Economic Growth and Agricultural Trade of Less-Developed Countries: Summary Report

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EXECUTIVE SUMMARY

Competing claims regarding the complementarity of U.S. development assistance to less developed countries (LDCs) and U.S. agricultural exports have long been discussed by researchers, policymakers, and agricultural producers. The relationship between U.S. development assistance to LDCs and LDC trade in agricultural products depends on two main linkages: (a) the link between development assistance and LDC income growth, and (b) the link between LDC income growth and increased food consumption. Food consumption growth that surpasses domestic production leads to increased agricultural commodity imports.

Altering LDC income growth rates and the global macroeconomic environment in the CARD/FAPRI agricultural trade models provides results for evaluating the income-trade link for LDCs. In this analysis, world and U.S. trade, trade value and prices, and LDC production, domestic use, and trade are evaluated under six income-growth scenarios for wheat, feed grains, and soybeans and soybean products.

Four scenarios increase the GDP growth rates for regional groupings of LDCs (All LDCs, Latin America, Africa and the Middle East, and Asia) by one percentage point for each of five years above baseline levels starting in 1987/88; two scenarios change GDP growth rates in <u>all</u> countries and alter the inflation rate and the oil price on optimistic (high growth) and pessimistic (low growth) paths, respectively, relative to a baseline for four years beginning in 1988/89.

Increasing real GDP growth rates of all LDCs by one percentage point for five years:

- increases corn price by 7.6 percent, wheat price by 16.7 percent, and soybean price by 6.4 percent above 1991/92 baseline levels. The larger increase in wheat price is due to the relatively large LDC share of world wheat net imports (62 percent in 1987/88) compared with LDC share of corn world net imports (38 percent in 1987/88);

- increases world feed grain trade by 3.4 percent, wheat trade by 3.4 percent, and soybean and soybean product trade by 1.3 percent above 1991/92 baseline levels; and

- increases U.S. feed grain exports by 4.7 percent, wheat exports by 3.5 percent, and soybean and soybean product exports by 2.8 percent above 1991/92 baseline levels.

Increasing GDP growth rates for LDCs by region show that higher Asian (including China) income has a greater impact on prices than increasing income in Latin America or Africa and the Middle East.

Increasing real GDP growth rates of LDCs and centrally planned countries by one percentage point, and industrial countries by 0.5 percentage point, while lowering world inflation rates by two percentage points, each year for four years:

- increases corn price by 12.3 percent, wheat price by 12.6 percent, and soybean prices by 17.0 percent above 1991/92 baseline levels;

- increases world feed grain trade by 5.6 percent, wheat trade by 3.9 percent, and soybean and soybean product trade by 2.4 percent above 1991/92 baseline levels; and

- increases U.S. feed grain exports by 9.7 percent, wheat exports by 8.6 percent, and soybean and soybean product exports by 4.8 percent above 1991/92 baseline levels.

In the optimistic scenario, although the largest increase in U.S. trade is in feed grains, the greatest increase in U.S. export revenue is from soybean and soybean products--$1.3 billion, or 38 percent of the $3.4 billion increase in U.S. export revenue above the 1991/92 baseline level.

With regard to market shares, U.S. export elasticity is large because of idled land and government stocks. When GDP growth rates increase for all LDCs, the U.S. marginally increases its trade share of both feed grains and soybeans and soybean products by 0.8 percentage points and of wheat by 0.1 percentage points. When GDP growth rates are increased globally and inflation is lowered, the U.S. increases market share for feed grains by 2.5 percentage points, wheat by 1.9 percentage points, and soybeans and soybean products by 1.2 percentage points.

These results support the hypothesis that U.S. development assistance that leads to increased LDC income growth also increases LDC agricultural imports, and is compatible with U.S. agricultural interests. Whether incomes rise globally or in LDCs only, increases in domestic use resulting from faster GDP growth rates outweigh domestic production increases, causing higher commodity prices and widening the import gap. In addition, the results show that the location of accelerated income growth has a significant impact on trade and world market prices (i.e., Asia versus Latin America or LDCs versus industrial countries).

INTRODUCTION

The United States has an extensive assistance program for less developed countries (LDCs), yet the cost of this program is the lowest among developed market economies in percent of allocated GNP (OECD 1988). On average for 1985-86, about 11.2 percent or $1.05 billion of U.S. official development assistance was related directly to agricultural production (OECD 1988). The impact of agricultural development assistance on U.S. agricultural export markets has been a concern of the U.S. government and agricultural producers, especially in periods of excess supplies of agricultural commodities. There is a concern among American commodity groups that U.S. development assistance replaces U.S. imports with domestic production or increases the volume of agricultural exports from other countries and therefore runs counter to U.S. short and long run agricultural interests. Alternatively, it is argued that agricultural development is an important contributor to overall economic growth in LDCs, leading to improved standards of living and an increased demand for U.S. agricultural imports.

The relationship between U.S. development assistance to LDCs and LDC trade in agricultural products depends upon two general linkages:

- the link between development assistance and LDC income growth, and
- the link between LDC income growth, higher food consumption, and increased agricultural commodity imports.

Analysis of these linkages provides a basis to evaluate the impacts of development assistance to LDCs on international trade.

Existing analyses of development assistance/agriculture trade linkages fall into three categories:

1. Descriptive studies of historical trends among groups of LDCs;
2. Single-equation statistical estimates of correlations between trade, production, and income growth using cross-sectional and/or time series data; and
3. Broader scope models of LDC trade, income, and/or agricultural production growth.

In general, these analyses indicate that development assistance, even that targeting LDC food production, leads to LDC agricultural import growth. These results emphasize economic growth (income growth) as the driving force for increased LDC agricultural imports.

What is lacking in existing studies is a comprehensive analysis of world agricultural trade under different income growth scenarios. The present project is designed to address this information gap by providing a quantitative analysis of the link between LDC income growth and trade. CARD/FAPRI models of world grains and soybean and soybean product markets are employed for the analysis. By altering LDC income growth rates and the macroeconomic variables conditioning the models, the nature of the income-trade link is evaluated. The results show the importance for U.S. agriculture of encouraging LDC income growth through development assistance programs, macroeconomic policies, and policies for structural reform.

The CARD analysis projects world and regional agricultural trade of grains and soybean products for alternative LDC income growth scenarios and different macroeconomic environments. A baseline projection for world, regional, and country specific trade is first established. The

models are then solved for alternative LDC income growth rates and optimistic and pessimistic world economic environments. Six scenarios are analyzed. The results are compared to the baseline to evaluate impacts on world and U.S. trade and prices, as well as on LDC production, domestic use, and trade of wheat, feed grains, and soybean products.

This Summary Report provides a brief overview of the background for the research project, which is presented in the Literature Review (Appendix C in Angel et al. 1988). This is followed by a description of the CARD/FAPRI trade models and the baseline, incorporating the relevant sections of the Technical Report (Angel et al. 1988). The following two sections summarize the results of the four regional income scenarios as found in the Technical Report and the Regional Incomes Scenarios Numerical Report, and the two macroeconomic scenarios as found in the Technical Report and the Macroeconomic Scenarios Numerical Report.

Background

A general conclusion from the available empirical results is that LDC income growth, whether based on agriculture or other sectors, leads to food consumption growth rates that typically exceed domestic production capacity and require food imports (Bachman and Paulino 1979; Christiansen 1987; de Janvry and Sadoulet 1987; Houck 1986; Kellogg et al. 1986; Lee and Shane 1985). A common denominator in these findings is the notion that national supply-demand balances for agricultural products shift during the development process. For example, Mellor and Johnston (1984) categorize national agricultural supply-demand balances in three phases:

1. The rough parity of domestic supply and demand at subsistence levels, generally characterizing low-income developing countries;

2. The rapid growth in demand exceeding growth in domestic supply, resulting in either an upward trend in the price of food or a rapid growth in net imports, generally characterizing middle-income developing countries, newly industrialized countries, and centrally planned economies; and

3. The virtual cessation of demand growth while production growth is maintained at a high level with a consequent downward trend in the real price of food or rapid growth in net exports, generally characterizing developed market economies such as the United States, Canada, and the EC-12.

In the second phase of development, adjustment in the supply-demand balance is led by demand, a situation in which agricultural production growth and net imports can coexist. Most studies reviewed indicate that the middle- to high-income LDCs are more likely to experience this second phase supply-demand imbalance than low-income LDCs (Bachman and Paulino 1979; de Janvry and Sadoulet 1987; Kellogg et al. 1986). This second phase is characterized by high income and price elasticities of demand for food (Marks and Yetley 1987) and shifts from direct coarse grain consumption to indirect coarse grain consumption in the form of livestock products as per capita income increases (Sarma 1986; Yotopoulos 1985; Marks and Yetley 1987).

There is less consensus about the critical level of development or level of per capita income at which LDCs make the transition from the first phase to the second. Yotopoulos' (1985) analysis of Tunisia indicates that the distribution of income within developing countries and the graduation from low- to high-income groups are more specific measures than the national average per capita income of how income growth affects the food supply-demand balance.

Of course, the situation in each country differs, depending upon the natural resource endowment, domestic agricultural and macroeconomic policies, international terms of trade, and other factors. Studies of global financial markets and macroeconomic and sectoral policy interdependencies between developed and developing countries provide a context for the longer term processes described by Mellor and Johnston (1984), and suggest conditions under which developing countries will be engines for rapid growth in agricultural trade.

Rossmiller and Tutwiler (1987) find that international financial flows and the macroeconomic policies affecting them are more significant determinants of agricultural trade and development than development assistance or sectoral policies (see also Goldsborough and Zaidi 1986). Increased capital flows to developing countries may have positive or negative effects on agricultural imports, depending on whether the countries choose to invest for income growth or simply to increase current consumption. It has been suggested that the per capita value of debtor country imports of U.S. agricultural products increases with per capita net transfers (Dutton, Grennes, and Johnson 1986). However, the debt problems of many LDCs in the 1980s have necessitated domestic economic adjustments that have negatively affected agricultural trade (Grigsby and Pagoulatos 1986; Rossmiller and Tutwiler 1987).

In addition, there is speculation on the effect of global agricultural trade liberalization being debated in the current round of General Agreement on Tariffs and Trade (GATT) talks (Hathaway 1987;

Meyers, Devadoss, and Helmar 1987; Tyers and Anderson 1986; Paarlberg 1987). Removal of trade distorting domestic agricultural policies would allow direct international competition for agricultural import markets among low-cost producers, forcing adjustments in the utilization of agricultural resources within and across nations. For developed and developing countries alike, this direct competition will likely generate agricultural sector expansion or contraction depending upon comparative advantage.

Changes to the GATT will alter the rules of the game and strategies for international agricultural trade and domestic agricultural policy formulation. Yet the prevailing pattern of shifts in the supply-demand balance leading to increased food imports, even concomitant with rapid agricultural sector growth, will likely still characterize the situation for developing countries under conditions of rapid income growth.

Model and Baseline

Model

The CARD/FAPRI agricultural trade model is a nonspatial equilibrium econometric model. Equilibrium prices, quantities, and net trade are determined by equating excess demand and supplies across countries and regions. Market-determined domestic prices in each country or region are explicitly tied to a world price by price linkages, which include exchange rates and transfer service costs. The model rests on an extensive set of predetermined or conditioning variables that reflect the U.S. domestic economy, the world economy, normal weather, and other determinants of prices in agricultural commodity markets, such as U.S. and foreign

agricultural and trade policies. A complete documentation of earlier versions of these trade models including estimation and validation statistics may be found in Bahrenian, Devadoss, and Meyers (1986); Devadoss, Helmar, and Meyers (1986); Meyers, Helmar, and Devadoss (1986); and FAPRI (1988b).

The CARD/FAPRI agricultural trade model has components (known as commodity models) for each of the major crop commodities including feed grains (corn, sorghum, barley, and oats), wheat, and soybean and soybean products (soybean oil and soymeal). Each commodity model includes country and regional units as shown in Table 1. Commodity models can be operated independently, but typically are combined into a larger system or agricultural trade model via price linkages permitting cross-commodity and cross-country interactions. These linkages between countries and commodities are designed to reflect the simultaneity of price determination in international agricultural markets.

Table 2 presents selected income elasticities of demand (estimated at the mean for the sample period) of the LDCs and regions of the CARD/FAPRI agricultural trade model. Other key structural parameters and a more detailed description of the commodity models are presented in Appendix B of the Technical Report (Angel et al. 1988).

Baseline

The purpose of the baseline projection is to evaluate the implications of current and projected agricultural policies of the United States and other countries in a likely world macroeconomic and financial environment. The baseline incorporates domestic and world financial forecasts and domestic and trade policy assumptions for major participants

Table 1. Regional composition of the CARD/FAPRI trade models

	Wheat Model		Feed Grains Model [a]		Sorghum Model	
	Exporters	Importers	Exporters	Importers	Exporters	Importers
Developing Countries	Argentina	High-Income East Asia India China Brazil Mexico Algeria Tunisia Morocco Egypt Other L. America Other LDC Asia Other LDC Africa & Middle East	Argentina Thailand China	High-Income East Asia Brazil Mexico Egypt Saudi Arabia Other L. America Other LDC Asia Other LDC Africa & Middle East	Argentina	Mexico Nigeria India ROW[b]
Other Countries	United States Canada Australia EC-12	Japan USSR Eastern Europe Other Western Europe Other Importers	United States Canada Australia EC-12 South Africa	Japan USSR Eastern Europe Other Importers	United States Australia South Africa	Japan

	Soybean Complex					
	Soybean Model		Soymeal Model		Soyoil Model	
	Exporters	Importers	Exporters	Importers	Exporters	Importers
Developing Countries	Argentina Brazil China	Taiwan South Korea Mexico ROW[b]	Argentina Brazil China	Taiwan South Korea Mexico ROW[b]	Argentina Brazil South Korea	China Taiwan Mexico ROW[b]
Other Countries	United States	Japan EC-12 USSR Eastern Europe	United States	Japan EC-12 USSR Eastern Europe	United States EC-12	Japan USSR Eastern Europe

[a]Corn, barley, and oats.
[b]ROW stands for "rest of the world."

Table 2. Estimated income elasticities of demand for food and feed grains from the CARD/FAPRI model

Country	Feed Grains	Wheat	Corn	Sorghum	Barley	Soybean Complex		
						Soybeans	Soymeal	Soyoil
Argentina			0.18	0.13			3.00	1.11
Brazil	0.49	0.59					0.50	1.48
Mexico	0.36	0.95		0.87			1.95	1.94
Other Latin America	2.09[a]	0.61						
Thailand			1.92					
China	0.01	0.24				0.12		
High-Income East Asia	0.99	0.57[b]						
Taiwan						0.29	0.75	0.62
South Korea						0.52	1.09	1.44
India		0.76						
Other Asia	0.17	0.66						
Egypt		0.72	0.46					
Saudi Arabia					0.65			
Algeria		0.55						
Tunisia		1.63						
Morocco		0.81						
Other Africa and Middle East	0.22	0.46						
ROW (sorghum)[c]				0.22				
ROW (soybeans)[c]							1.44	1.16

NOTE: Income elasticity estimates are from the CARD/FAPRI agricultural commodity trade models (1988). Income elasticities were estimated at the mean of the time period, 1967-1985.

[a]Income elasticity of demand with feed grains imports.

[b]Income elasticity of demand with wheat imports.

[c]ROW stands for "rest of the world," an aggregation of countries trading in a given commodity.

in world markets for feed grains, soybeans, and wheat. An in-depth description of the FAPRI baseline can be found in FAPRI's "Ten-Year International Agricultural Outlook," (1988a).

The macroeconomic environment in the 1988 baseline is slightly improved over that of the early 1980s, especially in the developing countries. However, GDP growth remains sluggish compared to the 1970s and some developing countries continue to struggle under heavy external debt.

U.S. domestic agricultural policies remain the same, as does the trade environment. Protectionism is expected to remain a threat to world trade, but is assumed to be held under control.

The baseline analysis was conducted in early 1988 before the summer drought. Incorporating the drought into the analysis would have resulted in significant changes in baseline stocks, U.S. agricultural program assumptions, price paths and trade, and therefore altered the outcomes of the different scenarios (see Westhoff et al. 1988).

Results

To study the link between LDC income growth and international agricultural trade and the sensitivity of the model solution to different macroeconomic environments, selected macroeconomic variables in the models were altered relative to the baseline. Six scenarios are analyzed. These include four regional scenarios, where only the income growth rates change relative to the baseline, and two macroeconomic scenarios reflecting more optimistic and more pessimistic global macroeconomic environments than the baseline.[1]

[1]In the four regional income scenarios inflation rates remain unchanged from the baseline and therefore prices and trade values (trade is valued at FOB Gulf Port prices) are reported in nominal terms. In the two macroeconomic scenarios inflation rates differ between scenarios and the baseline, and therefore prices and trade values (trade is valued at FOB Gulf Port prices) are reported in 1986/87 dollars.

Results of the regional income scenarios and the macroeconomic scenarios are not strictly comparable. In the regional scenarios, only developing country real GDP growth rates were changed relative to the baseline and the U.S. farm program provisions were maintained at baseline levels. The LDC income changes were initiated in 1987/88 and sustained for five years, until 1991/92. In the macroeconomic scenarios the real GDP growth rates and inflation rates of all the countries and regions in the models were changed relative to the baseline, and the growth rate of the oil price was changed for consistency with inflation rates. In addition, United States farm program provisions were altered to maintain anticipated balances in world markets. These changes--largely the relaxing of supply control measures--were initiated in 1988/89 and continued for four years, until 1991/92.

In reporting the results of the four regional scenarios and the two macroeconomic scenarios, the developing countries and regions of the three commodity models were combined into three groups:

Less Developed Country/Latin America. Argentina, Mexico, and Brazil as individual countries and an aggregate region, Other Latin America, which covers the rest of South and Central America and the Caribbean.

Less Developed Country/Africa and Middle East. Egypt, Saudi Arabia, Algeria, Morocco, Tunisia and Nigeria as individual countries and an aggregate region, Other Africa and Middle East.

Less Developed Country/Asia. China, Thailand, and India as individual countries, and two aggregate regions, High Income East Asia (Hong Kong, Republic of South Korea, Taiwan, and Singapore) and Other Asia.

These aggregated results should be interpreted with care because they mask important differences by country. This is especially important in the LDC Asia and the LDC Africa and Middle East regions. For example, both China and India, in the LDC Asia region, have domestic policies that insulate agriculture from world prices. The dampened response of trade to increased prices for these two countries dominated the aggregate results in the LDC Asia region. Other countries in LDC Asia, Thailand and the High Income East Asia countries, have trade patterns more responsive to world prices.

Regional LDC Income Scenarios

The impact of increasing economic growth rates can be evaluated by comparing the equilibrium prices and quantities for scenario and baseline values. Table 2.1 of the Technical Report (Angel et al. 1988) compares the baseline and scenario-specific real GDP levels and growth rates for the individual LDCs and LDC regions between 1984/85 and 1991/92.

The four scenarios compared to the baseline were:

1. **All LDC Scenario.** The real GDP growth rate for all LDCs in the commodity models were raised by one percentage point above baseline levels for five years starting in 1987/88.

2. **Latin America Scenario.** The real GDP growth rates for specific Latin American countries and those aggregated into the Other Latin America region were raised by one percentage point above baseline growth rates for five years starting in 1987/88.

3. **Africa and Middle East Scenario.** The real GDP growth rates for specific African and Middle Eastern countries and those aggregated into the Other Africa and Middle East region were raised by one percentage point above baseline growth rates for five years starting in 1987/88.

4. **Asia Scenario.** The real GDP growth rates for specific Asian countries and those aggregated into the Other Asia region were raised by one percentage point above baseline growth rates for five years starting in 1987/88.

Table 3 and Figures 1-5 present the results of the regional income scenarios, including FOB prices, world net trade and trade value, and U.S. net trade, trade value and share. Increasing real GDP growth rates for all LDCs leads to substantial trade and price effects for wheat, feed grains, and soybeans. Since developing countries have a larger share of world wheat net imports (61.8 percent in 1987/88) than of world feed grains net imports (37.5 percent), the rise in all LDCs' GDP growth rates has a greater impact on wheat prices than on soybean or corn prices.

In the All LDC scenario, world trade in feed grains and wheat increases by about 3.4 percent and in soybeans and soybean products world trade increases by 1.3 percent. Also, in this scenario, U.S. exports increase 4.7 percent for feed grains, 3.5 percent for wheat, and 2.8 percent for soybeans and products, indicating that U.S. trade shares are increasing.

The Asia scenario has the next highest impact on the commodity markets. Although the Africa and Middle East scenario has little impact on soybean and soybean product prices and trade, it has a larger impact on the world wheat market than the Latin America scenario.

Table 4 presents the results of the regional income shocks for net trade and trade value of wheat and feed grains for the three aggregate LDC regions and for all LDCs. Detailed domestic use, production and trade results by country are presented in tables in the Regional Income Scenarios Numerical Report (Angel et al. 1988). In addition, detailed country studies for Egypt and Brazil are included in Appendix A of the Technical Report.

Table 3. Regional income scenarios: change from baseline in world and U.S. net trade and prices, 1991/92

	FOB Prices ($/tn)			World Net Trade (1000 mt)			World Net Trade Value (mil. $)		
	Level	Change		Level	Change		Level	Change	
		Absolute	%		Absolute	%		Absolute	%
Feed Grains[a]									
Baseline	95.19			85,294			8,133		
All-LDCs scenario	102.44	7.25	7.62	88,194	2,900	3.40	9,065	932	11.46
Latin America scenario	97.75	2.56	2.69	86,418	1,124	1.32	8,458	325	4.00
Africa and M. East scenario	96.47	1.28	1.34	86,011	717	0.84	8,320	187	2.30
Asia scenario	98.18	2.99	3.14	86,176	882	1.03	8,479	346	4.56
Wheat									
Baseline	137.61			94,412			12,992		
All-LDCs scenario	160.61	22.99	16.71	97,598	3,186	3.37	15,675	2,682	20.65
Latin America scenario	142.13	4.52	3.28	94,763	351	0.37	13,469	476	3.67
Africa and M. East scenario	143.36	5.75	4.18	95,313	901	0.95	13,664	672	5.17
Asia scenario	149.93	12.32	8.95	96,296	1,884	2.00	14,438	1,445	11.12
Soybeans and soybean products[b]									
Baseline	236.02			55,072			12,671		
All-LDCs scenario	251.09	15.07	6.39	55,780	708	1.29	13,561	890	7.02
Latin America scenario	241.98	5.96	2.52	55,264	192	0.35	12,963	292	2.30
Africa and M. East Scenario	237.07	1.05	0.45	55,090	18	0.03	12,701	30	0.24
Asia scenario	243.38	7.36	3.12	55,573	501	0.91	13,148	478	3.77

Table 3. Continued

	U.S. Net Trade (1000 mt)			U.S. Net Trade Value (mil. $)			U.S. Trade Share
	Level	Change		Level	Change		
		Absolute	%		Absolute	%	
Feed Grains[a]							
Baseline	55,337			5,277			64.9
All-LDCs scenario	57,922	2,585	4.67	5,956	679	12.86	65.7
Latin America scenario	56,413	1,076	1.94	5,522	245	4.64	65.3
Africa and M. East scenario	55,842	505	0.91	5,403	126	2.39	64.9
Asia scenario	56,148	811	1.47	5,526	249	4.71	65.2
Wheat							
Baseline	40,175			5,529			42.6
All-LDCs scenario	41,597	1,422	3.54	6,681	1,152	20.84	42.6
Latin America scenario	40,422	247	0.61	5,745	217	3.92	42.7
Africa and M. East scenario	40,520	345	0.86	5,809	280	5.07	42.5
Asia scenario	40,961	786	1.96	6,141	613	11.08	42.5
Soybeans and soybean products[b]							
Baseline	29,020			6,668			52.7
All-LDCs scenario	29,836	816	2.81	7,270	602	9.02	53.5
Latin America scenario	29,376	356	1.23	6,904	235	3.53	53.2
Africa and M. East Scenario	29,027	7	0.02	6,689	21	0.31	52.7
Asia scenario	29,474	454	1.56	6,970	301	4.52	53.0

NOTES: Each scenario involves a one-percentage-point increase in the GDP growth rates of the corresponding region's LDCs. Crop prices are U.S. FOB Gulf Port prices and are reported in nominal dollars.
[a]Feed grains include corn, barley, sorghum, and oats; price given is U.S. corn FOB Gulf Port price.
[b]The price given for soybeans and soybean products is the U.S. soybean FOB Gulf Port price.

Figure 1. WORLD NET COMMODITY TRADE
Absolute and Percent Change from Baseline 1991/92

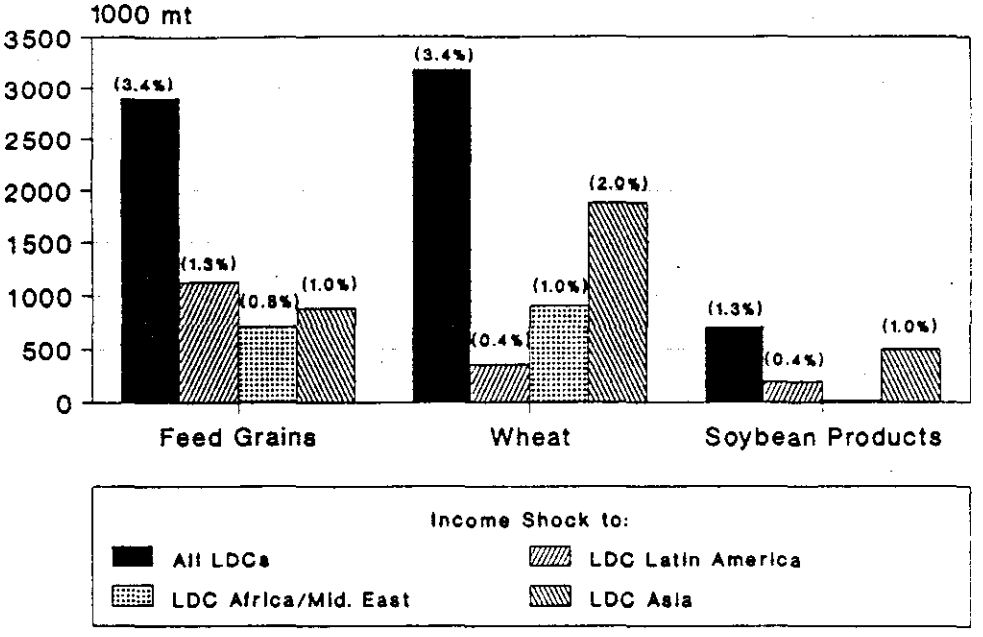


Figure 2. WORLD NET COMMODITY TRADE VALUE
Absolute and Percent Change from Baseline 1991/92

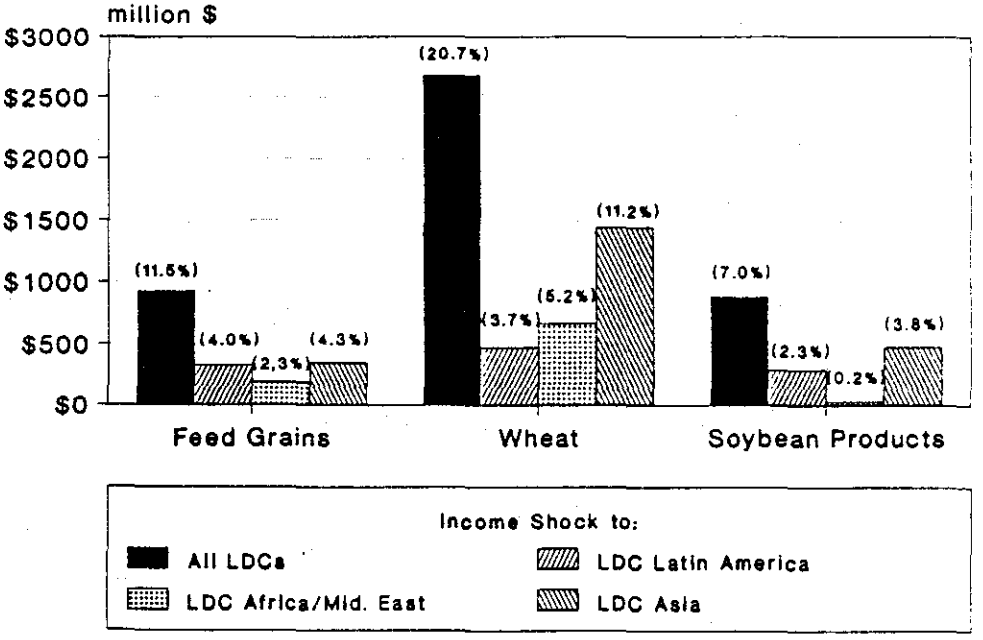


Figure 3. U.S. NET COMMODITY TRADE
Absolute and Percent Change from Baseline 1991/92

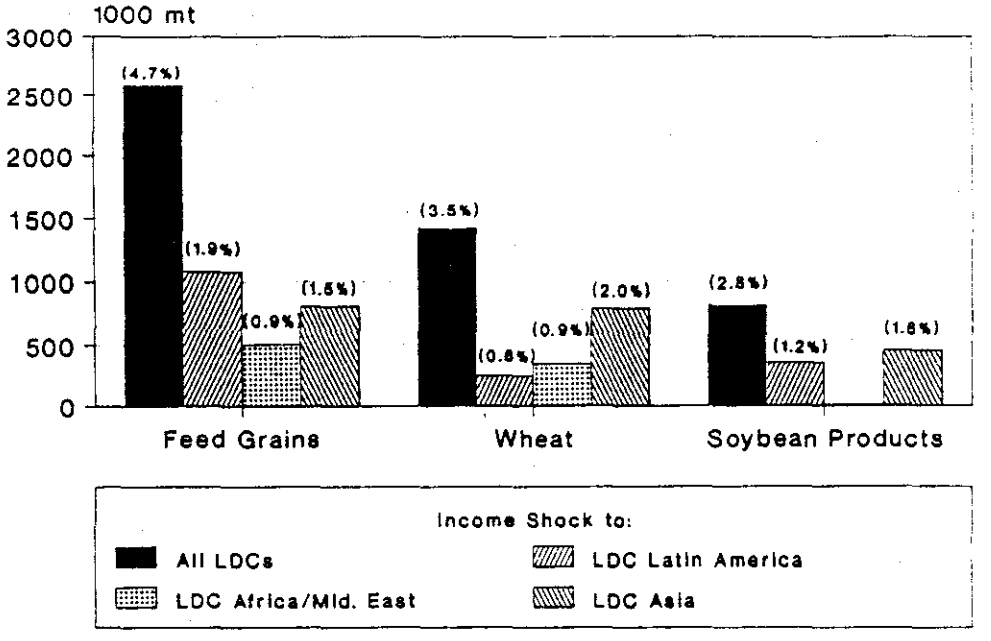


Figure 4. U.S. NET COMMODITY TRADE VALUE
Absolute and Percent Changes from Baseline 1991/92

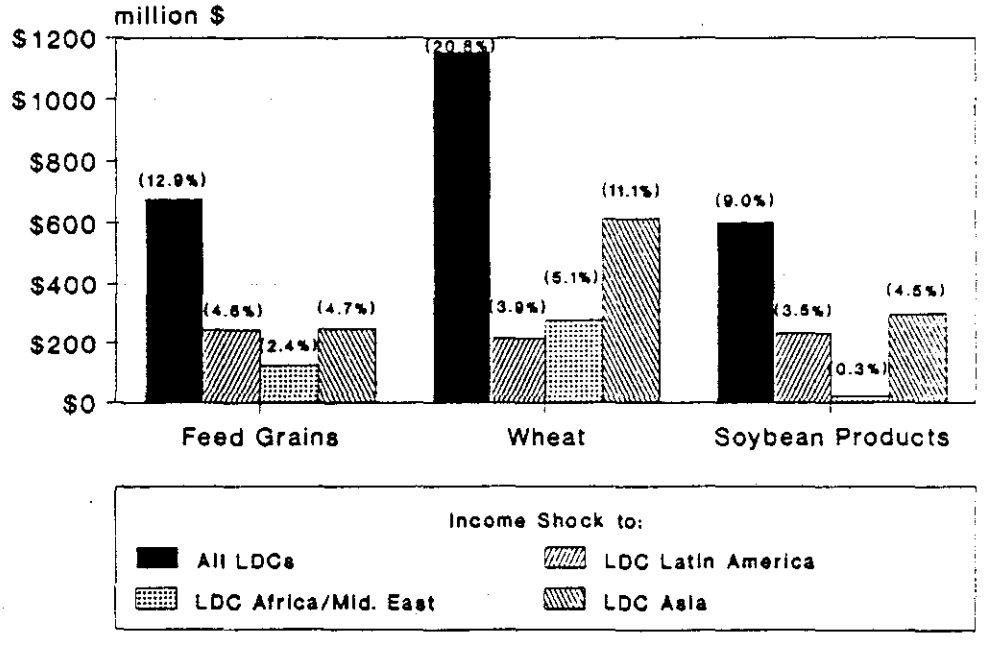


Figure 5. FOB GULF PORT PRICES IN REGIONAL SCENARIOS
Absolute and Percent Change from Baseline 1991/92

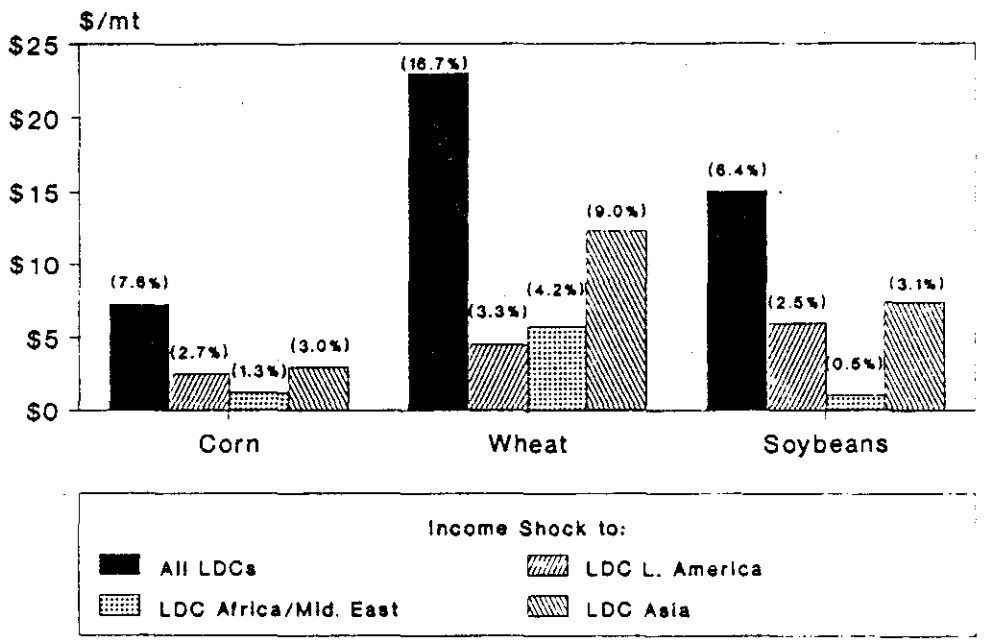


Table 4. Regional income scenarios: change from baseline in regional net trade and trade value, 1991/92

	LDC Net Imports (1000 mt)			LDC Net Import Value (mil. $)		
	Level	Change		Level	Change	
		Absolute	%		Absolute	%
Feed Grains (exc. sorghum)						
L. America net imports						
Baseline	1,806			172		
All-LDCs scenario	2,901	1,095	60.63	297	125	72.87
Latin America Scenario	2,989	1,183	65.50	292	120	69.95
Africa and M. East Scenario	1,766	(40)	-2.21	170	(2)	-0.90
Asia scenario	1,782	(24)	-1.33	175	3	1.77
LDC Africa and Middle East net imports						
Baseline	14,428			1,514		
All-LDCs scenario	15,078	650	4.51	1,734	220	14.56
Latin America scenario	14,425	(3)	-0.02	1,554	40	2.64
Africa and M. East scenario	15,084	656	4.55	1,613	100	6.58
Asia scenario	14,425	(3)	-0.02	1,590	76	5.05
LDC Asia net imports						
Baseline	11,541			1,099		
All-LDCs scenario	12,673	1,132	9.81	1,298	200	18.17
Latin America scenario	11,510	(31)	-0.27	1,125	27	2.41
Africa and M. East scenario	11,525	(16)	-0.14	1,112	13	1.20
Asia scenario	12,723	1,182	10.24	1,249	151	13.70
All-LDC feed grains net imports						
Baseline	27,775			2,785		
All-LDCs scenario	30,652	2,877	10.36	3,329	544	19.53
Latin America scenario	28,924	1,149	4.14	2,971	186	6.68
Africa and M. East scenario	28,375	600	2.16	2,895	110	3.95
Asia scenario	28,930	1,155	4.16	3,014	229	8.22

Table 4. Continued

	LDC Net Imports (1000 mt)			LDC Net Import Value (mil. $)		
	Level	Change		Level	Change	
		Absolute	%		Absolute	%
Wheat						
L. America net imports						
Baseline	4,268			587		
All-LDCs scenario	4,432	164	3.84	712	124	21.19
Latin America Scenario	5,007	739	17.31	712	124	21.17
Africa and M. East Scenario	4,083	(185)	-4.33	585	(2)	-0.34
Asia scenario	3,880	(388)	-9.09	585	(6)	-0.95
LDC Africa and Middle East net imports						
Baseline	30,644			4,217		
All-LDCs scenario	32,081	1,437	4.69	5,152	935	22.18
Latin America scenario	30,608	(36)	-0.12	4,350	133	3.16
Africa and M. East scenario	32,177	1,533	5.00	4,613	396	9.39
Asia scenario	30,516	(128)	-0.42	4,575	358	8.50
LDC Asia net imports						
Baseline	27,303			3,757		
All-LDCs scenario	29,278	1,975	7.23	4,702	945	25.15
Latin America scenario	27,043	(260)	-0.95	3,844	86	2.30
Africa and M. East scenario	26,955	(348)	-1.27	3,864	107	2.85
Asia scenario	29,904	2,601	9.53	4,484	726	19.33
All-LDC feed grains net imports						
Baseline	62,215			8,561		
All-LDCs scenario	65,791	3,576	5.75	10,566	2,005	23.42
Latin America scenario	62,658	443	0.71	8,906	345	4.03
Africa and M. East scenario	63,215	1,000	1.61	9,062	501	5.85
Asia scenario	64,300	2,085	3.35	9,644	1,083	12.65

NOTE: Each scenario involves a one-percentage-point increase in the GDP growth rates of the corresponding region's LDCs.

Each region increases wheat and feed grains imports most when only its income is increased, since larger price increases in the All LDC scenario offset more of the effect of increased income growth. For example, in the Asia scenario, LDC Asia wheat and feed grains imports rise 9.5 percent and 10.2 percent, respectively, while in the All LDC scenario, LDC Asia wheat and feed grains imports rise 7.2 percent and 9.8 percent, respectively.

Conversely, in the scenarios and regions in which the GDP growth rate is not increased, imports fall due to higher world commodity prices. For example, Latin American imports of wheat fall 4.3 percent and 9.1 percent, and imports of feed grains fall 2.2 percent and 1.3 percent, in the Africa and Middle East and the Asia scenarios, respectively.

Since prices are rising in all four scenarios, the cost of commodity imports increases faster relative to the baseline than does the level of imports. In general, even in regions where imports are falling, the cost of imports is higher than in the baseline. For example, in the Africa and Middle East scenario, LDC Asia wheat imports fall by 1.3 percent while wheat import value rises by 2.9 percent. Only in Latin America do declines in net imports result in lower net import costs; specifically, for wheat in both the Africa and Middle East and Asia scenarios, and for feed grains in the Asia scenario.

For the LDCs in total in the All LDC scenario, by 1991/92 feed grains imports rise by 10.4 percent while feed grains import cost rises by 19.6 percent, and wheat imports rise by 5.8 percent while wheat import cost rises by 23.4 percent, relative to the baseline.

Macroeconomic Scenarios

To examine the impact of different macroeconomic environments on wheat, feed grains and soybean trade, two scenarios are evaluated relative to the baseline. For each scenario a specific set of assumptions is made for each of three country groups--the industrial countries, the developing countries, and the centrally planned economies--to incorporate differences in expected macroeconomic performance.[2] The scenarios and associated assumptions are:

1. **Optimistic Scenario**
   a. Industrial Countries--Real GDP growth rates are increased by 0.5 percentage point each year above the baseline level and the inflation rate is reduced by 2.0 percentage points each year below the baseline level beginning in 1988/89.

   b. Developing Countries--Real GDP growth rates are increased by 1.0 percentage point each year above baseline levels and the rate of inflation is reduced by 2.0 percentage points each year below baseline levels beginning in 1988/89.

   c. Centrally Planned Economies--Real GDP growth rates are increased by 1.0 percentage point per year above baseline levels and, where relevant, the rate of inflation is reduced by 2.0 percentage points each year below baseline levels beginning in 1988/89.

   d. The rate of increase in oil prices is reduced by 2.0 percentage points each year beginning in 1988/89 for consistency with the inflation assumption.

2. **Pessimistic Scenario**
   a. Industrial Countries--Real GDP growth rates are reduced by 0.5 percentage point each year below the baseline and the rate of inflation is increased by 2.0 percentage points each year above baseline levels beginning in 1988/89.

   b. Developing Countries--Real GDP growth rates are reduced by 1.0 percentage point each year below the baseline and the rate of inflation is increased by 2.0 percentage points each year above baseline levels beginning in 1988/89.

[2] In the macroeconomic scenarios, China is classified as a centrally planned economy. However, in reporting the results of each scenario, China is included with the developing countries, specifically in the LDC Asia group.

c. Centrally Planned Economies--Real GDP growth rates are reduced by 0.5 percentage point each year below baseline levels and the rate of inflation, where relevant, is increased by 2.0 percentage points each year above baseline levels beginning in 1988/89.

d. The rate of increase in oil prices is increased by 2.0 percentage points each year beginning in 1988/89 for consistency with the inflation assumptions.

Impacts of the changes in macroeconomic variables on the real GDP growth rates of developing countries relative to the baseline are illustrated in Table 3.1 of the Technical Report (Angel et al. 1988).

Table 5 and Figures 6-10 present the results of the optimistic and pessimistic scenarios for FOB prices, world net trade and trade value, and U.S. net trade, trade value and trade share. Since the soybean market has a low price elasticity of supply, the largest impact of changing income growth rates and inflation rates in both scenarios is for the soybean price. Throughout the period of the shock in the optimistic scenario, the soybean/wheat and soybean/corn price ratios are above baseline levels, and by 1991/92 soybean prices have risen 17 percent above baseline levels while wheat and corn prices have risen 12.6 percent and 12.3 percent, respectively.

World trade in soybeans and soybean products rises 2.4 percent in the optimistic scenario and falls 2.0 percent in the pessimistic scenario. The change in feed grains trade is the largest of all three commodities, rising 5.6 percent in the optimistic scenario and falling 4.9 percent in the pessimistic scenario compared to the baseline in 1991/92. Changes in wheat trade are 3.9 percent and -3.5 percent in the optimistic and pessimistic scenarios respectively, as compared to the baseline in 1991/92.

Table 5. Macroeconomic scenarios: change from baseline in world and U.S. net trade, trade values, and prices, 1991/92

	FOB Prices ($/tn)			World Net Trade (1000 mt)			World Net Trade Value (mil. $)		
	Level	Change		Level	Change		Level	Change	
		Absolute	%		Absolute	%		Absolute	%
Feed Grains[a]									
Baseline	82.14			85,294			7,018		
Optimistic	92.24	10.10	12.30	90,099	4,806	5.63	8,298	1,280	18.24
Pessimistic	73.44	(8.70)	-10.59	81,062	(4,232)	-4.96	5,984	(1,033)	-14.73
Wheat									
Baseline	118.75			94,412			11,211		
Optimistic	133.72	14.97	12.61	98,131	3,719	3.94	13,122	1,911	17.05
Pessimistic	107.00	(11.74)	-9.89	91,096	(3,316)	-3.51	9,748	(1,464)	-13.05
Soybeans and soybean products[b]									
Baseline	203.67			55,072			10,934		
Optimistic	238.40	34.73	17.05	56,412	1,341	2.43	13,157	2,223	20.33
Pessimistic	173.12	(30.55)	-15.00	53,961	(1,111)	-2.02	9,077	(1,857)	-16.98

	U.S. Net Trade (1000 mt)			U.S. Net Trade Value (mil. $)			U.S. Trade Share
	Level	Change		Level	Change		
		Absolute	%		Absolute	%	
Feed Grains[a]							
Baseline	55,337			4,554			64.9
Optimistic	60,730	5,392	9.74	5,592	1,038	22.80	67.4
Pessimistic	50,076	(5,261)	-9.51	3,698	(856)	-18.79	61.8
Wheat							
Baseline	40,175			4,771			42.6
Optimistic	43,634	3,459	8.61	5,835	1,064	22.31	44.5
Pessimistic	37,047	(3,128)	-7.79	3,964	(806)	-16.90	40.7
Soybeans and soybean products[b]							
Baseline	29,020			5,754			52.7
Optimistic	30,401	1,381	4.76	7,089	1,334	23.19	53.9
Pessimistic	27,891	(1,129)	-3.89	4,682	(1,073)	-18.64	51.7

NOTE: Prices and values are given in real U.S. dollars (1986/87).
[a]The price given for feed grains is the U.S. corn FOB Gulf Port price. Feed grains include corn, barley, sorghum, and oats.
[b]The price given for soybeans and soybean products is the U.S. soybean FOB Gulf Port price.

Figure 6. REAL FOB GULF PORT PRICES, MACROECONOMIC SCENARIOS
Absolute and Percent Change from Baseline 1991/92

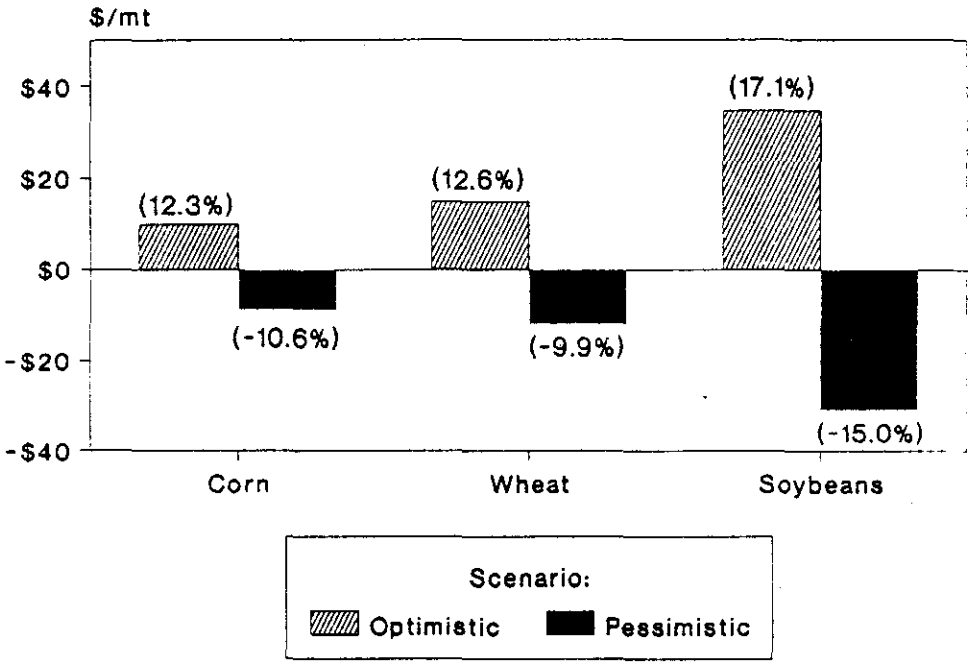


Figure 7. WORLD NET COMMODITY TRADE

Absolute and Percent Change from Baseline 1991/92

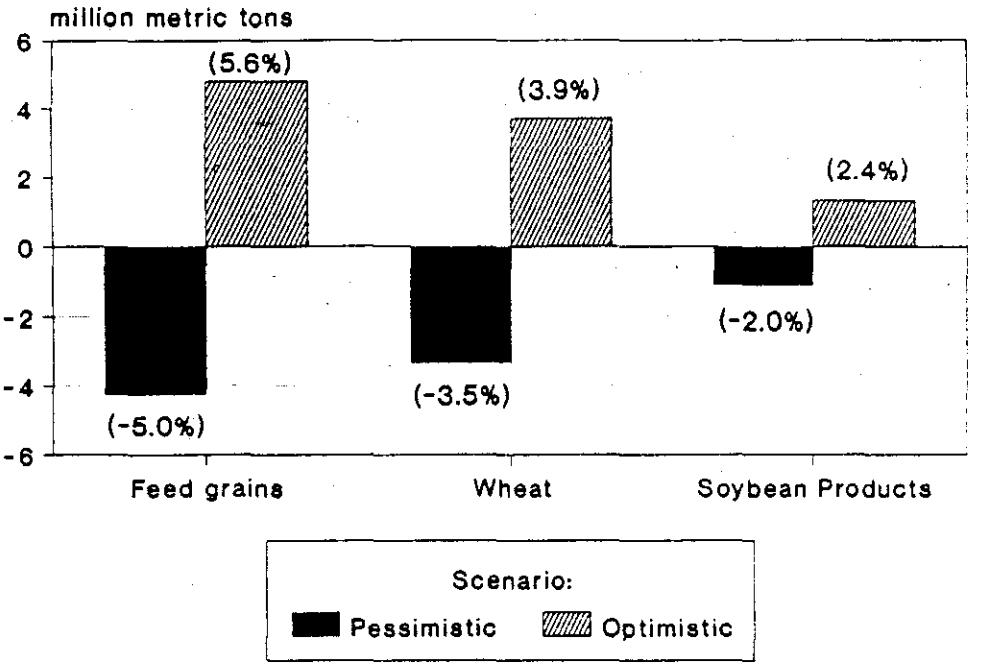


Figure 8. WORLD NET COMMODITY TRADE VALUE

Absolute and Percent Change from Baseline 1991/92

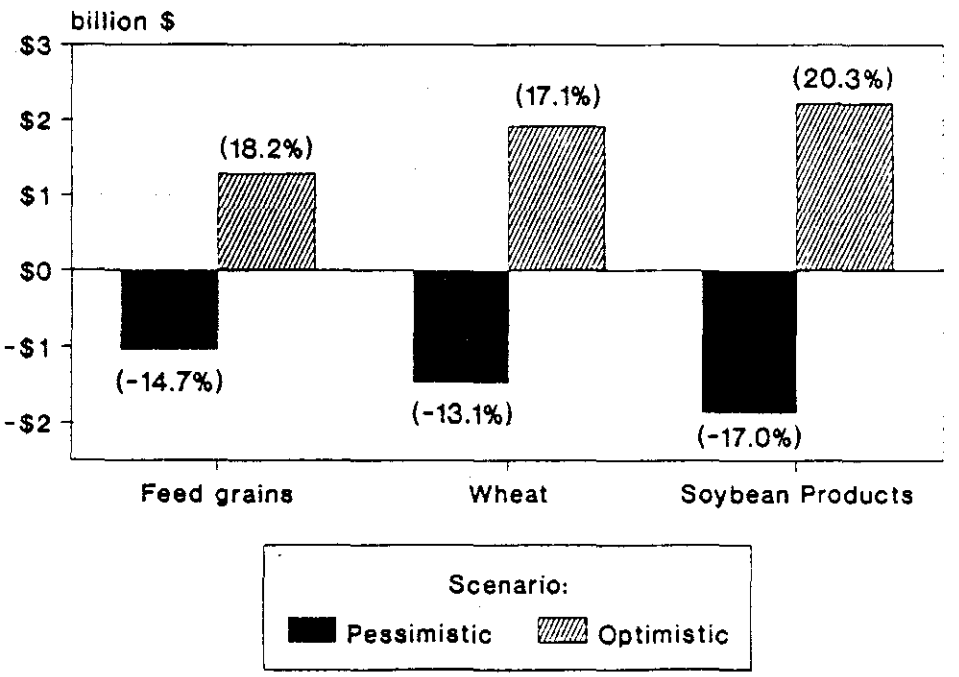


Figure 9. U.S. NET COMMODITY TRADE
Absolute and Percent Change from Baseline 1991/92

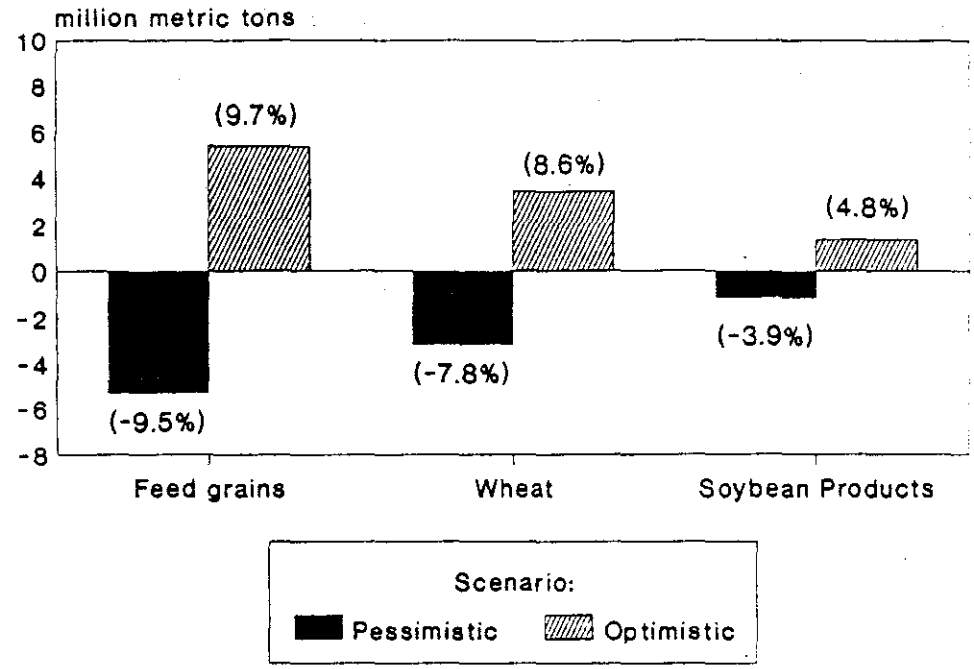
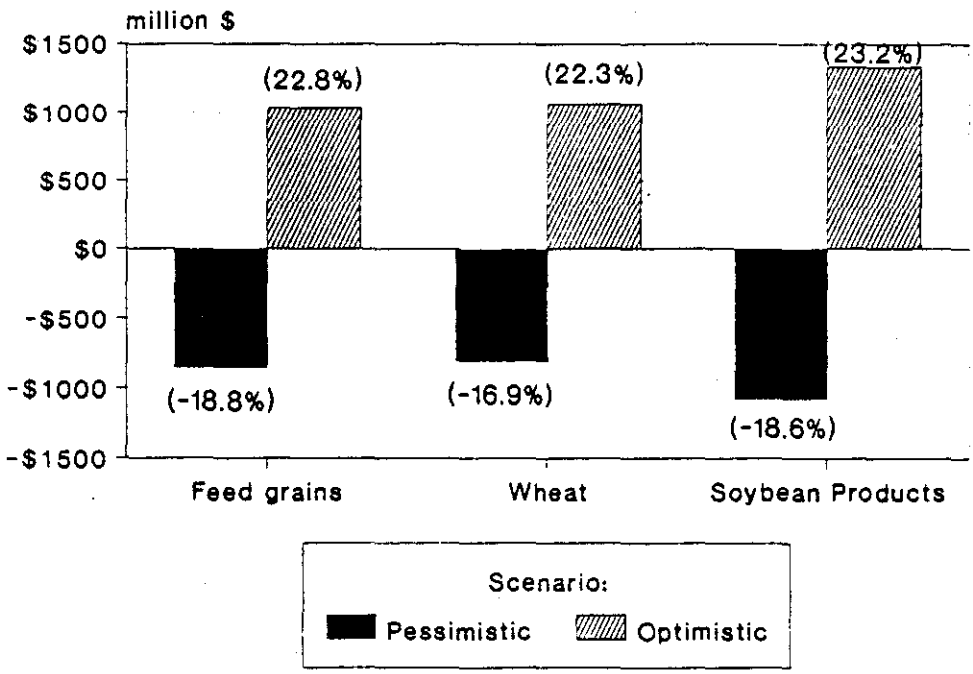


Figure 10. U.S. NET COMMODITY TRADE VALUE
Absolute and Percent Change from Baseline 1991/92



Expanding world incomes in the optimistic scenario are favorable to world agricultural trade. The combination of high prices and rising world trade leads to large increases in the value of world trade. With increasing income growth rates in Japan and the EC-12 leading to rising demand for soybeans and soybean products, the value of world trade in these commodities increases 20.3 percent while trade rises only 2.4 percent. Similarly for wheat and corn, the percentage changes in value of world trade in these commodities rise about four times their respective percentage changes in volume of trade.

The pattern of U.S. trade follows that of world trade. Feed grains experience the largest increase in U.S. exports, both in absolute and proportional terms (5.4 mmt and 9.7 percent in 1991/92, respectively), in the optimistic scenario. Increases in wheat exports are similar. Soybean and soybean product exports in 1991/92 increase only half as much as wheat exports in absolute and proportional terms (1.4 mmt and 4.8 percent in 1991/92, respectively).

Since the United States has the capacity (idled cropland and stocks) with which to meet increased export demand without having to cut back on supplies to the domestic market, the U.S. share of world wheat, feed grains, and soybean and soybean product markets increases. The U.S. market share falls in all commodity markets in the pessimistic scenario.

In real terms, the values of world and U.S. trade increase more in the optimistic scenario than they fall in the pessimistic scenario. In the optimistic scenario the value of U.S. exports of each of the commodities rises more than 20.0 percent relative to the baseline in 1991/92. In that year, the increase in total U.S. export revenues from

grain and soybean products relative to the baseline is $3.4 billion in real terms, with soybeans and soybean product exports of $1.3 billion accounting for 38 percent of the increase.

In the optimistic scenario, increases in domestic use associated with increased real GDP growth rates outweigh domestic production increases (resulting from higher prices occurring in the scenario). Thus, the import gap widens for the commodities under study. The cost to developing countries of imports rises faster than import volumes because they face increasing prices. For example, wheat net imports for all LDCs rise 5.7 percent relative to the baseline in 1991/92, but wheat import cost increases 14.6 percent.

In the pessimistic scenario the opposite occurs: decreases in LDC domestic use of wheat and feed grains resulting from reduced GDP growth rates are larger than decreases in production resulting from lower prices, the import gap narrows, and the cost of these imports falls by more than imports fall. For example, wheat net imports by all LDCs fall 5.1 percent in 1991/92 relative to the baseline and wheat import cost declines 11.1 percent.

Table 6 presents the impact of the macroeconomic shocks on the net trade positions of the three LDC regions. Detailed domestic use, production, and trade results by country are presented in tables in the Macroeconomic Scenarios Numerical Report (Angel et al. 1988). In addition, detailed country studies for Egypt and Brazil are included in Appendix A of the Technical Report.

Latin American wheat and feed grains imports are the most sensitive to changes in the world macroeconomic environment, and those of LDC Africa

Table 6. Macroeconomic scenarios: change from baseline in Latin America, Africa and Middle East, and Asia, net trade and trade value, 1991/92

Region and Scenario	LDC Net Imports (1000 mt)			LDC Net Import Value (mil. $)[a]		
	Level	Change		Level	Change	
		Absolute	%		Absolute	%
Feed Grains[b]						
L. America net imports						
Baseline	1,807			148		
Optimistic	2,962	1,155	63.90	273	125	84.05
Pessimistic	654	(1,153)	-63.82	48	(100)	-67.65
LDC Africa and Middle East net imports						
Baseline	14,428			1,306		
Optimistic	14,759	332	2.30	1,458	152	11.63
Pessimistic	14,141	(287)	-1.99	1,180	(126)	-9.65
LDC Asia net imports						
Baseline	11,540			948		
Optimistic	12,426	886	7.68	1,146	198	20.92
Pessimistic	10,706	(834)	-7.23	786	(162)	-17.05
All-LDC feed grains net imports						
Baseline	27,775			2,403		
Optimistic	30,148	2,372	8.54	2,877	475	19.77
Pessimistic	25,501	(2,274)	-8.19	2,014	(388)	-16.16
Wheat						
L. America net imports						
Baseline	4,268			507		
Optimistic	4,615	346	8.11	617	110	21.74
Pessimistic	3,965	(303)	-7.10	424	(83)	-16.29
LDC Africa and Middle East net imports						
Baseline	30,644			4,216		
Optimistic	31,862	1,218	3.97	4,593	377	8.94
Pessimistic	29,465	(1,179)	-3.85	3,921	(295)	-7.00
LDC Asia net imports						
Baseline	27,303			3,242		
Optimistic	29,278	1,974	7.23	3,915	673	20.75
Pessimistic	25,601	(1,703)	-6.24	2,739	(503)	-15.51
All-LDC wheat net imports						
Baseline	62,216			7,966		
Optimistic	65,754	3,538	5.69	9,125	1,160	14.56
Pessimistic	59,031	(3,185)	-5.12	7,085	(880)	-11.05

[a]Real (1986/87) dollars.
[b]Includes corn, barley, and oats.

and Middle East are the least sensitive. In the optimistic scenario, the LDC feed grains market share rises from 36.3 percent to 37.5 percent in 1991/92, with Latin America's share rising the most within this group, and Africa and the Middle East losing marginally.

In the optimistic scenario, the combined cost of feed grains and wheat imports increases $235 million in real terms in Latin America, and $529 million in real terms in Africa and the Middle East. The largest increase in feed grains and wheat import cost occurs in Asia, $871 million, mainly due to the rise in wheat imports. The total cost of wheat and feed grains imports for all LDCs rises in real terms by $1.6 billion in the optimistic scenario in 1991/92. This compares with an increase in U.S. export revenues from wheat and feed grains of $2.1 billion.

Summary and Conclusions

The results of the six scenarios and the baseline in part reflect initial conditions, such as the distribution and levels of world agricultural production, stocks, demand, and trade for different commodities across countries. Specific initial conditions or characteristics that influenced the results of the analysis include U.S. wheat and feed grains stocks levels and idle agricultural land, LDCs' large share of world wheat imports, and industrial and centrally planned countries' dominance of world feed grains and soybean imports.

U.S. export supply elasticity is high because of the nation's ability to draw upon idled acreage, government stocks, and excess capacity in the soybean crushing industry. For the period considered, wheat and feed grains stocks in the United States condition the relative export supply

elasticities of both commodities. In the initial year of the analysis there were relatively low levels of U.S. wheat stocks and relatively high levels of feed grains stocks. Therefore, U.S. feed grains export supply elasticity is larger than wheat export supply elasticity. For example, in the optimistic scenario in 1991/92, wheat and corn real FOB prices increase by about the same proportion relative to the baseline, 12.6 percent for wheat and 12.3 percent for corn, while world wheat trade increases by 3.9 percent and world feed grains trade increases by 5.6 percent (Table 5). The estimated short term production response to prices of competitors to the United States in world markets for feed grains is not large. Overall, in the scenarios with real GDP growth rates increasing relative to baseline projections, the U.S. trade share of wheat, feed grains, and soybean and soybean product markets rises.

The higher wheat price impact of regional income scenarios is due primarily to LDCs' large share of world wheat net imports (64.1 percent in 1986/87) relative to the LDCs' share of world feed grains imports (excluding sorghum, 37.9 percent in 1986/87). Also, the world wheat market is slightly more price inelastic than the world feed grains market, indicating that equal percentage increases in world demand for wheat and feed grains will have a larger impact on wheat prices than on feed grains prices.

Conversely, since the industrial and centrally planned economies have a greater share of world imports of feed grains and soybeans and soybean products than the developing countries, the impacts on commodity prices in the optimistic and pessimistic scenarios are substantially different from the regional income scenarios. Corn and soybean price movements are

closer to wheat price movements when all country GDP growth rates change than when only developing country GDP growth rates change. The results of the six scenarios indicate that the distribution of changes in income growth rates by country must be considered, as well as the magnitude of such changes, in establishing likely commodity price and trade impacts.

In addition to initial or historical conditions, factors such as income elasticities of demand, price elasticities of supply and demand, price transmission elasticities, and the degree of substitutability in supply and demand between commodities, play a role in determining the response of world trade and commodity prices to the changes in real GDP growth rates.

The income elasticity of demand for soybeans and soybean products is generally higher than that of wheat and feed grains. But this does not necessarily imply that soybean trade will increase more than grain trade in response to an increase in income. In fact, when all three prices are moving simultaneously, soybean and soybean product trade is less price elastic than wheat and feed grains trade. As a result, most of the demand adjustment is in the associated soybean price rather than in quantity.

Domestic use in the LDC Africa and Middle East region as a whole does not appear to be very income elastic. Several factors affecting the individual countries and the groups of countries modeled in this region contribute to this finding. In Africa and the Middle East, domestic use is strongly tied to production, and natural resource constraints and domestic policies that insulate domestic agriculture contribute to a lack of price responsiveness in production. In addition, in the macroeconomic

scenarios, oil prices move in the opposite direction to changes in income, thus offsetting part of the effect of income growth on domestic use in this region. These factors partly mask the higher income elasticity of demand of the oil exporting countries.

In Latin America, substitution among feed grains, wheat, and soybeans in production is greater than in other regions. Therefore, in Latin America the area harvested of different crops is more likely to adjust to relative price changes in the different scenarios than the area harvested in the other two developing country regions, LDC Asia and LDC Africa and Middle East. Great care should be exercised in interpreting the trade results for Latin America. Net trade values in Latin America are a very small proportion of total production and domestic use and even very small changes in production or domestic use can cause large swings in the net trade.

Overall, the large degree of substitutability between wheat and corn in supply and demand results in wheat and corn prices moving together. However, price transmission elasticities must also be considered in determining the impact of relative price changes for a given region. Changes in different commodities' FOB Gulf Port prices will not result in the same proportional changes in prices in the individual countries, if price transmission elasticities differ by commodity.

The hypothesis that expanding incomes in developing countries will lead to higher imports of agricultural commodities is supported by the analysis. Whether incomes rise in LDCs only, or globally, by the end of the projection period, 1991/92, the increases in domestic use resulting

from faster GDP growth outweigh production increases stimulated by higher commodity prices. Thus, the import gap for the commodities under study--wheat, feed grains, and soybeans and soybean products--widens and the cost to LDCs of increased imports rises faster than the rise in imports because of rising prices.

The greatest opportunities for successful use of development assistance to stimulate agricultural trade exist in countries with both a high import response to income growth and a high income response to development assistance.

This study has focused on the first of these two important relationships, import response to income growth. A remaining challenge is to improve the quantification of the second relationship, development assistance and accelerated income growth.

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