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Michael V. Martin

The world sugar market does not perform in a perfect competitive setting. This research has applied a new framework to analyze the impacts of liberalization in international trade in sugar. The current round of GATT negotiation has placed agricultural trade reform on top of the list. Trade in sugar will undoubtedly be affected by the outcome of the negotiation due to the substantial protection practiced by several governments.

International trade in sugar is characterized by two separate types of market: special arrangement market and free market. The law of one price does not hold in world trade in sugar. A spatial equilibrium model cannot explain the rigidity in trade flows. Thus this research proposes to use the Export Side International Trade (ESIT) model to determine equilibrium prices and trade flows. The ESIT model maintains the rigidity of trade flows consistent with an Armington type model but does not require importing country prices data.

The equilibrium in this model is determined by solving the excess supply and export demand functions in each exporting country.

The protection or trade distortion policies in this research are captured by the concept of producer subsidy equivalent (PSE) and consumer subsidy equivalent (CSE). Applying the ESIT model to data on prices, trade flows, and removals of PSE and CSE at 1986 levels reveals that developing countries, not including Cuba, would expand their sugar economies by half a million metric tons a year. The gain in foreign exchange earnings for these countries would be in the magnitude of $170 million annually. The developed countries' sugar economies would contract by three million metric tons a year.

The study identifies two developing countries from ASEAN, the Philippines and Thailand, as the major gainers both in terms of increases in export volume and exchange earnings.

In conclusion, the study provides timely and valuable insights for formulating more informed planning in trade negotiations. The findings concerning contraction in the sugar sectors of the developed countries suggest reallocating of their resources to other areas to achieve economic efficiency. The liberalization in sugar trade could help the developing countries meet their foreign debt obligations. Expansion in employment and income redistribution to rural areas would result in these countries as well.

An Economic Analysis of the Country Specific Impacts of Freer International Trade in Sugar

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CHAPTER I

INTRODUCTION

The current negotiation of the General Agreement on Tariffs and Trade (GATT) known as the Uruguay round, which began in 1986, has placed agriculture as the principal item on the agenda. This forum of multilateral trade negotiation (MTN) aims at eliminating or reducing protection and trade distortion policies in international commerce. Unlike the previous seven rounds, agricultural trade reform is of particular concern in this new sequence of talks. Huge production and export subsidies in agriculture are the vital issues to be tackled by negotiators.

It is the best interests for the world communities that all existing agricultural trade barriers be removed. Agriculture is the major source of foreign exchange earnings for most of the developing countries. Removal of protection in agriculture by the industrialized economies would help the developing countries strengthen their positions in servicing foreign debt obligations. This in turn would create bigger demand in goods and services from the developed countries. This argument is an idealistic view for the whole world as a united community. In reality, special interest and political pressure groups make it a formidable task to reach a legitimate solution.

Prospect of Agricultural Trade Liberalization

The breakdown of the midterm review at Montreal in December 1988 of the current GATT talks affirms the difficulty in the area of agricultural reform negotiations. Clash over the issue of agricultural subsidies and barriers between the United States and the European Community (EC) caused a stalemate on overall talks. The U.S. stand on eliminating all trade-distorting agricultural domestic policies, barriers and subsidies by the year 2000 was opposed by the EC which offered partial lift of protection. The EC rejected complete domestic agricultural reform. The Cairns Group[1] has proposed a plan compatible to that of the U.S. but also called for immediate steps to reach the long-term target. The impasse on farm issues froze the progress on the previously reached tentative agreements on other areas including freer trade in services such as banking and insurance; and better protection of intellectual property such as copyrights and patents. Negotiators agreed to postpone any decision for the midterm review on all issues until April 1989 hoping to find a compromise on farm issues.

The deadlock in the midterm review is by no mean a suggestion that agricultural trade liberalization is impossible. At least two points indicate that agricultural trade reform is necessary. The first is the likelihood of trade wars in agriculture if no substantial progress in this area is made. The latter is the strong stand of many developing

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[1] The Cairns Group is a coalition of 14 agricultural exporters including developed and developing countries. They are Argentina, Australia, Brazil, Canada, Chile, Columbia, Fiji, Hungary, Indonesia, Malaysia, Philippines, New Zealand, Thailand, and Uruguay.

countries that depend largely on farm exports not to make concessions in other areas such as trade in services and intellectual property without freer trade in agriculture. The Cairns Group has called for a compromise between the U.S. and the EC to avoid failure of this round of GATT negotiations. These points helped to bring about the breakthrough of the stalemate in the second session of the midterm review at Geneva in April 1989. At this new session the U.S. and the EC have compromised over farm support issues and settled on the "substantial progressive reductions" principle in a time frame to be negotiated. This break of the deadlock paves the way to abolish or cut all farm protections including export subsidies, import restrictions and internal price supports. Negotiations down the road do not look easy but productive and advanced outcomes seem to be a possibility. This emphasizes the importance of following up its development.

Sugar is a primary example of the distorting effects national policies can have on international markets. World trade in sugar is known as one of the most protected. Conflicting problems between developing and developed countries are characteristic of the world sugar economy. Many developing countries throughout the world are dependent to some extent on sugar exports for their foreign exchange earnings. Sugar production is also a significant source of employment. According to Brown (1987), in cane producing countries it takes up to six workers per 10 hectare. In addition, returns to cane farmers in such countries as Brazil, Fiji, India, Indonesia, the Philippines, and Thailand are approximately double or triple over those of rice farmers. There are a number of bottlenecks worldwide for production and consumption to

respond to market conditions. Any progress toward international agricultural trade reform would definitely have a major impact on sugar enterprise.

Types of Markets in World Sugar Trade

This study utilizes export reports by the International Sugar Organization (ISO). According to Sugar Year Book of the ISO, 26,991,803 metric tons (MT) of sugar are exported out of total production of 100,222,165 MT in 1986. The proportion of international trade is about 27 percent of total production. There are two big groups among sugar exporting countries. The first is the "Big Four" which consists of Cuba, the EC, Australia, and Brazil. The second is called "The Group of Six" consisting of South Africa, Argentina, Dominican Republic, India, the Philippines, and Thailand. In 1986 India became a net importer. Sugar trade is, in general, conducted under two types of markets.

Special Arrangement Market

This type of trade is done under government-to-government arrangements. The contracting governments agree on quantity, time of delivery, other special conditions, and price. This price is in general not the world price and may have no relation to world price. Examples for this market are exports of Cuba to the socialist countries in eastern Europe (U.S.S.R., Poland, Czechoslovakia, Hungary, Romania, and Bulgaria) and also exports to Albania, China, Korea D.P.R., Vietnam, and

Yugoslavia. Another example is the exports to the EC under the term of Lome Convention[2] by some developing countries.

Free Market

Trade in sugar outside special arrangements belongs to this market. In 1986, the internationally traded quantity of 18,078,494 MT out of 26,991,803 MT occurred in this market. The free market is therefore approximately 67 percent of the total. The 33 percent share of the special arrangement market is considered to be substantial. Since the contracting governments can control the terms and conditions by special arrangements, the variabilities of structural supply and demand are thus transferred and adjusted for in the free market. This results in considerable volatility in free market prices which will be discussed to some extent later.

At present, governments of many exporting countries have a major role in controlling and organizing their domestic markets. The purpose of these actions is to insulate their countries from the fluctuations in the free market. Figure 1.1 shows the movements of sugar trade in special arrangement and free markets from 1980 to 1986. The trend indicates that trade in special arrangement markets has risen over time from 7.4 to 8.9 million MT from 1980 to 1986 respectively. On the other hand, a downward trend is found in the free market, with a decline from

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[2] Lome Convention is the agreement for economic cooperation and assistance of the EC to the third world known as the African, Caribbean, and Pacific (ACP) countries. The EC has agreement to import sugar from certain ACP nations at guaranteed quantity and price. Since the EC is a net exporter there is a possibility of leakage of some amount of sugar into the free market.

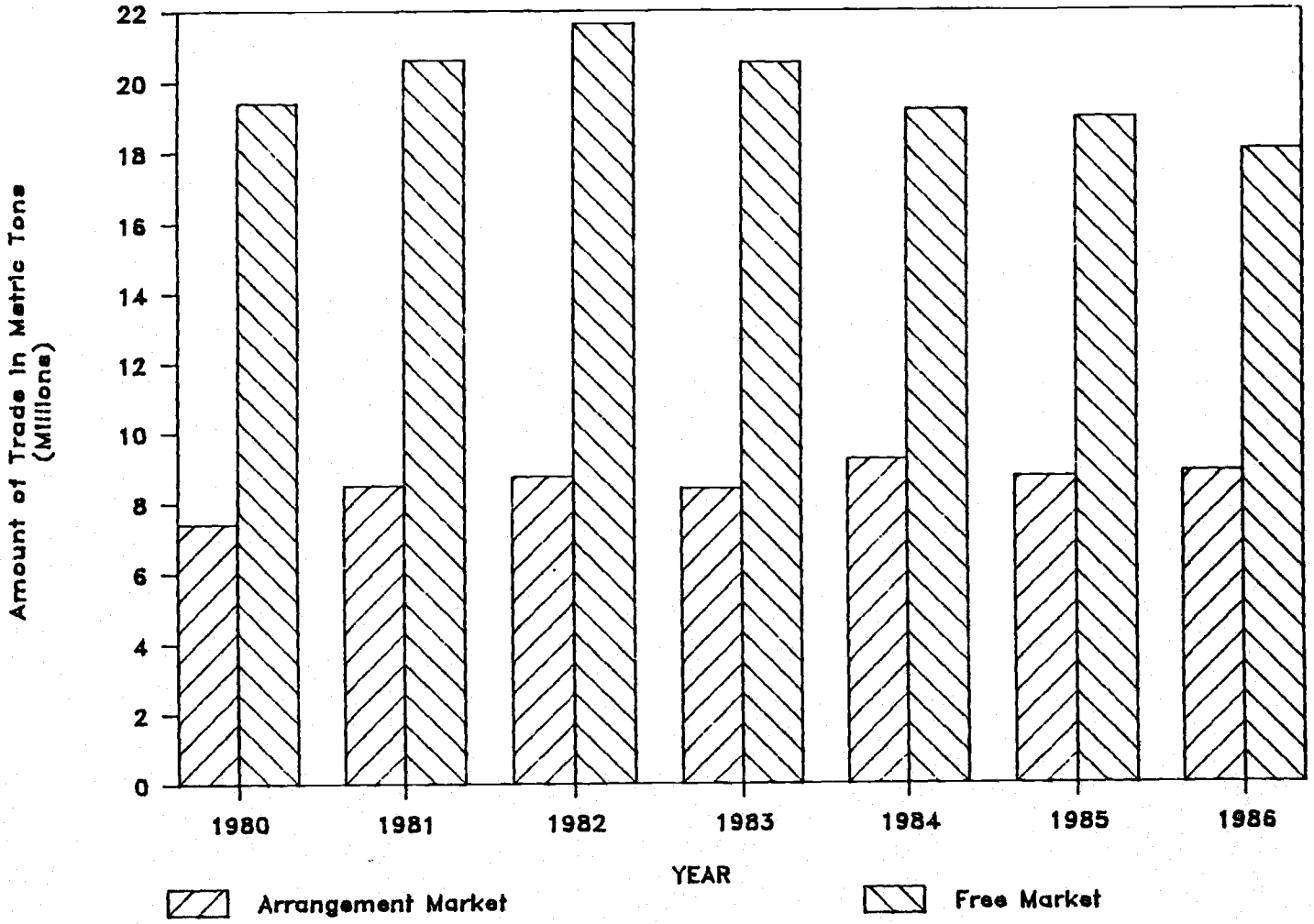

Figure 1.1. Sugar Trade in: Special Arrangement and Free Markets.

19.4 to 18.1 million MT during the same period. Figure 1.2 emphasizes the trends of the sizes of both markets. The size of the special arrangement market rose from 28 percent to 33 percent of the total international trade from 1980 to 1986. The free market size, on the contrary, is declining as shown by the 72 percent to 67 percent drop.

Magnitude of Government Intervention

Distortion in agricultural trade is now widely measured in terms of producer and consumer subsidy equivalent (PSE and CSE). They are the measures that capture the government intervention in the agricultural sector. These measures are valuable guides for negotiators at the current GATT talks to work their ways down to eliminating the protectionism.

A PSE (CSE) is the level of subsidy that would be required to compensate producers (consumers) in terms of revenue if the existing government support programs were abolished. Government support programs result in transfers to or from producers and/or consumers. In general, PSE is expressed as a ratio of the value of policy transfers to producers to the total farm income of producers. For CSE, such value of transfers is expressed as proportion of the total expenditure of consumers on agricultural products. The ratio expression thus permits comparisons of government protections across countries and across commodities. A positive PSE or CSE refers to government assistance while a negative value represents an implicit tax.

The approach of PSE/CSE is now widely used to measure the degree of government intervention in agriculture. The Organization for

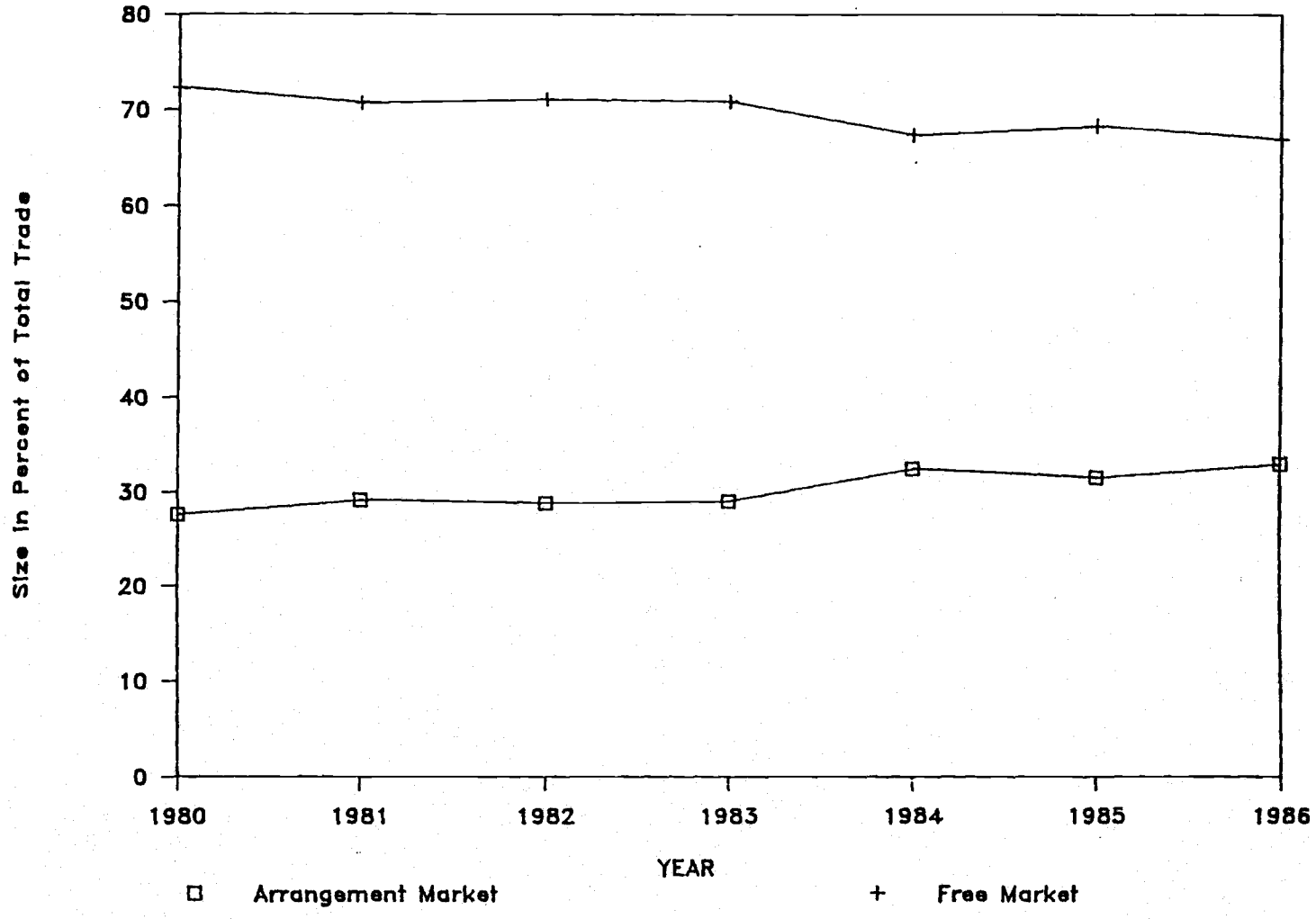

Figure 1.2. Size of Markets in: Special Arrangement and Free Markets.

Economic Cooperation and Development (OECD) has refined the techniques of estimation. It finds that PSE is the most appropriate measure for evaluating the effect of changes in government protection policies (OECD, 1987).

The Economic Research Service (ERS) of the USDA has studied and calculated PSE and CSE for various commodities in 16 countries and the EC. Sugar is one of the commodities studied, the result of which reveals significant government intervention in this enterprise. Figure 1.3 shows the magnitude of government assistance in sugar production as compared to other major commodities. The magnitude of PSE shown is the average over the period 1982-1986 for important trading countries. Sugar ranks very high in terms of government support, i.e. approximately 47 percent of producers' income is from policy transfers. The countries covered for the sugar study are Australia, Canada, EC(10),[3] Japan, Nigeria, South Africa, Taiwan, and the United States. The main categories of government intervention contributing to the size of policy transfers are price support, income support, input support, market support, and structural support. The details of these supports including those affecting CSE will be presented in the data section of Chapter III. The near top ranking in PSE for sugar supports the contention that agricultural trade reform may have a direct and significant impact on sugar trade.

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[3] EC(10) refers to the European Communities with ten member countries: Belgium, Denmark, France, West Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, and United Kingdom. In 1986, Portugal and Spain joined the Communities and where applicable the Communities will be referred to as EC(12).

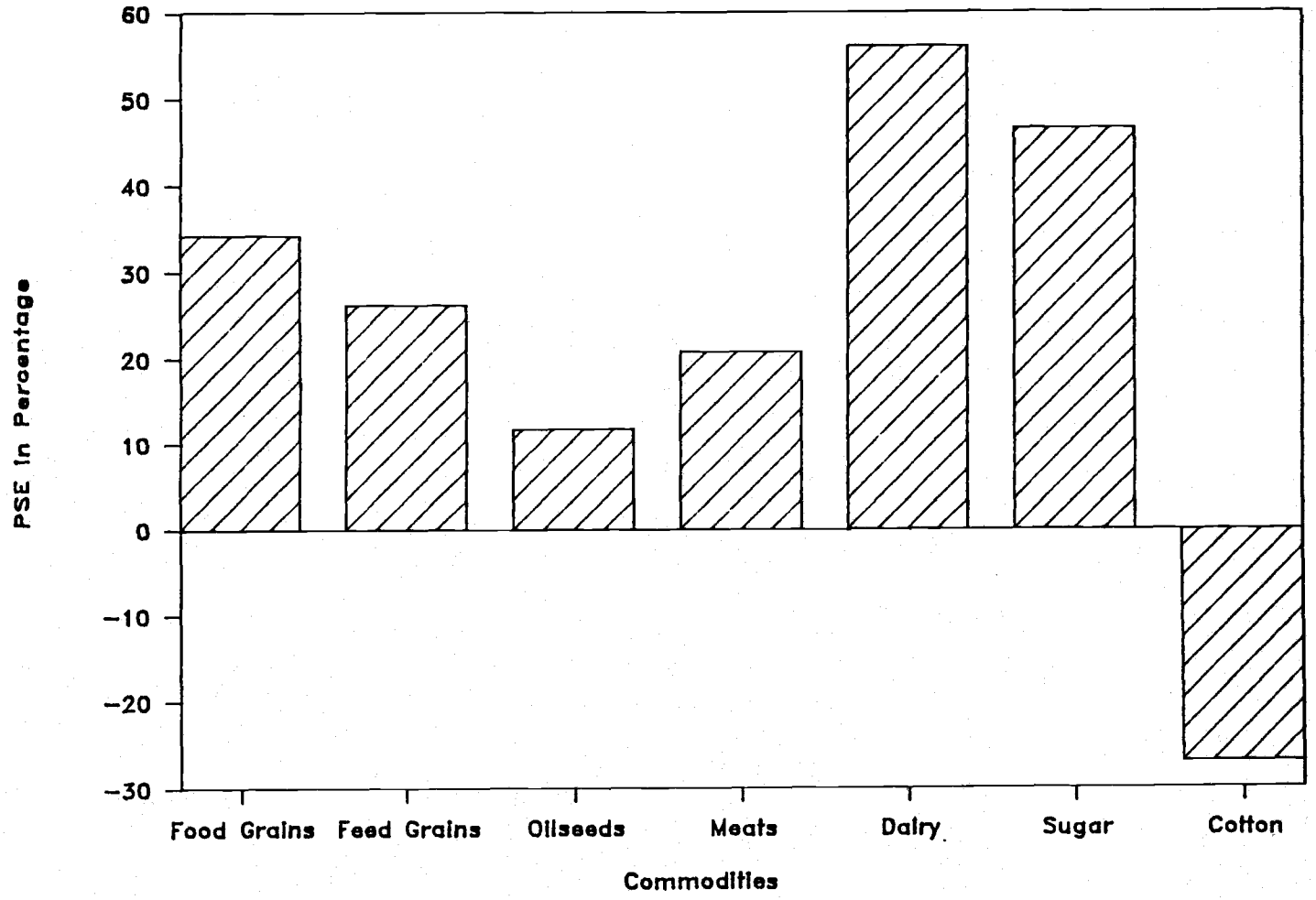

Figure 1.3. PSE of Major Commidities (Averaged over 1982-1986).

Comparisons of PSE for Sugar Across Countries

Figure 1.4 shows the level of averaged PSE over the period 1982-1986 in percentage among the eight sugar producing nations. Among the importing countries, the United States and Japan rank very high in terms of government support to producers. Approximately 77 percent of the U.S. producer income comes from policy induced transfers. The ratio is .72 in the case of Japanese producers (averaged for beet and cane sugar). Among the exporting countries, the EC(10) producers receive the highest support from government policies. The ratio is around .45.

Volatility of World Sugar Prices

The separation of the two types of sugar markets and the highly protective measures by most of the nations cause prices in the free market to fluctuate considerably. As previously discussed the free market functions as the residual market in which structural changes in supply and demand of sugar adjust themselves. Since the fluctuation in the free market is substantial many countries aim at utilizing more of the special arrangement market to smooth out returns to their sugar sector. Evidence in support of this argument is the declining trend of the size of the free market shown in Figure 1.2.

Figure 1.5 indicates clearly the fluctuations in the free market between the period 1979 to 1986. World prices used in this figure are the annual average I.S.A. (International Sugar Agreement) Daily Prices which are reported in the Sugar Year Book issued by the ISO. The I.S.A. Daily Price is the average of the New York Contract No.11 Spot Price and

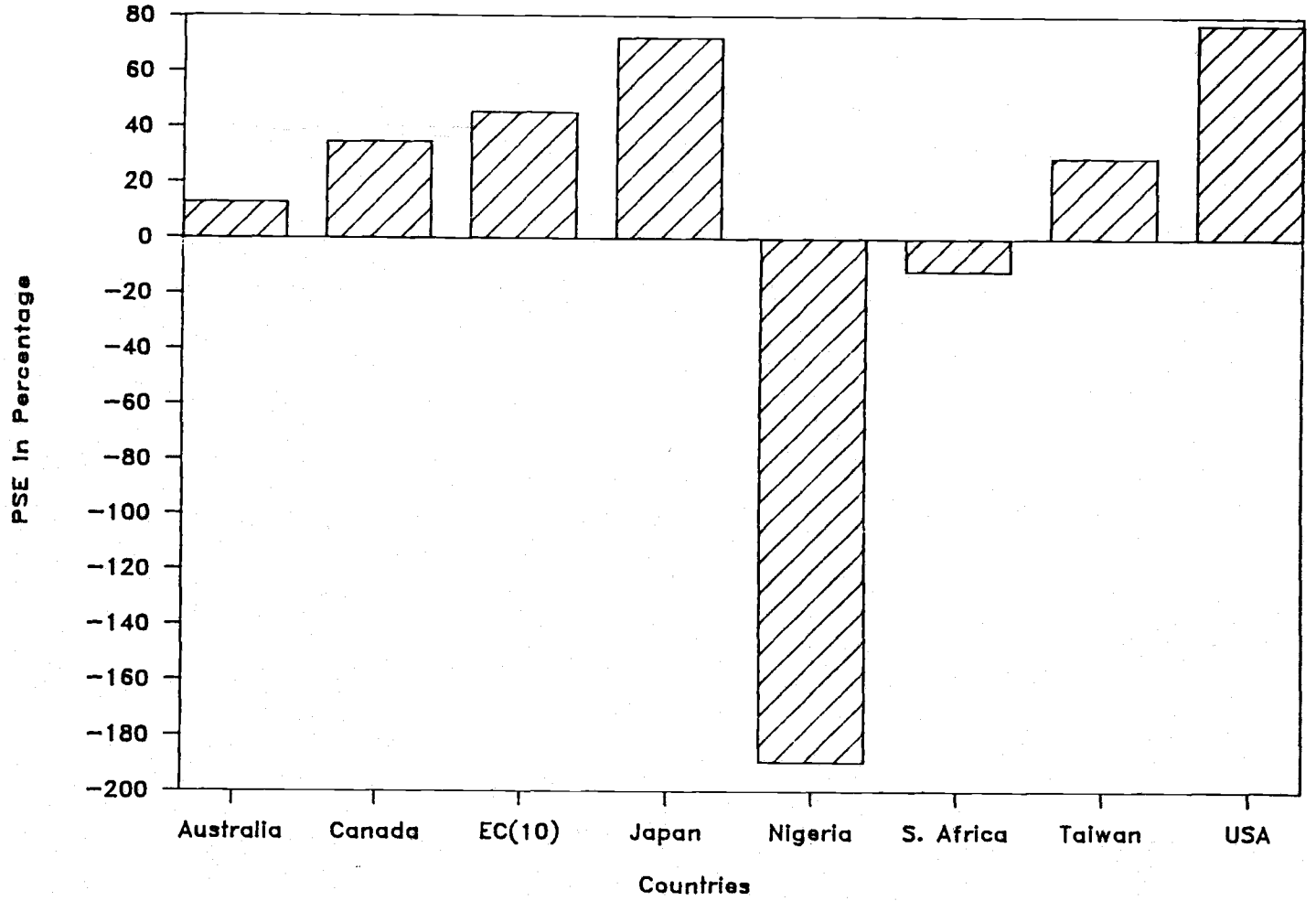

Figure 1.4. Sugar PSE of Some Countires (Averaged over 1982-1986).

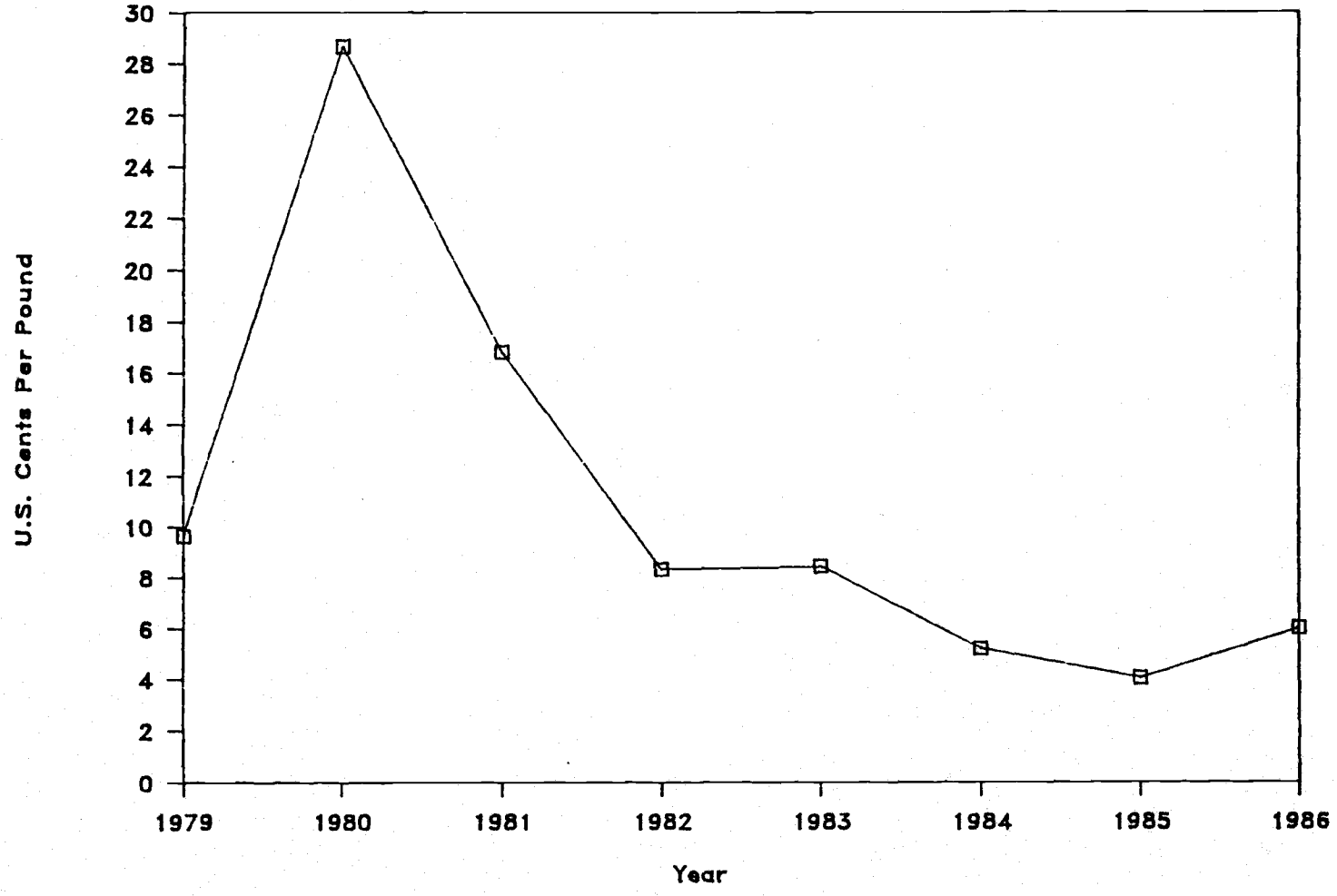

Figure 1.5. World Sugar Prices: Annual Averages for 1979-1986.

the London Daily Price, f.o.b. and stowed Caribbean Port. The price peak occurred in 1980 at 28.69 cents per pound. The low point came in 1985 at 4.06 cents per pound which is the lowest in the past 15 years.

Specific Problem Statement and Objectives

The sustained period of depressed world price and the seemingly pervasive spread of protectionism cause concern among all sugar producing countries. In international trade negotiation forum like GATT various agricultural producing countries strengthen their positions, such as the Cairns Group, and exert their influence for the needed agricultural trade reform. The linkage between negotiations on farm issues to other areas such as trade in services and intellectual property makes agricultural trade liberalization a real possibility.

The intriguing potential impact of agricultural trade reform on the sugar sector warrants analysis. The hypothesis of this study can be stated as follows. Theoretically, liberalization by a country has two kinds of impacts, domestic and international. Removal of protection policies for producers is expected to benefit domestic consumers and to be harmful to domestic producer through lower sugar prices. Internationally, it increases foreign producer welfare while foreign food consumers are worse off through a higher international price. This study proposes an economic analysis of the country specific impacts resulting from freer world trade in sugar. The research will examine the international effect of liberalization on sugar policies by major industrialized countries. In so doing, the research will address the following specific objectives:

1. Measure the impacts on foreign exchange earnings of exporting countries in the event of liberalization of sugar policies by the five industrialized countries: the United States, the EC(10), Canada, Japan, and Australia. This analysis focuses on multilateral liberalization as in the GATT context. An examination of unilateral liberalization will also be conducted. Emphasis will be on complete or 100 percent trade reforms but 20 and 50 percent scenarios of liberalization will also be provided.

2. Specific evaluation of the impacts of liberalization on developing exporting countries, such as Thailand, will also be studied. Thailand is the major exporter of sugar from ASEAN,[4] a group of countries dependent largely on agricultural trade. The specific impacts on farmers and sugar millers in Thailand will be examined.

The alternate goal of this study is to provide useful input for the policy and planning process. The results of the study should help trade negotiators in understanding the extent and the direction of reform impacts. This will facilitate the formulation of more fully informed proposals during negotiations.

The results from the unilateral reforms will be useful in bilateral talks outside the GATT forum. Such talks may be necessary for

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[4] ASEAN (Association of Southeast Asian Nations) was formed in 1967 to promote political and economic cooperation among the non-communist states in the region. Members are Brunei, Indonesia, Malaysia, Philippines, Singapore, and Thailand.

some countries in the interim period prior to a GATT multilateral settlement.

This study is a single commodity, partial equilibrium and comparative static analysis. It must be acknowledged from the outset that there will be limitations or qualifications for making inferences of the results.

General Procedures

To achieve the objectives discussed above, a model is needed to estimate the price and quantities in trade following liberalization. The primary incidence of the impacts on the exporting nations and the special characteristics of the world sugar market make the commonly used trade models in the literature inappropriate for this study. This research uses a model which determines equilibrium price and quantity in the export market, not the world market, for each exporting country. The equilibrium is determined by equating each exporting country's excess supply with export demand facing that country. Chapter II will discuss other trade models and point out the appropriateness of the model used in this research.

The new equilibrium price and quantity will be used to calculate the new foreign exchange earnings and hence the change in earnings of each exporting country. The winners and the losers from liberalization will be identified. Impacts on farmers and millers on Thailand will be assessed by means of comparing the change in unit revenue to unit cost of production.

Thesis Organization

Chapter II reviews the literature on commonly used trade models and discusses the theoretical framework for the model used in this research. Arguments for the selected model to the sugar market will be outlined. The methodology and data used for this study are discussed in Chapter III. Chapter IV presents the research results. Analysis of the country specific impact will also be given. Chapter V summarizes and gives conclusions of the findings. Appendices to this thesis show data used in the study. Some results requiring many pages of exposition are put in appendices. Derivations of elasticities of excess demand and excess supply together with that of export demand are also in an appendix.

CHAPTER II

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

This chapter will review trade models which have appeared in the literature in general. The theoretical groundwork for the model used in this research will be discussed. Arguments for the appropriateness of the chosen model to the international sugar market will be given. Finally, previous empirical works on liberalization of sugar policies will be examined.

International Trade Models

To appreciate the model used in this research, distinctions must be made between other trade models and the one applied here. Two major trade models involving bilateral flows commonly used in the literature are as follows.

Spatial Equilibrium Model

McCalla et al. (1986) identify the difference between spatial and nonspatial models. A nonspatial model gives only the total amount of imports or exports of the countries involved, whereas a spatial model also yields information on the trade flows from exporter A to importer B and others. Both types of models make use of excess supply and excess demand functions to solve for the solutions.

Samuelson (1952) proposes the idea of solving for the equilibrium price and trade flows in spatially separated markets using linear

programming. The algorithm proposed is to maximize net social pay-off (NSP). Smith (1963) introduces the dual to Samuelson's maximum problem by minimizing economic rent. Takayama and Judge (1964) shows that Samuelson's formulation can be converted to and solved by quadratic programming. Figure 2.1 demonstrates the spatial equilibrium model for the simple case of single commodity-two regions trade. The back-to-back diagram shows Region 1 as exporter and Region 2 as importer. D_1, S_1, D_2 and S_2 are regional demand and supply functions. ES_1 and ED_2 are excess supply and excess demand of Region 1 and Region 2 respectively. P_1^0 and P_2^0 are autarkic prices before trade in Regions 1 and 2 respectively. P_1^* and P_2^* are regional prices after trade, and t_{12} is transportation cost from Region 1 to Region 2.

Samuelson's maximization of net social pay-off in effect maximizes the difference between the areas under ED_2 and ES_1 minus the transportation cost. This can be represented graphically by areas: $P_2^0bao - P_1^0cao - P_2^*bcP_1^*$ (transportation cost = t_{12} * oa). This is equivalent to maximizing the areas of the triangles; $\Delta P_2^0bP_2^* + \Delta P_1^*cP_1^0$. Smith's formulation of minimizing economic rent is to minimize the areas $\Delta def + \Delta ghi$. The mechanism is the dual of Samuelson's maximization problem which yields exactly the same solutions of equilibrium prices and trade flow. The procedure is in effect to find the shortest distance for t_{12}, the transportation cost, which is the difference between the equilibrium prices in the two regions.

Mathematically, Samuelson's formulation can be written as:

$$\text{Max NSP} = \int_0^{ED_2} [D_2(Q_2)-S_2(Q_2)]dQ_2 - \int_0^{ES_1} [S_1(Q_1)-D_1(Q_1)]dQ_1 - t_{12}*ES_1$$

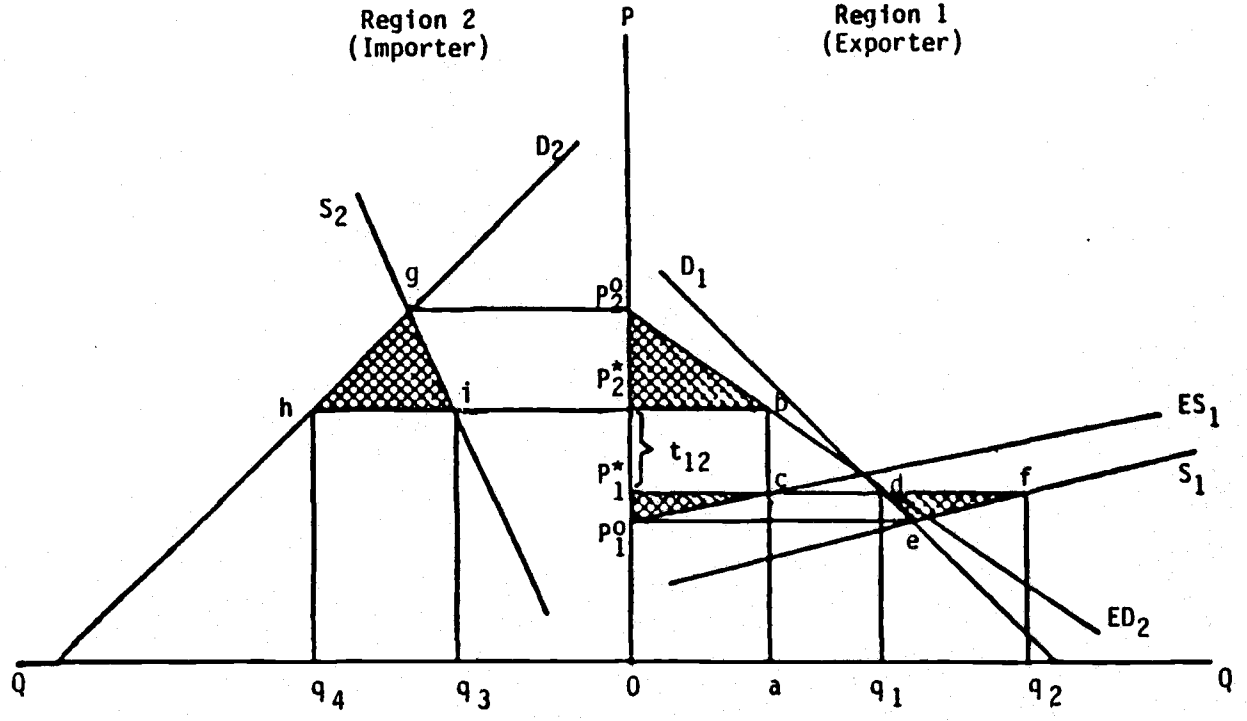

Figure 2.1. Spatial Equilibrium Model.

subject to: $ES_1 = ED_2$

Smith's specification of minimizing economic rent (ER) can be written as:

$$\text{Min ER} = R^0 + \int_{P_2^*}^{P_2^0} [D_2(P_2) - S_2(P_2)]dP_2 + \int_{P_1^0}^{P_1^*} [S_1(P_1) - D_1(P_1)]dP_1$$

subject to: $P_1^* - P_2^* + t_{12} \geq 0$

$$P_2^* - P_1^* + t_{21} \geq 0$$

where: $R_0 = R_1^0 + R_2^0$, which $R_i^0 = \int_{P_i^0}^{\infty} D_i(P_i)dP_i + \int_{0}^{P_i^0} S_i(P_i)dP_i$

t_{21} = transportation cost from Region 2 to Region 1.

The rationale behind the constraints is that the long run difference in prices between the two countries cannot be bigger than the unit transportation cost. If the constraints are not fulfilled, arbitrage would occur.

The specifications of both approaches can be validly generalized to n regions of trade. The world excess demand and supply functions are aggregated from individual importing and exporting countries respectively. The world price is determined in the international market from the intersection of aggregated excess demand and supply functions. The policy variables can be incorporated into the models as constraints, like the one of transportation cost.

The spatial equilibrium model is meant to apply to a purely competitive market. The product is homogenous and the economic agent responses immediately to price changes. The law of one price prevails

i.e. there is one equilibrium world price.

The algorithms of the model in minimizing transportation cost will give the solutions to achieve economic efficiency. The least expensive route in transporting goods will be filled first. Thus the flows or trade pattern are dictated by the magnitude of transfer costs. In reality, bilateral trade flows are determined by many other factors. Spatial equilibrium models cannot explain very well the trade flows in existence in the real world for certain products. In recent years researchers have turned to the use of what is known as the Armington model instead.

The Armington Model

The implication of the spatial equilibrium model discussed above is that products of the same kind from different countries are perfect substitutes to one another. Frequently, in the real world products exported by different regions are not homogenous. Armington (1969) presents a model that can deal with the existing behavior of importing countries in distinguishing products from different origins. Under his approach beef is a good while beef from different countries are different products. In this sense, beef from Argentina is a different product from beef from Australia in the viewpoint of the American importer. This model, thus, assumes only partial substitutability among products from different exporters. The bilateral trade flows are no longer influenced solely by transportation cost minimization but also by other factors such as quality differences, cultural and political ties.

For many agricultural products, different countries engage in

trade by long established arrangements. Many governments intervene in trade through national policies. These imperfect market characteristics give rise to trade flow rigidities. In a spatial equilibrium model a small change in transfer costs may cause the trade patterns to change completely because of the underlying assumptions of competitiveness including homogeneity. For an Armington-type model, the trade flows are not as quickly responsive to market shocks. The responses of trade flows to price changes are not immediate because the importers do not base buying decisions merely on cheapest sources of supplies.

Armington's process assumes weakly separable utility functions such that maximization of utility happens in two stages. In the first stage, an importing country j maximizes:

$$U_j = U(X_1, \ldots\ldots, X_k)$$

$$\text{subject to : } E_j = \sum_{t=1}^{k} X_t P_t$$

where: U_j = total utility in country j

X_t = a quantity index for good t

P_t = a price index for good t

E_j = total expenditure in country j

In this stage the maximizing process will yield an import demand for X_t of country j. Implicitly from the formulation of this stage, an import demand is estimated as a function of income, population, a traded-weighted index of world price for good t and prices of other

goods. From here the discussion will focus on one particular good of interest, hence the subscript t will be dropped. Import demand of country j for any good can be expressed as:

$$X_j = f_j(X_{ij}) = f_j(X_{1j}, X_{2j}, X_{3j}, \ldots\ldots, X_{mj})$$
$$i = 1, 2, \ldots, m$$

where i stands for exporting countries.

The expenditure on X_j is P_jX_j which can be expressed as $\sum_{i=1}^{m} P_{ij}X_{ij}$. X_{ij} is the country j's import demand for the product from i, and P_{ij} is the price of such product. The second stage of Armington's process is to minimize the cost of purchasing X_j determined in the first stage. Algebraically, the second stage can be written as:

$$\text{Minimize} \quad \sum_{i=1}^{m} P_{ij}X_{ij}$$

$$\text{subject to} \quad X_j = f_j(X_{1j}, X_{2j}, X_{3j}, \ldots\ldots, X_{mj})$$
$$i = 1, 2, \ldots, m$$

From this stage the demand for any product, X_{ij}, is determined. This is the trade flow for any particular product from country i to country j. The import demand function for a product can be expressed as:

$$X_{ij} = X_{ij}(P_{ij}, \ldots\ldots, P_{mj}, X_j)$$

To simplify the estimation process, Armington imposes the constant elasticity of substitution (CES) function on the import demand for the product. Two further assumptions are: 1) the elasticity of substitution

between any two products in each market is constant, and 2) this elasticity of any two products is equal to that of any other pair of products in the same market. With these assumptions, the import demand for a product can be expressed as:

$$X_{ij} = X_j b_{ij}^{\sigma_j} (P_{ij}/P_j)^{-\sigma_j}$$

where: b_{ij} = a constant

σ_j = elasticity of substitution in country j

P_j = average price for country j's imports i.e.

$= \Sigma P_{ij} X_{ij} / \Sigma X_{ij}$

This is, in effect, the estimation of each exporter's market share using relative prices of the products in the market.

The Armington model has been used in many occasions in agricultural trade analysis. Two examples are the followings. Dixit and Roningen (1986) apply an Armingtion-type model to the Static World Policy Simulation (SWOPSIM) framework in analyzing the impact of establishing a free trade area between two countries. Abbott and Paarlberg (1986) use the model to measure the impact of the 1980 grain embargo. The Armington model has a solid theoretical foundation. However, in the estimation process the restricted functional form of CES has to be utilized to avoid extreme problems of multicollinearity. Without this restriction the resulting econometric estimation will be very questionable. To avoid imposing such restriction this study

attempts to use an alternative model. This is also to avoid making the assumptions that sugar from the EC substitutes for sugar from Thailand in the U.S. market at the same rate and that this elasticity of substitution is constant.

Theoretical Framework of the ESIT Model

As discussed in Chapter I, international trade in sugar has unique characteristics with respect to the separation of the free market from the special arrangement market. Special arrangement market prices are vaguely related to those in the free market. Governments of most countries intervene in trade so that free market prices fluctuate considerably. All these phenomena apparently cause the existence of trade flow rigidities in sugar markets. The assumptions of a homogeneous product and a competitive market of the spatial equilibrium model are ruled out in this case by the government intervention. The need to find an appropriate magnitude of the constant elasticity of substitution for sugar is a drawback of the Armington model. One technical problem of using the Armington model for sugar trade will be nonexisting data about P_{ij}.

The alternative model which this research utilizes is the Export Side International Trade (ESIT) model developed by Kim (1989). Kim applies this model to world trade in wheat. The Armington-type model allocates trade flows to various exporters from the vantage point of the importers. Given the objectives of this study, the ESIT model is chosen for its focus on the exporter side. The spirit of the Armington's trade

flow rigidities is maintained in the ESIT model. The concept of excess demand and excess supply functions is also used as in the spatial equilibrium model. The ESIT model can thus be regarded as a hybrid of those two models.

The ESIT model is a single commodity model. The crux of the model is that the equilibrium occurs in each export market rather than in the international market as in the spatial equilibrium model. This is justified by the fact that the law of one price does not hold in the world sugar trade. The equilibrium prices are determined at the exporters' borders. Kim postulates a two step approach to the model.

Figure 2.2 demonstrates the first step, the linkage between the domestic markets and the international market. Graphically, this step is similar to that of the spatial equilibrium model. However, the international market in this case is used only to show the derivations of excess demand and excess supply functions and their movements from the shocks applied to domestic markets. The equilibrium does not occur there. With the original demand and supply, D_1 and S_1, in the importing and exporting countries, the excess demand and excess supply are ED_1 and ES_1 in the international market.

Suppose there is a policy shock in the sugar sector in the exporting country. An example of this shock may be the removal of a subsidy to sugar producers. The effect is similar to imposing an excise tax on producers which increases the cost of production. According to microeconomic theory, this would shift the exporting country's supply curve to the left to S_2 at the vertical magnitude of ab, the unit value of the subsidy (tax). This vertical magnitude can be converted to a

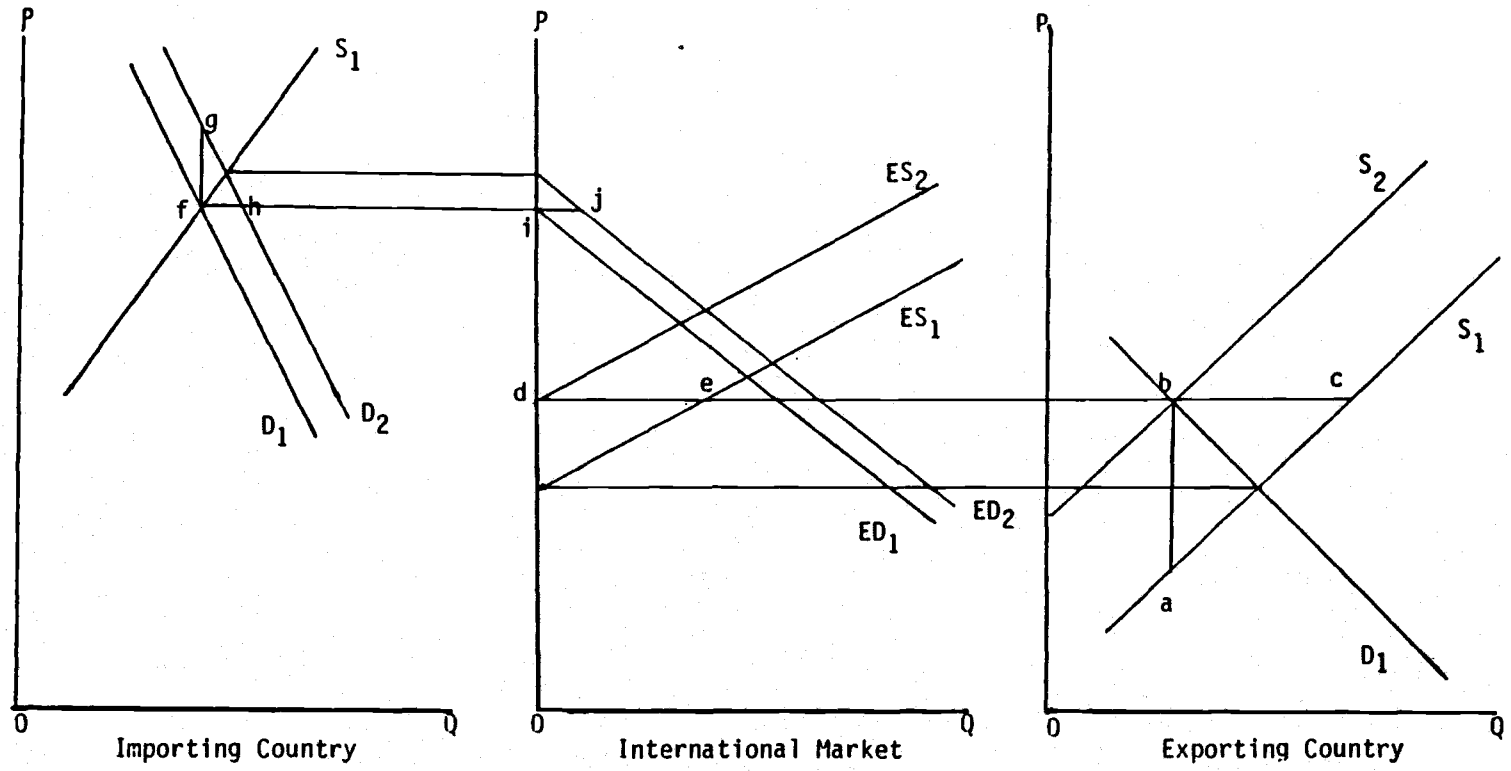

Figure 2.2. ESIT Model: Domestic vs International Markets.

horizontal shift, bc, by multiplying ab with the slope of the supply curve. The above policy shock transmits to the international market by shifting the excess supply to the left from ES_1 to ES_2. The horizontal magnitude of excess supply shift is de which is equal to bc. By the same token, a policy shock in the importing country that shifts domestic demand to the right would cause the excess demand to shift to the right in equal magnitude (fh = ij).

The second step in the process is the linkage between the international market and export markets. Figure 2.3 illustrates how the equilibrium occurs at each export market. Assume, for simplicity, that the world sugar market consists of one importing country and two exporting countries.

The export demand function facing the exporter A (XD_A) can be derived from ED - ES_B. Similarly, XD_B = ED - ES_A. The equilibrium occurs at the intersection of export demand and excess supply at each exporting country. Hence, the original equilibrium in exporter A market is at a, while it is at b in exporter B market. Now, suppose there is a policy change in the importing country shifting the domestic demand to the right. This would shift the excess demand in the same direction from ED to ED′. The export demand facing each exporting country would then shift in the same direction from XD_A to XD_A' and from XD_B to XD_B'. Furthermore, suppose there is policy shock in exporting country A shifting excess supply to the left from ES_A to ES_A'. This would cause export demand in exporter B market to shift further to the right to XD_B''. The final equilibria in the exporting markets would be a′ and b′, respectively.

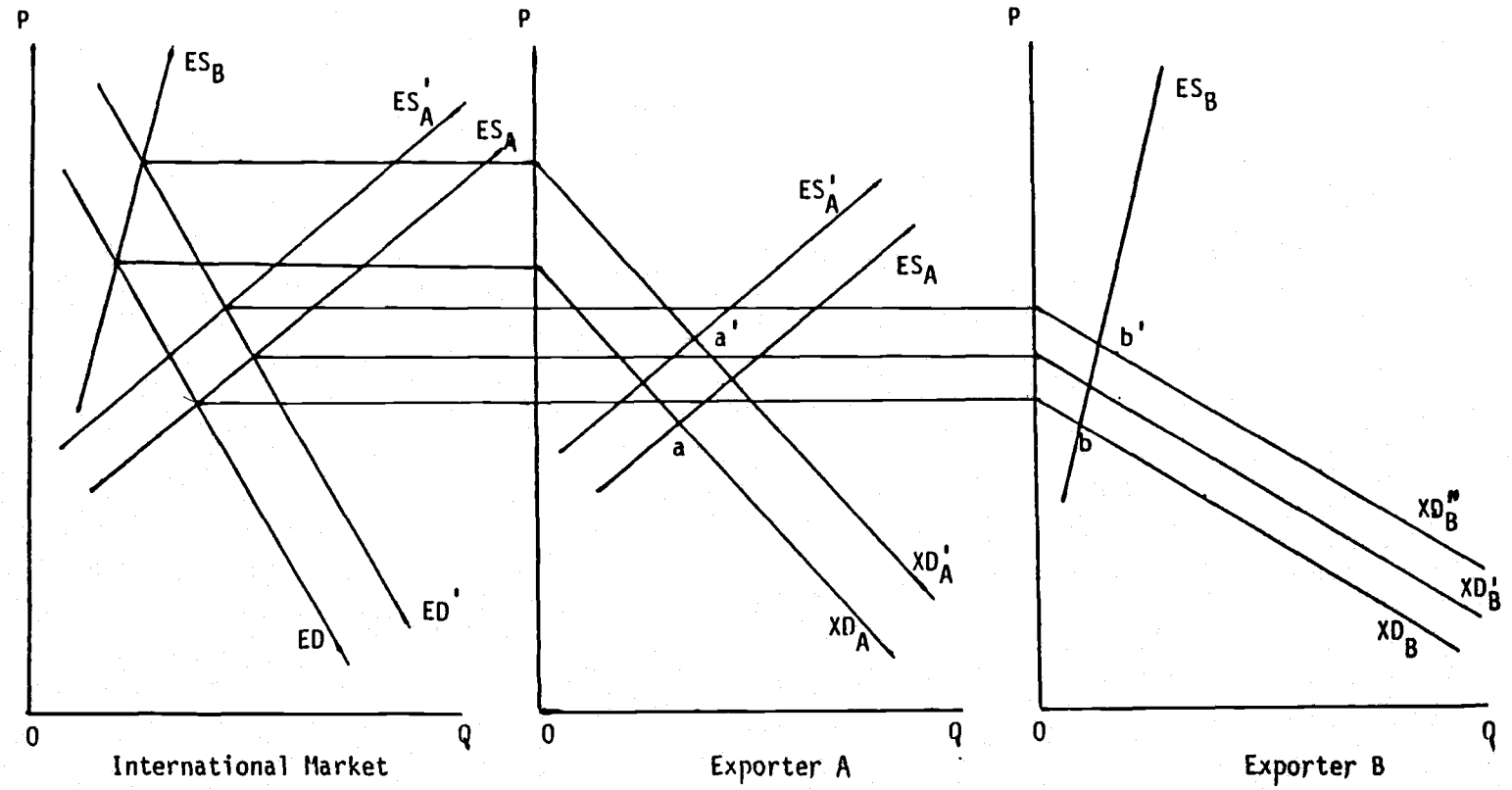

Figure 2.3. ESIT Model: Equilibriums in Exported Markets.

The unique characteristics of the ESIT model following from the focus on the exporter side make the model more applicable to the sugar problem. The model does not require price data for importing countries. The quantities or bilateral trade flows from an exporter to different importers are sufficiently reported. The price data of the type P_{ij} are not required. The model assumes each exporting country charges the same price to all importing countries. Since export price data are recorded in FOB (free on board) values, there is no need for data on transportation cost from regions to regions. Based on these characteristics and assumptions, the model will provide a tool for applied research concerning the world sugar market.

Previous Empirical Works on Sugar Trade Liberalization

The intensity of market distortions in sugar sector has been felt far beyond the current round of GATT talks. This is evidenced by some previous empirical studies on this matter many years ago. A diverse set of approaches has been used. Results are not directly comparable not only because of different methods used but also of different protection levels at the time of the studies.

Some works seek to quantify the impact of protectionism based on the single product setting while others attempt the general equilibrium analysis. Gemmill (1976) studies the world sugar economy using protection level existing in 1974. The policies included in the distortion set are: 1) U.S. quota of 4,882,000 tons and a 0.625 cent per pound tariff, 2) the EC levy on imported sugar at price less than 14.6172 cents per pound, 3) Cuban export quota of 2,745,000 tons to

communist countries, 4) the commonwealth export quota of 1,383,000 tons to the U.K., and 5) all other specific and ad valorem tariffs known to exist. Abolition of all these policies constitutes completely free world trade in sugar. The methodology used is a spatial equilibrium model.

According to prior arguments in this thesis, application of the spatial equilibrium model to the sugar problem is questionable. At that time the theory for trade flow rigidity, like the Armington process, may not have been well recognized. Gemmill's results assert that under complete liberalization, the free market price would increase from 7.76 to 10.85 cents per pound. The U.S. sugar imports would increase by 16 percent while the increase of import to the EC would be 103 percent. Unilateral trade liberalization by the U.S. and the EC would result in 24 and 23 percent contractions in their sugar industries respectively. In another report based on the same study, Gemmill (1977) discloses that unilateral free trade by the U.S. would benefit Cuba greatly. Three million tons of sugar would be imported from Cuba. This is not surprising because the algorithm of the spatial equilibrium model in minimizing transportation cost would naturally dictate such an outcome.

Trade liberalization study of a nonspatial equilibrium type can be found in Valdes and Zietz (1980). This study measures the impacts of a hypothetical 50 percent reduction in tariffs and nontariff barriers (NTBs) on 99 commodities by 17 developed countries of the Organization for Economic Cooperation and Development (OECD). The results indicate that such action with the protection level in 1975-1977 would increase world trade by $8.5 billion a year of which 36 percent go to 56 less

developed countries (LDC), 20 percent to OECD exporters, and 44 percent to the remaining countries.

The Valdes and Zietz study identifies that sugar is at the top of the list that would increase LDC export revenues. The magnitude of the increase would be $683 million in 1977 values (25.2 percent increase). The LDC share of total increase in world exports of sugar would be 42.9 percent. The findings also point out that sugar will be the most affected export commodity in 14 countries of the 56 LDCs. Due to this major impact on the sugar sector, Zietz and Valdes (1986) conduct another study with the 1979-1981 protection level. The distortion or protection level in this case is the amount of tariff and NTBs measured from the difference between domestic wholesale prices and border prices. With the assumptions of 0.6 for elasticity of domestic supply and -1.75 to -0.24 for elasticity of domestic demand, the world price would increase by 16.7 percent. This would increase foreign exchange earnings of LDCs by $2.75 billion at 1980 values. The greater magnitude of gain from the previous study implies an escalating distortion level during the period.

Another study by Landell Mills Commodities Studies (1987) constructs an econometric model of the world sugar market. The model is used to determine the world equilibrium price if all controls on the sugar market are removed. The report does not define clearly what constitutes such controls but tends to mix up or include the special arrangements or rigidity of trade among trading parties into the distortion or protection level. This is rather different from the logic of the previous works reviewed above and specially of this thesis.

However, the model projects the equilibrium world prices between 1987 to 2008. The average is 16.8 cents per pound, twice the level of 1987 (7 cents/lb.). The study argues that U.S. beet and cane sugar production would decline only six percent during the period but the increase in sugar price would boost the high fructose corn syrup (HFCS) sector tremendously. The U.S. would earn more export income from the increase in corn use and HFCS exports in the magnitude of $10.5 billion per year.

There are some other studies focusing on unilateral liberalization of the U.S. sugar program. One such study is Leu et al. (1987). This study, using a general equilibrium approach, analyzes the policy options for the U.S. It finds that the current quota program incurs the largest net societal cost to the U.S. when compare with tariff and deficiency payments options. For the foreign exporters, there is a dilemma here between quotas and deficiency payments. The U.S. quota program yields quota rent but decreases the volume of trade while deficiency payment option gives no rent but expands volume.

Another study by Maskus (1987) urges the U.S. to abandon the current quota program because of its huge costs to American consumers and foreign exporters. Concerning the issue of quota rent, Maskus estimates that, at the 1987 trade level, if the U.S. removes its quota barrier the gain by the exporters on the expanded trade would be around $800 million over the quota rent. This notion is also substantiated by the estimation of Leu et al. for the 1983 U.S. sugar program.

Tyers and Anderson (1988b) study of world food markets model consists of seven commodities, grouped as the grain, livestock and sugar (GLS) model. The findings indicate that phased liberalization of food

policies in industrial countries would, in 1995, increase producer welfare by $50.4 billion but decrease net economic welfare by $13.5 billion in all developing countries. They argue that the net welfare effect is not as important as the transfer of welfare from consumers to producers. Concerning the sugar sector, the trade liberalization by the industrialized countries would raise the international price by seven percent in the late 1980s and by 22 percent in 1995. They predict that the removal of protection by all industrialized countries would, in 1995, cause the sugar producer prices to decline by 60, 86, and 38 percent in the EC(12), Japan and the U.S., respectively.

CHAPTER III

METHODOLOGY AND DATA

This chapter describes the methodology and data used in measuring the impacts to exporting countries from liberalization of sugar policies in the five industrialized countries. Appropriate methodology will be developed first. Details about the sources, nature, qualifications and other pertaining information of data will be given in the final section of the chapter.

Discussion in Chapter II argued the appropriateness of applying the Export Side International Trade (ESIT) model to this study. This section will begin with the discussion of the Delphi process used in estimating the parameters needed for the ESIT model. Next, the specific model used to determine the equilibrium prices and quantities will be explored.

The Delphi Process

The ultimate two functions needed for the ESIT model for determination of the equilibrium conditions are export demand (XD) function and excess supply (ES) functions. There are two basic methods for estimation of the parameters for these two functions. The first approach is direct econometric estimation. The alternative is the so-called "Delphi process", or synthetic estimation.

Using direct econometric estimation requires collecting time series or cross-sectional data of all variables involved in the net trade functions. The true specifications of these functions are assumed

to be known. The researchers need to incorporate all variables affecting supply and demand in foreign markets into the specification. This requires a voluminous amount of work for a world model of sugar trade. Multicollinearity in the price data and specification error are some of the potential econometric problems. These two major drawbacks may not justify the time and difficulties incurred in using the direct estimation technique. In this regard, McCalla et al. argue for the adoption of the Delphi process in research of this type.

The Delphi method makes use of prior econometric estimation of domestic demand and supply for each country included in the model. The process involves compiling price elasticities of the two basic functions and other relevant parameters from existing works. Choices are made to incorporate parameters into the ESIT model on the basis of experience and expert judgment. Abbott (1988) cautions that the process is unlikely to succeed in the event of weak and inadequate prior works. In the following sections, steps in incorporating the chosen parameters into the specific model to arrive at the solution will be discussed.

Steps in the Process

The first step in the process is to compile information about elasticities of domestic demand and supply, levels of consumption, production, imports, and exports. This involves data for 30 net exporting countries and 44 net importing countries. The data section of this chapter will discuss details about the nature, sources, and other aspects of the data used.

The data are first used to estimate the elasticities of excess

demand and excess supply of the net importing and net exporting countries respectively. The results together with the data on elasticity of price transmission are used to estimate export demand elasticity of any exporting country.

Elasticity of export demand is then used to estimate the export demand (XD) function facing the k^{th} exporting country. Similarly, excess supply (ES) function of the k^{th} country is estimated from the elasticity of excess supply. The theoretical chapter has already discussed that the equilibrium condition in the ESIT model can be found from the intersection of XD_k with ES_k for any k^{th} country. When the industrialized countries change their sugar policies such that their domestic demand curves and/or domestic supply curves shift, this causes XD_k to shift to XD_k' (if the elasticity of price transmission in the liberalizing country is greater than 0). The new equilibrium can be solved by equating XD_k' with ES_k (or with ES_k' if the liberalizing country is the k^{th} country). Details of the steps in the model will be discussed in the next section.

The Specific Model

Estimation of Elasticity of Export Demand

The world trade model in sugar is divided into two groups of countries. Subscript i stands for the net exporting country and subscript j for the net importing country. Let there be m exporting and n importing countries respectively. Elasticity of excess demand of the j^{th} country (e_{edj}) and elasticity of excess supply of the i^{th} country

(e_{esi}) can be estimated by:

$$e_{edj} = (e_{dj}*Q_{dj} - e_{sj}*Q_{sj})/M_j \quad (1)$$

$$e_{esi} = (e_{si}*Q_{si} - e_{di}*Q_{di})/X_i \quad (2)$$

for i = 1, 2,..., m=30, and j = 1, 2,..., n=44.

e_d and e_s are elasticities of domestic demand and domestic supply respectively. Here Q_d is the level of domestic consumption and Q_s is domestic production while M_j is the total imports of sugar in the j^{th} country, and $M_j = \Sigma M_{ij}$. And, X_i is the total exports of sugar from the i^{th} country, and $X_i = \Sigma X_{ij}$.

The export demand facing any k^{th} exporting country (XD_k) can be represented by:

$$XD_k = \Sigma_j ED_j - \Sigma_{i \neq k} ES_i \quad (3)$$

for i, k = 1, 2,.., m, and j = 1, 2,.., n.

where ED_j is excess demand in importing country j and ES_i is excess supply in exporting country i. Differentiating (3) with respect to P_k, price in the k^{th} country, normalizing or manipulating all the terms into elasticity forms gives the following:

$$e_{xdk} = \Sigma_j (e_{tj}*e_{edj}*M_j/X_k) - \Sigma_{i \neq k} (e_{ti}*e_{esi}*X_i/X_k) \quad (4)$$

where:

e_{xdk} = elasticity of export demand of the k^{th} country

e_t = elasticity of price transmission of country i or j respectively

X_k = the total export of sugar of the k^{th} country

Bredahl et al. (1979) propose equation (4) as an alternative to Tweeten's (1967) calculation of price elasticity of export demand facing the U.S.[5]

Equation (4) has two parts, $\Sigma_j(e_{tj}*e_{edj}*M_j/X_k)$ is the import portion and $\Sigma_{i\neq k}(e_{ti}*e_{esi}*X_i/X_k)$ is the export portion. Using (4) for the wheat trade model, Kim has improved on the estimation of e_{xdk} over those of Bredahl et al., and Tweeten and Johnson (1977). This study adopts Kim's suggestion as follows: If $X_{kj} = 0$, meaning no export from the k^{th} to the j^{th}, the term $(e_{tj}*e_{edj}*M_j/X_k) = 0$. This is true because imports in the j^{th} have nothing to do with the elasticity in the k^{th} country. For the export portion, the term X_i that goes into this particular equation has to be adjusted. If $X_{kj} = 0$, X_{ij} must be excluded from X_i. In other words, the magnitude of e_{xd} of the k^{th} country must exclude the flow from the i^{th} to the j^{th} wherever the k^{th} has no transaction.

Price Transmission Elasticity

Price transmission elasticity (e_{ti} or e_{tj} in (4)) measures the response of price in the i^{th} or j^{th} country to change in the k^{th} country's price. In international trade models involving several importing and exporting countries, researchers often use the response of internal price to a change in world price as an alternative. In this study, the

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[5] Kim et al. (1987) have the derivation of (1) and (2) which is rearranged leading to the derivation of (4) in Appendix 3.1 of this study.

elasticity represents the percentage change in a country's domestic price to a percentage change in the border price.

Elasticity of price transmission captures the protection or insulation component of a country's commodity-specific trade policy. In previous studies, researchers have used $e_t = 1$ for the sake of convenience, in that $e_t = 1$ or perfect price transmission represents a no trade-distortion world. This is not realistic. Bredahl et al. and Bolling (1988) present strong evidence that internal prices in many countries are largely insulated from world prices. In the extreme case of complete insulation, e_t = zero. Tyers and Anderson (1988a) have estimated a parameter for many world trading regions in sugar. This research uses their estimates, the details of which will be discussed in the data section.

Functional Forms Used in the Model

The underlying domestic demand and supply functions assumed in this study are of a constant elasticity type. The constant elasticity assumption is imposed on the grounds that previous econometric works on demand and supply generally do not report the true functions used. The constant elasticity function has been used widely by researchers for reasons of better fit and ease of application. It is argued that the constant elasticity demand function is inconsistent with maximizing utility behavior, i.e. violating integrability condition. However, since the data used in this study are market data the function can be regarded as an approximation of aggregated individual maximizing behavior (Johnson et al., 1984). This point is also supported by

Koutsoyiannis (1979) which labels the method as a pragmatic approach.

With the above assumption, the functional forms of the demand and supply are:

$$Q_d = a_d P^{-\beta} \tag{5}$$

$$Q_s = a_s P^{\alpha} \tag{6}$$

Here a_d and a_s are constants, $-\beta$ is the price elasticity of demand, and α is the price elasticity of supply. In this study, the shifts of domestic demand and supply curves in the five liberalizing countries are estimated. This is because only these shifts in such countries affect the whole model.

For estimation purposes the assumed functions are converted to double log forms as:

$$\text{Demand Function: } \ln Q_d = \ln a_d - \beta * \ln P \tag{7}$$

$$\text{Supply Function: } \ln Q_s = \ln a_s + \alpha * \ln P \tag{8}$$

Here ln stands for the natural logarithm.

<u>Shifts in Demand and/or Supply Curves</u>

As suggested in the theoretical chapter, in this model liberalization in sugar policy by an industrialized country will shift the demand and/or supply curve(s) of the country in question. One assumption underlying the ESIT model is that no trade reversal allowed, i.e changing in policies will not cause any importer to become an exporter and vice versa. And as previously mentioned, in this study the

magnitude of liberalization is captured by the change in the producer subsidy equivalent (PSE) and/or consumer subsidy equivalent (CSE).

This research uses the aggregate measures of government intervention known as PSE and CSE, both per unit quantity, as a mechanism of shifting the domestic supply and domestic demand curves vertically for the purpose of converting these shifts into horizontal shifts in the excess supply and excess demand curves. A PSE gauges the level of government assistance to producers. It measures the amount of income required to compensate the producers if the government support is removed. By the same token, CSE gauges the impact on consumers from government subsidies or from a government implicit tax scheme.

The USDA 2 (1988) reports on the estimates of PSE and CSE for several commodities in 16 countries and the European Community. The estimates cover sugar policies in the five industrialized countries of interest in this study. These countries are Canada, the U.S.A., Japan, the EC(10), and Australia. Details of estimates and policies included in the calculation will be shown in the data section.

Conceptually, PSE and CSE can be positive or negative. For sugar programs, USDA's estimates show positive PSE, representing government assistance; and show negative CSE, equivalent to implicit tax on consumers. The USDA gives estimates both in percentage and per unit quantities.

A removal of producer support policies is in effect similar to a new tax imposed on the existing producers. Using a basic diagram of a supply curve on the price-quantity axes, this is equivalent to a shift to the left of the domestic supply curve. The magnitude of PSE per unit

is the distance of the vertical shift along the price axis. The concern here is the distance of the horizontal shift. For the constant elasticity supply function imposed in this study, the horizontal shift [$\Delta(\ln a_s)$] in the ln P-ln Q diagram can be calculated by:

$$\Delta(\ln a_s) = -\alpha * \ln (PSE/Unit) \qquad (9)$$

The minus sign indicates the shift to the left of the supply curve. Similarly, the horizontal shift of the demand curve [$\Delta(\ln a_d)$] can be represented by:

$$\Delta(\ln a_d) = \beta * \ln (CSE/Unit) \qquad (10)$$

Removal of a negative CSE results in a shift of the demand curve to the right. The absolute values of β and CSE are used in (10) to yield the positive change or shift to the right.

In reality a government policy intended for protection of producers may also affect consumers or vice versa. This may cause the possibility of overlapping of policy's effects in the estimated values of PSE and CSE. Therefore, when compiling data of PSE and CSE reported by the ERS, care must be taken to avoid double counting by utilizing the total values of both PSE and CSE in calculating the shifts in supply and demand. If there is an overlapping, either the PSE or CSE value must be adjusted. For the sugar study in this research, it is very difficult to segregate the values of policy overlapping. Hence, the study proceeds on the assumption that the degree of overlapping is not great enough to change the direction of the results. The possibility of overstating the magnitude of the results is acknowledged.

Excess Supply Function and Shift

With the estimated elasticity of excess supply in (2) and constant elasticity assumption, the excess supply function is:

$$ES = a_{es}P^{\delta} \tag{11}$$

where a_{es} is a constant, and δ is the elasticity of excess supply. In the log-log form, the excess supply curve for any k^{th} exporting country is:

$$\ln ES_k = \ln a_{esk} + \delta_k * \ln P_k \tag{12}$$

As discussed earlier, in this model the interest is in the horizontal shifts of curves. It is recognized that the horizontal shift of any exporting country's excess supply curve is equivalent to the magnitude of the combined horizontal shifts of its domestic supply and demand curves. The same argument applies to the shift in the excess demand curve of any importing country, which will be discussed shortly. For any exporting country which liberalizes the sugar policy, the excess supply curve will shift by $\Delta(\ln a_s) - \Delta(\ln a_d)$. Hence, the new excess supply curve of that country is:

$$\ln ES_k' = \{\ln a_{esk} + [-\alpha_k * \ln(PSE_k) - \beta_k * \ln(CSE_k)]\} + \delta_k * \ln P_k \tag{13}$$

Export Demand Function and Shift

Export demand facing any exporting country is

$$XD = a_{xd}P^{-\sigma} \tag{14}$$

where a_{xd} is a constant, and $-\sigma$ is price elasticity of export demand calculated by (4). This function is expressed in the log-log form for any k^{th} exporting country by:

$$\ln XD_k = \ln a_{xdk} - \sigma_k * \ln P_k \qquad (15)$$

Following Kim et al. (1987) and Kim (1989), multiplying both sides of (4) by XD_k/e_{xdk}, and after manipulating terms yields:

$$F_k = XD_k - \Sigma_j(e_{tj} * e_{edj} * M_j/e_{xdk}) + \Sigma_{i \neq k}(e_{ti} * e_{esi} * X_i/e_{xdk}) = 0 \quad \text{for all } k. \qquad (16)$$

Since $XD_k = X_k$, X_k is cancelled out.

Applying the implicit function theorem to the system of equations in (16) on a linear model, Kim estimates the horizontal shift in XD_k resulting from trade liberalization in a relating j^{th} importing country by: $\Delta a_{xdk} = (e_{tj} * e_{edj}/e_{xdk}) * \Delta a_{edj}$. Here a_{xdk} and a_{edj} are intercept terms of the linear export demand and excess demand functions respectively. For the log-log model in this study, the liberalizing effect of such importing countries on the k^{th} exporting country would be:

$$\Delta_j(\ln a_{xdk}) = \Sigma_j\{(e_{tj} * e_{edj}/e_{xdk}) * [\beta_j * \ln(CSE_j) - (-\alpha_j * \ln(PSE_j))]\} \qquad (17)$$
$$\text{for } X_{kj} > 0, \text{ otherwise} = 0$$

The term $[\beta_j * \ln(CSE_j) - (-\alpha_j * \ln(PSE_j))]$ represents $\Delta(\ln a_{edj})$, the shift in the j^{th}'s excess demand curve. And, $\Delta(\ln a_{edj})$ is comprised of the combined shifts in domestic demand and supply curves of the j^{th} country. The shift of the j^{th}'s excess demand causes XD_k to shift in the same direction.

The horizontal shift in XD_k resulting from trade policy

liberalization by other exporting countries i's, ($i \neq k$), can be estimated by:

$$\Delta_i(\ln a_{xdk}) = \Sigma_{i \neq k} -\{(e_{ti} * e_{esi} / e_{xdk}) * -[-\alpha_i * \ln(PSE_i) - (\beta_i * \ln(CSE_i))]\} \quad (18)$$

for all k.

The term $[-\alpha_i * \ln(PSE_i) - (\beta_i * \ln(CSE_i))]$ represents the shift in the excess supply in the i^{th} country $[\Delta(\ln a_{esi})]$. The negative sign in front of this term in (18) indicates that the shift of this curve results in a shift in the opposite direction shift of XD in the k^{th} country.

After liberalization, the new export demand curve facing any k^{th} country would be:

$$\ln XD_k' = \ln a_{xdk} + [\Delta_j(\ln a_{xdk}) + \Delta_i(\ln a_{xdk})] - \sigma_k * \ln P_k \quad (19)$$

Solutions to the Model

The new equilibrium can be solved by equating equation (19) with equation (13) if k is the liberalizing country, and with (12) when it is not. This procedure will yield a new value of $\ln P_k$ which can be substituted into (13) (or (12)) to find new value of $\ln ES_k$. Taking the antilog of these two values gives the new export price and new export quantity of each country. The new bilateral export-import trade flow is then estimated under the assumption of rigidity in trade flows. The new foreign exchange earnings on sugar of the countries of interest can be calculated accordingly.

Multilateral, Unilateral, and Scale of Liberalization

The procedure proposed above will be used to evaluate the impact of multilateral trade liberalization by the five industrialized countries. With some slight adjustments in the process, the model will also be used to find the effect of a unilateral liberalization by each of the five countries in turn. The modification occurs by deleting the Σ in either equation (17) or (18) as the case may be.

The model will be run first with the assumption of a 100 percent removal of protection levels. Two other scenarios will also be evaluated. The second scenario is under the assumption of 50 percent reduction in trade distorting policies. The third scenario assumes 20 percent of the existing level of protection is liberalized. For the second and third scenarios, PSE or CSE per unit reported by USDA are reduced by 0.5 and 0.2, respectively.

The Data

The international sugar trade model in this research includes 30 exporting and 44 importing countries. The 44th importing country is labeled "Others" to represent residual flows to various countries from an exporting country. Each country that is included in the model has a net position in 1986 of at least 50,000 metric tons (MT) either as a net exporting country or a net importing country. Those countries with less than a 50,000 MT net position are considered to have an inconsequential effect and thus are not specifically included.

Data on Basic Information and Trade Flows

Appendices 3.2 and 3.3 show basic data on exporting and importing countries respectively. These data are the values of production, consumption, elasticity of domestic supply (e_s), elasticity of domestic demand (e_d), elasticity of price transmission (e_t) and export price (P). Production and consumption are at 1986 levels and obtained from ISO, Sugar Year Book, 1986. The values of e_s's and e_d's are drawn primarily from Gemmill (1976) with the following exceptions: For those countries for which Gemmill does not provide estimates the values of $e_s = 0.6$ and $e_d = -0.4$ are drawn from Zietz and Valdes; the values of e_s and e_d for the United States, the EC, Canada and Japan are from Tyers and Anderson (1988a). The values of e_t are also from Tyers and Anderson (1988a). The values of P's or export prices are export unit values derived from Table 67 of FAO, Trade Yearbook, 1986. Sources and more explanations are also given in the appendices.

Appendix 3.4 presents the bilateral trade flows in 1986 of all the countries included in the model. The flows are total exports in metric tons. The source of these data is ISO, Sugar Year Book, 1986. The ISO discloses the flows both from the exporter and importer reports. The flows compiled and used in this research are based on exporter reports. However, attempts have been made here to reconcile or fill the gaps from importer reports wherever feasible.

Data on PSE and CSE

The source of the data on PSE and CSE is Estimates of Producer and

Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-86, ERS, USDA, 1988. The values of PSE and CSE used in this research are for 1986. The measures constituting the protection or distortion policies differ between countries. The USDA-ERS compiles information about such policies in the five countries of interest and quantifies the value of each policy to producers or consumers. The ERS reports the values of PSE and CSE both in percentage and per unit value. Total values of these policy transfers when divided by total level of production or consumption represent the value of PSE or CSE per unit respectively. Distortion policies can be grouped broadly as: market price support, input subsidies, marketing, structural or long-term policy. Tables 3.1 and 3.2 illustrate the policies from which the PSE and CSE for sugar in the five countries are derived. Appendix 3.5 shows the level of PSE and CSE (per metric ton) used in this research.

Table 3.1. Policies Included in the Calculation of PSE for Sugar (1986)

Policy/Country	USA	EC(10)	Canada	Japan	Australia
Market price support:					
Price support/quotas	X			X	
Income payments			X	X	
Tariff			X	X	
Input subsidies:					
Farmers home administration	X				
Crop insurance	X			X	
Fertilizer subsidies					X
Fuel subsidy			X		
Financial assistance			X		
Input assistance				X	
Marketing:					
Processing	X				
Transport	X				
Trade measures		X			
Export incentive					X
Long-term:					
Research	X		X		X
Advisory	X		X		
Disease control	X				
Land improvements	X				
Structural policy		X			
Other:					
Taxation	X				X
Producer levy		X			
State programs	X		X		
Interest concessions					X
Home consumption pricing					X
Rural adjustment scheme					X
Industrial assistance					X

Source: Derived from USDA, Estimates of Producer and Consumer Subsidy Equivalent: Government Intervention in Agriculture, 1982-86, ERS, USDA, April 1988.

Table 3.2. Policies Included in the Calculation of CSE for Sugar (1986)

Policy/Country	USA	EC(10)	Canada	Japan	Australia
Tariff			X	X	
Trade measures		X			
Excise tax				X	
Price stabilization				X	
Price support/quotas	X				

Source: Derived from USDA, Estimates of Producer and Consumer Subsidy Equivalent: Government Intervention in Agriculture, 1982-86, ERS, USDA, April 1988.

CHAPTER IV

THE RESULTS

This chapter presents the results of applying the proposed methodology to the data discussed in the previous chapter. The estimated parameters needed for the model will be provided first. Relevant functions estimated from these parameters will be displayed. Impacts of liberalization in general will be provided. The gainers and the losers in the exporting sector of the international market will be listed. The chapter will explore the impact of a complete multilateral liberalization. Results of the 50 and 20 percent removal of protection on a multilateral basis scenarios will also be shown. The impacts of different scenarios of a unilateral liberalization will be given. Finally, specific impacts on Thailand, a representative developing country from ASEAN, will be discussed.

Relevant Estimated Parameters

Table 4.1 shows the elasticities of excess demand for the importing countries as calculated by equation (1) of the previous chapter. Attention is called to the large values of excess demand elasticities of India and Indonesia. There are no direct econometric estimations for these values for comparison. However, note can be made, as in the case of trade embargo study, that synthetic estimation tends to yield larger estimates of elasticities than does a direct econometric approach (Abbott et al.). In this study, the small import shares

Table 4.1. Elasticity of Excess Demand (e_{ed}).

Algeria	-0.7090	Japan	-0.1267
Angola	-1.1841	Jordan	-0.4193
Egypt	-2.1183	Korea, South	-0.5063
Gambia	-0.1958	Lebanon	-0.3858
Ghana	-0.5675	Malaysia	-0.4271
Kenya	-1.5612	Pakistan	-1.5347
Libya	-0.2203	Persian Gulf	-0.4101
Morocco	-1.1693	Saudi Arabia	-0.4857
Nigeria	-2.6178	Singapore	-0.0967
Somalia	-0.7615	Sri Lanka	-0.6290
Tunisia	-0.3480	Syria	-0.3462
Canada	-0.0872	Vietnam	-7.1345
USA	-1.0651	Yemen AR.	-0.4900
Peru	-3.4092	Bulgaria	-0.5173
Bangladesh	-0.6266	EC(10)	-1.9822
China	-4.2490	Finland	-1.2765
Hong Kong	-1.9611	Norway	-0.1261
India	-12.9139	Portugal	-0.5615
Indonesia	-35.6752	Switzerland	-0.6270
Iran	-0.8845	New Zealand	-0.0997
Iraq	-0.2378	USSR	-1.5317
Israel	-0.0929	Others	-1.2872

Source: Derived.

of India and Indonesia in their production and consumption levels contribute to the large values of the estimates. In other words these two countries have the potential of reversing roles by becoming net exporting countries if there are slight changes in their production and consumption levels.

The elasticities of excess supply for the exporting countries calculated using equation (2) are shown in Table 4.2. Again, take note of the large elasticities of Mexico, Argentina, the Philippines and Turkey. These countries have small export shares relative to their production and consumption levels.

These values of elasticities of excess demand and excess supply together with the values of elasticity of price transmission given in the data section (Appendices 3.2 and 3.3) are used to calculate equation (4), the elasticity of export demand (e_{xd}). The values of e_{xd}'s are given in Table 4.3. The large values of the estimates for some countries should also be noted. However, a comparison with another study will be discussed in the next section. As explained in the methodology part of Chapter III, the export amount for country i (X_i) needed for the second portion of equation (4) must be adjusted. This is done by taking out X_{ij} from X_i wherever $X_{kj} = 0$. The values of X_i's adjusted are given in Appendix 4.1.

Comparison of Export Demand Elasticity

Table 4.4 compares the estimated export demand elasticities of some major countries from this study with those estimated for sugar

Table 4.2. Elasticity of Excess Supply (e_{es}).

Malawi	1.3935	Nicaragua	2.8653
Mauritius	0.5209	Argentina	12.0265
South Africa	0.4565	Brazil	1.8661
Swaziland	0.6663	Colombia	5.0622
Zimbabwe	1.4779	Guyana	0.5202
Barbados	0.8173	Philippines	6.3289
Belize	0.7838	Taiwan	2.0293
Costa Rica	2.7816	Thailand	0.3935
Cuba	0.4208	Turkey	8.6585
Dominican RP	0.6215	Austria	2.5763
El Salvador	2.8235	Czecho-slovakia	0.9388
Guatemala	1.2974	EC(10)	0.6452
Honduras	2.2948	Spain	4.3776
Jamaica	0.9004	Australia	0.4994
Mexico	15.7494	Fiji	0.8909

Source: Derived.

Table 4.3. Elasticity of Export Demand (e_{xd}).

Malawi	-22.8300	Nicaragua	-7.0223
Mauritius	-6.1711	Argentina	-36.9586
South Africa	-3.0495	Brazil	-1.6482
Swaziland	-5.8503	Colombia	-11.0500
Zimbabwe	-7.8043	Guyana	-12.6942
Barbados	-16.9913	Philippines	-2.2123
Belize	-12.6396	Taiwan	-25.6157
Costa Rica	-30.4578	Thailand	-2.4462
Cuba	-0.7453	Turkey	-2.3168
Dominican RP	-5.4210	Austria	-15.7500
El Salvador	-7.1486	Czecho-slovakia	-9.3592
Guatemala	-8.3007	EC(10)	-1.3869
Honduras	-26.5007	Spain	-11.2797
Jamaica	-5.7797	Australia	-1.1589
Mexico	-4.3829	Fiji	-2.9763

Source: Derived.

by Tyers and Anderson (1988a). Their study recognizes the significance of elasticity of price transmission (e_t) by using the values of e_t's less than one. However, their estimates are still large owing to the absence of adjustment in trade flows both for import and export portions in equation (4). Their estimates are for the very short run elasticity projected to 1988.

Estimated Excess Supply and Export Demand Functions

With the estimated values of e_{es} and e_{xd}, and the constant elasticity assumption, the resulting excess supply and export demand functions are presented in Table 4.5 and Table 4.6, respectively. These functions are transformed into double log form as per equations (12) and (15).

Shifts in Demand and Supply from Liberalization

When the five industrialized countries remove their protection of the sugar sector, their domestic demand and/or supply will shift. The magnitude of protection level measured by PSE/MT and CSE/MT are given in Appendix 3.5 and are summarized in Table 4.7.

Removal of a PSE and a CSE cause supply and demand to shift. The vertical distances in natural log values are calculated. These distances are converted to horizontal shifts as per equations (9) and (10). Each of these estimates can be found in Table 4.7. The table shows the expected signs with respect to the direction of the shifts. Removal of a positive PSE causes the supply to shift to the left, hence

Table 4.4. Comparison of Magnitude of Elasticity of Export Demand (e_{xd}).

	This Study	Tyers and Anderson's study
EC(10)	-1.3869	- 3.4
Australia	-1.1589	- 7.5
Argentina	-36.9586	-26.1
Brazil	-1.6482	- 3.6
Thailand	-2.4462	-13.8

Table 4.5. Excess Supply Function.

	$\ln ES_k$ =		
k	$\ln a_{esk}$	+	$e_{esk} * \ln P_k$
Malawi	3.8906	+	1.3935 *ln P_k
Mauritius	10.2366	+	0.5209 *ln P_k
South Africa	11.3580	+	0.4565 *ln P_k
Swaziland	9.5242	+	0.6663 *ln P_k
Zimbabwe	4.9525	+	1.4779 *ln P_k
Barbados	6.6696	+	0.8173 *ln P_k
Belize	7.0705	+	0.7838 *ln P_k
Costa Rica	-3.2138	+	2.7816 *ln P_k
Cuba	12.9625	+	0.4208 *ln P_k
Dominican RP	9.5337	+	0.6215 *ln P_k
El Salvador	-4.1928	+	2.8235 *ln P_k
Guatemala	5.6209	+	1.2974 *ln P_k
Honduras	-1.2694	+	2.2948 *ln P_k
Jamaica	6.6255	+	0.9004 *ln P_k
Mexico	-67.1334	+	15.7494 *ln P_k
Nicaragua	-5.7145	+	2.8653 *ln P_k
Argentina	-53.3386	+	12.0265 *ln P_k
Brazil	5.3906	+	1.8661 *ln P_k
Colombia	-12.9645	+	5.0622 *ln P_k
Guyana	9.3378	+	0.5202 *ln P_k
Philippines	-25.4290	+	6.3289 *ln P_k
Taiwan	1.2585	+	2.0293 *ln P_k

Table 4.5 (continued).

Thailand	12.5913	+	0.3935 *ln P_k
Turkey	-33.6132	+	8.6585 *ln P_k
Austria	-1.9225	+	2.5763 *ln P_k
Czechoslovakia	8.0615	+	0.9388 *ln P_k
EC(10)	11.6229	+	0.6452 *ln P_k
Spain	-11.0300	+	4.3776 *ln P_k
Australia	12.2873	+	0.4994 *ln P_k
Fiji	7.7905	+	0.8909 *ln P_k

Source: Derived.

Table 4.6. Export Demand Function.

	$\ln XD_k$ =		
k	$\ln a_{xdk}$	-	e_{xdk}*ln P_k
Malawi	135.1950	-	22.8300 *ln P_k
Mauritius	50.9082	-	6.1711 *ln P_k
South Africa	29.1951	-	3.0495 *ln P_k
Swaziland	44.6723	-	5.8503 *ln P_k
Zimbabwe	52.4030	-	7.8043 *ln P_k
Barbados	109.5062	-	16.9913 *ln P_k
Belize	83.9880	-	12.6396 *ln P_k
Costa Rica	167.8858	-	30.4578 *ln P_k
Cuba	20.5984	-	0.7453 *ln P_k
Dominican RP	44.0390	-	5.4210 *ln P_k
El Salvador	51.4111	-	7.1486 *ln P_k
Guatemala	58.9559	-	8.3007 *ln P_k
Honduras	158.5190	-	26.5007 *ln P_k
Jamaica	45.6995	-	5.7797 *ln P_k
Mexico	34.4024	-	4.3829 *ln P_k
Nicaragua	52.6213	-	7.0223 *ln P_k
Argentina	208.3562	-	36.9586 *ln P_k
Brazil	23.0228	-	1.6482 *ln P_k
Colombia	67.3323	-	11.0500 *ln P_k
Guyana	84.5325	-	12.6942 *ln P_k
Philippines	25.5509	-	2.2123 *ln P_k
Taiwan	146.6019	-	25.6157 *ln P_k

Table 4.6 (continued)

Thailand	26.6038	-	2.4462 *ln P_k
Turkey	24.0320	-	2.3168 *ln P_k
Austria	92.7289	-	15.7500 *ln P_k
Czechoslovakia	59.6610	-	9.3592 *ln P_k
EC(10)	23.0441	-	1.3869 *ln P_k
Spain	71.6907	-	11.2797 *ln P_k
Australia	20.6721	-	1.1589 *ln P_k
Fiji	29.0964	-	2.9763 *ln P_k

Source: Derived.

Table 4.7. Shifts in Demand and Supply (100 Percent Liberalization).

	Canada	USA	Japan	EC(10)	Australia
PSE/MT	104.50	226.35	1,105.71	165.66	17.85
CSE/MT	-22.20	-415.00	-673.31	-199.35	
Vertical Supply Shift (ln)	-4.6492	-5.4221	-7.0082	-5.1099	-2.8820
Vertical Demand Shift (ln)	3.1001	6.0283	6.5122	5.2951	
Horizontal Supply Shift [$\Delta(\ln a_s)$]	-0.4649	-0.3795	-0.7008	-0.5110	-1.0678
Horizontal Demand Shift [$\Delta(\ln a_d)$]	0.2480	1.2057	0.3256	0.6354	

Source: Derived.

the negative sign for supply shift. The same is true for the removal of a negative CSE which causes the demand curve to shift to the right (positive shift).

Shifts in Excess Supply and Export Demand

Using the magnitude shown in Table 4.7 the new excess supply of the liberalizing exporting countries can be calculated. In this study only two exporters are assumed to liberalize, they are the EC(10) and Australia. The new excess supply functions are calculated by equation (13) and are given in Table 4.8. Excess supply functions of all other exporting countries stay the same as in Table 4.5 after trade liberalization by the EC(10) and Australia.

The shift in the export demand functions comes from two sources. The first is from the liberalization in the j^{th} importing country. The second is from the removal of protection in the other exporting countries. Estimation of the shifts from these two sources is accomplished by equations (17) and (18) respectively. Table 4.9 compiles the shifts from both sources and shows the combined effect on each exporting country in natural log value.

As explained in the methodology section, the shift in excess demand of the j^{th} country causes XD_k to shift in the same direction. And the shift in other countries' excess supply curves will shift XD_k in the opposite direction. In this study removal of protection causes excess demand and excess supply to shift to the right and to the left respectively. Hence, the combined effect will cause the export demand

Table 4.8. Excess Supply Function After Liberalization (100 Percent).

	$\ln ES_k' =$		
k	$\ln a_{esk}'$	+	$e_{esk} * \ln P_k$
EC(10)	10.4765	+	0.6452 $*\ln P_k$
Australia	11.2195	+	0.4994 $*\ln P_k$

Source: Derived.

Table 4.9. Shifts in Export Demand Functions.

i,j\k	Malawi	Mauritius	South Africa	Swaziland	Zimbabwe
j=Canada	0.0000	0.0012	0.0024	0.0013	0.0010
j=USA	0.0074	0.0274	0.0554	0.0289	0.0000
j=Japan	0.0000	0.0000	0.0000	0.0000	0.0000
j=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=Australia	0.0114	0.0423	0.0857	0.0447	0.0335
Sum of shift	0.0188	0.0709	0.1435	0.0749	0.0345

i,j\k	Barbados	Belize	Costa Rica	Cuba	Dominican RP.
j=Canada	0.0004	0.0000	0.0000	0.0100	0.0000
j=USA	0.0099	0.0134	0.0055	0.0000	0.0311
j=Japan	0.0000	0.0000	0.0000	0.0000	0.0000
j=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=Australia	0.0154	0.0207	0.0086	0.3506	0.0482
Sum of shift	0.0257	0.0341	0.0141	0.3606	0.0793

Table 4.9 (continued)

i,j\k	El Salvador	Guatemala	Honduras	Jamaica	Mexico
j=Canada	0.0000	0.0000	0.0000	0.0000	0.0000
j=USA	0.0236	0.0203	0.0064	0.0292	0.0385
j=Japan	0.0000	0.0000	0.0000	0.0000	0.0000
j=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=Australia	0.0366	0.0315	0.0099	0.0452	0.0596
Sum of shift	0.0602	0.0518	0.0163	0.0744	0.0981
i,j\k	Nicaragua	Argentina	Brazil	Colombia	Guyana
j=Canada	0.0000	0.0000	0.0000	0.0000	0.0006
j=USA	0.0000	0.0046	0.1024	0.0153	0.0133
j=Japan	0.0000	0.0000	0.0000	0.0000	0.0000
j=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=Australia	0.0372	0.0071	0.1585	0.0236	0.0206
Sum of shift	0.0372	0.0117	0.2609	0.0389	0.0345

Table 4.9 (continued)

i,j\k	Philip-pines	Taiwan	Thailand	Turkey	Austria
j=Canada	0.0000	0.0000	0.0000	0.0000	0.0000
j=USA	0.0763	0.0066	0.0690	0.0000	0.0000
j=Japan	0.0000	0.0000	0.0000	0.0000	0.0000
j=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=Australia	0.1181	0.0102	0.1068	0.1128	0.0166
Sum of shift	0.1944	0.0168	0.1758	0.1128	0.0166

i,j\k	Czecho-slovakia	EC(10)	Spain	Australia	Fiji
j=Canada	0.0000	0.0000	0.0000	0.0064	0.0000
j=USA	0.0000	0.1217	0.0000	0.1457	0.0567
j=Japan	0.0000	0.0000	0.0000	0.0000	0.0000
j=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=EC(10)	0.0000	0.0000	0.0000	0.0000	0.0000
i=Australia	0.0279	0.1884	0.0232	0.2255	0.0878
Sum of shift	0.0279	0.3101	0.0232	0.3776	0.1445

Note: The values for Japan and EC(10) are always zero in this case since their elasticities of price transmission are equal to zero.

Source: Derived.

function of the k^{th} country to shift to the right (or positive shift) accordingly.

The new export demand functions of all exporting countries are shown in Table 4.10. These functions are derived according to equation (19). Notice that export demand functions of all exporting countries, liberalizing or nonliberalizing alike, are affected.

New Equilibrium Position

The model is solved by equating equations (12) or (13) with (19). For the derived numbers in natural log values, the antilogs are taken to yield the new price and export quantity. With the derived export quantity the new bilateral trade flows from each exporting country to importing countries are calculated and presented in Appendix 4.2. The changes in export quantity, price and foreign exchange earning in each exporting country predicted by the model are summarized in Tables 4.11, 4.12 and 4.13, respectively. These tables rank the impacts according to the absolute changes in export, price, and foreign exchange earnings.

Specific Impacts on Major Exporting Countries

The results shown in Tables 4.11, 4.12 and 4.13 demonstrate that Cuba would receive a windfall benefit since the 14 percent increase in export is accompanied by a 36 percent increase in price. The EC(10) and Australia are the losers in terms of export volume, but the huge increase in their export prices help maintain positive earnings. Thailand and the Philippines, the two exporting countries in ASEAN, are

Table 4.10. Export Demand Function After Liberalization (100 Percent).

	$\ln XD_k' =$		
k	$\ln a_{xdk}'$	-	$e_{xdk}*\ln P_k$
Malawi	135.2138	-	22.8300 *ln P_k
Mauritius	50.9791	-	6.1711 *ln P_k
South Africa	29.3386	-	3.0495 *ln P_k
Swaziland	44.7472	-	5.8503 *ln P_k
Zimbabwe	52.4375	-	7.8043 *ln P_k
Barbados	109.5319	-	16.9913 *ln P_k
Belize	84.0221	-	12.6396 *ln P_k
Costa Rica	167.8999	-	30.4578 *ln P_k
Cuba	20.9590	-	0.7453 *ln P_k
Dominican RP	44.1183	-	5.4210 *ln P_k
El Salvador	51.4713	-	7.1486 *ln P_k
Guatemala	59.0077	-	8.3007 *ln P_k
Honduras	158.5353	-	26.5007 *ln P_k
Jamaica	45.7739	-	5.7797 *ln P_k
Mexico	34.5005	-	4.3829 *ln P_k
Nicaragua	52.6585	-	7.0223 *ln P_k
Argentina	208.3679	-	36.9586 *ln P_k
Brazil	23.2837	-	1.6482 *ln P_k
Colombia	67.3712	-	11.0500 *ln P_k
Guyana	84.5670	-	12.6942 *ln P_k
Philippines	25.7453	-	2.2123 *ln P_k
Taiwan	146.6187	-	25.6157 *ln P_k

Table 4.10 (continued).

Thailand	26.7796	-	26.4462 *ln P_k
Turkey	24.1448	-	2.3168 *ln P_k
Austria	92.7455	-	15.7500 *ln P_k
Czechoslovakia	59.6889	-	9.3592 *ln P_k
EC(10)	23.3542	-	1.3869 *ln P_k
Spain	71.7139	-	11.2797 *ln P_k
Australia	21.0497	-	1.1589 *ln P_k
Fiji	29.2409	-	2.9763 *ln P_k

Source: Derived.

Table 4.11. Exports After Liberalization (100 Percent).

	New Exports (MT)	Change in Exports (MT)	% Change
Cuba	7,634,148	931,560	13.90
Brazil	2,946,259	391,822	15.34
Thailand	2,100,538	51,124	2.49
Philippines	265,768	35,646	15.49
Mexico	242,511	23,355	10.66
South Africa	890,732	17,055	1.95
Turkey	155,407	13,407	9.44
Fiji	337,966	10,610	3.24
Swaziland	502,323	4,519	0.91
Dominican RP	484,517	3,941	0.82
Mauritius	665,561	3,910	0.59
Zimbabwe	272,771	2,420	0.90
El Salvador	106,107	2,239	2.16
Guatemala	375,243	1,872	0.50
Jamaica	147,643	1,522	1.04
Nicaragua	73,007	572	0.79
Guyana	219,627	387	0.18
Belize	105,271	263	0.25
Czechoslovakia	349,929	12	0.00
Colombia	211,826	11	0.01
Spain	179,468	7	0.00
Taiwan	151,378	6	0.00

Table 4.11 (continued)

	New Exports (MT)	Change in Exports (MT)	% Change
Honduras	95,284	4	0.00
Costa Rica	66,468	3	0.00
Barbados	88,357	3	0.00
Argentina	54,775	1	0.00
Austria	87,863	(2)	-0.00
Malawi	93,349	(5)	-0.01
Australia	1,438,925	(1,271,009)	-46.90
EC(10)	2,115,961	(2,078,040)	-49.55

Source: Estimated.

Table 4.12. Export Price After Liberalization (100 Percent).

	New Export Price ($ per MT)	Change in Export Price ($ per MT)	% Change
EC(10)	565	289	104.71
Cuba	951	253	36.25
Australia	375	218	138.85
Brazil	163	12	7.95
Thailand	148	9	6.47
Fiji	256	9	3.64
Philippines	400	9	2.30
South Africa	169	7	4.32
Mauritius	441	5	1.15
Dominican RP	306	4	1.32
Jamaica	351	4	1.15
Swaziland	223	3	1.36
Turkey	193	2	1.05
El Salvador	266	2	0.76
Mexico	156	1	0.65
Zimbabwe	167	1	0.60
Guatemala	260	1	0.39
Guyana	297	1	0.34
Belize	309	1	0.32
Nicaragua	366	1	0.27
Czechoslovakia	150	0	0.00

Table 4.12 (continued)

	New Export Price ($ per MT)	Change in Export Price ($ per MT)	% Change
Colombia	146	0	0.00
Honduras	257	0	0.00
Argentina	209	0	0.00
Spain	197	0	0.00
Austria	175	0	0.00
Malawi	226	0	0.00
Taiwan	192	0	0.00
Costa Rica	172	0	0.00
Barbados	322	0	0.00

Source: Estimated.

Table 4.13. Foreign Exchange Earnings After Liberalization (100 Percent) .

	New Earnings ($)	Change in Earnings ($)	% Change
Cuba	7,260,074,748	2,581,668,324	55.18
Australia	539,596,875	114,137,237	26.83
Brazil	480,240,217	94,520,230	24.50
EC(10)	1,195,517,965	37,973,689	3.28
Thailand	310,879,624	26,011,078	9.13
Philippines	106,307,200	16,329,498	18.15
South Africa	150,533,708	8,998,034	6.36
Fiji	86,519,296	5,662,364	7.00
Mauritius	293,512,401	5,032,565	1.74
Mexico	37,831,716	3,862,536	11.37
Dominican RP	148,262,202	3,128,250	2.16
Turkey	29,993,551	2,871,551	10.59
Swaziland	112,018,029	2,501,149	2.28
Jamaica	51,822,693	1,118,706	2.21
Guatemala	97,563,180	860,091	0.89
El Salvador	28,224,462	803,310	2.93
Zimbabwe	45,552,757	674,491	1.50
Guyana	65,229,219	334,179	0.51
Nicaragua	26,720,562	281,787	1.07
Belize	32,528,739	186,275	0.58
Czechoslovakia	52,489,350	1,800	0.00

Table 4.13 (continued)

	New Earnings ($)	Change in Earnings ($)	% Change
Colombia	30,926,596	1,606	0.01
Spain	35,355,196	1,379	0.00
Taiwan	29,064,576	1,152	0.00
Honduras	24,487,988	1,028	0.00
Barbados	28,450,954	966	0.00
Costa Rica	11,432,496	516	0.00
Argentina	11,447,975	209	0.00
Austria	15,376,025	(350)	-0.00
Malawi	21,096,874	(1,130)	-0.01

Source: Estimated.

among the top five gainers on the three categories of change (in absolute values). Detailed assessment of the specific impacts on a developing country in ASEAN (specifically Thailand) will be discussed later.

Figure 4.1 ranks, in percent terms, the first ten countries receiving significant impacts from international trade liberalization in sugar policies. It orders the list by magnitude of changes in foreign exchange earnings. Cuba is on top of the list with a 55 percent increase in earnings. Australia and Brazil follow with 27 and 25 percent increases. The Philippines and Thailand fare quite well with 18 and 9 percent increases, respectively. Although the EC(10) suffers from a 50 percent loss in volume, the massive price increase can offset the loss and the final gain in earnings is three percent.

Impacts on Developing Countries

As is clearly seen, most of the exporting countries in the model are the developing countries. It is interesting to see the impacts on these countries as a whole. Figure 4.2 illustrates the magnitude of the increase in export volume in the less developed countries (LDCs) as compared to the developed countries (DCs). Cuba is separated from other LDCs in order to better evaluate the effects on other developing countries. Cuba alone would gain .9 million metric tons in export volume. All other developing countries would benefit by a more than half a million metric tons increase in export. This would induce large scale new employment in the sugar production sector in those countries.

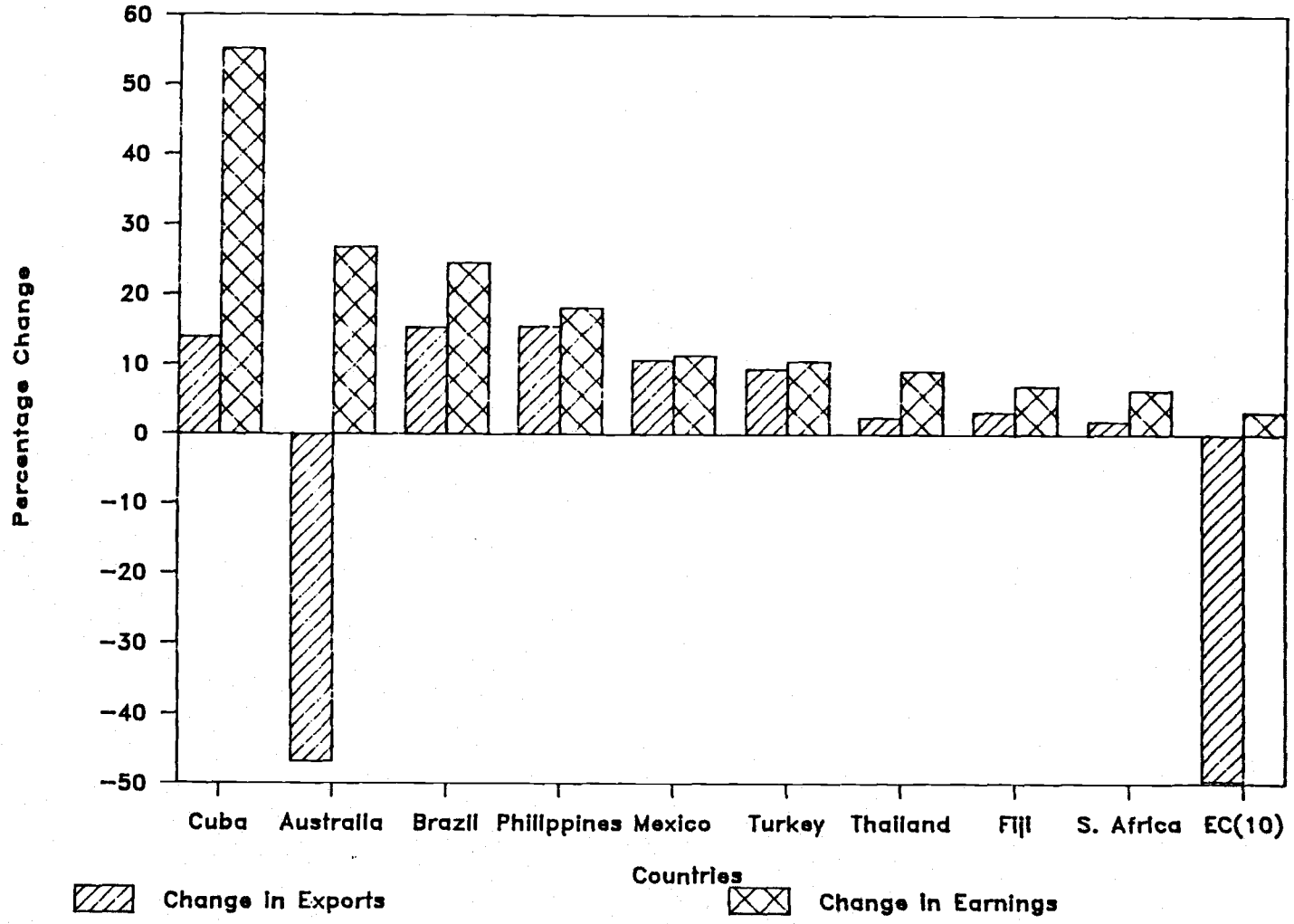

Figure 4.1. Impacts on Top Ten Nations: Ranked by Change in Exchange Earnings.

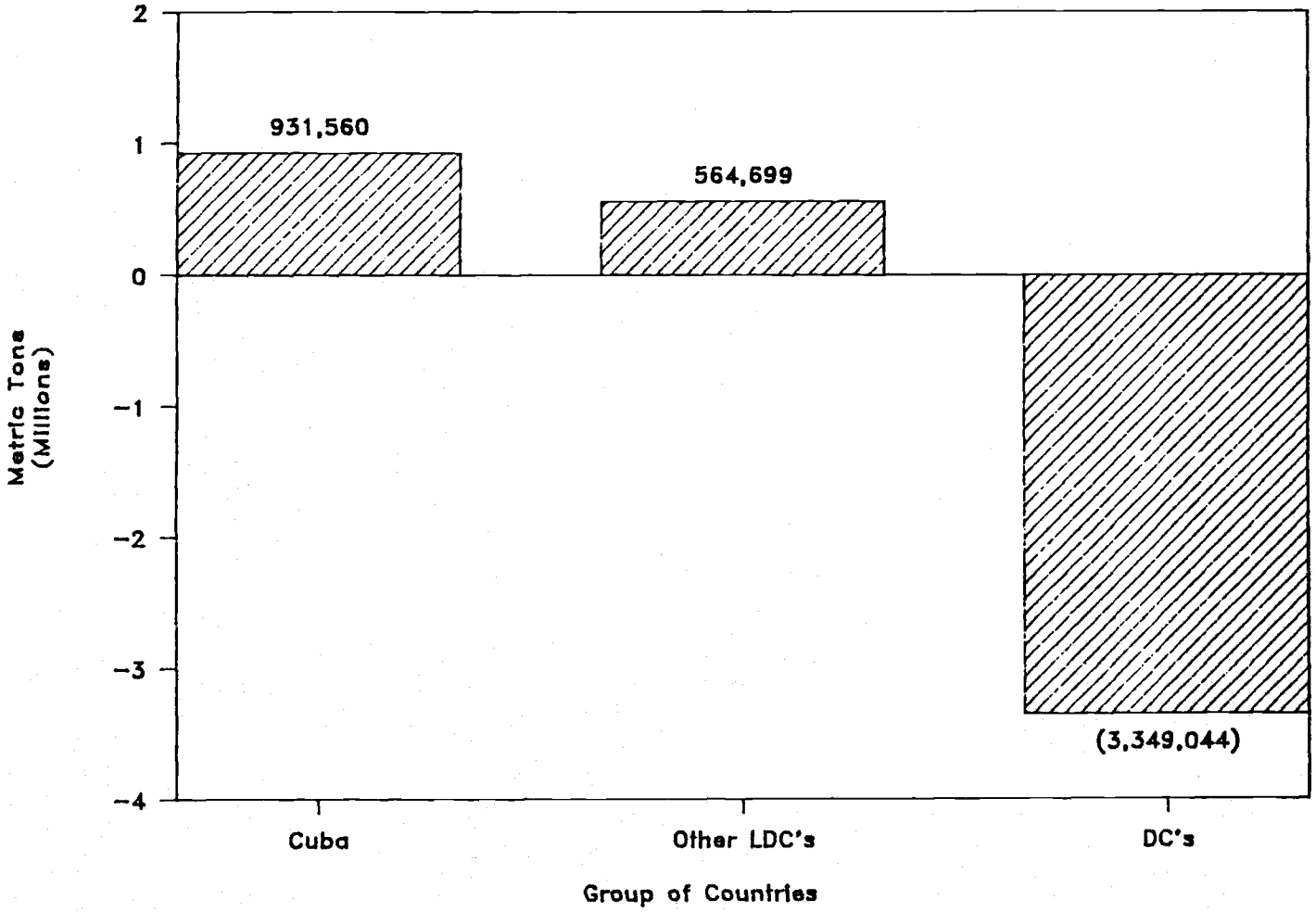

Figure 4.2. Changes in Exports by: Groups of Countries.

The trade reform, inducing the expansion of employment to the rural area, would thus help to alleviate the income distribution problem in the developing countries. The EC(10), Australia and Austria, which constitute the developed countries in this model, would encounter contraction in their sugar sectors of about 3.3 million metric tons a year.

Figure 4.3 shows the impact on foreign exchange earnings for the three group of countries. In addition to the $2.6 billion gain by Cuba, all other developing countries would experience $173 million gain. The DCs would still gain because of the sizeable increase in export prices.

Fifty and Twenty Percent Liberalization

The model is also used to evaluate scenarios of reducing the existing level of protection by 50 and 20 percent. Results are, in general, in the same direction as in the case of complete liberalization. Only the magnitude of the impact differs. It is obvious that the greater reduction in protectionist interventions, the greater the impacts. Table 4.14 summarizes the effects on some countries facing significant impacts from the changes in policies under the two scenarios. This table ranks the effect according to the magnitude of change in export volume.

The EC(10) and Australia are still the principal losers in terms of declining export volumes under both scenarios. However, under the twenty percent reduction scenario, the EC(10) becomes worse off in

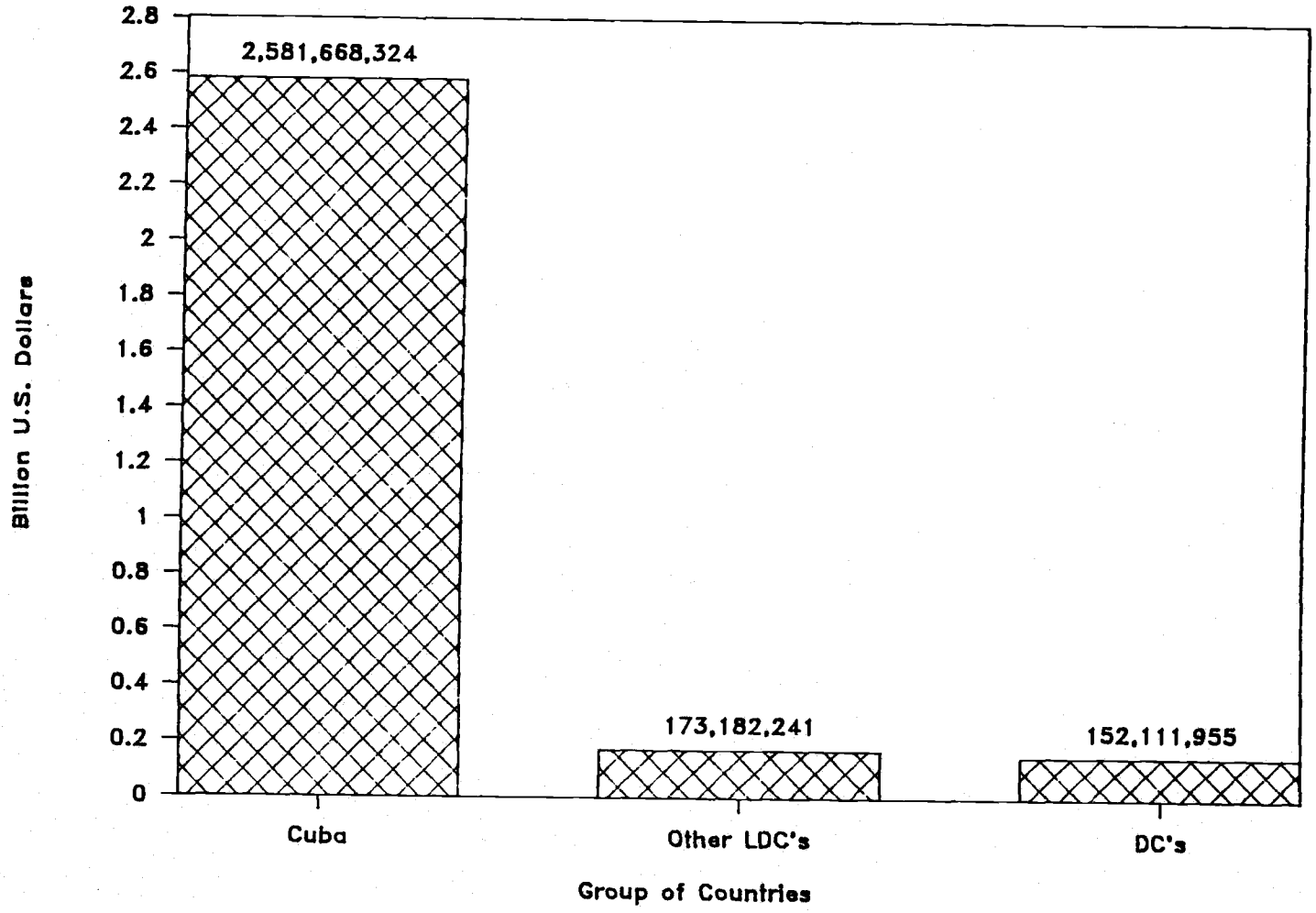

Figure 4.3. Changes in Earnings by: Groups of Countries.

Table 4.14. Impacts of Fifty and Twenty Percent Liberalization

	Export (MT)	Change (%)	Export Price ($)	Change (%)	Foreign Exchange ($)	Change (%)
Fifty Percent Reduction of Protection						
Cuba	696,913	10.40	185	26.50	1,855,352,959	39.66
Brazil	291,440	11.41	9	5.96	69,620,333	18.05
Thailand	39,908	1.95	7	5.04	20,172,466	7.08
Philippines	27,347	11.88	7	1.79	12,494,960	13.89
Mexico	23,355	10.66	1	0.65	3,862,536	11.37
Australia	(1,024,200)	-37.79	151	96.18	93,746,434	22.03
EC (10)	(1,889,959)	-45.06	233	84.42	15,213,102	1.31
Twenty Percent Reduction of Protection						
Cuba	399,578	5.96	103	14.76	1,010,428,542	21.60
Brazil	192,673	7.54	6	3.97	45,576,283	11.82
Thailand	28,595	1.40	5	3.60	14,364,750	5.04
Philippines	19,268	8.37	5	1.28	8,780,738	9.76
South Africa	9,802	1.12	4	2.47	5,121,840	3.62
Australia	(632,697)	-23.35	80	50.96	66,845,531	15.71
EC (10)	(1,613,160)	-38.46	168	60.87	(11,650,872)	-1.01

Source: Estimated.

foreign exchange earnings because the export price does not increase enough to compensate for the loss in volume.

Unilateral Liberalization

All the results reported above assume multilateral liberalization by the five industrialized countries. The model is also used to simulate the opening up of trade policy by each individual developed country separately. The purpose of running the model in such a context is to gauge the boundary of the impact. The magnitude of such effect may be useful in formulating bilateral negotiating plans in the interim stage before the advent of GATT settlement. Moreover, in some countries, specifically the U.S., considerable pressure is being applied by internal sources for unilateral policy reform for the sake of reducing consumer expenditures on sugar and enhancing efficiency in production.

Tables 4.15, 4.16 and 4.17 list the major gainers or losers from unilateral liberalization by the United States, the EC(10) and Australia. As before, the tables rank the countries according to the absolute changes in export volume. The opening up of free trade in sugar by Canada and Japan would have very minimal impacts on the export side of the international market, hence the reports are omitted.

Table 4.15 shows that the EC(10), Brazil and Australia would gain the most from the U.S. liberalization. Thailand and the Philippines would also receive significant impacts. Unilateral liberalization by the EC(10) in Table 4.16 shows no impact on other exporting countries.

Table 4.15. Unilateral Liberalization by the U.S.A.

	Export (MT)	Change (%)	Export Price ($)	Change (%)	Foreign Exchange ($)	Change (%)
(100 Percent)						
EC(10)	164,973	3.93	17	6.16	119,635,106	10.34
Brazil	127,731	5.00	4	2.65	30,016,053	7.78
Australia	117,971	4.35	14	8.92	58,112,117	13.66
Thailand	17,191	0.84	3	2.16	8,589,364	3.02
Philippines	15,309	6.65	4	1.02	6,967,543	7.74
(50 Percent)						
EC(10)	145,753	3.48	15	5.43	105,324,138	9.10
Brazil	127,731	5.00	4	2.65	30,016,053	7.78
Australia	109,700	4.05	13	8.28	53,878,142	12.66
Thailand	17,191	0.84	3	2.16	8,589,364	3.02
Philippines	11,403	4.96	3	0.77	5,183,148	5.76
(20 Percent)						
EC(10)	116,833	2.79	12	4.35	83,975,916	7.25
Brazil	95,529	3.74	3	1.99	22,374,777	5.80
Australia	84,740	3.13	10	6.37	41,250,920	9.70
Thailand	11,454	0.56	2	1.44	5,713,842	2.01
Philippines	11,403	4.96	3	0.77	5,183,148	5.76

Source: Estimated.

Table 4.16. Unilateral Liberalization by the EC(10).

	Export (MT)	Change (%)	Export Price ($)	Change (%)	Foreign Exchange ($)	Change (%)
(100 Percent)						
South Africa	18	0.00	0	0.00	2,916	0.00
Czecho-slovakia	12	0.00	0	0.00	1,800	0.00
EC (10)	(2,276,536)	-54.28	209	75.72	(227,573,751)	-19.66
(50 Percent)						
South Africa	18	0.00	0	0.00	2,916	0.00
Czecho-slovakia	12	0.00	0	0.00	1,800	0.00
EC (10)	(2,066,017)	-49.26	174	63.04	(199,951,476)	-17.27
(20 Percent)						
South Africa	18	0.00	0	0.00	2,916	0.00
Czecho-slovakia	12	0.00	0	0.00	1,800	0.00
EC (10)	(1,750,190)	-41.73	132	47.83	(160,469,388)	-13.86

Source: Estimated.

Table 4.17. Unilateral Liberalization by Australia.

	Export (MT)	Change (%)	Export Price ($)	Change (%)	Foreign Exchange ($)	Change (%)
(100 Percent)						
Cuba	904,471	13.49	245	35.10	2,495,050,213	53.33
EC(10)	260,391	6.21	27	9.78	192,136,500	16.60
Brazil	225,414	8.82	7	4.64	53,496,471	13.87
Thailand	28,595	1.40	5	3.60	14,364,750	5.04
Philip-pines	19,268	8.37	5	1.28	8,780,738	9.76
Aus-tralia	(1,335,705)	-49.29	185	117.83	44,526,680	10.47
(50 Percent)						
Cuba	675,713	10.08	179	25.64	1,792,363,553	38.31
EC(10)	193,716	4.62	20	7.25	141,219,956	12.20
Brazil	160,112	6.27	5	3.31	37,749,657	9.79
Thailand	22,907	1.12	4	2.88	11,473,357	4.03
Philip-pines	15,309	6.65	4	1.02	6,967,543	7.74
Aus-tralia	(1,091,131)	-40.26	127	80.89	34,280,414	8.06
(20 Percent)						
Cuba	384,632	5.74	99	14.18	970,107,916	20.74
EC(10)	116,833	2.79	12	4.35	83,975,916	7.25
Brazil	95,529	3.74	3	1.99	22,374,777	5.80
Thailand	11,454	0.56	2	1.44	5,713,842	2.01
Philip-pines	7,549	3.28	2	0.51	3,427,001	3.81
Aus-tralia	(699,428)	-25.81	65	41.40	20,872,694	4.91

Source: Estimated.

The EC(10) itself would suffer a huge loss in volume ranging from 40 to 54 percent under different degrees of policy reform. Table 4.17 illustrates the effect of free trade on the part of Australia. Cuba, the EC(10) and Brazil would be the major gainers. Thailand and the Philippines would also benefit significantly. Australia itself would encounter the contraction in its sugar trade.

Specific Impacts on Thailand

Sugar is one of the major foreign exchange generating commodities of Thailand. It provides a large scale of employment and distributes income to rural areas. Thailand has developed the production technology and marketing skills and become the world's number five sugar exporter. Thailand holds 7.59 percent of the world sugar trade in 1986. Despite this superficial look of success Thailand's sugar enterprise has had to confront enormous conflicts between cane farmers and sugar millers.

The 70:30 Revenue Sharing Scheme

Before 1982 the Thai sugar industry operated under no particular guidance from the government. With the peak of world sugar price of $632 a ton in 1980 cane farmers expanded their production significantly. The world price plummeted to $371 and $184 in 1981 and 1982 respectively and became the major cause of annual cane-farmer demonstrations, demanded for government's assistance. The government responded by fixing the cane price to be paid by millers to farmers. The government also allocated fund to subsidize the cane price.

The prolonged decline in world sugar price since 1981 has made the situation very politically vulnerable and costly in term of government budget. The government therefore introduced the 70:30 revenue sharing system effective in 1983. The rationale for this system is that both farmers and millers jointly participate and are responsible in the process of producing the finished product. It was generally agreed that approximately 70 percent of cost of producing sugar is the cost of producing cane. The system stipulates that 70 percent of the revenue from sales, domestic sales of refined sugar plus exports of raw sugar, will be appropriated to farmers. Under this system, the government fixes the domestic price of refined sugar and controls the quantity sold domestically. With the domestic price currently fixed three times above the world price, in effect the domestic consumers partially subsidize the producers.

Thailand Sugar Production Costs

Brown (1987) provides a comparison of the cost of producing sugar among various producing countries. Using a 1979-1983 average and weighted world average = 100, Thailand's cost index is 90. This index is still high in comparison to other major exporting countries, e.g. 79 for Argentina, 75 for the Philippines, 71 for Cuba, 62 for Australia, and 57 for Brazil.

The stipulated 70:30 ratio is meant to represent roughly the production costs of cane and sugar. To be fair to both parties involved in the production process, additional research is needed to determine

the accurate ratio. In 1987 the government assigned the Asian Institute of Technology (AIT) to estimate comparative production costs. The AIT has conducted a preliminary study based on data provided by principal parties involved in the production process but still has not arrived at a precise ratio.

Table 4.18 shows the main components in the production costs of sugar. The costs are divided into two parts: cost of producing cane and cost of milling. The numbers reported here are those submitted by government agencies. With the cost structure shown in the table the ratio would be 57:43 rather than 70:30. However, the government has decided to maintain the original ratio on the ground that all other revenue from by-products, e.g. molasses, have not been included in the calculations. These additional proceeds belonged solely to the millers in 1986.

Specific Impacts on Farmers and Millers

Since the multilateral liberalization is the more probable event in the world trade arena, the analysis will be emphasized in that setting rather than a unilateral environment. The study will be conducted under complete or 100 percent removal of distorting policies to see the upper extent of the impact.

As shown in Tables 4.11, 4.12, and 4.13, removal of protection by the industrialized countries has a favorable impact on Thailand, increasing export volume by 51,124 MT/year. With the price increase of $9/MT the foreign exchange earnings rise by $26,011,078, from

Table 4.18. Thailand Costs of Producing Canes and Milling (1986/1987).

Costs of Producing Canes[a/]		
Cane production costs per ton	Baht 222.33	
Harvesting costs	68.82	
Transporting costs to mills	100.00	
Total costs per ton of cane	391.15	
Converted at $38.037/Baht1,000[b/]	$ 14.88	
Costs per ton of sugar[c/]		$ 153.13
Costs of Milling[d/]		
Fixed costs per sack (100 kg.)	Baht 167.32	
Variable costs per sack	130.19	
Total costs per sack	297.51	
Converted at $38.037/Baht1,000[b/]	$ 11.32	
Costs per ton of sugar		$ 113.20
Total costs per ton of sugar		**$ 266.33**

a/ Estimated by Office of Agricultural Economics, Ministry of Agriculture and Cooperatives, Thailand.

b/ Exchange Rates Table, FAO, Trade Yearbook, 1986.

c/ Average rate of production of sugar per ton of cane is 97.17 kg., calculated from Tables 80 and 82, 1948-1985 World Crop and Livestock Statistics, FAO Processed Statistics Series, averaged for the year 1983-1985.

d/ Estimated by Office of the Cane and Sugar Board, Ministry of Industry, Thailand.

Source: Derived from Research Project on Cost of Production of Cane and Sugar by The Asian Institute of Technology, Bangkok.

$284,868,546 to $310,879,624, equivalent to a 9.13 percent change. This is quite a significant impact to the whole country.

At the old export price of $139/MT and with the cost of production, $266.33/MT, shown in Table 4.18 Thai sugar industry operates at a loss in 1986. With the new export price of $148/MT and increasing export volume it is interesting to note the specific effects on farmers and millers.

A survey by Far Eastern Economic Review in central Thailand, where there are intensive cane plantings, asserts that most farmers are heavily in debt (Sricharatchanya, 1987). Table 4.19 estimates the per unit revenue to farmers and millers and clearly confirms that assertion. Before liberalization the cane farmers are operating at a loss of $0.35 ($14.53 - $14.88) for each ton of cane produced. Since the government fixes the domestic price of refined sugar and the domestic consumption is controlled, the domestic sales are assumed to be the same before and after liberalization. Also, for simplicity, assume that unit costs of production stay the same. Therefore, after removal of protection by the major industrialized countries Thai farmers are slightly better off by $0.02 ($14.90 - $14.88) per ton of cane production. On the millers' side, the huge loss per ton of sugar produced reduces from $49.12 ($64.08 - $113.20) to $47.48 ($65.72 - $ 113.20) after liberalization. However, the loss on the millers' side may be overstated owing to the fact that proceeds of many by-products are excluded in the calculation to offset the cost of the milling. Molasses is one of the by-products for which in some years export prices are higher than for raw sugar.

Table 4.19. Per Unit Impact on Thai Farmers and Millers

	Before Liberalization	After Liberalization
Domestic Sales		
744,075 @ $397.52/MT[a/]	$ 295,784,694	$ 295,784,694
Export Sales		
2,049,414 @ $139/MT	284,868,546	
2,100,538 @ $148/MT		310,879,624
Total Revenue	**$ 580,653,240**	**$ 606,664,318**
70% of revenue to farmers	$ 406,457,268	$ 424,665,023
Cane production (MT)	27,975,208[b/]	28,501,337[c/]
Revenue per MT of cane	$ 14.53	$ 14.90
Gain (Loss) per MT of cane	($ 0.35)	$ 0.02
30% of revenue to millers	$ 174,195,972	$ 181,999,295
Sugar production (MT)	2,718,351	2,769,474
Revenue per MT of sugar	$ 64.08	$ 65.72
Loss per MT of sugar	$ 49.12	$ 47.48

a/ Wholesale price of refined sugar from ISO, Sugar Year Book, 1986 is 19.6 cents/lb, equivalent to $432.10/MT. Convert to raw value by dividing by 1.087, a factor from FAO, Trade Yearbook, 1986.

b/ From Note c/ of Table 4.18, 97.17 kg. of sugar are produced from 1 MT of cane, hence 2,718,351 MT of sugar in 1986 are extracted from 27,975,208 MT of cane.

c/ Increase in sugar export of 51,124 MT with 97.17 kg. factor result in 526,129 MT increase in cane production from previous level of 27,975,208 MT.

Source: Estimated.

These proceeds belonged to the millers under the system enforced in 1986.

Quota Rent from Sugar Exports to the U.S.A.

The U.S.A. has implemented a policy of a quota system for its imports of sugar. It agrees to pay for imports at its high domestic price. The difference between this high price and the depressed world price is known as "quota rent" in economic term. With the huge margin of the quota rent it has been argued that the quota recipients may be better off under the quota system than under a free trade regime. Table 4.20 analyzes the impacts of liberalization with respect to advantages and disadvantages of the price premium Thailand receives as quota rent. All Thailand exports to the U.S.A. in 1986, 21,910 MT, are under the quota. With the high unit price Thailand receives from sales to the U.S. comparing to average export price of Thailand, the quota rent is of significant magnitude at $5,904,964. However, with the $9/MT price increase and significant flows of Thai sugar to other importing countries, Thailand is still better off in terms of foreign exchange gain despite the loss of $5,904,964 in quota rent. Even under the unilateral liberalization of sugar policy by the U.S.A., Thailand's overall foreign exchange earning still increases regardless of the loss ($5,904,964) in quota rent. This is because the export price still increases enough and the flows of Thai sugar to other countries are quite substantial.

Table 4.20. Analysis of Quota Rent on Thai Exports to the U.S.A.

Multilateral Liberalization		
Price received under U.S. quota per MT	$ 408.51[a/]	
Thailand unit price to all countries	139.00	
Quota Rent per MT	**$ 269.51**	
Total quota rent received (21,910 @ 269.51/MT)		$ 5,904,964
Loss in quota rent after liberalization		5,904,964
Thailand's overall gain in foreign exchange		26,011,078
Net gain ($26,011,078 - $5,904,964)		$ 20,106,114
Unilateral Liberalization		
Loss in quota rent after liberalization		$ 5,904,964
Thailand's overall gain in foreign exchange		8,589,364
Net gain ($8,589,364 - $5,904,964)		$ 2,684,400

a/ Thai Cane and Sugar Corporation, Annual Report, 1987. This price includes $13.78/MT for GSP allocated to Thailand.

Source: Estimated.

CHAPTER V

SUMMARY AND CONCLUSIONS

This research has centered on economic analysis of the impacts on exporting countries resulting from freer international trade in sugar. The measurements of impacts are in terms of the changes in export volume, export price and foreign exchange earnings. In this study, freer trade arises from trade liberalization through the elimination or reduction of protection policies in the five industrialized countries; the U.S., the EC(10), Japan, Canada, and Australia. The research aims to provide indicators for formulation of negotiating positions to those countries participating in the multilateral and/or bilateral trade talks.

Summary

Agricultural trade reform is on top of the list in the current Uruguay round of GATT talks. The tying of farm issues to others, such as services and intellectual property, in the process of negotiations makes the agricultural trade liberalization a realistic prospect. Most developing countries depend heavily on agricultural exports. With their united stand and the emergence of a strong and influential farm exporting coalition like the Cairns Group, the concessions on farm issues by the developed countries in return for liberalized trade in services and intellectual property are evidenced.

The distortion or protection policies used in this study are at the 1986 level. Trade distortion policies are for example the price

support and quotas, income payment, input subsidies, export subsidies, research and advisory, and other programs such as taxation schemes. These policies are quantified in terms of PSE per quantity unit for producers and CSE/Unit for consumers. Sugar trade is one of the most protected among the agricultural commodities. This is evidenced by the high PSE (averaged for the period 1982-1986) at the level of 47 percent of producers' income coming from government policy transfers. Any outcome from the agricultural trade reform would definitely affect the world sugar trade.

World trade in sugar is characterized by two types of markets. At the 1986 level, the special arrangement market accounts for 33 percent while 67 percent of trade is accomplished in the free market. Price in the special arrangement market is somewhat remotely related to that in the free market in which price volatility has recently been evidenced. The structural changes in world demand and supply and the increasing intensity of policy distortions have directly contributed to the depressed world price since 1981. The free market price fell to the lowest level at four cents a pound in 1985. The United States and Japan rank in the top for supporting their sugar sectors, at 77 and 72 percent in PSE level, respectively.

This research uses the Export Side International Trade (ESIT) model to determine the export price and trade flows. The model includes 30 exporting and 44 importing countries. The ESIT model is a mixture of the spatial equilibrium model and the Armington-type model. The spatial equilibrium model determines trade flows by minimizing transportation cost between source and destination regions. The model uses the excess

demand and excess supply concepts and the equilibrium takes place in the international market with the prevailing law of one price.

The Armington model recognizes trade flow rigidities and that the law of one price does not hold. Each importing country allocates imports from various exporting countries using relative prices of the products.

The ESIT model uses the concept of excess demand and excess supply but a separate equilibrium occurs at the border of each exporting country. The law of one price does not hold here since the allocation of trade flows is rigid from the vantage point of the exporting country. Unlike the Armington case, the ESIT model does not require data on the prices each importing country pays to each exporting country. This contributes analytical efficiency to the conduct of this study.

With the theoretical background based on the ESIT model this study proceeds by using the Delphi process in estimating the basic parameters. The elasticities of excess demand and excess supply are estimated from the elasticities of domestic demand and supply together with data on shares of consumption and production in the amount imported or exported. From these elasticities of excess demand and supply in conjunction with the data on elasticities of price transmission, the elasticities of export demand facing exporting countries are derived. The elasticities of export demand used in this study are of smaller magnitude than others' because the latter ignore the significance of trade flows effect on the parameters. The derived export demand function and the excess supply function are assumed to constitute the equilibrium in each export

market. The policy changes in the liberalized country are viewed as shifting the domestic demand or domestic supply in that country. This shift translates to an excess demand or excess supply shift and hence to the export demand shift. The new equilibrium is determined by equating the new export demand and excess supply in each export market. This study assumes constant elasticity demand and supply functions. For the estimation process, all the functions are transformed into double log forms.

Applying the ESIT model to the 1986 data on trade flows, production, consumption and assumed removal of protection by the industrialized countries result in the new equilibrium export prices, export volumes and trade flows. With complete liberalization, the model predicts the first ten gainers in terms of percentage change in exchange earnings in the following order: Cuba, Australia, Brazil, the Philippines, Mexico, Turkey, Thailand, Fiji, South Africa and the EC(10). The gains range from 55 percent to three percent. Cuba, Brazil, Thailand, the Philippines would fare quite well in that order in terms of absolute change in export volume. The export volumes of the EC(10) and Australia would decline by 50 and 47 percent respectively. The massive price rises would help offset their loss in volume. The trade liberalization would stimulate the expansion in exports from Cuba by .9 million metric tons and from other LDCs by one-half million tons. The developed countries' exports would contract by three million tons. In terms of exchange earnings, the other LDCs would gain by $173 million. With the 50 and 20 percent removal of distortions, the model gives the same direction of the impacts. Only the magnitude of the

impacts would be smaller.

The model is also used to run in the scenario of unilateral liberalization by each of the five industrialized countries. The EC(10), Brazil, Australia, Thailand, and the Philippines would gain significantly from unilateral liberalization by the United States. No other exporting countries would gain from unilateral liberalization by the EC(10), and the EC(10) itself would lose greatly. Opening up sugar policy by Australia alone would benefit Cuba, the EC(10), Brazil, Thailand, and the Philippines significantly. Unilateral liberalization by Canada and Japan would have no noticeable effects on any exporting countries.

For Thailand specifically, under the 70:30 revenue sharing scheme between farmers and millers, specific impacts on these two parties of Thailand sugar sector is analyzed. With the hundred percent and multilateral liberalization setting, the revenue to cane farmers would increase from $14.53 to $14.90 per ton of cane produced. This would cover the cost of production which is estimated to be $14.88. The revenue to millers would also increase from $64.08 to $65.72 per ton of sugar produced. Although liberalization would deprive Thailand of quota rent from exporting to the United States, the increase in international price and volume would still make Thailand better off in the freer trade setting.

Conclusions

It is clearly seen that the intensity of distortion in the world

sugar market is high. The political ties and the special arrangements between traders play a major role in the market mechanism. However, in the final analysis, demand and supply would determine prices, buyers, sellers and the amount of trade. The findings of this research are consistent with the theory in general that international prices would rise after liberalization. It also confirms the implication of Tyers and Anderson's (1988b) study that the larger the number of countries pursuing trade liberalization, the bigger the impacts on prices.

From the above findings, some implications can be drawn concerning the formulation of trade negotiation positions by various parties. The connotation on interregional trade relationship can also be determined. The results can be considered as timely input for trade negotiators in the current round of GATT talks which is targeted to conclude in the next two years.

Although this study focuses on the export side of the international sugar market, the conclusions drawn from the research are useful to major importing countries such as the United States and Japan as well. Knowing impacts, and hence negotiation positions of the other sides, can help U.S or Japanese negotiators formulate give-and-take bargaining chips more efficiently.

At 1986 levels the developing countries' share in the world trade in sugar is 71 percent. These countries should unite their positions and push for reforms leading to freer trade. The increase in foreign exchange earnings in the other LDCs, except Cuba, by $173 million a year would help boost their capacities in servicing foreign debts. Further, these earnings are vital to their economic development. In addition the

expanded volume of trade in these LDCs, by more than half a million tons a year, would bring about new employment which can redistribute income more to the rural areas. As far as the developed countries are concerned, the results suggest that resources from the contraction in their sugar sectors would be more economically and appropriately reallocated to other sectors.

All exporting countries involved in the model would prefer multilateral liberalization to unilateral liberalization individually by any of the five developed countries. However, if need arises for unilateral negotiation, all countries would be indifferent for opening up policies by the EC(10), Canada or Japan unilaterally. The results indicate that the EC(10) and Australia would not want to offer a unilateral liberalization.

The study does not directly model the impacts on importing countries. The effects on such countries could still be explored if desired. Nevertheless, a qualitative judgment can be made here especially about the United States. Due to the U.S. good faith in striving for agricultural trade reforms and the huge net societal cost to the U.S. studied by Leu et al., it would be wise to abandon the current quota program. The abandonment of the quota program would relieve the consumers' burden of paying the high domestic sugar price and would also create efficiency in the U.S. sugar production. This action would not only directly benefit the U.S. but also would substantiate its commitment to help the third world nations out of the debt crisis. The repercussion could be the, at least partial, alleviation in the U.S. food and/or financial aid budget to those

countries in the long run.

This study identifies two developing countries from ASEAN, Thailand and the Philippines, as major gainers. ASEAN is a group of countries which has a staunchly anti-communist stand. The benefits from trade reforms would help this group of countries become stronger and become a vital part of prosperous Asian-Pacific rim countries in the next decade. It has been asserted that Asia would become the world attention economically and politically in the next century. Many indications now point in that direction. The free world, especially the United States, should try in every way to strengthen these countries' positions. The United States would still have the prominent role in that region of the world if it is willing and prepared to deal with it.

Besides gaining in foreign exchange earnings, the expanded export volume resulting from trade reforms would help Thailand tremendously. At present the domestic price of sugar is controlled at a high level. The expansion of the sugar industry would, in the long run, lower the cost of production and could bring down the domestic price. This would expand related industries using sugar as raw material. The increase in employment both directly in sugar production and indirectly in other businesses would be many fold. One clear example would be the expansion in canned-fruit (canned pineapple) industry.

The strengthening economy would reinforce the potential of Thailand to become the fifth member of the newly industrialized countries (NICs). In fact, in the case of Thailand, it would be more appropriate to be a NAC (newly agri-industrialized country). This is because the backbone of Thailand economy is agriculture and is likely to

remain so. It is more economically efficient for Thailand to turn agricultural products to finished goods.

The well being of Thailand has one vital implication for countries in that region. The impressive economic growth in recent year has made Thailand a role model for countries in that area. The success of Thailand in economic terms has not only helped it survive the so called Domino theory but also serves as a prospect for the "Reversed Domino" theory. This is evidenced by the present Thai government's policy of turning Indochina from a battlefield to a marketplace is responded very well by the three socialist countries in Indochina. There are perception and hope in general that those countries would look upon Thailand and incline to operate their economy in the capitalist context instead of the centrally planned systems.

Limitations and Suggestions for Future Research

The model used in this study has limited applications. It is not intended to confront all aspects of impacts from trade liberalization. It is a static model in nature, no policy reaction variables are incorporated into the model. This is to say that the model lacks the dynamic components. The results are as good as the data on elasticities of domestic demand and supply, and on elasticities of price transmission. These data are from secondary sources. Econometric work may be further conducted to confirm the accuracy of these parameters.

As noted from the beginning of the thesis, this study is of single commodity and partial equilibrium analysis. Thus, there are limitations on how far the magnitude of the results may be pushed or implied in

policy recommendations. For example, this study identifies Cuba would expand its sugar sector by almost one million metric ton a year. In the real world scenario which involves many commodities, the interactions among economic factors would limit such expansion to some extent. This is because an expansion in sugar sector would need to compete for more land, labor and capital from other sectors of the economy. Hence, there would be restrictions on the implications of the results.

There is another warning to be noted. In practice, the negotiating process is carried on as a package consisting of different commodities. The settlement would be likely in terms of reducing an aggregate PSE. In this case the PSE approach may fail to bring about the intended freer markets in the event of partial liberalization (McMinimy 1988). For example, the liberalizing countries may agree to reduce an aggregate PSE of all commodities by fifty percent. If the countries involved manipulate by adjusting PSE to each commodity at different percentages, this would lead to an increase imbalance in each commodity among various countries. This kind of imbalance could cause interest and pressure groups in a particular commodity to increase more intervention. However, the findings of this study are based on the assumption that all participants stand firmly on the agreed upon percentage of reduced protection in sugar sector.

For further research, it may be of interest to incorporate other related products, e.g. high fructose corn syrup, in order to capture the cross effect. This is to say, a general equilibrium setting would be more appropriate and realistic. The analysis may be extended to projection of reaction to policy changes by all countries. Forecasting

of demand and supply for the next ten years may be necessary and phased liberalization during that period may occur.

Lastly, continued research is needed to look at the level of protection beyond 1986. It has been felt in general that the distortion policies have been pervasively practiced by most countries in spite of the current talks aiming at scaling them down. The magnitude of impacts might be much different using today's protection levels.

Contributions of this Research

Besides the explicit usefulness of the results to trade negotiators as stated in the objectives of the study, this thesis also provides some development to the literature. The special contributions to the literature may fall into two areas.

Firstly, the study identifies and adapts the appropriate model for applying to international trade in sugar. The chosen model is the new approach which differs from those traditional models previously applied to sugar trade. In the process of the study, attempts have been made to improve the adapted model to apply to a constant elasticity function rather than to a linear function as originally proposed.

Secondly, this study has examined the scenarios of freer world trade in sugar from the perspective of the less developed countries. This additional vantage can be incorporated to the existing empirical works, focusing on impacts on developed countries, in order to arrive at a better negotiating plan of any country.

Despite the limitations of the ESIT model noted in the previous section, the approach taken here has contributed a plausible framework

for analyzing the world sugar market. This research has provided a means of estimating the country specific impacts of freer international trade in sugar.

BIBLIOGRAPHY

Abbott, P. C. "Estimating U.S. Agricultural Export Demand Elasticities: Econometric and Economic Issues." Chapter 3 in Elasticities in International Agricultural Trade, edited by C.A. Carter and W.H. Gardiner, Westview Press, Inc., Boulder, Colorado, 1988.

Abbott, P. C. and P. L. Paarlberg. "Modeling the Impact of the 1980 Grain Embargo." Chapter 11 in Embargoes, Surplus Disposal, and U.S. Agriculture, Staff Report No. AGES860910, Economic Research Service, United States Department of Agriculture, November 1986.

Armington, P. S. "A Theory of Demand for Products Distinguished by Place of Production." IMF Staff Papers, V. 16, 1969, pp.159-178.

Bolling, C. "Price and Exchange Rate Transmission Revisited: The Latin American Case." Chapter 6 in Elasticities in International Agricultural Trade, edited by C.A. Carter and W.H. Gardiner, Westview Press, Inc., Boulder, Colorado, 1988.

Bredahl, M. E., W. H. Meyers and K. J. Collins. "The Elasticity of Foreign Demand for U.S. Agricultural Products: The Importance of the Price Transmission Elasticity." American Journal of Agricultural Economics, V. 61, February 1979, pp.58-63.

Brown, J. G. The International Sugar Industry: Development and Prospects, World Bank Staff Commodity Working Papers Number 18, World Bank, Washington D.C., 1987.

Dixit, P. M. and V. O. Roningen. Modeling Bilateral Trade Flows with the Static World Policy Simulation (SWOPSIM) Modeling Framework, Staff Report No. AGES861124, Economic Research Service, USDA, December 1986.

Food and Agriculture Organization (FAO). 1948-1985 World Crop and Livestock Statistics, FAO Processed Statistics Series, Rome, 1987.

Food and Agriculture Organization (FAO). Trade Yearbook, Rome, 1986.

Gemmill, G. "An Equilibrium Analysis of U.S. Sugar Policy." American Journal of Agricultural Economics, V. 59, November 1977, pp.609-618.

Gemmill, G. The World Sugar Economy: An Econometric Analysis of Production and Policies, Agricultural Economics Report No. 313, Department of Agricultural Economics, Michigan State University, East Lansing, October 1976.

International Sugar Organization (ISO). Sugar Year Book, ISO, London, 1986.

Johnson, P. R. "The Elasticity of Foreign Demand for U.S. Agricultural Products." American Journal of Agricultural Economics, V. 59, November 1977, pp.735-736.

Johnson, S. R., Z. A. Hassan and R. D. Green. Chapter 4 in Demand Systems Estimation, The Iowa State University Press, Ames, Iowa, 1984.

Kim, C. S. "Gains from Trade Liberalization in the World Wheat Market." Manuscript, Economic Research Service, United States Department of Agriculture, January 1989.

Kim, C. S., M. D. Shane, A. Webb and J. R. Jones. "Mathematical Modeling of World Grain Trade Restrictions." Economic Research Service Technical Bulletin No.1735, United States Department of Agriculture, September 1987.

Koutsoyiannis, A. Chapter 2 in Modern Microeconomics, second edition, St. Martin's Press Inc., New York, 1979.

Landell Mills Commodities Studies. A Structural Model of the World Sugar Market, Landell Mills Commodities Studies, London, March 1987.

Leu, G. M., A. Schmitz and R. D. Knutson. "Gains and Losses of Sugar Program Policy Options." American Journal of Agricultural Economics, V. 69, August 1987, pp.591-602.

Maskus, K. E. The International Political Economy of U.S. Sugar Policy in the 1980's, PSA Working Paper No. WP/87/1, The United States Department of State, Washington, D.C., September 1987.

McCalla, A., P. Abbott, and P. Paarlberg. "Policy Interdependence, Country Response, and the Analytical Challenge." Chapter 6 in Embargoes, Surplus Disposal, and U.S. Agriculture, Staff Report No. AGES860910, Economic Research Service, United States Department of Agriculture, November 1986.

McMinimy, V. R. "World Commodity Markets: There Are Ways to Improve Them." Choices, First Quarter 1988, pp.19-21.

Organization for Economic Co-Operation and Development (OECD). National Policies and Agricultural Trade, OECD, Paris, 1987.

Samuelson, P. A. "Spatial Price Equilibrium and Linear Programming." American Economic Review, V. 42, June 1952, pp.283-303.

Smith, V. L. "Minimization of Economic Rent in Spatial Price Equilibrium." Review of Economic Studies, V. 30, 1963, pp.24-31.

Sricharatchanya, P. "Artificial Sweetener." Far Eastern Economic Review, August 13, 1987, pp.82-83.

Takayama, T. and G. G. Judge. "Spatial Equilibrium and Quadratic Programming." Journal of Farm Economics, V. 46, February 1964, pp.67-93.

Thai Cane and Sugar Corporation. Annual Report, Thai Cane and Sugar Corporation, Bangkok, 1987.

The Asian Institute of Technology (AIT). Research Project on Cost of Production of Cane and Sugar, AIT, Bangkok, October, 1987.

Tweeten, L. G. "The Demand for United States Farm Output." Food Research Institute Studies, Stanford University, V. 7, 1967, pp.343-369.

Tyers, R. and K. Anderson. "Imperfect Price Transmission and Implied Trade Elasticities in a Multi-commodity World." Chapter 9 in Elasticities in International Agricultural Trade, edited by C.A. Carter and W.H. Gardiner, Westview Press, Inc., Boulder, Colorado, 1988a.

Tyers, R. and K. Anderson. "Liberalising OECD Agricultural Policies in the Uruguay Round: Effects on Trade and Welfare." Journal of Agricultural Economics, V. 39, May 1988b.

United States Department of Agriculture (USDA 1). Agriculture in the Uruguay Round: Analyses of Government Support, Staff Report No. AGES880802, Economic Research Service, USDA, December 1988.

United States Department of Agriculture (USDA 2). Estimates of Producer and Consumer Subsidy Equivalents: Government Intervention in Agriculture, 1982-86, Staff Report No. AGES880127, Economic Research Service, USDA, April 1988.

Valdes, A. and J. Zietz. Agricultural Protection in OECD Countries: Its Cost to Less-Developed Countries, Research Report 21, International Food Policy Research Institute, December 1980.

Zietz, J. and A. Valdes. "The Potential Benefits to LDCs of Trade Liberalization in Beef and Sugar by Industrialized Countries." Weltwirtschaftliches Archiv, V. 122, Heft 1, 1986, pp.93-111.

Appendices

Appendix 3.1

The Derivations of Excess Demand, Excess Supply, and Export Demand Elasticities

The excess demand (ED) of country i can be written as:

$$ED_i(P_i) = D_i(P_i) - S_i(P_i) \tag{A1}$$

where D_i, S_i, and P_i are domestic demand, supply and price in country i, respectively. Taking partial derivative of (A1) with respect to P_i yields:

$$\partial ED_i/\partial P_i = \partial D_i/\partial P_i - \partial S_i/\partial P_i \tag{A2}$$

Multiplying both sides of (A2) by P_i/ED_i and manipulating both terms on the right hand side results in:

$$(\partial ED_i/\partial P_i)(P_i/ED_i) = (\partial D_i/\partial P_i)(P_i/D_i)(D_i/ED_i) - (\partial S_i/\partial P_i)(P_i/S_i)(S_i/ED_i) \tag{A3}$$

(A3) can be rewritten in elasticity forms as:

$$e_{edi} = (e_{di}*D_i - e_{si}*S_i)/ED_i \tag{A4}$$

where e_{edi}, e_{di}, and e_{si} are elasticities of excess demand, domestic demand, and domestic supply respectively. (A4) is equivalent to equation (1) in the text. Starting with the equation of excess supply, $ES_i(P_i) = S_i(P_i) - D_i(P_i)$, and with the same procedure, elasticity of excess supply can be derived as:

$$e_{esi} = (e_{si}*S_i - e_{di}*D_i)/ES_i \tag{A5}$$

which is equivalent to equation (2) in the text.

Repeat equation (3), export demand (XD) of the k^{th} exporting country, from the text:

$$XD_k(P_k) = \Sigma_j ED_j(P_j) - \Sigma_{i \neq k} ES_i(P_i) \qquad (A6)$$

where i and j stand for exporting and importing countries respectively. Assuming prices in all countries relate through international price transmission. Thus, $P_j = P_j(P_k)$ and $P_i = P_i(P_k)$. Taking partial derivatives on (A6) with respect to P_k, price in the k^{th} country,

$$\partial XD_k/\partial P_k = \Sigma_j(\partial ED_j/\partial P_j)(\partial P_j/\partial P_k) - \Sigma_{i \neq k}(\partial ES_i/\partial P_i)(\partial P_i/\partial P_k) \qquad (A7)$$

Multiplying both sides of (A7) by P_k/XD_k and manipulating both terms on the right hand side gives the following:

$$\begin{aligned}(\partial XD_k/\partial P_k)(P_k/XD_k) = {} & \Sigma_j(\partial ED_j/\partial P_j)(\partial P_j/\partial P_k) \\ & (P_k/XD_k)(ED_j/ED_j)(P_j/P_j) - \\ & \Sigma_{i \neq k}(\partial ES_i/\partial P_i)(\partial P_i/\partial P_k) \\ & (P_k/XD_k)(ES_i/ES_i)(P_i/P_i)\end{aligned} \qquad (A8)$$

(A8) can be expressed in elasticity form as:

$$e_{xdk} = \Sigma_j(e_{edj} * e_{tj} * ED_j/XD_k) - \Sigma_{i \neq k}(e_{esi} * e_{ti} * ES_i/XD_k) \qquad (A9)$$

e_{edj} and e_{esi} are excess demand and excess supply elasticities of the j^{th} and the i^{th} countries respectively. e_t is the elasticity of price transmission; e_{tj} is the response of price in the j^{th} country to the price change in the k^{th} country, while e_{ti} is such response in the i^{th}

country. e_{xdk} is the export demand elasticity of the k^{th} country. (A9) is equivalent to equation (4) in the text.

Appendix 3.2

Basic Data on Exporting Countries

	Production[a/] (MT)	Consumption[a/] (MT)	e_s[b/]	e_d[b/]	e_t[c/]	p[d/] ($)
Malawi	167,847	73,453	0.6000	-0.400	0.05	226
Mauritius	748,472	40,440	0.4536	-0.128	0.05	436
South Africa	2,248,300	1,380,964	0.1000	-0.126	0.30	162
Swaziland	536,594	24,306	0.6000	-0.400	0.05	220
Zimbabwe	507,276	237,948	0.6000	-0.400	0.05	166
Barbados	112,633	13,500	0.5932	-0.400	0.00	322
Belize	104,704	6,270	0.7621	-0.400	0.00	308
Costa Rica	219,682	164,728	0.7621	-0.106	0.00	172
Cuba	7,467,415	673,415	0.3416	-0.400	0.00	698
Dominican RP	894,538	293,619	0.2807	-0.162	0.00	302
El Salvador	292,435	176,011	0.7621	-0.400	0.00	264
Guatemala	650,988	300,057	0.6524	-0.199	0.00	259
Honduras	226,819	114,469	0.7621	-0.400	0.00	257
Jamaica	198,771	101,753	0.6051	-0.111	0.00	347
Mexico	4,068,218	3,451,415	0.7305	-0.139	0.00	155
Nicaragua	256,037	156,828	0.5656	-0.400	0.00	365
Argentina	1,100,000	950,000	0.4909	-0.125	0.00	209
Brazil	7,999,473	6,589,225	0.4880	-0.131	0.24	151
Colombia	1,272,154	1,002,530	0.6750	-0.213	0.00	146
Guyana	260,547	34,710	0.4207	-0.128	0.00	296

Appendix 3.2 (continued).

	Production[a/] (MT)	Consumption[a/] (MT)	e_s[b/]	e_d[b/]	e_t[c/]	p[d/] ($)
Philippines	1,514,105	1,180,031	0.7390	-0.286	0.31	391
Taiwan	535,484	532,953	0.2492	-0.326	0.51	192
Thailand	2,718,351	744,075	0.1650	-0.481	0.24	139
Turkey	1,414,135	1,482,613	0.6000	-0.257	0.20	191
Austria	307,148	356,602	0.6000	-0.118	0.00	175
Czecho.	850,000	800,000	0.0100	-0.400	0.02	150
EC(10)	14,125,507	10,779,878	0.1000	-0.120	0.00	276
Spain	970,759	1,116,195	0.6000	-0.182	0.06	197
Australia	3,438,662	817,829	0.3705	-0.097	0.49	157
Fiji	508,106	34,526	0.5468	-0.400	0.50	247
Total	55,715,160	33,630,343				

Sources:

a/ ISO, Sugar Year Book, 1986, values at 1986 level.

b/ These values are short-run elasticities and are mostly obtained from Gemmill (1976) except those $e_s = 0.6$ and $e_d = -0.4$ are as assumed by Zietz and Valdes, and that for the EC is from Tyers and Anderson (1988a).

c/ Tyers and Anderson (1988a), short-run elasticity of price transmission for producers.

d/ Derived from Table 67 of FAO, Trade Yearbook, 1986.

Appendix 3.3

Basic Data on Importing Countries

	Production[a/] (MT)	Consumption[a/] (MT)	e_s[b/]	e_d[b/]	e_t[c/]
Algeria	0	575,000	0.0000	-0.600	0.15
Angola	50,000	100,000	0.6000	-0.400	0.05
Egypt	950,000	1,650,000	0.6000	-0.400	0.15
Gambia	0	35,000	0.0000	-0.400	0.05
Ghana	0	55,000	0.0000	-0.554	0.05
Kenya	240,000	440,000	0.6000	-0.315	0.05
Libya	0	190,000	0.0000	-0.152	0.15
Morocco	351,711	725,103	0.6000	-0.189	0.15
Nigeria	45,000	650,000	0.6000	-2.284	0.05
Somalia	30,000	115,000	0.6000	-0.400	0.05
Tunisia	21,493	189,074	0.6000	-0.264	0.15
Canada	106,000	1,100,000	0.1000	-0.080	0.12
USA	5,676,300	7,085,200	0.0700	-0.200	0.10
Peru	585,312	732,516	0.6875	-0.173	0.00
Bangladesh	180,000	340,000	0.6000	-0.100	0.00
China	5,670,000	6,700,000	0.3200	-0.400	0.05
Hong Kong	0	120,000	0.0000	-0.295	0.20
India	7,594,466	8,693,726	0.3190	-0.788	0.09
Indonesia	2,149,532	2,122,863	0.1000	-0.694	0.02
Iran	600,000	1,300,000	0.5444	-0.192	0.15
Iraq	0	600,000	0.0000	-0.170	0.15

Appendix 3.3 (continued).

	Production[a/] (MT)	Consumption[a/] (MT)	e_s[b/]	e_d[b/]	e_t[c/]
Israel	0	250,000	0.0000	-0.085	0.15
Japan	953,375	2,737,997	0.1000	-0.050	0.00
Jordan	0	140,000	0.0000	-0.400	0.15
Korea, South	0	643,353	0.0000	-0.831	0.02
Lebanon	0	65,000	0.0000	-0.400	0.15
Malaysia	70,000	615,000	0.6000	-0.400	0.20
Pakistan	1,150,685	1,750,000	0.6000	-0.100	0.35
Persian Gulf	0	105,000	0.0000	-0.400	0.15
Saudi Arabia	0	350,000	0.0000	-0.400	0.15
Singapore	0	145,000	0.0000	-0.093	0.20
Sri Lanka	34,851	350,000	0.6000	-0.295	0.20
Syria	50,000	385,000	0.6000	-0.203	0.15
Vietnam	200,000	230,000	0.3200	-0.473	0.20
Yemen AR.	0	200,000	0.0000	-0.400	0.15
Bulgaria	115,000	475,000	0.3200	-0.400	0.02
EC(10)	14,125,507	10,779,878	0.1000	-0.120	0.00
Finland	133,476	182,776	0.6000	-0.110	0.00
Norway	0	170,372	0.0000	-0.118	0.00
Portugal	15,000	315,000	0.6000	-0.186	0.07
Switzerland	128,921	289,039	0.6000	-0.110	0.00
New Zealand	0	165,000	0.0000	-0.099	0.50

Appendix 3.3 (continued).

	Production[a/] (MT)	Consumption[a/] (MT)	e_s[b/]	e_d[b/]	e_t[c/]
USSR	8,660,000	13,400,000	0.3200	-0.400	0.02
Others	2,177,957	2,777,118	0.6000	-0.400	0.50
Total	52,064,586	70,039,015			

Sources:

a/ ISO, Sugar Year Book, 1986, values at 1986 level.

b/ These values are short-run elasticities and are mostly obtained from Gemmill (1976) except those $e_s = 0.6$ and $e_d = -0.4$ are as assumed by Zietz and Valdes, and those for the U.S., the EC, Canada and Japan are from Tyers and Anderson (1988a). The values of e_s's for the following centrally planned economies; China, Vietnam and Bulgaria are assumed to be the same as that of the USSR. e_s's of those countries with no production are assumed to be zero. The value of e_d for Vietnam is that of South Vietnam reported by Gemmill.

c/ Tyers and Anderson (1988a), short-run elasticity of price transmission for consumers.

Appendix 3.4

Bilateral Trade Flows in 1986 (Metric Ton)

Im-\Exporter porter	Malawi	Mauritius	South Africa	Swaziland
Algeria				
Angola				
Egypt		11,436		
Gambia				
Ghana				
Kenya				
Libya				
Morocco		29,640		15,873
Nigeria				
Somalia				
Tunisia				
Canada		46,320	128,465	177,909
USA	412	13,292	22,525	16,825
Peru				
Bangladesh				
China				
Hong Kong			10,150	
India		13,215		
Indonesia				
Iran				
Iraq				
Israel				
Japan			363,548	
Jordan				
Korea, South			193,994	
Lebanon				
Malaysia				
Pakistan				
Persian Gulf				
Saudi Arabia				
Singapore				
Sri Lanka				10,964
Syria				
Vietnam				
Yemen AR.				
Bulgaria				
EC(10)	16,525	516,944	177	155,353
Finland		14,078		
Norway	27			
Portugal	13,590			37,000
Switzerland				
New Zealand				

Appendix 3.4 (continued).

	Malawi	Mauritius	South Africa	Swaziland
USSR		15,569		60,741
Others	62,800	1,157	154,818	23,139
Total Export	93,354	661,651	873,677	497,804

	Zimbabwe	Barbados	Belize	Costa Rica
Algeria				
Angola				
Egypt				
Gambia				
Ghana				
Kenya				
Libya				
Morocco	42,174			
Nigeria				
Somalia				
Tunisia				
Canada	33,504	3,512		
USA		12,089	55,441	65,206
Peru				
Bangladesh				
China				
Hong Kong				
India				
Indonesia				
Iran				
Iraq				
Israel				
Japan				
Jordan				
Korea, South				
Lebanon				
Malaysia				
Pakistan				
Persian Gulf				
Saudi Arabia				
Singapore				
Sri Lanka				
Syria				
Vietnam				
Yemen AR.				
Bulgaria				
EC(10)	58,624	51,632	43,972	

Appendix 3.4 (continued)

	Zimbabwe	Barbados	Belize	Costa Rica
Finland				
Norway				
Portugal	44,000			
Switzerland				
New Zealand				
USSR	12,855	21,121	5,595	
Others	79,194			1,259
Total Export	270,351	88,354	105,008	66,465

	Cuba	Dominican RP.	El Salvador	Guatemala
Algeria	98,767			
Angola	57,991			
Egypt	138,569			
Gambia				
Ghana	12,388			
Kenya				
Libya	57,819			
Morocco		26,780		14,152
Nigeria				
Somalia				
Tunisia	37,563	34,788		
Canada	168,025			
USA		357,789	103,868	118,674
Peru	40,859			
Bangladesh	12,349			53,000
China	307,241			
Hong Kong				
India	1,541			
Indonesia				
Iran				
Iraq	55,318			
Israel				
Japan	534,487			
Jordan				
Korea, South				
Lebanon				
Malaysia	56,311			
Pakistan	28,458			11,909
Persian Gulf				
Saudi Arabia				
Singapore				

Appendix 3.4 (continued)

	Cuba	Dominican RP.	El Salvador	Guatemala
Sri Lanka	12,999			27,417
Syria	50,775			
Vietnam	10,487			
Yemen AR.				
Bulgaria	302,838			14,961
EC(10)				
Finland	61,744			
Norway				
Portugal	12,438			4,043
Switzerland	3,257			
New Zealand				
USSR	4,019,793	51,243		45,288
Others	620,571	9,976		83,927
Total Export	6,702,588	480,576	103,868	373,371

	Honduras	Jamaica	Mexico	Nicaragua
Algeria				
Angola				
Egypt				
Gambia				
Ghana				
Kenya				
Libya				
Morocco			53,000	
Nigeria				
Somalia				
Tunisia			11,400	
Canada				
USA	63,949	17,362	118,500	
Peru				
Bangladesh				13,341
China				
Hong Kong				
India				
Indonesia				
Iran				
Iraq				
Israel				
Japan				
Jordan				
Korea, South				
Lebanon				

Appendix 3.4 (continued)

	Honduras	Jamaica	Mexico	Nicaragua
Malaysia				
Pakistan				
Persian Gulf				
Saudi Arabia				
Singapore				
Sri Lanka				
Syria				
Vietnam				
Yemen AR.				
Bulgaria	17,081		24,256	
EC(10)		128,759	12,000	
Finland				
Norway				
Portugal				
Switzerland				
New Zealand				
USSR	4,750			59,094
Others	9,500			
Total Export	95,280	146,121	219,156	72,435

	Argentina	Brazil	Colombia	Guyana
Algeria		227,749		
Angola				
Egypt		119,264		
Gambia				
Ghana				
Kenya		47,350		
Libya				
Morocco		28,000	28,000	
Nigeria		134,837		
Somalia		61,615		
Tunisia		23,991	12,000	
Canada				20,896
USA	51,242	140,365	145,155	4,989
Peru		54,997		
Bangladesh		14,290		
China				
Hong Kong				
India		308,949		
Indonesia				
Iran		196,601		
Iraq		304,535		
Israel				

Appendix 3.4 (continued)

	Argentina	Brazil	Colombia	Guyana
Japan				
Jordan		43,846		
Korea, South			12,000	
Lebanon				
Malaysia				
Pakistan		147,046		
Persian Gulf				
Saudi Arabia				
Singapore				
Sri Lanka		42,785		
Syria				
Vietnam				
Yemen AR.				
Bulgaria		16,595		
EC(10)				160,591
Finland				
Norway				
Portugal		2,725		
Switzerland				
New Zealand				
USSR		567,800		27,866
Others	3,532	71,097	14,660	4,898
Total Export	54,774	2,554,437	211,815	219,240

	Philippines	Taiwan	Thailand	Turkey
Algeria				
Angola				
Egypt				
Gambia				
Ghana				
Kenya				
Libya				
Morocco				
Nigeria				
Somalia				
Tunisia				
Canada				
USA	225,307	18,578	21,910	
Peru				
Bangladesh			60,935	
China			307,191	
Hong Kong			819	
India		10,761	78,064	

Appendix 3.4 (continued)

	Philippines	Taiwan	Thailand	Turkey
Indonesia		2,117	15,630	
Iran				110,000
Iraq				32,000
Israel				
Japan		44,250	377,342	
Jordan				
Korea, South	4,815	47,090	483,672	
Lebanon				
Malaysia			171,608	
Pakistan		26,305	54,905	
Persian Gulf				
Saudi Arabia				
Singapore			2,245	
Sri Lanka			89,341	
Syria				
Vietnam			12,520	
Yemen AR.				
Bulgaria			62,725	
EC(10)		3		
Finland				
Norway				
Portugal				
Switzerland				
New Zealand			20,810	
USSR			250,143	
Others		2,268	39,554	
Total Export	230,122	151,372	2,049,414	142,000

	Austria	Czecho-slovakia	EC(10)	Spain
Algeria			113,221	46,844
Angola			1,124	
Egypt		77,651	208,718	25,022
Gambia			71,496	
Ghana			41,307	
Kenya			133,659	
Libya			73,278	
Morocco			26,588	33,459
Nigeria			442,594	
Somalia			22,429	
Tunisia			60,735	
Canada				
USA			16,089	

Appendix 3.4 (continued).

	Austria	Czecho-slovakia	EC(10)	Spain
Peru			59,349	
Bangladesh			41,783	
China				
Hong Kong			7,082	
India		45,971	259,587	
Indonesia			29,575	
Iran			344,862	
Iraq		12,582	14,727	9,783
Israel			203,100	25,544
Japan			4	
Jordan			89,699	
Korea, South				
Lebanon			67,393	
Malaysia				
Pakistan		76,385	218,899	
Persian Gulf			102,420	
Saudi Arabia		112,972	175,243	
Singapore			2,136	
Sri Lanka			202	13,696
Syria		12,960	223,562	25,109
Vietnam			1,212	
Yemen AR.			163,257	
Bulgaria			6	
EC(10)	38,195	7,972		
Finland			2,669	
Norway			159,433	
Portugal			6,586	
Switzerland	1,819		168,989	
New Zealand				
USSR			8,053	
Others	47,851	3,424	632,935	4
Total Export	87,865	349,917	4,194,001	179,461

	Australia	Fiji	Total Import
Algeria			486,581
Angola			59,115
Egypt			580,660
Gambia			71,496
Ghana			53,695
Kenya			181,009
Libya			131,097
Morocco			297,666

Appendix 3.4 (continued).

	Australia	Fiji	Total Import
Nigeria			577,431
Somalia			84,044
Tunisia			180,477
Canada	551,482		1,130,113
USA	99,233	14,736	1,703,536
Peru			155,205
Bangladesh		30,934	226,632
China	443,327		1,057,759
Hong Kong			18,051
India			718,088
Indonesia			47,322
Iran			651,463
Iraq			428,945
Israel			228,644
Japan	513,938		1,833,569
Jordan			133,545
Korea, South	314,411		1,055,982
Lebanon			67,393
Malaysia	380,300	66,097	674,316
Pakistan			563,907
Persian Gulf			102,420
Saudi Arabia			288,215
Singapore	135,139		139,520
Sri Lanka			197,404
Syria			312,406
Vietnam			24,219
Yemen AR.			163,257
Bulgaria			438,462
EC(10)		174,469	1,365,216
Finland			78,491
Norway			159,460
Portugal			120,382
Switzerland			174,065
New Zealand	101,888	41,120	163,818
USSR	158,600		5,308,511
Others	11,616		1,878,180
Total Export	2,709,934	327,356	24,311,767

Source: Compiled from ISO, Sugar Year Book, 1986, based on exporter reports.

Appendix 3.5

PSE and CSE of the Five Industrialized Countries (US$ Per Metric Ton)

	PSE	CSE
Canada	104.50[a/]	-22.20
USA	226.35	-415.00
Japan	1,105.71[b/]	-673.31[c/]
EC(10)	165.66	-199.35[d/]
Australia	17.85	0

a/ ERS's figure for the total value of policy transfers, Can $15.4 million, for Canada is for beet production. With 106,000 MT production in 1986 of raw sugar, the PSE per unit for raw sugar = Can $145.28 (15.4 million/106,000). Convert to US$ by multiplying Can $145.28 with a factor 12.3/17.1.

b/ ERS gives separate values of PSE's of sugar produced from beet and from cane and the values are for refined basis. The value used here is a weighted average of the two type of sugar after adjustment to raw basis with a factor 1.087 is made.

c/ Adjusted to raw basis, i.e. (-731.89/1.087).

d/ ERS does not have the value for 1986. The value for 1985 is used instead. However, there is a discrepancy in ERS's figure when converted to US$. The derived figure, -$199.35, comes from (-284.00*0.763) = -216.69, divide this by 1.087 to adjust to raw basis.

Source: Derived from USDA, Estimates of Producer and Consumer Subsidy Equivalent: Government Intervention in Agriculture, 1982-86, ERS, USDA, April 1988.

Appendix 4.1

X_i's Adjusted for Each k^{th} Country

i\k	Malawi	Mauritius	South Africa	Swaziland
Malawi		79,737	79,737	93,327
Mauritius	531,393		577,713	622,922
South Africa	177,520	305,985		305,985
Swaziland	232,317	449,840	373,226	
Zimbabwe	181,818	226,351	171,322	270,351
Barbados	63,721	88,354	67,233	88,354
Belize	99,413	105,008	99,413	105,008
Costa Rica	66,465	66,465	66,465	66,465
Cuba	633,009	5,010,243	1,323,083	4,833,826
Dominican RP	367,765	445,788	367,765	445,788
El Salvador	103,868	103,868	103,868	103,868
Guatemala	206,644	262,041	202,601	293,501
Honduras	73,449	78,199	73,449	78,199
Jamaica	146,121	146,121	146,121	146,121
Mexico	130,500	183,500	130,500	183,500
Nicaragua	0	59,094	0	59,094
Argentina	54,774	54,774	54,774	54,774
Brazil	214,187	1,235,475	211,462	852,772
Colombia	159,815	187,815	171,815	187,815
Guyana	170,478	219,240	191,374	219,240
Philippines	225,307	225,307	230,122	225,307
Taiwan	20,849	31,610	112,189	20,849
Thailand	61,464	389,671	923,297	400,948
Turkey	0	0	0	0
Austria	86,046	86,046	86,046	86,046
Czecho.	11,396	135,018	11,396	11,396
EC(10)	815,043	1,154,639	656,110	690,453
Spain	4	58,485	4	47,159
Australia	110,849	820,931	1,490,680	820,931
Fiji	189,205	189,205	189,205	189,205

Appendix 4.1 (continued)

i\k	Zimbabwe	Barbados	Belize	Costa Rica
Malawi	92,915	16,937	16,937	63,212
Mauritius	609,630	592,125	545,805	14,449
South Africa	283,460	151,167	22,702	177,343
Swaziland	470,015	410,828	232,919	39,964
Zimbabwe		104,983	71,479	79,194
Barbados	76,265		84,842	12,089
Belize	49,567	105,008		55,441
Costa Rica	1,259	65,206	65,206	
Cuba	4,820,827	4,187,818	4,019,793	620,571
Dominican RP	87,999	409,032	409,032	367,765
El Salvador	0	103,868	103,868	103,868
Guatemala	147,410	163,962	163,962	202,601
Honduras	14,250	68,699	68,699	73,449
Jamaica	128,759	146,121	146,121	17,362
Mexico	65,000	130,500	130,500	118,500
Nicaragua	59,094	59,094	59,094	0
Argentina	3,532	51,242	51,242	54,774
Brazil	669,622	708,165	708,165	211,462
Colombia	42,660	145,155	145,155	159,815
Guyana	214,251	214,342	193,446	9,887
Philippines	0	225,307	225,307	225,307
Taiwan	2,271	18,581	18,581	20,846
Thailand	289,697	272,053	272,053	61,464
Turkey	0	0	0	0
Austria	86,046	38,195	38,195	47,851
Czecho.	11,396	7,972	7,972	3,424
EC(10)	674,162	24,142	24,142	649,024
Spain	33,463	0	0	4
Australia	721,698	809,315	257,833	110,849
Fiji	174,469	189,205	189,205	14,736

Appendix 4.1 (continued)

i\k	Cuba	Dominican RP.	El Salvador	Guatemala
Malawi	76,390	63,212	412	76,802
Mauritius	101,775	59,658	13,292	59,658
South Africa	646,831	177,343	22,525	177,343
Swaziland	309,753	116,578	16,825	164,542
Zimbabwe	169,553	134,223	0	178,223
Barbados	24,633	33,210	12,089	33,210
Belize	5,595	61,036	55,441	61,036
Costa Rica	1,259	66,465	65,206	66,465
Cuba		4,677,927	0	5,009,446
Dominican RP	96,007		357,789	445,788
El Salvador	0	103,868		103,868
Guatemala	240,545	262,041	118,674	
Honduras	31,331	78,199	63,949	95,280
Jamaica	0	17,362	17,362	17,362
Mexico	35,656	182,900	118,500	195,756
Nicaragua	72,435	59,094	0	72,435
Argentina	3,532	54,774	51,242	54,774
Brazil	1,901,823	831,253	140,365	1,030,703
Colombia	26,660	199,815	145,155	187,815
Guyana	53,660	37,753	4,989	37,753
Philippines	0	225,307	225,307	225,307
Taiwan	83,584	20,846	18,578	47,151
Thailand	1,504,328	311,607	21,910	579,513
Turkey	32,000	0	0	0
Austria	49,670	47,851	0	47,851
Czecho.	228,973	3,424	0	79,809
EC(10)	2,136,946	744,400	16,089	951,141
Spain	120,458	33,463	0	47,159
Australia	2,059,263	269,449	99,233	269,449
Fiji	97,031	14,736	14,736	45,670

Appendix 4.1 (continued)

i\k	Honduras	Jamaica	Mexico	Nicaragua
Malawi	63,212	16,937	16,937	0
Mauritius	30,018	530,236	559,876	15,569
South Africa	177,343	22,702	22,702	0
Swaziland	100,705	172,178	188,051	60,741
Zimbabwe	92,049	58,624	100,798	12,855
Barbados	33,210	63,721	63,721	21,121
Belize	61,036	99,413	99,413	5,595
Costa Rica	66,465	65,206	65,206	0
Cuba	4,943,202	0	340,401	4,032,142
Dominican RP	419,008	357,789	419,357	51,243
El Salvador	103,868	103,868	103,868	0
Guatemala	262,850	118,674	147,787	98,288
Honduras		63,949	81,030	4,750
Jamaica	17,362		146,121	0
Mexico	142,756	130,500		0
Nicaragua	59,094	0	0	
Argentina	54,774	51,242	51,242	0
Brazil	795,857	140,365	208,951	582,090
Colombia	159,815	145,155	185,155	0
Guyana	37,753	165,580	165,580	27,866
Philippines	225,307	225,307	225,307	0
Taiwan	20,846	18,581	18,581	0
Thailand	374,332	21,910	84,635	311,078
Turkey	0	0	0	0
Austria	47,851	38,195	38,195	0
Czecho.	3,424	7,972	7,972	0
EC(10)	657,083	16,089	103,418	49,836
Spain	4	0	33,459	0
Australia	269,449	99,233	99,233	158,600
Fiji	14,736	189,205	189,205	30,934

Appendix 4.1 (continued)

i\k	Argentina	Brazil	Colombia	Guyana
Malawi	63,212	76,802	63,212	79,737
Mauritius	14,449	84,309	44,089	593,282
South Africa	177,343	177,343	371,337	305,985
Swaziland	39,964	164,542	55,837	433,967
Zimbabwe	79,194	178,223	121,368	184,177
Barbados	12,089	33,210	12,089	88,354
Belize	55,441	61,036	55,441	105,008
Costa Rica	66,465	66,465	66,465	66,465
Cuba	620,571	5,382,063	658,134	4,808,389
Dominican RP	367,765	480,576	429,333	419,008
El Salvador	103,868	103,868	103,868	103,868
Guatemala	202,601	373,371	216,753	247,889
Honduras	73,449	95,280	73,449	78,199
Jamaica	17,362	17,362	17,362	146,121
Mexico	118,500	207,156	182,900	130,500
Nicaragua	0	72,435	0	59,094
Argentina		54,774	54,774	54,774
Brazil	211,462		263,453	779,262
Colombia	159,815	199,815		159,815
Guyana	9,887	37,753	9,887	
Philippines	225,307	225,307	230,122	225,307
Taiwan	20,846	57,912	67,936	20,849
Thailand	61,464	657,577	545,136	311,607
Turkey	0	142,000	0	0
Austria	47,851	47,851	47,851	86,046
Czecho.	3,424	216,013	3,424	11,396
EC(10)	649,024	2,700,721	736,347	657,077
Spain	4	128,808	33,463	4
Australia	110,849	269,449	425,260	820,931
Fiji	14,736	45,670	14,736	189,205

Appendix 4.1 (continued)

i\k	Philippines	Taiwan	Thailand	Turkey
Malawi	412	79,737	63,212	0
Mauritius	13,292	544,608	43,233	0
South Africa	216,519	735,062	745,035	0
Swaziland	16,825	195,317	111,669	0
Zimbabwe	0	137,818	92,049	0
Barbados	12,089	63,721	33,210	0
Belize	55,441	99,413	61,036	0
Costa Rica	65,206	66,465	66,465	0
Cuba	0	1,185,057	5,907,075	55,318
Dominican RP	357,789	367,765	419,008	0
El Salvador	103,868	103,868	103,868	0
Guatemala	118,674	214,510	355,176	0
Honduras	63,949	73,449	95,280	0
Jamaica	17,362	146,121	17,362	0
Mexico	118,500	130,500	142,756	0
Nicaragua	0	0	72,435	0
Argentina	51,242	54,774	54,774	0
Brazil	140,365	667,457	1,308,927	501,136
Colombia	157,155	171,815	171,815	0
Guyana	4,989	170,478	37,753	0
Philippines		230,122	230,122	0
Taiwan	65,668		151,369	0
Thailand	505,582	1,071,077		0
Turkey	0	0	0	
Austria	0	86,046	47,851	0
Czecho.	0	133,752	125,780	12,582
EC(10)	16,089	1,157,089	1,217,563	359,589
Spain	0	4	13,700	9,783
Australia	413,644	939,198	2,158,452	0
Fiji	14,736	189,205	152,887	0

Appendix 4.1 (continued)

i\k	Austria	Czecho-slovakia	EC(10)	Spain
Malawi	79,325	79,325	76,829	62,800
Mauritius	518,101	542,752	98,387	42,233
South Africa	154,995	154,995	551,041	154,818
Swaziland	178,492	178,492	164,542	49,976
Zimbabwe	137,818	137,818	178,223	121,368
Barbados	51,632	51,632	33,210	0
Belize	43,972	43,972	61,036	0
Costa Rica	1,259	1,259	66,465	1,259
Cuba	623,828	895,232	6,171,011	976,999
Dominican RP	9,976	9,976	480,576	36,756
El Salvador	0	0	103,868	0
Guatemala	83,927	95,836	373,371	125,496
Honduras	9,500	9,500	95,280	9,500
Jamaica	128,759	128,759	17,362	0
Mexico	12,000	12,000	207,156	53,000
Nicaragua	0	0	72,435	0
Argentina	3,532	3,532	54,774	3,532
Brazil	71,097	950,891	2,554,437	793,430
Colombia	14,660	14,660	199,815	42,660
Guyana	165,489	165,489	37,753	4,898
Philippines	0	0	225,307	0
Taiwan	2,271	39,337	104,279	2,268
Thailand	39,554	172,523	1,066,133	128,895
Turkey	0	32,000	142,000	32,000
Austria		86,046	49,670	47,851
Czecho.	11,396		341,945	106,617
EC(10)	801,924	1,733,671		1,423,053
Spain	4	59,918	179,461	
Australia	11,616	11,616	918,526	11,616
Fiji	174,469	174,469	45,670	0

Appendix 4.1 (continued)

i\k	Australia	Fiji
Malawi	63,212	16,937
Mauritius	76,338	530,236
South Africa	863,350	22,702
Swaziland	278,614	172,178
Zimbabwe	125,553	58,624
Barbados	36,722	63,721
Belize	61,036	99,413
Costa Rica	66,465	65,206
Cuba	5,706,428	68,660
Dominican RP	419,008	357,789
El Salvador	103,868	103,868
Guatemala	247,889	171,674
Honduras	78,199	63,949
Jamaica	17,362	146,121
Mexico	118,500	130,500
Nicaragua	59,094	13,341
Argentina	54,774	51,242
Brazil	779,262	154,655
Colombia	171,815	145,155
Guyana	58,649	165,580
Philippines	230,122	225,307
Taiwan	112,186	18,581
Thailand	1,674,475	275,263
Turkey	0	0
Austria	47,851	38,195
Czecho.	3,424	7,972
EC(10)	659,217	57,872
Spain	4	0
Australia		581,421
Fiji	121,953	

Source: Estimated.

Appendix 4.2
New Bilateral Trade Flows After Liberalization
(100 Percent)

	Malawi	Mauritius	South Africa	Swaziland
Algeria	0	0	0	0
Angola	0	0	0	0
Egypt	0	11,504	0	0
Gambia	0	0	0	0
Ghana	0	0	0	0
Kenya	0	0	0	0
Libya	0	0	0	0
Morocco	0	29,815	0	16,017
Nigeria	0	0	0	0
Somalia	0	0	0	0
Tunisia	0	0	0	0
Canada	0	46,594	130,973	179,524
USA	412	13,371	22,965	16,978
Peru	0	0	0	0
Bangladesh	0	0	0	0
China	0	0	0	0
Hong Kong	0	0	10,348	0
India	0	13,293	0	0
Indonesia	0	0	0	0
Iran	0	0	0	0
Iraq	0	0	0	0
Israel	0	0	0	0
Japan	0	0	370,645	0
Jordan	0	0	0	0
Korea, South	0	0	197,781	0
Lebanon	0	0	0	0
Malaysia	0	0	0	0
Pakistan	0	0	0	0
Persian Gulf	0	0	0	0
Saudi Arabia	0	0	0	0
Singapore	0	0	0	0
Sri Lanka	0	0	0	11,064
Syria	0	0	0	0
Vietnam	0	0	0	0
Yemen AR.	0	0	0	0
Bulgaria	0	0	0	0
EC(10)	16,524	519,998	180	156,763
Finland	0	14,161	0	0
Norway	27	0	0	0
Portugal	13,589	0	0	37,336
Switzerland	0	0	0	0
New Zealand	0	0	0	0
USSR	0	15,661	0	61,292

Appendix 4.2 (continued).

	Malawi	Mauritius	South Africa	Swaziland
Others	62,797	1,164	157,840	23,349
Total Export	93,349	665,561	890,732	502,323

	Zimbabwe	Barbados	Belize	Costa Rica
Algeria	0	0	0	0
Angola	0	0	0	0
Egypt	0	0	0	0
Gambia	0	0	0	0
Ghana	0	0	0	0
Kenya	0	0	0	0
Libya	0	0	0	0
Morocco	42,551	0	0	0
Nigeria	0	0	0	0
Somalia	0	0	0	0
Tunisia	0	0	0	0
Canada	33,804	3,512	0	0
USA	0	12,089	55,580	65,209
Peru	0	0	0	0
Bangladesh	0	0	0	0
China	0	0	0	0
Hong Kong	0	0	0	0
India	0	0	0	0
Indonesia	0	0	0	0
Iran	0	0	0	0
Iraq	0	0	0	0
Israel	0	0	0	0
Japan	0	0	0	0
Jordan	0	0	0	0
Korea, South	0	0	0	0
Lebanon	0	0	0	0
Malaysia	0	0	0	0
Pakistan	0	0	0	0
Persian Gulf	0	0	0	0
Saudi Arabia	0	0	0	0
Singapore	0	0	0	0
Sri Lanka	0	0	0	0
Syria	0	0	0	0
Vietnam	0	0	0	0
Yemen AR.	0	0	0	0
Bulgaria	0	0	0	0
EC(10)	59,149	51,634	44,082	0
Finland	0	0	0	0

Appendix 4.2 (continued)

	Zimbabwe	Barbados	Belize	Costa Rica
Norway	0	0	0	0
Portugal	44,394	0	0	0
Switzerland	0	0	0	0
New Zealand	0	0	0	0
USSR	12,970	21,122	5,609	0
Others	79,903	0	0	1,259
Total Export	272,771	88,357	105,271	66,468

	Cuba	Dominican RP.	El Salvador	Guatemala
Algeria	112,494	0	0	0
Angola	66,051	0	0	0
Egypt	157,828	0	0	0
Gambia	0	0	0	0
Ghana	14,110	0	0	0
Kenya	0	0	0	0
Libya	65,855	0	0	0
Morocco	0	27,000	0	14,223
Nigeria	0	0	0	0
Somalia	0	0	0	0
Tunisia	42,784	35,073	0	0
Canada	191,378	0	0	0
USA	0	360,723	106,107	119,269
Peru	46,538	0	0	0
Bangladesh	14,065	0	0	53,266
China	349,943	0	0	0
Hong Kong	0	0	0	0
India	1,755	0	0	0
Indonesia	0	0	0	0
Iran	0	0	0	0
Iraq	63,006	0	0	0
Israel	0	0	0	0
Japan	608,773	0	0	0
Jordan	0	0	0	0
Korea, South	0	0	0	0
Lebanon	0	0	0	0
Malaysia	64,137	0	0	0
Pakistan	32,413	0	0	11,969
Persian Gulf	0	0	0	0
Saudi Arabia	0	0	0	0
Singapore	0	0	0	0
Sri Lanka	14,806	0	0	27,554
Syria	57,832	0	0	0

Appendix 4.2 (continued)

	Cuba	Dominican RP.	El Salvador	Guatemala
Vietnam	11,945	0	0	0
Yemen AR.	0	0	0	0
Bulgaria	344,928	0	0	15,036
EC(10)	0	0	0	0
Finland	70,325	0	0	0
Norway	0	0	0	0
Portugal	14,167	0	0	4,063
Switzerland	3,710	0	0	0
New Zealand	0	0	0	0
USSR	4,578,484	51,663	0	45,515
Others	706,821	10,058	0	84,348
Total Export	7,634,148	484,517	106,107	375,243

	Honduras	Jamaica	Mexico	Nicaragua
Algeria	0	0	0	0
Angola	0	0	0	0
Egypt	0	0	0	0
Gambia	0	0	0	0
Ghana	0	0	0	0
Kenya	0	0	0	0
Libya	0	0	0	0
Morocco	0	0	58,648	0
Nigeria	0	0	0	0
Somalia	0	0	0	0
Tunisia	0	0	12,615	0
Canada	0	0	0	0
USA	63,952	17,543	131,128	0
Peru	0	0	0	0
Bangladesh	0	0	0	13,446
China	0	0	0	0
Hong Kong	0	0	0	0
India	0	0	0	0
Indonesia	0	0	0	0
Iran	0	0	0	0
Iraq	0	0	0	0
Israel	0	0	0	0
Japan	0	0	0	0
Jordan	0	0	0	0
Korea, South	0	0	0	0
Lebanon	0	0	0	0
Malaysia	0	0	0	0
Pakistan	0	0	0	0

Appendix 4.2 (continued)

	Honduras	Jamaica	Mexico	Nicaragua
Persian Gulf	0	0	0	0
Saudi Arabia	0	0	0	0
Singapore	0	0	0	0
Sri Lanka	0	0	0	0
Syria	0	0	0	0
Vietnam	0	0	0	0
Yemen AR.	0	0	0	0
Bulgaria	17,082	0	26,841	0
EC(10)	0	130,100	13,279	0
Finland	0	0	0	0
Norway	0	0	0	0
Portugal	0	0	0	0
Switzerland	0	0	0	0
New Zealand	0	0	0	0
USSR	4,750	0	0	59,561
Others	9,500	0	0	0
Total Export	95,284	147,643	242,511	73,007

	Argentina	Brazil	Colombia	Guyana
Algeria	0	262,683	0	0
Angola	0	0	0	0
Egypt	0	137,558	0	0
Gambia	0	0	0	0
Ghana	0	0	0	0
Kenya	0	54,613	0	0
Libya	0	0	0	0
Morocco	0	32,295	28,001	0
Nigeria	0	155,520	0	0
Somalia	0	71,066	0	0
Tunisia	0	27,671	12,001	0
Canada	0	0	0	20,933
USA	51,243	161,895	145,162	4,998
Peru	0	63,433	0	0
Bangladesh	0	16,482	0	0
China	0	0	0	0
Hong Kong	0	0	0	0
India	0	356,338	0	0
Indonesia	0	0	0	0
Iran	0	226,757	0	0
Iraq	0	351,247	0	0
Israel	0	0	0	0
Japan	0	0	0	0
Jordan	0	50,572	0	0

Appendix 4.2 (continued)

	Argentina	Brazil	Colombia	Guyana
Korea, South	0	0	12,001	0
Lebanon	0	0	0	0
Malaysia	0	0	0	0
Pakistan	0	169,601	0	0
Persian Gulf	0	0	0	0
Saudi Arabia	0	0	0	0
Singapore	0	0	0	0
Sri Lanka	0	49,348	0	0
Syria	0	0	0	0
Vietnam	0	0	0	0
Yemen AR.	0	0	0	0
Bulgaria	0	19,140	0	0
EC(10)	0	0	0	160,874
Finland	0	0	0	0
Norway	0	0	0	0
Portugal	0	3,143	0	0
Switzerland	0	0	0	0
New Zealand	0	0	0	0
USSR	0	654,894	0	27,915
Others	3,532	82,003	14,661	4,907
Total Export	54,775	2,946,259	211,826	219,627

	Philippines	Taiwan	Thailand	Turkey
Algeria	0	0	0	0
Angola	0	0	0	0
Egypt	0	0	0	0
Gambia	0	0	0	0
Ghana	0	0	0	0
Kenya	0	0	0	0
Libya	0	0	0	0
Morocco	0	0	0	0
Nigeria	0	0	0	0
Somalia	0	0	0	0
Tunisia	0	0	0	0
Canada	0	0	0	0
USA	260,207	18,579	22,457	0
Peru	0	0	0	0
Bangladesh	0	0	62,455	0
China	0	0	314,854	0
Hong Kong	0	0	839	0
India	0	10,761	80,011	0
Indonesia	0	2,117	16,020	0
Iran	0	0	0	120,386

Appendix 4.2 (continued)

	Philippines	Taiwan	Thailand	Turkey
Iraq	0	0	0	35,021
Israel	0	0	0	0
Japan	0	44,252	386,755	0
Jordan	0	0	0	0
Korea, South	5,561	47,092	495,737	0
Lebanon	0	0	0	0
Malaysia	0	0	175,889	0
Pakistan	0	26,306	56,275	0
Persian Gulf	0	0	0	0
Saudi Arabia	0	0	0	0
Singapore	0	0	2,301	0
Sri Lanka	0	0	91,570	0
Syria	0	0	0	0
Vietnam	0	0	12,832	0
Yemen AR.	0	0	0	0
Bulgaria	0	0	64,290	0
EC(10)	0	3	0	0
Finland	0	0	0	0
Norway	0	0	0	0
Portugal	0	0	0	0
Switzerland	0	0	0	0
New Zealand	0	0	21,329	0
USSR	0	0	256,383	0
Others	0	2,268	40,541	0
Total Export	265,768	151,378	2,100,538	155,407

	Austria	Czecho-slovakia	EC(10)	Spain
Algeria	0	0	57,122	46,846
Angola	0	0	567	0
Egypt	0	77,654	105,303	25,023
Gambia	0	0	36,071	0
Ghana	0	0	20,840	0
Kenya	0	0	67,434	0
Libya	0	0	36,970	0
Morocco	0	0	13,414	33,460
Nigeria	0	0	223,298	0
Somalia	0	0	11,316	0
Tunisia	0	0	30,642	0
Canada	0	0	0	0
USA	0	0	8,117	0
Peru	0	0	29,943	0
Bangladesh	0	0	21,080	0

Appendix 4.2 (continued)

	Austria	Czecho-slovakia	EC(10)	Spain
China	0	0	0	0
Hong Kong	0	0	3,573	0
India	0	45,973	130,967	0
Indonesia	0	0	14,921	0
Iran	0	0	173,990	0
Iraq	0	12,582	7,430	9,783
Israel	0	0	102,468	25,545
Japan	0	0	2	0
Jordan	0	0	45,255	0
Korea, South	0	0	0	0
Lebanon	0	0	34,001	0
Malaysia	0	0	0	0
Pakistan	0	76,388	110,439	0
Persian Gulf	0	0	51,673	0
Saudi Arabia	0	112,976	88,414	0
Singapore	0	0	1,078	0
Sri Lanka	0	0	102	13,697
Syria	0	12,960	112,792	25,110
Vietnam	0	0	611	0
Yemen AR.	0	0	82,367	0
Bulgaria	0	0	3	0
EC(10)	38,194	7,972	0	0
Finland	0	0	1,347	0
Norway	0	0	80,437	0
Portugal	0	0	3,323	0
Switzerland	1,819	0	85,259	0
New Zealand	0	0	0	0
USSR	0	0	4,063	0
Others	47,850	3,424	319,329	4
Total Export	87,863	349,929	2,115,961	179,468

	Australia	Fiji	Total Import
Algeria	0	0	479,145
Angola	0	0	66,618
Egypt	0	0	514,870
Gambia	0	0	36,071
Ghana	0	0	34,950
Kenya	0	0	122,047
Libya	0	0	102,825
Morocco	0	0	295,424
Nigeria	0	0	378,818

Appendix 4.2 (continued)

	Australia	Fiji	Total Import
Somalia	0	0	82,382
Tunisia	0	0	160,786
Canada	292,827	0	899,545
USA	52,691	15,214	1,725,889
Peru	0	0	139,914
Bangladesh	0	31,937	212,731
China	235,398	0	900,195
Hong Kong	0	0	14,760
India	0	0	639,098
Indonesia	0	0	33,058
Iran	0	0	521,133
Iraq	0	0	479,069
Israel	0	0	128,013
Japan	272,892	0	1,683,319
Jordan	0	0	95,827
Korea, South	166,946	0	925,118
Lebanon	0	0	34,001
Malaysia	201,932	68,239	510,197
Pakistan	0	0	483,391
Persian Gulf	0	0	51,673
Saudi Arabia	0	0	201,390
Singapore	71,756	0	75,135
Sri Lanka	0	0	208,141
Syria	0	0	208,694
Vietnam	0	0	25,388
Yemen AR.	0	0	82,367
Bulgaria	0	0	487,320
EC(10)	0	180,123	1,378,875
Finland	0	0	85,833
Norway	0	0	80,464
Portugal	0	0	120,015
Switzerland	0	0	90,788
New Zealand	54,101	42,453	117,883
USSR	84,214	0	5,884,096
Others	6,168	0	1,661,726
Total Export	1,438,925	337,966	22,458,982

Source: Estimated.