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Impacts of trade liberalizations under the Uruguay Round on the world sugar market

Stephen Devadoss *, Jurgen Kropf

Department of Agricultural Economics, University of Idaho, Moscow, ID 83844-2334, USA

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Abstract

The impacts of the Uruguay Round policy provisions on the world sugar market show that these policies will stabilize the world sugar price at slightly higher levels than in the baseline. Global sugar consumption will increase as a result of the income growth caused by the Uruguay Round. Economic resources will be allocated more efficiently among the sugar industries of the various countries. However, the impacts on the sugar industries in countries with strong producer supports will be rather small because the negotiation process of the Uruguay Round has accommodated the changes in sugar policies already implemented by individual countries in the past few years. Low-cost sugar producing countries will benefit from the higher world sugar price, and consumers in countries with protected markets will benefit from lower domestic prices.

1. Introduction

Sugar is an important commodity in the world market with a total production of 115.79 million t, consumption of 111.15 million t, and world trade equal to 27% of production in 1992. Sugar is produced in more than 100 countries and is one of the most heavily traded commodities. The international sugar market has several unique characteristics that distinguish it from other commodity markets. Among these are heavy government interventions, large price volatility, widespread production in many parts of the world, and a growing market for sugar substitutes. These features make the world sugar market a rich target for policy analysis, although they also pose considerable modeling difficulties.

Sugar is derived from sugarcane and sugarbeet. Sugarcane is mostly grown in tropical climates and low-income countries, and sugarbeet is predominantly grown in temperate climates and high-income countries. Sugar is, therefore, produced in sizeable quantities in many parts of the world. The cost of sugar production is relatively lower in the low-income countries than in the high-income countries. Furthermore, most of these countries compete directly in the world market. Consequently, the developed countries in the northern hemisphere heavily protect domestic producers, often at the expense of domestic consumers. Webb et al. (1990) estimated that in 1987, 67% of sugar producers' income in Japan, 60% in the United States, 54% in Canada, and 41% in the European Union was derived from government subsidies and price supports. Ives and Hurley (1988) noted that the US sugar programs maintain the domestic price at a much higher level than the free-market price at a cost to US consumers of

* Corresponding author.

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over $3 billion annually. Borrell and Duncan (1993) also concluded that the total cost to US consumers over the 1982–1988 period was about $2.5 billion annually. Roberts and Whish-Wilson (1991) estimated that the European Union's sugar policies during the period 1979–1989 imposed an annual implicit cost on consumers of about $3.8 billion. Sturgiss et al. (1988) estimated that Japanese sugar policies during 1985–1987 cost the consumers about $2.3 billion annually.

The sugar policies of developed countries also inflicted significant economic loss on low-income sugar exporters as these countries experienced lower world prices and production, and displacement of employment opportunities. For example, Borrell and Duncan (1993) predicted that the combined effects of the sugar policies of the United States, the European Union, and Japan could depress the world price by 33% and increase world price variability by 28%. Ives and Hurley (1988) predicted that, because of reduction in the volume of the US import quota in 1987, countries exporting sugar to the United States incurred a loss in export earnings of over $700 million annually. Borrell and Duncan (1993) also provide estimates of individual exporting country's losses inflicted by the United States, the European Union, and Japan. Evidence from such studies lead Marks and Maskus (1993) to conclude that: developed countries' sugar policies have "made sugar markets among the most egregiously distorted of all agricultural commodity markets and have caused significant global welfare losses."

Because of the level of distortion in the world sugar market, trade liberalization resulting from the Uruguay Round (UR) of the General Agreement on Tariffs and Trade (GATT) should lead to a significant improvement in world resource allocation by shifting sugar production to more efficient areas and reducing the inefficient production of corn-based sweeteners. For example, Sturgiss et al. (1987) found that previous international sugar agreements to raise and stabilize the world price through stock management were inefficient, but elimination of government subsidies and other forms of intervention would improve world welfare.

As UR policy provisions are implemented, it is important for the sugar exporting and importing countries to assess the effects of these trade reforms on their sugar markets. The objective of this study is to empirically quantify the effects of the trade liberalization agreements negotiated under the UR on sugar production, consumption, trade, and prices of the major sugar exporting and importing countries. This is accomplished by estimating a non-spatial equilibrium model of the world sugar market consisting of 21 countries/regions. For each country, important components of supply and demand are estimated by incorporating the domestic and trade policies and modeling sugar substitutes. The results of these trade liberalization analyses will be useful to producers and policymakers.

2. Sugar policies and UR provisions

Among the reasons countries intervene in the sugar market are (a) sugar production requires a huge investment; (b) producers seek to maintain stable prices and incomes; (c) many countries rely on the sugar industry for employment opportunities; (d) low-income countries generate foreign exchange from exports; and (e) some countries pursue self-sufficiency goals because sugar is widely used in many products. Since UR trade reforms are aimed at liberalizing the existing domestic and trade policies, a brief review of the current policies of selected countries and the effects of the UR provisions on these policies are provided next. The policy reviews presented in this section are drawn from Ives and Hurley (1988), Lord and Barry (1990), and Borrell and Duncan (1993). The detailed UR sugar policy provisions for various countries are reported in Devadoss and Kropf (1995).

2.1. The United States

The major features of the US sugar programs in the 1980s were a loan rate scheme and an import quota system. The loan rate scheme guaranteed sugar processors a minimum price for their sugar. The processors in turn passed these loan rate guarantees to beet and cane producers by paying a fixed minimum price. The loan rate was set considerably higher than the world sugar price. The processors could forfeit their stocks to the Commodity Credit Corporation (CCC) at the loan rate. Though loan forfei-

tures could cost the US treasury, the 1985 farm legislation mandated that the US program should not impose budgetary burdens on the government. This mandate was achieved by maintaining a domestic price higher than the loan rate and transferring the cost of the sugar programs to consumers.

To keep processors from forfeiting their stocks to the CCC and to prevent the domestic price from falling below the loan rate, import quotas were enacted to limit the amount of import. Until 1990, the US allocated these quotas among various exporting countries. In 1990, in response to pressure from GATT, the United States established a tariff-rate quota system. Under this system, the United States currently implements a country-by-country quota with a low tariff of 0.625 c per lb. Imports above the quota limits are charged a tariff of 16 c per lb.

Because of the relatively high domestic prices, beet and, to some extent, cane production are expanding stronger than the level desired by the US government. To restrict domestic production the USDA implements a marketing allotment arrangement, which allocates the amount of sugar the millers and processors can sell in the domestic market in a year. The marketing allotment is triggered if the USDA estimates show that for a given year the projected supply will exceed demand. Specifically, the formula used by the USDA, known as marketing allotment import estimate (MAIE), to determine the allotment is domestic consumption + ending stocks < domestic production + beginning stocks + 1.250 million short tons. This program was implemented in fiscal years 1993 and 1995. Furthermore, high price support policies in the United States have encouraged rapid expansion of high fructose corn syrup (HFCS), displacing domestic sugar consumption.

The UR provisions for agriculture can be broadly classified under the categories: *market access*, *domestic support*, and *export competition* (refer to the appendix table in Devadoss and Kropf, 1995, for specific policy reduction schedules by various countries). For the United States, the computed value of the price support program is $1054 million, and the United States is expected to apply a reduction of 20%, resulting in $843 million in price supports. The computed sugar tariff equivalent is 39.59 c per kg (149.40%) and the required reduction is 15%. The US government has modified its sugar programs to meet the UR requirement of reducing price supports and tariff equivalents. The market access provision of minimum imports does not pose a constraint since the US imports are greater than 3% of its consumption. The export competition provision does not apply to the United States because of its limited export capabilities.

2.2. The European Union (EU)

The major sugar policies of the EU include domestic production and price controls backed by variable import levies, export subsidies, and production controls on high fructose starch syrup (HFSS). These policies have led to increased sugar production. As a result the EU has switched from a net sugar importer to a major sugar exporter. Domestic production is controlled by administering A and B production quotas. Under Quota A, sugar is produced to meet the domestic demand. Sugar produced under Quota A qualifies for the EU intervention price, an administered price substantially higher than the world market price.

Quota B also receives the domestic price support but faces a higher co-responsibility levy than Quota A. Thus, the producer price for Quota B sugar equals the intervention price minus a higher levy. Quota A and B sugar in excess of domestic consumption is exported with subsidies, which are financed by the production levies on A and B sugar. Sugar produced in excess of these quotas, termed as C sugar, receives the world price and is sold in the world market without subsidies.

Furthermore, the EU administers threshold prices and variable levies to protect the domestic market from sugar imports. All these policies provide substantial support to domestic producers, but the administration of these policies is very costly. In order to pay for these policies, the EU taxes domestic consumers by setting the price at high levels.

For the EU, the computed aggregate measurement of support (AMS) is 5.3 billion ECU, and the EU is expected to apply a reduction of 20%, which results in an AMS of 4.2 billion ECU. To meet the AMS requirement, the EU is expected to reduce its intervention price. The computed sugar tariff equivalent is 524 ECU per t. A 20% reduction brings the tariff equivalent to 419 ECU per t. The current import

access of 1.9 million t, mostly imported from African, Caribbean, and Pacific (ACP) countries through the Lomé agreement, exceeds 3% of EU consumption, and thus, the import access requirement is being met by the EU. The computed volume of subsidized exports is 1.6 million t and a reduction of 21% brings these exports to 1.3 million t. A 36% reduction in the value of subsidized exports is applied which causes the EU export subsidies to come down from 777 to 497 million ECU.

2.3. Australia

Australia is a sugar exporting country and ranked third in the world in exports from 1986 to 1988. Australia grows only sugarcane and is considered to be a low-cost producer of sugar. Australia regulates its sugar industry by implementing policies through a sugar board that regulates producers as well as consumers.

The sugar board assigns sugarcane areas to producers. The sugar produced in these areas is sold for an administratively established price. Sugar produced from unassigned areas is acquired by the government for a price of Aus$1 per ton, which effectively prevents cane production in these areas. The returns from sugar sold in the domestic and export markets are pooled by the sugar board and distributed to producers and mills. In the past, the return from exports fluctuated since world sugar prices varied markedly. Until 1989, domestic prices were fixed in Australia and in some years were lower than the world price. Since 1989, domestic prices are allowed to follow the world price. The import quota, in place before 1989, was replaced by a tariff system which liberalized the Australian sugar market. This liberalization resulted in a market-determined consumer price.

For Australia, the computed value of the AMS for sugar is Aus$64.73 million. A reduction of 20% results in an AMS of Aus$51.8 million. The computed sugar tariff equivalent is Aus$143 per t (149.40%) and the required reduction is 15%.

2.4. Brazil

Brazil is a sugar exporting country and a leading producer of sugarcane. Brazil is a low-cost sugar producer. In Brazil, sugarcane is used to produce sugar and ethanol (which is a primary domestic fuel). The production of both commodities is highly regulated by a quasi-government agency, the Brazilian Institute of Sugar and Alcohol, by allocating annual quotas to farms, mills, and refineries.

Brazilian sugar policies include the allocation of sugarcane areas into sugar and ethanol production areas. For example, in 1989, the ratio of ethanol to sugar production was 60 to 40%. Other policies include sugar export controls and determination of producer and consumer prices. Producer prices are fixed at a level above the world price and consumer prices are set at a level well below the world price. The price controls insulate domestic producers and consumers from the world market. Brazil's ability to switch between ethanol and sugar production is restricted because of the country's high dependency on ethanol production as a vehicular fuel. Nevertheless, Brazil has an enormous sugarcane production capacity that allows the country to increase sugar production and exports in response to rising world sugar prices. Production and exports are expected to increase in the future if the attempts of the Brazilian government to reduce the country's ethanol dependency as a fuel source are successful.

For Brazil, the computed AMS is $857 million, and a reduction of 13.3% results in an AMS of $743 million. The sugar tariff equivalent is reduced from 46 to 35%. The computed volume of subsidized exports is 791 300 t, which is reduced to 601 400 t. A 24% reduction in the value of subsidized exports is applied which causes Brazil's export subsidies to decline from $56 000 to $43 000.

2.5. Japan

Japan is the world's third largest sugar importer, importing approximately twice the amount of sugar it produces domestically. Since Japan is a high-cost sugar producer, it controls the sugar market in order to secure a minimum level of domestic production. These controls include producer subsidies and import policies. Japan's producers receive a government guaranteed price that is considerably higher than the world price. For example, in 1987 the Japanese farm price was set at about 65 c per lb of raw sugar. Farmers receive the guaranteed price from proces-

sors who, in turn, sell the raw sugar to a government-established corporation for a higher price and buy the commodity back from this corporation for a lower price. Thus, the government provides subsidy to processors and producers. To support these subsidies and maintain a stable market price, Japan establishes high fixed and variable levies on sugar imports. In 1987, duties, excise taxes, and variable levies amounted to 31 c per lb of imported sugar, which raised the final price for the imports to 41 c per lb. Japanese consumers also contribute to the revenue by paying higher domestic sugar prices, which results in a relatively low per capita consumption. Japan's policies also encourage HFCS consumption.

For Japan, the computed value of the AMS for sugarcane production is 88 billion yen, and a reduction of 20% calls for an AMS of 71 billion yen. The computed sugar tariff equivalent is 41.5 yen per kg and a reduction of 15% brings the tariff equivalent to 35.3 yen per kg. Japan does not face the import access requirement because of its large volume of sugar imports. Similarly, the export competition provisions do not apply to Japan because it does not export sugar.

Though the other countries and regions included in the model pursue intervention policies, these policies and the corresponding UR provisions are not discussed here owing to space limitations. However, these policies are incorporated in the analysis.

3. Empirical model

A non-spatial equilibrium world sugar model consisting of 21 countries/regions is used for the analysis. The exporting countries/regions included in the model are Australia, Brazil, Cuba, the European Union, India, South Africa, Thailand, other Central America, and other South America. The importing countries/regions are the United States, Canada, Japan, Mexico, Indonesia, China, the Former Soviet Union, Eastern Europe, other Western Europe, other Asia, other Africa, and the rest of the world (ROW).

This large-scale model allows us to incorporate the influence of domestic and trade policies on production, consumption, stocks, and trade. Furthermore, the incorporation of government intervention policies enables us to accurately capture the effects of trade liberalization. The model includes the dynamic behavior of the sugar market, which captures the adjustments in the endogenous variables over time in response to policy changes. The influence of macroeconomic variables (exchange rates, interest rates, inflation rates, and GNP) and time lags in production are also explicitly modelled.

Data for production, consumption, exports, imports, and ending stocks are obtained from the Economic Research Service and from the Foreign Agricultural Service of the US Department of Agriculture. Data for area harvested, yield, and extraction rates are obtained from the Food and Agricultural Organization (FAO) of the United Nations. Macroeconomic data such as income, population, exchange and inflation rates are obtained from the International Monetary Fund (IMF). The estimation period includes the years 1970 to 1992.

For each country, functional relationships for supply and demand components and price linkage equations are estimated. The estimation of the supply side consists of sugarcane or sugarbeet area planted and a total sugar production equation that is the product of the area planted, the extraction rate, and the yield. The supply functions incorporate the domestic policies pursued by various countries. The estimation of the demand components consists of sugar consumption and ending stocks. If countries pursue domestic policies that tax the consumers by making them pay a higher domestic price than the world price, then the domestic price is used to estimate the consumption functions. The price linkage equation links the domestic price to the world price. The wedge between the domestic price and the world price reflects the effects of trade policies conducted by a country. For each country, the net excess demand or excess supply is derived and the world market clearing is established by equating the net import demand of all importers and the net export supply of all exporters.

The model incorporates a great many details such as inclusion of a large number of country-level disaggregations and the modeling of HFCS, incorporation of domestic and trade policies, inclusion of macroeconomic factors, and accounting for unique production characteristics. A rigorous analysis can be conducted, therefore, to accurately estimate the effects of trade liberalizations.

Table 1
Estimated supply and demand elasticities from the world sugar trade model

Country/region	Supply elasticities			Demand elasticities		
	Own price	Cross price [a]	Input price	Consumption		Stocks, own price
				Own price	Income	
United States				−0.042	0.254	−0.157
Beet area	0.215	−0.077				
Cane area	0.054	−0.050	−0.046			
European Union					0.304	−0.005
Quota A	0.228					
Quota B	0.223					
C-sugar	0.215					
Australia	0.066	−0.184		−0.041	0.044	−0.230
Brazil	0.085	−0.619		−0.012	0.812	−0.302
Canada	0.140	−0.196		−0.066	−0.195	−0.283
Indonesia	0.320		−0.196	−0.085	1.247	−0.120
India	0.978		−0.061	−0.020	0.117	−0.220
Japan	0.336			−0.002		
Mexico	0.891			−0.019	0.246	−0.022
South Africa	0.047		−0.002	−0.013	0.425	
Thailand	0.138		−0.007	−0.023	0.009	−0.041
Eastern Europe	0.025			−0.020		
Western Europe	0.712		−0.012	−0.021		−0.101
Asia	0.144			−0.121	0.414	−0.072
Africa	0.017			−0.015		
Central America	0.008			−0.016		
South America	0.018		−0.061	−0.478		

[a] The cross prices include wheat for US beet, cotton for US cane, wheat for Australia and Canada, and ethanol for Brazil.

The model includes a total of 82 endogenous equations and 21 market-clearing equations, which determine 103 endogenous variables and use 205 exogenous variables. Both linear and non-linear techniques are used in estimating the endogenous equations. The estimation procedure used is ordinary least squares (OLS). The OLS estimation technique is preferred over simultaneous estimation techniques because, with a large number of exogenous variables and a limited number of observations, simultaneous estimation techniques pose a degrees of freedom problem. The principal component technique is frequently used to circumvent the degrees of freedom problem. Since the number of exogenous variables is too large in the model, the principal component technique was not used to estimate the model.

In the interest of brevity, the complete empirical model could not be included in the text. In Table 1 we report the estimated supply and demand elasticities for various countries. In Table 2 we report price transmission elasticities. These elasticity estimates represent behavioral relationships in the model, which are compared with those found in the literature. The estimated own-price supply elasticity for beet in the United states is 0.215 and cross-price (wheat price) elasticity is −0.077. The own-price beet supply elasticity is comparable to the estimates of Lopez (1989) at 0.246 and Vroomen (1984) at 0.280. Sudaryanto's estimate (Sudaryanto, 1987) for an earlier period is 0.70. The estimated own-price elasticity

Table 2
Price transmission elasticities for selected countries

Countries	Price transmission elasticity
United States	0.46
European Union	0.48
Australia	0.69
Brazil	0.68
Canada	0.63
Indonesia	0.90
Japan	0.70
Thailand	0.92

for cane in the United States is 0.054; cross-price (cotton price) elasticity is −0.05; and input price elasticity is −0.046. The own-price cane elasticity is very inelastic because of the ratooning practices for sugarcane, which limit the acreage adjustment to price changes. This inelastic estimate is comparable to the elasticity reported by Lopez at 0.103, Vroomen at 0.135, Leong (1985) at 0.16, and Sudaryanto at 0.17. Wong et al. (1989) (WSB) estimated an aggregate US sugar supply elasticity of 0.221. The estimated own-price consumption elasticity is −0.042 and income elasticity is 0.254. The own-price elasticity estimate is very similar to the ones reported by WSB at −0.048, Vroomen at −0.114, and Lopez at −0.141. The income elasticity estimate is comparable to that of WSB at 0.287.

Table 2 reports price transmission elasticities for selected countries. The restrictive trade policies pursued by these countries insulate their domestic prices from world price movements, thereby reducing price transmission elasticities to less than one. For example, the US domestic price support scheme and the import quota system result in a price transmission elasticity of 0.46 only. Similarly, the EU price intervention scheme and the variable import levy policies generate a price transmission elasticity of 0.48 only.

4. Impacts of the Uruguay Round on the world sugar market

To examine the effects of the UR, a baseline scenario is run to project the endogenous variables over the period 1993 to 2001 by using the forecast values of the exogenous variables. The forecast values of the exogenous variables are derived from various sources: GDP, GDP deflator, exchange rates, commodity production, and prices are obtained from the Food and Agricultural Policy Research Institute (FAPRI, 1994b). Population forecasts are obtained from the USDA (1993). Crude oil prices and coffee prices come from a World Bank (1992) report. The baseline values of the endogenous variables serve as a benchmark to measure the effects of trade liberalization.

The GATT member countries will implement the policy provision schedule by reducing the aggregate measurement of support, tariff equivalents, and export subsidies and by increasing import access. The UR policy parameters along with the new income growths under the UR (obtained from the USDA) are incorporated in the world sugar trade model and the UR scenario is run for the period 1995 to 2001. The UR provisions will liberalize the world sugar market as sugar producing countries reduce their domestic producer support, sugar importing countries increase their market access, and sugar exporting countries reduce their export subsidies.

Table 3 presents the baseline projections and the impacts of the UR on the net trade of major sugar exporters and importers and on the world sugar price. Most major sugar exporting countries increase their net exports because of higher world sugar prices resulting from the UR. However, the EU's net sugar exports decline by an average of about 6% (Fig. 1) as a result of lower export subsidies required by the export competition provision of the UR. Thailand's net exports decrease by a very small amount (an average of 0.7%) because the strong consumption increases, resulting from the higher income growth under the UR, outpace the production increases. India gains significantly from the UR because of its developing country status, availability of more inputs, and improved technology, which result in net exports about 9.5% higher than the baseline (Fig. 2). Australia and Brazil also post modest increases in net exports.

The impacts of the UR on major importing countries vary. Net imports by some countries decline slightly because of higher world prices (Canada), increased substitution from HFCS (Japan), and production increases (Soviet Union). Higher income growth, population growth, and reduction in tariff equivalents increase US net sugar imports by an average of 16.03%. It should be noted that although this percentage increase seems large, the volume of the net import increase is very small compared with the level of consumption in the United States. In Indonesia, China, and Mexico, strong consumption increases outpace production increases causing the net imports in these countries to rise.

The world income growth caused by the UR increases global sugar consumption, surpassing production increases, which causes world sugar prices to increase. The average increase in the world price is about 8.83%, which translates into an increase of

Table 3
Baseline projections and Uruguay Round (UR) impacts on world price and net trade of major exporters and importers

Country	Units	1995	1996	1997	1998	1999	2000	2001	1995–2001 avg.
Net exporters									
Australia									
Baseline	1000 t	3153.35	3309.44	3162.67	3451.54	3526.25	3432.17	3605.44	
UR impact	%	0.06	0.90	1.43	2.12	4.12	6.06	5.55	2.89
Brazil									
Baseline	1000 t	2796.16	1781.31	2290.93	2520.37	2513.93	2497.73	2478.74	
UR impact	%	−0.01	1.25	0.12	3.77	1.59	0.81	8.57	2.30
European Union									
Baseline	1000 t	2985.52	2524.21	2980.14	2757.45	2544.39	2464.84	2306.24	
UR impact	%	−2.72	−3.68	−5.79	−10.48	−6.66	−7.67	−5.91	−6.13
Cuba									
Baseline	1000 t	7724.52	7926.38	8069.92	8100.83	8112.72	8202.95	8021.38	
UR impact	%	−0.00	0.03	0.06	0.21	0.28	0.76	1.00	0.33
India									
Baseline	1000 t	422.52	1601.97	1314.47	987.25	963.68	1016.52	1094.66	
UR impact	%	4.79	0.08	8.70	17.33	16.54	7.40	11.90	9.54
South Africa									
Baseline	1000 t	787.44	1608.96	1471.79	1669.06	1669.96	1576.58	1771.58	
UR impact	%	−0.64	−0.34	−4.52	−3.53	−5.87	28.07	9.84	3.29
Thailand									
Baseline	1000 t	3361.65	3587.27	3704.07	3774.37	3978.88	4104.15	4211.09	
UR impact	%	−0.03	−0.20	0.29	−0.49	−0.98	−1.32	−2.13	−0.70
Net importers									
United States									
Baseline	1000 t	1200.67	1386.17	1502.44	1321.36	1347.37	1452.82	1563.84	
UR impact	%	0.13	1.54	7.42	19.50	25.09	25.46	33.10	16.03
Canada									
Baseline	1000 t	857.19	876.44	881.77	854.78	858.22	866.09	869.82	
UR impact	%	−0.12	−0.63	−1.02	−1.55	−2.99	−4.48	−5.47	−2.32
China									
Baseline	1000 t	1178.43	1212.98	1177.21	1004.83	883.58	556.99	321.71	
UR impact	%	−0.37	−1.83	−1.40	−13.01	−10.64	20.05	59.43	7.46
Indonesia									
Baseline	1000 t	638.88	555.48	631.50	744.94	671.28	644.21	703.45	
UR impact	%	0.94	4.06	6.03	9.59	17.35	26.14	18.06	11.74
Japan									
Baseline	1000 t	1657.96	1668.14	1606.34	1633.72	1633.28	1631.99	1636.25	
UR impact	%	−0.49	0.20	−0.45	−3.67	−5.59	−7.29	−10.01	−3.90
Mexico									
Baseline	1000 t	146.78	240.92	192.10	246.32	297.19	342.05	341.01	
UR impact	%	−3.74	−1.11	3.33	0.79	3.50	8.57	11.53	3.27
USSR									
Baseline	1000 t	6598.87	6570.25	6406.48	6464.39	6492.35	6331.41	6373.58	
UR impact	%	−0.22	−0.00	0.00	−0.44	−0.76	0.26	0.12	−0.15
World sugar price									
Baseline	US cents lb^{-1}	12.78	10.19	12.79	12.36	12.16	12.11	11.92	
UR impact	%	3.17	4.26	4.97	10.52	13.23	12.01	13.62	8.83

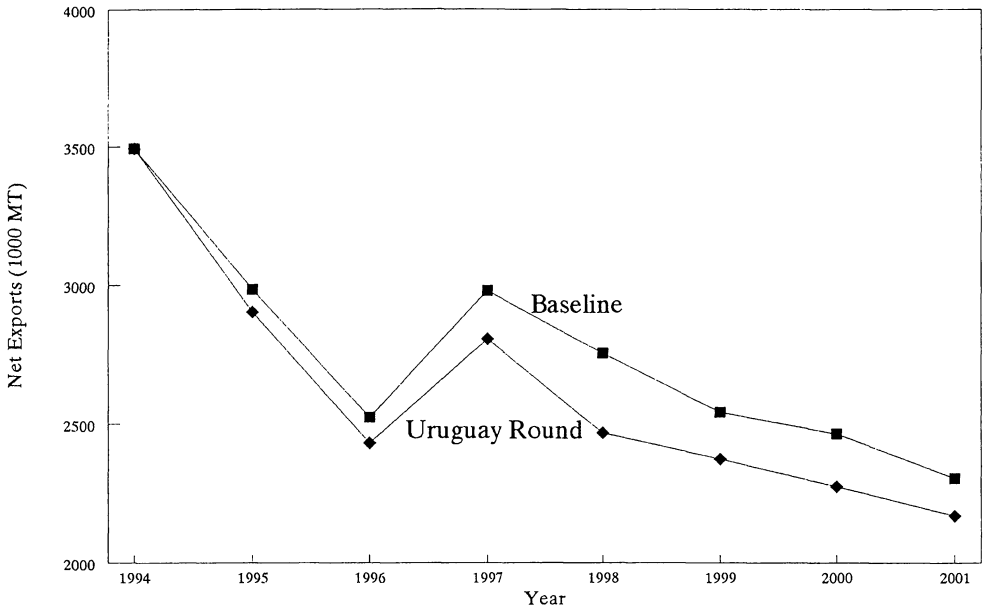

Fig. 1. EU sugar net exports under baseline and Uruguay Round.

only about 1 c per lb (Fig. 3). These results are very similar to the findings of the USDA (1994). Furthermore, reduction in trade barriers increases the price transmission elasticities slightly, which results in modest world price stability.

Table 4 reports the baseline projections and the

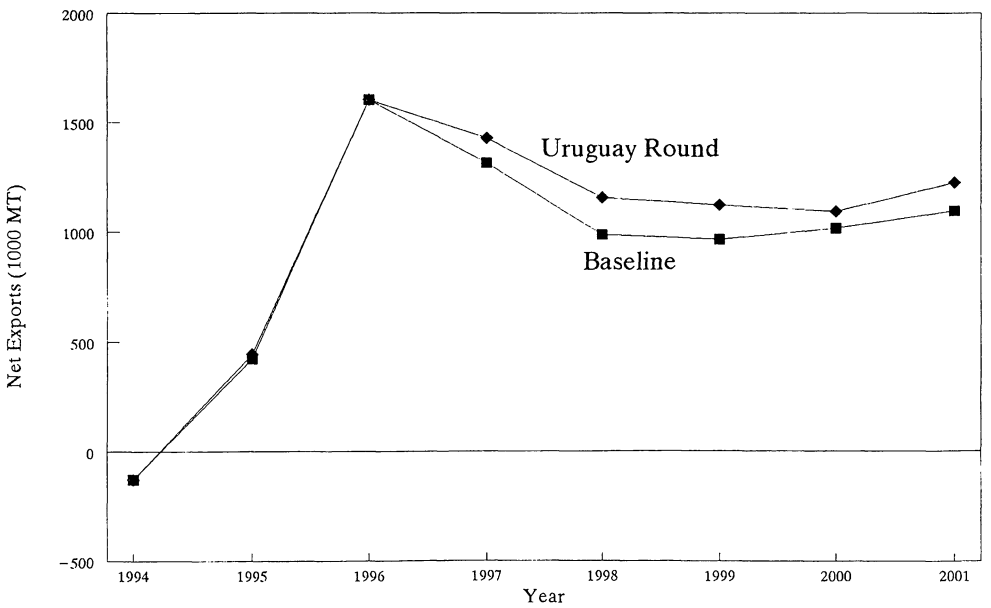

Fig. 2. India's sugar net exports under baseline and Uruguay Round.

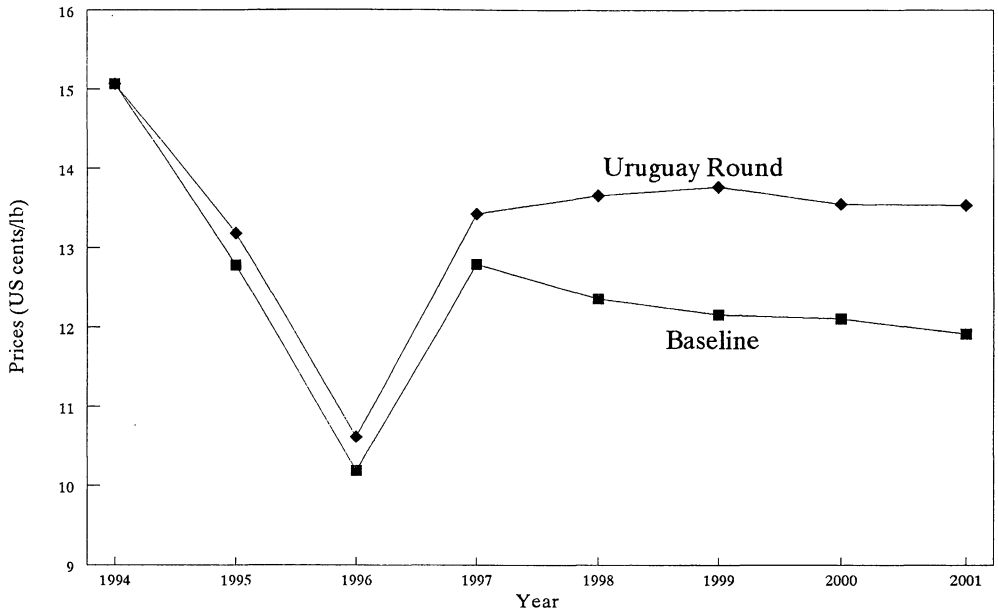

Fig. 3. World sugar price under baseline and Uruguay Round.

impacts of the UR on sugar production, consumption, and exports or imports for selected countries only. Readers interested in the results for other countries refer to Devadoss and Kropf (1995). Here, we provide a detailed explanation of the UR impacts on selected countries.

4.1. The United States

The baseline projections show a small decline in sugarcane area of about 6000 acres and a modest decline in sugarbeet area of about 100000 acres from 1995 to 2001. These declines in area are in response to US farm policies which, in recent years, have reduced the domestic price supports. As a result of the UR, the cane and beet areas are lower than the baseline areas by an average of about 0.26 and 1.24%, respectively. These decreases are caused by the continued reduction in US domestic price support and the ensuing decline in the producer price. The slightly larger response of sugarbeet area to sugar price changes is because beet supply is more elastic than sugarcane supply. The reason for this result is that sugarbeet is a short-term crop with significant potential for year-to-year variation in area planted, whereas sugarcane area is a long-term crop with 3–4-year crop cycle due to ratooning practices. Consequently, cane area planted shows little year-to-year variation in the short run. As a result of the decreases in cane and beet area planted, the baseline predicts total US sugar production declines from 1995 to 2001 of about 170000 t. The UR causes an additional decrease by an average of 1.06% (Fig. 4).

The baseline projections of the US sugar consumption show a small increase of about 40000 t from 1995 to 2001 caused by an increase in US population and income. The UR contributes to an additional income increase in the United States, lowers the price for the US consumer, and increases HFCS prices relative to sugar prices. These developments result in an average increase in US sugar consumption of about 1.82% over the baseline consumption.

The declining production and increasing consumption trends in the baseline will cause US sugar imports to rise by about 360000 t from 1995 to 2001. The tariff reductions in the market-access provision of the UR and the developments in US domestic supply and demand during the implementation

Table 4
World sugar market: baseline projections and the Uruguay Round (UR) impacts

Country and item	Units	1995	1996	1997	1998	1999	2000	2001	1995–2001 avg.
United States									
Cane area (base)	1000 acres	836.76	833.77	832.58	833.22	830.80	829.45	830.34	
UR impacts	%	0.00	−0.12	−0.31	−0.53	−0.33	−0.35	−0.21	−0.26
Beet area (base)	1000 acres	1391.86	1364.99	1346.18	1353.28	1344.16	1332.30	1299.02	
UR impacts	%	0.03	−0.04	−0.59	−1.55	−1.67	−2.63	−2.21	−1.24
Production (base)	1000 t	6680.38	6621.56	6591.48	6636.21	6589.21	6559.18	6513.53	
UR impacts	%	−0.01	−0.07	−0.46	−1.09	−1.06	−1.89	−2.81	−1.06
Consumption (base)	1000 t	7995.45	7956.35	7989.74	7945.83	7989.71	7995.77	8035.07	
UR impacts	%	0.01	0.27	0.93	1.97	2.81	2.76	3.99	1.82
Total imports (base)	1000 t	1700.67	1886.17	2002.44	1821.36	1847.37	1952.82	2063.84	
UR impacts	%	0.09	1.13	5.57	14.15	18.30	18.94	25.08	11.89
European Union									
Quota A (base)	1000 t	10771.29	10380.31	10480.69	10457.15	10430.20	10406.72	10403.50	
UR impacts	%	−0.62	−0.57	−0.71	−1.09	−1.25	−1.27	−1.49	−1.00
Quota B (base)	1000 t	2591.25	2497.20	2521.34	2515.68	2509.20	2504.03	2502.77	
UR impacts	%	−0.62	−0.57	−0.71	−1.09	−1.25	−1.27	−1.49	−1.00
Quota C (base)	1000 t	2694.83	2661.08	2573.31	2608.16	2528.87	2397.54	2366.14	
UR impacts	%	0.74	0.77	0.62	2.38	3.45	2.92	4.56	2.21
Total production (base)	1000 t	16057.38	15538.59	15575.34	15630.98	15468.26	15310.28	15272.41	
UR impacts	%	−0.39	−0.34	−0.49	−0.82	−0.46	−0.61	−0.55	−0.53
Consumption (base)	1000 t	12824.34	12858.02	12844.15	12838.40	12851.35	12854.09	12892.12	
UR impacts	%	0.09	0.20	0.46	0.87	0.85	0.77	0.62	0.55
Total exports (base)	1000 t	6246.30	5776.90	6133.99	5899.45	5746.69	5666.65	5552.00	
UR impacts	%	−0.98	−0.94	−1.63	−2.65	−0.69	−1.12	−0.58	−1.23
Australia									
Production (base)	1000 t	4306.66	3570.24	4323.41	4060.46	4444.44	4410.48	4423.72	
UR impacts	%	0.00	0.86	0.73	1.80	2.93	4.29	4.08	2.10
Consumption (base)	1000 t	839.27	832.47	843.47	845.87	847.56	849.50	850.83	
UR impacts	%	0.01	0.08	0.12	0.38	0.58	0.68	0.92	0.40
Total exports (base)	1000 t	3153.35	3309.44	3162.67	3451.54	3526.25	3432.17	3605.44	
UR impacts	%	0.06	0.90	1.43	2.12	4.12	6.06	5.55	2.89
Brazil									
Production (base)	1000 t	10490.92	9965.90	10263.82	10605.41	10639.92	10718.20	10802.65	
UR impacts	%	0.05	0.69	1.22	1.58	1.71	1.52	3.76	1.50
Consumption (base)	1000 t	7602.90	7947.50	7978.22	8057.29	8101.35	8191.56	8289.70	
UR impacts	%	0.26	0.66	1.58	1.43	2.11	1.95	2.46	1.49
Total exports (base)	1000 t	2796.16	1781.31	2290.93	2520.37	2513.93	2497.73	2478.74	
UR impacts	%	−0.01	1.25	0.12	3.77	1.59	0.81	8.57	2.30
India									
Production (base)	1000 t	15259.44	16908.62	16035.44	16208.64	16143.14	16285.62	16557.36	
UR impacts	%	0.05	0.12	1.40	1.55	2.21	2.32	1.96	1.37
Consumption (base)	1000 t	14142.23	14666.43	15115.45	15146.67	15191.64	15221.32	15367.91	
UR impacts	%	0.02	0.11	0.36	0.67	1.17	1.89	1.42	0.81
Total exports (base)	1000 t	1219.81	2434.22	2167.29	1843.95	1824.47	1880.27	1967.84	
UR impacts	%	1.60	0.05	5.36	9.45	9.12	4.71	7.10	5.34

period will cause the United States to increase its imports by an average of about 12% above the baseline. The increase in US sugar imports will be relatively small from 1995 to 1997, but will pick up in later years due to a larger increase in domestic consumption and a modest decline in production.

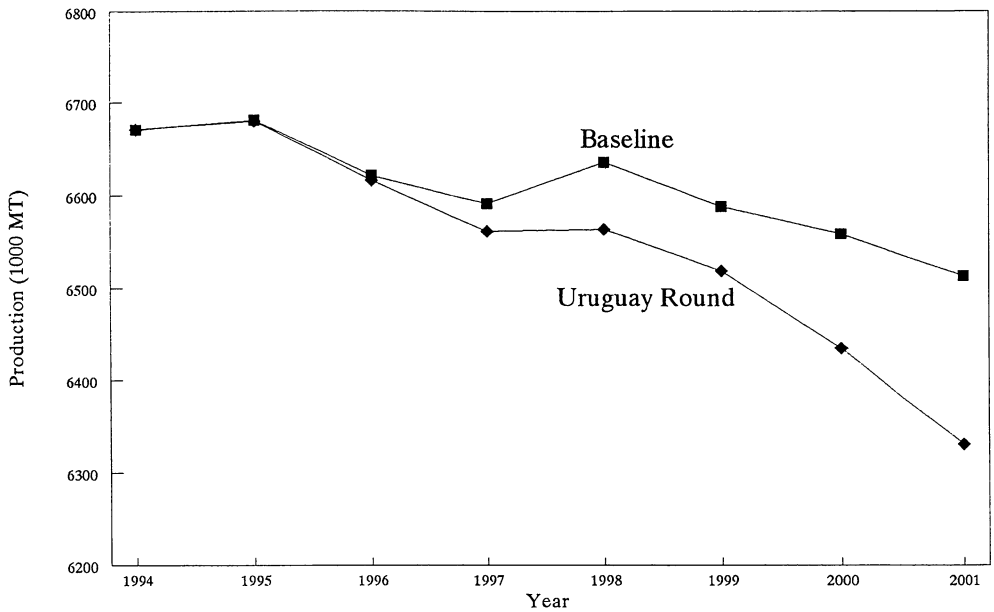

Fig. 4. US sugar production under baseline and Uruguay Round.

4.2. European Union

The Common Agricultural Policy's 1992 reforms reduce domestic support for sugar producers. This reduction will result in a decrease in total EU sugar production of about 800 000 t in the baseline projections from 1995 to 2001. Declines in domestic supports, tariffs, and export subsidies as required by the UR will lead to an additional decrease in total EU sugar production by an average of about 0.53%. The production Quotas A and B, which receive the domestic price supports, will decline by an average of about 1% as a result of the UR. Larger declines will occur in the later years than in the earlier years as market signals arising from the UR tend to be stronger toward the end of the implementation period. The EU production of C sugar, which receives the rising world price, will grow by an average of 2.21% during the implementation period. Some of the area allocated for Quotas A and B are used for C sugar production because sugarbeet production in the EU, even under C sugar, is still more profitable than the production of alternative crops. Consequently, the impact of the UR on EU sugar production is not expected to be as pronounced as the impacts on other crops.

The EU sugar consumption will increase slightly by an average of 0.55% as a result of lower prices and higher income growth from the UR. A projected stagnation in EU population growth, however, will limit the increase in sugar consumption. The decrease in total EU sugar production, the small increase in sugar consumption, and the reduction in export subsidies as required by the UR will cause a decrease in EU sugar exports by an average of 1.23%. This reduction in sugar exports will be less than the EU's commitment of reducing subsidized exports by 340 000 t because the increase in unsubsidized exports from C production is expected to compensate for the decline in subsidized exports. These results also corroborate the findings of FAPRI (1994a) and USDA (1994). Thus, this decline would have been larger if it were not for the increase in the unsubsidized exports resulting from higher production of C sugar.

4.3. Australia

Australia's sugar production is strongly affected by developments in the world sugar market and the world sugar price because the country is a sugar exporter and sells its exports at the world price.

Australian sugar producers are responding to the higher world price from the UR by increasing their production by an average of about 2.1% over baseline production. This increase in production is accomplished by relaxing rigid government regulations on cane area and by transferring land from other crop production to sugarcane production. Australia's sugar consumption will increase only slightly (by 0.4%) as a result of higher income growth from the UR and population growth. Larger production increases relative to consumption increases will lead to higher sugar exports by an average of about 2.89% over the baseline levels.

4.4. Brazil

The UR provisions entail that the developments in the world sugar market and the world sugar price will influence the Brazilian sugar market by relaxing the production controls and export limits. Allowing the sugar industry to export at world prices will let the efficient producers adjust their production. Consequently, the increase in the world price under the UR will cause Brazilian sugar producers to increase their sugarcane area, which will result in production increases of an average of about 1.5% over baseline production. Brazil's sugar consumption will increase by an average of 1.49% as a result of the higher income growth from the UR, higher population growth, and lower domestic prices. These developments will enable Brazil to increase its sugar exports by an average of 2.3% over baseline exports.

4.5. India

Sugar production in India will increase by an average of about 1.37% over baseline production. This increase is due to the increased availability of improved technology and inputs for production, higher producer income, less government control, and a higher world sugar price resulting from the UR. Population and income increases will cause sugar consumption to rise by an average of about 0.81% over the baseline projections. These developments will enable India to increase its sugar exports by an average of 5.34% over baseline exports.

5. Conclusion

The liberalization of domestic and trade sugar policies as required by the UR will have an impact on sugar supply and demand in various countries. The demand side will be affected by global income growth, causing an increase in sugar consumption that is more significant in developing countries than in developed countries. Consumers in countries with strong domestic and trade policy interventions will also enjoy lower domestic consumer prices, which will increase the competitiveness of sugar with HFCS.

The impact of the UR on the supply side will be less pronounced. Low-cost sugar producing countries will benefit from the slightly higher world price and will increase their production and exports, as is the case in Australia, Brazil, and India. High-cost sugar producing countries will reduce their production slightly because of lower producer supports and domestic prices. However, the policy reforms required by the UR have been accommodated by most countries through policy changes, which have been already implemented during the past 10 years or so. For these countries, the UR largely serves to codify existing policies. Therefore, the impact on sugar production in these countries is rather small. This case exists in the United States, where sugar production will decrease by only an average of 1%. In the EU, subsidized sugar production will decrease while unsubsidized production will increase, resulting in a small decline of sugar exports.

As a result of the UR, the consumption increases will exceed the production increases, causing the world price to rise only slightly. In general, the liberalization of the sugar market caused by the UR will contribute to a more stable world sugar price and a more efficient allocation of economic resources in sugar production in various countries.

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