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# Agricultural Trade Liberalization and Developing Countries

Barry Krissoff  
John Sullivan  
John Wainio  
Brian Johnston

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### Abstract

We examine the effects on developing countries of liberalizing agricultural domestic and trade policies in both the industrial and developing market economies. In order to undertake the analysis, we utilize the SWOPSIM framework to create a static global agricultural net trade model that contains 36 countries or regions and 22 commodities. We find that if the industrial and developing economies liberalize access to their agricultural markets, world prices of most agricultural goods will increase. Developing countries' producers benefit with increases in income, but consumers lose with a higher food bill. Agricultural trade balances improve, particularly when the developing countries participate in the liberalization process. The gains (or losses) attributed to developing countries, though, are highly skewed. With higher food costs there are potential problems for some low-income countries and low-income consumers.

Keywords: Agricultural trade liberalization, developing countries, aggregate support measures, SWOPSIM

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## Summary

In this report, we examine the effects on developing countries of liberalizing agricultural domestic and trade policies in both the industrial and developing market economies. In order to undertake the analysis, we utilize the SWOPSIM framework to create a static global agricultural net trade model that contains 36 countries/regions and 22 commodities. We use aggregate summary support measures, either in the form of producer or consumer subsidy equivalents or nominal rates of protection to reflect 1986 agricultural policy.

In analyzing the effects of trade liberalization on developing countries, we consider three scenarios. Two of these reflect liberalization by only the industrial market economies, with different assumptions regarding the degree to which changes in world prices are allowed to affect domestic prices in the developing market economies; the third reflects a global liberalization. When we simulate the liberalization scenarios for industrial economies, the average world price increase for the 22 commodities in the model is 21 percent when developing countries allow full transmission of world price changes to their domestic economies (first scenario), and 16 percent when they only allow partial (50 percent) transmission (second scenario). If both the industrial and developing economies liberalize their agricultural markets, world prices increase on average 16 percent, the same as in the second scenario. However, there is considerable variation in world price changes across individual commodities when comparing global and industrial economy liberalization. For example, the world price increase of beef will be lower, while the price increase of rice will be lower. This reflects the removal of export taxes on beef by Latin American countries and producer subsidies and consumer taxes on rice for several Asian countries.

Developing countries' agricultural trade balances improve by \$14 billion under global trade liberalization, versus improvements of \$6 billion (partial transmission) and \$12 billion (full transmission) when only industrial economies liberalize. Latin American countries experience the greatest improvements, reflecting their strong orientation toward agricultural commodity exports. Improved trade balances enable Latin America to take advantage of increases in world prices and to increase production and exports. In contrast, there is a small deterioration in the agricultural trade balance of the African and Middle Eastern region due to the higher costs of importing food.

With commodity prices generally increasing under each scenario of trade liberalization, producers tend to gain while consumers tend to lose. In global liberalization, farmers experience income gains of \$19 billion, while consumers incur losses of \$17.5 billion. The only exception occurs in some Asian countries. Consumers there actually gain because removal of large consumer taxes, mostly on rice, reduce prices.

Economic theory suggests that efficiency gains are realized when a small economy liberalizes access to its markets. Our findings agree. If developing countries do not participate in removing agricultural supports, they incur welfare losses of over \$4 billion. But by participating, developing countries realize a gain of \$2.5 billion. This represents nearly a \$7-billion net welfare turnaround for the developing countries when they participate with industrial economies in liberalizing trade.

This report focuses on effects of agricultural trade liberalization on developing countries. Thus, the detailed reporting on the effects of liberalization is restricted to those countries. For a summary of results for each of the 36 country/regions in our model, see appendix tables 3-5.



# Agricultural Trade Liberalization and Developing Countries

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## Introduction

This report discusses some of the potential effects of agricultural trade liberalization on the economies of developing nations. It draws upon and complements earlier work from the Economic Research Service, U.S. Department of Agriculture, which used the Static World Policy Simulation (SWOPSIM) framework to model and estimate the effects of eliminating assistance to agriculture in the industrial market economies (IME's) (23).<sup>1</sup> This previous work, based on an 11-region static world net trade model, called ST86, concluded that eliminating all subsidies to agriculture in the IME's would drive up world prices for most commodities.

The implications drawn from the ST86 study for the developing world were of a very general nature, contingent to a great extent on each country's agricultural trade balance. While exporters would benefit from rising world prices, importers would lose since food imports would become more expensive. At the same time, higher world prices would induce all developing countries to increase agricultural production. In some countries, increased production would supplant imports, while in others increased production would lead to expanded exports. More detailed analyses for the developing world were not attempted, because the ST86 model included only three aggregate developing country regions (one each representing net exporters, net importers, and newly industrialized Asian countries). In addition, no analysis was done on the effects of removing assistance to agriculture in the developing countries.

This study examines and quantifies the effects on developing countries of liberalizing agricultural trade policies in both the industrial and the developing economies. To accomplish this, we have extended the ST86 model to include analysis of 24 individual developing countries and regions. The current model, referred to as DC86, contains a total of 36 regions and 22 commodities. The developing world is represented by the following countries and regions: Mexico, Central America/Caribbean, Brazil, Argentina, Chile, Venezuela, Other Latin America, Nigeria, Kenya, Other Sub-Saharan Africa, Egypt, Middle East Oil-Exporters, Other Middle East, India, Pakistan, Bangla-

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<sup>1</sup>Underscored numbers in parentheses refer to sources listed in the References section.

desh, Indonesia, Thailand, Malaysia, the Philippines, South Korea, Taiwan, Other East Asia, and Other Asia.<sup>2</sup> Eight IME country or regional groupings, three regions representing the centrally planned economies, and a rest-of-world balancing region round out the country coverage. Commodity coverage encompasses the grain, oilseed, livestock, and dairy sectors, as well as cotton, sugar, and tobacco sectors.

The international production and trade of farm products are characterized by pervasive government intervention in the marketplace. In the IME's, production decisions are affected by an assortment of programs that ensure producers a guaranteed price or level of income and provide marketing services, inputs, infrastructure, or other benefits at reduced costs. In addition to influencing the level of product output, these interventions affect land use, input supplies, consumer prices, and net trade.

Because of the importance of these countries in the international market, their policies also affect international trade flows, with import restrictions or export subsidies usually imposed in conjunction with price guarantees. Studies measuring the effects of government intervention in the IME's conclude that it has resulted in distorted markets worldwide, with misused resources, depressed and volatile world prices, heavy burdens on government budgets, and tensions between otherwise friendly nations (23,28).

The United States and other parties to the General Agreement on Tariffs and Trade (GATT) are currently participating in an eighth round (the Uruguay Round) of multilateral trade negotiations aimed at alleviating the negative effects of government intervention. Two earlier attempts were made within the GATT to liberalize agricultural trade: The Kennedy Round of GATT negotiations in 1964-67 and the Tokyo Round in 1973-79. Neither was successful, partly because governments in the IME's maintained that domestic farm policies should not be subject to international negotiation.

Thus far, what has distinguished the Uruguay Round from the previous negotiations is an apparent willingness of the IME's to discuss domestic farm programs and policies. Some observers maintain that this willingness to negotiate domestic farm programs in the Uruguay Round is due to the perceived failure of these programs to meet their social objectives. While the costs of domestic programs in the IME's have escalated rapidly in recent years, some feel the groups for which this assistance was intended have been largely missed (1). Others cite budget pressures from the increased cost of these programs as the motivation for current negotiations.

Interest in the current GATT negotiations is not limited to the IME's. Many Third World countries, the developing market economies (DME's), are also interested, although their motivations differ from those of the IME's. What has brought the DME's to the negotiating table is not so much the failure of their own farm programs to meet social objectives, nor is it due to an escalation in the costs of those programs. Rather, most DME's are interested in how dismantling programs in IME's will affect key variables such as world prices or food availabilities. For some DME's, these negotiations are an opportunity to aid their producers by gaining access to industrialized country

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<sup>2</sup>See appendix table 2 for a listing of countries included in each regional model.

markets at higher world prices. But for other DME's, liberalizing agricultural markets will adversely affect their consumers and their balance of trade should world prices rise by great amounts. In general, however, the DME's appear to be taking a "wait and see" approach, unsure of how changes in IME policies will affect their agricultural sectors as well as to what extent a new GATT accord will require the DME's to modify their policies.

The DME's have historically presented the GATT with the challenging problem of how to reconcile the goal of having trade be determined by market forces with the need for special dispensations to encourage economic development. In an attempt to address these needs, GATT accords the DME's "special and differential" treatment in a number of ways. DME's can impose quotas or other restrictions on trade to aid infant industries or to cope with balance of payments problems; they do not have to extend most-favored-nation treatment to other GATT signatories in the manner imposed on IME's; they may receive special treatment under separate codes on nontariff barriers; they are exempt from GATT provisions concerning customs unions and free-trade areas; and they benefit from lower tariff rates on exports under the General System of Preferences.

India is one country that has publicly stated a strong preference for continued special and differential treatment for developing countries' agricultural exports (3). At the same time, many of the large DME's are calling for removal of restrictive trade measures imposed by the IME's. Brazil, Malaysia, and Thailand, for instance, have expressed an interest in improving market access for their agricultural and tropical products (3,5). Mexico has favored a reduction of developed countries' tariffs (basically those of the United States) on fruits and vegetables (13). In general, the developing world maintains that existing trade barriers restrict access to IME markets in which the DME's claim they have a natural comparative advantage. Whether the IME's will be willing to lower trade barriers to allow increased imports from DME's without some reciprocity on the part of the DME's will surely be a point of contention throughout the trade talks. At the current time, the United States envisions participation by the DME's in instituting any reforms agreed to at the Uruguay Round negotiations.

It is not just IME policies that have diminished the profitability of agriculture in developing countries. Agricultural sectors in the DME's have been taxed both explicitly and implicitly by developing countries themselves. Explicit taxation has arisen due to the financial requirements of development strategies aimed at import substitution, export development of the manufacturing sector, and infrastructure investment. Implicit taxation of agriculture has arisen due to protecting manufacturing sector from import competition by influencing the exchange rate (14). Exchange rates have been overvalued, effectively taxing the traded goods sector of an economy.

The objective of this study is to examine and quantify the effects on developing countries of liberalizing agricultural trade policies in both the developed and the developing economies. Since there is a complex mix of commodity exports and imports within and across developing countries, it is not clear, in advance, in which countries and in which commodities gains and losses are likely to be concentrated.

It is important to keep in mind that this study's coverage is limited in terms of both the range of commodities included in the model and the extent of available policy information. Our commodity coverage tends to be 50 to 75

percent of the value of agricultural exports for developing exporters and 30 to 70 percent of the value of agricultural imports for developing importers. Excluded are some important tropical products: coffee, cocoa, rubber, vegetables, and fruits.<sup>3</sup> This is partly due to a lack of information and data and to a concession to the fact that tropical commodities have been awarded their own negotiating group in the Uruguay Round. We do, however, include several important subtropical products, such as rice, oilseeds and products (such as palm and coconut), cotton, sugar, and tobacco. Furthermore, in contrast to temperate and subtropical agricultural products, many tropical products such as rubber and raw materials face relatively low levels of protection in Organization for Economic Cooperation and Development (OECD) countries (25). Trade liberalization in these commodities would not be expected to yield significant direct effects.

### The Model Structure

Predicting the markets' responses to changes in government programs and policies and quantifying the potential effects are very difficult, since the interactions between countries and commodities are wide-ranging and complicated. There is little doubt that liberalizing agricultural trade will result in fundamental changes in a number of variables, including: prices; quantities produced, consumed, and traded; producer incomes; and government expenditures. In an effort to predict these changes, economists construct commodity trade models that simulate the changes in certain variables, such as prices and quantities, resulting from changes in other variables, such as government policies.

The trade model used for this analysis is based on the Static World Policy Simulation (SWOPSIM) modeling framework. SWOPSIM models are characterized by four basic features: static, nonspatial, partial equilibrium, and net trade models. (For more details on the structure of SWOPSIM models, see 22,23.) The world model includes 22 commodities and is made up of 36 linked country or regional models, 24 of which represent countries or regions in the developing world. For each country/region  $i$  and commodity  $j$  (or  $k$ ) in the model, a demand and supply function is specified:

$$D_{ij} = D_{ij}(C_{Pij}, C_{Pik}) \quad (1)$$

$$S_{ij} = S_{ij}(P_{Pij}, P_{Pik}) \quad (2)$$

where  $C_{Pij}$  and  $P_{Pij}$  are the domestic incentive prices facing consumers and producers of commodity  $j$ .<sup>4</sup>  $C_{Pik}$  is the cross-product consumer price for commodity  $k$  (for all relevant  $k$ 's).  $P_{Pik}$  is an input and/or product substitute or complement producer price with respect to commodity  $k$ . Trade is the difference between domestic supply and total demand:

---

<sup>3</sup>Also not included are processed agricultural products that often have higher protection rates in developed countries.

<sup>4</sup>The supply and demand equations are specified with constant elasticities in the SWOPSIM framework. Other conditions and restrictions regarding the supply and demand functions can be found in Roningen (22), and Roningen and Dixit (23). The data set is published in Sullivan, Wainio, and Roningen (24).



$$T_{ij} = S_{ij} - D_{ij}. \quad (3)$$

Domestic incentive prices depend on the level of consumer and producer support wedges (CSW<sub>ij</sub> and PSW<sub>ij</sub>) and world prices denominated in local currency:

$$C_{Pij} = CSW_{ij} + F(E_i * WP_j) \quad (4)$$

$$P_{Pij} = PSW_{ij} + G(E_i * WP_j) \quad (5)$$

where CSW<sub>ij</sub> and PSW<sub>ij</sub> depend on the level of government support in each country, as measured by producer and consumer subsidy equivalents (PSE's/CSE's). The PSE/CSE is a broader measure of policy support than is the nominal rate of protection. PSE/CSE includes direct income payments; input, marketing, and structural assistance; and market price supports. (A subsidy is positive support and a tax is negative support.) E<sub>i</sub> is the exchange rate defined in local currency (i) per U.S. dollar, and WP<sub>j</sub> is the world reference price of commodity j. The functional relationships, denoted as F() and G(), allow a mapping of world to domestic prices to be less than or equal to 1, depending on price transmission coefficients. If the developing country's government wants to protect its consumers from a 10-percent world price increase, for instance, then the consumer (and producer) price may rise by less than 10 percent.

World markets clear when net trade of a commodity across all countries is equal to 0. For commodity j, this occurs when:

$$\sum_{i=1}^n T_{ij} = \sum_{i=1}^n S_{ij} - \sum_{i=1}^n D_{ij} = 0 \quad (6)$$

The commodity supply and demand equations are parameterized to reproduce 1986 base period data for each country's supply, demand, prices, and trade. When a change is made in the support wedges, the model recalculates domestic supply and demand levels, rebalancing world trade, production, consumption, and prices in the process. The pattern of prices and quantities observed in the base period is then compared with the pattern that emerges from the model. Output from the exercises indicate what might have happened if trade-distorting support did not exist in 1986 and if all other exogenous variables pertinent to agricultural markets remained the same.

### Measures of Agricultural Support

The GATT's goal of allowing trade to be determined by market forces conflicts with the pressures placed on governments to intervene in their domestic agricultural sectors in order to achieve social and economic objectives. These objectives include ensuring food security, maintaining market stability, protecting national health, maintaining balance of payments, promoting development of infant industries, and shielding producers against the painful economic adjustments associated with new patterns of comparative advantage. Not all of these interventions in the marketplace result in subsidies to producers. In many DME's, for instance, the collection of government revenue is an objective best accomplished by placing a tax on exports.

The general perception is that policies in the developing world are biased against domestic production of food crops in favor of imports of staple foods. A common argument is that most DME governments are controlled by political elites with an urban bias, whose goals are to provide sufficient and inexpensive food to advance urbanization and industrialization (4). This perception has not been reflected in recent studies, which indicate that direct price discrimination toward food grain producers in developing countries is not as widespread as generally believed (28). The support data in our model tend to corroborate this latter viewpoint. We show that, on average, the developing countries supported agricultural producers and taxed consumers in 1986, although the overall level of support is relatively slight (table 1). The average PSE and CSE, weighted by the value of production and consumption, equal 6 and -4 percent, respectively.

The studies cited above recognize that while direct price discrimination may not be widespread, agricultural producers in the DME's face significant indirect price discrimination, when the tax effect due to exchange rate distortions is included. This means that a country which maintains an

Table 1--Levels of support to agriculture in developing countries, 1986<sup>1</sup>

Commodity	Country's level of PSE's														
	MX	BZ	AR	VE	NG	EG	ND	PK	DO	TH	ML	PH	SK	TW	Average
	Percent														
BF	-67	-22	-48	--	--	46	-52	--	--	--	--	5	48	22	-16
PK	--	--	--	--	--	--	--	--	--	--	--	20	-30	2	-1
ML	--	--	--	--	--	35	-35	--	--	--	--	--	--	--	-13
PM	--	3	--	--	--	47	--	--	--	--	--	--	44	36	12
PE	--	--	--	--	--	--	--	--	--	--	--	--	4	--	1
DM	-24	--	--	--	--	--	-35	--	--	--	--	--	--	--	-21
DB	--	13	--	--	--	--	22	--	--	--	--	--	--	--	20
DC	--	--	--	--	--	--	22	--	--	--	--	--	--	--	1
DP	--	--	--	--	--	--	22	--	--	--	--	--	--	--	14
WH	-13	39	-13	--	68	5	-29	-32	--	--	--	18	60	16	-15
CN	39	41	-24	63	--	25	--	-15	-26	--	--	20	70	70	29
CG	29	--	-71	67	--	15	--	-12	--	--	--	--	72	75	12
RI	-47	42	--	55	12	-83	-5	-61	17	4	41	29	72	31	18
SB	24	29	-48	--	--	--	13	--	26	--	--	55	75	60	18
SM	--	--	--	--	--	--	-40	--	--	--	--	--	--	--	-1
SO	--	--	--	--	--	--	62	--	--	--	--	--	--	--	5
OS	-44	--	--	--	--	--	10	--	16	--	--	-10	--	--	5
OM	--	--	--	--	--	--	-30	--	--	--	--	--	--	--	-11
OO	--	--	--	--	--	31	43	27	--	--	-3	-5	--	--	17
CT	-89	--	--	--	29	-99	--	-27	--	--	--	--	--	--	-15
SU	-7	--	--	--	77	11	40	--	33	40	10	30	--	43	28
TB	--	--	--	--	--	--	--	--	--	--	--	--	--	30	1
Average <sup>2</sup>	-6	15	-16	13	5	13	-4	-20	14	11	6	17	52	18	6 <sup>3</sup>

See notes at end of table.

--Continued

Table 1--Levels of support to agriculture in developing countries,  
1986<sup>1</sup>--Continued

Commodity	Country's level of CSE's														Average
	MX	BZ	AR	VE	NG	EG	ND	PK	DO	TH	ML	PH	SK	TW	
	Percent														
BF	37	--	27	--	--	-27	32	--	--	--	--	-3	-57	-9	1
PK	--	--	--	--	--	--	--	--	--	--	--	-11	-5	--	-2
ML	--	--	--	--	--	-15	15	--	--	--	--	--	--	--	7
PM	--	-2	--	--	--	-27	--	--	--	--	--	--	-32	-30	-8
PE	--	--	--	--	--	--	--	--	--	--	--	--	-12	--	-1
DM	12	--	--	--	--	--	15	--	--	--	--	--	--	--	9
DB	--	-10	--	--	--	--	-17	--	--	--	--	--	--	--	-15
DC	--	--	--	--	--	--	-15	--	--	--	--	--	--	--	-1
DP	--	--	--	--	--	--	-17	--	--	--	--	--	--	--	-4
WH	6	--	9	2	-8	47	15	30	--	--	--	-13	-2	-7	13
CN	25	--	22	-57	--	43	--	--	23	--	--	-18	--	-19	2
CG	21	--	64	-60	--	-14	--	-30	--	--	--	--	-75	-20	-9
RI	24	--	--	-27	-2	29	1	-24	-14	-50	-21	-15	-56	-20	-16
SB	24	--	45	--	--	--	-13	--	-25	--	--	-52	-75	-22	-11
SM	--	--	--	--	--	--	32	--	--	--	--	--	--	--	1
SO	--	--	--	--	--	--	-31	--	--	--	--	--	--	--	-10
OS	40	--	--	--	--	--	-5	--	-15	--	--	9	--	--	-2
OM	--	--	--	--	--	--	24	--	--	--	--	--	--	--	12
OO	--	--	--	--	--	-15	-22	-13	--	--	14	3	--	--	-13
CT	67	--	--	--	-9	92	9	18	--	--	--	--	--	--	7
SU	4	--	--	--	-13	7	-23	--	-18	-24	--	-18	-60	-54	-17
TB	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Average <sup>4</sup>	10	--	10	-9	-2	--	1	3	-12	-37	-8	-10	-39	-11	-4 <sup>5</sup>

-- = Not applicable or less than 1

<sup>1</sup> See appendix table 1 for a definition of the country and commodity codes.

<sup>2</sup> Commodity average PSE's are weighted by the quantity of production.

<sup>3</sup> Country and world average PSE's are weighted by the value of production.

<sup>4</sup> Commodity average CSE's are weighted by the quantity of consumption.

<sup>5</sup> Country and world average CSE's are weighted by the value of consumption.

overvalued exchange rate (as do many DME's) effectively taxes its exports and subsidizes its imports, thereby taxing domestic production while subsidizing the domestic consumption of imported goods. Due to insufficient information, however, our support data set does not include information on the level of exchange rate misalignment in developing countries. If it did, then the PSE's in table 1 probably would be largely negative and the CSE's probably would be largely positive.<sup>5</sup>

Even though our average PSE for the DME's is positive, the DME's level of support to agricultural producers tends to be substantially below that of the

<sup>5</sup>For a treatment of how exchange rate policies in the developing world may affect commodity markets, see (15).

IME's, with the exception of South Korea. In both groups, there is wide variation in the level of support, depending on country and commodity. Of the 14 developing countries for which we have some policy information, 4 have an average PSE that is negative. Two of these are Latin American countries (Mexico and Argentina); the other two are Asian (India and Pakistan). All four have a history of strong government intervention in the agricultural sector, particularly in the regulation of exports to assure adequacy of domestic supply. In fact, the negative PSE's in these countries may have been even larger if commodity prices were not depressed in 1986. The low 1986 world food prices encouraged some developing countries to reduce taxes on producers or to increase producer subsidies. It is against this background of relatively low commodity prices in 1986 that support for producers in the DME's should be evaluated.

The Latin American group of countries have widely disparate policies and net agricultural trade positions. The region is a net exporter of farm products, mainly sugar, beef, soybeans, cotton, coffee, and cocoa (the latter two commodities are not included in our model). Export taxes are used to raise government revenue, particularly in Argentina, Brazil, and some other exporting countries. Imports are restricted by the use of import licenses, exchange licenses, or centralized purchasing. Tariffs are also used to limit imports, and luxury goods are sometimes prohibited (17). Brazil, Venezuela, and Mexico subsidized crop production (for corn and coarse grains) in 1986. In contrast, Mexico, Brazil, and Argentina taxed livestock, although the rates of taxation in Brazil in 1986 were modest.

Many countries in Africa and the Middle East are food deficit countries. Population growth has exceeded food production growth in the African group for a number of years, and declining per capita gross domestic product (GDP) has been associated with recurrent droughts and large debt burdens (18). Middle Eastern countries are also dependent on food imports. In the oil-producing countries, adequate levels of foreign exchange are usually available for this purpose.

Of the African and the Middle Eastern countries, only Egypt and Nigeria are represented in the support data set. In Egypt, basic grain crops (wheat, corn, and other coarse grains) are moderately supported by holding producer prices above border prices. The livestock sector is substantially protected from import competition, while the rice sector is taxed. Consumer subsidies are used to offset the costs of grains to consumers, but not the costs of livestock. In Nigeria, there are fertilizer and credit subsidies for wheat and rice producers. A marketing board helps boost producer prices in wheat, but this is sometimes offset (depending on the year) by an overvalued exchange rate. An overvalued exchange rate acts as an import subsidy and helps consumers by keeping costs of food low. As already mentioned, exchange rate policy effects are not included in the PSE's and CSE's, because exchange rate effects have been estimated for only a few countries. Including such effects for a few countries would imply a lack of exchange rate distortions for the other countries, when some unknown level of distortion may be present.

Exporters in developing Asian countries are highly dependent on the agricultural sectors, because a high proportion of GDP and employment is provided by agriculture. Self-sufficiency, diversification of agricultural production, and export promotion have been the main goals of these countries (19). A wide variety of policy interventions is used to achieve these goals, including protection of the domestic farm sector by import restrictions, tariffs, and



widespread input subsidies. Malaysia, the Philippines, Thailand, and Indonesia supported their crop sectors in 1986, resulting in higher costs for consumers. The livestock sectors of these economies tend not to be large. In the Philippines, most imports of livestock products are licensed and subject to import duties.

South Korea and Taiwan have highly protected agricultural sectors. High priority has been given to securing stable food supplies. Domestic production and self-sufficiency are encouraged through high levels of domestic price support and import restrictions (6). The support data show high-support levels for crops in both South Korea and Taiwan but only moderate-support levels for livestock.

India and other parts of South Asia generally have rich agricultural resources, and agriculture is an important sector of their economies (16). Gains in food production have been achieved through investments in infrastructure and new technology. Governments have intervened to provide price supports for basic grains, subsidies for inputs, and infrastructure supports for irrigation and marketing. However, with state trading, both India and Pakistan moderately taxed their crop and oilseed sectors in 1986, although the patterns of support varied among commodities. Beef and mutton were also taxed in India in 1986, although the dairy sector was generally protected from import competition by import controls.

#### Industrial and Global Market Liberalization

We consider three similar but distinct simulation exercises in this study. They bear a similarity to each other because each exercise simulates a world free of government intervention in the agricultural sectors of the IME's. The simulations differ from each other in what we assume about the responses taken by governments in the DME's in reaction to an IME liberalization.

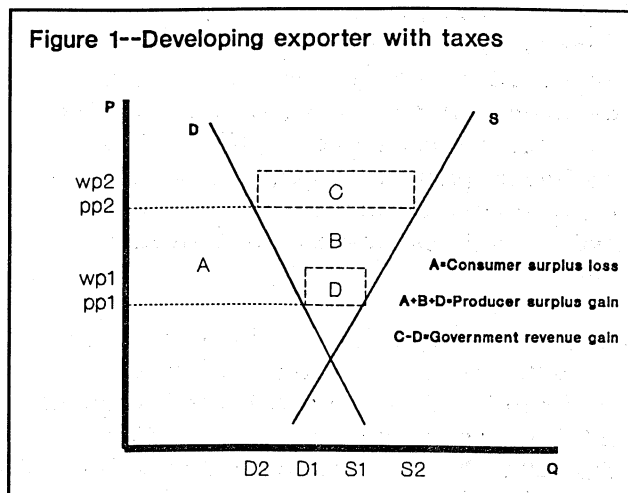
In the first simulation, we explore a scenario where the DME's keep their policies in place and partially protect their domestic markets from changes in world prices resulting from the IME liberalization. We do this by imposing a price transmission elasticity of 0.5 in each of the price equations found in the DME regions of the model. In the second simulation, we change the DME response to allow complete transmission of world price changes to the domestic economy (imposing a price transmission elasticity of 1). In the third simulation, we assume that the DME's are willing partners in the liberalization process and remove their own farm programs.

Under scenario 1 (IME-1), a \$1 change in world price affects the developing country price by only \$0.50. DME policies are assumed to be equivalent to those of a state trading board, which permits only half of the change in world prices to be passed on to domestic producers and consumers. Subsidy or tax equivalent wedges are implicitly allowed to change. For instance, a \$1 world price increase would be partially offset by an implicit \$0.50 increase in producer tax and consumer subsidy equivalents. For producers, the government is effectively imposing a tax by not allowing producers to receive the entire price increase. For consumers, the government is effectively providing a subsidy by buffering the full amount of the price increase. If production exceeds consumption, that is the country is a net exporter, the government obtains revenue (or a quota rent). If production is less than consumption, the government incurs an expenditure.

Scenario 2 (IME-2) is an alternative assumption that allows complete transmission of world prices to DME's.<sup>6</sup> With a price transmission coefficient of 1, the subsidy or tax equivalents are fixed at 1986 levels. That is, the developing countries maintain a fixed wedge between world and domestic prices. We deliberately chose 0.5 and 1 as our two alternative price transmission coefficients. We did not have sufficient information on policies to determine the price transmission for each commodity and for each country. We know that countries with policy regimes in place change these in response to changes in world prices, thus exhibiting a price transmission of less than 1. For example, Argentina reduced export taxes on wheat and corn during the 1985-86 period when world grain prices were declining. The consequences of lower world prices and earnings were partially absorbed by the government; therefore, the Argentine farmer did not bear the entire burden. Whether a developing country would allow no price transmission, full price transmission, or partial price transmission in response to an IME liberalization, and for which commodities, is unclear. By choosing alternative price transmission coefficients, we can provide some sensitivity analysis of the effects on developing countries of an IME liberalization.

In the third simulation (GLOBAL), both IME's and developing countries fully liberalize their markets. Producer subsidies and taxes and consumer subsidies and taxes are all eliminated.<sup>7</sup> The price transmission coefficient is set at 1; all world price changes are fully transmitted. The results of the global simulation indicate the effects of global agricultural liberalization on developing countries. The results of the GLOBAL simulation, compared with scenarios IME-1 and IME-2, give an indication of the extent to which the developing countries' policies affect their agricultural sectors.

A few graphs may help illustrate what happens when IME'S and developing countries liberalize just one commodity. Figure 1 illustrates the assumption that IME liberalization has occurred and world price changes are fully transmitted (scenario IME-2) to the developing country exporter that maintains an export tax. An example would be the case of beef in Argentina. Imposition of the export tax effectively lowers domestic prices to producers and consumers, to point pp1. Quantity demanded is D1, and quantity supplied is S1. The government collects revenue denoted by the rectangle area D. With an IME liberalization, world prices rise to point wp2. Domestic prices then rise to pp2, maintaining a fixed wedge. Consumption falls to D2, production



<sup>6</sup>For the centrally planned countries in the model (Soviet Union, China, and Eastern Europe), we assume an even smaller price transmission coefficient of 0.2. This latter assumption is maintained in all the simulation exercises.

<sup>7</sup>We have included the removal of producer taxes in our global liberalization scenario to reflect a complete elimination of market intervention. However, there is no precedent in the GATT to address the reduction or removal of producer taxes.

increases to  $S_2$ , and volume of trade increases to  $S_2 - D_2$ . The value of trade increases to  $(wp_2) * (S_2 - D_2)$ . Consumer surplus loss is calculated as the area A, producer surplus gains as area  $A + B + D$ , and government revenue gain as area  $C - D$ .

Now consider the case where there is a partial price transmission (scenario IME-1), and this time consider a developing country importer (fig. 2). For simplicity, suppose the developing country importer initially has no support but that government wants to protect consumers from some of the world price increase. Suppose only half of the world price change is transmitted to the domestic economy; that is, a government action establishes an import subsidy. In this case, the quantity supplied increases from  $S_1$  to  $S_2$ , quantity demanded decreases from  $D_1$  to  $D_2$ , trade volume declines from  $D_1 - S_1$  to  $D_2 - S_2$ , and the change in the trade value is ambiguous, depending on the elasticities. Area A represents producer surplus gain, area  $A + B$  consumer surplus loss, and area C new government expenditures.

Now consider an example in which the developing country liberalizes its agriculture policy (scenario GLOBAL, fig. 3). Suppose that the developing country initially subsidizes producers and taxes consumers with an import tariff. An example would be some of the policies in Taiwan. The initial world and domestic prices are  $wp_1$  and  $pp_1$ . Quantity supplied and demanded equal  $S_1$  and  $D_1$ . The area D represents government revenue obtained from the tariff. With a global liberalization (in both IME's and developing countries), world prices rise to  $wp_2$ . Quantity supplied increases to  $S_2$ , quantity demanded moves to  $D_2$ , and the volume of imports decrease to  $D_2 - S_2$ . Area A reflects producer surplus gain, area  $A + B$  represents consumer surplus loss, and area D is government revenue loss.

Many other cases can illustrate the effects of opening agricultural markets. We have simplified figures 1-3 by excluding cross-commodity effects, but our illustrations should be sufficient to provide a flavor of what is occurring in the model's simulation exercises.

Figure 2--Developing importer, partial price transmission

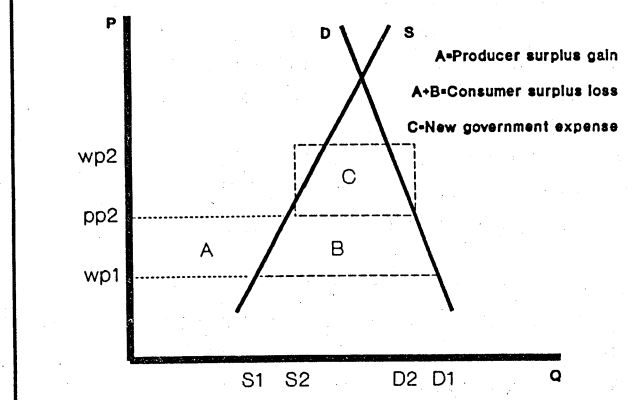
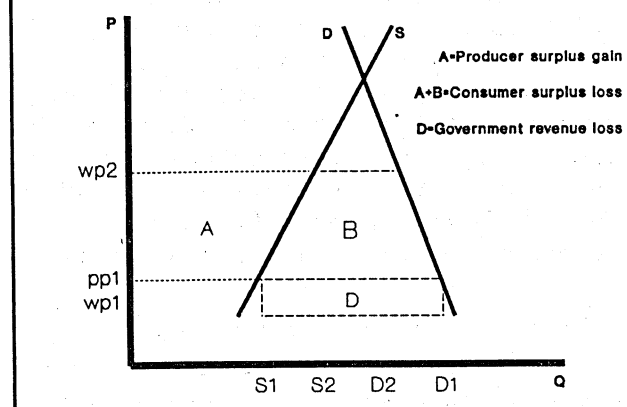


Figure 3--Developing importer removing a subsidy



## Changes in World Prices

Figure 4 shows the average percentage change in world prices needed to clear world markets in each of the three experiments. The average world price, weighted across all 22 commodities, increases 21 percent when we simulate an IME liberalization with partial price transmission in the DME's (IME-1). In this case, the average price increase facing DME producers and consumers would be roughly 10.5 percent.<sup>8</sup> In simulation IME-2, the average world price increases by only 16 percent. The smaller increase is not surprising. Other studies have shown that when governments insulate domestic markets from world price movements, they contribute to greater price variability in world markets.<sup>9</sup> With complete transmission of world price changes, there is a larger supply response from the DME's. Therefore, the world price increases needed to clear world markets of the excess demand in the IME's are smaller. Assuming a global liberalization, we again see an average world price increase of 16 percent after world markets have cleared. One would expect the average world price change to be similar in simulations IME-2 and GLOBAL, because the average PSE and CSE in the developing world for 1986 was very small. Liberalizing the DME's means removing a combination of taxes and subsidies on producers and consumers. On a global basis, the effects tend to offset each other, implying that DME policies have a neutral effect on the average world price. Within individual commodity markets, however, we see a different story.<sup>10</sup>

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<sup>8</sup>The average world price change is calculated by weighting commodity price changes by the value of production across all countries. The average price change experienced by the DME's, however, would be somewhat different, since the weights would be based on the value of production in the DME's.

<sup>9</sup>Varying price transmission elasticities in the DME's reveals the caution one must take in reporting the effect that IME policies have on world prices. When we simulated an IME liberalization, assuming the DME's allow full transmission of world price changes into their domestic economies, the average world price change was 16 percent. With partial transmission, the change was 21 percent. We also simulated an IME liberalization with no price transmission in the DME's. The increase in average world prices under this scenario was 42 percent. The results indicate that, should the IME's liberalize their agricultural sectors, the effect on average world price would be between 16 and 42 percent, depending on the extent to which the DME's allow their domestic markets to absorb this policy shock. It should be added that in all the simulations, the centrally planned economies were assumed to have a price transmission elasticity for all commodities of 0.2, reflecting a transmission of one-fifth of world price changes into their domestic economies. The extent to which their markets absorb the IME policy shocks would also have a tremendous bearing on the variability in world prices.

<sup>10</sup>The change in the average world price moving from IME-1 liberalization (21 percent) to IME-2 (16 percent) exceeds the change in moving from IME-2 to global liberalization (16 percent). Thus, the change in the assumption concerning price transmission--in effect an assumption on developing countries' agricultural policies--has a greater effect on average world price changes than does removing PSE's and CSE's. This occurs for two reasons. First, the price transmission coefficient of 0.5 is assumed for all commodities, whereas data coverage on support measures is more limited. Second, the support measures are positive and negative so that there are some offsetting incentives to production and consumption.



Table 2 shows the considerable variation in the size of world price changes within individual commodity markets resulting from each simulation. When we simulate full transmission of price changes into the DME's (IME-2), we see smaller changes in all world prices. We would expect the biggest differences to be in those commodity markets where the DME's are important producers or consumers on a world basis. In 1986, the DME's were significant producers (over 40 percent of world total) of rice, other oilseeds and products, cotton, and sugar and significant consumers of food grains, oils, cotton, and sugar. It is in these markets that we see the biggest drops in price when price changes are allowed to be fully transmitted to DME domestic markets.

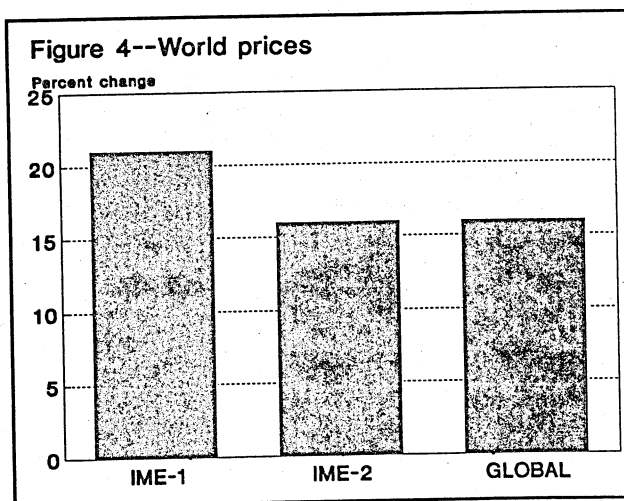


Table 2--World price changes in each simulation

Commodity	IME-1	IME-2	GLOBAL
<u>Percent</u>			
Beef	19	16	11
Pork	14	12	11
Mutton and lamb	31	25	21
Poultry meat	18	16	16
Poultry eggs	6	5	4
Dairy milk	0	0	0
Dairy butter	99	84	85
Dairy cheese	43	37	38
Dairy products	88	81	81
Wheat	37	27	20
Corn	29	22	23
Coarse grains	22	16	15
Rice	19	11	15
Soybeans	-2	-2	-3
Soymeal	-4	-3	-5
Soyoil	5	4	8
Other oilseeds	12	8	8
Other meals	-1	1	2
Other oils	9	7	14
Cotton	12	8	4
Sugar	48	29	40
Tobacco	4	3	3
Average	21	16	16

Under global liberalization, the changes in prices are not as easily deduced in advance. World prices of beef, mutton and lamb, wheat, and cotton are lower under global liberalization, while prices for rice, oils, and sugar are higher. These differences reflect the importance of DME policies in these markets. Livestock producers in Latin America and cotton producers in Pakistan are taxed, and their consumers are subsidized, so that removing supports has a price-depressing effect on world markets. By contrast, several Asian countries subsidize rice and sugar producers and tax consumers. Because Asian countries are also large producers and consumers of these commodities, removing supports has a price-enhancing effect in these markets.

## Agricultural Production

Quantity of production in the DME's increases in all three scenarios. With partial transmission of prices, the overall increase (weighted by value of production at constant prices) is equal to about 2.2 percent (fig. 5). With full transmission of prices, the production response is larger (about 3.3 percent). In terms of specific commodities, the largest gains occur in dairy products, wheat, and sugar (fig. 6). With global liberalization, the production response from the DME's is still positive although the increase is lower, at 1.3 percent. The production response in the DME's is smaller in this scenario than under IME liberalization, because domestic prices change in response to both movements in world prices and elimination of farm policies. With coarse grains and rice accounting for 30 percent of DME's value of agricultural production, the removal of subsidies on these commodities generates a small decrease in corn and rice production. Decreases for those commodities limit the gain in overall production.

Figure 5 also displays production gains according to regional breakdowns. In all scenarios, production growth occurs in all three regions, with Latin America leading the way. Under IME-1, gains are fairly similar across regions, 2.5 percent for Latin America, 2.1 percent for Asia, and 2.0 percent for Africa/Middle East. The largest production growth occurs for all three regions under simulation IME-2. But in this case, Africa/Middle East experiences slightly larger production gains than does Asia. This is largely a function of the difference in the price of rice under each scenario and the importance of rice to Asian agriculture (the world price of rice rises 19 percent in IME-1 but only 11 percent in IME-2).

Figure 5--Agricultural production among DME's

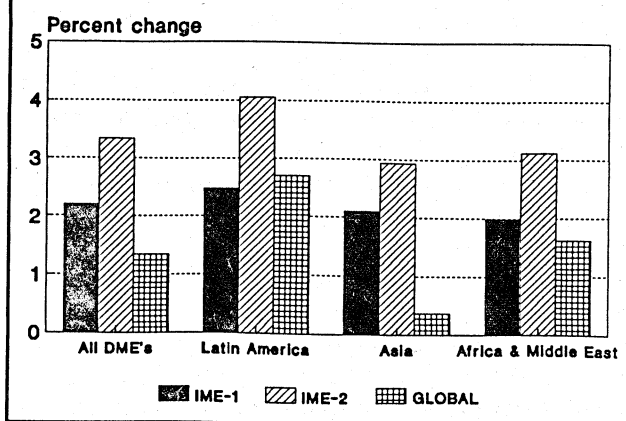
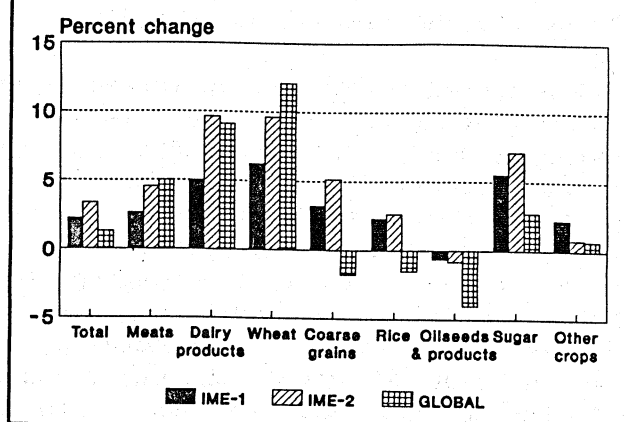


Figure 6--Agricultural production among commodities



Under a global simulation scenario, gains between regions become more skewed. Latin America experiences a production increase of 2.7 percent, Africa/Middle East of about 1.7 percent, and Asia of less than 0.5 percent (see fig.5). The gains for Asia are small compared with gains in the other two regions because of the removal of positive PSE's in cereals for Indonesia, Thailand, Malaysia, the Philippines, South Korea, and Taiwan. However, the differences in production responses between countries, even within a region, are highly diverse.

#### Latin America

Argentina and the Central America/Caribbean region, both net agricultural exporters, showed the largest agricultural production increases in Latin America in simulations IME-1 and IME-2 (tables 3, 4). Both simulations displayed aggregate growth of about 3 percent with partial price transmission. With full transmission, aggregate growth in Argentina increased to about 5.4 percent, while growth in Central America/Caribbean increased to about 4.6 percent. Brazil, the other net exporter in the region, showed smaller growth: less than 2 percent in IME-1 and 3.2 percent in IME-2. The Latin American net importers (Mexico, Venezuela, Chile, and Other Latin America) also showed overall production increases of between 2.1 and 2.6 percent in simulation IME-1 and between 3.2 and 4.5 percent in IME-2. Sugar and grains were the commodities exhibiting the strongest supply response in these countries. Contributing most to the growth of overall regional production were the livestock sectors in Argentina and Brazil, the grains sector in Argentina, and the sugar sectors in Argentina, Brazil, and Central America/Caribbean.

Under global liberalization, some Latin American countries experience further gains, while for others the gains are less than those experienced with only IME liberalization (table 5). The two determining factors are higher world prices and the removal of support in global liberalization. The results for Argentina show a strong positive response (about 10 percent) from the agricultural sector. The removal of Argentine export taxes combined with world price increases provide the impetus for soybean, other coarse grain, and beef production to expand by 20 to 35 percent. On the other end of the spectrum, Brazilian gains in beef production are outweighed by decreases of approximately 10 percent in wheat, corn, and soybean production. As a result, the model shows Brazilian production of temperate commodities falling by about 1.7 percent. The production changes occur because of Brazil's mixed agricultural policy, which taxes beef producers and subsidizes cereal and soy producers. The livestock industry gains by facing higher world prices and by eliminating of taxes. Other Brazilian farmers find that increases in world prices do not make up for the removal of subsidies.

Mexican aggregate production increases by about 2 percent, as the removal of beef and cotton tax equivalents lead to increases in output levels. The removal of coarse grain subsidies, on the other hand, leads to decreases in Mexican production, despite higher world prices. Venezuela's policies are similar to Mexico's: the removal of subsidies adversely affects grain production. Venezuela's overall production, however, increases almost 10 percent because of the strong supply response to increased world prices exhibited in other commodities. Although this percentage is high compared with most countries in Latin America, Venezuela's volume of production in metric tons is small relative to that of the other countries. The importing Latin American countries and the exporting Central American and Caribbean countries expand

Table 3--Changes in agricultural production, scenario IME-1

Area	Commodity group <sup>1</sup>								
	MT	DY	WH	CG	RI	OI	SU	OC	AGG
<u>Percentage change from base</u>									
Mexico	2.8	4.6	8.3	3.4	3.6	-.4	3.8	.8	2.6
Central America/Caribbean	2.5	--	1.9	1.4	2.6	.7	5.8	.8	3.3
Brazil	2.3	10.6	3.2	3.3	.6	-1.1	11.4	1.0	1.9
Argentina	5.1	6.5	8.1	6.3	3.1	.1	10.0	1.5	3.2
Chile	--	--	5.7	1.7	-.1	-.4	6.0	--	2.1
Venezuela	3.2	4.9	7.4	-.1	-1.8	.4	7.3	-.1	2.2
Other Latin America	3.5	2.7	3.4	2.8	3.3	.4	5.7	1.3	2.6
Latin American average	3.2	6.5	4.9	3.2	1.2	-.6	7.4	1.0	2.5
Nigeria	--	--	2.3	4.6	2.3	--	8.1	2.2	2.5
Kenya	--	--	7.6	5.1	2.4	-.3	2.4	-2.2	4.5
Other Sub-Saharan Africa	--	--	7.6	3.9	2.4	-.3	2.2	1.0	1.7
Egypt	1.3	1.7	4.1	1.8	2.7	.1	2.4	2.4	1.5
Middle East and North Africa-- oil producers	1.4	5.1	4.9	2.5	1.3	.1	2.0	1.5	2.6
Middle East and North Africa-- other	2.2	1.4	4.2	2.2	1.1	-.3	2.0	.3	2.0
African/Middle East average	1.7	2.5	4.6	3.3	2.3	-.2	2.2	1.0	2.0
India	2.6	4.2	7.7	2.6	2.6	-1.8	4.8	--	2.2
Pakistan	--	--	6.9	1.1	11.3	.8	9.8	-.1	4.2
Bangladesh	--	--	9.0	.5	4.4	-.3	-.1	.4	4.4
Indonesia	--	--	3.2	4.5	2.0	.4	5.7	.9	2.0
Thailand	4.7	--	4.9	6.8	2.6	.5	3.5	-.1	3.0
Malaysia	--	--	1.6	2.7	2.6	.3	3.5	.7	.9
Philippines	1.7	--	2.7	2.7	.9	.4	6.5	.8	1.5
South Korea	1.4	--	2.2	.8	.9	-.3	4.0	.7	1.0
Taiwan	1.1	--	3.5	1.8	1.0	--	2.0	.1	1.1
Other East Asia	1.8	--	5.4	4.7	1.2	-.4	5.5	1.0	1.7
Other Asia	--	--	5.6	3.3	2.3	-.8	8.4	-.4	1.9
Asian average	1.9	4.2	7.5	3.0	2.4	-.8	4.8	.1	2.1
Rest of world	.4	.8	3.6	1.9	1.6	.2	7.6	.9	.2
Developing country average	2.6	5.0	6.2	3.2	2.3	-.6	5.5	.5	2.2

-- = Not applicable.

<sup>1</sup>MT (meats:beef, pork, mutton and lamb, poultry meat, and eggs), DY (dairy products: milk, butter, cheese, and powder), WH (wheat), CG (coarse grains: corn and other coarse grains), RI (rice), OI (oilseeds: soybeans, soymeal, soyoil, other oilseeds, other oilmeals, and other oils), SU (sugar), OC (other crops: cotton and tobacco), AGG (aggregate average of all 22 commodities). All aggregate averages are weighted by base production values.



Table 4--Changes in agricultural production, scenario IME-2

Area	Commodity group <sup>1</sup>								
	MT	DY	WH	CG	RI	OI	SU	OC	AGG
	<u>Percentage change from base</u>								
Mexico	4.8	8.4	12.7	5.4	2.9	-.5	4.9	1.0	4.4
Central America/Caribbean	4.4	--	3.9	2.5	2.6	1.0	7.5	1.2	4.6
Brazil	4.1	20.8	4.9	5.4	.5	-1.6	15.1	1.3	3.2
Argentina	8.7	12.6	12.3	10.0	2.8	.2	13.1	2.2	5.4
Chile	--	--	8.7	2.8	-1.5	-.6	7.8	--	3.2
Venezuela	5.6	9.1	11.4	.4	-3.3	.7	8.9	-.3	3.9
Other Latin America	5.9	5.0	5.4	4.5	3.5	.6	7.5	1.8	4.2
Latin American average	5.5	12.5	7.5	5.2	1.1	-.8	9.6	1.4	4.1
Nigeria	--	--	3.5	6.8	2.7	.1	10.3	3.1	3.6
Kenya	--	--	11.7	7.9	2.8	-.4	3.1	-3.4	6.9
Other Sub-Saharan Africa	--	--	11.7	5.9	2.8	-.3	2.9	1.4	2.5
Egypt	2.3	3.1	6.3	2.8	3.1	.2	3.2	3.2	2.4
Middle East and North Africa-- oil producers	2.9	10.0	7.4	3.6	1.5	.2	2.6	2.2	4.3
Middle East and North Africa-- other	3.8	2.6	6.4	3.2	1.3	-.3	2.6	.3	3.1
African/Middle East average	3.0	4.6	7.0	5.0	2.6	-.2	2.9	1.3	3.1
India	4.2	8.1	11.9	4.1	2.8	-2.5	6.1	.1	3.2
Pakistan	--	--	10.1	2.0	15.2	1.2	12.0	.1	6.0
Bangladesh	--	--	14.1	.7	5.2	-.4	-.1	.6	5.3
Indonesia	--	--	4.8	7.3	2.3	.7	7.5	1.4	2.5
Thailand	8.4	--	7.4	11.1	3.0	.7	4.5	-.2	4.1
Malaysia	--	--	2.4	4.4	3.0	.5	4.6	1.1	1.1
Philippines	3.1	--	4.1	4.5	.9	.7	8.4	1.2	2.2
South Korea	2.8	--	3.5	1.2	1.0	-.4	5.2	1.1	1.5
Taiwan	2.3	--	5.8	3.4	1.2	.1	2.5	.2	1.9
Other East Asia	3.2	--	8.8	7.9	.9	-.4	6.8	1.4	3.1
Other Asia	--	--	8.6	5.7	2.6	-1.0	11.0	-.2	2.4
Asian average	3.4	8.1	11.5	5.0	2.7	-1.0	6.2	.2	2.9
Rest of world	.7	1.3	5.4	3.0	1.8	.3	9.9	1.2	.3
Developing country average	4.5	9.6	9.6	5.1	2.6	-.8	7.1	.8	3.3

-- = Not applicable.

<sup>1</sup>MT (meats: beef, pork, mutton and lamb, poultry meat, and eggs), DY (dairy products: milk, butter, cheese, and powder), WH (wheat), CG (coarse grains: corn and other coarse grains), RI (rice), OI (oilseeds: soybeans, soymeal, soyoil, other oilseeds, other oilmeals, and other oils), SU (sugar), OC (other crops: cotton and tobacco), AGG (aggregate average of all 22 commodities). All aggregate averages are weighted by base production values.

Table 5--Changes in agricultural production, scenario GLOBAL

Area	Commodity group <sup>1</sup>								
	MT	DY	WH	CG	RI	OI	SU	OC	AGG
<u>Percentage change from base</u>									
Mexico	6.2	9.7	15.4	-15.8	58.7	-4.2	9.0	11.6	2.2
Central America/Caribbean	3.5	--	-.4	2.1	4.0	2.2	10.1	.7	5.3
Brazil	5.9	20.2	-12.1	-10.3	-14.0	-7.9	39.8	5.7	-1.7
Argentina	19.0	12.1	13.0	21.8	3.2	1.4	17.7	-.5	9.8
Chile	--	--	6.6	3.2	.8	-.2	10.5	--	2.8
Venezuela	19.1	11.2	40.3	-24.9	2.4	1.8	86.8	60.9	9.7
Other Latin America	4.7	5.0	3.0	4.5	5.5	1.0	10.0	1.0	3.7
Latin American average	8.8	12.7	-2.5	-9.5	-7.3	-4.1	20.7	5.4	2.7
Nigeria	--	--	-3.2	6.7	.5	1.6	15.5	19.0	4.1
Kenya	--	--	9.3	8.2	3.9	-.2	4.1	-3.4	7.0
Other Sub-saharan Africa	--	--	9.3	5.9	3.9	2.0	3.8	.5	3.3
Egypt	-16.7	2.6	1.9	-1.5	15.5	-1.1	1.3	20.6	-6.1
Middle East and North Africa-- oil producers	3.1	10.1	5.7	3.5	2.1	1.5	3.4	1.1	3.9
Middle East and North Africa-- other	3.2	2.6	5.0	3.5	1.8	1.5	3.4	-.3	2.9
African/Middle East average	-3.8	4.3	5.2	4.6	4.8	1.6	3.4	1.7	1.7
India	5.5	6.6	20.7	4.1	6.3	-14.4	-11.0	-1.5	2.2
Pakistan	--	--	28.4	2.1	85.7	-1.2	15.3	-17.2	16.6
Bangladesh	--	--	10.2	.7	7.2	.9	--	.1	7.0
Indonesia	--	--	3.8	15.8	-1.6	3.2	-7.3	1.5	-.1
Thailand	8.8	--	5.7	15.0	3.0	1.2	-17.9	-.2	.6
Malaysia	--	--	1.9	9.2	-17.9	1.0	-15.1	5.8	-3.3
Philippines	-2.0	--	.1	4.7	-5.8	2.5	17.3	1.4	-.8
South Korea	4.0	--	1.3	-14.0	-33.1	18.0	7.0	1.1	-19.4
Taiwan	-2.2	--	5.0	-4.4	-3.2	9.3	-4.9	-10.0	-1.8
Other East Asia	3.1	--	4.9	7.9	2.1	.2	10.3	1.2	3.1
Other Asia	--	--	6.4	5.8	3.9	1.0	14.9	-.7	3.3
Asian average	2.5	6.6	20.8	5.3	-1.3	-5.9	-9.4	-2.3	.5
Rest of world	.4	1.3	3.8	3.3	2.7	.5	13.2	.6	.2
Developing country average	5.0	9.1	12.1	-1.8	-1.5	-4.0	2.7	.7	1.3

-- = Not applicable.

<sup>1</sup>MT (meats: beef, pork, mutton and lamb, poultry meat, and eggs), DY (dairy products: milk, butter, cheese, and powder), WH (wheat), CG (coarse grains: corn and other coarse grains), RI (rice), OI (oilseeds: soybeans, soy meal, soy oil, other oilseeds, other oil meals, and other oils), SU (sugar), OC (other crops: cotton and tobacco), AGG (aggregate average of all 22 commodities). All aggregate averages are weighted by base production values.

production by nearly 4 and 6 percent with global liberalization. This is solely due to world price increases (the model contains no support information for these regions).

### Asia

With nearly all commodity prices rising under IME liberalization, Asian countries' agricultural production expands between 1 and 4 percent in IME-1 and 1 to 6 percent in IME-2 (tables 3, 4). Asian grain and sugar producers are the main beneficiaries, with particularly significant growth in rice production among Asian agricultural exporters (Pakistan, India, Indonesia, and Thailand).

With mainly subsidization of agriculture in the Asian countries, production responses under global liberalization tend to yield smaller gains and greater losses than under IME liberalization, although there is a wider pattern of adjustment (table 5). The production responses range from 16 percent for Pakistan to -19 percent for South Korea. Among the Asian agricultural exporters, Malaysia produces 3 percent less than in the 1986 base, while Thailand and the Philippines produce approximately the same quantity as in 1986. Production falls below the 1986 level for specific commodities. The removal of support for rice in Malaysia and the Philippines reduces rice output. Sugar production falls in Malaysia and Thailand, and pork production falls in the Philippines, reflecting the elimination of assistance levels to these sectors.

Under global liberalization, production levels increase for three large Asian countries, India, Pakistan, and Bangladesh, by 2, 17, and 7 percent, respectively. For Pakistan, this represents a larger production increase than that of IME liberalization. Pakistan farmers benefit with strong gains in cereal (particularly rice) and cotton production. The removal of Pakistan's producer tax (and an even greater consumer subsidy) on cotton increases production. Pakistan's export taxes have an implied subsidy to its textile industry.<sup>11</sup> For Indian agriculture, livestock, wheat, and rice production increase but oils, meals, and sugar production decline. In Bangladesh, rice production increases due to the increase in the world price. For Indonesia, the removal of taxes on corn producers raises domestic prices and encourages output. This production response is counteracted by the lower domestic prices on rice and soybeans due to the elimination of subsidies, so that on average production is unchanged.

South Korean and Taiwanese agricultural production fall 19 and 2 percent in global liberalization compared with a small increase in IME liberalization. The removal of large producer subsidies and consumer taxes on beef, poultry, and grains reduces domestic production. Beef, poultry, and rice quantities in South Korea each fall by over 25 percent. In contrast, pork production rises over 35 percent, reflecting the removal of the taxes on pork producers, and contributes to the small increase in overall livestock production. Taiwan's production falls in livestock, grains, sugar, and tobacco as support is eliminated.

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<sup>11</sup>Our partial equilibrium model is unable to capture the effects of agricultural liberalization on the textile and, in general, the nonagricultural sector. For a discussion on trade liberalization of primary and processed commodities, see (9).

## Africa and the Middle East

Coverage of Africa and the Middle East is the most limited. Three heavily populated countries, Egypt, Kenya, and Nigeria, are reported in the model. These countries produce very few of the agricultural commodities contained in our model and are large agricultural importers.<sup>12</sup> Similarly, the two Middle East regions in our coverage, Middle East Oil Producers and Middle East Other, are significant agricultural importers. Under IME liberalization there are modest increases in agricultural production for these regions, mostly in grains and in dairy products. The last region, Other Sub-Saharan Africa, produces and exports sugar, cotton, and tobacco to more than offset their agricultural imports of grains.<sup>13</sup> This region also experiences gains in production under IME liberalization, which benefit mainly the grain sector.

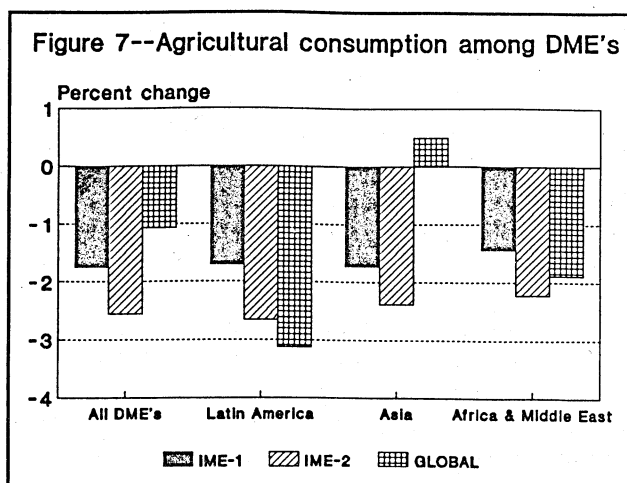
The differences in scenarios for Africa and the Middle East are basically due to world price changes, because support information is available for only Nigeria and Egypt. Nigeria tends to tax its agricultural sectors, and eliminating the tax promotes overall production gains of 4 percent. In contrast, removing producer subsidies for livestock, wheat, and corn in Egypt induces a 6-percent decline in its agricultural production.

### **Agricultural Consumption**

The quantity of developing countries' agricultural consumption decreases due to the world price increases accompanying liberalization (fig. 7). Consumption decreases 1.7 percent in simulation IME-1 and 2.5 percent in simulation IME-2. The larger response in simulation IME-2 is to be expected, given the full transmission of world price changes. Consumption recovers somewhat, on a relative basis, by only declining 1 percent under global liberalization. This can be traced to removal of consumer taxes, most notably on rice, for nearly all Asian countries (fig. 8).

Consumption declines in all three regions in both IME liberalization scenarios. For Latin America, Asia, and Africa and the Middle East, respectively, simulation IME-1 losses are 1.7, 1.7, and 1.4 percent. These declines in consumption change to 2.7, 2.4, and 2.2 percent in simulation IME-2.

Changes under global liberalization reflect the levels of consumer support or tax being removed. Consumers are supported the most in Latin America. Consequently, global liberalization brings decreases in consumption to 3 percent.



<sup>12</sup>Nigeria produces mainly root crops, while Egypt produces and exports cotton (included in our coverage), citrus, and potatoes. Kenya is a significant exporter of tea, coffee, and pyrethrum.

<sup>13</sup>South Africa is also contained in our 36-country/region model, but we have not included it in our discussion.

For African and Middle Eastern countries, some consumers are taxed and some are supported. On average, consumption declines 1.9 percent, slightly less than in simulation IME-2. On the other hand, consumption in Asia increases 0.5 percent with global liberalization. In Asia, therefore, the removal of taxes is a slightly stronger influence than the increase in world prices.

### Latin America

Consumption losses are evenly shared across Latin America in both IME liberalization scenarios. Mexico and Argentina show the biggest losses, at just over 2 percent in simulation IME-1 and 3 percent in simulation IME-2 (tables 6, 7). The other countries' losses are closer to the regional averages of 1.7 and 2.7 percent, respectively. Beef, dairy products, and sugar experience the largest declines in consumption.

This pattern persists in the global liberalization scenario, with the exception of Venezuela (table 8). In Venezuela, the removal of high consumption taxes on grains, particularly corn and other coarse grains, increases average consumption by 4 percent. Losses persist elsewhere, exceeding 5 percent in Mexico and Argentina and averaging roughly 2 percent in other Latin American countries. The largest percentage decrease occurs for beef, dairy products, and sugar. The removal of consumer support combined with the increase in world prices account for these losses. Argentine corn and coarse grain consumption also declines 4 and 12 percent, respectively, with global liberalization.

### Asia

IME liberalization has the largest negative effect on wheat, coarse grains, and sugar consumption throughout the Asian countries. Declines in consumption of these commodities of between 5 and 10 percent account for the largest part of the average regional losses of 1.7 percent in simulation IME-1 and 2.4 percent in simulation IME-2. Individual country losses closely conform to the average. In both simulations, India and Bangladesh experience the largest average percentage losses of between 2 and 3 percent.

The distribution is more skewed with global liberalization. India and Bangladesh continue to register consumption losses, along with Pakistan, Thailand, Malaysia, Other East Asia, and Other Asia. On the other hand, average consumption increases in Indonesia, the Philippines, South Korea, and Taiwan. Strong gains are seen for beef, other coarse grains, rice, and sugar for both South Korea and Taiwan. This result occurs because of the removal of high consumer taxes on these commodities. The effect is so strong that Asia is the only developing country region to register an average consumption gain in any of the three liberalization scenarios.

Figure 8--Agricultural consumption among commodities

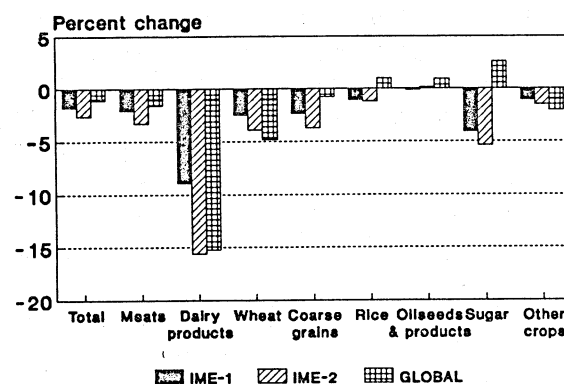


Table 6--Changes in agricultural demand, scenario IME-1

Area	Commodity group <sup>1</sup>								
	MT	DY	WH	CG	RI	OI	SU	OC	AGG
<u>Percentage change from base</u>									
Mexico	-2.5	-4.2	-1.8	-2.8	-1.0	.1	-6.4	-.9	-2.0
Central America/Caribbean	-2.1	--	-2.2	-.5	-1.9	-.5	-3.1	-.6	-1.6
Brazil	-1.7	-10.6	-2.3	-2.3	-.8	1.3	-6.0	-1.1	-1.5
Argentina	-3.1	-9.3	-1.9	-1.0	-.7	-.3	-5.2	-.4	-2.0
Chile	-3.9	-15.2	-3.9	-2.2	-3.4	1.1	-3.9	-1.0	-1.7
Venezuela	-1.7	-6.4	-1.8	.6	-.1	1.6	-5.0	-.6	-1.1
Other Latin America	-2.3	-10.5	-2.2	-2.1	-1.0	.9	-2.0	-.4	-1.8
Latin American average	-2.3	-8.2	-2.2	-1.9	-1.0	.6	-5.1	-.8	-1.7
Nigeria	--	--	-25.2	-1.6	-1.4	-.5	-1.0	-.9	-1.7
Kenya	--	--	-7.1	-2.1	1.3	-.8	-5.0	-2.2	-2.7
Other Sub-Saharan Africa	--	--	-5.1	-1.7	-.9	-.8	-2.5	-.9	-1.5
Egypt	-1.1	-4.1	-3.0	-5.0	-1.2	-.1	-1.1	-1.6	-1.6
Middle East and North Africa-- oil producers	-1.3	-7.4	-1.1	-2.1	-.9	.1	-1.0	-.5	-1.8
Middle East and North Africa-- other	-.9	-2.6	-1.0	-1.7	-.3	-.1	-1.0	-.6	-.8
African/Middle East average	-1.1	-6.0	-1.9	-2.1	-1.0	-.3	-1.4	-.7	-1.4
India	-4.4	-14.5	-2.8	-4.9	-1.6	-.1	-4.2	-1.5	-2.2
Pakistan	--	--	-3.5	-.6	2.7	-1.5	-8.5	-3.4	-1.9
Bangladesh	--	--	-5.3	-.5	-2.4	-1.5	-12.1	-3.6	-2.6
Indonesia	--	--	-4.8	-5.1	-1.2	-1.1	-4.1	-1.0	-1.5
Thailand	-3.7	--	-3.7	.6	-.4	.3	-3.0	-.8	-.9
Malaysia	--	--	-2.3	-3.0	-.5	-.6	-6.7	-.6	-1.3
Philippines	-1.8	--	-1.4	-2.2	-.4	.1	-8.3	-1.0	-1.3
South Korea	-1.4	--	-3.5	-3.0	-.2	.4	-3.3	-.4	-.9
Taiwan	-1.5	--	-.9	-1.3	-.3	1.1	-3.8	-1.5	-1.1
Other East Asia	-1.4	--	-9.4	-1.4	.3	-.7	-6.0	-1.6	-1.6
Other Asia	--	--	-2.6	-2.4	-.9	-1.4	-5.3	-.9	-1.2
Asian average	-2.3	-14.5	-2.9	-3.5	-1.1	-.3	-4.5	-1.3	-1.7
Rest of world	-4.2	-14.0	-3.6	-3.9	-2.4	-.5	-3.3	-1.0	-5.8
Developing country average	-2.1	-8.9	-2.5	-2.4	-1.1	-.1	-4.1	-1.1	-1.8

-- = Not applicable.

<sup>1</sup>MT (meats: beef, pork, mutton and lamb, poultry meat, and eggs), DY (dairy products: milk, butter, cheese, and powder), WH (wheat), CG (coarse grains: corn and other coarse grains), RI (rice), OI (oilseeds: soybeans, soymeal, soyoil, other oilseeds, other oilmeals, and other oils), SU (sugar), OC (other crops: cotton and tobacco), AGG (aggregate average of all 22 commodities). All aggregate averages are weighted by base consumption values.



Table 7--Changes in agricultural demand, scenario IME-2

Area	Commodity group <sup>1</sup>								
	MT	DY	WH	CG	RI	OI	SU	OC	AGG
	<u>Percentage change from base</u>								
Mexico	-4.1	-7.6	-2.6	-4.1	-.6	.4	-8.3	-1.3	-3.2
Central America/Caribbean	-3.5	--	-3.3	-.7	-2.0	-.5	-4.0	-.9	-2.3
Brazil	-2.9	-18.7	-3.6	-3.3	-.5	2.5	-7.8	-1.6	-2.2
Argentina	-5.2	-16.1	-2.9	-1.1	-.5	.1	-6.8	-.6	-3.2
Chile	-6.4	-25.7	-5.7	-3.5	-4.0	2.0	-5.0	-1.4	-2.5
Venezuela	-2.9	-11.3	-2.6	1.2	--	2.8	-6.5	-.8	-1.7
Other Latin America	-3.8	-18.4	-3.3	-3.0	-.9	1.7	-2.7	-.6	-2.9
Latin American average	-3.8	-14.4	-3.4	-2.6	-.8	1.4	-6.5	-1.2	-2.7
Nigeria	--	--	-34.2	-2.3	-1.6	-.7	-1.3	-1.3	-2.3
Kenya	--	--	-10.5	-3.3	2.9	-1.2	-6.4	-3.1	-3.9
Other Sub-Saharan Africa	--	--	-7.7	-2.6	-.9	-1.1	-3.2	-1.2	-2.0
Egypt	-1.8	-7.3	-4.5	-7.4	-1.3	--	-1.4	-2.2	-2.5
Middle East and North Africa-- oil producers	-2.2	-13.6	-1.6	-2.7	-1.0	.3	-1.3	-.6	-2.9
Middle East and North Africa-- other	-1.5	-4.7	-1.4	-2.3	-.4	--	-1.3	-.8	-1.2
African/Middle East average	-1.8	-11.0	-2.8	-2.9	-1.1	-.4	-1.8	-1.0	-2.2
India	-5.5	-24.4	-4.7	-9.0	-1.9	.3	-5.5	-2.1	-3.1
Pakistan	--	--	-5.5	-.9	5.1	-2.1	-11.0	-4.7	-2.6
Bangladesh	--	--	-8.1	-.8	-2.8	-2.2	-15.4	-5.0	-3.2
Indonesia	--	--	-7.7	-7.9	-1.4	-1.7	-5.5	-1.4	-1.9
Thailand	-6.4	--	-5.8	1.5	-.5	.8	-3.9	-1.1	-1.3
Malaysia	--	--	-3.6	-4.7	-.5	-.9	-8.6	-.9	-1.7
Philippines	-3.1	--	-2.3	-3.3	-.3	.4	-10.8	-1.4	-1.9
South Korea	-2.4	--	-5.2	-4.3	-.1	.7	-4.4	-.5	-1.3
Taiwan	-2.6	--	-1.5	-1.5	-.2	2.0	-5.0	-2.1	-1.6
Other East Asia	-2.4	--	-14.2	-1.9	.8	-1.0	-7.8	-2.2	-2.5
Other Asia	--	--	-4.2	-3.9	-.9	-1.9	-7.0	-1.3	-1.4
Asian average	-3.5	-24.4	-4.8	-5.9	-1.2	-.2	-5.9	-1.8	-2.4
Rest of world	-6.8	-23.3	-5.2	-5.9	-2.7	-.7	-4.3	-1.5	-9.4
Developing country average	-3.3	-15.6	-3.9	-3.7	-1.2	.1	-5.4	-1.5	-2.6

-- Not applicable.

<sup>1</sup>MT (meats: beef, pork, mutton and lamb, poultry meat, and eggs), DY (dairy products: milk, butter, cheese, and powder), WH (wheat), CG (coarse grains: corn and other coarse grains), RI (rice), OI (oilseeds: soybeans, soymeal, soyoil, other oilseeds, other oilmeals, and other oils), SU (sugar), OC (other crops: cotton and tobacco), AGG (aggregate average of all 22 commodities). All aggregate averages are weighted by base consumption values.

Table 8--Changes in agricultural demand, Scenario GLOBAL

Area	Commodity group <sup>1</sup>								
	MT	DY	WH	CG	RI	OI	SU	OC	AGG
<u>Percentage change from base</u>									
Mexico	-6.1	-7.6	-1.0	-8.8	-8.1	-4.5	-12.5	-5.7	-5.0
Central America/Caribbean	-2.8	--	-1.5	-1.6	-3.4	-1.7	-5.3	-.5	-2.4
Brazil	-2.4	-18.3	-1.6	-3.2	-1.8	2.7	-10.4	-.8	-2.0
Argentina	-10.6	-16.2	-.6	-6.6	-1.1	-4.7	-9.0	-.4	-6.6
Chile	-5.6	-25.3	-4.2	-4.4	-5.4	.2	-6.5	-.7	-2.5
Venezuela	-2.4	-11.3	-2.5	41.7	4.5	-5.1	-8.7	-.5	4.1
Other Latin America	-3.1	-18.4	-2.0	-3.7	-1.9	.9	-3.6	-.4	-2.7
Latin American average	-4.9	-14.3	-1.6	1.1	-2.0	-.8	-9.1	-1.2	-3.0
Nigeria	--	--	-66.4	-1.0	-1.3	-.6	-1.8	-8.3	-3.2
Kenya	--	--	-8.1	-3.4	1.7	-2.2	-8.5	-1.6	-4.1
Other Sub-Saharan Africa	--	--	-5.8	-2.6	-1.5	.3	-4.4	-.6	-1.6
Egypt	6.6	-7.3	-9.3	-21.4	-8.0	-2.4	-2.4	-11.5	-1.4
Middle East and North Africa-- oil producers	-2.1	-13.6	-1.2	-2.5	-1.4	.4	-1.8	-.3	-2.8
Middle East and North Africa-- other	-1.3	-4.7	-1.0	-2.4	-.5	.6	-1.8	-.4	-.9
African/Middle East average	1.0	-11.0	-3.2	-3.9	-2.1	-.1	-2.6	-2.2	-1.9
India	-12.2	-22.8	-5.7	-4.5	-2.6	2.1	5.8	-4.1	-2.5
Pakistan	--	--	-13.0	8.8	14.1	-.3	-6.7	-9.6	-2.2
Bangladesh	--	--	-5.8	-.9	-3.9	-3.1	-20.3	-2.8	-4.1
Indonesia	--	--	-3.7	-17.2	3.0	2.9	4.8	-1.0	2.2
Thailand	-6.6	--	-2.9	1.2	-.5	.2	14.6	-.7	-.4
Malaysia	--	--	-4.7	-6.8	6.6	-8.1	-12.6	-.7	-.4
Philippines	1.3	--	.2	-4.7	4.4	-2.8	-20.1	-1.1	.7
South Korea	24.8	--	-16.7	48.1	16.6	11.2	77.2	-.4	18.9
Taiwan	1.6	--	-4.8	-5.2	4.0	4.1	60.6	-1.0	3.3
Other East Asia	-2.3	--	-9.1	-3.3	-.2	-2.5	-10.4	-1.1	-2.4
Other Asia	--	--	-2.6	-4.6	-1.7	-1.2	-8.8	-1.1	-1.8
Asian average	3.2	-22.8	-6.7	.6	1.4	2.0	8.5	-2.4	.5
Rest of World	-5.1	-23.8	-4.0	-6.1	-3.8	-1.6	-5.6	-1.5	-8.8
Developing Country average	-1.6	-15.2	-4.8	-.8	1.0	.9	2.6	-2.1	-1.1

-- = Not applicable.

<sup>1</sup>MT (meats: beef, pork, mutton and lamb, poultry meat, and eggs), DY (dairy products: milk, butter, cheese, and powder), WH (wheat), CG (coarse grains: corn and other coarse grains), RI (rice), OI (oilseeds: soybeans, soy meal, soy oil, other oilseeds, other oil meals, and other oils), SU (sugar), OC (other crops: cotton and tobacco), AGG (aggregate average of all 22 commodities). All aggregate averages are weighted by base consumption values.

## Africa and the Middle East

Given the paucity of support information for this region, world price increases are the main factor causing consumption decreases in all three liberalization scenarios. The average declines of 1.4, 2.2, and 1.9 percent in scenarios IME-1, IME-2, and global liberalization, respectively, are close to the average consumption decreases experienced within each region. On a percentage basis, wheat, coarse grains, dairy, and sugar register the largest declines. A notable example is a 9-percent drop in Egyptian wheat consumption with global liberalization, reflecting the removal of a high level of consumer support. Egypt, along with Nigeria, are the only African countries for which we have support information.

In general, the drop in food consumption in African countries, which are already in food-deficit status, is a troubling implication of these liberalization scenarios. However, one must also question whether the commodity coverage of our model, which is mostly restricted to temperate products, is representative of the African diet or agricultural economy. The exclusion of roots, tubers, and millet from our model is a factor to be considered in the evaluation of these results.

## Agricultural Balance of Trade

We have seen that under IME liberalization, world prices tend to increase, encouraging production responses and discouraging demand. The volume of developing countries' net exports tends to increase. For the developing country exporter, the greater volume of exports and the higher world prices bring in foreign exchange revenues. For the developing country importer, the smaller import volume mitigates the budget effect of higher world prices. The importing country may face a higher or lower food import bill, depending on the import demand elasticity.

Under global liberalization, the removal of taxes increases domestic producer prices, and the removal of consumer subsidies increases domestic consumer prices. The removal of subsidies decreases domestic producer prices, and the removal of consumer taxes decreases domestic consumer prices. Production expands while consumption contracts in the first case, whereas production contracts and consumption expands in the latter case. For the exporting country that removes producer taxes and consumer subsidies, the value of exports would expand beyond that of IME liberalization. For the importing country that removes producer subsidies and consumer taxes, the value of imports would also expand. However, in this case, the world price increases dampen the effects of removing agricultural policies. The import food bill may be smaller or larger than with IME liberalization.

We find that foreign exchange revenue from the net sale of agricultural exports by developing countries expands nearly \$6 billion and \$12 billion under IME-1 and IME-2 liberalization, respectively (fig. 9). The value of net beef exports alone grows over \$2 billion, followed by a \$1.7-billion gain in rice, and a \$1.3-billion increase in sugar in IME-1 (fig. 10). Net imports of dairy powder, though, increase by over \$500 million. In the 1986 base period, gross agricultural exports equaled \$24.5 billion, and gross imports equaled \$34.5 billion (both valued at world reference prices). Therefore, under IME-2, developing countries become slight net exporters of agricultural products.

Under global liberalization, net export sales value increases by \$14 billion. Asia and Latin America gain \$6 billion and \$9 billion in net agricultural exports, respectively, while Africa and the Middle East region suffer losses of almost \$0.5 billion. For each of these three geographic regions, participation in liberalization improves their overall agricultural trade balances relative to IME-1 and, hence, their foreign exchange positions.<sup>14</sup> Although Africa and the Middle East are less well off in terms of agricultural trade balances with global liberalization relative to the base period, the region incurs a more substantive trade cost in IME-1 liberalization of \$2 billion.

#### Latin America

The Latin American countries' agricultural trade balances improve mainly due to increased exports of sugar and meats. The expansion in the value of sugar exports, and therefore total agricultural exports, is overstated, however (tables 9, 10, 11). The United States and the European Community (EC) have afforded developing countries access to sugar markets on a quota basis. Under the quota, the sugar price is considerably higher than the world price. For instance, the U.S. consumer subsidy equivalent on sugar equals \$415 a metric ton, an extra payment that is received by developing countries within the quota limits. Hence, the sugar-exporting countries (as well as U.S. and EC sugar producers) obtain an economic rent. We estimate that the \$1.3-billion gain in sugar exports by developing countries (mainly in Latin America), as shown in model results, is reduced to roughly \$300 million when the quota rent is removed. The gain to sugar exporters in Central America and the Caribbean is approximately reduced in half from \$700 million to \$400 million. If the

Figure 9--Balance of trade changes among DME's

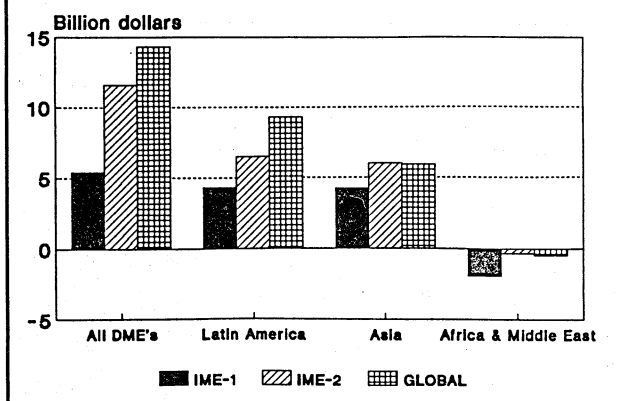
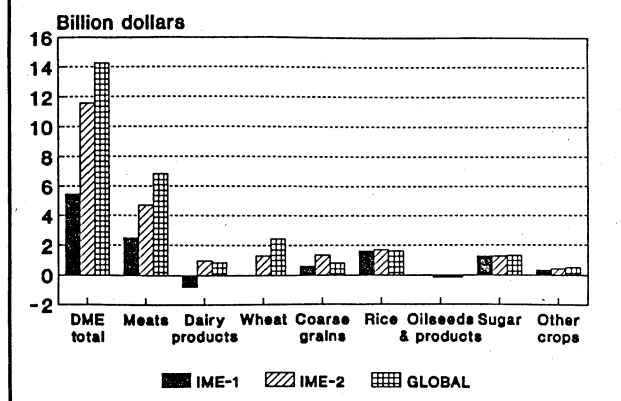


Figure 10--Balance of trade changes among commodities



<sup>14</sup>The improvement in the foreign exchange position may be overstated, depending on the initial level of employed resources. We have assumed that the agricultural sector can expand without any effect on the trade balance of the nonagricultural sector. If there are unemployed resources in the domestic economy that become employed in the agricultural sector, then this may be a reasonable assumption. We also have assumed that there are no income effects from increased production levels. In developing countries where agriculture is a significant part of the economy, this assumption leads to an overestimation of the improvement in agricultural trade. The significance of including the income effect is addressed in (15).

Table 9--Changes in net trade value, scenario IME-1

Area	Commodity group <sup>1</sup>								
	MT	DY	WH	CG	RI	OI	SU	OC	AGG
	<u>Change from base, \$million</u>								
Mexico	540	-167	52	16	4	-29	89	15	520
Central America/Caribbean	93	--	-115	-26	5	-4	700	12	664
Brazil	464	11	-60	165	22	-177	426	62	913
Argentina	892	207	319	238	8	15	43	8	1,730
Chile	1	2	27	-2	--	-2	1	-2	25
Venezuela	104	49	-42	-17	-1	-8	7	-1	91
Other Latin America	330	4	-98	12	24	-8	44	27	334
Latin American total	2,423	107	82	385	63	-213	1,309	122	4,278
Nigeria	--	--	-1	60	-5	-6	-34	-2	12
Kenya	--	--	-1	33	-1	-6	0	-1	28
Other Sub-Saharan Africa	--	--	-108	163	-54	27	112	124	264
Egypt	-34	-53	-219	-3	21	-17	-40	32	-314
Middle East and North Africa-- oil producers	-41	-1,128	-315	-190	-86	-49	-170	8	-1,971
Middle East and North Africa-- other	110	10	-22	7	-13	-20	-45	29	56
African/Middle East total	35	-1,172	-666	70	-138	-71	-174	190	-1,925
India	404	598	789	218	644	-137	46	84	2,647
Pakistan	--	--	216	4	135	12	21	110	498
Bangladesh	--	--	-27	--	275	-11	-2	-4	232
Indonesia	--	--	-56	56	219	60	34	-10	302
Thailand	58	--	-7	109	241	2	158	-28	534
Malaysia	--	--	-24	-29	-3	243	-26	-4	157
Philippines	58	--	-40	22	23	74	60	-1	196
South Korea	48	--	-145	-71	14	-14	-40	-47	-254
Taiwan	112	--	-36	-99	13	-4	17	-55	-52
Other East Asia	-124	--	-11	-13	-22	-11	-36	-34	-251
Other Asia	--	--	-31	36	193	19	-2	-4	211
Asian total	557	598	627	231	1,733	233	230	8	4,218
Rest of world	-504	-332	-88	-99	-50	22	-92	17	-1,126
Developing country total	2,511	-799	-44	588	1,607	-29	1,274	337	5,445

-- = Not applicable.

<sup>1</sup>MT (meats: beef, pork, mutton and lamb, poultry meat, and eggs), DY (dairy products: milk, butter, cheese, and powder), WH (wheat), CG (coarse grains: corn and other coarse grains), RI (rice), OI (oilseeds: soybeans, soymeal, soyoil, other oilseeds, other oilmeals, and other oils), SU (sugar), OC (other crops: cotton and tobacco), and AGG (aggregate average of all commodities).

Table 10--Changes in net trade value, scenario IME-2

Area	Commodity group <sup>1</sup>								
	MT	DY	WH	CG	RI	OI	SU	OC	AGG
<u>Change from base, \$million</u>									
Mexico	887	-44	87	93	3	-26	93	17	1,110
Central America/Caribbean	130	--	-76	-13	10	-2	489	12	550
Brazil	797	313	-3	244	15	-248	395	66	1,580
Argentina	1,372	354	317	242	5	-11	44	10	2,334
Chile	1	3	39	2	--	-2	4	-1	45
Venezuela	170	81	-28	-14	-2	-11	12	--	207
Other Latin America	497	81	-59	26	23	-13	46	24	625
Latin American total	3,854	788	278	579	54	-313	1,083	128	6,452
Nigeria	--	--	22	85	1	-1	-19	1	87
Kenya	--	--	5	42	-1	-4	5	--	47
Other Sub-Saharan Africa	--	--	-39	237	-13	32	82	99	399
Egypt	7	18	-122	30	20	-13	-20	36	-44
Middle East and North Africa-- oil producers	43	-784	-128	-109	-43	-40	-96	13	-1,144
Middle East and North Africa-- other	179	16	85	40	-7	-16	-20	25	301
African/Middle East total	229	-749	-179	325	-42	-42	-68	174	-354
India	534	975	1,140	360	650	-165	109	92	3,696
Pakistan	--	--	308	6	126	34	39	95	608
Bangladesh	--	--	7	--	293	-5	1	-1	295
Indonesia	--	--	-31	86	228	67	39	2	390
Thailand	87	--	-4	107	180	--	105	-17	458
Malaysia	--	--	-16	-18	3	195	-11	-2	151
Philippines	101	--	-27	33	20	67	57	3	254
South Korea	89	--	-90	-40	15	-16	-21	-29	-94
Taiwan	181	--	-25	-70	10	-11	13	-31	68
Other East Asia	-75	--	-4	-9	-13	-7	-17	-19	-145
Other Asia	--	--	26	56	204	16	6	7	314
Asian total	917	975	1,283	509	1,715	176	320	100	5,995
Rest of world	-291	-57	-55	-58	-24	19	-50	13	-502
Developing country total	4,707	958	1,327	1,355	1,703	-160	1,285	415	11,591

-- = Not applicable.

<sup>1</sup>MT (meats: beef, pork, mutton and lamb, poultry meat, and eggs), DY (dairy products: milk, butter, cheese, and powder), WH (wheat), CG (coarse grains: corn and other coarse grains), RI (rice), OI (oilseeds: soybeans, soymeal, soyoil, other oilseeds, other oilmeals, and other oils), SU (sugar), OC (other crops: cotton and tobacco), and AGG (aggregate average of all commodities).



Table 11--Changes in net trade value, scenario GLOBAL

Area	Commodity group <sup>1</sup>								
	MT	DY	WH	CG	RI	OI	SU	OC	AGG
<u>Change from base, \$million</u>									
Mexico	1,535	-30	91	-135	57	39	162	125	1,843
Central America/Caribbean	101	--	-62	-11	19	-2	687	9	740
Brazil	1,002	292	-141	-197	-213	-693	872	139	1,062
Argentina	2,976	349	270	481	7	452	63	1	4,601
Chile	1	3	27	3	1	-1	6	--	40
Venezuela	416	89	-21	-175	-1	14	97	39	457
Other Latin America	382	81	-50	30	40	-8	67	12	555
Latin American total	6,413	784	114	-4	-91	-199	1,955	326	9,297
Nigeria	--	--	73	71	-6	-2	-26	27	137
Kenya	--	--	3	44	-1	-8	7	--	45
Other Sub-Saharan Africa	--	--	-32	239	-14	54	116	53	416
Egypt	-405	13	-36	117	104	-15	-30	169	-84
Middle East and North Africa-- oil producers	54	-784	-105	-112	-59	-78	-132	5	-1,212
Middle East and North Africa-- other	151	16	58	46	-9	-26	-27	10	220
African/Middle East total	-200	-755	-40	405	15	-75	-92	263	-479
India	956	889	1,717	235	1,290	-569	-361	89	4,246
Pakistan	--	--	796	-7	687	-32	30	-152	1,323
Bangladesh	--	--	1	--	424	-10	2	--	417
Indonesia	--	--	-29	189	-282	-4	-39	8	-157
Thailand	90	--	-4	127	216	4	16	-6	443
Malaysia	--	--	-10	-16	-83	452	-17	1	328
Philippines	-91	--	-24	40	-139	166	114	5	71
South Korea	-68	--	-1	-123	-672	55	-136	-10	-954
Taiwan	29	--	-14	-50	-24	13	-44	-23	-115
Other East Asia	-64	--	-4	-9	-17	-13	-23	-9	-139
Other Asia	--	--	9	61	346	36	9	3	464
Asian total	852	889	2,436	448	1,746	99	-449	-94	5,927
Rest of world	-250	-53	-42	-58	-33	37	-68	6	-463
Developing country total	6,815	864	2,468	790	1,637	-139	1,346	500	14,283

-- = Not applicable.

<sup>1</sup>MT (meats: beef, pork, mutton and lamb, poultry meat, and eggs), DY (dairy products: milk, butter, cheese, and powder), WH (wheat), CG (coarse grains: corn and other coarse grains), RI (rice), OI (oilseeds: soybeans, soy meal, soy oil, other oilseeds, other oil meals, and other oils), SU (sugar), OC (other crops: cotton and tobacco), and AGG (aggregate average of all commodities).

United States and the EC compensated sugar-exporting developing countries with a cash equivalent transfer rather than the less transparent economic rent, then there would not be the \$1-billion shortfall in developing countries' foreign exchange earnings.<sup>15</sup> Under global liberalization, the Latin American countries experience trade balance gains of \$9.3 billion. With the removal of export taxes and higher world prices, Argentina realizes the most significant benefit, over \$4.5 billion. Argentina profits mainly from enhanced beef export revenues, which account for approximately 70 percent of its trade gains. Brazil's agricultural trade balance improves by \$1.1 billion, mostly in beef and sugar. Mexico's and Venezuela's agricultural trade positions also improve in global liberalization. For Mexico, the internally imposed ban on beef exports is removed, and beef exports increase by nearly \$1.5 billion. That increase equals almost all of Mexico's agricultural trade balance improvement. Venezuela gains in trade of meats and sugar but imports more grains.

### Asia

India, Bangladesh, Thailand, Malaysia, the Philippines, Pakistan, and Other Asia expand exports under IME and global liberalizations. India and Indonesia each shift from net imports of under \$200 million to net exports of nearly \$2.5 billion and \$250 million, respectively, in simulation IME-1. Most of the change in their trade picture is due to the nearly \$900-million increase in net rice exports. The Asian developing exporters, Thailand and the Philippines, gain \$500 million and \$200 million in export revenues, mostly in rice exports. Japan increases rice imports by over \$1.5 billion, all of which may be coming from their Asian neighbors. Thailand also gains in sugar exports, and Malaysia gains in other oils (particularly palm oil).

South Korea, Taiwan, and Other East Asia expand their agricultural imports by \$250 million, \$50 million, and \$250 million, respectively, in the IME-1 liberalization. Most of the increase is in cereals, cotton, and sugar.

With global liberalization, some Asian countries have additional gains, while others do not prosper as well in agricultural trade. India, Bangladesh, and Pakistan incur further increases in rice exports, but Indonesia and the Philippines become importers of rice. The removal of producer support accounts for the decline in rice production for these three countries. For Malaysia, increased rice imports are more than offset by gains in other oil exports. The Malaysian Government taxed palm oil exports before global liberalization.

Three countries (South Korea, Taiwan, and Indonesia) experience increased import costs with global liberalization compared with the IME-1 liberalization. The removal of large producer subsidies and consumer taxes on beef, poultry, cereals, and soybeans encourages consumers, particularly in South Korea, to purchase foreign foods. The value of Korean net imports increases nearly \$1 billion, a 10-percent increase over the initial 1986 foreign food bill. South Korea's 1986 overall trade surplus was approximately \$5 billion,

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<sup>15</sup>Some of the developing country sugar exporters tax their sugar producers. Consequently, the quota rents are received partly by producers and partly by governments. We assumed that the taxes would be eliminated in an IME liberalization, creating budgetary implications for those sugar exporters.

so increased foreign agricultural purchases would represent roughly 20 percent of the trade surplus. This share does not account for reallocation of resources away from the agricultural sector to the manufacturing sector, thus providing potential for additional nonagricultural production and exports.

#### Africa and the Middle East

The Africa and Middle East region suffers a \$2-billion decline in net export revenue in simulation IME-1, 25 percent of its total agricultural net imports. That number is reduced to \$500 million with global liberalization. The major losses are incurred by the oil-exporting countries. Foreign purchases increase mostly in dairy powder, wheat, coarse grains, and sugar. Egypt also incurs additional agricultural import costs, a 5-percent increase from its already large import bill of \$2 billion.

#### Producer, Consumer, and Net Welfare

Whether or not developing countries participate in agricultural trade liberalization, the welfare of producers, consumers, and taxpayers is affected. A shock to agricultural markets that raises world prices benefits producers but hurts consumers: welfare gains accrue to producers but welfare losses are incurred by consumers. Increases in world prices also may affect government outlays or revenue collection. If government policy is to provide a fixed consumer subsidy per unit of output (IME-2) and domestic consumption declines, then government expenditures on support will decrease as well. However, if government policy is to mitigate world price increases from reaching the consumer (IME-1), government expenditures will rise. Producer gains and taxpayer gains/losses through changes in government spending may be more or less than offset by consumer losses. As a result, without further analysis and data, the effect on net welfare is ambiguous.

Under a global liberalization, the removal of support affects domestic prices and, therefore, farmer incomes and consumer food costs. If producer support is initially negative, then the elimination of a tax equivalent plus a higher world price augment producer welfare. If producer support is initially positive, then the elimination of a subsidy equivalent counterbalances the higher world price. The effect on producer welfare cannot be predicted in advance. An analogous story can be depicted for the consumer with high domestic prices being associated with consumer welfare losses. Note that a dollar gain or loss to producers is treated the same as a dollar loss or gain to consumers or government revenues. Equity or political considerations across producers and consumers are not considered, since we do not place greater emphasis on consumer and taxpayer welfare relative to producer welfare.<sup>16</sup>

Changes in producer welfare, consumer welfare, government expenditures, and net welfare (efficiency gains or losses) are calculated under IME and global

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<sup>16</sup>For details on the use of welfare measures, both theoretically and in the SWOPSIM framework, see (10).

liberalization.<sup>17</sup> With commodity prices generally increasing in the IME liberalization, producers tend to gain while consumers tend to lose (figs. 11, 12). Developing country producers' gain \$16 billion and \$25 billion, while the consumer surplus loss is \$20 billion and \$30 billion in IME-1 and IME-2, respectively. The complete transmission of world prices to developing countries' domestic markets explains the larger producer and consumer welfare results in IME-2. The partial price transmission assumption in IME-1 also generates some government expenditures, approximately \$1 billion, because of increases in consumer subsidies that overshadow increases in export tax collections. As for overall efficiency, the developing countries experience a net welfare loss under both IME-1 and IME-2 of over \$4 billion (fig. 13).

Producer and consumer welfare changes are smaller, in absolute terms, in global liberalization compared with changes under IME-2: producers gain nearly \$19 billion, while consumers lose \$17.5 billion. Producer surplus gains are smaller because of the removal of some large producer subsidies on grains (particularly in South Korea), although this is partially offset by the elimination of taxes on livestock (mainly Argentine beef) and on cotton (Pakistan). Consumer welfare loss is diminished by the removal of consumer taxes, most notably in rice (particularly in South Korea). (Note: subsidies to rice producers and corresponding taxes to consumers may be unusually large in our 1986 base period.)

Figure 11--Producer surplus

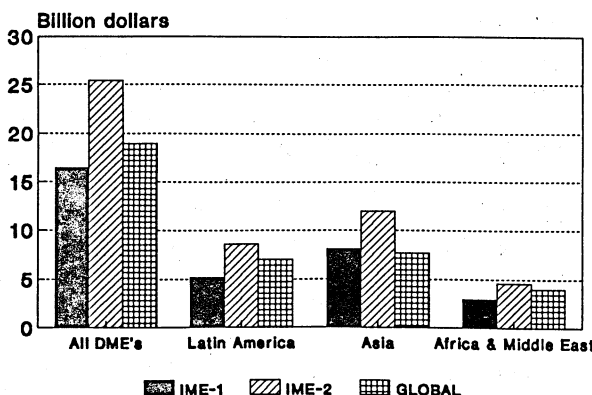
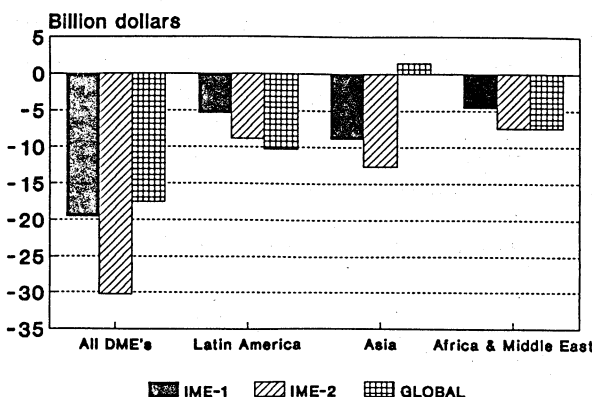


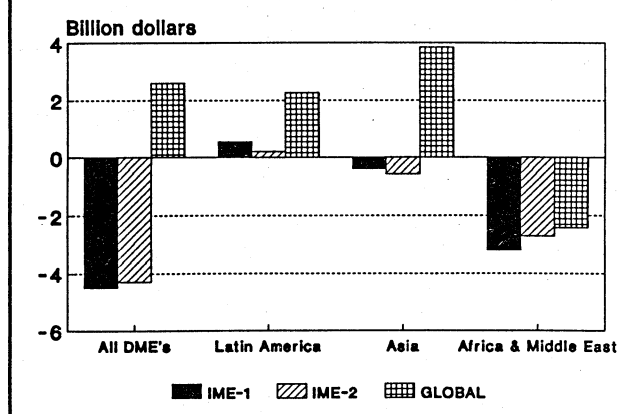
Figure 12--Consumer surplus



<sup>17</sup>The sum of producer surplus, consumer surplus, changes in government expenditures, and economic rent equals net welfare. Domestic or border policies that involve explicit subsidies or taxes by the government affect government revenues. Policies that are nonbudgetary, such as quotas and voluntary export restraints, affect economic rent that accrues to individuals involved in the trade chain. This economic rent may go to producers, exporters, or importers. It is not always clear whether the country imposing the quantitative restriction collects the economic rent. The most familiar example is the voluntary export restraint by the United States on imported automobiles from Japan, which may lead to economic rent for Japanese exporters. U.S. and EC import quotas on sugar are an example in agriculture. Because we have a net trade model, we cannot always delineate, within the context of the model, where the gains and losses from economic rent accrue. As is indicated below, adjustments are made for the sugar market.

Under global liberalization, governments' budgetary allocations diminish with the cessation of subsidies, but budgetary collections are reduced by the removal of producer and export taxes. For the developing countries as a group, the net reduction in government spending is very small, approximately \$1 billion. However, there is considerable variation on a country basis. The potential shortfall in government revenue for some countries may have serious repercussions on the supply of government services and investments if alternative means of taxation are not found.

Figure 13--Net welfare



Given the changes in producer and consumer welfare and government spending, a net welfare gain of over \$2.5 billion is realized for developing countries under global liberalization (fig. 13). Although the amount is small, it represents a \$7-billion turnaround if developing countries liberalize their agricultural markets compared with the case where only the IME countries liberalize. Latin American and Asian countries realize gains of \$2 billion and \$4 billion, respectively, while African and Middle Eastern countries lose \$2.5 billion. (Approximately \$1 billion is unallocated; that is, it is in the rest of the world region.)

#### Latin America

Latin American producers receive increases in producer surplus of roughly \$5 billion in simulation IME-1, \$9 billion in simulation IME-2, and \$7 billion in global simulation (table 12). In IME-2, Brazil and Mexico experience the largest gains, \$2.8 billion and \$1.9 billion. However, in global liberalization, the removal of taxes allows Argentine farmers to augment producer gains by \$3.6 billion, while the removal of grain subsidies in Brazil reverses the income gains to a loss of \$1 billion. Mexico and Other Latin America have significant increases in producer surplus as well, \$2.3 billion and \$1 billion, respectively. All four of these countries/regions, plus Venezuela, experience two-thirds of their gains in meats. The sugar sector provides the main contribution to the \$900-million producer surplus gain of Central American and the Caribbean, although that figure may be overstated due to sugar quotas. The estimated economic rent from the sugar quotas for Central American and Caribbean producers is calculated to be \$300 million. Therefore, the net gain may be only \$600 million.

The increase in costs for food due to higher world prices and the elimination of consumer subsidies creates hardships for Latin American consumers. The costs increase in each successive scenario, rising from \$5 billion to over \$10 billion in global liberalization. The large consumer surplus loss in the global liberalization relative to the two IME liberalization scenarios can be attributed to the increased cost of purchasing beef, grains, and soybeans. Net welfare improves in all three experiments, reaching over \$2 billion in global liberalization for the Latin American region. While the loss to consumers exceeds the gain to producers, there is a reduction in government outlays, most notably the cessation of transfers to Brazilian and Mexican

Table 12--Changes in producer, consumer, and net welfare: Latin America

Area	IME-1	IME-2	GLOBAL
<u>\$Million</u>			
Change from base in producer surplus:			
Mexico	1,111	1,868	2,298
Central America/Caribbean	496	711	860
Brazil	1,691	2,769	-1,008
Argentina	995	1,727	3,626
Chile	60	93	87
Venezuela	229	404	158
Other Latin America	632	1,048	983
Latin American total	5,214	8,620	7,004
Change from base in consumer surplus:			
Mexico	-1,304	-2,170	-3,337
Central America/Caribbean	-306	-461	-465
Brazil	-1,943	-3,111	-2,930
Argentina	-851	-1,420	-2,744
Chile	-67	-100	-95
Venezuela	-259	-431	393
Other Latin America	-684	-1,107	-1,052
Latin American total	-5,414	-8,800	-10,230
Change from base in net welfare:			
Mexico	-133	-59	505
Central America/Caribbean	432	250	394
Brazil	-292	-431	406
Argentina	656	532	637
Chile	-9	-7	-9
Venezuela	-39	-22	400
Other Latin America	-69	-59	-69
Latin American total	546	204	2,264

grain producers. We estimate the government net savings for these two countries at \$6 billion. On the other hand, Argentina loses \$250 million in net government revenue because of the elimination of export taxes on beef, grains, and soybeans.

#### Asia

Asian farmers have income gains of \$8 billion, \$12 billion, and \$8 billion for the three simulation exercises (table 13). Much of the gain, approximately 70 percent, goes to Indian producers (\$4.5 billion), Indonesian producers (\$755 million), and Other Asian producers (\$705 million) in IME-1. Rice farmers experience the largest benefits. Producer surplus in rice equals nearly \$3 billion, or over 40 percent of the total gain for these three large countries/regions. For all Asian countries, the contribution of rice to increases in farmer income ranges from 40 to 50 percent.



Table 13--Changes in producer, consumer, and net welfare: Asia

Area	IME-1	IME-2	GLOBAL
<u>\$Million</u>			
Change from base in producer surplus:			
India	4,486	6,964	7,420
Pakistan	528	784	1,702
Bangladesh	333	405	549
Indonesia	755	961	-38
Thailand	409	546	158
Malaysia	100	144	425
Philippines	312	454	-30
South Korea	281	408	-3,423
Taiwan	212	329	-268
Other East Asia	27	47	46
Other Asia	705	907	1,153
Asian total	8,148	11,949	7,694
Change from base in consumer surplus:			
India	-4,662	-6,931	-4,139
Pakistan	-500	-734	-827
Bangladesh	-359	-445	-573
Indonesia	-775	-984	895
Thailand	-245	-323	-235
Malaysia	-93	-128	38
Philippines	-322	-466	127
South Korea	-485	-713	7,084
Taiwan	-374	-575	530
Other East Asia	-171	-272	-263
Other Asia	-788	-1,019	-1,232
Asian total	-8,774	-12,590	1,405
Change from base in net welfare:			
India	332	335	1,746
Pakistan	109	50	317
Bangladesh	-40	-40	-24
Indonesia	-84	-105	119
Thailand	334	195	346
Malaysia	63	12	130
Philippines	10	-27	67
South Korea	-439	-385	1,490
Taiwan	-254	-273	-58
Other East Asia	-293	-225	-217
Other Asia	-117	-112	-79
Asian total	-379	-575	3,837

The major determinant affecting producer surplus gains in global liberalization, other than world price increases, is the removal of producer support in cereals, mainly in rice. For South Korea and Taiwan, and to a lesser extent, Thailand, Indonesia, Malaysia, and the Philippines, this means eliminating subsidies to producers. For India and Pakistan, this means

removing producer taxes. As a result, overall producer benefits in India and Pakistan increase to \$7.4 billion and \$1.7 billion, while producer losses in South Korea and Taiwan equal \$3.4 billion and \$268 million. Thai farmers still attain benefits, but less than they did in IME-2. Philippine and Indonesian farmers suffer a marginal decline in producer income. Malaysian producers, in contrast, realize greater benefits because of the removal of export taxes on other oils.

Asian consumers experience increased costs of \$9 billion and \$13 billion in the IME liberalization scenarios, but gain \$1 billion in global liberalization. Higher world prices explain consumer losses in IME liberalization. The main reason for the turnaround for Asian consumers in global liberalization is the removal of consumer taxes on beef, cereals, and soybeans in South Korea and, to a lesser extent, in Taiwan and Indonesia. With IME liberalization, the prices of rice and beef to South Korean consumers increase due to the rise in world prices. In contrast, with global liberalization, rice and beef prices fall over 50 percent, contributing to an overall Korean consumer gain of \$7 billion.

The Asian countries have losses in net welfare of under \$1 billion with IME liberalization, but that loss changes into nearly a \$4-billion gain with global liberalization. Producer and consumer surplus gains total \$9 billion. But, government revenue (or economic rent) declines by \$5 billion due to the removal of consumer or export taxes or to the discontinuation of state trading boards. South Korea's disposal of taxes on food accounts for over \$2 billion of the \$5 billion.

#### Africa and the Middle East

The African and Middle Eastern farmers have increases in producer surplus of \$3-\$4.5 billion with IME and global liberalization (table 14). In IME-1 liberalization, Egyptian and Nigerian producers gain \$500 million and \$150 million, respectively. Other Sub-Saharan Africa, Middle East oil producers, and Other Middle East regions attain producer benefits of \$660 million, \$650 million, and \$875 million, respectively. Cereal producers experience 50 percent of all farmer gains for the African and the Middle Eastern region. In global liberalization, Egyptian farmers gain over \$300 million. This is a lower gain than in IME liberalization, reflecting the effect of removing farmer subsidies on producer incentive prices. On the other hand, Nigerian farmers achieve further income gains, \$260 million, as taxes (on cotton in particular) are eliminated.

Africa and Middle East consumers lose between \$5 billion and \$7.5 billion in IME and global liberalization. This is mainly due to higher world prices. The most substantive cost increases are to consumers, \$3 billion, in the Middle East oil producing region.

Net welfare losses in developing countries are concentrated mostly in Africa and the Middle East, \$3 billion in IME and \$2.5 billion in global liberalization. In the latter case, there is also a government expenditure reduction of \$1 billion for Egypt and Nigeria.

Table 14--Changes in producer, consumer, and net welfare: Africa/Middle East

Area	IME-1	IME-2	GLOBAL
<u>\$Million</u>			
Change from base in producer surplus:			
Nigeria	146	214	263
Kenya	54	83	89
Other Sub-Saharan Africa	666	971	1,090
Egypt	511	847	313
Middle East and North Africa-- oil producers	649	1,084	989
Middle East and North Africa-- other	871	1,386	1,229
African/Middle East total	2,897	4,585	3,973
Change from base in consumer surplus:			
Nigeria	-220	-313	-543
Kenya	-57	-86	-95
Other Sub-Saharan Africa	-715	-1,033	-1,138
Egypt	-801	-1,304	-1,201
Middle East and North Africa-- oil producers	-1,759	-3,048	-2,975
Middle East and North Africa-- other	-1,032	-1,606	-1,454
African/Middle East total	-4,584	-7,390	-7,406
Change from base in net welfare:			
Nigeria	-62	-28	24
Kenya	-4	-3	-6
Other Sub-Saharan Africa	-47	-61	-48
Egypt	-529	-442	-181
Middle East and North Africa-- oil producers	-2,291	-1,964	-1,986
Middle East and North Africa-- other	-265	-220	-225
African/Middle East total	-3,198	-2,718	-2,422

### Conclusions

The focus of our analysis has been the effects of IME and global liberalization on developing countries. Several key points emerge from the study. First, developing countries, on average, marginally subsidized producers and taxed consumers, given the sector-specific policies in 1986. This pattern of support occurred most noticeably with grains. An exception to this structure of agricultural support is the livestock sector. Export taxes and quotas on beef in Latin American countries largely determine the negative support in livestock.

Second, with opening of agricultural markets, world commodity prices tend to increase. Higher world prices provide incentives to developing countries' agricultural producers to increase output. Producers benefit by accruing

nearly \$19 billion in income (producer surplus) when developing countries participate in the liberalization. Consumers, though, face higher world prices and reduce their demand for agricultural goods. Consumer losses are approximately \$17.5 billion. With an expansion of production in developing countries and a contraction of domestic consumption, the volume and value of agricultural exports increase, while the volume and value of imports decrease. The developing countries improve their agricultural trade balances by \$14 billion and, thus, go from being net importers to slight net exporters of agricultural goods.

Third, the gains (or losses) attributed to developing countries are not evenly spread under agricultural liberalization. With IME-1 liberalization, Argentina, Central America and the Caribbean, India, Pakistan, Thailand, the Philippines, and Malaysia profit from increased production, foreign exchange earnings, and small gains in net welfare. Brazil, Other Asian countries, and Indonesia attain increased production and foreign exchange earnings, although they experience slight net welfare losses. In contrast, South Korea, Taiwan, and Other East Asian countries face more foreign exchange costs in purchasing food and incur small net welfare losses. Relying heavily on imports for their food supply, consumers in these three regions currently benefit from the depressed world prices brought on by government intervention around the world. Yet, these are the newly industrialized Asian countries that perhaps can further exploit their comparative advantage in industrial goods by shifting resources out of agriculture into manufacturing. Foreign exchange costs and net welfare losses are also incurred by the Middle Eastern countries. Middle East oil-producing countries may be able to best afford these losses. As for Egypt and Other Middle East countries, foreign aid may be necessary to assist them in making the adjustment to a global environment with liberalized trading in agriculture.

Fourth, with global liberalization (relative to IME-1 liberalization), increased foreign exchange earnings, larger producer gains, and smaller consumer losses are achieved by developing countries. For developing countries that tax agricultural exports, liberalization reinforces the positive impacts on production, trade, and net welfare. Argentina is a prime example: as production expands, the value of net exports increases under a global liberalization scenario. Argentina accounts for nearly 30 percent of the gain in foreign exchange revenue of developing countries.

For developing countries that subsidize agricultural production and tax consumers, participation in liberalization counteracts the effects of higher world commodity prices on domestic markets. When producer subsidies and consumer taxes are substantial, the removal of support lowers domestic producer and consumer prices, despite world price increases: agricultural production falls, domestic consumption expands, and commodity imports increase. South Korea, with large producer subsidies to beef, poultry, and cereal producers, and, in some cases, even larger taxes to consumers, realizes a decline in production and an increase in its food import bill. However, consumers are considerably better off with lower food prices. The overall economy experiences net welfare gains, as opposed to losses under IME liberalization.

Fifth, economic theory suggests that efficiency gains are realized when a small economy liberalizes its markets. Our findings agree: a \$7-billion net welfare gain for the developing countries is achieved when a comparison is made between global and IME liberalizations. Gains can occur whether a

country is initially taxing or subsidizing its producers (consumers). Thus, Argentina and South Korea incur large efficiency benefits from participation in agricultural trade liberalization.

There are many limitations to our study and, at the very least, some should be mentioned. We have included in our commodity coverage only the more important traded temperate and sub-tropical products. We assumed that these products are homogeneous. Even within this subset of agricultural goods, there are shortcomings and uncertainty regarding parameter estimates. For example, parameter values may change when policy shocks occur. Another limitation is the paucity of support information. Our global liberalization results are dependent on the developing country support data included in the model. In some ways, 1986 may be an atypical year in agricultural markets. Support may be subject to significant adjustments, depending on the base year. These are but some of the factors that may have a bearing on the results.

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# Appendix

Appendix table 1--Product groups and country/region codes

Code	Product group	Code	Product group
BF	Beef and veal	CG	Other coarse grains
PK	Pork	RI	Rice
ML	Mutton and lamb	SB	Soybeans
PM	Poultry - meat	SM	Soymeal
PE	Poultry - eggs	SO	Soyoil
DM	Dairy - fresh milk	OS	Other oilseeds
DB	Dairy - butter	OM	Other meals
DC	Dairy - cheese	OO	Other oils
DP	Dairy - milk powder	CT	Cotton
WH	Wheat	SU	Sugar
CN	Corn	TB	Tobacco
Country/region		Country/region	
Developed countries		Sub-Saharan Africa & Middle East	
US	United States	NG	Nigeria
CN	Canada	KY	Kenya
EC	European Community	AF	Other Sub-Saharan Africa
WE	Other Western Europe	EG	Egypt
JP	Japan	MP	Middle East/North Africa-oil producing
AU	Australia	MO	Middle East/North Africa-other
NZ	New Zealand		
SF	South Africa		Asia
Centrally planned		ND	India
EE	Eastern Europe	PK	Pakistan
SV	Soviet Union	BG	Bangladesh
CH	China (Peoples' Republic)	DO	Indonesia
		TH	Thailand
		ML	Malaysia
	Latin America	PH	Philippines
		SK	South Korea
MX	Mexico	TW	Taiwan
CA	Central America/Caribbean	EA	Other East Asia
BZ	Brazil	OA	Other Asia
AR	Argentina		
CL	Chile		
VE	Venezuela		
LA	Other Latin America		
		RW	Rest of world

Appendix table 2--Country composition of regional aggregates

Region	Country composition
EC	Denmark, France, West Germany, Greece, Ireland, Italy, Belgium/ Luxembourg, the Netherlands, United Kingdom, Spain, Portugal
WE	Austria, Finland, Iceland, Malta, Norway, Sweden, Switzerland
EE	Albania, Bulgaria, Czechoslovakia, East Germany, Poland, Hungary, Romania, Yugoslavia
MP	Syria, Iraq, Iran, Kuwait, Qatar, Saudi Arabia, United Arab Emirates, Oman, Bahrain, Algeria, Tunisia, Libya
MO	Turkey, Cyprus, Lebanon, Israel, Gaza, West Bank, Jordan, North Yemen, South Yemen, Morocco
LA	Bolivia, Colombia, Ecuador, Paraguay, Peru, Uruguay
CA	Belize, Costa Rica, El Salvador, Honduras, Guatemala, Nicaragua, Panama, Bahamas, Bermuda, Cuba, Dominican Republic, Haiti, Jamaica, Trinidad & Tobago, Barbados, Bonaire, Curacao, French West Indies, Guadeloupe, Martinique, Turks & Caicos, Cayman Islands, Aruba, British West Indies, Leeward-Windward Islands, St. Kitts, Netherland Antilles, Antigua, Nevis, Montserrat, British Virgin Islands, Grenada, St. Vincent, St. Lucia, Dominica, Guyana, French Guiana, Surinam
AF	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros Islands, Congo, Djibouti, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Reunion, Rwanda, Sao Tome/Principe, Seychelles, Sierra Leone, Somalia, Senegal, Sudan, Swaziland, Tanzania, Togo, Uganda, Zaire, Zambia, Zimbabwe
EA	Hong Kong, Singapore
OA	Afghanistan, Bhutan, Brunei, Burma, Cambodia, Fiji, Laos, Mongolia, Nepal, North Korea, Sri Lanka, Vietnam

Appendix table 3--Industrial market liberalization, scenario IME-1

Area	Change in--		Change in--			
	Supply quantity	Demand quantity	Net trade	Producer surplus	Consumer surplus	Net welfare
	-- Percent --		----- \$ Million -----			
United States	-1.5	-1.2	2,832	-15,974	-4,645	8,822
Canada	-2.1	-.4	703	-1,275	150	2,609
European Community	-5.6	2.8	-9,213	-23,466	21,510	12,059
Other Western Europe	-16.3	-1.1	-1,909	-7,146	2,184	1,293
Japan	-30.4	9.4	-6,212	-22,011	23,575	4,985
Australia	6.2	-3.6	3,151	1,543	-1,546	1,109
New Zealand	12.0	2.2	2,478	1,745	-837	1,354
South Africa	3.0	-1.6	442	503	-485	87
Eastern Europe	.7	-.4	1,738	2,378	-2,374	789
Soviet Union	.4	-.4	-588	3,507	-3,912	-1,790
China	.7	-.3	1,133	3,476	-3,570	-73
Mexico	2.6	-2.0	520	1,111	-1,304	-133
Central America/Caribbean	3.3	-1.6	664	496	-306	432
Brazil	1.9	-1.5	913	1,691	-1,943	-292
Argentina	3.2	-2.0	1,730	995	-851	656
Chile	2.1	-1.7	25	60	-67	-9
Venezuela	2.2	-1.1	91	229	-259	-39
Other Latin America	2.6	-1.8	334	632	-684	-69
Nigeria	2.5	-1.7	12	146	-220	-62
Kenya	4.5	-2.7	28	54	-57	-4
Other Sub-Saharan Africa	1.7	-1.5	264	666	-715	-47
Egypt	1.5	-1.6	-314	511	-801	-529
Middle East/North Africa-- oil producers	2.6	-1.8	-1,971	649	-1,759	-2,291
Middle East/North Africa--other	2.0	-.8	56	870	-1,032	-265
India	2.2	-2.2	2,647	4,486	-4,662	332
Pakistan	4.2	-1.9	498	528	-500	109
Bangladesh	4.4	-2.6	232	333	-359	-40
Indonesia	2.0	-1.5	302	755	-775	-84
Thailand	3.0	-.9	534	409	-245	334
Malayasia	.9	-1.3	157	100	-93	63
Philippines	1.5	-1.3	196	312	-322	10
South Korea	1.0	-.9	-254	281	-485	-439
Taiwan	1.1	-1.1	-52	212	-374	-254
Other East Asia	1.7	-1.6	-251	27	-171	-293
Other Asia	1.9	-1.2	211	705	-788	-117
Rest of world	.2	-5.8	-1,126	109	-817	-1,445
Developing country total	2.2	-1.8	5,445	16,367	-19,590	-4,476

Appendix table 4--Industrial market liberalization, scenario IME-2

Area	Change in--		Change in--			
	Supply quantity	Demand quantity	Net trade	Producer surplus	Consumer surplus	Net welfare
	-- Percent --		----- \$ Million -----			
United States	-2.5	-.7	191	-18,745	-1,768	8,928
Canada	-3.0	.3	154	-1,847	596	2,483
European Community	-6.3	3.3	-10,899	-26,986	25,571	12,600
Other Western Europe	-17.2	-.8	-2,058	-7,527	2,669	1,397
Japan	-31.5	9.9	-5,884	-22,295	24,598	5,724
Australia	4.2	-3.2	2,295	1,095	-1,369	838
New Zealand	9.9	1.9	2,041	1,457	-754	1,148
South Africa	5.0	-2.7	597	853	-802	19
Eastern Europe	.6	-.3	1,489	1,996	-1,978	691
Soviet Union	.3	-.3	-395	2,856	-3,164	-1,373
China	.5	-.3	879	2,563	-2,634	-69
Mexico	4.4	-3.2	1,110	1,868	-2,170	-59
Central America/Caribbean	4.6	-2.3	550	711	-461	250
Brazil	3.2	-2.2	1,580	2,769	-3,111	-431
Argentina	5.4	-3.2	2,334	1,727	-1,420	532
Chile	3.2	-2.5	45	93	-100	-7
Venezuela	3.9	-1.7	207	404	-431	-22
Other Latin America	4.2	-2.9	625	1,048	-1,107	-59
Nigeria	3.6	-2.3	87	214	-313	-28
Kenya	6.9	-3.9	47	83	-86	-3
Other Sub-Saharan Africa	2.5	-2.0	399	971	-1,033	-61
Egypt	2.4	-2.5	-44	847	-1,304	-442
Middle East/North Africa-- oil producers	4.3	-2.9	-1,144	1,084	-3,048	-1,964
Middle East/North Africa--other	3.1	-1.2	301	1,386	-1,606	-220
India	3.2	-3.1	3,696	6,964	-6,931	335
Pakistan	6.0	-2.6	608	784	-734	50
Bangladesh	5.3	-3.2	295	405	-445	-40
Indonesia	2.5	-1.9	390	961	-984	-105
Thailand	4.1	-1.3	458	546	-323	195
Malayasia	1.1	-1.7	151	144	-128	12
Philippines	2.2	-1.9	254	454	-466	-27
South Korea	1.5	-1.3	-94	408	-713	-385
Taiwan	1.9	-1.6	68	329	-575	-273
Other East Asia	3.1	-2.5	-145	47	-272	-225
Other Asia	2.4	-1.4	314	907	-1,019	-112
Rest of world	.3	-9.4	-502	218	-1,382	-1,164
Developing country total	3.3	-2.6	11,591	25,374	-30,160	-4,251

Appendix table 5--Global market liberalization, scenario GLOBAL

Area	Change in--		Change in--			
	Supply quantity	Demand quantity	Net trade	Producer surplus	Consumer surplus	Net welfare
	-- Percent --		-----\$ Million-----			
United States	-3.0	-.5	-1,207	-19,886	-771	8,784
Canada	-3.3	.7	-103	-2,047	721	2,409
European Community	-6.6	3.4	-11,196	-27,288	26,126	12,853
Other Western Europe	-17.4	-.6	-2,099	-7,564	2,707	1,397
Japan	-31.1	10.1	-5,810	-22,103	24,414	5,732
Australia	3.6	-2.9	1,954	985	-1,329	768
New Zealand	9.4	2.0	1,921	1,426	-750	1,122
South Africa	1.5	-2.0	368	228	-623	152
Eastern Europe	.6	-.3	1,493	1,924	-1,892	729
Soviet Union	.3	-.3	-461	2,649	-2,947	-1,341
China	.5	-.3	856	2,587	-2,656	-76
Mexico	2.2	-5.0	1,843	2,298	-3,337	505
Central America/Caribbean	5.3	-2.4	740	860	-465	394
Brazil	-1.7	-2.0	1,062	-1,008	-2,930	406
Argentina	9.8	-6.6	4,601	3,626	-2,744	637
Chile	2.8	-2.5	40	87	-95	-9
Venezuela	9.7	4.1	457	158	393	400
Other Latin America	3.7	-2.7	555	983	-1,052	-69
Nigeria	4.1	-3.2	137	263	-543	24
Kenya	7.0	-4.1	45	89	-95	-6
Other Sub-Saharan Africa	3.3	-1.6	416	1,090	-1,138	-48
Egypt	-6.1	-1.4	-84	313	-1,201	-181
Middle East/North Africa-- oil producers	3.9	-2.8	-1,212	989	-2,975	-1,986
Middle East/North Africa--other	2.9	-.9	220	1,229	-1,454	-225
India	2.2	-2.5	4,246	7,420	-4,139	1,746
Pakistan	16.6	-2.2	1,323	1,702	-827	317
Bangladesh	7.0	-4.1	417	549	-573	-24
Indonesia	-.1	2.2	-157	-38	895	119
Thailand	.6	-.4	443	158	-235	346
Malayasia	-3.3	-.4	328	425	38	130
Philippines	-.8	.7	71	-30	127	67
South Korea	-19.4	18.9	-954	-3,423	7,084	1,490
Taiwan	-1.8	3.3	-115	-268	530	-58
Other East Asia	3.1	-2.4	-139	46	-263	-217
Other Asia	3.3	-1.8	464	1,153	-1,232	-79
Rest of world	.2	-8.8	-463	226	-1,309	-1,083
Developing country total	1.3	-1.1	14,283	18,896	-17,538	2,597