



# AGRICULTURAL PROTECTION IN OECD COUNTRIES: ITS COST TO LESS-DEVELOPED COUNTRIES

Alberto Valdés  
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December 1980.

INTERNATIONAL  
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IN OECD COUNTRIES: ITS COST  
TO LESS-DEVELOPED COUNTRIES**

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**Research Report 21  
International Food Policy Research Institute  
December 1980**

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Library of Congress Cataloging  
in Publication Data

Valdés, Alberto, 1935-  
Agricultural protection in OECD countries.

(Research report—International Food Policy  
Research Institute ; 21)

Bibliography: p. 53.

1. Underdeveloped areas—Farm produce. 2. Underdeveloped areas—Commerce. 3. Underdeveloped areas—Food supply. 4. Organization for Economic Cooperation and Development. 5. Commercial policy. I. Zietz, Joachim, 1953-joint author. II. Title. III. Series: International Food Policy Research Institute. Research report—International Food Policy Research Institute ; 21.

HD9000.5.V34 381'.41'091724 81-398  
ISBN 0-89629-022-0 AACRI

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## FOREWORD

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Many less-developed countries (LDCs) are finding it increasingly difficult to obtain the foreign exchange to pay for growing imports of basic food staples as well as the capital goods and raw materials necessary for their growth and modernization. Agricultural performance particularly is affected by a country's capacity to import fertilizers and other agricultural inputs. Traditionally agriculture has been a major source of export earnings for developing countries and is a logical place to turn for increased earnings. The extent to which agricultural exports can be increased affects the patterns of output growth as well as the allocations of resources to crop-specific research and other inputs. In addition, increasing agricultural exports can lead to an increase in the level of income and employment among low-income families in LDCs.

This study examines the effect a reduction in agricultural trade restrictions of selected OECD countries would have on the export earnings and import expenditures of developing countries. It indicates the minimum effect a 50 percent reduction in the trade barriers of 99 commodities would have on export revenues and import expenditures as well as how agricultural production in the LDCs would be generally affected.

This is not the first trade-oriented study undertaken by IFPRI. Although the bulk of IFPRI's research focuses on areas of study related to improved domestic policy in the LDCs, occasionally background information is needed on developed-country policies that so strongly affect those of LDCs. IFPRI has commissioned studies on the effect of developed-country policies on the food

security of LDCs and on the future course of grain imports by the Soviet Union in an effort to accumulate such information. These studies interact with IFPRI's work on production trade-offs between food crops for domestic consumption and export.

Other international organizations share IFPRI's concern with these important issues. In July 1978 the Food and Agriculture Organization of the United Nations asked IFPRI to further develop its earlier model for trade analysis and to provide estimates of the effect of OECD trade reductions for its *Agriculture Towards 2000* study. This report is an expansion and refinement of that effort.

The findings of the Valdés and Zietz research are clear. A major reduction in trade restrictions on agricultural commodities by the OECD countries would provide substantial additional foreign exchange earnings to less-developed countries; in fact, earnings that are slightly larger than current foreign aid flows to agricultural development. In addition, the resulting expansion of production in LDCs would raise the level of income and employment in agriculture in developing countries. Although reduction of trade barriers by the Soviet bloc was not analyzed, undoubtedly it would add to the benefits.

The policy implications of this research are complex at best. Although developing countries would realize substantial benefits, an amount equivalent to two thirds of all the developing-country increment in export revenues is concentrated in three developed countries: the United States, Canada, and Australia. These positions change substantially if a few temperate-latitude commodi-

ties are removed from the list of selected goods, but that would affect the benefits to the developing countries as well. Furthermore, the bulk of the import adjustment falls on four developed countries. Three are members of the European Community, with a major share of this adjustment arising from trade within the Community.

In view of the research results, future IFPRI research will emphasize potential for selective reduction in trade restrictions by OECD countries and the rapidly rising potential for intra-Third World trade. It is notable that while such trade has in the past accounted for only one quarter of total developing-country trade, today it is growing, dynamic, and has great potential. IFPRI is commencing its research on this issue with in-depth analyses of selected cases and will carry it out to implications for the agricultural production patterns and resource allocations of the less-developed countries.

A final note. The developing countries' share of world trade is declining in some agricultural commodities. This suggests that they are experiencing supply problems as well as problems of trade restrictions. Some of these result from the increase in domestic demand that accompanies economic growth. Some are due to difficult production and trade policy problems. Future IFPRI research is expected to shed light on these complex policy issues.

John W. Mellor

Washington, D.C.  
December 1980

## ACKNOWLEDGMENTS

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Alberto Valdés, the senior author, wishes to thank Arnold C. Harberger for substantive comments on the approach and gratefully acknowledges Denis Bergmann, Yujiro Hayami, D. Gale Johnson, John W. Mellor, Grant M. Scobie, Ammar Siamwalla, Stephan Tangermann, and Robert Thompson for many useful suggestions on an earlier draft. The remaining weaknesses are his own responsibility.

Alberto Valdés and Joachim Zietz, research assistant, wish to acknowledge the assistance of Robin Donaldson and Pat Tillman in programming the model.

## SUMMARY

This report assesses the effects of agricultural protectionism in developed countries on the annual export earnings and concomitant welfare gains of less-developed countries (LDCs). It measures the results of a hypothetical 50 percent reduction across the board in tariffs and other trade barriers for 99 commodities in 17 developed countries belonging to the Organization for Economic Cooperation and Development (OECD).

Such a reduction would increase world trade by about \$8.5 billion per year. Approximately 36 percent of this expansion would accrue to the selected LDCs, 20 percent to OECD exporters, and 44 percent to the remaining countries.

Because of the wide variety and complexity of domestic policies among the OECD countries and the inadequacy of the information on relevant elasticities, exact measurements are virtually impossible, but the estimates arrived at in this study are believed to provide a realistic approximation of the extent of agricultural protectionism and its implications for the balance of payments of LDCs, both as exporters and importers.

The trade restrictions imposed by developed countries include tariffs and nontariff barriers (NTBs), and they vary considerably in severity among countries and products. They all tend to lower world prices and restrict the volume of exports from both LDCs and developed-country exporters. In addition, trade restrictions tend to escalate as goods are developed from raw materials to semiprocessed products to finished goods. This discourages LDCs from processing raw materials in their own countries.

In recent years LDCs have greatly increased their imports of cereals, predominantly wheat. Because trade liberalization would lead to higher prices on cereal imports, some LDCs could be adversely affected by trade liberalization in developed countries.

But greater market access would probably encourage agricultural production in LDCs.

The study analyzes the geographic distribution of the benefits accruing to LDCs from trade liberalization and identifies the products with the most potential for export growth for Asia, Sub-Saharan Africa, North Africa and the Middle East, and Latin America. For LDCs as a whole, raw sugar, refined sugar, and beef and veal are the three most significant commodities, followed by green coffee, wine, tobacco, and maize. When the commodities are formed into the groups used in the General Agreement on Tariffs and Trade (GATT) negotiations, sugar and derivatives and meats capture 47 percent of the total increase in export revenues expected for the LDCs. In most commodities LDCs capture 50 to 80 percent of the increase in world trade.

Wheat, pork, and mutton and lamb, however, play a significant part in world agricultural trade, and most of the benefits from liberalization in these commodities accrue to developed countries.

Among the OECD members the major increases in the cost of imports would occur in Japan, Germany, the United Kingdom, and Italy. Major increases in exports would be experienced in the United States, Canada, Australia, New Zealand, and Sweden. French and Italian exports would be substantially decreased.

The results of trade liberalization arrived at in this report are probably lower than would actually take place because existing trade patterns have greatly distorted the import levels on which calculations are based. Furthermore, LDCs would most likely experience other gains from liberalization that cannot be determined numerically. These might arise from expansion of export markets to include new products or processing industries and stimulation of investment in and concern for agriculture in LDCs.

# 2

## INTRODUCTION

Agricultural commodities account for a large percentage of the export earnings of many LDCs. As a consequence the barriers to trade imposed by developed countries on markets for these commodities could have a significant effect on LDCs. For many of them accelerating economic development depends on expanding export revenues to bridge the trade gap. Moreover, the expansion of domestic production in LDCs that would probably result from a reduction in the trade barriers of developed countries would raise the level of income and employment among low-income farm families in LDCs.

A better understanding of the agricultural export prospects of LDCs is thus important. What changes in trade policies could developed countries undertake to help developing countries realize their full export potential? What would this trade consist of, and what are the possible implications for the balance of payments of LDCs? Trade liberalization is one critical element in this external environment. But although there has been a lively debate about agricultural protectionism and trade among the developed nations, sufficient attention has not been paid in agricultural commodities negotiations to the effects of developed-country protectionism on LDCs. There is a serious lack of well-documented research identifying the LDCs' interests.<sup>1</sup>

Negotiations on agricultural trade are particularly complex, given that many of the trade distortions are by-products of policies primarily domestic in nature. In the Dillon and Kennedy Rounds of the Multilateral

Trade Negotiations (MTN), agricultural commodities were given a special status that in effect excluded them from the negotiations.<sup>2</sup>

On the other hand, the Tokyo Round, concluded in 1979, was explicitly committed to paying more attention to agriculture. It included negotiations on NTBs in contrast to previous negotiations, which had been confined largely to the reduction of tariffs.<sup>3</sup> Nontariff restrictions on agricultural imports—institutionalized through the regime of "exceptions" from the GATT—are often more important than tariffs. The major NTBs affecting agriculture are import quotas, variable import levies, state trading and discriminatory government procurement, product standards, and export subsidization. For some of these the protective effect is genuinely unintentional.

Within the OECD the most sensitive conflicts in agricultural trade pertain to temperate-zone products that compete with domestic production. This has been a central issue on the agenda of the MTN. Essentially the developed countries have negotiated on the issue with only minor accommodations to the LDCs' interests considered.

As a group, however, developing countries are net exporters of agricultural products. Exports include tropical products as well as many temperate-zone products; some, like sugar, are produced in both tropical and temperate zones. Protection is further increased by the escalation effect, a feature of the protective systems used by most countries that reduces the possibilities for expanding the processing of raw materials in LDCs. That is to say, the degree of protection

<sup>1</sup> This study does not estimate the cost of protection imposed upon the countries that restrict trade, in this case the OECD countries. The issue is well summarized and discussed, for example, by Thomas K. Warley, "Western Trade in Agricultural Products," in *International Economic Relations of the Western World 1959-1971*, ed. Arifrew Schonfield (London: Oxford University Press, 1976); and D. Gale Johnson, "Impact of Farm Support Policies on International Trade," in *In Search of a New Economic Order*, ed. Hugh Corbet and Robert Jackson (New York: J. Wiley and Sons, 1974).

<sup>2</sup> Johnson, "Farm Support Policies."

<sup>3</sup> A final judgment on the Tokyo Rounds on agricultural trade cannot yet be made. However, many countries have expressed their initial dissatisfaction with the results as a whole. For tentative assessments by GATT and FAO, see General Agreement on Tariffs and Trade, *The Tokyo Round of Multilateral Trade Negotiations* (Geneva: GATT, 1979); General Agreement on Tariffs and Trade, *Supplementary Report* (Geneva: GATT, 1980); and Food and Agriculture Organization of the United Nations, *Agriculture Towards 2000* (C79/24) (Rome: FAO, 1979), pp. 190-194.

tends to increase the more the good in question is processed. Tariffs and NTBs tend to be low on raw materials, such as cotton, higher on semiprocessed products (cloth), and still higher on finished goods (clothing), thus discriminating against the processing of agricultural goods in LDCs. Hence, if trade liberalization is confined to agricultural raw materials, effective protection for processing activities in the developed nations may actually increase. However, trade concessions on semiprocessed and finished goods could potentially offer great benefits to export-oriented agricultural processing industries in LDCs.

A detailed assessment of the effects of these protective agricultural policies is virtually impossible due to the complexities of domestic policies and to the inadequacy of information on some of the relevant trade elasticities. The main purpose of this study is to illustrate the essential nature of the problem of protectionism for LDCs with numbers that are realistic but do not pretend to be precise forecasts.

The actual outcome of a major liberalization of trade by OECD countries will depend on domestic policy decisions as well as natural economic forces at work in LDCs. In this study an attempt is made to quantify the natural economic forces on the assumption that policymakers in LDCs will permit them to function. In the real world undoubtedly there would be some LDCs that would counteract the natural outcome of trade liberalization because of domestic political pressures. As shown in an earlier paper, differences observed in the export performances of LDCs facing similar world markets point to the influence of domestic policy variables.<sup>4</sup>

Specifically, the study presents estimates of the possible effects of a hypothetical 50 percent reduction in trade barriers in 17 OECD countries for about 100 agricultural commodities: it estimates foreign exchange earnings for 56 LDCs, expressed as additional export earnings per year, and the

distribution of foreign exchange gains between developed and developing countries. The countries are listed in Table 1.

Answers are sought to the following question: What fraction of the total gains in world trade would go to developed countries? In which commodities would a larger proportion of the export revenue gains be captured by LDC exporters? Among developing countries what would this trade consist of for each region, and would the relatively lower-income countries be among the main beneficiaries of trade liberalization? What are the potential benefits for Asia, North Africa and the Middle East, Sub-Saharan Africa, and Latin America? What are the potential welfare or real income gains to LDCs through trade liberalization? And which of the OECD countries would absorb the major increase in imports?

The approach taken allows for changes in world prices resulting from liberalization and does not assume a constant market share,<sup>5</sup> which would automatically confine potential benefits to existing major suppliers. Foreign exchange effects are calculated for LDCs as both exporters and importers of agricultural products. Both primary and semiprocessed goods are included. Considering LDCs as importers of food, the analysis of trade liberalization suggests that not all of the protectionist policies of the developed countries are necessarily harmful to the LDCs, at least from a static viewpoint.

The analysis emphasizes market access as it relates to the size of export earnings and the import bill. It does not address the issue of instability of world prices. Although price stability can be conceptually separated from market access, from a political standpoint they may not be separable.<sup>6</sup> Thus, in taking a broad view of the MTNs, it must perhaps be recognized that the amount of protection and the system used could be interrelated.

First, the situation in the trade-liberalizing countries before and after the hypothetical reduction in trade barriers is examined, and

<sup>4</sup> Alberto Valdés and Barbara Huddleston, *Potential of Agricultural Exports to Finance Increased Food Imports in Selected Developing Countries*, Occasional Paper 2 (Washington, D.C.: International Food Policy Research Institute, 1977).

<sup>5</sup> Previous studies have assumed both an infinitely elastic world export supply and constant market share. See W. R. Cline et al., *Trade Negotiations in The Tokyo Rounds, a Quantitative Assessment* (Washington, D.C.: The Brookings Institution, 1978); and Valdés and Huddleston, *Potential of Agricultural Exports*.

<sup>6</sup> Timothy Josling, "Agricultural Trade Policies: Issues and Alternatives," in *International Food Policy Issues, A Proceedings*, U.S. Department of Agriculture, Foreign Agricultural Economic Report No. 143 (Washington, D.C.: USDA, 1977), pp. 59-68.

**Table 1—List of selected countries**

Trade-Liberalizing OECD Countries <sup>a</sup>		
Australia	Germany, Federal Republic of	Norway
Austria	Ireland	Sweden
Belgium/Luxembourg	Italy	Switzerland
Canada	Japan	United Kingdom
Denmark	Netherlands	United States
France	New Zealand	
Selected LDCs <sup>b</sup>		
Afghanistan	Hong Kong	Peru
Algeria	India	Philippines
Angola	Indonesia	Rwanda
Argentina	Iran	Saudi Arabia
Bangladesh	Iraq	Senegal
Bolivia	Ivory Coast	Sri Lanka
Brazil	Kenya	Sudan
Burma	Korea, Republic of	Syria
Cameroon	Madagascar	Tanzania
Chile	Malawi	Thailand
Colombia	Malaysia	Tunisia
Dominican Republic	Mali	Turkey
Ecuador	Mexico	Uganda
Egypt	Morocco	Upper Volta
El Salvador	Mozambique	Venezuela
Ghana	Nepal	Yemen, Arab Republic of
Guatemala	Niger	Zaire
Guinea	Nigeria	Zambia
Haiti	Pakistan	

<sup>a</sup> Excludes Finland, Greece, Iceland, Portugal, Spain, and Turkey.

<sup>b</sup> Includes less-developed countries with mid-1975 populations of more than 4 million.

the possible effect on trade flows and world prices is estimated. Then a simple model is developed that examines the potential benefits to LDCs. This is followed by an empirical estimation. Then the results showing the

size and distribution of benefits to LDCs and their commodity composition are presented. Finally, there is a brief discussion of the impact of liberalization on world trade and on food supplies in LDCs.

## THE MODEL OF TRADE LIBERALIZATION AND DATA

The model is designed to analyze a hypothetical liberalization of import restrictions covering agricultural products in raw or semifinished form by a group of OECD countries. It illustrates the effects of a reduction of trade barriers in the world market divided into three trading blocs: a group of 17 developed countries (designated as OECD), a group of 56 selected developing countries, and the rest of the world (ROW).

The world supply of exports includes all exporters; similarly, the world demand for imports includes all importers. However, only the results for selected LDCs and developed countries (OECD members) are included individually in this study. The remaining countries of the world (other LDCs, other OECD countries, and centrally planned countries) are treated as one country, named ROW, which reacts to changes in world prices like any of the countries included individually. In this study, however, their trade elasticities (export supply and import demand) are equal to the weighted average elasticities of the selected LDCs plus the selected OECD members. As importers, the ROW share of world imports will decrease, given that their volume of imports will decline as a result of the increase in the world price. As exporters, the ROW share of world exports could increase, decline, or stay the same.

The model first describes the situation in an individual trade-liberalizing country, a member of the OECD. Then the impact on world markets of the sum of trade-liberalizing countries is assessed. As a result of these measures to liberalize trade, the world price of the product concerned will rise. Once the predicted rise in world price is obtained, the impact on each LDC can be calculated by looking at its situation alone. The study of the impact on LDCs of trade liberalization focuses on foreign exchange and welfare (or

resource transfer) effects. To examine the impact on foreign exchange in the LDCs, the effects on both exports and imports resulting from the change in world price as a result of trade liberalization in the OECD countries are considered.

In this study welfare is measured as conventional consumer and producer surplus. When they exist, possible discrepancies between the domestic market supply curves and the social opportunity costs of factors of production would tend to cause an underestimation of the welfare gains to LDCs.<sup>7</sup>

The model<sup>8</sup> first demonstrates the effects for a single homogeneous product. Then adjustments are introduced to allow for interdependence in import demand and export supply as is necessary when considering a simultaneous reduction in trade barriers affecting many products. A simple diagrammatic presentation is followed by an algebraic description of the model, which is the base for the computer program used in the empirical analysis.

### Description of the Model

First, the world market for the single commodity is postulated. The market includes all those countries that can be considered as actual or potential participants in it, including countries that at present neither export nor import the good in question simply because at the prevailing world price it does not pay them to either export or import. However, countries are excluded whose barriers to trade rule out their entering the market on either side in view of the range of price variation considered in the study.

In each country that liberalizes, the domestic price of the product will tend to

<sup>7</sup> Harry G. Johnson, *Economic Policies Toward the Less Developed Countries* (Washington, D.C.: The Brookings Institution, 1967).

<sup>8</sup> For a clear and systematic presentation of the underlying concepts, see W. Max Corden, *The Theory of Protection* (Oxford: Clarendon Press, 1971).

fall, and this price change will result in an increase in the country's import demand. Figure 1 considers a single homogeneous product that is both imported and produced at home.<sup>9</sup> The supply curve of domestic production is  $SS$ . The domestic product is assumed to be the perfect substitute for the import. The domestic demand curve for the product is  $DD$ ; it represents the demand for imports and domestic production combined.  $WW$  is the supply curve of imports, which under the "small country" assumption is assumed to be infinitely elastic for that country. It is drawn for a given exchange rate and defined at the importing country frontier (c.i.f.) price, expressed in domestic currency.

The tariff, equal to  $TPw^0$ , raises the price received by domestic producers and paid by domestic consumers from  $OPw^0$  to  $OT$ .<sup>10</sup> Thus, the consumer subsidizes the output

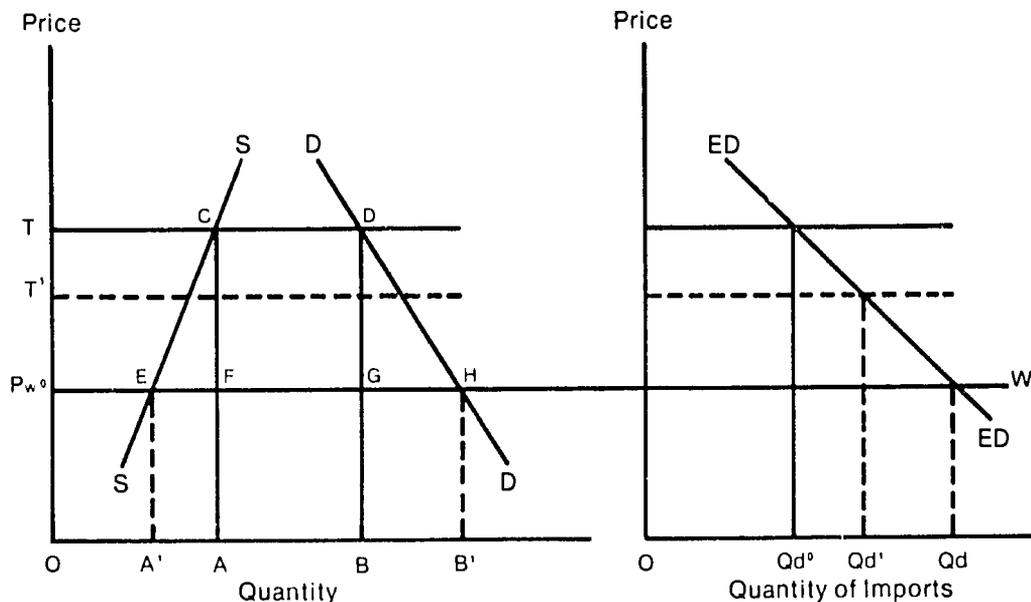
of the domestic product by  $TPw^0$  per unit and is taxed to yield the customs revenue represented by the area  $CFGD$ .

The quantity  $OB$  represents the total amount demanded in the initial situation at the world price of  $Pw^0$ . This corresponds to an internal price of  $OT$ , a demand that can be satisfied by either local production or imports. Compared to a free trade situation, the reduction in consumption as a result of the higher price due to the tariff is equal to  $BB^1$ . The protective effect, that is, the increase in domestic supply, is equal to  $AA^1$ . The rate of protection,  $t$ , is measured by  $(TPw^0/OPw^0)$ .<sup>11</sup>

$ED$  represents the country's import demand for the same product. It is equal to the sum of the production and the consumption effects. The import or trade effect of the tariff is measured by  $Qd^0 Qd^1$ .

After liberalization, that is, a reduction

**Figure 1—Impact of trade liberalization on the level of imports in an OECD country**



<sup>9</sup> It must be recognized that it is sometimes difficult to determine if a commodity is homogeneous because the chain of substitution is not always clear.

<sup>10</sup> Throughout the presentation the superscripts <sup>0</sup> and <sup>1</sup> refer to before and after liberalization, respectively.

<sup>11</sup> In this illustration the support price ( $OT$ ) is determined independently of the world price; thus the tariff rate is assumed not to be a function of the import price, as it would be in an "equalizing" tariff system such as the variable-leve system. This is discussed below under nontariff barriers.

in the tariff to  $T^1 P_w^0$ , the domestic price falls from  $OT$  to  $OT^1$  (before the change in world price) and import demand increases to  $Qd^1$ . This is a movement along each country's excess demand curve for the product in the world market. But the world market demand for the product will shift to the right because the price that is relevant for the definition of the world market demand is a net-of-tariff price.

If assumptions can be made about the elasticity of world demand and supply, the rise in world price that would result from the assumed package of individual country measures to liberalize trade can be calculated, as is shown in Figure 2.

Figure 2 illustrates the effect of trade liberalization in a world market composed of three trading blocs: the OECD countries, which for this example are assumed to be net importers as a bloc; the LDCs; and the ROW. The latter two are assumed to be net exporters of the particular commodity. The curve  $ED_{OECD}$  thus represents the sum of the

import demand of OECD members. Given that this bloc is the only net importer,  $ED_{OECD}$  corresponds to world import demand. The curves  $S_{LDC}$  and  $S_{ROW}$  represent the supply of exports of developing countries and of the ROW respectively; the sum of the two is the world supply of exports, depicted by  $S_w$ .

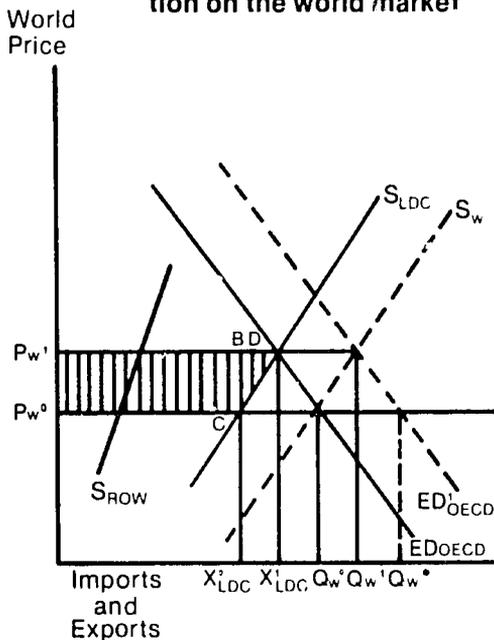
The difference between  $Q_w^*$  and  $Q_w^0$  is the shift to the right of world total import demand at the price  $P_w^0$ . It can be estimated for each country  $j$  when the levels  $t^0$  and  $t^1$  are known for the country, and the relevant elasticity (slope) of the country's import demand curve is known. The combined effect of these individual country demand shifts is to cause the world demand schedule,  $ED_{OECD}$ , to shift to the right: to  $ED'_{OECD}$ .

The resulting excess demand in the world market raises the world price to  $P_w^1$ . The new equilibrium level of imports  $Q_w^1$  is less than  $Q_w^*$ . It will be shown later that the percentage rise in price is approximately equal to the right-hand shift in world demand (at  $P_w^0$ ) divided by the sum of the absolute values of the elasticity of world supply and demand.

Once the predicted rise in world price is obtained independently for each commodity, the effect for each LDC is calculated by examining its situation alone, assuming it is a price taker in world markets. As mentioned earlier, trade liberalization affects each LDC only through the induced changes in the world market price.

Two important assumptions are made. First, it is assumed that exchange rates in LDCs, as in the two other blocs, remain constant; adjustments in the exchange rate are clearly outside the scope of this study because they would require an individual country analysis. Second, ordinary demand and supply curves are used, but an attempt is made to adjust elasticities for the possible interdependence of consumption and production among the commodities considered. The approach, however, remains partial equilibrium; that is, changes in any one commodity market are assumed to be small enough not to cause a shift in demand and supply schedules elsewhere in the economy.<sup>12</sup>

**Figure 2—Effect of trade liberalization on the world market**



<sup>12</sup> Advocates of the practical advantages of using partial equilibrium analysis to discuss the gains from trade have been Corden, Harberger, and H. G. Johnson. See W. Max Corden, "The Calculation of the Cost of Protection," *Economic Record* 33 (April 1957): 29-51; Arnold C. Harberger, "Using the Resources at Hand More Effectively," *American Economic Review* 49 (May 1959): 134-146; and Harry G. Johnson, "The Cost of Protection and the Scientific Tariff," *Journal of Political Economy* 68 (August 1960): 327-345.

The analysis does not adjust for possible shifts in demand and supply functions resulting from improved access to world markets for LDCs (such as from improved incentives for investments or the establishment of new marketing linkages) unless these are reflected in the long-run elasticity parameters.

For LDC exporters as a whole, the volume of exports grows from  $X_{LDC}^0$  to  $X_{LDC}^1$  (Figure 2). The gain in the value of exports is equal to the sum of  $\Delta Pw X_{LDC}^0$  and  $Pw^1 \Delta X_{LDC}$ , which represents export revenues after the increase in world price and quantity minus export revenues before trade liberalization. As is shown below, the increases in either the quantity or the value of exports for each LDC will vary according to the share of the country's production that is exported (assuming that the domestic demand and supply elasticities are the same in each LDC), and will vary in other ways if these elasticities differ among LDCs.

For an individual developing country, simultaneous trade concessions in OECD countries in several products could result both in an expansion of the value of exports of some commodities and in a change in the value of imports of other products. The effects on exports as well as on imports should be estimated to anticipate the potential impact on the balance of trade for a given developing country. The situation for an LDC importer can be described with the same diagram used for the OECD importer in Figure 1. If the external change is to raise the world price from  $Pw^0$  to  $Pw^1$  (now represented by OT), then the value of imports changes from  $(B^1A^1)Pw^0$  to  $(BA)Pw^1$ .<sup>13</sup> As in the case of exports, the quantity or value of imports will vary according to the share of the country's consumption that is imported.

The increase in the world price of a commodity could cause some importing LDCs to drop out of the world market entirely, in which case the absolute change in the value of imports will equal or be greater than the initial value of imports.

Given the rise in the world price and assuming that it is transmitted to the domestic market, it can be seen that trade liberalization always directly implies a loss to consumers and a gain to producers in LDCs.<sup>14</sup> This holds true for all countries except those reducing protection.

To the extent that the price received by LDCs as exporters increases as a result of liberalization, the welfare benefits made available to LDCs represent a resource transfer to them from developed countries. In a sense the move toward freer trade can be viewed as aid to LDCs.<sup>15</sup> This transfer of real income to LDC exporters from trade liberalization is equal to the increase in export earnings less the (social) cost of increased exports; that is, the welfare gains to LDCs as a block come from an increase in the value of the original volume of exports (area  $Pw^1BCPw^0$  in Figure 2) and the increase of producer surplus in the additional production for exports (area CDB) depicted by the shaded areas in Figure 2. This welfare gain is less than the foreign exchange benefits by an amount equal to the resource cost of the increased exports. The size of the welfare gain clearly depends on the elasticity of supply of exports.

Similarly the welfare loss to LDC importers can be viewed as a negative transfer to those LDCs. The loss in welfare results from the increased value of a lower volume of imports plus the loss in consumer surplus from the reduction in imports.

The estimates of the welfare gains and

<sup>13</sup> To illustrate the case of the LDC importer,  $Pw^1$  was assumed to be equal to OT. (But, for the OECD importer in Figure 1, OT represents the domestic price at  $Pw^0$ , before liberalization.) Imports by LDCs fall by the sum of the production and consumption effect.

<sup>14</sup> However, from an income distribution point of view, there are offsetting indirect factors. A larger value of exports is likely to affect the exchange rate, reducing the price of imports and raising the real income of consumers. Moreover, the probable expansion of domestic production will raise the level of employment in agricultural activities, thus increasing the income of rural workers in addition to the positive effect on farmers' net income.

<sup>15</sup> For a theoretical discussion on resource transfer through trade with LDCs, see Richard Blackhurst, "Trade Preferences for LDC Exports: A Note on the Welfare Component of Additional Exports," *Rivista Internazionale di Scienze Economiche e Commerciali* 18 (December 1971): 1180-1186; and Richard Blackhurst, "General versus Preferential Tariff Reduction for LDC Exports: An Analysis of the Welfare Effects," *Southern Economic Journal* 38 (January 1972): 250-262; and Rachel McCulloch and José Pin̄era, "Trade as Aid: The Political Economy of Tariff Preferences for Developing Countries," *American Economic Review* 67 (December 1977): 959-967. Trade-liberalizing countries have, of course, a welfare gain themselves as well.

losses to LDCs could be under- or overestimated if the supply curve of exports or the demand curve for imports do not correctly measure the social cost of extra domestic supply or the consumption forgone. In LDCs prevailing distortions are likely to overstate the social cost of additional production and, hence, underestimate the welfare gains of additional exports.<sup>16</sup>

## Algebraic Representation

Turning to the algebraic expression of the model just described, the situation in an individual tariff-reducing country would appear as follows. For a tariff-reducing importing country  $j$ , for a given commodity, the direct effect of the reduction of tariff and nontariff barriers on imports is equal to:

$$\Delta M_j = M_j^0 n_j^m [\Delta t / (1 + t_j)] , \quad (1)$$

where  $M_j^0$  denotes the initial level of country  $j$  imports,  $n_j^m$  is the import demand elasticity,  $\Delta t$  is the rate of the tariff reduction, and  $t_j$  is the original tariff rate.<sup>17</sup> The term  $\Delta t / (1 + t_j)$  represents the initial percentage decline in the domestic price of imports of the given commodity in country  $j$ .

The underlying formula for the import demand elasticity is:

$$n_j^m = n_j^d \frac{C_j}{M_j} - \epsilon_j^s \frac{Q_j}{M_j} \quad (2)$$

( $n^m$  and  $n^d < 0$ , and  $\epsilon^s > 0$ ),

where  $C_j$ ,  $Q_j$ , and  $M_j$  denote domestic consumption, domestic production, and imports, respectively, and  $n^d$  and  $\epsilon^s$  are the domestic price elasticities of demand and supply for the commodity. In this concept of  $n_j^m$ , allowance has been made for the full response of domestic producers to the change in the price of imports resulting from liberalization. That is, the amount demanded can be satisfied by either local production or imports. Equation (2) shows that inelasticity of domestic demand and supply do not necessarily imply an inelastic import demand. The import demand elasticity also depends on the degree of self-sufficiency. The smaller imports are relative to domestic production and consumption, the higher will be  $n_j^m$ . Moreover, given the tariff structure and the domestic supply and demand elasticities, it can be inferred from equations (1) and (2) that the more self-sufficient a country, the more its tariff structure will restrict trade.<sup>18</sup>

The total stimulus to world-market demand arising out of tariff reductions by OECD countries is equal to the sum of the movements along each country's import demand curve, measured at  $P_w^0$ . This sum across all country  $j$  importers corresponds to  $(Q_w^* - Q_w^0)$  and can be expressed as:

$$\sum_j \Delta M = (Q_w^* - Q_w^0) = \sum_j M_j^0 n_j^m [\Delta t / (1 + t_j)] \quad (3)$$

This total stimulus to the world market can also be viewed as the excess demand at  $P_w^0$  created by the tariff reductions under study.

The total stimulus referred to above represents the sum of three distinct situa-

<sup>16</sup> H.G. Johnson, *Economic Policies*

<sup>17</sup>  $t_j$  represents tariffs plus the tariff equivalent rate of nontariff barriers, expressed as a fraction of the c.i.f. price exclusive of duty.

<sup>18</sup> If it is necessary to distinguish between dutiable and duty-free imports of the same good, the elasticity of import demand for dutiable imports is:

$$n^{m_t} = n^d \left( \frac{C}{M^t} \right) - \epsilon^s \left( \frac{Q}{M^t} \right) - \epsilon^f \left( \frac{M^f}{M^t} \right)$$

where  $M^d$  and  $M^f$  represent the quantity of dutiable and duty-free imports respectively,  $M^t = C - Q - M^f$ , and  $\epsilon^f$  is the price elasticity of supply of duty-free imports. In this case, there are two groups of suppliers, those with duty-free access and those without. This formula applies only to imports from the latter. It applies for the OECD countries that admit duty-free imports under a preference system (such as the European Community under the Lomé Convention). If the value of  $\epsilon^f$  is near 1, the absolute value of the import demand elasticity increases by the value of the share of  $M^f$  in  $M$ . In other words, the addition of a new source of supply (for example, duty-free imports) makes  $n^{m_t}$  more elastic. But if duty-free entry was in existence before the liberalization on dutiable imports from Third-World countries, then the  $n^{m_t}$  faced by LDC exports (those which are not members of the Lomé Convention) does not change.

tions within the OECD member countries, reflecting each country's position in the world market of the particular commodity. These three situations are: net importers, for which equation (1) above applies; the European Community, which is treated as a single unit, and which, for many commodities, includes net importers and net exporters (a separate discussion of the treatment of the European Community is presented later in the section on NTBs); and net exporters, for which in most cases the rate of nominal protection (at  $P_w^0$ ) is near zero. Hence, there is no effect on equation (3) above, although they do increase exports in response to the world price increase.

The percentage increase in world price ( $\hat{p}$ ) needed to eliminate the excess demand is equal to:<sup>19</sup>

$$\hat{p} = \frac{Q_w^* - Q_w^0}{Q_w^0 \epsilon_w - Q_w^* n_w} \quad (4)$$

or

$$\hat{p} = \frac{\sum_j M_j^0 n_j^m [\Delta v(1 + t_j)]}{Q_w^0 \epsilon_w - Q_w^* n_w} \quad (5)$$

where  $\epsilon_w$  and  $n_w$  represent world export supply and world import demand elasticities, respectively. Equations (4) and (5) show that the newly created gap between world demand and world supply (at  $P_w^0$ ) is filled in two ways, both of which respond to the induced rise in the world price: an increase in output at all sources of supply and a reduction in demand by all consumers.

The net change in imports of the tariff-reducing countries is equal to the initial stimulus to world demand modified by the price-induced reduction of imports in these countries. The initial stimulus in any one net importing country is given by equation (1). The response of net importing country  $j$  to the rise in the world price is simply

$\Delta M_j = M_j^0 n_j^m \hat{p}$  in quantity units, where  $n_j^m$  is recalculated,<sup>20</sup> and  $M_j^0 P_j^0 (1 + n_j^m) \hat{p}$  in value terms. So, for the tariff-reducing countries as a whole, the net change in the value of the imports will equal:

$$P_w^0 (Q_w^* - Q_w^0) + \sum_j M_j^0 P_j^0 (1 + n_j^m) \hat{p} \quad (6)$$

Except for the European Community, those members of the OECD that are net exporters of the commodity in question have no influence on the shift in world excess demand, but they certainly do influence the price change needed to eliminate such excess demand, as calculated in equations (4) and (5) above.

In any exporting country  $i$ , the change in the level of exports is equal to:

$$\Delta X_i = X_i^0 \epsilon_i^x \hat{p} \quad (7)$$

where

$$\epsilon_i^x = \epsilon_i^s \frac{Q_i}{X_i} - n_i^d \frac{C_i}{X_i} \quad (8)$$

where  $Q_i$ ,  $C_i$ , and  $X_i$  represent domestic production, consumption, and exports, respectively. Equation (8) shows that the higher the share of exports in domestic production, the smaller (less elastic) will be  $\epsilon_i^x$ .

The world export supply elasticity ( $\epsilon_w$ ) is a critical parameter in the model because of its role in determining the world price change. However, there are few estimates available. The more inelastic the world export supply, the smaller will be the resulting change in the volume of imports into the OECD.

An infinitely elastic export supply assump-

<sup>19</sup> This is derived from  $Q_w^0 \epsilon_w \frac{\Delta P_w}{P_w^0} = (Q_w^* - Q_w^0) + Q_w^* n_w \frac{\Delta P_w}{P_w^0}$ , that is, the excess quantity demanded equals the excess quantity supplied.

<sup>20</sup> The trade elasticity is recalculated at the new (C/M) and (Q/M) ratio after liberalization, using expression (2) above. Thus, although the underlying domestic elasticities remain constant, the trade elasticities are allowed to vary, reflecting the change in the degree of self-sufficiency. The same adjustment is done in the actual computation for export elasticities.

tion in which there is no world price change has been frequently used in studies following a constant-market-share approach.<sup>21</sup> Such an assumption could be reasonable for particular commodities where the world market is dominated by large countries and exports of the good in question are a small fraction of domestic production. However, for most agricultural commodities in which the increase in exports represents a share of production of some significance, the constant price assumption clearly overestimates the change in the volume of trade.<sup>22</sup>

In this study the model first makes a direct estimate of export supply elasticity for each commodity at the country level, according to equation (8) above, which is then used to compute the weighted average elasticity representing the world export supply elasticity for that commodity.

Turning to the algebraic expression of the model to estimate the impact upon LDCs, the equation is presented for a single commodity for a single homogeneous product. As in the previous analysis,<sup>23</sup> this equation is applied successively to each product and country.

For an LDC exporter  $i$ , the increase in export revenues ( $E_i^1 - E_i^0$ ) for a given commodity<sup>24</sup> is expressed:

$$E_i^1 - E_i^0 = Pw^0 X_i^0 \hat{p} + Pw^1 (Q_i^0 \epsilon_i^1 - C_i^0 n_i^d) \hat{p} \quad (9)$$

or approximately

$$E_i^1 - E_i^0 \approx Pw^0 X_i^0 (1 + \epsilon_i^1) \hat{p} \quad (10)$$

where  $n_i^d$  and  $\epsilon_i^s$  are as in (2) above and  $\epsilon_i^x$  as in (8) above, and  $Q$  and  $C$  represent domestic production and consumption, respectively.

For an LDC importer  $j$ , the (absolute) change in the value of imports<sup>25</sup> ( $I_j^1 - I_j^0$ ) is:

$$I_j^1 - I_j^0 = Pw^0 M_j^0 \hat{p} - Pw^1 (Q_j^0 \epsilon_j^s - C_j^0 n_j^d) \hat{p} \quad (11)$$

or

$$I_j^1 - I_j^0 \approx Pw^0 M_j^0 (1 + n_j^m) \hat{p} \quad (12)$$

If the LDCs' import demand for the commodity is elastic (that is,  $n_j^m > 1$ ), the value of imports will decline. The increase in the world price of a commodity will cause some importing LDCs to drop out of the world market entirely, in which case  $M$  will equal zero and the (absolute) change in the value of imports will equal the initial value of imports.

For LDC exporters welfare gains are:<sup>26</sup>

$$\Delta W_i^1 = \left( X_i^0 Pw^0 + Pw^0 \frac{\Delta X_i}{2} \right) \hat{p} \quad (13)$$

where  $\Delta X_i = X_i^0 \epsilon_i^1 \hat{p}$ .

or, in terms of elasticities:

<sup>21</sup> Robert E. Baldwin and Wayne E. Lewis, "U.S. Tariff Effects on Trade and Employment in Detailed SIC Industries," paper prepared for the Conference on the Impact of International Trade and Investment on Employment, U.S. Department of Labor, held in Washington, D.C., December 2-3, 1976; W. R. Cline et al., *Trade Negotiations in the Tokyo Round* and Valdés and Huddleston, *Potential of Agricultural Exports*

<sup>22</sup> Given export policies in LDCs, it assumes there will be an increase in exports at constant cost, implying idle plant capacity and other unemployed resources. Alternatively the extra supply would have to come from a reduction in domestic consumption, by itself quite unlikely.

<sup>23</sup> In this study it is assumed that policymakers in LDCs will permit the transmission of the world price changes into domestic markets. However, in the real world political pressures in some LDCs will undoubtedly lead them to counteract the natural outcome of this trade liberalization.

<sup>24</sup> The value of exports rises by  $Pw^1 BCPw^0$  plus  $BX^0 X^1 D$  in Figure 2.

<sup>25</sup> The value of imports rises by  $(CABD - EA^1 B^1 H)$  in Figure 1.

<sup>26</sup> This is depicted by the shaded area  $Pw^1 DCPw^0$  in Figure 2.

$$\Delta W_1^e = \left[ X_1^e P W^e + \Delta P W \left( \frac{Q_1^e \epsilon_1^s - C_1^e n_1^d}{2} \right) \right] \hat{p}. \quad (14)$$

Similarly for LDC importers the welfare loss is expressed by

$$\Delta W_1^m = \left( M_1^e P W^e + P W^e \frac{\Delta M_1}{2} \right) \hat{p}, \quad (15)$$

where  $\Delta M_1 = M_1^e n_1^m \hat{p}$ .

or, again in terms of elasticities,

$$\Delta W_1^m = \left[ M_1^e P W^e + \Delta P W \left( \frac{C_1^e n_1^d - Q_1^e \epsilon_1^s}{2} \right) \right] \hat{p}. \quad (16)$$

As shown above, the real income gain (or transfer) to LDC exporters from trade liberalization results from the increase in export earnings less the (social) cost of increased exports, as depicted by the shaded area in Figure 2. Or, in other words, the real income gain is equal to the sum of the increase in the value of the original volume of exports and an increase in producer surplus in the additional production for exports.

The algebraic expression of the transfer is then:

$$T_1^e = \Delta P W X_1^e + \Delta P W \frac{\Delta X_1}{2} \\ \approx P W^e X_1^e \left( 1 + \frac{1}{2} \epsilon_1^s \right) \hat{p} \quad (17)$$

or, in terms of elasticities of domestic demand and supply,

$$T_1^m = \left[ X_1^e P W_1^e + \Delta P W \left( \frac{Q_1^e \epsilon_1^s - C_1^e n_1^d}{2} \right) \right] \hat{p}. \quad (18)$$

which is equal to the net welfare gains calculated by equations (13) and (14) above.

Similarly, the net welfare loss to LDC importers can be viewed as a negative transfer to LDCs. The loss in welfare results from the increased value of a lower volume of imports plus the loss in consumer surplus from the reduction in imports. Algebraically, this negative transfer is calculated by the equations:

$$T_1^m = \left[ M_1^e P W^e + P W^e \frac{\Delta M_1}{2} \right] \hat{p} \\ \approx P W^e M_1^e \left( 1 - \frac{1}{2} \eta_1^m \right) \hat{p} \quad (19)$$

or, in terms of domestic supply and demand elasticities,

$$T_1^m = \left[ M_1^e P W^e + \Delta P W \left( \frac{C_1^e n_1^d - Q_1^e \epsilon_1^s}{2} \right) \right] \hat{p}. \quad (20)$$

which equal expressions (15) and (16) above.

## Nontariff Barriers

Several studies have shown the importance and widespread use of NTBs in agricultural trade.<sup>27</sup> NTBs are more diverse, less visible, and more selective than tariffs, and there are literally dozens of different NTBs affecting agricultural trade. Important NTBs in agriculture include: quantitative restrictions, such as import and export quotas; subsidies and countervailing duties, including export subsidies and variable levies; government procurement policies; technical

<sup>27</sup> For example, for the European Community in 1974 Sampson and Yeats have observed that on an overall basis for food and live animals, beverages, tobacco, and animal and vegetable oils enjoyed nominal protection levels of over 60 percent with nontariff barriers accounting for over three fourths of the protection levels. Gary Sampson and Alexander Yeats, "An Evaluation of the Common Agricultural Policy as a Barrier Facing Agricultural Exports to the European Community," *American Journal of Agricultural Economics* 59 (February 1977): 99-106. For clarification of the concept of NTBs, see Peter Lloyd, "Strategies for Modifying Non-Tariff Distortions," in *In Search of a New World Economic Order*, ed. Hugh Corbet and Robert Jackson (New York: John Wiley and Sons, 1974).

barriers to trade, including health and sanitary regulations, packaging and labeling requirements, and so forth; and customs valuation and nomenclature.

Nontariff barriers can have a frustrating effect not only on international trade itself, but also on trade liberalization efforts. Fixed import quotas, in a sense, insulate the quota-imposing country from the effects of world market changes for the affected commodities. If a quota exists, a tariff reduction would have no effect at all, as long as the quota were effective, both before and after the change. A quite similar result occurs when variable import levies are used to maintain a fixed internal price in the face of variations in world market conditions. If the target internal price is the same both before and after a reduction in standard tariff rates, no increase in imports and no net reduction in trade barriers will result from the apparent liberalization move.

The treatment of NTBs presents some of the most difficult problems in this study. One problem is to determine which of the NTBs can be equated to an import quota for which the tariff equivalent can be computed; a second is to be able to distinguish between the negotiable and nonnegotiable NTBs. The latter are probably not independent from the former. In fact, it is not unrealistic to think that what can be measured may end up being what is negotiable. Third, a tariff cut and a reduction of the tariff equivalent on some NTBs could have no effect at all on the volume of imports if the same commodity is subject to other NTBs that are equivalent to an import prohibition in their effect on trade. An example would be the sanitary regulations imposed on beef trade from South America.

Determining which NTBs can realistically be negotiated is a complex issue. In practice, how can one distinguish less justifiable barriers to trade from a country's natural right to generate revenue through taxes that do not discriminate between domestic and foreign sources? Or to subsidize some industries to correct for other distortions? Or to impose legitimate product standards? MTN negotiat-

ing procedures recognize that although tariffs and some NTBs may be subject to general cuts, other trade barriers should be dealt with on a request/offer basis.

This study recognizes the existence of many restrictions other than tariffs. However, "tariff" in this study is really a summary measure of the net effect of most trade restriction and is measured by  $t = (p^d/pw) - 1$ , corrected for domestic taxes, at a given exchange rate. It corresponds to what has been called an "equivalent" tariff.

Hence, if a reduction is contemplated of 10 percent across the board in  $t$ , this could sometimes require that the tariff rate be reduced from 30 percent to 27 percent. In other cases, however, it could mean simply an enlargement of the quota sufficient to decrease  $p^d/pw$  from 4.0 to 3.6, for example.

This approach does not imply that all NTBs have been incorporated into the study or that they could be made to disappear if they were included. That would be utopian. With the approach suggested, those NTBs that have a direct effect on the domestic price (at wholesale) can be captured, but the effect of subsidies on inputs is clearly not captured.<sup>28</sup> Thus the approach underestimates the actual level of protection in some cases.

For many country/commodity combinations, however, domestic price information is not readily available. In these cases only quantitative restrictions and subsidies and variable levies that can be easily converted into tariff equivalents are incorporated into the "tariff" rate  $t$ . Of these, variable levies and import quotas are the most prevalent and important border protection devices for which reliable estimates of tariff equivalencies can be obtained.

The sources for estimates of total protection levels and tariff equivalents of NTBs are given in Appendix 1.

## The European Community

The characteristics of the farm price

<sup>28</sup> Normally inversely related with the degree of tariff protection, cases of subsidies on nontraded inputs are frequent in agriculture. Examples are subsidies for land and water improvement, credit subsidies, and direct subsidies for capital improvements. These subsidized inputs are common to several crops; as such, it is difficult to determine their resource allocation effect among products, but they would certainly represent a right-hand shift in aggregate supply.

regime of the European Community have been well documented elsewhere.<sup>29</sup> The concern of this study is with the trade effects of liberalization on the European Community's Common Agricultural Policy (CAP). CAP operates as a border protection device ensuring that internal production has first claim on the internal market, whereas external production enters the European Community market only as a residual. Agricultural commodities entering the Common Market from other countries face variable levies that make certain the threshold price (the minimum import price) is slightly above the established internal target price for each good. For most temperate-zone products CAP policies have resulted in high price supports to European farmers, justified by Common Market officials as being in the interest of preserving family farms and preventing the social disruption caused by massive migration to crowded urban areas.

This analysis treats the European Community as a single aggregate in a manner parallel to that accorded other trade-liberalizing countries, yet it fully recognizes that both net importing and exporting countries exist within the Community for many of the commodities. In practical terms this means that the trade between European Community countries is not directly considered. However, it has an impact on the final outcome.

Within the European Community commodities move freely from one country to another. There is a commitment to common farm prices within the European Community which implies that exports within the Community face free entry.<sup>30</sup> Hence, the expansion of imports as a result of trade liberalization will exceed the total amount by which Community importers expand their total imports by taking into account the reduction in exports by European Community exporters.

For any net importing country, the domestic price reduction from trade liberalization causes all domestic suppliers of the good to contract their production and all individual demanders to increase their demand. The sum of these two effects is the country's increase in the level of import

demand. The same holds true for the European Community. The induced internal price reduction causes all European suppliers to decrease their production and all individual demanders to increase their demand. The increase in imports from suppliers outside the European Community is thus the total amount by which European Community net importers expand their total imports plus the amount by which European exporters reduce their total exports.

Consider an example where France is an exporter of wheat and Germany an importer. Assuming that all of France's exports of wheat go to Germany (because the European Community price is higher than the world price), a reduction in the European Community external tariff will cause the volume of German imports to rise, and that of French exports (to Germany) to fall. The end result is that the increase in Germany's demand for imports from outside the European Community is equal to the sum of these two components—the increase in Germany's total imports plus the reduction in French exports.

Similarly, when analyzing how European Community imports from other countries respond to a change in the world price of wheat, it must be recognized that if the price rises, French exports to Germany will rise, while Germany's total imports will fall. The end result is that imports from outside the Community will be reduced as a consequence of both these factors.

Another way to show this is to express imports from outside of the European Community as the difference between total demand and total supply in the European Community. When this is done, the shift in import demand stemming from a tariff reduction can be seen as simply the sum of movements along all individual demand curves (for wheat, in this case) increasing the demand for wheat and the sum of movements along all individual supply curves reducing the supply of wheat. All European Community demanders—French, German, and others—are treated in a completely parallel fashion as are all European Community suppliers. Once the nature of these

<sup>29</sup> Theodor Heidhues, Timothy E. Josling, Christopher Ritson, and Stephen Tangermann, *Common Prices and Europe's Farm Policy*. Thames Essays No. 14 (London: Trade Policy Research Centre, 1978); and Alan Swinbank, "European Community Agriculture and the World Market," *American Journal of Agricultural Economics* 62 (August 1980): 426-433.

<sup>30</sup> The differences in farm prices within the European Community are discussed below.

relationships is understood, it can be seen that the European Community imports are treated in precisely the same way as imports and exports from the United States, Canada, or any other country.

Therefore, if tariffs are reduced in the European Community, there will be at the initial world price an increase in total demand equal to  $-\sum Q_i^d n_i^d \Delta t / (1 + t)$  and a decrease in total supply equal to  $\sum Q_i^s \epsilon_i^s \Delta t / (1 + t_i)$ . The total effect in import demand of commodity  $i$  is equal to  $[\sum Q_i^d n_i^d - \sum Q_i^s \epsilon_i^s] \Delta t / (1 + t_i)$ , the signs reflecting that the  $n_i^d$  are negative and the  $\epsilon_i^s$  is positive. When France and Germany are looked at separately, the expression for France is  $[Q_{iF}^d n_{iF}^d - Q_{iF}^s \epsilon_{iF}^s] \Delta t / (1 + t_{iF})$  and for Germany  $[Q_{iG}^d n_{iG}^d - Q_{iG}^s \epsilon_{iG}^s] \Delta t / (1 + t_{iG})$ . These, together with similar expressions for the other European Community members, add up precisely to the total effect  $[\sum Q_i^d n_i^d - \sum Q_i^s \epsilon_i^s] \Delta t / (1 + t_i)$ . This total expression can be written as  $M_{EC} n_{EC}^m \Delta t / (1 + t_{EC})$ . It is equal to the sum of components from individual member countries which equal:

$$\sum_{EC} M - \sum_{EC} X = \sum_j M_j^c n_j^m \Delta t / (1 + t_j) - \sum_i X^c \epsilon_i^x \Delta t / (1 + t_i) \quad (21)$$

or its equivalent:

$$\sum_{EC} M - \sum_{EC} X = \left[ \sum_j M_j^c n_j^m - \sum_i X^c \epsilon_i^x \right] \Delta t / (1 + t_{EC}), \quad (22)$$

where  $n_j^m$  and  $\epsilon_i^x$  denote the import demand and export supply elasticities, respectively, calculated separately for each European Community member using domestic price elasticities of demand and supply for each country, as in equations (2) and (8).

Up to this point common farm prices in the European Community have been assumed. In fact, however, prices have not been

uniform throughout the 1970s, despite CAP's commitment to common farm prices supported by a general system of levies on internal imports and subsidies on external exports.<sup>31</sup>

Prices vary because some countries are in a transitional phase and have not fully implemented common prices. They also differ due to exchange rate divergencies, border taxes, and subsidies within the Community. In fact, the European Community agrees upon a common intervention price for those products subject to the CAP market support system. These include grains (excluding rice), sugar, vegetables, beef and veal, pork, eggs, milk, and poultry. This price expressed in "units of accounts" is then converted into the currencies of the nine countries at what is known as the "green rate." Because the foreign exchange rate does not necessarily coincide with the cross rate implied by the use of the green rates, domestic prices could differ among the member countries when expressed in a common currency. As a result of these price differences, a variable protection system against currency changes is imposed on trade with the Community. The system uses monetary compensatory amounts (MCAs) and accessionary compensatory amounts (ACAs) for the transition of new members. These are additional taxes and subsidies levied on products subject to the CAP intervention system. Thus, prices within the European Community are constrained by the CAP system in the sense that the scope for domestic manipulation of any national price is quite limited, but prices are not determined by the CAP system and they could differ among Community members as the result of a combination of exchange-rate and administered-price effects. Hence, there is at present no clearly defined European Community level of protection that applies to all its members.<sup>32</sup> Ideally, protection levels should be estimated for each country within the European Community. A market response of the European Community as a whole to, say, a reduction in the variable levies could then be estimated by aggregating the individual country changes.

<sup>31</sup> Swinbank, "European Community Agriculture"; and Cathy L. Jabara and Alan S. Brigida, *Variable Levies: Barriers to Grain Imports in France, the Netherlands, Federal Republic of Germany, and United Kingdom*, Foreign Agricultural Economics Report No. 156, Washington, D.C.: U.S. Department of Agriculture, March 1980).

<sup>32</sup> During 1979 a European Monetary System (EMS) was introduced which may modify the operation of CAP; see Swinbank, "European Community Agriculture."

Unfortunately, except for a few commodities, reliable estimates of the national levels of protection were not available. Instead, the estimated levels of protection by activity for the European Community as a whole were adopted primarily from the work of Gary Sampson and Alexander Yeats.<sup>33</sup> These represent a weighted average level of protection.<sup>34</sup> These values are applied to each country individually to compute the trade effects for each member, which are then aggregated for the European Community as a whole.<sup>35</sup>

The potential implications of the possible entry of Greece, Portugal, and Spain into the European Community are not considered in this study. The enlargement could have a major impact on the CAP itself and would affect the trade relations of the European Community with overseas suppliers of temperate-zone farm products whose markets might be adversely affected. The three countries would be likely to expand their exports of wine, rice, olive oil, and fruits to the European Community and reduce their imports of wheat, sugar, pork, and dairy products from countries outside of the European Community.<sup>36</sup>

## Interdependencies Among Commodities

By using a multiproduct partial equilibrium model, this analysis is able to show the effects of a reduction in tariffs on many imports and exports at the same time. Goods are included at various levels of processing; some of the goods are final goods only, some are inputs, and some are both inputs and final goods. In some cases a good is

shown as a raw material and as an input to a semiprocessed product, which in turn contributes to a final product. In other words, there are vertical relationships among inputs and final goods. There are also horizontal relationships between uses at each level of processing brought about by interdependencies in demand, which are reflected in the cross-price effects resulting from substitutions or complementarities in demand. The question is whether the shifts in world demand would be as great under these conditions as they would be if just a single commodity were liberalized at a time. Similarly, there are vertical and horizontal relationships which could affect the predicted expansion in exports from LDCs and other exporters if there are simultaneous changes in world prices. Thus, if trade effects are predicted based on the assumption that imports, demands, and export supplies are independent, how must these be modified to take into account the interdependencies that exist in reality?

In trade-liberalizing countries, in most cases, taking account of interdependencies in import demand causes the shift of the world demand curve for a given commodity to be smaller.<sup>37</sup>

Palm oil and soybean oil are an example of goods that can substitute in demand. A reduction in the tariff on palm oil causes the demand for soybean oil to shift to the left, and vice versa. These are the effects that take place in the tariff-reducing country. Thus, the right-hand shift in world demand for each of the two commodities is going to be less in the presence of a tariff reduction for the other than it would be in its absence. Actually, the quantity demanded at world prices of one of the two could (though need not) shift to the left.

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<sup>33</sup> Sampson and Yeats, "Common Agricultural Policy."

<sup>34</sup> See Jabara and Brigida, *Variable Levies* for discrepancies in the calculations of Sampson and Yeats in "Common Agricultural Policy."

<sup>35</sup> As a test, results with the method utilized in this study were compared with those obtained using estimates of national protection rates for five cereals from Jabara and Brigida, *Variable Levies*. The alternative calculations for 1977/78 yielded world price changes with less than 1 percentage point difference between the five cereals. In terms of percentage change in export revenues for LDCs for the five cereals on aggregate, the calculations based on national protection rates are approximately 5 percent below those based on a common tariff equivalent. The major discrepancy occurs for the United Kingdom, for which the "common" tariff overestimates its protection rates.

<sup>36</sup> Timothy Josling, "Questions for Farm Policy in an Enlarged European Community," *The World Economy* 2 (September 1979): 343-361.

<sup>37</sup> For a comparison of the effects of a change in import tariff on predicted prices using single-product and multiproduct partial equilibrium models, see Philip L. Paalberg and Robert L. Thompson, "Interrelated Products and the Effects of an Import Tariff," *Agricultural Economics Research* 32 (October 1980): 21-32.

Feedgrains and beef are commodities related as input and output.<sup>38</sup> In this case reducing tariffs on the importation of feedgrains causes an increase (shift to the right) in the local production of beef in the developed country. Therefore, its net demand for beef (at the same price as before) from the world market must decrease. Similarly, a reduction in the tariff on beef causes less beef to be raised in the developed country. There would be at any given world price less demand for feedgrains than before, and LDC exports of beef could increase. Hence, the domestic supply of beef, adjusting for this interdependence, is relatively more inelastic than it would be without a simultaneous reduction in the tariff on feedgrains. That is, the response of beef production to a change in  $P_w$  will be less.

An example of commodities related as separate (complementary) inputs into the same output would be steel and rubber in the auto industry. Here a reduction in the tariff on steel will cause the demand for rubber to increase; likewise, a reduction in the tariff on rubber will lead to a rise in the demand for steel. In this case the increase in trade is greater in the presence of interdependency than in its absence. In the other two cases interdependency reduces the stimulus liberalization gives to the world market.

Actually, in agricultural commodities it is easy to find examples of the first two types of interdependence. However, it is hard to come up with a single clear case of importance similar to the third type.

Hence it can be concluded that if calculations are made as if the demand for the commodities in question were independent, and if adjustments are then made to reflect interdependence, it is most likely that the adjustment in import demand elasticity will be downward.

If predictions of trade effects are first made on the assumption that supplies are independent in the LDCs, how must they be modified to take interdependencies into account? Like import demand elasticity, export supply elasticity will decrease.

For net exporters the following kinds of supply interdependencies can be distinguished: competition in production (for example, rice and sugar); complements in production, including "joint products" (for example, wool and lamb, soybean oil and soy meal); and commodities related as raw materials and final (or semiprocessed) goods (for example, oilseeds and their derivatives).<sup>39</sup>

Interdependencies among both exports and imports are extremely complex to trace. At least conceptually one could aggregate activities with high substitution elasticities compared with each other but with low ones compared with the rest of the commodities. To test the sensitivity of the estimated import demand and export supply parameters to the aggregation, some groups of activities related as raw materials and semifinished goods were aggregated vertically. However, extending this analysis empirically beyond a few sets of interrelated products involves too many guesses because it depends on numerous parameters that are not available. Results that are certain when the model is limited to three or four products become only speculative when the model is expanded. Any trade liberalization study is bound to be controversial, at least on this issue. Often there is no reason to believe that the consumption or the production substitution elasticities are higher between one set of commodities (or activities in production) than between another set. Predictions concerning the impact of tariff reductions can be very sensitive to the relationship between the cross elasticities (for which there are few available estimates) and their own price elasticities.<sup>40</sup>

The approach used in this study involves adjusting downward the underlying domestic supply and demand elasticities to correct for simultaneities among products. This approach is rather intuitive and seems broadly sensible for a study dealing with 70 or more countries and a total of approximately 90 commodities where the main purpose is to provide a broad order of magnitudes and direction of effects.

<sup>38</sup> Rachel Dardis estimates the cost of protection of the feed-livestock sector, which she applies to West Germany in 1960, incorporating protection in the intermediate goods. Rachel Dardis, "Intermediate Goods and the Gain from Trade," *Review of Economics and Statistics* 49 (November 1967): 502-509.

<sup>39</sup> Romeo Bautista discusses the effect of the interrelated products on the export supply function, applying his model to the case of Philippines exports of copra and coconut oil; see Romeo M. Bautista, "Interrelated Products and the Elasticity of Export Supply in Developing Countries," *International Economics* 19 (February 1978): 181-194.

<sup>40</sup> This is illustrated for the wheat and coarse grain markets in Paalberg and Thompson, "Interrelated Products."

## Trade Preferences for Developing Countries

Since 1971 two systems of trade preferences to LDCs have been initiated: the generalized system of preferences (GSP), which became effective in the European Community and Japan in 1971 and in the United States in 1976, and the Lomé Convention I, signed by the European Community and 46 African, Caribbean, and Pacific states (ACPs) in February 1975, followed by Lomé II in early 1980.

There are different views about the potential merit to LDCs of the GSP scheme as compared with nondiscriminatory methods of freeing trade.<sup>41</sup> Such views will not be dealt with in this study. The main idea of the GSP is to allow LDCs to compete in markets for manufactured and semimanufactured products. Although it does include some agricultural products, its coverage is very limited. Moreover, the GSP applies only to tariffs, whereas for most agricultural products, LDCs would benefit more from a general attack on nontariff barriers. Furthermore, GSP concessions apply for only 10 years, and are severely restricted through a complex system of exceptions and ceilings instituted by the preference-giving country, such as escape-clause relief and ceilings on the volume of imports under preferential treatment. And although concessions have been made on a large number of products, many of these are quite insignificant in trade. For these reasons the overall effect of GSP concessions has been and is likely to continue to be relatively small in stimulating additional LDC exports in agricultural products.<sup>42</sup>

Under the Lomé Convention, the European Community grants duty-free access to

a large proportion of the exports of ACP countries, including some agricultural products such as sugar. Actually most of the trade concessions offered under the Lomé Convention are merely a continuation of previously existing arrangements with former dominions. As in the GSP, quantitative restrictions and other NTBs apply to many important ACP products, such as beef, bananas, and sugar.<sup>43</sup>

This study does not address the issue of preferential versus most favored nation (MFN) freeing of trade. However, it provides information that could be of value for selecting commodities to be emphasized in future negotiations on trade concessions under the GSP and the Lomé Convention. Liberalization is approached on an MFN basis rather than in a way that is preferential to LDCs. The analysis is also consistent with the established principle of nonreciprocity for LDCs.

## Data Notes

Although the model liberalizes trade for 17 OECD countries, 6 other OECD members (Greece, Finland, Iceland, Portugal, Spain, and Turkey) are excluded because of the lack of data on tariffs and NTBs. The 56 developing countries selected are all countries with mid-1975 populations of more than 4 million, according to the World Bank. Smaller developing countries are included in the ROW category. Low-income developing countries are those with World Bank estimates of 1976 GNP per capita at current market prices below \$350. (See Chapter 2 for a list of the countries covered.)

The study includes 99 individual raw and processed agricultural commodities but

<sup>41</sup> Robert E. Baldwin and Tracy Murray, "MFN Tariff Reductions and LDC Benefits under the GSP," *Economic Journal* 87 (March 1977): 30-46; Jaleel Ahmad, "Tokyo Rounds of Trade Negotiations and the Generalized System of Preferences," *Economic Journal* 88 (June 1978): 285-295; W. Max Corden, *The NIEO Proposals: A Cool Look* (Thames Essays No. 21 (London: Trade Policy Research Centre, 1979)); and M. McQueen, "Trade Preferences for Developing Countries versus Most Favored Nation Tariff Reductions: An Appraisal of the EEC Schemes," *Journal of Agricultural Economics* 30 (September 1979): 345-360.

<sup>42</sup> Analyzing the GSP potential in trade with the European Community, Borrmann et al. conclude that the European Community imports in all commodities from LDCs (including mineral, industrial, and agricultural) for which the GSP can provide effective preference amount to 8 percent of all European Community imports from LDCs (Axel Borrmann, Christine Borrmann, and Manfred Stegger, "The Impact of the Generalized System of Preferences on Imports," *Intereconomics* 14 [September/October 1979]: 221-225).

<sup>43</sup> A detailed analysis of the Lomé Convention and the European Community agricultural policy can be found in Stuart Harris, K. Parris, Christopher Ritson, and E. Tollens, *The Lomé Convention and the Common Agricultural Policy*. The Centre for European Studies, Wye College, Ashford, Kent, England, 1978. (Mimeographed.)

excludes some other commodities due to inadequate domestic production data or unavailable data on tariffs and NTBs.<sup>44</sup> Dairy products as a group are excluded because of the limited exports from developing countries.

Production, export, and import figures are averages for the period 1975-77 taken from the FAO *Food Balance Sheets*.<sup>45</sup> Consumption is calculated for the same period, taking into account changes in stock levels when applicable. Implicit world unit export prices are based on 1975-77 averages calculated using FAO figures as the value of world exports divided by the quantity of world exports. All values are expressed in constant U.S. dollars for 1977 deflated by the World Consumer Price Index of the International Monetary Fund (IMF). Total export revenue figures for each region/income group are also 1975-77 averages from the *International Financial Statistics* of the IMF expressed in constant U.S. dollars for 1977.

Tariff levels are from the GATT tape on tariffs. They are nominal levels expressed in *ad valorem* equivalents. Estimates of total protection levels and tariff equivalents of NTBs were obtained from direct price comparisons, GATT documents, and estimates culled from other sources, as shown in Appendix 1. In some cases where NTBs were known to be significant but no estimates of their tariff equivalencies were available, levels were estimated consistent with the country's protection levels on substitutes. All calculations of the model are based on reductions of 50 percent in the total level of protection by all OECD net importers of a

particular commodity. Potential reductions in exports by OECD net exporters induced by trade liberalization are not incorporated into the study (except implicitly for European Community exporters since the European Community is treated as a single unit).

Estimates of domestic supply and demand elasticity parameters were applied separately to each commodity and were assumed the same for all countries for each product.

The main sources for supply elasticities in LDCs were the reviews by Krishna, Askari and Cummings, and Peterson.<sup>46</sup> Other sources for single countries were examined in completing the parameter file. Krishna's review of long-run acreage response reports elasticity values exceeding 0.5 for important food crops for much of the developing world. Timmer reports yield elasticities for rice production in Asia of 0.33.<sup>47</sup> In his analysis of 20 developed countries and 33 LDCs, Peterson reports that the long-run price supply elasticity of aggregate agricultural output ranges between 1.25 and 1.66.<sup>48</sup> Thus, the empirical evidence gathered during the last decade supports the hypothesis that there is a significant long-run supply response to price in LDCs.<sup>49</sup> The elasticity for individual commodities is greater than that for aggregate farm output. However, considerable uncertainty exists concerning its exact value, particularly when a simultaneous expansion in several crops is considered. For developed countries the principal sources for supply parameters were the Food and Agriculture Organization of the United Nations and Askari and Cummings,<sup>50</sup> but other sources

<sup>44</sup> Citrus juice, sugar syrups, boneless and canned beef, poultry meat, palm kernel cake, tomato paste, cherries, vermouth, maize starch, sugar beet pulp, cassava flour, yams, sweet potatoes, and pulses "not elsewhere specified" in SITC classification were excluded.

<sup>45</sup> In a previous run, 1970-74 was used instead for both trade flows and prices; see Alberto Valdés and Jonathan Hayssen, "Liberalización de Comercio en Países Desarrollados y sus Beneficios Potenciales a los Países Pobres: El Caso de Agricultura," *Cuadernos de Economía* 49 (December 1979): 323-341.

<sup>46</sup> Raj Krishna, "Agricultural Supply Policy," in *Agricultural Development and Economic Growth*, ed. Herman M. Southworth and Bruce E. Johnson (Ithaca, Cornell University Press, 1967); Hassan Askari and John T. Cummings, *Agricultural Supply Response: A Survey of the Econometric Evidence* (New York: Praeger, 1976); and Willis L. Peterson, "International Farm Prices and the Social Cost of Cheap Food Policies," *American Journal of Agricultural Economics* 61 (February 1979): 12-21.

<sup>47</sup> Peter C. Timmer, "Food Prices and Food Policy Analysis in LDCs," *Food Policy* 5 (August 1980): 188-199.

<sup>48</sup> Peterson, "International Farm Prices."

<sup>49</sup> *Ibid*

<sup>50</sup> Food and Agriculture Organization of the United Nations, *Agricultural Protection and Stabilization Policies: A Framework of Measurement in the Context of Agricultural Adjustment* (C 75/LIM/2), Rome, FAO, October 1975; and Askari and Cummings, *Agricultural Supply Response*.

for single countries were examined.

Demand parameters are generally less controversial than supply. At least for developed countries there is some agreement on the range of own-price elasticities.<sup>51</sup> However, the information on the cross-price elasticity matrix is quite inadequate. There is an abundant supply of sources for own-price elasticities in LDCs; however, results vary widely for the same products.<sup>52</sup>

The elasticity estimates of demand and supply used in this study range from absolute values of 0.2 for cocoa beans and green coffee to 0.8 for many of the processed products, with average values at about 0.4 for both domestic supply and demand (see Appendix 2, Table 7). The analysis of sensitivity to domestic elasticities is reported in Chapter 5. The assumptions of domestic elasticities were deliberately set low to account for any interdependence between commodities. Import demand and export supply elasticities, calculated using the domestic elasticity estimates, vary among countries according to the share of trade for each product; they were not allowed to exceed maximum absolute values of 10.0. World import demand and export supply elasticities were calculated as the weighted average of the values for individual countries, that is, for the members of the OECD (excluding the European Community), the selected LDCs, and the European Community as a single unit. The European Community enters into the calculation of the world elasticities as a weighted average elasticity of all its members.<sup>53</sup> The ROW, which includes centrally

planned economies and LDCs whose population was less than 4 million in mid 1975, is taken as a single unit. Its trade elasticities are assumed to be equal to the weighted average elasticity of the OECD and selected LDCs. Thus the ROW group is excluded from the computation of the world elasticity because it does not affect its value. However, the trade reaction of the ROW has an impact on the final outcome of trade liberalization.

For each commodity the change in the world volume of exports and imports is equal to the sum of the respective volume change (exports or imports) in the OECD, plus the European Community, the selected LDCs, and the ROW. Starting from an initial equilibrium in trade flows ( $\Sigma_j^x = \Sigma_j^m$ ), given the initial stimulus in the import demand as a result of the reduction in trade barriers in the OECD, ( $\Sigma_j \Delta M_{OECD}$ ) at the initial world price, the system is solved for  $\hat{p}_w$  to find the new equilibrium situation in which  $\Sigma_j \Delta X = \Sigma_j \Delta M$ .<sup>54</sup> The calculated change in  $\hat{p}_w$  is presented in Appendix 2.

The calculated results should be viewed as the minimum effects of trade liberalization because many NTBs could not be quantified and were thus excluded; reductions in exports by liberalizing OECD net exporters could not be included; and for many commodities, especially processed products, existing trade patterns are so distorted by the current protection systems of developed countries that the base year net import levels upon which the analysis is based are often artificially low, if not zero, or the country may actually be a net exporter.<sup>55</sup>

<sup>51</sup> See, for example, P. S. George and G. A. King, *Consumer Demand for Food Commodities in the United States with Projections for 1980* (Giannini Foundation Monograph No. 26 (Berkeley: University of California, 1974)) and Food and Agriculture Organization of the United Nations, *Agricultural Protection and Stabilization*.

<sup>52</sup> Pasquale L. Scandizzo and Colin Bruce, *Methodology for Measuring Agricultural Price Intervention Effects*, World Bank Staff Working Paper No. 394 (Washington, D.C.: International Bank for Reconstruction and Development, June 1980), Appendix 3.

<sup>53</sup> It is weighted by their initial share of exports (or imports, according to the commodity in question) in world exports (imports) where "world" is restricted to the OECD (excluding the European Community), the selected LDCs, and the European Community.

<sup>54</sup> For example, for exports,  $\Sigma_j \Delta X = \Sigma_j \Delta X_{OECD} + \Delta X_{EC} + \Sigma_j \Delta X_{LDC} + \Sigma_j \Delta X_{ROW}$

where  $\Delta X = X \cdot \hat{p}$ . The same structure applies to imports.

<sup>55</sup> Although domestic prices of some products are well above world prices as a result of trade restrictions, some developed countries have become self-sufficient. Thus the potential expansion of imports is missed by the model. For example, a number of countries import green coffee and do not import roasted coffee. New Zealand applies tariffs of 5 percent on green coffee and 50 percent on roasted coffee. Similarly Japan imports wheat at low tariffs but applies a 167 percent tariff on wheat flour, which in some years is exported with subsidy. The model does not capture these countries as potential importers of roasted coffee or wheat flour. The potential switch from oilseeds to vegetable oil exports from LDCs could also be significant.

# 4

## ESTIMATION OF BENEFITS TO LDCS

### Overall Impact by Region and Income Group

A 50 percent reduction in trade barriers in the OECD would result in an increase of approximately \$9.5 billion per year in exports (which, of course must equal the increase in world imports). It would accrue approximately 36 percent to the selected LDCs, 20 percent to OECD exporters, and 44 percent to the ROW. As shown in Table 2, the estimated potential increment in export revenues of the LDCs is approximately \$3 billion per year. This represents an annual increment approximately equal to 11 percent of total developing-country exports of agricultural products.<sup>56</sup> The estimates in Table 2, as in the rest of the calculations, represent the potential long-run increases, expressed in annual flows, of export earnings to LDCs over and above the expected trend growth in exports likely to occur independently of liberalization. However, given the changes in world prices and trade volume growth that are likely to occur independently of trade liberalization by OECD members, it is unrealistic to think that all the effects of trade liberalization would be captured by a static, base-year analysis. Although trend price and volume growth are not incorporated in this study because the information on projected growth is lacking, they would add

an important dimension. The resulting distribution of benefits to LDCs from trade liberalization would favor those LDCs whose exports are concentrated in items with large projected increases in the trend growth of exports and/or world prices.

The analysis shows significant differences in potential gains between major commodities and individual regions (and countries). Table 2 shows the approximate size and distribution of the potential increment in export earnings.<sup>57</sup> Latin America receives approximately 60 percent of the total benefits, Asia receives 23 percent, and North Africa/Middle East and Sub-Saharan Africa receive approximately 9 percent each. Needless to say, each individual country or region is more interested in the size of its potential benefits compared with the size of its export earnings than with the benefits received by other regions or countries. Table 2 also presents the increase in exports relative to agricultural exports, cereal imports, and total export revenues (with and without petroleum exports) by region and income group. On this basis benefits would be particularly significant for Latin America under all four criteria and for agricultural exports and cereal imports for North Africa/Middle East, Sub-Saharan Africa, and Asia. As a group low-income countries would capture an 8.5 percent increment in agricultural export revenues, which certainly can-

<sup>56</sup> These results show gains to LDCs that are twice the size of those estimated by Cline et al. in *Trade Negotiations*. Assuming no change in world prices as a result of liberalization, Cline et al. estimate that complete liberalization in agriculture in the OECD would add \$2.5 billion (in 1974 dollars) to LDC exports, whereas a 60 percent cut on tariffs and NTBs (closer to the 50 percent reduction assumed here) would add \$1.5 billion. There are several differences in the approach and data base of the two studies. Cline et al. assume no change in world prices, the treatment of the European Community differs, and this study includes LDCs as importers as well as exporters.

An earlier estimate by D. Gale Johnson concludes that exports from Third World countries would increase by about \$2 billion per year (D. Gale Johnson, *World Agriculture in Disarray*, [London: Macmillan and St. Martin Press in association with the Trade Policy Research Centre, 1973]). Although a scenario of removal of trade barriers is simple to compute with the model, it was not done because of the difficulty in reporting even more results in a study already congested with numbers, especially considering its remote political acceptability.

For a discussion of estimates done prior to 1966 see H. G. Johnson, *Economic Policies*, pp. 84-94.

<sup>57</sup> To test the sensitivity of results showing an increase in LDC export earnings to the composition of commodities included in the trade liberalization package, a rough alternative calculation excluding all commodities chiefly exported by OECD countries was done. All products for which the initial preliberalization market share of the selected LDCs was below 50 percent were excluded. This approach is not fully appropriate, however, because the selected LDCs exclude some small countries with a major share of world exports (for example, Cuba in sugar). By using this alternative, the increase in LDC export earnings is reduced from \$3 billion to approximately \$1 billion.

**Table 2—Size and distribution of potential increase in export revenues of LDCs by region and income group**

Income Group/Region	Increase in Export Revenues	Increase as a Share of			
		Agricultural Exports <sup>a</sup>	Exports Exclud- ing Petroleum <sup>b</sup>	Total Exports <sup>c</sup>	Cereal Imports <sup>d</sup>
	(U.S. \$ million 1977)	(percent)			
Total LDCs	3,008 <sup>e</sup>	11.0	2.6	1.3	39.3
Income groups					
Low income	512	8.5	2.0	1.6	16.7
Middle and higher income	2,496	11.7	2.8	1.3	55.6
Region					
Sub-Saharan Africa	253	4.9	1.8	1.1	40.9
Asia	681	9.7	1.5	1.3	20.8
North Africa/Middle East	270	17.8	1.7	0.3	12.6
Latin America	1,804	13.2	4.6	3.6	110.1

Note: LDCs include 56 selected developing countries. The initial value of exports is based on data for 1975-77.

<sup>a</sup> Agricultural exports refers to the 99 products included in this report.

<sup>b</sup> Net of petroleum export revenues for the following countries in the sample: Nigeria, Indonesia, Algeria, Iran, Iraq, Saudi Arabia, Ecuador, and Venezuela.

<sup>c</sup> This column includes petroleum export revenues.

<sup>d</sup> This column shows the share of the cereal import bill that could be covered by the increase in exports using the 1975-77 value of cereal imports in current U.S. dollars deflated by the *IMF World Consumer Price Index* (1977 = 100).

<sup>e</sup> If there were no trade liberalization for cereal commodities (wheat, rice, and coarse grains), potential foreign exchange revenues to total LDCs would be reduced by \$253 million, from \$3.0 to \$2.7 billion. The main loser is Latin America (\$189 million) followed by North Africa/Middle East (\$30 million).

not be considered trivial. These are static economic gains, which would grow along with the trade base.

Table 2 indicates that on an average for the selected LDCs the addition of \$3 billion in export receipts would finance 39 percent of their nominal cereal import bills.<sup>58</sup> This figure underestimates the food import bill because the 40 percent is not adjusted for the possible increase in the world price of cereals resulting from liberalization. Is the increment in export revenues a significant contribution to the financing of food imports? It is not clear that examining the balance of trade by sectors sheds much light on the real economic significance of these estimates. For example, Latin America, the region for which potential benefits are the

highest compared to its food import bill, is also the region with the lowest share of food imports in its balance of trade.<sup>59</sup> In contrast Asia gains the least relative to its food import bill precisely because it is so dependent on food imports. This is apart from the fact that Asia receives a lower share than Latin America in the total benefits. Thus, it seems that more economic significance should be attached to the size of potential gains in comparison to overall indicators of the balance of trade (such as total exports or imports) than to its specific components (such as food imports). However, if trade is liberalized in industrial countries, developing countries, particularly Sub-Saharan Africa, will be in a much improved financial position for importing food.<sup>60</sup>

<sup>58</sup> Cereal import bills are nominal in that approximately 13 percent of these imports came in concessional terms under food aid programs. The food import bill figure is at the quoted import price, thus overestimating the true cost of imports under food aid.

<sup>59</sup> Ammar Siamwalla and Alberto Valdés, "Food Insecurity in Developing Countries: Issues and Policies," in *Food Policy* 5 (November 1980): 258-272.

<sup>60</sup> However, the marginal propensity to import cereals out of the extra foreign exchange may be quite low.

The welfare benefits to LDCs under this trade liberalization scheme represent an increase in real income for the 56 selected LDCs of approximately \$1 billion a year (see Table 3). This resource transfer is lower than the foreign exchange benefits by an amount equal to the resource cost of the additional exports. In fact, the calculated welfare benefits represent approximately 35 percent of the increase in export revenues for the same countries. The ratio of welfare gains is lowest for Latin America (31 percent) and highest for Sub-Saharan Africa (50 percent), reflecting differences in the elasticity of supply of exports.

As importers of agricultural commodities, LDCs as a whole suffer a welfare loss estimated at \$583 million for the selected LDCs. This leaves an estimated net welfare gain to LDCs of approximately \$473 million per year. The main source of the welfare loss is the increase in the unit value of cereal

imports, specifically wheat, which accounts for approximately \$280 million of the loss. The welfare losses are particularly severe for the low-income countries as a group, which see their net welfare gains practically disappear when welfare losses, including cereals, are adjusted for. The consideration of net welfare gains in static terms suggests the simple but not always recognized implication that not all the protectionist policies of the developed countries are necessarily harmful to the LDCs as a whole. However, dynamic gains from freer trade could be much greater than static gains.<sup>61</sup>

The change in the cost of imports to LDCs for the same commodities indicates that overall there is a reduction of approximately \$700 million per year. A reduction occurs because the calculated import demand for most of the commodities is relatively elastic (that is, greater than -1.0).<sup>62</sup> A foreign exchange saving resulting from

**Table 3—Potential welfare effects of trade liberalization and changes in the agricultural import bill of selected LDCs by income group and region**

Income Group/Region	Welfare Gains from Increased Exports <sup>d</sup>	Welfare Losses from Reduced Imports		Reduction in LDCs' Expenditure on Agricultural Imports	
		Cereals Included	Cereals Excluded	Cereals Included	Cereals Excluded
(U.S. \$ million 1977)					
Total LDCs	1,056	583	304	704	255
Income group					
Low income	174	176	66	350	78
Middle and higher income	882	407	238	354	177
Region					
Sub-Saharan Africa	146	59	41	23	18
Asia	260	184	78	290	63
North Africa/Middle East	92	224	132	260	93
Latin America	558	116	54	131	81

Note: Calculations use the base period 1975-77.

<sup>d</sup> This may also be described as the net transfer in real income to LDCs, defined as the increase in export earnings less the (social) production cost of increasing exports. Welfare gains in this column relate only to gains to LDCs as exporters.

<sup>61</sup> D. Gale Johnson, *World Agriculture*, pp. 243-248.

<sup>62</sup> Alternatively, if it is assumed that there is no change in the volume of imports (that is, an elasticity of import demand equal to zero), the protectionist policies in these developed countries would have resulted in a foreign exchange "saving" to the selected LDCs of approximately \$660 million per year. In other words, the increase in world prices as a consequence of trade liberalization would raise the value of agricultural imports to LDCs by this amount. However, it is clearly unrealistic to assume there would be no reduction in imports in LDCs, part of which would come from an increase in domestic production.

liberalization can hardly be interpreted as a benefit. It is clearly a welfare loss to LDCs. Although unlikely, it is possible that some LDCs may be hurt by agricultural trade liberalization if they import commodities with high rates of protection in developed nations and export commodities facing low rates of protection (fibers such as cotton lint, jute, or sisal, and rubber).

If cereals are excluded from the trade liberalization package, the reduction in LDC imports is greatly reduced, particularly for the poorest countries.

Thus, net welfare gains and import costs to LDCs are significantly affected by the inclusion of cereals in the trade reform package. It is important, however, to note that trade liberalization would stimulate more production of cereals in LDCs. Considering that some developed countries have subsidized cereal production in ways not captured in this model, and many LDCs have restricted agriculture (directly and through macroeconomic policies such as currency overvaluation), the combination of these policies has probably turned the whole balance of comparative advantages against agriculture in LDCs.

Potential trade effects for each of the selected LDCs are presented in Table 4. As expected, the large and/or export-oriented countries such as Brazil, Argentina, and India capture more of the absolute increase in export revenue than smaller countries. But for individual LDCs their interest in trade liberalization coincides more with their gains compared to the initial value of their exports. For 20 of the 56 countries, the resulting increase in export revenue is above 10 percent. Although relative gains are substantial, 5 to 10 percent, for a number of the poorest countries, some LDCs would not benefit from more open markets. There is a group of countries for which the trade effect on imports outweighs that for exports of agricultural commodities, as can be observed by comparing export revenues with agricultural imports in Table 4. These are Upper Volta, Bangladesh, Pakistan, Hong Kong, Egypt, Yemen, Iran, Syria, and Venezuela. These countries either export few agricultural products (such as Venezuela) and/or

export commodities facing low rates of protection (such as jute from Bangladesh) and import foods bearing high rates of protection in the OECD.

## Most Promising Export Commodities

The calculated change in world prices from trade liberalization varies a great deal among commodities (see Appendix 2, Table 7). For most commodities the price change ranges between 2 and 10 percent. As expected, for the few commodities that face practically no protection in the OECD markets, the world price change is nil. These commodities include cotton lint, jute, natural rubber, sisal, and hemp tow. At the other extreme the calculated price change fluctuates between 10 and 15 percent for wine, roasted coffee, malt, and cocoa paste cake. Apart from the change in world price, which mainly reflects the degree of protection, the other factors determining the size of the increase in export revenues are the initial market share of LDCs and their relative export supply elasticities.

Table 5 shows the product composition of increased export revenues for the selected LDCs ranked according to the absolute increase in the value of exports.<sup>63</sup> Raw sugar, refined sugar, and beef and veal are the three most important commodities, but the list in Table 5 identifies many other commodities with significant potential. These include green coffee, wine, tobacco, and maize. If products are classified into commodity groups similar to those used in the GATT negotiations instead of as single commodities (at the five-digit Standard International Trade Classification level), the results indicate that there are two critical commodity groups, which capture approximately 47 percent of the potential increase in export revenues in LDCs. These are sugar and derivatives (36 percent) and meats (11 percent). The information in Appendix 2, Tables 8 to 19, permits the identification of the major beneficiaries for regions and/or income groups. For example, for sugar and

<sup>63</sup> These results are of course sensitive to the elasticity values used. Lowering the domestic supply elasticities to 0.2 (from 0.4, which is used for most commodities in this study) reduces the increase in export earnings between 10 and 20 percent for most commodities. For example, for the commodity groups sugar and derivatives and vegetable oils, the reduction in export earnings for the selected LDCs corresponds to 13.0 and 8.7 percent, respectively.

**Table 4-- Potential trade effects on LDCs from reducing trade barriers for exports, imports, and commodities**

Country	Change in Export Revenues	Change in Agricultural Import Expenditures	Increase in Agricultural Export Revenues	Most Affected Export Commodity in Absolute Terms
	(U.S. \$ 1,000)		(percent)	
<b>Sub-Saharan Africa</b>				
Angola	11,623	-2,452	3.9	Coffee
Cameroon	21,391	-552	4.8	Cocoa
Ghana	31,152	-1,945	4.4	Cocoa
Guinea	245	-102	2.7	Coffee
Ivory Coast	49,581	-2,101	4.2	Cocoa
Kenya	18,415	-5,884	5.9	Beef
Madagascar	16,925	-1,185	8.4	Sugar
Malawi	9,686	-220	6.3	Beverages/tobacco
Mali	2,955	142	10.0	Vegetable oils
Mozambique	12,251	-1,219	17.1	Sugar
Niger	1,045	311	7.7	Vegetable oils
Nigeria	19,840	829	3.9	Cocoa
Rwanda	1,597	59	2.9	Coffee
Senegal	20,500	649	7.1	Vegetable oils
Tanzania	11,653	-4,371	5.8	Beef
Uganda	13,369	-64	3.1	Coffee
Upper Volta	195	-387	2.1	Pulses
Zaire	9,879	-4,802	4.3	Coffee
Zambia	943	-449	8.2	Beverages/tobacco
<b>Asia</b>				
Bangladesh	2,017	-5,511	5.3	Beverages/tobacco
Burma	6,344	-466	3.0	Rice
Hong Kong	723	-16,168	16.2	Fats
India	254,872	-181,576	18.4	Sugar
Indonesia	42,461	-29,256	6.1	Vegetable oils
Malaysia	49,314	3,626	6.4	Vegetable oils
Nepal	1,034	-605	2.3	Rice
Pakistan	14,850	-52,631	4.5	Beverages/tobacco
Philippines	154,356	-12,480	10.7	Sugar
South Korea	34,986	1,739	22.9	Sugar
Sri Lanka	14,841	3,823	4.1	Beverages/tobacco
Thailand	105,518	-106	6.6	Sugar
<b>North Africa/Middle East</b>				
Afghanistan	14,084	-291	32.8	Temperate fruits
Algeria	78,899	-34,873	28.5	Beverages/tobacco
Egypt	17,392	-63,160	12.4	Temperate fruits
Iran	190	-107,955	...	Temperate fruits
Iraq	914	-11,828	9.7	Wheat
Morocco	28,681	-17,810	10.1	Vegetable oils
Saudi Arabia	...	5,425	...	...
Sudan	6,947	-1,767	3.0	Oilseeds
Syria	4,933	-11,515	17.6	Coarse grains
Tunisia	35,944	-9,059	22.2	Vegetable oils
Turkey	81,026	-10,117	23.1	Beverages/tobacco
Yemen, Arab Republic of	156	2,618	5.1	Coffee
<b>Latin America</b>				
Argentina	568,009	1,516	17.3	Beef
Bolivia	14,508	-1,427	22.6	Sugar
Brazil	773,788	-20,584	12.8	Sugar
Chile	39,731	-10,949	40.1	Temperate fruits
Colombia	99,702	-3,109	8.5	Sugar
Dominican Republic	79,384	-1,194	11.7	Sugar
Ecuador	28,930	-652	5.8	Sugar
El Salvador	25,228	-38	5.8	Coffee
Guatemala	39,608	-2,088	7.6	Sugar
Haiti	5,572	-87	8.4	Sugar
Mexico	87,379	-46,810	16.8	Coffee
Peru	38,419	-5,819	14.1	Sugar
Venezuela	3,898	-39,816	5.9	Coffee

Note: Calculations use the base period 1975-77 for the 99 selected agricultural commodities only.

**Table 5—Potential absolute and percent increase in exports of selected LDCs after trade liberalization, by commodity**

Commodity	Increase in LDC Export Revenues	LDC Increase as Percentage of Initial Export Revenues	LDC Share of Total Increase in World Exports	LDC Share of Total World Exports	
				Initial	Post Liberalization
	(U.S. \$ 1,000 1977)			(percent)	
Raw sugar	682,766	25.2	42.9	38.0	38.9
Refined sugar	334,202	46.1	<sup>a</sup>	34.8	51.4
Beef and veal	243,488	74.9	42.7	19.2	25.1
Green coffee	210,168	3.1	88.8	88.8	88.8
Wine	161,028	46.3	29.0	28.0	28.3
Tobacco	139,628	11.8	43.3	53.0	51.8
Maize	83,361	7.9	14.9	14.9	14.9
Wheat	78,570	13.2	8.5	6.7	6.9
Soy cake	77,631	8.3	30.2	50.1	47.7
Cocoa butter oil	56,492	18.6	90.5	90.5	90.5
Pork	51,018	104.4	7.8	7.8	7.8
Tea	50,646	5.0	90.5	90.5	90.5
Molasses	49,493	21.8	71.3	72.0	71.9
Palm oil	43,580	4.9	96.7	96.7	96.7
Cocoa beans	40,899	2.1	92.3	92.3	92.3
Copra oil	40,695	9.7	91.3	91.4	91.4
Roasted coffee	38,099	94.9	55.6	61.1	58.3
Olive oil	36,100	22.0	56.3	56.3	56.3
Potatoes	32,875	53.0	16.0	19.0	17.8
Soybeans	32,028	3.6	22.2	18.6	18.7
Soy oil	30,278	10.0	<sup>a</sup>	33.6	35.8
Barley	29,302	85.7	8.2	2.9	4.1
Coffee extracts	28,930	10.7	73.5	80.0	79.3
Apples	28,878	22.9	17.0	25.2	23.2
Groundnut oil	28,617	9.3	74.4	82.5	81.8
Grapes	28,412	76.4	14.1	14.9	14.6
Cocoa paste cake	27,814	19.1	100.0	100.0	100.0
Wheat flour	25,263	86.9	<sup>a</sup>	2.9	6.5
Cocoa powder	21,703	39.9	<sup>a</sup>	36.3	46.1
Bananas	21,267	4.3	53.1	53.1	53.1
Milled rice	16,713	1.3	<sup>a</sup>	45.0	45.5
Groundnut cake	16,014	7.3	93.0	93.0	93.0
Beef preparations	15,181	5.6	52.4	57.0	56.7
Mutton and lamb	13,345	28.2	14.7	6.1	7.0
Oranges	13,028	6.4	15.1	23.5	22.8
Copra cake	12,834	13.8	95.5	95.5	95.5
Malt	12,196	63.8	39.4	3.9	6.0
Beans, dry	11,528	7.0	46.4	50.2	49.9
Groundnuts, shelled	11,438	4.0	62.1	60.8	60.8
Chicken	8,597	28.3	<sup>a</sup>	4.1	5.4
Sugar, confectionary	7,634	95.1	21.9	28.8	25.0
Castor oil	6,559	6.4	98.0	98.0	98.0
Lemon and lime	6,382	18.7	18.9	16.6	16.9
Oats	6,091	51.8	5.4	7.5	6.7
Sorghum	5,853	1.3	27.8	33.9	33.8
Copra	5,512	2.7	80.5	80.5	80.5
Sunflower cake	5,151	11.4	76.3	76.3	76.3

Notes: This table includes those of 99 selected commodities with an increase in world export revenues of more than \$5 million. Commodities with an increase in world export revenues of less than \$5 million include paddy and husked rice, maize flour, millet, rye, dry broad beans, peas, chick peas, lentils, tangerines, grapefruit, palm kernel oil, sunflower oil, rape colza oil, cottonseed oil, tung oil, sesame cake, rapeseed cake, linseed cake, cottonseed cake, sesame cake, lard, margarine, tallow, wool grease, stearine, boiled oils, hydrogenated oils, greasy wool, scoured wool, groundnuts in shell, coconuts, desiccated coconuts, sesame seeds, mustard seed, linseed, cottonseed, salt-dry beef, meat extracts, bacon and ham, pork sausages, pork preparation, chicken preparation, cigarettes, pears, plums, and tomato juice.

Calculations use the base period 1975-77.

<sup>a</sup> Total world exports from this commodity would decrease.

derivatives for the selected LDCs, Latin America captures 63 percent, followed by Asia with 34 percent. However, small countries not included in the sample,<sup>64</sup> such as Cuba, Mauritius, and Jamaica, would benefit substantially from liberalization.

It should be noted that the selected LDCs capture a very high share of the increment in world trade in most commodities. They capture 50 and often as much as 70-80 percent of the additional trade resulting from liberalization. As expected, the exceptions are commodities such as wheat, pork, and mutton and lamb, all of which represent the other side of the spectrum, where most of the benefits accrue to developed countries. In these three commodities the sample LDCs capture 8.5, 7.8, and 14.7 percent, respectively.

Finally, the average market share of the LDCs in world trade does not change dramatically in most commodities after liberalization, with the exception of refined sugar and beef and veal. For these two commodities average shares for the LDCs increase 16.6 and 5.9 percent, respectively.

### **Increases in Export Revenues by Commodity Group**

*Sugar and Derivatives:* The sugar group includes four commodities: raw sugar, refined sugar, molasses, and confectionary sugar. A high share of the benefits from liberalization goes to countries included under the ROW group. (Most noteworthy are Mauritius, Reunion, Jamaica, and some centrally planned countries, especially Cuba). Yet over half of the selected LDCs receive some foreign exchange benefits.

Sugar is one of the most highly protected commodities in the study, with protection-level estimates as high as 200 percent. Consequently the total benefits to LDCs for raw sugar,<sup>65</sup> refined sugar, and, to a lesser extent, molasses are high, even though the results do not capture the shift from the LDC

export of raw sugar to refined sugar that would take place after liberalization. Many developed countries currently import raw sugar at lower tariffs; they import little of the more highly protected refined sugar, and some even export it. Growing U.S. imports of sugar represent approximately 63 percent of the expansion in net world exports of sugar and derivatives. The European Community is initially a net exporter of \$120 million in sugar and derivatives. After liberalization the European Community would reduce its exports by \$690 million and increase its imports by \$644 million, with a net effect of increasing imports of sugar and derivatives by \$1.3 billion per year.

Within sugar-exporting LDCs there is a shift in market shares, with large current exporters (the Philippines and Thailand with export elasticities of 1.1 and 0.8 respectively for raw sugar) receiving a smaller share of the increased world exports than they now enjoy, whereas other countries currently less export-oriented increase their market shares (Brazil and other Latin American countries).

As shown in Appendix 2, Table 8, middle- and higher-income LDCs capture as much as 81 percent of the potential benefits. However, as a percentage of the initial value of exports for low-income countries the foreign exchange benefits represent an increment of 37.4 percent.

*Beverages and Tobacco:* This group includes wine, tea, tobacco, and cigarettes. Vermouth and cigars were excluded because of data problems. Most of the potential benefits come from wine and tobacco, both of which face considerable protection.<sup>66</sup> For instance, in Japan there is a 300 percent tariff on tobacco and a 220 percent tariff on wine. Major wine exporters excluded from our sample but receiving substantial benefits are Spain, Bulgaria, Portugal, Romania, and Cyprus, grouped under ROW. As shown in Appendix 2, Table 9, within the LDCs foreign exchange benefits are confined to the North Africa/Middle East and South American regions, with Turkey, Argentina, and Chile

<sup>64</sup> Their share of benefits is captured under the ROW group. For sugar a large proportion of the benefits to ROW countries accrues to LDCs not included among the selected LDCs.

<sup>65</sup> This is derived mainly from the high initial trade base.

<sup>66</sup> Wine, and to some extent tobacco, are probably products where the assumption of perfect substitutability by country of origin is unrealistic. Also, the possible enlargement of the European Community could affect results for wine.

(all three with a calculated export supply elasticity for wine of 10.0) increasing their market shares at the expense of Morocco, Tunisia, and Algeria (with calculated export supply elasticities for wine of only 1.9, 1.1, and 0.7 respectively).

Benefits from liberalization in tea are small and their distribution among LDCs is consistent with their current market shares. Protection levels on tea are generally low in developed countries, except in Japan, because tea imports do not compete with domestic production. The model does not capture any potential benefits to LDCs should trade liberalization encourage increased packaging of tea in developing countries.

Important tobacco exporters excluded are Bulgaria, Greece, and Zimbabwe. Overall, countries in North Africa/Middle East and Argentina and Chile in South America capture a substantial share of the benefits for these commodities.

*Meats:* This commodity group covers 11 commodities, including beef and veal, mutton and lamb, chicken, and pork. Canned and boneless beef and poultry meat are excluded due to incomplete data. Some major meat exporters in the ROW groups are: for beef, Uruguay, Costa Rica, South Africa, Yugoslavia, Hungary, and Rumania; for mutton and lamb, Uruguay and Mongolia; and for pork, China, Yugoslavia, and Rumania.

By far the greatest increase in the value of LDC exports of meat occurs for beef and veal (see Appendix 2, Table 10). The value of world beef exports for the period was almost half the value of all other commodities combined. In addition, the LDCs had a 19 percent market share for beef but only an 8 percent share, for instance, for pork. Also protection level estimates for the OECD average over 60 percent for beef and veal and only about 35 percent for pork.

After trade liberalization the LDCs increase their total share of the world market only for beef and veal. African countries slightly increase their share in beef products and Asian countries in other meat products.

*Coffee:* The coffee group includes green coffee (unroasted coffee beans), roasted coffee, and coffee extracts and essences (see Appendix 2, Table 11). Over 90 percent of world coffee trade (in absolute terms) is in green coffee. This is because developed-country trade barriers effectively protect their domestic coffee-roasting industries.

Trade liberalization in the long run would shift much of the roasting of coffee to the LDCs, where the coffee beans themselves are grown, once large-scale roasting facilities were built. Currently only the Dominican Republic and Mexico among the LDCs export appreciable amounts of roasted coffee.

*Cereals:* Total cereals, summarized in Appendix 2, Table 12, include 12 commodities: wheat and wheat flour; paddy, husked, and milled rice; and the coarse grains barley, maize, maize flour, oats, millet, sorghum, and rye.

For cereals as a group, Latin America (mainly Argentina) captures 75 percent of the benefits to LDCs. However, as a share of the initial value of exports, North Africa/Middle East captures the highest percentage increase in foreign exchange earnings. Approximately 76 percent of the potential additional exports accrue to developed-country exporters.

World production and exports of wheat and wheat flour are dominated by the developed countries as shown in Appendix 2, Table 13. Argentina is the only developing country with sizable exports. Consequently only 13.8 percent of the benefits from trade liberalization would accrue to these developing countries, although in absolute terms the foreign exchange benefit would be substantial for Argentina. In addition, many more developing countries that import wheat would be adversely affected by any world price increase resulting from trade liberalization to the extent that their imports are commercial rather than concessionary. The impact of trade liberalization on wheat and wheat flour would benefit mostly the developed countries. However, the model does not capture sufficiently the exact shifts in market shares within these countries mainly because of the complex interaction between production and/or export subsidies and tariff protection.

The effect of trade liberalization on rice exports is not substantial. Protection levels and calculated elasticities for rice are low because imports generally do not compete with domestic production in most OECD countries except for Italy, where exports decline dramatically as a result of liberalization. Although Japan's likely swing from being a net exporter to a net importer of rice deserves attention, trade reversal was not allowed for in the model, due to computational constraints.

Table 14 of Appendix 2 summarizes the results for coarse grains. Most of the potential benefits to LDCs are in maize and barley, where LDCs directly compete with production in developed countries and face high levels of protection. In both cases the sum of benefits to LDCs would be only about 20 percent of the benefits accruing to the United States, by far the major world exporter.

Within the LDCs the current major exporters (Argentina and Thailand) receive proportionately a much smaller share of the increased world exports than do low-income countries such as Kenya and Pakistan. The calculated export supply elasticities for maize, for example, are 1.07 for Argentina, 0.55 for Thailand, and 10.0 for Kenya and Pakistan.

*Vegetable Oils:* Vegetable oils included in this study are soy oil, groundnut oil, coconut oil, palm oil, palm kernel oil, olive oil, castor oil, sunflower oil, rape and colza oil, linseed oil, cottonseed oil, and tung oil. As shown in Appendix 2, Table 15, most of the 56 LDCs receive some foreign exchange benefits from trade liberalization in vegetable oils. Benefits to developed countries accrue mostly to the United States for soy and groundnut oil. However, if the United States reduced its high protection of groundnuts and their derivatives, it would probably switch from a net exporter to a net importer of groundnuts and groundnut oil. Foreign exchange benefits accruing primarily to ROW countries include olive oil exports of Greece and Spain and sunflower oil exports of Eastern European countries.

*Cocoa:* The cocoa group includes cocoa beans, cocoa powder, cocoa paste cake, and cocoa butter or oil. Predictably, the protection levels of OECD members are very low (often zero) on raw cocoa beans and much higher on cocoa derivatives (see Appendix 2, Table 16). Consequently much of the processing of cocoa beans currently takes place in developed countries. The LDCs hold over 90 percent of the world exports of cocoa beans, butter oil, and paste cake but only 36 percent of exports of cocoa powder and an almost negligible share of world exports of chocolate and cocoa preparations (not included in the study). Most of the benefits go to Brazil, Ghana, the Ivory Coast, and Nigeria.

*Vegetable Oil Cakes:* As shown in Appendix 2, Table 17, the oil cakes group includes soy, groundnut, copra, sunflower, rapeseed, sesame, linseed, and cottonseed cakes. Oil cakes are joint products obtained when vegetable oils are extracted from oilseeds and are chiefly used as animal feed. Protection levels on oil cakes are much lower than on vegetable oils; they are generally on a par with, or just slightly above, levels on the oilseeds themselves. They are highest in the European Community. Low protection on oil cakes is advantageous to OECD meat producers. Base-period world trade levels for oil cakes are, as for vegetable oils, artificially low due to domestic production of oil cakes in OECD countries that import oilseeds to extract vegetable oils. However, if world trade in meats were liberalized, OECD demand for oil cakes as animal feed might also decline.<sup>67</sup> As calculated, the largest potential beneficiaries of trade liberalization in oil cakes are the United States (which dominates the world market for soy cake) followed by Brazil and Argentina. However, over three fourths of the LDCs export oil cakes and would receive some foreign exchange benefits.

*Temperate-Zone Fruits and Vegetables:* This group includes pears, apples, plums, grapes, potatoes, and tomato paste. Protection levels in industrial countries range between 30 and 50 percent (see Appendix 2, Table 18). Major exporters in the ROW group, which receive almost all the benefits of liberalization, are countries in North Africa/Middle East and South America, the former receiving relatively higher benefits. Important exporting countries not included individually are South Africa, Hungary, Lebanon, Spain, Bulgaria, Greece, and Rumania.

*Oilseeds and Oil Nuts:* The structure of protection on oilseeds and their derivatives in most OECD countries (where protection levels on oils are often 2 to 10 times as high as on oilseeds) encourages importing and domestic processing of oilseeds at the expense of indigenous processing (and exporting) by LDCs. Thus, the base-period trade levels from which the model calculates the effect of trade liberalization are artificially low. The long-run effects of a restructuring of OECD protection systems on oilseed

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<sup>67</sup> This could possibly have an impact on protection of corn in the European Community.

products could result in much greater benefits to LDCs than those calculated by the model.

The oilseeds group includes 15 commodities: soybeans, groundnuts in shell, shelled groundnuts, coconuts, desiccated coconuts, copra, palm kernels and nuts, preserved olives, castor beans, sunflower seeds, rape and colza seeds, mustard seed, sesame seed, linseed, and cottonseed (see Appendix 2, Table 19). Trade liberalization in oilseeds generally does not offer much potential for increasing foreign exchange in LDCs. Most developed countries have little if any protection on oilseeds, which they import in order to process into vegetable meals and oils, using the oil cake residual for animal feed. Vegetable oils, on the other hand, and, to a lesser extent, oil cakes, are generally highly protected. Therefore, an across-the-board reduction in protection of both oilseeds and their derivatives may result in the long run in an actual reduction of LDC exports of oilseeds, as well as an increase in exports of vegetable oils and oil cakes much larger than calculated.

The large share captured by the developed countries is essentially caused by the U.S. domination of world soybean exports, the major commodity in the oilseeds group. Brazil has become the second largest exporter.

*Other Commodities.* Protection levels on citrus fruit are highest in Japan (estimated at well above 100 percent), high in the European Community (approximately 50 percent), and quite low in most other OECD countries.

However, all countries highly protect their domestic industries that process citrus juice, with protection levels for juices up to 10 times the levels for the fruits themselves. Thus citrus juice could offer a great potential foreign exchange benefit to LDCs, despite low base-period world trade levels. Even the United States, currently a net exporter of citrus juice, would probably import large quantities of citrus juice if trade were liberalized. Unfortunately, the trade data on citrus juice suffer from serious inconsistencies—the total value of world exports is considerably below the value of world imports—that finally prevented calculations of trade effects on this commodity. For citrus fruits (lemons, limes, tangerines, and oranges) the total trade effect for all LDCs was quite low, approximately \$40 million.

Since there are no developed-country exporters of bananas, all the benefits from trade liberalization accrue to the selected LDCs and to other LDC exporters (especially Costa Rica, Honduras, and Panama). However, it is difficult to determine postliberalization shifts in market shares within the group of LDCs. Trade preferences are quite significant for bananas. Many OECD countries import the bulk of their bananas at low tariffs from preferred countries, while imposing much higher protection on (often higher quality) imports from other countries. Removing these trade barriers would probably increase total banana imports and shift trade patterns away from those countries formerly receiving preferential treatment.

# 5

## IMPACT OF TRADE LIBERALIZATION ON WORLD TRADE AND ON FOOD SUPPLIES IN LDCS

### Adjustments in Trade in Developed Countries

Trade liberalization in the OECD countries would result in a significant increase in world trade, amounting to more than \$8 billion a year in additional imports alone, as shown in Table 6. For some countries imports would increase and exports would decline. This is the case for Italy, which would expand its imports by approximately \$1.4 billion per year and reduce its agricultural exports by a similar amount. In absolute values the major increases in imports would take place in Japan, Germany, the United Kingdom, Italy, and the United States in that order. These five countries would increase their imports by approximately \$7 billion. For exports, also shown in Table 6, the major OECD expansion would come from the

United States, Canada, and Australia, with approximately \$3 billion from these three countries alone. But most significant is the considerable reduction in exports predicted for France, Italy, Germany, and others, some of which would be replaced by exports from LDCs.

For specific commodity groups the calculations indicate that the largest expansion in imports of meats, for example, would take place in Japan (\$558 million) and the United Kingdom (\$431 million). The United States and New Zealand are the major meat exporters to the OECD, with increased exports of \$265 and \$116 million per year, respectively. For sugar the United States and the United Kingdom absorb the largest share of the additional imports into the OECD, whereas Australia captures the largest share in exports of the OECD members.

**Table 6—Increase in the value of agricultural exports and imports in the OECD countries as a result of trade liberalization**

Country	Import Expenditures	Most Affected Commodity Group	Export Revenues	Most Affected Commodity Group
(U.S. \$ million 1977)				
Australia	11.9	Beverages/tobacco	472.1	Sugar
Austria	42.1	Beverages/tobacco	15.5	Sugar
Belgium/Luxembourg	218.8	Coarse grains	-178.6	Sugar
Canada	24.0	Sugar	517.8	Wheat
Denmark	72.2	Coarse grains	-111.5	Coarse grains
France	522.5	Sugar	-1,368.3	Wheat
Germany	1,556.5	Coarse grains	-370.9	Sugar
Ireland	60.2	Sugar	-106.4	Meats
Italy	1,395.2	Meats	-1,310.6	Beverages/tobacco
Japan	1,616.7	Meats	20.8	Sugar
Netherlands	286.2	Coarse grains	-286.0	Meats
New Zealand	2.0	Sugar	132.7	Meats
Norway	43.2	Coarse grains	23.7	Fats
Sweden	108.6	Sugar	122.3	Coarse grains
Switzerland	91.1	Meats	28.3	Coffee
United Kingdom	1,447.9	Sugar	-48.1	Meats
United States	995.1	Sugar	2,136.2	Wheat

Note: Figures are the sum of the agricultural commodities included in this study. Imports are from three sources—LDCs, other OECD countries, and centrally planned economies. Similarly, exports are to these three destinations.

## Trade Liberalization and Food Supplies in LDCs

Although less than one tenth of food output for the world as a whole normally enters international trade, for many LDCs a large portion of their domestic supply of cereals comes from abroad.<sup>68</sup> These countries depend on trade to cover the deficits in their aggregate food supplies, and in turn they often depend on their agricultural exports to finance food imports. Whether LDCs can rely on foreign supplies for a larger amount of their food requirements depends in part on their gaining greater access to the markets of the developed countries. This analysis focuses on what this trade would consist of and its potential implications for the balance of payments of LDCs.

A movement toward freer trade would undoubtedly result in a more effective use of world resources. But some authors<sup>69</sup> have expressed doubt that trade liberalization in the industrial countries would result in a significant improvement in the food supply of LDCs. This may be true. Important as it is, however, food supply is not the only, and for many LDCs not the primary, concern underlying their desire for greater market access for their exports. More real income is their target. Furthermore, for most LDCs development is dependent on expanding their foreign exchange earnings, which are often concentrated in a few agricultural exports. This study concludes that trade policies in in-

dustrial countries do represent an important barrier—although not necessarily the major one<sup>70</sup>—to the expansion of agricultural production in the LDCs. Therefore it is pertinent to examine the direct implications of trade liberalization for food production and availability of food in LDCs.

The foods considered in this analysis include the major staples, cereals, pulses, and root crops, which are aggregated according to their calorie equivalence.<sup>71</sup> Assuming that policies in LDCs would allow domestic prices to vary commensurate with the change in world prices resulting from trade liberalization, total food production in LDCs would expand by the equivalent of approximately 7 million tons of wheat. This increase, although small compared with production in LDCs, is over and above the expansion of nonfood agricultural production in LDCs.<sup>72</sup>

The potential effect of trade liberalization on the selected LDCs' food supply can be summarized:

Changes in World Trade in Food	Food in Wheat Equivalents (million tons)
Exports from OECD and ROW (gross)	10.7
Imports by OECD and ROW (gross)	16.7
Exports from selected LDCs	2.2
Imports by selected LDCs	-3.8
Expansion in LDC food production	7.0

<sup>68</sup> International Food Policy Research Institute, *Food Needs of Developing Countries: Projections of Production and Consumption to 1990*. Research Report No. 3 (Washington, D.C.: IFPRI, 1977).

<sup>69</sup> Hans Linnemann, Jerrie de Hoogh, Michiel A. Keyzer, and Henk D. J. van Heemst, *MOIRA—Model of International Relations in Agriculture* (Amsterdam: North-Holland, 1979); and Keith Campbell, *Food for the Future: How Agriculture Can Meet the Challenge* (Lincoln: University of Nebraska Press, 1979), p. 67.

<sup>70</sup> Domestic trade policies in LDCs themselves have sometimes been a strong factor limiting their agricultural growth. This has been documented for a number of countries in, for example, South America, such as Argentina (Lucio Rea, "Argentina: Country Cost Study of Agricultural Prices and Incentives," World Bank Staff Working Paper, International Bank for Reconstruction and Development, Washington, D.C., 1979 [Mimeographed]); Brazil (Affonso C. Pastore, "Exportações Agrícolas e Desenvolvimento Econômico," in *Ensaio sobre Política Agrícola Brasileira*, ed. A. Vega [São Paulo: Governo do Estado de São Paulo, Secretaria de Agricultura, 1979]); Colombia, (Jorge García García, "Exchange Rate, Commercial Policy and Agricultural Development: The Experience of Colombia from 1953 to 1978," [Washington, D.C.: International Food Policy Research Institute, forthcoming]; Chile, (Alberto Valdés, "Trade Policy and its Effect on the External Agricultural Trade of Chile 1945-1965," *American Journal of Agricultural Economics* 55 [May 1973]: 154-164).

<sup>71</sup> See International Food Policy Research Institute, *Food Needs of Developing Countries*. As defined in this paper, food includes 17 products comprising cereals and other major staples (that is, pulses, groundnuts, bananas, and potatoes). Each product is expressed in wheat equivalents according to its calorie content relative to wheat.

<sup>72</sup> That is, after adjusting for the reallocation effect of the expansion of export crops. However, given the inherent difficulty in handling empirically the interdependency issue, this conclusion may seem too strong.

Thus, aggregate availability of food does not decline for the LDCs as a whole because their increase in production (7 million tons) compensates for the net reduction in supply from the trade effect (sum of 2.2 and -3.8 million tons). World trade in food products increases considerably, primarily among the developed countries and the ROW group.

These results indicate that trade expansion arising from liberalization is not at the expense of agricultural development and food supply in LDCs, particularly if the net gain in LDC export revenues and welfare gains are considered. On the contrary, it is likely to stimulate more investment in and concern for agriculture in LDCs.

# 6

## CONCLUSIONS

To summarize the conclusions of this study, if developed countries were to reduce their level of agricultural protection by 50 percent, export earnings of the 56 LDCs would increase by at least \$3 billion a year over and above trend growth. This represents an annual increase of approximately 11 percent of total LDC agricultural exports in 1975-77. Viewed in another light, the addition of \$3 billion in export receipts would finance 39 percent of LDC cereal imports. This potential gain in export revenues to LDCs from trade liberalization equals the total volume of agricultural aid to low-income countries from all sources. In 1977 this aid was estimated to be approximately \$3 billion.<sup>73</sup>

The hypothetical reduction in trade barriers by the OECD would result in an increase of approximately \$8.5 billion per year in world trade. Some of the increased import demand would be met by developed countries such as the United States, Canada, and Australia, and some would be met by the ROW exporters. Approximately 36 percent of this expansion would accrue to the selected LDCs, 20 percent to developed-country exporters, and 44 percent to the exporters from the ROW.

Among the OECD members the major increases in the value of imports occur in Japan (\$1.6 billion), Germany (\$1.5 billion), the United Kingdom (\$1.5 billion), and Italy (\$1.4 billion). The major increases in exports occur in the United States (\$2.1 billion), Canada (\$0.5 billion), Australia (\$0.5 billion), New Zealand (\$0.1 billion), and Sweden (\$0.1 billion). France and Italy experience a substantial reduction in exports.

Looking at LDCs as exporters only, the potential gains to LDCs under the liberalization scheme represent an increase in real income of approximately \$1 billion a year.<sup>74</sup>

This is equivalent to about one third of the gains in export revenues. The difference represents the cost of the domestic resources used to generate the additional exports.

There are potential welfare losses arising from increases in the world price of imports that would follow trade liberalization. The welfare losses to the lowest-income LDCs from liberalization originate predominantly in the cereal market, mainly from wheat. If absolutely no change in the volume of LDC agricultural imports were assumed in response to the higher world prices, the current protectionist policies of developed countries would be "saving" approximately \$660 million per year in foreign exchange for the selected LDCs. However, the calculated import demand elasticity for most of the commodities is greater than unity. Thus, as the results indicate for the 56 LDCs, after trade liberalization there is a reduction in the value of LDC imports of approximately \$700 million per year. Although it does save foreign exchange, it is clearly a welfare loss to LDCs of approximately \$580 million.

The study does not consider the issue of the cost of protection to developed countries, such as the income transfer from the non-agricultural sectors, higher prices to consumers, and the resource costs. This issue has been explored by other researchers whose evidence indicates that developed countries would benefit the most from trade liberalization. In fact, potential gains to LDCs could be viewed merely as side benefits of the gains to developed countries. Neither does the study take into consideration the viewpoint that some of the difficulties LDCs experience in export markets are of their own making. This is indicated by wide differences in the export performances of LDCs facing similar world market conditions.

Although these issues are relevant, apart

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<sup>73</sup> Willy Brandt, *North-South: A Programme for Survival* The Report of the Independent Commission on International Development Issues under the Chairmanship of Willy Brandt (London: Pan World Affairs Books, 1980), p. 93.

<sup>74</sup> Conversely, protection of agricultural producers in developed countries has resulted in an income transfer from LDCs to developed countries for those products for which the two groups compete.

from the high cost imposed on developed-country consumers, and with the exception of the wheat market where LDCs are net importers, it is clear that protection adopted by developed countries directly hurts most of the developing countries by reducing their opportunity to earn foreign exchange and to increase their income through expanded trade.

The numerical results of this study should be viewed as only the minimum effects of trade liberalization. For many commodities, especially semiprocessed products, existing trade patterns are so distorted by the current protection systems of developed countries that the base-year net import levels on

which the analysis is based are often artificially low, or even zero. And many nontariff barriers could not be quantified and were thus excluded.

Furthermore, it would be erroneous to assume that the gains to LDCs as delineated in this study are the only real gains from a permanent reduction of trade restrictions. Permanently reducing trade barriers would lead the LDCs to develop new export products, including the expansion of their own processing operations. In addition, it would probably encourage LDCs to concentrate more resources on increasing agricultural production.

## APPENDIX 1

### SOURCES FOR ESTIMATES OF TOTAL PROTECTION LEVELS AND TARIFF EQUIVALENTS OF NTBS

Estimates for protection levels and the tariff equivalent of NTBs were arrived at after examining a number of sources. The primary references, however, were:

General Agreement on Tariffs and Trade. Document COM.AG/W/68/Add.3.

Cline, William R.; Kawanabe, Naboru; Kronsjo, Tom; and Williams, Thomas. *Trade Negotiations in the Tokyo Round. A Quantitative Assessment*. Washington, D.C.: The Brookings Institution, 1978.

The major source for data on protection rates in the European Community was:

Sampson, Gary and Yeats, Alexander. "An Evaluation of the Common Agricultural Policy as a Barrier Facing Agricultural Exports to the European Economic Community." *American Journal of Agricultural Economics* 59 (February 1977): 99-106.

Other sources are listed below.

On Japan's protection rates: Bale, Malcolm and Greenshields, Bruce. "Japanese Agricultural Distortions and their Welfare Value." *American Journal of Agricultural Economics* 60 (February 1978).

On beef protection rates in Japan: Hayami, Yujiro. "Trade Benefits to All: A Design of Beef Imports Liberalization in Japan." *American Journal of Agricultural Economics* 61 (May 1979): 342-347.

On U.S. protection rates: Bell, Harry H. *Some Domestic Price Implications of U.S. Protective Measures*. Report to the President of the Commission on International Trade and Investment Policy, Washington, D.C., July 1971.

On Europe's protection rates: Borrmann, Axel; Borrmann, Christine; and Stegger, Manfred. "The Impact of the Generalized System of Preferences on Imports." *Intereconomics* 14 (September/October 1979): 221-225; and Jabara, Cathy L. and Brigida, Alan S. *Variable Levies. Barriers to Grain Imports in France, the Netherlands, Federal Republic of Germany, and United Kingdom*. Foreign Agricultural Economics Report No. 156. Washington, D.C.: U.S. Department of Agriculture, March 1980.

On Canadian protection rates: Dauphin, Roma. *The Impact of Free Trade in Canada*. Ottawa: Economic Council of Canada, 1978.

On the Lomé Convention: Harris, S.; Parris, K.; Ritson, C.; and Tollens, E. "The Lomé Convention and the Common Agricultural Policy." The Centre for European Studies, Wye College, Ashford, Kent, England, 1978. (Mimeographed.)

General information:

Department Federal de l'Economie Publique. *La Vie Economique*. January 1977.

European Economic Community. *Marches Agricoles*, various issues.

McQueen, M. "Trade Preferences for Developing Countries versus Most Favored Nation Tariff Reductions: An Appraisal of the EEC Schemes." *Journal of Agricultural Economics* 30 (September 1979): 345-360.

Wipf, Larry. "Tariffs, Nontariff Distortions and Effective Protection in U.S. Agriculture." *American Journal of Agricultural Economics* 53 (August 1971): 423-430.

## APPENDIX 2

### SUPPLEMENTARY TABLES

Table 7—Calculated world price increases from trade liberalization and basic elasticities

Commodity	Price Increase	Domestic Supply and Demand Elasticities	World Elasticity	
			Export Supply	Import Demand
	(percent)			
Raw sugar	7.7	0.4	1.77	1.13
Refined sugar	6.2	0.4	6.27	4.66
Beef and veal	6.8	0.4	5.56	4.16
Green coffee	2.3	0.2	0.34	0.20
Wine	15.7	0.2	1.63	2.80
Tobacco	3.4	0.4	3.14	0.79
Maize	2.1	0.4	2.67	1.12
Wheat	4.9	0.4	1.06	2.08
Soy cake	5.0	0.4	1.66	1.41
Cocoa butter oil	9.0	0.6	0.99	2.50
Pork	8.8	0.4	10.00	6.20
Tea	2.7	0.4	0.83	0.56
Molasses	8.8	0.4	1.40	0.96
Palm oil	2.9	0.4	0.69	0.44
Cocoa beans	1.6	0.2	0.35	0.21
Copra oil	4.6	0.4	1.05	1.01
Roast coffee	10.8	0.6	7.83	4.23
Olive oil	6.8	0.4	2.11	2.00
Potatoes	6.0	0.4	8.90	7.60
Soybeans	1.0	0.4	1.90	0.51
Soy oil	3.4	0.4	4.33	0.91
Barley	7.6	0.4	2.76	3.14
Coffee extracts	6.4	0.6	0.75	1.38
Apples	7.8	0.4	3.10	3.70
Groundnut oil	5.1	0.4	0.97	0.92
Grapes	7.3	0.4	9.46	3.04
Cocoa paste cake	11.0	0.6	0.66	0.99
Wheat flour	7.4	0.4	5.79	3.10
Cocoa powder	14.1	0.6	2.14	0.80
Bananas	1.6	0.4	1.73	0.45
Milled rice	0.4	0.2	1.80	3.39
Groundnut cake	3.4	0.4	1.13	0.55
Beef preparations	3.8	0.4	0.56	0.69
Mutton and lamb	4.2	0.4	1.76	1.61
Oranges	1.6	0.4	5.21	0.48
Copra cake	8.1	0.4	0.66	0.67
Malt	13.4	0.8	4.80	1.29
Beans, dry	2.1	0.4	2.50	1.57
Groundnuts, shelled	0.7	0.4	4.31	0.53
Chicken	2.5	0.4	12.60	4.81
Sugar, confectionary	9.2	0.8	1.77	0.79
Castor oil	3.7	0.4	0.69	0.58
Lemons and limes	3.7	0.4	3.26	2.24
Oats	8.4	0.4	6.93	2.39
Sorghum	0.6	0.4	1.65	1.42
Copra	0.8	0.4	2.43	0.45
Sunflower cake	5.7	0.4	0.95	0.84

**Table 8—Sugar and derivatives: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues <sup>a</sup>	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
Region			
Sub-Saharan Africa	23.7	30.3	2.2
Asia	370.2	23.1	34.2
North Africa/Middle East	4.0	30.5	0.4
Latin America	683.4	33.8	63.2
Income Group			
Low income	202.0	37.4	18.7
Middle and higher income	879.3	27.7	81.3
Total selected LDCs	1,081.2 <sup>a</sup>	29.1	

Note: Of the increased LDC export revenues in this group, raw sugar accounts for 63.1 percent; refined sugar, 30.8 percent; molasses, 4.6 percent; and confectionary sugar, 0.7 percent.

<sup>a</sup> The OECD countries as a whole would receive \$509.9 million and the rest of the countries as a whole would receive \$1,103.6 million of the remaining additional export revenues for this commodity group.

**Table 9—Beverages and tobacco: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
Region			
Sub-Saharan Africa	17.3	4.9	4.9
Asia	101.1	8.6	28.7
North Africa/Middle East	129.7	26.6	36.8
Latin America	104.3	18.4	29.6
Income group			
Low income	98.4	7.3	27.9
Middle and higher income	253.8	20.5	72.1
Total selected LDCs	352.4 <sup>a</sup>	13.6	

Note: Of the increased LDC export revenues in this group, wine accounts for 45.7 percent; tobacco, 39.6 percent; tea, 14.4 percent; and cigarettes, 0.3 percent.

<sup>a</sup> The OECD countries would receive \$69.1 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$542.3 million.

**Table 10—Meats: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	13.3	62.9	4.0
Asia	13.7	89.1	4.1
North Africa/Middle East	3.9	47.6	1.2
Latin America	304.7	42.6	90.7
<b>Income group</b>			
Low income	17.0	61.3	5.1
Middle and higher income	318.7	43.5	94.9
Total selected LDCs	335.8 <sup>a</sup>	44.2	

Note: Of the increased LDC export revenues in this group, beef and veal account for 72.5 percent; pork, 15.2 percent; beef preparations, 4.5 percent; and mutton and lamb, 4.0 percent.

<sup>a</sup> The OECD countries would receive \$154.1 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$883.7 million.

**Table 11—Coffee: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	66.3	2.9	23.9
Asia	17.1	3.5	6.2
North Africa/Middle East	0.2	6.5	0.1
Latin America	193.7	4.5	70.0
<b>Income group</b>			
Low income	62.8	2.9	22.7
Middle and higher income	214.4	4.3	77.3
Total selected LDCs	277.2 <sup>a</sup>	3.9	

Note: Of the increased LDC export revenues for this group, green coffee accounts for 75.8 percent; roasted coffee, 13.7 percent, and coffee extracts, 10.4 percent.

<sup>a</sup> The OECD countries would receive \$27.1 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$40.6 million.

**Table 12—Total cereals: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	6.1	17.1	2.4
Asia	27.2	1.9	10.8
North Africa/Middle East	30.4	28.9	12.0
Latin America	188.9	9.8	74.8
<b>Income group</b>			
Low income	15.7	2.7	6.2
Middle and higher income	237.0	8.0	93.8
<b>Total selected LDCs</b>	<b>252.7<sup>a</sup></b>	<b>7.1</b>	

Notes: Includes wheat and coarse grains. See Appendix 2, Tables 13 and 14.

Of the increased LDC export revenues for this group, maize accounts for 33.0 percent; wheat, 31.1 percent; barley, 11.6 percent; and wheat flour, 10.0 percent.

<sup>a</sup> The OECD countries would receive \$1,388.9 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$197.6 million.

**Table 13—Wheat: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	0.0	0.0	0.0
Asia	0.0	0.0	0.0
North Africa/Middle East	6.9	67.5	6.6
Latin America	97.0	15.8	93.4
<b>Income group</b>			
Low income	0.0	0.0	0.0
Middle and higher income	103.8	16.6	100.0
<b>Total selected LDCs</b>	<b>103.8<sup>a</sup></b>	<b>16.6</b>	

Notes: See also Appendix 2, Table 12.

Of the increased LDC export revenues for this group, wheat accounts for 75.7 percent and wheat flour, 24.3 percent.

<sup>a</sup> The OECD countries would receive \$566.1 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$83.2 million.

**Table 14— Coarse grains: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	5.0	16.5	3.9
Asia	11.7	3.8	9.1
North Africa/Middle East	22.5	67.3	17.6
Latin America	88.7	7.3	69.3
<b>Income group</b>			
Low income	7.0	16.4	5.5
Middle and higher income	121.0	7.8	94.5
<b>Total selected LDCs</b>	<b>127.9<sup>a</sup></b>	<b>8.1</b>	

Notes: See also Appendix 2, Table 12.

Of the increased LDC export revenues for this group, unmilled maize accounts for 65.2 percent; unmilled barley, 22.9 percent; unmilled oats, 4.8 percent; and sorghum, 4.6 percent.

<sup>a</sup> The OECD countries would receive \$830.0 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$103.8 million.

**Table 15— Vegetable oils: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	30.3	9.9	14.7
Asia	88.2	6.6	42.9
North Africa/Middle East	35.9	23.0	17.5
Latin America	51.1	7.9	24.9
<b>Income group</b>			
Low income	31.3	9.3	15.2
Middle and higher income	174.1	8.3	84.8
<b>Total selected LDCs</b>	<b>205.4<sup>a</sup></b>	<b>8.4</b>	

Note: Of the increased LDC export revenues for this group, palm oil accounts for 21.2 percent; copra oil, 19.8 percent; olive oil, 17.6 percent; and soy oil, 14.7 percent.

<sup>a</sup> The OECD countries would lose \$3.6 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$85.6 million.

**Table 16—Cocoa: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	82.2	4.6	56.0
Asia	1.4	4.1	1.0
North Africa/Middle East	0.0	0.0	0.0
Latin America	63.2	10.3	43.0
<b>Income group</b>			
Low income	10.8	5.3	7.4
Middle and higher income	136.1	6.1	92.6
<b>Total selected LDCs</b>	<b>146.9<sup>a</sup></b>	<b>6.1</b>	

Note: Of the increased LDC export revenues for this group, cocoa butter oil accounts for 38.5 percent; cocoa beans, 27.8 percent; cocoa paste cake, 18.9 percent; and cocoa powder, 14.8 percent.

<sup>a</sup> The OECD countries would lose \$10.2 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$13.0 million.

**Table 17—Vegetable oil cakes: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	3.3	5.8	2.8
Asia	26.5	11.1	22.8
North Africa/Middle East	3.3	15.4	2.8
Latin America	83.1	8.3	71.5
<b>Income group</b>			
Low income	20.7	10.2	17.8
Middle and higher income	95.5	8.6	82.2
<b>Total selected LDCs</b>	<b>116.2<sup>a</sup></b>	<b>8.8</b>	

Note: Of the increased LDC export revenues for this group, soy cake accounts for 66.8 percent; groundnut cake, 13.8 percent; copra cake, 11.0 percent; and sunflower cake, 4.4 percent.

<sup>a</sup> The OECD countries would receive \$180.6 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$7.7 million.

**Table 18—Temperate-zone fruits and vegetables: LDCs' share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	0.5	74.7	0.5
Asia	8.4	78.7	8.3
North Africa/Middle East	37.6	47.9	37.3
Latin America	54.4	31.4	53.9
<b>Income group</b>			
Low income	30.9	62.7	30.6
Middle and higher income	70.0	32.8	69.4
Total selected LDCs	100.9 <sup>a</sup>	38.4	

Note: Of the increased LDC export revenues for this group, potatoes account for 32.6 percent; apples, 28.6 percent; grapes, 28.2 percent; and pears, 9.7 percent.

<sup>a</sup> The OECD countries would receive \$157.4 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$403.5 million.

**Table 19—Oilseeds and oil nuts: LDCs share of increased foreign exchange revenues from trade liberalization by region and income group**

Region/Income Group	Increase in Export Revenues	Increase as Percentage of Initial Export Revenues	Distribution of Total LDC Increase in Revenue
	(U.S. \$ million 1977)	(percent)	(percent)
<b>Region</b>			
Sub-Saharan Africa	5.9	3.4	10.6
Asia	12.2	3.1	21.7
North Africa/Middle East	3.9	1.5	7.0
Latin America	34.0	3.5	60.7
<b>Income group</b>			
Low income	10.5	2.9	18.7
Middle and higher income	45.5	3.2	81.3
Total selected LDCs	56.0 <sup>a</sup>	3.1	

Note: Of the increased LDC export revenues for this group, soybeans account for 57.2 percent; shelled groundnuts, 20.4 percent; copra, 9.8 percent; and palm kernel nuts, 2.9 percent.

<sup>a</sup> The OECD countries would receive \$163.5 million in additional export revenues for this commodity group; the rest of the countries as a whole would receive \$17.8 million.

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