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The Future of CARICOM Sugar under a Liberalized Trading Regime

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Abstract

The primary objective of this study was to assess and analyse the implications of liberalization of the European Union (EU) and United States of America (USA) sugar markets on CARICOM producers.

Traditionally the EU has been the major market for CARICOM sugar, traded under the EU/ACP Sugar Protocol (SP) and Special Preferential Sugar (SPS) quota arrangement. Additionally, sugar is also sold to the USA through a quota arrangement under the Caribbean Basin Initiative (CBI). Currently Brazil, Thailand and Australia have requested a WTO panel against the EU, challenging the special arrangements for sugar imports from a number of ACP countries as agreed in the Uruguay Round. This has caused sugar exporting ACP countries to express strong concerns and opposition to this action which runs the risk of undermining this preferential market. But the challenge does not stop there. There are also efforts to change what is considered as "market-distorting sugar regimes" in the United States and Japan through both bilateral and multilateral channels.

Much like the case of banana, the outcome of these challenges can pose serious problems for CARICOM economies. This study therefore sought to assess the possible impact of loss of these preferential sugar markets on CARICOM's raw centrifugal sugar industry.

In order to do this, an econometric single commodity static market model was constructed and partial equilibrium analysis was used for the impact analysis. Regression models were constructed for the demand and supply equations in order to derive the respective elasticities to be used in the partial equilibrium model.

It was found that if the EU and the USA were to discontinue the preferential sugar marketing arrangements and CARICOM producers were required to sell their sugar at the world 'free' market equilibrium price, such a measure will have negative quantity, financial and welfare effects.

1.0 Background to the study

The raw centrifugal sugar industry is a major contributor to the income and social *sine qua non*¹ of many CARICOM countries. Its contribution to agricultural GDP ranges from 22% to 45% and is a direct employer of more than 100,000 persons of a total population of 13.8 million. It is a major foreign exchange earner, estimated at approximately USD300 mn and also performs a formidable multifunctional role. Sugar represents one of CARICOM's major traditional export commodities.

The EU has been accused of exporting highly subsidised sugar and distorting world markets to the detriment of sugar exporters worldwide. This is being challenged at the WTO and has raised concerns among ACP nations that preferential sugar quota arrangements with the EU may be at risk. But the challenge does not stop there. There are also efforts to change what is considered in many quarters as "market-distorting sugar regimes" in the United States and Japan through both bilateral and multilateral channels.

1.1 Exports and Foreign Exchange Earnings

Most of the sugar produced in CARICOM is exported to the EU and smaller amounts are exported to the USA under preferential arrangements. Raw centrifugal sugar exports to the EU under the EU/ACP

protocol was estimated at 431,500 tonnes in 2002/2003 and export to the USA at 43,000 tonnes. Table 1 presents the CARICOM sugar situation.

1.2 The Global and World "Free" Market

An estimated 72% to 75% of the sugar produced globally is either consumed in the country where it is produced or exported under long-term supply agreements and arrangements. The remaining 25% – 28% sugar is freely traded in the "free or residual" world market.

1.3 The European Union Market

Production of centrifugal sugar has been on a gradual decline in the European Union. Production declined from 19.5 million in 1999/00 to 18.7 million tonnes in 2002/03. Annual exports range from 5-6 million tonnes and imports ranges from 1.8 to 2.2 million tonnes. During the same period, the European Union consumed an average of 14.5 million tonnes, annually (Table 2).

1.4 United States of America

The USA is also important in world sugar production and trade. The country produced an estimated 7.6 million tonnes in the 2002/03 and imported 1.5 million tonnes (Table 2). Exports were negligible, estimated at 0.1 million tonnes and consumption was estimated at 8.7 million tonnes.

¹ *Sine qua non*: An essential element or condition. Latin, means without which not.

1.5 The World 'Free' Sugar Market

South American producers are the major exporters of sugar to the world 'free' market followed by Europe. In 2000-02, South America exports comprised 36% of total exports and European exports were estimated at 20%. The other major exporters were Asia (16%), Oceania (12%), Central America (10%) and Africa (6%) as presented in Figure 1.

During the same period, Asia was the major importer from the world free market, estimated at 42%. This is followed by Europe (19%) and Africa (17%) as presented in Figure 2. The Russian Federation imported an average of 11% from the Free Market in 2000 – 02, while Japan, USA and Canada, other major importers of sugar from the free market, imported an average of 13% of total imports. Japan imported 5% of total, while the USA and Canada imported an average of 4% each. Imports by the 'Rest of the World' averaged 48% over the same period (Figure 3).

1.6 Marketing Arrangements and Agreements

Sugar production in CARICOM is heavily dependent on preferential trading agreements and arrangements. The three most significant PTAs are trade with the European Union under the Lome / Cotonou Agreement, trade arrangements with the United States of America under the CBI/CBERA and trade with Canada under CARIBCAN (Northover, Thomas 2002:

101)¹. CARICOM nations also enjoy a significant preferential domestic market under CARICOM's Treaty of Chaguaramas for its sugar.

The WTO compatibility of the preferential agreements and NTBs – the issues revisited

The Sugar Protocol is an agreement between governments whereby the EU Member States guarantee to buy and import agreed quantities of sugar which the ACP Signatory States undertake to sell (*About ACP Sugar*²). The Sugar Protocol states that,

"the [European] Community undertakes for an indefinite period to purchase and import, at guaranteed prices, specific quantities of cane sugar, raw or white, which originate in the ACP states and which these States undertake to deliver to it"

- Article 1 of the ACP/EU Sugar Protocol

"Subject to Article 7, these quantities may not be reduced without the consent of the individual states concerned"

Article 3(2) of the ACP/EU Sugar Protocol

After a review of the protocol, it may be argued that the ACP Sugar Protocol is

¹ Reference: Sugar and Related Sweetener Markets. International Perspectives. Edited by A.Schmitz, T.H. Spreen, W.A., Messina and C.B. Moss. CABI Publishing.

² About ACP Sugar website:
<http://www.acpsugar.org/protocols.htm>

sacrosanct. However, others may argue that EU's internal sugar price will have to fall because of WTO rules. The EU regulation on the common organization of the markets in the sugar sector (No. 2038/1999) ensures that the Protocol quantities are irreducible even in cases where the Community has to reduce A&B production quotas¹ on account of its Uruguay Round commitments. Further, Article 1 of ACP/EU Sugar Protocol is reflected in the ACP/EU Partnership Agreement ("Cotonou Agreement") which states that:

"In accordance with Article 25 of the ACP-EEC Convention of Lomé signed on 28 February 1975 and with Protocol 3 annexed thereto, the Community has undertaken for an

indefinite period ... to purchase and import, at guaranteed prices, specific quantities of cane sugar, raw or white, which originates in the ACP States producing and exporting cane sugar and which those States have undertaken to deliver to it."

- Article 13 of Annex V: Trade Regime
Applicable During the Preparatory Period

Against the uncertainties that has developed in the CARICOM market for sugar, and given the experience of bananas, an early attempt is made here to develop a model that can assess the future of CARICOM sugar, the most important agriculture export commodity at this time.

2.0 Analytical method

The analytical model developed for the present study examines the potential impact of liberalization of the EU and the USA raw centrifugal sugar markets as a result of WTO rules. The analytical framework comprised two components. Component 1 developed the demand and supply model with a view to obtain the responsiveness of buyers and suppliers in the major markets to changes in raw centrifugal sugar prices in the world 'free' market. This is followed by Component 2 which analyses the impact of changes in prices / loss of preferential sugar market prices and tariff rate quotas on CARICOM producers. This is done using a partial equilibrium comparative static model using a base period of 1999/01. The quantity, financial and welfare effects were estimated in this component.

¹Production control by means of quotas (fixed by country and by company) under which producers benefit from guaranteed prices. The "A quotas" correspond more or less to Community domestic demand and the "B quotas" to the quantities which can be exported with export refunds. Non-quota sugar or "C sugar" is sugar produced over and above the combined total of A and B quotas; it is exported without refund. Quotas can be adapted annually taking into account production, consumption, stocks and imports. Exports under quotas are of two types:

- net exports (of Community surplus production), giving rise to refunds financed under a system of self-financing via contributions (in the form of production levies) paid entirely by all the producers (farmers and the sugar industry);
- re-exportation, financed by the Community budget, of products imported under preferential agreements with the ACP countries and India.

Source of explanation / footnote: European Commission Directorate-general of Agriculture No. 27 > October 2000 file
http://europa.eu.int/comm/agriculture/publi/newsletter/27/27_en.pdf

2.1 Conceptual Issues

Sugar is used for household consumption as well as industrial uses. This multiplicity of uses creates difficulties in defining the model and therefore led to aggregation for estimation. Similarly on the supply side, sugar is produced from sugarcane and sugar beet which are grown in two different geographical zones – tropical and temperate respectively. These two different plants produce identical raw centrifugal sugar. Further, sugar is retained in various countries to ensure adequate supplies for consumption and industry as well as speculative purposes. The crop is planted and harvested from many ratoons and supplies in one year may be influenced by production factors from previous years. Being agricultural commodities, the crop is also susceptible to yield variations – grown under various climatic conditions and in various equatorial zones. Further, most of the sugar produced is consumed in the same country and subjected to some type of governmental control and preferential arrangement. There are also conditionalities to meet quota, difficulties with the concepts of carryover stock and crop year¹. These variables differential also create difficulties in defining the model and estimation. Consideration was given to these computation and conceptual difficulties in the construction of the model.

¹ There are 112 sugar-producing countries and 126 crop years in the world. The number of crop years is larger than the number of sugar producing countries simply because several countries have more than one crop year.

Policy changes manifest themselves in different forms in society and in a country. One of the difficulties experienced by policy makers is its measurement and expression. Frequently used measurement parameters are the quantity, financial and welfare effects. These quantify the effects of changes in policy, thereby allowing easy comparison. Thus, the impact analysis is used to quantify the impact of policy changes on society. It is also important to evaluate the impact of policy on the commodity of interest and to assess the competitiveness in the marketplace.

2.3 Outline of Empirical Procedure

- (i) Collect data to be used in the analysis. This includes the determination of the various market prices for raw centrifugal sugar.
- (ii) Using regression analysis, estimate the demand and supply equations, the equilibrium market price and elasticities for raw centrifugal sugar traded at the world 'free' market.
- (iii) Using a single commodity market model and partial equilibrium analysis, determine the impact of changes in the prices for raw sugar on CARICOM.

2.4 Data Sources and Treatment

In order to test the hypotheses, data were collected from various sources. These include various issues of the Sugar Year Book, USDA FASonline, Sugar Association of the Caribbean, Napier Brown (UK) and NYBOT. In addition, other data were obtained from Europa, the CARICOM Secretariat, The Hemispheric Database.

Amad database, the FAO and the International Monetary Fund as well as Energy Information Administration, Agriculture and Agri-Food Canada, Milling and Baking News.

Production and Trade Data on Sugar:

The quantity of sugar produced, consumed, exported and stock as well as various prices were obtained from various issues of the Sugar Year Book (Annex Table A1). The ISA daily price is the arithmetical average of the New York Coffee and Sugar Exchange Contract No. 11 spot price and the London Daily Price after conversion of the latter to U.S. cents per pound avoirdupois f.o.b. and stowed Caribbean Port in bulk. The ISA average annual price is reported in USD cents per pound, that is, the currency and units commonly used in the sugar trade.

Price of High Fructose Corn Syrup: HFCS-45 is also traded in USD cents per pound and the data was used as given. Historical prices were obtained from Milling and Baking News.

Gross Domestic Product: The average annual GDP for three major world economies – the USA, Japan and Canada were sourced at the Energy Information Administration website. These are considered as three major world economies and also major players in the world free sugar market. The data were reported as GDP per capita in thousands at 1995 Market Exchange Rates. While the former Soviet Union and other Asian countries are important consuming countries, time series data were not readily available. Thus, the arithmetic mean of the three countries' GDP per capita was used

as a proxy for major consuming countries' GDP.

Year End Stock: Time series data for sugar year-end stock were obtained from various issues of the Sugar Year Book.

Other data examined for the study
Ethanol: The prices paid to producers were the only time series data located. This was therefore used as a proxy for the price of ethanol in the regression analysis.

Crude Oil Prices: The crude oil price (FOB OPEC Price, landed costs of crude oil imports from selected countries) quoted in USD per barrel was obtained from Energy Information Administration's, Historical Monthly Energy Review. These prices were also used in the regression as given.

3.0 Model Structure and Development

The partial equilibrium model used in this study was developed from World Bank research initiated in 1976 by Marto Ballesteros and Colin Bruce (Tsakok 1990) who set out to investigate the application of protection analysis to the problems of agricultural price policy. This was summarized in "Methodologies for Measuring Agricultural Price Intervention Effects" by Pasquale L. Scandizzo and Colin Bruce. These models were further treated by Tsakok (1990), Bivings and Gotsh (1993) and Sadoulet and de Janvery (1995). The model is also used in this study to calculate the impact of output price policy on the quantity produced, consumed and traded of a single commodity, and the impact on the government budget. Moreover, the model addresses the distributional impact of price policy between

consumers, producers and taxpayers, and the deadweight efficiency losses that arise from distorting price policies.

Alternative scenarios were developed on the basis of possible policy changes in the preferential marketing agreements and arrangements under which sugar is traded. The study specifically examined the possible loss of preferential market prices in the European Union and the United States of America on CARICOM. The alternative scenarios developed for the study are as follows:

1. The European Union liberates its sugar market by eliminating its preferential trade agreement for sugar with CARICOM and purchases sugar at world free market prices (Scenario 1).
2. The United States of America liberates its sugar market by eliminating its TRQ and purchases sugar at world free market prices (Scenario 2).
3. The European Union and the United States of America liberates its sugar market by eliminating its TRQ simultaneously and purchases sugar at world free market prices (Scenario 3).

The following assumptions were made:

- (a) The market clearing condition requires that the sum of all countries' excess demand for sugar, which is a function of the world price of sugar, is zero.

- (b) The 'residual' nature of the world market is noted¹.

Thus, with the exception of distortions that may exist, the perfect competition model is assumed to hold at the International Sugar Agreement Daily Price.

3.1 The Demand Function

In this section an attempt is made to identify those critical variables that are impacting on the demand of sugar on the world 'free' market. Regression analysis was utilized to examine the relationship between the quantity demanded and other variables. The analysis was done using the Statistical Package of Social Scientist (SPSS 11.0 for Windows) computer programme. The data were transformed to natural logarithm and various time lags were examined for the best fit. The quantity of sugar demanded on the free market was expressed as a function of price of sugar, price of HFCS-42 and GDP as an indicator of income.

The Demand Function

$$D = f(P_s, HFCS_p, GDP) \dots\dots\dots (1)$$

Where D = Quantity of Raw Sugar demanded

¹ "Most sugar is either consumed in the country where it is produced under government controlled pricing arrangements or moved from one country to another under long-term supply agreements. The sugar not subject to such agreements is freely traded among a number of nations, corporations and individuals. This makes the market for sugar a residual market - a market in which freely traded sugar is only a fraction of worldwide production".

- Ps = World Raw Sugar price
- GDP₋₁ = Gross Domestic Product (lag 1 year)
- HFCSp₋₄ = World High Fructose Corn Syrup price (lag 4 years)

3.2 The Supply Function

Regression analysis was utilized to examine the relationship between the quantity supplied (or quantity exported into the free market) and other variables in order to identify the factors that impact on the supply of sugar on the world 'free' market. The data were also transformed to natural logarithm and various time lags were examined for the best fit. The quantity of sugar supplied to the world free sugar market was expressed as a function of the price of sugar and year-end stocks.

The Supply Function

$$S = f(Ps_{-1}, St_{-2}) \dots\dots\dots (2)$$

Where S = Quantity of Raw Sugar supplied

- Ps₋₁ = World Raw Sugar price
- St₋₂ = Year End Stocks

3.3 Equilibrium Market Price

The equilibrium price in the market is obtained by equating the demand and supply equations and solving for price. This is the price at which the quantity demanded is precisely equal to the quantity supplied.

3.4 Price Elasticity of Demand and Supply

Given that the best fit was obtained using the log-log function, the price elasticity of demand (and supply) is the constant b₁. The slopes of the curves change at every point, but the elasticity is constant and equal to b₁.

3.5 Quantity Effects, Trade Adjustments, Financial Effects and Welfare Effects

Changes in the policy environment will be reflected by changes in the volume of trade as well as financial receipts and welfare. The implications of liberalization are measured through quantity effects, trade adjustments, financial as well as welfare effects.

4.0 Results of the Regression Analysis

The price elasticity of demand and supply as well as the world 'free' sugar market equilibrium price are required for the partial equilibrium model in order to estimate the quantity, financial and welfare effects. Thus, regression analysis using the ordinary least squares method was used to estimate the demand and supply elasticities using the data in Annex Table 2.

4.1 Sugar Demand Model

The quantity of sugar demanded on the free market was expressed as a function of the ISA price of sugar, GDP and the price of HFCS-42 (Table 3).

The International Sugar Agreement Prices, the New York No. 11 Sugar (World Contract and the London Daily Prices (No. 5 Contract) were regressed against the quantity of sugar demanded on the world free market. Only the ISA prices were found to be significant and also the sign was *a priori* correct. The GDP per capita of Canada, USA and Japan were used as a proxy for the income of the major buyers on the world free sugar market¹. They were regressed separately as well as the three-country average was applied. Only the three-country average was found to be significant. The best fit was obtained when the data was lagged one year.

HFCS is another sweetener and is considered a substitute for cane sugar. When the HFCS-42 prices were lagged four years, the coefficient was significant, but the sign was found to be negative rather than positive. Substitutes are defined as products among which the cross elasticity of demand is positive and complements are defined as products among which the cross elasticity of demand is negative. However, HFCS-42 is not a complementary good to cane sugar; rather, it can be considered as a superior good which is in agreement with Evans and Davis 2002. The four-year lag may be explained to some extent by the rate of

development and the conduct in the industry as expressed by Evans and Davis (2002):

"...again it seems plausible given the developments that have been taking place on the supply side when differentiating the product from liquid sugar and making it much more user-friendly. Recalling the sugar and HFCS competition within the framework of a Stackelberg-like model, the observed pattern is consistent with the theory that suggest differentiating a product to such an extent that it is perceived as completely different from its competitor is possible to drive the competitor out of the market. This has been the case to some extent with competition between HFCS and liquid sugar. Judging from statements made by some industry experts, HFCS is now considered to be a superior input to sugar in some applications"

(Evans and Davis 2002).

The annual average GDP of the major importing countries was used as the income variable. When lagged one year, the coefficient obtained was significant, indicating that the previous year's income positively influenced the quantity of sugar demanded on the world free sugar market.

Consumption was also expressed as a function of the quantity of sugar demanded on the world 'free' sugar market. The functional relationship of world per capita

¹ Data for the other major buyers were not readily available

consumption as well as total world consumption was expressed in the regression analysis. However the coefficients were not significant and the signs were negative. They were also found to substantially increase the standard error.

The functional relationship of crude oil (petroleum) and ethanol prices were also examined. It was envisaged that when crude oil prices increase, more sugar will be used for further processing into ethanol and less will be sold on the world market. Even a lagged relationship was expected. The data used in the analysis were the OPEC Crude Oil annual average price. However, the analysis indicated that the relationship was not significant. Also the price paid to producers of ethanol in Brazil was regressed against the quantity of sugar demanded in the world free market. However, when expressed with the ISA price, the ethanol coefficient was found to be highly significant but the sign of its coefficient was negative. The standard error was very large when this variable was introduced.

Functional Form of the Demand Function: The log-log form of the model improved the results / fit of the model compared to the linear model (linear in the variables). The R and R² values remained at 0.84 and 0.71 respectively. However, the adjusted R² reduced from 0.66 to 0.65. Further, the Durbin Watson statistic increased from 0.94 to 1.08 in the transformed model; the standard errors reduced and the values of the *t*-statistic improved – the constant and the ISA price variable are now also significant.

4.2 Sugar Supply Model

The quantity of sugar supplied to the free market was expressed as a function of the price of sugar (lagged one year) and the year-end or carry-over stocks (lagged two years). The result of the analysis is presented in Table 4.

The quantity of sugar supplied to the free market was expressed as a function of the price of sugar (lagged one year) and the year-end or carry-over stocks (lagged two years). The agronomy of sugarcane, its manufacture and accounting system for sale of sugar as well as the residual nature of the world free sugar market may make such a functional relationship significant.

The year-end or carry-over stock (lagged two years) was found to be significant rather than the total production and total exports. Given that only an estimated 20 – 25% of world sugar production is sold on the world free market, the *a priori* goodness of fit of the production coefficient is unsure. The coefficient of the total exports was also rejected although it was highly significant when regressed against quantity supplied. It was found that when this variable was included in the regression, the sign of the intercept was negative and the standard error was very large. This may be due to a high degree of autocorrelation with the quantity supplied, which is expected (most sugar produced is also consumed in the same country, as such, exports are expected to be highly correlated with the free market supply). However, the year-end or carry-over stock coefficient (lagged two years) can be expected to be significant given the residual nature of the market and that

carry-over or carry-out stocks are a precaution against unexpected shortfalls in production. These stocks, therefore, are likely related to the level of domestic production and since the opportunity cost of holding sugar stocks depends on the price of sugar, the stocks should respond to price changes as expressed by Koo (2002).

The prices of crude oil and ethanol were also regressed against the quantity supplied because it can be argued that the major supplier to the world market –Brazil, may retain stocks to convert to ethanol (or produce ethanol rather than sugar) if crude oil and ethanol prices were high. Both variables however were not significant in the relationship.

Functional Form of the Supply Function: The log-log form of the model gave a better fit than the linear model (linear in the variables). The R value remained at 0.79. However, the R² increased from 0.62 to 0.63 and the adjusted R² increased from 0.59 to 0.60. Further, in transforming the model the Durbin Watson statistic increased from 1.03 to 1.12; the standard errors reduced and the values of the *t*-statistic improved.

4.3 The Elasticity of Demand and Supply

The price elasticities of demand and supply for sugar traded on the world free sugar market are presented in Table 5.5.

The price elasticity of demand computed above for sugar at the world free market level was found to be inelastic (-0.24) which means that the quantity demanded changes by a smaller

percentage than does price. If price increases by 1%, the quantity demanded will decrease by 0.24%. This is within the range found by FAO (the price elasticity of demand was in the range of -0.1 to -0.45 for all countries except for Japan and India).

The price elasticity of supply computed above for sugar at the world free market level was found to be inelastic (0.18) which means that the quantity supplied changes by a smaller percentage than does price. If price increases by 1%, the quantity supplied will increase by 0.18%. This is also within the range found by FAO (0.2 to 0.4 for most countries).

The elasticity of 0.18% may be a reflection of the difficulties facing sugar farmers in changing their production decisions, given the existing institutional and economic constraints, as well as the residual nature of the market where suppliers may dump surplus sugar on the market and take whatever remuneration they receive.

4.4 The Market Equilibrium

The equilibrium condition is solved to determine the market clearing prices of sugar on the world free market. The market equilibrium price computed was USD 7.69 cents/lb or USD 169.18/tonne at an equilibrium quantity of 23,861 thousand tonnes.

4.5 Results of Analysis of Market Interventions

Scenario 1: Partial effect - the European Union eliminates its preferential trade

agreement for sugar and purchase sugar at the world 'free' market equilibrium price, while other countries maintain their subsidies and import restricting programs. The summary of the results are presented in Table 6.

Scenario 2: Partial effect - the United States eliminates its TRQ and loan rates on sugar and purchase sugar at the world 'free' market equilibrium price while other countries maintain their subsidies and import restricting programs. The summary of the results are presented in Table 7.

Scenario 3: Total effect - both the United States and the EU eliminate import restrictions and subsidies, respectively, and purchase sugar at the world 'free' market equilibrium price, while other countries maintain their subsidies and import restricting programs. The summary of the results are presented in Table 8.

Quantity Effects: Impact of Loss of Preferential Prices on Production and Exports of Sugar

The new level of production after policy intervention or market price changes is given by adding the change in production to the initial production level. The new level of consumption is given by adding the change in consumption to the initial consumption level.

CARICOM's average production of raw centrifugal sugar for the base period 1999 – 2001 was estimated at 784,999 tonnes and exports to the EU 494,313 tonnes at an average price of USD 502.50 per tonne. Additionally, exports to the USA during the

base period averaged 50,582 tonnes at an average price of USD 394.50 per tonne.

Under Scenario 1 where the EU stop trading at preferential prices and purchase sugar from CARICOM at the world market equilibrium price of USD 169.18 per tonne, the new production level will fall to 506,609 tonnes and the new consumption level will increase to 728,049 tonnes. In the case of the USA (Scenario 2), the new production level will fall to 596,811 tonnes and the new consumption level will increase to 66,750 tonnes. In the case where both countries liberalize their sugar market (Scenario 3), the new production level will fall to 514,719 tonnes and the new consumption level will increase to 795,043 tonnes (Figure 4).

Quantity Effects: Impact of Loss of Preferential Prices on Stock Levels of Sugar

The net surplus refers to the difference between the new production level and the new consumption (export) level. During the base period, there was a surplus of 290,686 tonnes of sugar after supplying the EU market and 734,417 tonnes when only export to the US market is considered. Under a liberalized EU market, the consumption level exceeded production and 221,440 tonnes would be required to satisfy the shortfall. However, in the case of the USA, consumption will not exceed production and there will be a surplus of 530,061 tonnes. When both markets are liberalized simultaneously (total effect), there will be a stock deficit of 2280,324 tonnes (Figure 5).

Financial Changes: Impact of Loss of Preferential Prices on Foreign Exchange Earnings

Change in Foreign Exchange Costs: Since foreign exchange is used to purchase imports, the cost of the policy in terms of foreign exchange is equal to the change in exports times the border price before intervention. When the EU market is liberalized, the foreign exchange earnings are reduced by USD 257.3 million and in the case of the USA (only), by USD 80.6 million. However, when both EU and USA markets are liberalized, the foreign exchange earnings are reduced by USD 256.5 million (Figure 6)

Welfare Effects: Producer Surplus as a Result of Loss of Preferential Prices

Liberalization of the EU sugar market results in a loss of USD 215.3 million to CARICOM sugar producers. In the case of the USA market, this loss is estimated at USD 155.7 million and when both are liberalized simultaneously, results in a loss of 210.3 million (Figure 7).

Welfare Effects: Consumer Surplus as a Result of Loss of Preferential Prices

Liberalization of the EU sugar market results in a gain of USD 203.7 million to CARICOM sugar producers. In the case of the USA market, this gain is estimated at USD 13.2 million and when both are liberalized simultaneously, results in a gain of 216.8 million (Figure 8).

Welfare Effects: Efficiency Loss in Production as a Result of Loss of Preferential Prices

Liberalization of the EU market leads to a USD 46.4 million efficiency loss in production and in the case of the USA USD 21.2 million. In the case of simultaneous liberalization of both markets, the efficiency loss was USD 43.7 million (Figure 9).

Welfare Effects: Efficiency Loss in Consumption as a Result of Loss of Preferential Prices

Liberalization of the EU market lead to a USD 39.0 million efficiency loss in consumption and USD 1.8 million in the case of the USA. When both markets are simultaneously liberalized, the loss is estimated at USD 40.5 million (Figure 10).

Welfare Effects: Total Deadweight Loss as a Result of Loss of Preferential Prices

Total Deadweight Loss is the sum of the production efficiency loss and the consumption efficiency loss. This amount represents how much society as a whole is losing, in monetary terms, from the new marketing arrangement or policy.

Liberalization of the EU market lead to a total deadweight loss was USD 85.4 million and in the case of the USA USD 23.0 million. However, when both markets are liberalized simultaneously, the total deadweight loss was estimated at USD 84.2 million (Figure 11).

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Table 1: CARICOM Centrifugal Sugar Situation, Tonnes (Av 1999-01)

Country	Production	Import	Total Supply	Export	Domestic Consumption
Bahamas	0	7,757	7,757	4	7,753
Barbados	53,856	2,291	56,147	51,187	4,960
Belize	118,310	0	118,310	105,185	13,125
Dominica	0	2,267	2,267	38	2,229
Grenada	2	4,758	4,760	0	4,760
Guyana	293,072	0	293,072	268,348	24,724
Haiti	8,333	90,433	98,766	0	98,766
Jamaica	205,000	0	205,000	167,897	37,103
Saint Kitts / Nevis	18,693	0	18,693	18,600	93
Saint Lucia	0	3,951	3,951	0	3,951
Saint Vincent	1,600	2,785	4,385	0	4,385
Suriname	9,000	497	9,497	0	9,497
Trinidad and Tobago	96,068	41,445	137,513	61,594	75,919
	803,934	156,184	960,118	672,853	287,265

Source: FAOStat Database

Table 2: World Production, Supply and Distribution of Centrifugal Sugar 2002 / 03 (1,000 Tonnes Raw Value)

Country	Production	Import	Export	Consumption	% of Total Production	% of Total Export
European Union	18664	2100	6094	14458	13	13
Thailand	6813	0	5100	1900	5	11
Australia	5350	5	4219	1050	4	9
Brazil	23760	0	14230	9640	17	31
Colombia	2450	56	1109	1410	2	2
Total Africa	8334	5421	3143	10181	6	7
India	20100	20	1700	20750	14	4
USA	7620	1510	141	8699	5	0
Mexico	5038	100	100	5266	4	0
Total Caribbean	3093	302	2048	1412	2	4
CARICOM	804	156	672	287	1	1
Cuba	2200	0	1550	700	2	3
World Total	143275	38048	46578	136550		

Source: Sugar: World Markets and Trade, May 2003. (* CARICOM: FAOStat Database Av 1999-01)

Table 3: Results of the Sugar Demand Model (Log – Log)

Coefficients	Predictors / Model			
	Constant	ISA price	HFCS-42 price (Lag 4 years)	Average GDP (Lag 1 Year)
B	6.72	-0.24	-0.67	1.79
Standard Error	0.77	0.11	0.24	0.30
T statistic	8.71	-2.06	-2.81	6.04
Significance	0.00	0.05	0.01	0.00
R= 0.84 R ² = 0.71 Adjusted R ² = 0.65 Durbin Watson = 1.08 Std. Error of estimate= 0.13				

**Table 4: Results of the Regression Analysis – Quantity Supplied
(Dependent Variable: Free Export) Log – Log**

Coefficients	Predictors / Model		
	Constant	ISA price (Lag 1 year)	Year-End Stocks (Lag 2 years)
B	1.09	0.18	0.80
Standard Error	1.43	0.07	0.13
T statistic	0.76	2.69	6.23
Significance	0.46	0.01	0.00
R= 0.79 R ² = 0.63 Adjusted R ² = 0.60 Durbin Watson = 1.12 Std. Error of estimate= 0.13			

Table 5: Price Elasticity of Demand and Supply

Item of Elasticity	Value of Elasticity
Price Elasticity of Demand	= -0.24
Price Elasticity of Supply	= 0.18

Table 6: Impact of EU Sugar Market Liberalization on CARICOM

ASSUMPTIONS AND DATA	EU 1999-2001 Average SP Price	EU (1999-2001 Av.) Equilibrium World 'Free' Market Price
Supply elasticity	0.18	0.18
Demand elasticity	-0.24	-0.24
Initial production (T)	784999	784999
Initial EU consumption (T)	494313	494313
Initial net imports (Export) (T)	-494313	-494313
New Price (USD / T)	502.50	169.18
Exchange rate (USD = \$1.00)	1	1
Foreign exchange premium (%)	0	0
Equilibrium price of exchange	1	1
Unloading Cost (USD / T)	0	0
Border price – market rate (USD)	502.50	169.18
Border price – equilibrium rate	502.50	169.18
PRICES (USD / T)		
Initial Producer price	502.50	502.50
Initial Consumer price	502.50	502.50
Producer price change	0	-333.32
Consumer price change	0	-333.32
QUANTITY EFFECTS (T)		
Change in production	0	-278390
Change in consumption	0	233736
New production level	784999	506609
New consumption level	494313	728049
Net surplus (Stock)	290686	-221440
Change in net stock	0	-512126
FINANCIAL (USD)		
Change in producer receipts	0	-308753923
Change in consumer expenditures	0	125220951
Change in forex costs (\$US)	0	-257343426
Budget costs (revenues)	0.00	73810455
WELFARE EFFECTS (USD)		
Producer gain (loss)	0.00	-215259354
Consumer gain (loss)	0	203718853
Efficiency loss in production	0.00	46396513
Efficiency loss in consumption	0.00	38954443
Total deadweight loss	0.00	85350956
CHECK	0.00	0.00

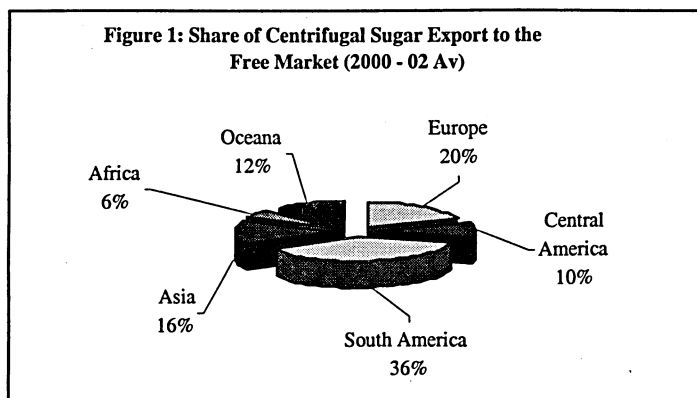
Table 7: Impact of USA Sugar Market Liberalization on CARICOM

ASSUMPTIONS AND DATA	USA 1999-2001 Average TRQ Price	USA (1999-2001 Av.) Equilibrium World 'Free' Market Price
Supply elasticity	0.18	0.18
Demand elasticity	-0.24	-0.24
Initial production (T)	784999	784999
Initial USA consumption (T)	50582	50582
Initial net imports (Export) (T)	-50582	-50582
Price (USD / T)	394.50	169.18
Exchange rate (USD = \$1.00)	1	1
Foreign exchange premium (%)	0	0
Equilibrium price of exchange	1	1
Unloading Cost (USD / T)	0	0
Border price – market rate (USD)	394.50	169.18
Border price – equilibrium rate	394.50	169.18
PRICES (USD / T)		
Initial Producer price	394.50	394.50
Initial Consumer price	394.50	394.50
Producer price change	0	-225.32
Consumer price change	0	-225.32
QUANTITY EFFECTS (T)		
Change in production	0	-188188
Change in consumption	0	16168
New production level	784999	596811
New consumption level	50582	66750
Net surplus (Stock)	734417	530061
Change in net stock	0	-204356
FINANCIAL (USD)		
Change in producer receipts	0	-208713650
Change in consumer expenditures	0	8661824
Change in forex costs (\$US)	0	-80618535
Budget costs (revenues)	0.00	-119433291
WELFARE EFFECTS (USD)		
Producer gain (loss)	0.00	-155674695
Consumer gain (loss)	0	13218630
Efficiency loss in production	0.00	21201280
Efficiency loss in consumption	0.00	1821494
Total deadweight loss	0.00	23022774
CHECK	0.00	0.00

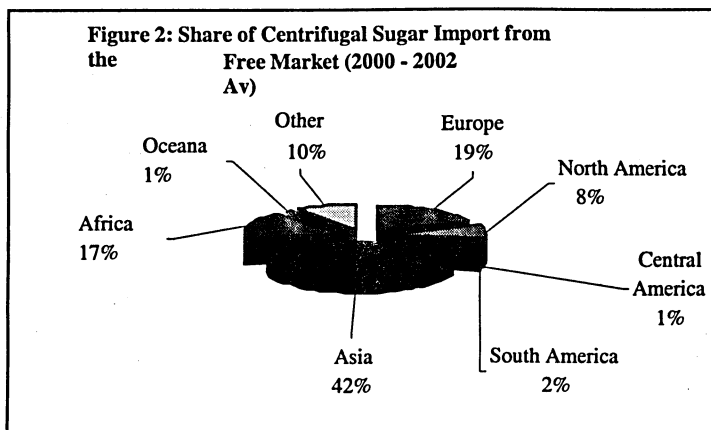
Table 8: Impact of the EU and USA Sugar Market Liberalization on CARICOM

ASSUMPTIONS AND DATA	EU & USA 1999-2001 Weighted Average Price ¹	EU & USA (1999-2001 Av.) World 'Free' Market Equilibrium Price
Supply elasticity	0.18	0.18
Demand elasticity	-0.24	-0.24
Initial production (T)	784999	784999
Initial USA consumption (T)	544895	544895
Initial net imports (Export) (T)	-544895	-544895
New Price (USD / T)	492.79	169.18
Exchange rate (USD = \$1.00)	1	1
Foreign exchange premium (%)	0	0
Equilibrium price of exchange	1	1
Unloading Cost (USD / T)	0	0
Border price – market rate (USD)	492.79	169.18
Border price – equilibrium rate	492.79	169.18
PRICES (USD / T)		
Initial Producer price	492.79	492.79
Initial Consumer price	492.79	492.79
Producer price change	0	-323.61
Consumer price change	0	-323.61
QUANTITY EFFECTS (T)		
Change in production	0	-270280
Change in consumption	0	250148
New production level	784999	514719
New consumption level	544895	795043
Net surplus (Stock)	240104	-280324
Change in net stock	0	-520428
FINANCIAL (USD)		
Change in producer receipts	0	-299759561
Change in consumer expenditures	0	134013438
Change in forex costs (\$US)	0	-256461885
Budget costs (revenues)	0.00	90715762
WELFARE EFFECTS (USD)		
Producer gain (loss)	0.00	-210300809
Consumer gain (loss)	0	216808663
Efficiency loss in production	0.00	43732717
Efficiency loss in consumption	0.00	40475192
Total deadweight loss	0.00	84207909
CHECK	0.00	0.00

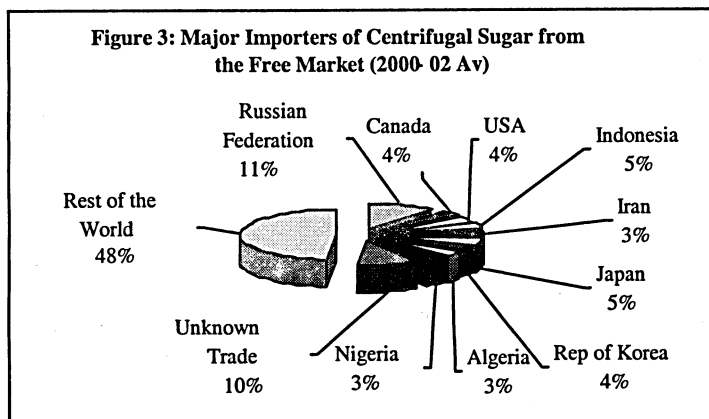
¹ Weighted average price = $(494,313/544,895) = 0.91$; $(50,582/544,895) = 0.09$
 $= (0.91 * \$502.50) + (0.09 * \$394.50) = \$492.79$



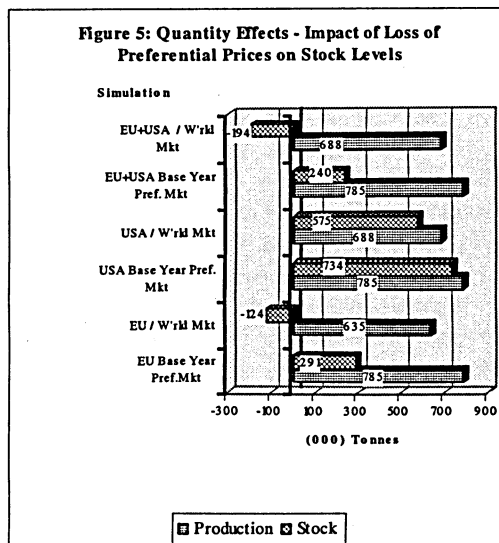
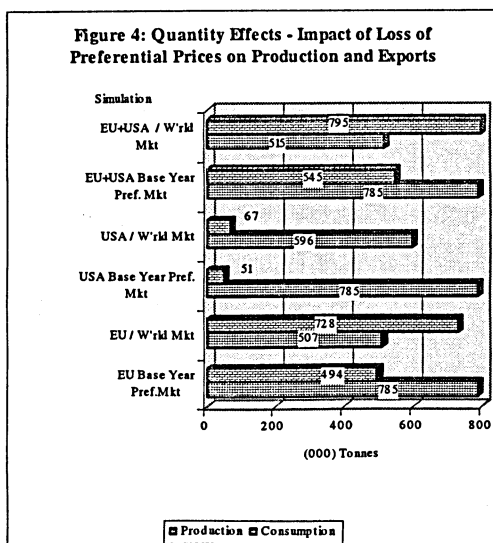
Data source: Sugar Year Book 2002. International Sugar Organization

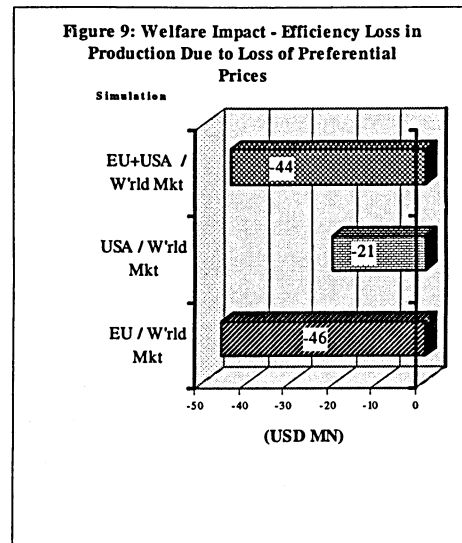
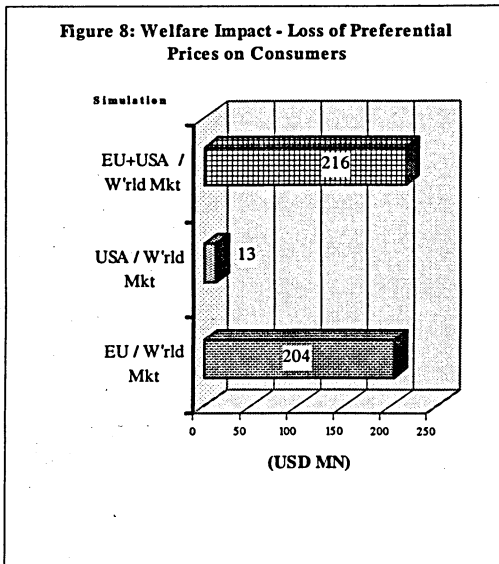
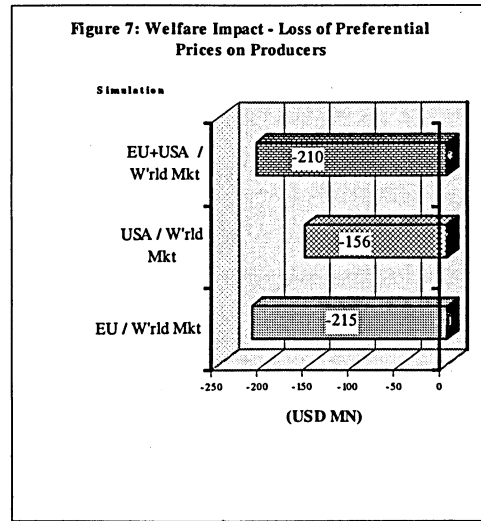
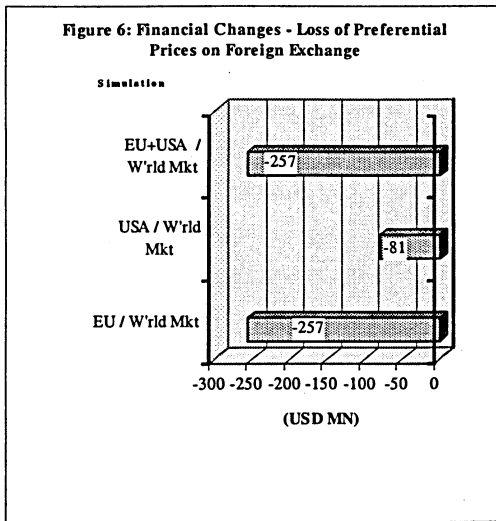


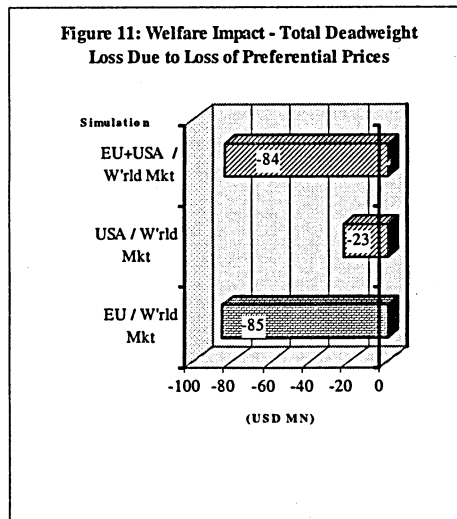
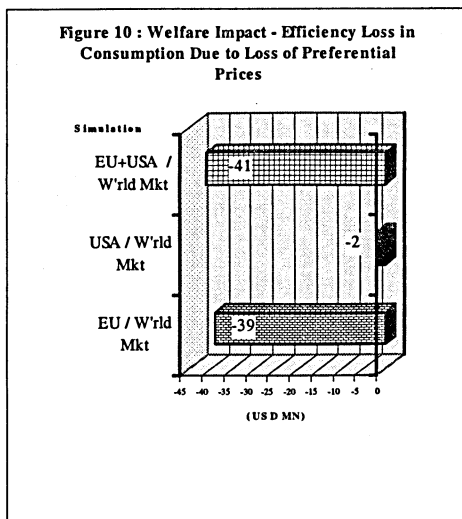
Data source: Sugar Year Book 2002. International Sugar Organization



Data source: Sugar Year Book 2002. International Sugar Organization







Annex Table A1: World Sugar Situation – Production and Trade
(Thousand Tonnes Raw Value)

Year	Production	Consumption	End Year Stocks	Exports	Imports	Net Exports	Net Imports	Free Market Net Exports	Free Market Net Imports
1974	76397	77303	27895	22097	21519	19913	19336	16240	15711
1975	78846	74438	32065	20599	20495	18505	18401	13351	13496
1976	82400	79241	34266	22794	21783	20040	19030	15549	14682
1977	90350	82592	40623	28471	26869	25455	23854	20760	19404
1978	90832	86354	43630	25072	24807	22361	22097	17490	17297
1979	89342	90287	41639	25985	25058	23408	22502	18270	17715
1980	84489	88646	37455	26832	26746	23140	23093	19418	19503
1981	92764	89906	39126	29142	28223	25179	24257	20628	19842
1982	102004	93967	48015	30427	29599	27291	26473	21652	21157
1983	96971	93755	48788	28981	27745	25298	24062	20555	19623
1984	99219	96681	50887	28497	28058	24328	23889	19197	18859
1985	98365	97859	50203	27757	26567	24203	23013	18984	18238
1986	100018	101251	48865	27203	27098	22605	22499	18224	18066
1987	103528	105657	46287	28385	27663	23447	22726	18611	17936
1988	104591	105863	44717	27420	27123	23044	22746	18537	18444
1989	107183	107406	44647	27956	27760	22815	22619	17913	17556
1990	110650	107870	47300	28469	27698	23960	23189	19989	19123
1991	112254	108860	52508	27262	26264	22793	21795	18372	17328
1992	117443	112237	57438	31850	30835	25710	24694	22939	22131
1993	111942	111387	54568	29308	29266	24431	24388	22685	22609
1994	110457	112914	52242	29980	30048	24496	24564	21541	22561
1995	117883	116416	52234	34068	34241	28461	28634	25131	26058
1996	125014	119878	57912	35542	35083	29227	28768	25819	26139
1997	125037	122980	60539	36602	37173	30678	31249	28369	29236
1998	125893	122607	63455	37625	37255	31936	31566	30277	30409
1999	135005	126183	72031	39975	39729	34145	33899	32019	32088
2000	130037	127307	74739	36303	36281	30576	30554	27968	28284
2001	130616	130939	73924	40897	40407	34698	34208	30498	32141

Source: Sugar Year Book (various issues)

Annex Table 4: World Sugar, HFCS, Oil and Ethanol Prices, Per Capita Consumption and Various Countries GDP

Year	Per Caput Cons (Kg)	London Daily Price ¹ (Cents/lb)	I.S.A Daily Price ² (Cents/lb)	New York No. 11 Contract ³ (Spot)	HFCS - 42 (Cents/lb dry wt.) ⁴	Crude Oil Cost FOB Opec Price (\$US/barrel) ⁵	Canada GDP / capita (000' 1995 \$US) at Market Exchange Rates ⁶	USA GDP / capita (000' 1995 \$US) at Market Exchange Rates ⁶	Japan GDP / capita (000' 1995 \$US) at Market Exchange Rates ⁶	Ethanol Price paid to producers ⁷	
										\$US / m ³	\$US / barrel
1974	20.0	30.11	29.66	29.1	-	12.49	-	-	-	-	-
1975	18.9	20.86	20.37	20.44	21.00	12.70	-	-	-	-	-
1976	19.7	11.6	11.51	11.54	15.52	13.32	-	-	-	-	-
1977	20.2	8.17	8.10	8.19*	14.13	14.35	-	-	-	-	-
1978	20.7	7.81	7.81	-	16.40	14.34	-	-	-	952.41	152.30
1979	21.2	9.72	9.65	12.21	17.32	21.29	-	-	-	968.88	155.00
1980	20.2	29.03	28.69	29.07	29.15	33.56	17.0	21.1	28.2	422.33	147.50
1981	19.8	17.27	16.83	16.87	29.52	36.60	17.4	21.4	29.0	862.42	138.00
1982	20.2	8.44	8.35	8.36	27.07	34.81	16.7	20.8	29.7	827.09	132.30
1983	20.2	8.6	8.49	8.51	26.14	29.84	17.0	21.5	30.3	745.45	119.30
1984	20.4	5.32	5.20	5.14	26.41	29.06	18.0	22.9	31.4	733.04	117.20
1985	20.3	4.22	4.06	4.04	24.12	26.86	18.7	23.5	32.8	764.07	122.20
1986	20.6	6.14	6.04	6.04	23.55	13.46	19.2	24.1	33.5	581.23	93.00
1987	21.1	6.94	6.75	6.71	22.70	17.64	19.1	24.7	34.7	612.50	98.00
1988	20.7	10.47	10.20	10.16	25.39	14.18	19.8	25.6	36.7	532.54	85.20
1989	20.8	12.97	12.82	12.8	25.29	17.78	20.0	26.2	38.3	446.84	71.50
1990	20.5	12.71	12.55	12.55	24.50	21.23	19.6	26.4	40.0	406.13	65.00
1991	19.2	9.08	8.97	9.04	24.50	18.08	19.0	26.0	41.0	413.40	66.14
1992	20.5	9.18	9.06	9.09	24.50	17.81	18.9	26.5	41.2	428.53	68.60
1993	20.1	10.19	10.02	10.0	24.50	15.68	19.2	26.9	41.3	385.04	61.60
1994	20.2	12.22	12.11	12.12	25.89	15.08	19.8	27.7	41.6	384.33	61.50
1995	20.2	13.40	13.28	13.43	25.50	16.61	20.2	28.2	42.2	345.15	56.82
1996	20.6	11.97	11.96	12.24	25.50	20.14	20.3	28.9	43.5	-	-
1997	20.6	11.33	11.37	12.06**	25.50	17.73	20.9	29.9	44.2	-	-
1998	20.4	8.88	8.92	9.68**	29.79	11.46	21.4	30.9	43.6	-	-
1999	20.8	6.25	6.27	6.54**	19.17	16.94	22.2	31.9	43.9	-	-
2000	20.8	8.15	8.18	8.52**	15.75	27.29	23.0	32.0	44.5	-	-
2001	21.0	8.60	8.64	9.12**	16.13	21.52	23.1	31.8	44.4	-	-

1. Sugar Year Book. Various issues. International Sugar Organization. London daily Price adjusted to f.o.b. and stowed Caribbean Port, in bulk, by deducting the cost of insurance and freight. Converted from Pound Sterling at the closing spot rate of exchange in London for the relevant day, between the Pound Sterling and the US Dollar.

2. Sugar Year Book. Various issues. International Sugar Organization. The International Sugar Agreement daily Price is the arithmetical average of the New York Coffee and Sugar Exchange Contract No. 11 spot price and the London Daily Price after conversion of the latter to U.S. cents per pound avoirdupois f.o.b. and stowed Caribbean Port in bulk or, if the difference between these two f.o.b. prices is more than ten points, the lower of the two prices plus five points

3. Sugar Year Book. Various issues. International Sugar Organization.

*Quotations suspended from 3 November 1977 to 17 August 1979 inclusive. Average for 1977 is for 1 January to 2 November only, and for 1979 is for 20 August to 31 December only

**F.O.B. & Stowed, Far East, in bulk

4. HFCS - 42 Source: Milling and Baking News

(-) Data unavailable

5. Energy Information Administration, Historical Monthly Energy Review. Landed Costs of Crude Oil Imports from Selected Countries (\$US / Barrel)

<http://tonto.eia.gov/FTPROOT/multifuel/00357392.pdf>

6. Source: <http://www.eia.doe.gov/pub/international/leal/tables2c.xls> eia.doe.gov

7. Source: http://www.mct.gov.br/clima/ingles/commnic_old/alcobol4.htm. The Cost of Ethanol. Convention on Climate Change. As cited from Goldemberg, J.,

1996 - "The Evolution of Ethanol Costs in Brazil", Energy Policy, vol. 24, no 12, pp 1127-1128.