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THE IOWA STATE UNIVERSITY FAPRI TRADE MODEL

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The Food and Agricultural Policy Research Institute (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 demand of importers (EDT), less the net supply 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:

$$EDT = \sum DM_i - \sum SM_i = \sum f_i(P_i, X_i) - \sum h_i(P_i, Z_i) \quad i = 1,..,n \text{ importers} \quad (1)$$

$$ESO = \sum SX_j - \sum DX_j = \sum h_j(P_j, Z_j) - \sum f_j(P_j, X_j) \quad j = 1,..,m \text{ exporters} \quad (2)$$

$$ESUS = h_u(P_u, Z_u) - f_u(P_u, X_u) \quad \text{U.S. exports} \quad (3)$$

$$ESUS = EDT - ESO \quad \text{world market equilibrium} \quad (4)$$

$$P_i = P_u e_i + M_i \quad i = 1,..,n \quad (5)$$

$$P_j = P_u e_j + M_j \quad j = 1,..,m \quad (6)$$

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). 1/

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1/ Underscored numbers in parentheses refer to sources cited in the References.

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; 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 Food Security Act of 1985, 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.

Soybean Baseline Projections

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

Brazilian soybean production is projected to increase 6 percent as a result of increased acreage and higher yields. Brazil is expected to experience substantial competition from the United States as a result of the lower value of the dollar and reduced prices. Brazilian crush demand hovers around 13.3 MMT. Argentine 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 is expected to increase from 4 MMT in 1985/86 to 4.6 MMT in 1989/90, a 15-percent increase, and soybean imports are expected to increase accordingly. World trade of soybeans is expected to continue its increase in developing countries as they attempt to improve diets with meat and poultry.

U.S. soymeal use projections remain stable, except for the last 2 years of the projection period. A modest decline in use 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 is projected to increase from 2.2 MMT in 1985/86 to 2.7 MMT in 1989/90, while Brazilian exports are expected to remain stable. Argentine soymeal exports are projected to increase rapidly as Argentine crush expands.

Over the projection period, EC domestic consumption of meal increases from 15 MMT in 1985/86 to 16.3 MMT in 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.

Table 1--Soybean baseline forecast and projected changes

Country and item	Unit	1985/86	1986/87	1987/88	1988/89	1989/90
United States:						
Bean production (base)	1,000 metric tons	57,643	52,907	51,873	52,526	53,043
1-year yield impact	Percent	-5.0	2.6	.1	-.6	-.3
5-year yield impact	Percent	-5.0	-2.3	-2.9	-3.1	-3.3
Trade lib. impact	Percent	0	-1.2	-2.7	-3.8	-4.3
End stocks (base)	1,000 metric tons	16,139	16,819	15,241	13,336	11,839
1-year yield impact	Percent	-4.4	-.1	.3	-.2	-.3
5-year yield impact	Percent	-4.4	-4.1	-4.1	-4.8	-5.6
Trade lib. impact	Percent	.8	1.1	1.0	.5	0
Crush (base)	1,000 metric tons	29,338	30,264	30,808	30,917	31,026
1-year yield impact	Percent	-1.7	1.7	0	-.2	0
5-year yield impact	Percent	-1.7	0	0	-.2	-.2
Trade lib. impact	Percent	.4	.1	0	.0	.2
Bean exports (base)	1,000 metric tons	18,289	19,486	20,221	21,038	21,065
1-year yield impact	Percent	-9.1	.9	0	-1.0	-.7
5-year yield impact	Percent	-9.1	-7.0	-6.3	-6.9	-7.4
Trade lib. impact	Percent	-1.4	-3.8	-6.8	-9.2	-10.8
Meal exports (base)	1,000 metric tons	4,568	5,270	5,478	6,008	6,425
1-year yield impact	Percent	7.1	2.7	-.7	.1	.5
5-year yield impact	Percent	7.1	8.4	6.9	6.4	6.8
Trade lib. impact	Percent	-5.4	-8.7	-9.6	-6.6	-4.4
Bean farm price (base)	Dollars/bushel	5.29	5.15	5.24	5.34	5.65
1-year yield impact	Percent	11.0	-5.6	-.5	-.8	.5
5-year yield impact	Percent	11.0	5.2	4.4	5.4	5.8
Trade lib. impact	Percent	-4.2	-5.1	-4.7	-3.2	-2.5
Meal price, Decatur (base)	Dollars/short ton	133	140	142	145	156
1-year yield impact	Percent	14.5	-5.0	-.7	.8	.7
5-year yield impact	Percent	14.5	8.2	7.0	7.9	8.4
Trade lib. impact	Percent	-6.9	-9.4	-9.8	-7.5	-5.8
Value bean exports (base)	Million dollars	3,737	3,879	4,099	4,338	4,601
1-year yield impact	Percent	.7	-4.8	-.6	-.3	-.2
5-year yield impact	Percent	.7	-2.2	-2.2	-1.9	-2.0
Trade lib. impact	Percent	-5.4	-8.7	-11.2	-12.1	-134.1
Value meal exports (base)	Million dollars	671	812	866	962	1,104
1-year yield impact	Percent	22.8	-2.5	-1.5	.8	1.2
5-year yield impact	Percent	22.8	17.2	14.4	14.8	15.8
Trade lib. impact	Percent	-11.9	-17.3	-18.4	-13.5	-10.0

Continued--

Table 1--Soybean baseline forecast and projected changes--Continued

Year	Unit	1985/86	1986/87	1987/88	1988/89	1989/90
Brazil:						
Bean exports (base)	1,000 metric tons	2,578	2,534	2,451	2,441	2,525
1-year yield impact	Percent	7.8	.6	2.4	3.9	1.2
5-year yield impact	Percent	7.8	6.1	7.0	9.3	8.4
Trade lib. impact	Percent	19.7	30.9	38.9	43.5	44.4
Meal exports (base)	1,000 metric tons	7,860	7,846	7,917	7,992	7,964
1-year yield impact	Percent	-2.0	.6	.2		-.1
5-year yield impact	Percent	-2.0	-.8	-.4	-.4	-.5
Trade lib. impact	Percent	-5.5	-8.0	-9.3	-9.6	-9.7
Argentina:						
Bean exports (base)	1,000 metric tons	2,917	2,976	2,908	2,810	2,663
1-year yield impact	Percent	1.3	1.1	1.5	1.9	1.1
5-year yield impact	Percent	1.3	2.1	3.0	4.2	4.5
Trade lib. impact	Percent	0	.1	.2	0	0
Meal exports (base)	1,000 metric tons	2,736	3,042	3,193	3,328	3,438
1-year yield impact	Percent	-.9	-.1	-.1	-.1	-.1
5-year yield impact	Percent	-.9	-.8	-.6	-.5	-.5
Trade lib. impact	Percent	-.1	-.1	-1.0	-1.2	-1.4
World:						
Bean net imports (base)	1,000 metric tons	23,780	25,003	25,581	26,289	26,254
1-year yield impact	Percent	-6.0	.9	.4	-.3	-.3
5-year yield impact	Percent	-6.0	-4.6	-4.0	-4.2	-4.7
Trade lib. impact	Percent	1.0	.2	-1.6	-3.3	-4.4
Meal net imports (base)	1,000 metric tons	15,164	16,158	16,628	17,328	17,827
1-year yield impact	Percent	.9	1.1	-.1	0	.1
5-year yield impact	Percent	.9	2.2	2.0	2.0	2.1
Trade lib. impact	Percent	-4.5	-6.8	-7.8	-7.0	-6.2

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 United States, 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 in table 2.

The projections show U.S. production increasing from 66.8 MMT in 1985/86 to 69.3 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 Food Security Act of 1985. The wheat price in 1983/84 was $137.90 per metric ton and is projected to be $112.80 per metric ton 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.

Table 2--Wheat baseline forecast and projected changes

Country and item	Unit	1985/86	1986/87	1987/88	1988/89	1989/90
United States:						
Production (base)	Million metric tons	66.76	68.71	68.96	68.25	69.32
1-year yield impact	Percent	-5.0	1.1	1.9	.2	-1.0
5-year yield impact	Percent	-5.0	-3.9	-2.1	-1.6	-2.5
Trade lib. impact	Percent	0	2.3	5.1	7.6	9.0
End stocks (base)	Million metric tons	46.07	53.44	57.17	56.08	54.01
1-year yield impact	Percent	-5.5	-1.1	1.4	1.0	-.3
5-year yield impact	Percent	-5.5	-6.0	-4.4	-3.1	-3.2
Trade lib. impact	Percent	-2.8	-3.4	-3.3	-2.7	-1.4
Feed use (base)	Million metric tons	7.27	7.24	8.52	9.44	8.82
1-year yield impact	Percent	-9.0	-12.8	3.5	6.3	1.5
5-year yield impact	Percent	-9.0	-22.0	-15.9	-8.1	-6.2
Trade lib. impact	Percent	-19.3	-34.5	-39.9	-39.2	-39.0
Exports (base)	Million metric tons	31.95	33.18	35.54	38.46	40.9
1-year yield impact	Percent	-.4	-.8	.9	-.8	-.1
5-year yield impact	Percent	-.4	-1.3	-2.2	-2.9	-2.9
Trade lib. impact	Percent	8.5	13.9	20.0	22.4	22.2
Farm price (base)	Dollars/bushel	3.09	2.9	2.72	2.8	3.07
1-year yield impact	Percent	4.9	9.3	-2.6	-5.4	-1.0
5-year yield impact	Percent	4.9	13.1	11.8	6.4	4.2
Trade lib. impact	Percent	10.7	20.7	30.1	31.8	26.8
Value of exports (base)	Million dollars	3,628	3,535	3,552	3,956	4,614
1-year yield impact	Percent	4.4	8.4	-3.5	-6.1	-1.1
5-yearr yield impact	Percent	4.4	11.7	9.4	3.4	1.2
Trade lib. impact	Percent	20.0	37.2	60.0	61.3	54.9
Value of product (base)	Million dollars	7,579	7,322	6,892	7,022	7,819
1-year yield impact	Percent	-.4	10.5	-.7	-5.2	-1.9
5-year yield impact	Percent	-.4	8.7	9.4	4.7	1.6
Trade lib. impact	Percent	10.9	23.5	36.8	42.2	34.9
Canada:						
Exports (base)	Million metric tons	17.12	18.35	19.15	19.23	19.28
1-year yield impact	Percent	.5	1.5	2.1	1.7	.1
5-year yield impact	Percent	.5	2.0	4.1	5.9	6.2
Trade lib. impact	Percent	1.2	4.9	7.8	11.2	15.0
Australia:						
Exports (base)	Million metric tons	15.53	15.7	16.23	16.06	15.93
1-year yield impact	Percent	.2	.1	-.3	-.1	.1
5-year yield impact	Percent	.2	.3	0	-.1	.0
Trade lib. impact	Percent	3.2	2.5	2.5	1.2	.6
World:						
Net imports (base)	Million metric tons	85.92	90.06	93.99	97.23	99.34
1-year yield impact	Percent	0	0	0	0	0
5-year yield impact	Percent	0	0	0	0	0
Trade lib. impact	Percent	.7	1.3	1.7	2.3	2.3

Canada produced 20.8 MMT in 1985/86, and production increases over the projection period. Canadian exports for the last 3 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 EC's heavy subsidies for 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.

Japan's net imports hover 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 85.9 MMT in 1985/86 to 99.3 MMT in 1989/90, a 15.6-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 use (both food and feed) and for exports over the projection period.

For Canada, 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 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 with Argentina, corn and sorghum in Thailand are modeled together. Domestic consumption of corn and sorghum in Thailand remains stable at 1.3 MMT over the projection period. The production of corn and sorghum are expected to increase 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 are expected to 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 multiperiod 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.

Table 3--Feed grains baseline forecast and projected changes

Country and Item	Unit	1985/86	1986/87	1987/88	1988/89	1989/90
United States:						
Production (base)	Million metric tons	219.6	204.2	203.3	202.2	202.8
1-year yield impact	Percent	-4.9	.3	.1	0	0
5-year yield impact	Percent	-4.9	-4.0	-3.8	-3.8	-3.8
Trade lib. impact	Percent	0	0	.1	.2	.2
End stocks (base)	Million metric tons	74.9	84.1	92.5	100.1	101.8
1-year yield impact	Percent	-4.1	0	.1	.5	0
5-year yield impact	Percent	-4.1	-2.9	-2.4	-2.1	-2.2
Trade lib. impact	Percent	-.6	-1.2	-1.4	-1.3	-1.2
Feed use (base)	Million metric tons	106.9	114.7	115.3	113.1	117.9
1-year yield impact	Percent	-5.5	0	.2	.1	0
5-year yield impact	Percent	-5.5	-4.1	-3.8	-3.9	-3.7
Trade lib. impact	Percent	-.8	-1.7	-2.1	-2.4	-2.0
Food use (base)	Million metirc tons	22.6	23.6	24.5	25.3	26
1-year yield impact	Percent	-1.9	0	.1	0	0
5-year yield impact	Percent	-1.9	-1.4	-1.2	-1.2	-1.1
Trade lib. impact	Percent	-.3	-.6	-.7	-0.7	-.6
Exports (base)	Million metric tons	53.8	56.8	55.2	56.3	57.2
1-year yield impact	Percent	-2.6	-4.7	-.2	0	0
5-year yield impact	Percent	-2.6	-6.6	-5.8	-5.5	-5.3
Trade lib. impact	Percent	2.7	4.7	5.6	5.9	4.9

Continued--

Table 3--Feed Grains baseline forecast and projected changes--Continued

Country and Item	Unit	1985/86	1986/87	1987/88	1988/89	1989/90
United States:						
Farm price (base)	Dollars per bushel	2.48	2.22	2.09	2.15	2.31
1-year yield impact	Percent	24.3	-.2	-1.0	-.5	-.2
5-year yield impact	Percent	24.3	22.5	23.0	22.7	22.6
Trade lib. impact	Percent	3.6	8.0	10.6	12.0	11.3
Value of exports (base)	Million dollars	5,255.5	4,959.9	4,538.2	4,763.1	5,197.4
1-year yield impact	Percent	21.1	-4.8	-1.2	-.5	-.2
5-year yield impact	Percent	21.1	14.4	15.8	15.9	16.1
Trade lib. impact	Percent	6.3	14.3	19.0	21.0	17.9
Value of product (base)	Million dollars	21,442.9	17,845.3	16,726.1	17,118.6	18,442.7
1-year yield impact	Percent	18.2	.1	-.9	-.5	-.2
5-year yield impact	Percent	18.2	27.3	27.7	27.3	27.3
Trade lib. impact	Percent	3.5	9.3	12.8	14.4	12.6
Argentina:						
Corn/sorghum exports (base)	Million metric tons	12.1	13.1	13	13.2	13.7
1-year yield impact	Percent	2.3	1.6	.5	.2	0
5-year yield impact	Percent	2.3	3.3	3.6	3.5	3.5
Trade lib. impact	Percent	1.0	1.2	4.8	3.3	2.5
Canada:						
Corn/barley exports (base)	Million metric tons	8.5	6.6	8.8	9.3	9.9
1-year yield impact	Percent	1.8	28.9	.2	.7	.3
5-year yield impact	Percent	1.8	30.7	18.6	16.6	15.1
Trade lib. impact	Percent	.3	5.1	7.8	9.3	9.3
Australia:						
Barley exports (base)	Million metric tons	2.2	2	1.8	1.7	1.6
1-year yield impact	Percent	18.2	13.7	7.7	4.4	2.3
5-year yield impact	Percent	18.2	28.4	32.7	36.4	37.9
Trade lib. impact	Percent	2.8	8.1	13.2	18.1	19.8
Thailand:						
Corn/sorghum exports (base)	Million metric tons	2.8	2.9	2.9	3	3.1
1-year yield impact	Percent	1.1	5.7	.1	.2	.1
5-year yield impact	Percent	1.1	6.6	5.4	5.0	4.7
Trade lib. impact	Percent	.2	1.2	2.3	2.8	2.9
World:						
Net imports (base)	Million metric tons	90.5	93.1	96.2	99.2	102.32
1-year yield impact	Percent	-.6	-.1	.1	.2	.1
5-year yield impact	Percent	-.6	-.5	-.4	-.3	-.3
Trade lib. impact	Percent	.1	.2	.2	.2	.2

The one-period yield impact analysis was conducted by reducing U.S. yields by 5 percent in the first year (1985/86) only and comparing the resulting 5-year simulation to the baseline. The multiperiod yield impact was conducted by reducing yields by 5 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 (see table 1). 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 shortrun reduced-form flexibility of about 2 percent. Soybean exports decline by 9.1 percent, giving a shortrun response elasticity of -0.83 relative to price. Over the 4-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 longrun adjustments. The price impacts are dampened over time to 5 or 6 percent, as production in the United States and other countries responds 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 2 years. 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 (table 2). Wheat price increases by nearly 5 percent, implying a shortrun, reduced-form flexibility of about one. The shortrun 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 those in the first year. Thus, the price impacts increase in the second and third years before declining. Canada's export gradually 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 estimated 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 (table 3). Corn price increases by 24 percent, implying a reduced-form flexibility of nearly 5. The shortrun 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 5-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 of 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 -0.25 to -0.30 range. Exports of competitors are responding with substantial percentage increases, but the overall impact on the United States is small because its 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 in this model include the high and fixed corn prices in the EC and Spain, the Brazilian export tax rates that 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) multiplied by the baseline price levels.

A summary of the impacts of these changes indicates losses to the United States and Argentine soybean sectors, gains to the Brazilian soybean producers, and losses to Brazil's crushing industry (table 1). The lower corn prices in the EC 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 3-5 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 values of bean and meal exports are 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 centrally planned economies would not alter their domestic price insulation policies, so the EC, India, and Japan are the countries affected by 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 (table 2). Australia's exports increase by less than 0.5 percent, since the supply elasticity is very small. By the last year of the analysis, U.S. exports increased by 22 percent and Canada's by 15 percent, while EC exports 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, they are probably 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.; Argentina taxes feed grain exports. The model assumes that the centrally planned economies will not change their domestic price insulation policies, so EC countries are affected by 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.

In summary, the impacts of these policy changes will be to shift feed grain production from the EC to the exporting countries and increase market prices by 10-15 percent (table 3). 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 1-4 million tons per year in the 5-year period to net import levels of 1-2.5 million tons, a change of about 5 million tons in the later years of the period. The United States 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 1 million tons by the last year, mostly provided by higher production. The remaining 800,000-900,000 metric tons come from Australia, Argentina, and Thailand. Canada and Australia proportionately gain the most from these changes. Total net exports decline, but the change is less than 1 percent of the baseline level.

Price changes in the exporting countries increased by 10-15 percent after the first year. Argentine prices increase more than the others in the first 3 years, because of the removal of export taxes. Feed grain prices in the EC decline by 20-25 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.

Conclusion

In this study, soybean, wheat, and feed grain 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 5-year baseline projection from 1985/86 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. For example, in a cross-commodity equilibrium framework an endogenous corn price will have significant effects on soybean and soymeal supply and demand. Similarly, an endogenous soymeal price will influence corn feed demand. In addition, not all commodities and countries are endogenized in these models. Further work to combine these three models and to incorporate additional regions is underway.

The yield impacts demonstrate that the export response to supply and price changes varies by 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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