1.0	-0.5	-0.2
5-YR YIELD IMPACT (%)	24.3	22.5	23.0	22.7	22.6
TRADE IMPACT (%)	3.6	8.0	10.6	12.0	11.3
VALUE OF EXPORTS (BASE)	5255.5	4959.9	4538.2	4763.1	5197.4
1-YR YIELD IMPACT (%)	21.1	-4.8	-1.2	-0.5	-0.2
5-YR YIELD IMPACT (%)	21.1	14.4	15.8	15.9	16.1
TRADE IMPACT (%)	6.3	14.3	19.0	21.0	17.9
VALUE OF PRODUCTION (BASE)	21442.9	17845.3	16726.1	17118.6	18442.7
1-YR YIELD IMPACT (%)	18.2	0.1	-0.9	-0.5	-0.2
5-YR YIELD IMPACT (%)	18.2	27.3	27.7	27.3	27.3
TRADE IMPACT (%)	3.5	9.3	12.8	14.4	12.6
=====					

TABLE 3. FEED GRAINS BASELINE FORECAST AND IMPACT % CHANGES

YEAR	1985/86	1986/87	1987/88	1988/89	1989/90
=====					
(MILLION METRIC TONS)					
ARGENTINA					
CORN/SORGHUM EXPORTS (BASE)	12.1	13.1	13	13.2	13.7
1-YR YIELD IMPACT (%)	2.3	1.6	0.5	0.2	0.0
5-YR YIELD IMPACT (%)	2.3	3.3	3.6	3.5	3.5
TRADE IMPACT (%)	1.0	1.2	4.8	3.3	2.5
CANADA					
CORN/BARLEY EXPORTS (BASE)	8.5	6.6	8.8	9.3	9.9
1-YR YIELD IMPACT (%)	1.8	28.9	0.2	0.7	0.3
5-YR YIELD IMPACT (%)	1.8	30.7	18.6	16.6	15.1
TRADE IMPACT (%)	0.3	5.1	7.8	9.3	9.3
AUSTRALIA					
BARLEY EXPORTS (BASE)	2.2	2	1.8	1.7	1.6
1-YR YIELD IMPACT (%)	18.2	13.7	7.7	4.4	2.3
5-YR YIELD IMPACT (%)	18.2	28.4	32.7	36.4	37.9
TRADE IMPACT (%)	2.8	8.1	13.2	18.1	19.8
THAILAND					
CORN/SORGHUM EXPORTS (BASE)	2.8	2.9	2.9	3	3.1
1-YR YIELD IMPACT (%)	1.1	5.7	0.1	0.2	0.1
5-YR YIELD IMPACT (%)	1.1	6.6	5.4	5.0	4.7
TRADE IMPACT (%)	0.2	1.2	2.3	2.8	2.9
WORLD					
NET IMPORTS (BASE)	90.5	93.1	96.2	99.2	102.32
1-YR YIELD IMPACT (%)	-0.6	-0.1	0.1	0.2	0.1
5-YR YIELD IMPACT (%)	-0.6	-0.5	-0.4	-0.3	-0.3
TRADE IMPACT (%)	0.1	0.2	0.2	0.2	0.2
=====					

remain stable at 1.3 MMT over the projection period. The production of corn and sorghum increases from 4.0 MMT in 1985/86 to 4.4 MMT in 1989/90. This increase in production is absorbed by increasing exports.

EC corn and barley are modeled separately, since they are major feed grains in the EC. Corn is an import crop, whereas barley is an export crop. EC corn imports are expected to decrease from 4.8 MMT in 1985/86 to 3.9 MMT in 1989/90. The decline in corn imports will be offset by the increase in corn production. Barley net exports show a sharp increase of 32.1 percent.

Spain's corn consumption and net exports exhibit modest increases over the projection period. Japan is a major feed grains importer. Japan's corn and sorghum imports increase 15 percent from 20 MMT in 1985/86 to 23 MMT in 1989/90, a 15 percent increase.

U.S. Yield Impact Analysis

Analysis of the impacts of yield or production shocks provides valuable information about the dynamic behavior of a model. An important objective of the U.S. yield impact analysis is to reveal the U.S. export response behavior. We report both the one period shock and the multi-period shock impacts so that the short and medium-term export response can be evaluated. All yield impacts are conducted holding government stocks and acreage reductions constant. This makes all price impacts larger than they would be under current conditions when government stock programs absorb much of the yield variation impact.

The one-period yield impact analysis was conducted by reducing U.S. yield by 5 percent in the first year (1985/86) only and comparing the resulting 5-year simulation to the baseline. The multi-period yield impact was conducted by reducing yield by five percent from 1985/86 to 1989/90.

Soybean Yield Impacts

In the first year of the yield impact, nearly 60 percent of the production loss is absorbed by declining exports and the remaining is about equally divided between crush and ending stocks. A production shortfall in soybeans increases prices of soymeal and soyoil as well as soybeans, but the net effect is a decline in crushing margins. Thus, imports of meal increase while soybean imports fall. Brazil and Argentina gain part of the soybean market lost to the United States, but increasing U.S. meal exports partially offset its soybean export decline. Soybean prices increase by 11 percent, implying a short-run reduced-form flexibility of about two. Soybean exports decline by 9.1 percent, giving a short-run response elasticity of -0.83 relative to price. Over the four-year period after the initial shock the results quickly converge toward the baseline values.

When yield is reduced by 5 percent every year, it is possible to evaluate the long-run adjustments that occur. The price impacts are dampened over time to 5 or 6 percent, as production in the U.S. and other countries respond to continually higher prices. The change in total soybean supply (production) in the first year is -2.8 million tons (-105 million bushels), compared with -2.3 million tons (-80 million bushels), including production plus beginning stocks, in the last two years. The leftward shift in the export demand schedule can be seen in the result that in the last year the export adjustment absorbs 66 percent of the supply reduction. This shift, in addition to the direct price effect, leads to a 7.4 percent decline in exports associated with a 5.8 percent increase in price. As expected, the export response to price changes as the length of time increases.

Wheat Yield Impacts

In the first year, over 75 percent of the production loss is replaced by declining stocks, and a mere 4 percent comes from exports. Wheat price increases by nearly 5 percent, implying a short-run, reduced-form flexibility of about one. The short-run response elasticity of exports relative to price is less than -0.1, so the value of exports increases only slightly less than the price. The results quickly converge toward the baseline levels.

When yield is reduced every year, the large stock adjustments cause even larger supply impacts in the later years than that in the first year. Thus, the price impacts increase in the second and third years before declining. Gradually, Canada's export responds to the higher prices and the U.S. export impact increases. By the last year over 30 percent of exports are lost due to the supply reduction. An export decline of 2.9 percent is associated with a price increase of 4.2 percent. The implied export response elasticity is approaching -1 and could cross that magic threshold in one more year.

Feed Grains Yield Impacts

The yield impacts in the feed grains model are conducted by reducing U.S. corn yield, and are reported on the basis of the major feed grains in each country. In the first year, more than 50 percent of the production loss comes out of feed use, 28 percent out of stocks and less than 15 percent out of exports. Corn price increases by 24 percent, implying a reduced-form flexibility of nearly five. The short-run response elasticity of exports relative to prices is -0.06, and the second year's response is nearly twice as large. The results quickly converge toward the baseline levels.

The five-year yield reduction leads to supply (production plus beginning stocks) reductions every year of nearly the same magnitude as the first year. Price impacts decline and export impacts increase but not to the extent seen

in other commodities. By the last year, 30 percent of the supply loss is coming out of exports, 44 percent out of feed use, and 22 percent out of stocks. After the first year, the implied export response elasticity is in the $-.25$ to $-.30$ range. The exports of competitors are responding with substantial percentage increases, but the overall impact on the United States is small because their share of the market is relatively small.

Trade Liberalization Impacts

The impact of trade liberalization is evaluated by removing existing policies that inhibit the transmission of world market price variability to domestic markets. Specific changes to remove these barriers are defined for each model. The results do not reflect a complete trade liberalization, since not all commodities and countries are endogenous in these models. Internal policies that do not affect price transmission at the border are not altered.

Procedure and Results for Soybeans

Relatively few markets in the soybean sector are currently insulated from world price variability. The price and trade policies that are in this model include the high and fixed corn prices in the European Community and Spain, the Brazilian export tax rates which favor meal over beans, and the fixed domestic meal prices in Brazil. The fixed corn prices are replaced in the model by the Rotterdam corn price, which is linked to the U.S. corn price and exchange rates. The Brazilian meal price is permitted to fluctuate with world price changes, and the margins in the price linkages are reduced by the amount of the current tax rates (13 percent for beans and 11 percent for meal) times the baseline price levels.

A summary of the impacts of these changes indicates losses to the U.S. and Argentine soybean sectors, gains to the Brazilian soybean producers, and

losses to Brazil's crushing industry. The lower corn prices in the EEC and Spain reduce demand for soymeal and the beans from which meal is derived. This demand shift causes U.S. exports of soybeans and meal to fall and leads to lower soybean prices (-3 to -5 percent) and export values (-10 to -15 percent). Production falls by 3 to 5 percent in the United States and by less than 1 percent in Argentina.

Meal exports in Brazil also decline, but the expansion of soybean exports more than compensates for this loss. When the export taxes are removed, the policy bias toward meal exports is removed. Soybean exports respond, domestic soybean prices rise, and production increases. Soymeal prices, the crushing margin, and crush fall. By the last year of this analysis the value of production is 18 percent higher than the baseline and the total value of the bean and meal exports is 12 percent higher.

Overall, current grain policies in Europe benefit the soybean industry in exporting countries, and Brazil's export tax policies appear to be damaging to their own soybean industry.

Procedure and Results for Wheat

The wheat trade model includes many protected markets--the EC, India, Japan, U.S.S.R., China, and Eastern Europe. It must be assumed that the Central Planned Economies would not alter their domestic price insulation policies, so the EC, India, and Japan are the ones affected by the trade liberalization. For the EC, Rotterdam prices are again used to reflect border prices for wheat; and barley prices are permitted to adjust with the wheat price. For India and Japan, border prices are constructed by adding transport costs to U.S. prices of wheat and (for India only) sorghum. These prices are then linked to U.S. prices and exchange rates. In all cases, these changes reduce internal prices.

The result of these changes in trade policy is to reduce EC wheat production and exports, reduce production and increase imports for India, and increase prices, production, and exports for the United States and Canada. Australia's exports increase by less than half a percent, since the supply elasticity is very small. By the last year of the analysis, U.S. exports have increased by 22 percent and Canada's by 15 percent, EC exports have dropped by two-thirds, and India has moved from a net export to a net import status. The United States and EC prices move by nearly equal percentages in opposite directions, starting from over 10 percent and moving up to nearly 30 percent in the later years.

While these impacts appear to have the expected direction, it is likely that they are exaggerated by the omission of Argentina and many small developing countries. Rising world prices would dampen imports by these developing countries and moderate the U.S. price impact. Recent work on Argentina--not yet included in the model--suggests that the export supply elasticity of Argentina to world price changes is approximately one. This, too, would dampen the U.S. price impacts.

Procedure and Results for Feed Grains

The major protected markets in the feed grain model are the EC and the U.S.S.R.; and, Argentina taxes feed grain exports. It is assumed that the Central Planned Economies would not change their domestic price insulation policies, so the EC policy is the one affected by the trade liberalization. The Rotterdam corn prices replace the corn threshold prices and are linked to the U.S. prices of corn. EC barley prices are linked to the Rotterdam prices of corn as well. Argentine tax rates have been endogenized in a separate study of Argentina and are projected to decline to zero by 1988/89. In the

trade liberalization analysis the positive tax rates projected for 1985/86 to 1987/88 have been reduced to zero.

A summary of the impacts of these policy changes indicates a significant shift of feed grain production from the EC to the exporting countries and a 10 to 15 percent increase in market prices. As a result of the decline in EC prices, internal feed grain production declines and use increases in nearly equal magnitude. The EC moves from being a net exporter of one to four million tons per year in the five year period to net import levels of one to two and one-half million tons, a change of about five million tons in the later years of the period. The U.S. provides about 60 percent of the increased export demand, most of which is drawn from domestic private stocks and feed use. Canada's exports increase by nearly one million tons by the last year, mostly provided by higher production. The remaining 800 to 900 thousand metric tons come from Australia, Argentina, and Thailand. Proportionately, Canada and Australia gain the most from these changes. Total net exports decline but the change is less than one percent of the baseline level.

Price changes in the exporting countries increased by 10 to 15 percent after the first year. Argentine prices increase more than the others in the first three years, because of the removal of export taxes. Feed grain prices in the EC decline by 20 to 25 percent.

Overall, there is a substantial shift in export supplies from the EC to other exporters, but no significant change in total trade. The EC bears about two-thirds of the price adjustment in moving to border pricing.

Summary

In this study, soybeans, wheat, and feed grains trade models were used to quantify trade and policy interactions among the major importing and exporting

regions. This study reports the results of three analyses that were conducted using these models. These analyses are a five-year baseline projection from 1986/87 to 1989/90, the impact of a 5 percent decline in U.S. crop yields, and the impact of a trade liberalization scenario.

Since these trade models are partial equilibrium models, they do not capture the interactions among these crops. In addition, not all commodities and countries are endogenized in these models.

The results of the yield impacts demonstrate that the export response to supply and price changes varies with commodity and with the duration of the changes. In all cases, the magnitude of the export response to changes in price increases with time. The trade liberalization impacts show significant adjustments in prices and trade flows compared with the baseline. Total trade increases slightly, but there is a major shift in export patterns. Cross-commodity analysis of trade liberalization would probably moderate the feed grain and soybean impacts, but the directions of change would be the same.

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