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TRADE LIBERALIZATION IN THE WORLD SUGAR MARKET: PLAYING ON A LEVEL FIELD?

by

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Abstract

The costs and benefits of the U. S. sugar program have historically been estimated with reference to a "world price." This price is highly distorted because of extensive government intervention in sugar markets around the world. The effect of U. S. quotas depends on the level of the world price relative to the U. S. producer price. Under free trade, the effect of a quota would be different than under distorted trade since freer trade will raise world prices.

Several studies have estimated the effects of freer trade in sugar, and they all show a rise in the world price. These models, however, generally do not allow for freer trade by the Soviet Union and China where it is assumed that trade remains unchanged or that imports are reduced in response to higher world prices brought about by trade liberalization by such blocs as the European Community (EC). We allow for an increase in imports by the Soviet Union and China under a freer trade environment (implying a market economy) given that they are among the highest cost producers in the world. Also, we allow for exchange rate movements which in recent years have made the internal EC price of sugar (measured in U. S. dollars) much higher than in the United States.

Our results show that, under a freer trade world, the world price of sugar could rise well above the U. S. price in the presence of existing quotas. For this to happen, increases in imports would have to be made by centrally planned countries.

If only the United States liberalized its sugar policy, the effect on world price is generally small (less than a 20 percent increase). This result appears to be consistent with other findings. However, if the EC liberalized its policy (all other countries remaining protectionist), the world price would rise significantly—in some of our results, the world price approaches or exceeds the current U. S. price in the presence of quotas. In other models, prices also rise but not to the same extent. The result that the EC has a greater impact on world price than does the U. S. policy is not consistent with other studies. This may be because we use an EC tariff equivalent which is larger than that of the United States. Interestingly, the United States and EC combined trade liberalization has the same effect on world price as if only the EC liberalized. Given our free-trade results, it follows that, when measured against distorted world prices, both the EC and the U. S. sugar producers are protected (as measured by producer subsidy equivalents (PSEs) and tariff equivalents) but, when measured against a free-trade price or a price when only the EC and United States liberalized, U. S. sugar producers are not protected.

What is badly needed are data on the actual prices received by major sugar producers. Given existing programs and cost of production data, consumers and producers in sugar producing regions which ship to countries such as the United States and the Soviet Union consume and produce at prices above the world price. This was especially true when world prices were below 5 cents per pound. (Because of internal prices that are often above the world price, caution should be exercised when determining who has the comparative advantage in sugar production.) Because of price supports and other distortions, the price elasticities are more inelastic than would be the case under free trade. The more price inelastic the exporters' excess supply schedules the greater will be the effect of trade liberalization on world sugar prices.

Trade Liberalization in the World Sugar Market: Playing on a Level Field?

Introduction

The world sugar market is highly distorted. Most sugar producing nations support their producers through various means, including quotas and price supports. Under the auspices of the General Agreement on Tariffs and Trade (GATT), there is an attempt to reduce trade distortions.

There have been numerous studies on the effects of U. S. sugar quotas. All studies use as a reference point against which to measure quota effects the "world price." The purpose of this paper is to assess how this world price is affected by trade liberalization. Although several studies have been done on this topic, they assume that, in response to freer trade by such nations as the European Community (EC) and the United States, countries such as the Soviet Union and China actually maintain or even increase production. However, because they are high-cost producers, a *world* of free trade (rather than in a world where China and the Soviet Union respond to liberalization by other nations) would imply that production in these regions would decrease. Our results show that as a consequence of worldwide free trade the world price can rise above U. S. internal prices with quotas. The results also show that it is possible that total liberalization by the EC alone could raise world prices above internal U. S. prices. In this case a move to freer trade could bring about higher consumer costs for the United States than in the presence of U. S. quotas with low world prices.

Empirical Results

There have been several recent studies which have analyzed the effects of moving to freer trade in sugar. Some of the studies include those by Brown (1987); Zietz and Valdes (1986); Tyres and Anderson (1987); Johnson et al. (1988); Kirby et al. (1988); Roningen and Dixit (1989); and Wong, Sturgiss, and Borrell (1989). Virtually all of the studies found that the world sugar price rises in response to trade liberalization. However, the degree of the price increase varies with the model used.

Tables 1 and 2 provide summaries of some of the empirical models on the effects of trade liberalization. Tyres and Anderson (1987) found that the world price would increase by as much as 22 percent if all industrial market economies (IMEs) liberalized. Zeitz and Valdes (1986) reported price gains of up to 65 percent.[1] Roningen and Dixit (1989) found a price increase in the neighborhood of 50 percent to 55 percent. They also found that, among the IMEs, the policies of the EC had a less depressing effect upon the world price than did U. S. policies. Ives and Hurley (1988) estimate that the world price would rise 2-3 cents with a 3 million metric ton increase in U. S. demand. Brown (1987) simulated the effects of full trade liberalization by IMEs. This study found that liberalization by the EC would raise the world sugar price by 3 percent, and the gain would be 1 percent if either the United States or Japan liberalized trade.

Part of the problem in interpreting these results is that the conclusions depend on the base price year. For example, if one applies these results to 1989 prices, then the implications are far different than if these results were applied to the 1983-84 period when world prices were significantly lower. It would seem that the primary losers of the sugar policies of the IMEs are the sugar exporters. However, some countries with access to preferential arrangements may gain. For example, the EC subsidizes the production of

Table 1

Results from studies on impacts of trade liberalization on world sugar price, price variability, and trade

Study	Base year	Liberalization by: 1/	World price effect	World price variability effect 2/	World trade effect
				Percent	
World Bank	1980-82	EC	3	NA	-5
		Japan	1	NA	1
		United States	1	NA	3
		OECD	5	-15	2
		All market economies (10 percent only)	8	-80	60
		Developing countries	3	-70	60
Zietz and Valdez	1979-81	All industrial market economies	13-30	NA	10-31
	1983	All industrial market economies	29-65	NA	36-75
Tyers and Anderson	1980-82	EC	18	-22	NA
		Japan	2	-8	NA
		United States	3	-14	NA
		All industrial market economies	22	-31	NA
Johnson and others	1986	Industrial market economies	29-46	NA	NA
		Global	45	NA	NA
Kirby and others	1986	10-percent liberalization by: 3/			
		All market economies	1.4	NA	1.4
		United States, EC, and Japan	1.3	NA	.6
		World minus United States, EC, Japan	0	NA	.9
Roningen and Dixit	1986	Industrial market economies	53	NA	13
Wong, Sturgiss, and Borrell	1985	10-percent liberalization by OECD	3.8	0	1

NA = Not available.

1/ Complete liberalization unless otherwise specified.

2/ Percent reduction in the coefficient of variation.

3/ Reducing all producer subsidy equivalents and consumer subsidy equivalents by 10 percent. See Webb, Lopez, and Penn for definition of producer subsidy equivalents and consumer subsidy equivalents.

Sources: See references for citations.
Lord and Barry, 1990.

Table 2

Studies of Trade Liberalization

World Bank (1986): Static simulation model, 30 countries, and 7 commodities. Liberalization simulated by removing nominal protection coefficients. Base years for data are 1980-82, but liberalization assumed to start in 1986. Simulates variability in prices by utilizing historical supply variability "shock" for each of 100 computer forecasts, and then taking the variation of the 100 forecasts. Model similar to Tyers and Anderson (1987).

Zietz and Valdes (1986): Static, synthetic, single-commodity sugar model, 58 less-developed countries, 17 Organization for Economic Cooperation and Development countries, and a "rest-of-world" category. Liberalization simulated by removing a "tariff-equivalent" price wedge. Base years are 1979-81 and 1983.

Tyers and Anderson (1987): Static simulation model, 30 countries, and 7 commodities. Liberalization simulated by removing nominal protection coefficients. Base years for data are 1980-82, but liberalization assumed to start in 1988. Simulates variability in prices by utilizing historical supply variability "shock" for each of 100 computer forecasts, and then taking the variation of the 100 forecasts. Forecasts given are for 1995, that is, after enough time for longrun adjustments.

Johnson and others (1988): Static synthetic model framework. Liberalization simulated by producer subsidy equivalent (PSE) and consumer subsidy equivalent (CSE) removal, in less-developed countries as well as industrial market economies. Base year is 1986. Medium-term (3-5 year) results.

Kirby and others (1988): Static synthetic model framework, 12 regions, and 22 commodities. Liberalization simulated by PSE and CSE reductions of 10 percent. Base year is 1986. Medium term (3-5 year) results.

Roningen and Dixit (1989): Static synthetic model framework, 11 regions, and 22 commodities. Liberalization simulated with PSE and CSE removal in industrial market economies. Base year is 1986. Medium-term (3-5 year) results.

Wong, Sturgiss, and Borrell (1989): Dynamic, structural, single-commodity sugar model. Nine regional sectors and a rest-of-world category. Sugar supply is asymmetric; that is, for important countries, increases in sugar supply following price peaks are not matched by equivalent decreases in supply following symmetric price declines. Responses to a 10-percent cut in producer and consumer price support levels in the United States, Japan, and the EC are reported.

See also: Sudaryanto; Rendleman and Hertel; Bureau of Agricultural Economics; Borrell, Sturgiss, and Wong; Sturgiss, Tobler, and Connell; Sparks Commodities; and Landell Mills Commodities (1987).

Source: Lord and Barry, 1990.

some Third World sugar producers through the Lome Agreement; as noted earlier, the United States grants the quota rents to exporters. Thus, it is an empirical question whether foreign holders of U. S. quotas gain or lose from the U. S. program.[2] Maskus (1989), assuming a world price of 12 cents per pound, estimates that the U. S. sugar program benefited quota holders in 1982-83, increasing the value of their exports by $166 million. However, by 1986-87, the sugar program cost quota holders nearly $800 million relative to the no-program value. Consistent with this, Leu (1990) observes that quota-holding countries switched their support from more to less restrictive U. S. sugar import policies in lobbying activities related to the 1985 Farm Bill. Ives and Hurley (1988) estimate that total export earnings of quota-holding countries would have been $2.8 billion higher for the period 1983-1987 had the U. S. loan rate been set at 12 cents instead of 18 cents per pound. These estimates, like the earlier ones on the effect of free trade, depend on the size of supply and demand elasticities and on the size of the distortions caused by non-U. S. exporters and importers.

A more specific concern, from the U. S. standpoint, is the effect of the U. S. sugar program in the Caribbean. Roughly 35 percent of U. S. sugar imports come from the Caribbean region; the largest exporter is the Dominican Republic, which exported approximately 204,000 metric tons to the United States in 1989. This area has always been of special interest, not only because it is the source of a substantial proportion of U. S. imports but also because of its political and strategic value to the United States.

Messina (1989) and Messina and Seale (1990) have studied the impact of quota allocations to the Caribbean. Messina and Seale (1990) find that the Caribbean would benefit from a larger quota allocation despite the fall in the U. S. sugar price that would ensue. Specifically, they find that raising the quota from 1.24 million to 1.935 million short tons raw value would provide a net gain to Caribbean exporters of $134.6 million.[3]

Price Elasticities

A point of contention when estimating the effects of U. S. quotas and trade liberalization centers on the price elasticity of supply of sugar exporters. The empirical findings clearly depend on the elasticities assumed in the models developed. As Schmitz and Christian (1990) point out:

> "There is a wide range of supply elasticities used in empirical work. Lopez estimated short-run price elasticities of supply for cane and beet sugar to be 0.231 and 0.479 in the short run, and 0.579 and 1.201 in the long run. For beets, this short run own-price elasticity is comparable to the 0.40 estimate of Jesse (1977). Gemmill estimated a U. S. cane supply elasticity of 1.57 and a beet supply elasticity of 1.74. Jesse and Zepp (1977) implicitly find a total U. S. supply elasticity of 0.20 for cane and 1.65-2.15 for beets.[4] Leu et al. used an aggregate elasticity of 1.5 and 2.0. For foreign supply, Gemmill found the foreign cane sugar supply elasticity to range from 0.3-1.0 while the excess supply curve of quota-holding countries was estimated by Lopez to have an elasticity of 0.05. Clearly, such disparate measures of the sugar supply response inevitably lead to a wide range of cost and benefit estimates.
>
> "Demand elasticities also vary by study, but generally, aggregate demand for both sugar and corn sweeteners is price inelastic.[5]"

Gemmill's (1976) general conclusion was that the foreign supply curves are highly inelastic. Tables 3, 4, and 5 give a summary of his results. These findings are based on individual country studies.[6] Note that for the 28 countries listed in Table 5, which includes Cuba, most of the supply price elasticities are well below one.

Choudhury (1976), using ordinary least squares (OLS) estimation of geometric lags, found only two of his nine chosen countries to have significant long-run price elasticities, those being 1.13 for Mexico and 2.29 for Nicaragua. The short-run results are lower in magnitude. Ilag (1970) found an elasticity of 1.09 for the Philippines (c.f., 0.92 here). Fan (1967) gave estimated supply elasticities for Taiwan in the range 2.47-2.75

Table 3

Cane Investment Equations (1950-72)

Country	β_{0Y}	S.E.	β_{1Y}	S.E.	$(1-\gamma)$	S.E.	R^2	h^d	N	Mean pp^*_t/PMX_t	Mean HA_t/pp^*_t	Short-Run Investment Elasticity	Long-Run Investment Elasticity
Argentina	46.3158	(8.9646	-30.0537	(8.3464)	0.5232	(0.1114)	0.812	3.804	22	0.706	38.773	0.295	1.007
Australia	48.1616	(7.9826)	-46.7868	(8.1325	0.4947	(0.0942)	0.942	3.330	22	0.676	31.179	0.011	0.539
Barbados	3.2378	(0.7911)	- 2.3512	(0.5529)	0.5287	(0.1368)	0.936	1.659	20	0.778	2.897	0.383	0.835
Bolivia & Chile[a,b]	58.9871	(14.3634)	-74.5606	(20.0553)	0.6203	(0.1069)	0.864	2.217	22	0.571	38.123	-0.006	0.212
Brazil	290.3890	(45.2711)	-241.9839	(43.2507	0.4613	(0.0963)	0.859	2.479	21	0.684	225.626	0.281	0.676
China-Taiwan	30.2881	(4.1425)	-25.1200	(3.9378)	0.1628	(0.1223)	0.831	2.494	19	0.546	19.738	0.308	0.424
Colombia	6.7489	(1.8868)	- 5.8283	(1.8700)	0.6892	(0.1060)	0.835	1.916	22	0.700	7.806	0.508	0.807
Cuba	376.2057	(61.1289)	-345.4885	(60.1326)	0.3508	(0.1178)	0.865	0.003	22	0.648	229.154	0.039	0.485
Dominican Republic[c]	37.2931	(5.2282)	-31.0342	(5.1204)	0.2584	(0.1175)	0.763	0.576	22	0.732	19.519	-0.159	0.579
Fiji	7.2134	(1.9072)	- 6.8717	(1.9063)	0.6651	(0.1041)	0.933	1.365	22	0.746	5.585	0.121	0.726
Guatemala	5.6735	(1.1770)	- 3.0368	(0.9926)	0.2308	(0.1610)	0.423	2.542	20	0.769	4.300	0.464	0.844
Guyana	10.0230	(2.7105)	- 8.0917	(2.5244)	0.3789	(0.1612)	0.736	0.352	20	0.772	5.990	-0.034	0.701
India[c]	588.7980	(54.1298)	487.3653	(52.0954)	0.2630	(0.0825)	0.875	1.798	22	0.619	385.866	0.225	0.526
Indonesia	39.0081	(5.4300)	-41.6582	(6.4813)	0.3459	(0.1010)	0.890	0.447	19	0.517	26.041	0.190	0.244
Iran[a]	74.4989	(24.5818)	-91.2884	(33.5141)	0.7404	(0.1031)	0.892	2.761	21	0.559	72.284	0.359	0.508
Jamaica	9.5953	(2.5407)	- 6.6875	(2.3215)	0.52	(0.1332)	0.648	1.913	22	0.768	9.140	0.448	0.840
Japan[a,b]	95.2820	(29.2527)	-116.5271	(39.6954)	0.7026	(0.1036)	0.888	3.356	21	0.559	85.844	0.295	0.455
Mauritius	18.2007	(2.2087)	-14.2713	(1.7425)	0.3833	(0.0878)	0.951	1.693	22	0.755	11.807	0.100	0.716
Mexico	26.9632	(10.8648)	-26.1228	(12.5095)	0.9135	(0.9752)	0.881	0.153	22	0.794	47.773	0.610	0.931
Nicaragua	4.2091	(1.2245)	- 4.0584	(1.2804)	0.7847	(0.1279)	0.728	1.073	22	0.853	2.965	-0.131	0.836
Peru	5.9025	(1.5847)	- 4.0266	(1.3918)	0.5922	(0.1235)	0.699	1.057	22	0.774	6.664	0.543	0.874
Philippines	24.8275	(12.8026)	-24.5710	(12.5926)	0.9157	(0.1316)	0.741	-0.498	22	0.867	34.987	0.408	0.923
South Africa	63.6174	(8.4031)	-63.9327	(8.8258)	0.1909	(0.1110)	0.937	1.876	22	0.670	25.364	-0.679	0.178
Thailand	45.5105	(5.5183)	-42.5551	(6.6123)	0.2379	(0.1152)	0.714	0.278	21	0.657	22.773	-0.217	0.368
Trinidad & Tabago	8.2546	(1.0249)	- 6.3265	(0.8302)	0.3563	(0.0903)	0.925	1.812	22	0.781	5.0796	0.036	0.736
Venezuela	11.3660	(3.5270)	- 9.8064	(3.4543)	0.8135	(0.0949)	0.893	-1.388	22	0.901	5.925	-0.451	0.877
Central America[a]	41.3728	(16.1140)	-40.1663	(17.2084)	0.8231	(0.0972)	0.934	2.582	22	0.741	44.691	0.417	0.850
Paraguay & Uruguay	22.2308	(3.8777)	-24.4171	(4.6067)	0.5789	(0.0894)	0.917	1.228	21	0.559	18.548	0.306	0.461

[1] Dependent variable is Q_t/PP^*_t rather than HA_t/PP^*_t

[2] Includes some sugar-beet also.

[3] Hectares growing and not hectares harvested used.

[4] ... test for serial correlation for large samples. h is a standard normal deviate for which the 5% level

Table 4

Yield Equations for Cane[a]

Country	α_0	α_1	t Value	α_3	t Value	α_4	t Value	$\bar{R}^2$	DW	N
Argentina	-5.2074	0.0935	(1.389)	0.1345	(8.050)			0.843	2.289	22
Australia	-1.8927			0.2082	(2.720)	-0.0061	(0.511)	0.638	1.954	22
Barbados	18.2167			-0.1582	(4.138)			0.459	2.020	22
Brazil	2.8871			0.1334	(4.033)	-0.0016	(2.388)	0.839	1.572	22
China-Taiwan	9.9606			-0.0243	(0.775)			0.000	2.267	19
Colombia	-14.7805			0.4723	(4.072)	-0.1124	(2.117)	0.781	0.531	22
Cuba	8.1566			-0.0275	(0.948)	-0.0014	(1.462)	0.120	1.610	22
Dominican Republic	3.4060			0.0462	(2.148)			0.147	0.723	22
Fiji	6.9350									
Guatemala	-10.5203			0.2703	(8.134)	-0.0843	(2.807)	0.860	1.084	20
Guyana	13.0229			-0.0856	(4.923)			0.550	1.754	20
India	-0.7090			0.0312	(5.401)			0.573	1.439	22
Indonesia	18.6995			-0.1890	(5.695)			0.636	1.013	19
Jamaica	-1.1829	0.4254	(2.177)	0. 135	(3.763)	-0.03[illegible]6	(1.922)	0.412	0.863	22
Mauritius	11.8884			0.1747	(2.474)	-0.1992	(2.266)	0.166	2.368	22
Mexico	-4.2860			0.2095						
Nicaragua	-7.5807	0.2549	(2.164)	0.1636	(4.150)	-0.0426	(1.268)	0.787	1.850	22
Peru	21.7978			0.0262	(0.309)	-0.1626	(2.833)	0.536	0.667	22
Philippines	1.0448			0.1297	(7.496)	-0.0132	(7.694)	0.794	1.069	22
South Africa	-2.2989			0.2132	(3.229)	-0.0169	(1.517)	0.467	1.735	22
Thailand	-6.1961	0.0567	(1.827)	0.1180	(5.683)			0.868	1.098	21
Trinidad & Tobago	0.1150	0.2804	(1.649)	0.0621	(1.340)			0.269	1.757	22
Venezuela	-12.3893			0.3240	(6.788)	-0.0491	(2.481)	0.829	1.008	22

[a]The equation was $YLD_t = \alpha_0 + \alpha_1 PP_{t-1} + \alpha_2 PFERT_{t-1} + \alpha_3 T + \alpha_4 HA_t$; α_2 was not significantly different from zero in all cases and incorporated into α_0 here.

Table 5

Short-Run Elasticities of Supply (At An Export Price of 6 Cents Per Pound)

Country	Elasticity
Argentina	0.4909
Australia	0.3705
Barbados	0.5932
Bolivia-Chile	0.2044
Brazil	0.4880
China-Taiwan	0.2492
Colombia	0.6750
Cuba	0.3416
Dominican Republic	0.2807
Fiji	0.5468
Guatemala	0.6524
Guyana	0.4207
India	0.3190
Indonesia	0.1000[a]
Iran	0.5444
Jamaica	0.6051
Japan	0.4267
Mauritius	0.4536
Mexico	0.7305
Nicaragua	0.5656
Peru	0.6875
Philippines	0.7390
South Africa	0.1000[a]
Thailand	0.1650
Trinidad-Tobago	0.4323
Venezuela	0.5060
Central America	0.7621
Paraguay-Uruguay	0.4405

[a]Denotes minimum imposed.

(c.f., 0.42 here). Hughes (1971) projected an unrestricted elasticity of supply of 3.5 for large farmers in Brazil in 1969.

A large exporter and producer of sugar is the EC. Elasticity estimates are summarized in Table 6. In the EC, France and West Germany are the largest producers. According to Gemmill (1976), France's supply is price elastic (1.64) but also sensitive to the price of fertilizer (-2.09). West Germany's supply is moderately price elastic (0.87) and relatively sensitive to the price of wheat [-0.61). The U. K. supply is probably price elastic, since the response for yield alone is 0.44. A weighted average price elasticity for the EC, given the assumption of unitary elasticity for the United Kingdom, is 1.09. In the recent work by Roningen and Dixit (1989), they used a supply elasticity for the EC of 0.5.

Production, Consumption, and Trade

Table 7 gives an overview of world sugar production, supply, and distribution over the last 15 years. Throughout the Eighties, annual production has been in the neighborhood of 100 million metric tons (raw value), of which slightly over 25 percent has been exported.

Table 8 presents the same data for specific regions. The largest producer is the EC followed by India, the USSR, and Brazil. The largest exporters are Cuba and the EC. Cuba exports more sugar than the United States produces. The EC in the late 1980s exported an amount of sugar which was only slightly below U. S. production. By far the largest importers are the Soviet Union and China where aggregate imports exceeded 8 million metric tons in 1988-89. For the same period, U. S. imports were roughly 1.5 metric tons.

Table 6

Elasticities for European Sugar Supply (1950-73)

Country	Production in Thousand Metric Tons Raw Value[a] 1974	Elasticity With Respect To			Percent Annual Change Due To Other Factors
		Own Price[b]	Input Price	Alternative Product Price	
Belgium	604	0.30	-0.30	--	3.85
Denmark	416	1.30	-1.65	--	0.93
France	2,945	1.64	-2.09[c]	--	0.53
West Germany	2,436	0.87	-0.10[c]	-0.61 (wheat)	2.60
Ireland	146	--	--	--	0.25
Italy	1,008	0.57	-0.55	-0.03 (apples)	1.56
Netherlands	777	1.14[d]	-3.87[c]	-0.29 (potatoes)	4.33
United Kingdom	617	0.44[d]	-0.27[c]	--	2.00
Sub-Total (EEC)	9,300	1.09	--	--	1.88
Austria	403	--	--	--	--
Finland	82	--	--	--	--
Greece	187	--	--	--	6.84
Portugal	9	--	--	--	--
Spain	667	--	--	--	4.75
Sweden	301	--	--	--	--
Switzerland	72	--	--	--	--
Turkey	834	--	--	--	3.43

[a]From CEFS for EEC, converted to raw value and French Overseas Departments included at 356 thousand metric tons.

[b]World Free market price for Communist nations, domestic price otherwise.

[c]Fertilizer price only.

[d]For yield only.

[e]From land-area equation.

Table 7

Sugar: World production, supply, and distribution

Marketing Year	Beginning Stocks	Sugar Production	Imports	Total Supply/ Distribution	Exports	Domestic Consumption	Ending Stocks
			1,000 metric tons, raw value				
74/75	13,159	79,077	22,882	115,118	22,640	76,710	15,768
75/76	15,768	82,449	23,438	121,655	23,201	81,736	16,718
76/77	16,718	86,484	26,032	129,234	26,554	83,115	19,565
77/78	19,565	93,079	26,482	139,126	28,368	87,036	23,722
78/79	23,722	91,573	26,817	142,112	27,045	90,825	24,242
79/80	24,242	84,786	29,329	138,357	28,039	90,692	19,626
80/81	19,626	88,451	27,893	135,970	28,736	90,122	17,112
81/82	17,112	100,399	31,794	149,305	32,362	93,351	23,592
82/83	23,592	101,317	30,177	155,086	30,999	94,707	29,380
83/84	29,380	96,227	29,137	154,744	30,241	97,412	27,091
84/85	27,091	100,680	29,246	157,017	30,427	98,313	28,282
85/86	28,282	98,964	29,015	156,261	29,534	100,604	26,123
86/87	26,123	103,438	27,432	156,993	28,473	104,689	23,831
87/88	23,831	103,555	28,082	155,463	28,957	106,344	21,162
88/89	21,162	106,447	28,740	155,349	27,683	107,525	21,141

Source: Foreign Agricultural Service, USDA

Table 8

Sugar: World Production, Consumption, and Stocks by Country and Region

Region/Country	Marketing year	Beginning stocks	Sugar production	Imports	Total supply/ distribution	Exports	Domestic consumption	Ending stocks
			1,000 metric tons, raw value					
United States[a]	1985-86	1,597	5,473	2,356	9,426	416	7,511	1,499
	1986-87	1,499	6,075	1,666	9,240	712	7,170	1,358
	1987-88	1,358	6,651	1,181	9,190	374	7,622	1,194
	1988-89	1,194	6,260	1,530	8,984	139	7,358	1,487
Cuba	1985-86	1,156	7,200	0	8,356	7,000	806	550
	1986-87	550	7,220	0	7,770	6,630	780	360
	1987-88	360	7,250	0	7,610	6,350	770	490
	1988-89	490	8,000	0	8,490	7,200	770	520
Dominican Republic	1985-86	374	894	0	1,268	480	331	457
	1986-87	457	815	0	1,272	587	351	334
	1987-88	334	700	0	1,034	575	350	109
	1988-89	109	800	0	909	475	375	59
TOTAL Caribbean	1985-86	1,646	8,727	197	10,570	7,874	1,563	1,133
	1986-87	1,133	8,624	218	9,975	7,549	1,570	856
	1987-88	856	8,592	178	9,626	7,299	1,564	763
	1988-89	763	9,408	180	10,351	8,039	1,577	735
TOTAL Central Amercia	1985-86	468	1,824	18	2,310	980	971	359
	1986-87	359	1,813	23	2,195	817	1,006	372
	1987-88	372	1,707	17	2,096	744	1,030	322
	1988-89	322	1,815	7	2,144	681	1,066	397
Brazil	1985-86	1,571	8,270	0	9,841	2,560	6,300	981
	1986-87	981	8,650	0	9,631	2,086	6,700	845
	1987-88	845	8,457	0	9,302	2,131	6,400	771
	1988-89	771	8,500	0	9,271	1,800	6,600	871

Table 8 continued

TOTAL South America	1985-86	2,745	13,001	453	16,199	3,290	10,961	1,948
	1986-87	1,948	13,595	415	15,958	2,516	11,727	1,715
	1987-88	1,715	13,406	728	15,849	2,654	11,525	1,670
	1988-89	1,670	13,575	572	15,817	2,363	11,774	1,680
France	1985-86	1,007	4,297	350	5,654	2,622	1,990	1,042
	1986-87	1,042	3,707	367	5,116	1,917	2,165	1,034
	1987-88	1,034	3,966	361	5,361	2,535	2,116	710
	1988-89	710	4,457	360	5,527	2,480	2,110	937
TOTAL EC[b]	1985-86	3,246	14,520	2,987	20,753	5,604	11,635	3,514
	1986-87	3,514	14,989	2,436	20,939	5,709	11,802	3,428
	1987-88	3,428	14,039	2,812	20,279	5,762	11,884	2,633
	1988-89	2,633	14,958	2,532	20,123	5,380	11,880	2,863
TOTAL Eastern Europe	1985-86	1,643	5,755	1,162	8,560	1,140	5,876	1,544
	1986-87	1,544	5,812	965	8,321	1,056	5,989	1,276
	1987-88	1,276	5,589	1,131	7,996	935	5,839	1,222
	1988-89	1,222	4,950	1,585	7,757	870	5,821	1,066
USSR	1985-86	3,894	8,260	5,183	17,337	327	13,400	3,610
	1986-87	3,610	8,700	5,057	17,367	173	14,494	2,700
	1987-88	2,700	9,560	5,000	17,260	200	14,560	2,500
	1988-89	2,500	9,400	5,300	17,200	200	14,100	2,900
TOTAL North Africa	1985-86	747	1,859	2,103	4,709	0	3,995	714
	1986-87	714	1,940	2,108	4,762	0	4,092	670
	1987-88	670	2,008	2,159	4,837	0	4,169	668
	1988-89	668	2,126	2,051	4,845	0	4,231	614
TOTAL Sub-Saharan Africa	1985-86	1,230	5,791	1,636	8,657	2,939	4,614	1,104
	1986-87	1,104	5,950	1,581	8,635	2,911	4,642	1,082
	1987-88	1,082	5,922	1,438	8,442	2,796	4,742	904
	1988-89	904	5,859	1,405	8,168	2,451	4,868	849

Table 8 continued

China (Mainland)	1985-86	2,177	5,535	1,216	8,928	271	6,600	2,057
	1986-87	2,057	5,774	1,507	9,338	459	7,200	1,679
	1987-88	1,679	4,763	3,208	9,650	300	7,700	1,650
	1988-89	1,650	4,900	3,200	9,750	300	8,100	1,350
India[c]	1985-86	1,803	7,983	1,775	11,561	57	9,338	2,166
	1986-87	2,166	9,474	1,020	12,660	25	9,675	2,960
	1987-88	2,960	10,000	90	13,050	30	10,220	2,800
	1988-89	2,800	10,900	0	13,700	320	10,680	2,700
TOTAL Asia	1985-86	6,862	22,773	8,243	37,878	3,328	27,806	6,744
	1986-87	6,744	24,750	7,847	39,341	3,183	29,593	6,565
	1987-88	6,565	24,947	8,550	40,062	2,828	30,805	6,429
	1988-89	6,429	26,937	8,393	41,759	3,955	31,922	5,882
Australia	1985-86	603	3,404	0	4,007	2,858	801	348
	1986-87	348	3,457	0	3,805	2,658	837	310
	1987-88	310	3,528	0	3,838	2,797	805	236
	1988-89	236	3,650	0	3,886	2,775	831	280
WORLD TOTAL	1985-86	28,282	98,964	29,015	156,261	29,534	100,604	26,123
	1986-87	26,123	103,438	27,432	156,993	28,473	104,689	23,831
	1987-88	23,831	103,550	28,082	155,463	27,957	106,344	21,162
	1988-89	21,162	106,447	28,740	156,349	27,683	107,525	21,141

[a]Domestic consumption represents total statistical disappearance and includes sugar which does not enter the customs territory of the United States (i.e., includes sugar used in U. S. foreign trade zones). Sources for U. S. trade figures: Department of Commerce general imports and exports, including re-exports, plus shipments to and from Puerto Rico. Trade figures adjusted from tel quel to raw value (96 degree polarity) by using a factor of 1,035 for imports and 1.07 for refined exports.
[b]Includes intra-EC trade.
[c]Includes khandsari sugar.

Source: U. S. Department of Agriculture. "Sugar and Sweetener: Situation and Outlook Report," U. S. Government Printing Office, Washington, D. C., 1989.

Cost of Production

Tables 9 and 10 present costs of producing sugar for selected major producers and sugar exporters. Note that, for major exporters of refined sugar from cane production, costs run from between 14 and 20 cents per pound while, for exporters producing beet sugar, costs range from 16 to 22 cents per pound. For high-cost producers of sugar beets, costs exceed 30 cents per pound.

Note that two of the larger producers and importers, the USSR and China, are in the high-cost category. According to USDA cost estimates, China and the Soviet Union are among the highest cost producers in the world (Lord, Barry, and Fry). (For Bulgaria, China, Japan, Romania, and the USSR, as a group their weighted average cost over the period 1979/80-1986-87 ranged from 36.78 to 48.60 cents per pound, making these countries among the highest cost producers in the world.)[7] Using the production cost data presented above, production in these regions would fall under free trade. In 1988-89 these regions produced roughly 14.3 million metric tons of sugar, more than twice the U. S. production of sugar. If one uses an aggregate excess supply curve elasticity of sugar of 0.5, the export price of sugar rises due to a domestic production shortfall of 7 million metric tons.

Given these cost of production data, many of the large producers and exporters do not produce at the world price especially when the world price was below 5 cents per pound. Because of domestic price supports where prices are supported above world levels, within a range of prices the effective excess supply price elasticity is zero.

Table 9

Sugar: Cost of producing raw cane sugar, beet sugar, and high fructose corn syrup, by category of world producers, 1986-88[1]

In cents per pound

Category	1986	1987	1988
Raw cane sugar:[2]			
Low-cost producers[3]	8.60-9.60	7.70-10.30	[4]
High-cost producers[5]	28.50-38.30	27.80-42.10	[4]
Major exporters[6]	9.10-14.50	10.30-14.70	[4]
Cane sugar, white value equivalent:			
Low-cost producers[3]	13.54-14.63	12.56-15.39	[4]
High-cost producers[5]	35.17-45.82	34.41-49.95	[4]
Major exporters[6]	14.08-19.95	15.39-20.17	[4]
Beet sugar, refined value:			
Low-cost producers[7]	10.60-20.90	13.30-23.90	[4]
High-cost producers[8]	30.90-62.00	33.60-46.40	[4]
Major exporters[9]	15.90-21.90	14.00-23.90	[4]
High fructose corn syrup:[10]			
Major producers[11]	14.30-24.60	12.60-28.20	[4]

[1] Crop year basis.
[2] Ex-mill/factory basis.
[3] Average of 5 countries (Malawi, South Africa, Swaziland, Zambia, and Zimbabwe).
[4] Not available.
[5] Average of 5 countries (Congo, Guadaloupe, Paraguay, Vietnam, and Japan).
[6] Average of 7 countries (Cuba, Brazil (Center-South), Australia, Thailand, Dominican Republic, South Africa, Mauritius).
[7] Average of 5 producing countries (Belgium, Chile, France, West Germany, and Turkey).
[8] Average of 6 producing countries (Bulgaria, China, Japan, Romania, USSR, and East Germany).
[9] Average of 6 exporting countries (France, West Germany, Belgium, Denmark, Netherlands, and Turkey).
[10] Dry weight, 42-percent HFCS basis.
[11] Average of 12 countries (Canada, Argentina, Japan, South Korea, Spain, Belgium, France, West Germany, Italy, Netherlands, United Kingdom, and the United States).

Source: Lord, Ronald C., Robert D. Barry, and James Fry, "World Sugar and HFCS Production Costs, 1979/80-1986/87," Sugar and Sweetener Situation and Outlook Report, June 1989, U.S. Department of Agriculture, Washington, D.C. Data originally from Landell Mills Commodities Studies, Ltd., London.

Table 10

Costs of producing starch and processing raw cane sugar, beet sugar, and high fructose starch syrup, United States and selected categories of world producers, 1979/80-1986/87

Category	Range of average production costs, between 1979/80-1986/87
	Cents/lb 1/
Raw cane sugar:	
United States	13.90-18.30
Low-cost producers 2/	8.03-12.23
High-cost producers 3/	32.58-45.20
Major exporters 4/	10.38-13.07
World total 5/	12.59-15.36
Cane sugar, white-value equivalent:	
United States	18.96-23.75
Low-cost producers 2/	12.58-17.15
High-cost producers 3/	39.27-52.99
Major exporters 4/	15.14-18.06
World total 5/	17.54-20.55
Beet sugar, white value:	
United States	16.70-23.10
Low-cost producers 6/	14.88-20.68
High-cost producers 7/	36.78-48.60
Major exporters 8/	15.13-20.98
World total 9/	25.52-29.47
High fructose syrup: 10/	
United States	12.20-15.86
World total 11/	13.83-17.88

Note: Weighted averages except for the United States.

1/ Measured in current U.S. cents a pound, ex-mill/factory basis.

2/ Average of five countries (Malawi, South Africa, Swaziland, Zambia, and Zimbabwe).

3/ Average of five countries (Congo, Paraguay, Guadeloupe, Vietnam, and Japan). Excludes Uganda.

4/ Average of seven countries (Cuba, Brazil (center-south), Australia, Thailand, Dominican Republic, South Africa, Mauritius).

5/ Average of 61 sugarcane-producing countries.

6/ Average of five countries (Chile, France, Turkey, West Germany, and Belgium).

7/ Average of five countries (China, Japan, Romania, Bulgaria, and USSR).

8/ Average of six countries (France, West Germany, Belgium, Denmark, the Netherlands, and Turkey).

9/ Average of 31 countries.

10/ Cents per pound, dry weight, 42-percent HFSS.

11/ Average of 12 countries (Canada, Argentina, Japan, South Korea, Spain, Belgium, France, West Germany, Italy, the Netherlands, United Kingdom, and United States).

Source: Lord and Barry, 1990.

GATT Countries and the Role of Centrally Planned Countries

Table 11 gives countries that have GATT membership. Note that two of the large sugar producers and exporters, China and the Soviet Union, are not included. What if a movement toward a truly free-trade world market in sugar occurred, where adjustments also occurred in these two regions?

The Case of the European Economic Community

The EC over time moved from a net importer of sugar to a net sugar exporter. As Figures 1 and 2 show, EC producers receive high price supports when judged either with references to world prices or to the U. S. support price.[8]

Note how the level of support for the EC relative to the United States has increased through time. This is because of the weakening of the U. S. dollar vis-à-vis such currencies as the German mark. A change in exchange rates clearly affects the relative rates of protection.

Clearly, the year chosen influences the degree of protection in the EC versus that in the United States. Roningen and Dixit for 1986 used a subsidy equivalent of 257 for the U. S. producers and 173 for the EC. However, these magnitudes should at least be reversed if 1989, for example, were used as a base.

Consider a proposal where sugar producers, who in the course of the last 20 years were on a net import basis, were obligated to adhere to a food security rule which stated

Table 11

GATT Membership as of March 1, 1988

Contracting Parties:

Antigua
Argentina
Australia
Austria
Bangladesh
Barbados
Belgium
Belize
Benin
Botswana
Brazil
Burkina Faso
Burma
Burundi
Cameroon
Canada*
Central African Republic
Chad
Chile
Colombia
Congo
Cuba
Cyprus
Czechoslovakia
Denmark
Dominican Repubic
Egypt*
Finland
France
Gabon
Gambia
Germany, Fed. Rep. of*
Ghana
Greece
Guyana
Haiti
Hong Kong
Hungary
Iceland
India
Indonesia
Ireland
Israel
Italy*
Ivory Coast
Jamaica
Japan*
Kenya
Korea, Rep. of*
Kuwait
Lesotho
Luxembourg
Madagascar
Malawi
Malaysia
Maldives
Malta
Mauritania
Mauritius
Mexico*
Morocco
Netherlands*
New Zealand
Nicaragua
Niger
Nigeria
Norway
Pakistan
Peru
Philippines
Poland
Portugal
Romania
Rwanda
Senegal
Sierra Leone
Singapore
South Africa
Spain
Sri Lanka
Surinam
Sweden
Switzerland
Tanzania
Thailand
Togo
Trinidad and Tobago
Turkey
Uganda
United Kingdom
United States
Uruguay
Yugoslavia
Zaire
Zambia
Zimbabwe

Acceded provisionally: Tunisia

De Facto Application:

Algeria
Angola
Bahamas
Bahrain
Brunei Darussalam
Cape Verde
Dominica
Equatorial Guinea
Fiji
Grenada
Guinea-Bissau
Kampuchea
Kiribata
Mali
Mozambique
Papua New Guinea
Mali
St. Christopher & Nevis
St. Lucia
St. Vincent
Sao Tome and Principe
Seychelles
Solomon Islands
Swaziland
Tonga
Tuvalu
United Arab Emirates
Yemen, Democractic

*Among top ten markets for U.S. agricultural products. (The other two are the Soviet Union and Taiwan.)

Figure 1

U.S. and E.C. SUPPORT LEVELS In Dollars and ECU's Per Pound 1985/86-89/90

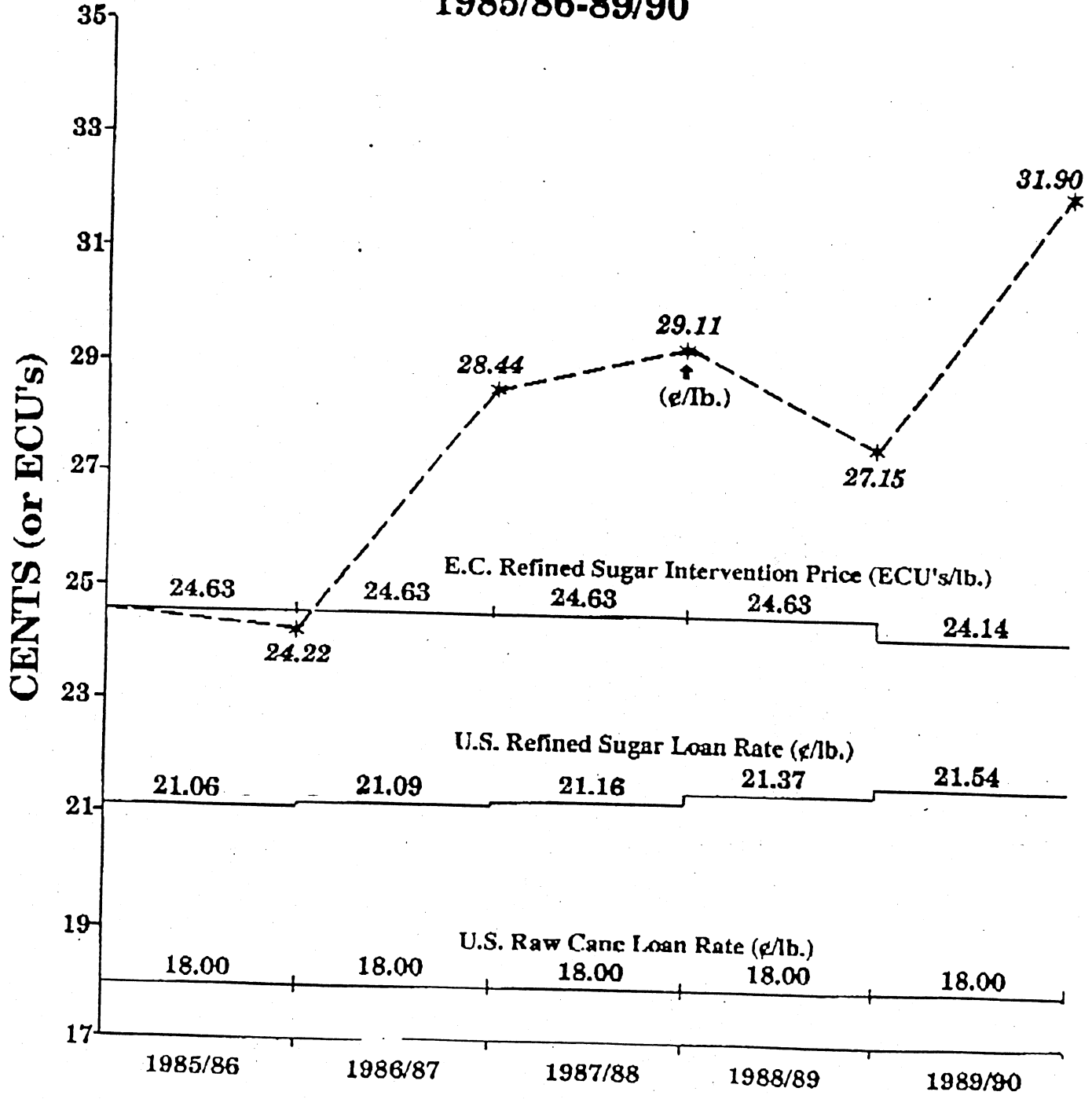
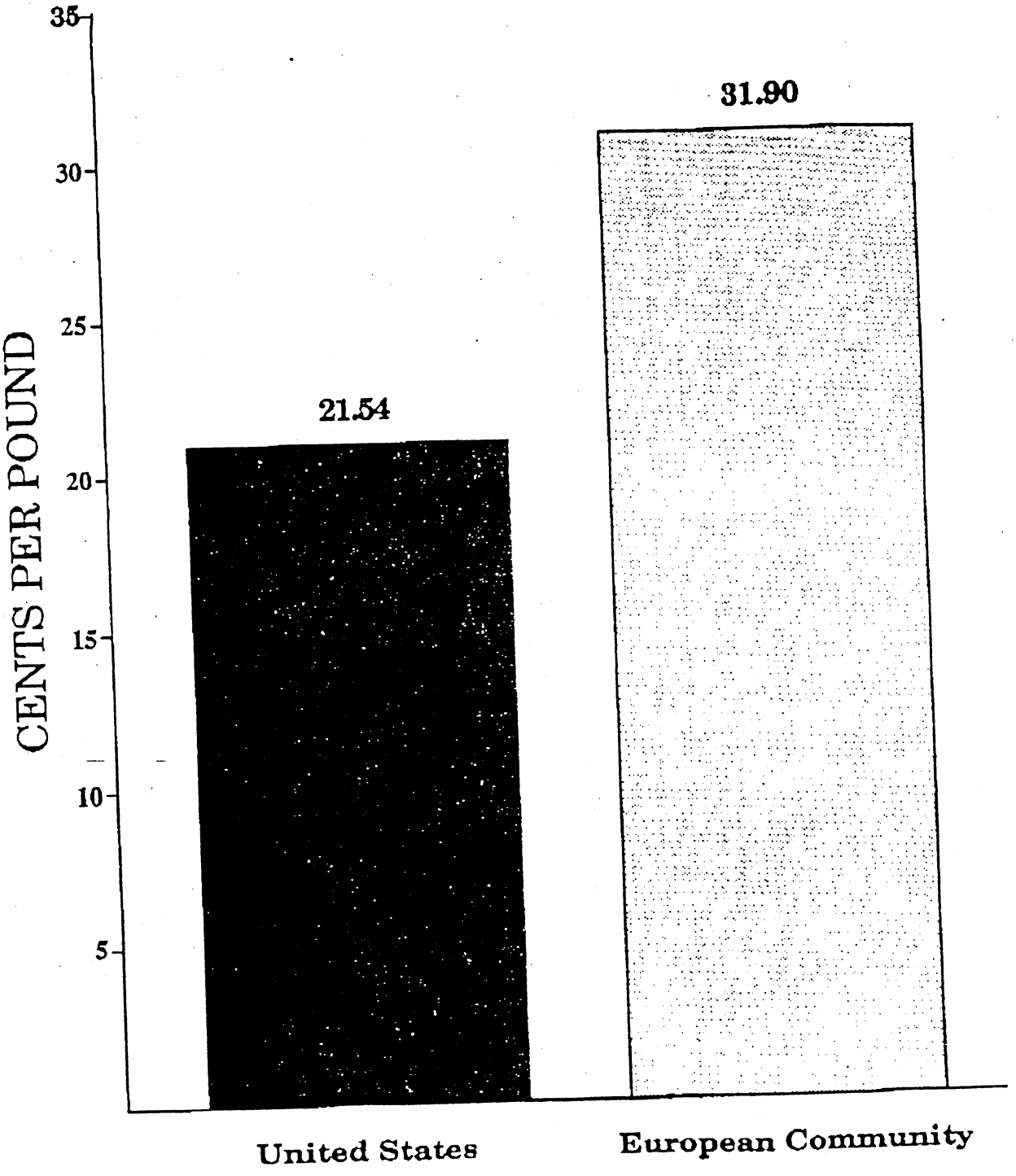


Figure 2

U.S. and E.C. SUGAR SUPPORT LEVELS
Refined Sugar Basis, 1989/90



that at most 80 percent of domestic consumption was to come from domestic production with the remainder being imported. Table 12 shows sugar self-sufficiency ratios for several periods. For example, for the period 1965-1967, the EC was a net sugar importer and had a self-sufficiency ratio of 0.83.

At 80 percent self-sufficiency, the EC would produce in 1988-89 an amount 80 percent of 11.9 million metric ton consumption and import the remainder. The EC would have to cut production by roughly 5 million metric tons (currently production is roughly 15 million metric tons). The price and trade implications become clear in our simulation results.

Supply and Transmission Elasticities

Tables 13 and 14 give both short-run and long-run supply elasticities of various commodities for Canada, the EC, Japan, and the United States. The results show that sugar supplies are highly price inelastic. Even in the long-run, price elasticities are less than one.

When discussing elasticities, it is important to deal with the export supply elasticities (i.e., elasticity of excess supply). If both the domestic demand and supply are highly price inelastic, then the country's excess supply will generally be inelastic but to a lesser degree than the price elasticity of domestic supply. If a country uses internal price supports which gives producers a price above the world price, supply is perfectly inelastic below the support price, as exports will not rise in response to higher world prices.

Unfortunately, little is known about excess supply elasticities. Every country that exports sugar likely has a different excess supply elasticity due to many factors, including

Table 12

Sugar self-sufficiency ratios, 1965-88 1/

Country/region	1965-67	1975-77	1986-88
Industrial market economies:			
EC-12 2/	0.83	1.09	1.23
United States	.40	.62	.85
Japan	.27	.25	.34
Total 3/	.67	.93	1.07
Less-developed countries:			
India	1.12	1.66	.95
Brazil	1.48	1.96	1.30
Mexico	1.46	1.38	1.08
Indonesia	1.06	1.08	.94
Total 4/	1.38	1.00	.95
Centrally planned economies:			
USSR	1.04	.91	.66
China	.94	.74	.73
Poland	1.42	1.51	1.03
Total 3/	1.42	1.29	.98

1/ Ratio of production to consumption.
2/ Data for EC-12 countries for all years.
3/ See table 1 for list of countries.
4/ Calculated as world minus industrial market economies' and centrally planned economies' totals.

Sources: International Sugar Organization.
Lord and Barry, 1990.

Table 13

Key Demand, Supply and Price Transmission Elasticities for Major Industrial Countries

	Reference consumption (kt)	Elasticity of demand with respect to the price of:						
		Rice	Wheat	C. Grain	Sugar	Dairy	R. Meat	NR. Meat
Canada								
Rice	107	-0.30	0.10	0.10	0.0	0.0	0.0	0.0
Wheat	5505	0.0	-0.18	0.05	0.0	0.0	0.0	0.0
C. Grain	17075	0.0	0.15	-0.20	0.0	0.0	0.0	0.0
Sugar	992	0.0	0.0	0.02	-0.08	0.0	0.0	0.0
Dairy	6999	0.0	0.0	0.0	0.0	-0.40	0.0	0.0
R. Meat	1099	0.0	0.0	0.0	0.0	0.0	-0.65	0.30
NR. Meat	1285	0.0	0.0	0.0	0.0	0.0	0.25	-0.75
Indirect Demand Parameters for Coarse Grain:								
Shares of livestock sectors grain-fed						0.78	0.78	1.00
Grain use per unit of output						0.40	6.00	5.00
The European Community								
Rice	945	-0.80	0.25	0.10	0.0	0.0	0.0	0.0
Wheat	47850	0.01	-0.30	0.02	0.0	0.0	0.0	0.0
C. Grain	70195	0.0	0.17	-0.20	0.05	0.0	0.0	0.0
Sugar	10533	0.0	0.0	0.01	-0.12	0.0	0.0	0.0
Dairy	107187	0.0	0.0	0.0	0.0	-0.40	0.02	0.02
R. Meat	7632	0.0	0.0	0.0	0.0	0.02	-0.60	0.25
NR. Meat	14029	0.0	0.0	0.0	0.0	0.02	0.26	-0.90
Indirect Demand Parameters for Coarse Grain:								
Shares of livestock sectors grain-fed						0.38	0.38	0.38
Grain use per unit of output						0.40	6.00	5.00
Japan								
Rice	10472	-0.23	0.03	0.01	0.0	0.0	0.0	0.0
Wheat	6331	0.24	-0.60	0.14	0.0	0.0	0.0	0.0
C. Grain	19436	0.16	0.25	-0.40	0.0	0.0	0.0	0.0
Sugar	2851	0.01	0.0	0.0	-0.05	0.0	0.0	0.0
Dairy	8113	0.0	0.0	0.0	0.0	-0.80	0.0	0.0
R. Meat	706	0.0	0.0	0.0	0.0	0.0	-1.40	0.40
NR. Meat	2904	0.0	0.0	0.0	0.0	0.0	0.25	-1.00
Indirect Demand Parameters for Coarse Grain:								
Shares of livestock sectors grain-fed						0.46	0.46	1.00
Grain use per unit of output						0.40	6.00	5.00
The United States								
Rice	2015	-0.20	0.08	0.04	0.0	0.0	0.0	0.0
Wheat	26958	0.01	-0.12	0.06	0.0	0.0	0.0	0.0
C. Grain	155456	0.01	0.08	-0.20	0.07	0.0	0.0	0.0
Sugar	8693	0.0	0.0	0.05	-0.20	0.0	0.0	0.0
Dairy	60503	0.0	0.0	0.0	0.0	-0.30	0.02	0.01
R. Meat	11190	0.0	0.0	0.0	0.0	0.02	-0.50	0.20
NR. Meat	13825	0.0	0.0	0.0	0.0	0.01	0.20	-0.80
Indirect Demand Parameters for Coarse Grain:								
Shares of livestock sectors grain-fed						0.67	0.67	1.00
Grain use per unit of output						0.40	6.00	5.00

Table 13 continued

	Reference consumption (kt)	Long-run elasticity of supply with respect to the price of:						
		Rice	Wheat	C. Grain	Sugar	Dairy	R. Meat	NR. Meat
Canada								
Rice	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wheat	26042	0.0	0.53	-0.22	0.0	0.0	-0.60	0.0
C. Grain	23130	0.0	-0.34	0.68	0.0	0.0	0.0	0.0
Sugar	132	0.0	0.0	0.0	0.50	0.0	0.0	0.0
Dairy	7772	0.0	0.0	-0.10	0.0	0.50	0.0	-0.08
R. Meat	1092	0.0	0.0	-0.28	0.0	0.08	0.60	-0.18
NR. Meat	1406	0.0	0.0	-0.25	0.0	-0.09	-0.14	0.89
The European Community								
Rice	699	0.40	0.0	0.0	0.0	0.0	0.0	0.0
Wheat	57772	0.0	0.90	-0.66	-0.06	0.0	0.0	0.0
C. Grain	67299	0.0	-0.51	0.92	-0.05	0.0	0.0	0.0
Sugar	14164	0.0	-0.10	-0.10	0.50	0.0	0.0	0.0
Dairy	118757	0.0	0.0	-0.01	0.0	0.51	-0.03	0.0
R. Meat	7520	0.0	0.0	-0.01	0.0	0.12	1.02	-0.48
NR. Meat	14813	0.0	0.0	-0.37	0.0	0.0	-0.30	1.14
Japan								
Rice	9375	0.20	0.0	0.0	0.0	0.0	0.0	0.0
Wheat	675	0.0	0.60	-0.30	0.0	0.0	0.0	0.0
C. Grain	399	0.0	-0.40	0.60	0.0	0.0	0.0	0.0
Sugar	853	0.0	0.0	0.0	0.50	0.0	0.0	0.0
Dairy	6798	0.0	0.0	-0.06	0.0	0.80	-0.09	0.0
R. Meat	478	0.0	0.0	-0.06	0.0	0.04	0.80	-0.10
NR. Meat	2619	0.0	0.0	-0.23	0.0	0.0	-0.06	0.99
The United States								
Rice	4713	0.75	-0.20	0.0	-0.04	0.0	0.0	0.0
Wheat	72301	-0.04	0.80	-0.53	0.0	0.0	0.0	0.0
C. Grain	211494	0.0	-0.28	0.75	0.0	0.0	0.0	0.0
Sugar	5321	-0.04	0.0	0.0	0.28	0.0	0.0	0.0
Dairy	61807	0.0	0.0	-0.08	0.0	0.85	-0.20	0.0
R. Meat	10578	0.0	0.0	-0.24	0.0	0.03	0.72	-0.16
NR. Meat	13991	0.0	0.0	-0.38	0.0	0.0	-0.13	1.12

Table 14

Short-run elasticity of supply with respect to the price of:

	Rice	Wheat	Coarse Grain			Sugar	Dairy			Ruminant meat			Nonruminant meat		
	t-1	t-1	t	t-1	t-2	t-1	t	t-1	t-2	t	t-1	t-2	t	t-1	t-2
Canada															
Rice	0.0	0.0		0.0		0.0		0.0			0.0			0.0	
Wheat	0.0	0.33		-0.14		0.0		0.0			-0.4			0.0	
C. Grain	0.0	-0.26		0.52		0.0		0.0			0.0			0.0	
Sugar	0.0	0.0		0.0		0.10		0.0			0.0			0.0	
Dairy	0.0	0.0	0.0	-0.02	-0.01	0.0	0.0	0.06	0.06	0.0	0.01	-0.01	0.0	0.0	-0.02
R. Meat	0.0	0.0	0.05	0.0	-0.19	0.0	0.0	0.0	0.04	-0.12	0.12	0.30	0.0	0.0	-0.09
NR. Meat	0.0	0.0	-0.06	-0.02	0.0	0.0	0.0	0.0	-0.03	0.0	-0.05	0.00	0.0	0.31	0.0
The European Community															
Rice	0.20	0.0		0.0		0.0		0.0			0.0			0.0	
Wheat	0.0	0.30		-0.22		-0.02		0.0			0.0			0.0	
C. Grain	0.0	-0.22		0.40		-0.02		0.0			0.0			0.0	
Sugar	0.0	-0.02		-0.02		0.10		0.0			0.0			0.0	
Dairy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.07	0.10	0.0	0.02	-0.03	0.0	0.0	0.0
R. Meat	0.0	0.0	0.0	0.0	-0.01	0.0	0.0	0.0	0.04	0.0	0.12	0.22	0.0	0.0	-0.16
NR. Meat	0.0	0.0	-0.22	-0.03	0.0	0.0	0.0	0.0	0.0	0.0	-0.06	-0.14	0.0	0.76	0.0
Japan															
Rice	0.08	0.0		0.0		0.0		0.0			0.0			0.0	
Wheat	0.0	0.30		-0.15		0.0		0.0			0.0			0.0	
C. Grain	0.0	-0.20		0.30		0.0		0.0			0.0			0.0	
Sugar	0.0	0.0		0.0		0.10		0.0			0.0			0.0	
Dairy	0.0	0.0	0.0	-0.01	-0.02	0.0	0.0	0.05	0.30	0.0	-0.02	-0.02	0.0	0.0	0.0
R. Meat	0.0	0.0	0.01	-0.01	-0.04	0.0	0.0	0.0	0.02	-0.10	0.10	0.40	0.0	0.0	-0.05
NR. Meat	0.0	0.0	-0.05	-0.03	0.0	0.0	0.0	0.0	0.0	0.0	-0.02	0.0	0.0	0.33	0.0
The United States															
Rice	0.35	-0.09		0.0		-0.02		0.0			0.0			0.0	
Wheat	-0.02	0.45		-0.30		0.0		0.0			0.0			0.0	
C. Grain	0.0	-0.15		0.40		0.0		0.0			0.0			0.0	
Sugar	-0.01	0.0		0.0		0.07		0.0			0.0			0.0	
Dairy	0.0	0.0	-0.01	-0.01	0.0	0.0	0.07	0.02	0.08	0.03	0.03	-0.10	0.0	0.0	0.0
R. Meat	0.0	0.0	0.0	-0.02	-0.10	0.0	0.0	0.01	0.0	-0.20	0.24	0.32	0.0	0.0	-0.08
NR. Meat	0.0	0.0	-0.20	-0.01	0.0	0.0	0.0	0.0	0.0	0.0	-0.05	-0.02	0.0	0.61	0.0

government policy. Many countries produce sugar at a price above world prices especially during periods of low price. Consider Cuba which is the world's largest sugar exporter. Under free trade, it is usually assumed that Cuban production and exports would rise on the premise that producer prices would rise under free trade. Reconcile this, however, with a recent report that Cuba at times has sold sugar to the Soviet Union and Eastern Europe at prices of 40 cents per pound or more (Wall Street Journal, 1990). This is significantly above U. S. producer prices and well above world prices. Using this information, it does not follow that trade liberalization which brings about a 50 percent increase in world sugar prices would bring about a production increase in Cuba—it could have the opposite effect!

Table 15 presents assumed international price transmission elasticities. These show the effect on producers and consumers from a change in international prices. The elasticities are very price inelastic, although some countries, such as Australia, show more responsiveness than others. Two of the large producers and importers, China and the USSR, are assumed to have positive but small elasticities for both producers and consumers. This was assumed to be generally the case for all of the empirical models estimating the effects of freer trade in sugar. These imply that, if world market prices rise, production will actually go up in these regions. However, as discussed earlier, these elasticities have to be viewed with caution when discussing the effects of trade liberalization. Due to the fact that these regions are high cost producers, a movement to freer trade by all countries including China and the USSR would bring about an increase in world price coupled with a *decrease* in sugar production in these regions. In many of the empirical models, trade liberalization is only partial in that the USSR and China together increase production in response to a price rise brought about by production and consumption adjustments by the United States and the EC. This type of modeling is a

Table 15

Assumed Elasticities of Transmission of International Price Changes to Domestic Prices*

		Wheat		Coarse grain		Rice		Ruminant meat		Nonruminant meat		Dairy products		Sugar	
		P	C	P	C	P	C	P	C	P	C	P	C	P	C
Australia	SR	0.78	0.11	0.69	0.69	0.62	0.23	0.73	1.00	0.46	0.25	0.40	0.13	0.49	0.00
	LR	1.00	0.63	0.96	0.96	0.84	1.00	1.00	1.00	0.52	0.34	0.45	0.39	0.54	0.00
Canada	SR	0.68	0.68	1.00	1.00	0.90	0.90	0.27	0.08	0.08	0.83	0.06	0.06	0.07	0.12
	LR	1.00	1.00	1.00	1.00	0.90	0.90	0.46	0.40	0.40	0.85	0.40	0.40	0.25	0.60
EC-10	SR	0.09	0.08	0.24	0.13	0.11	0.11	0.24	0.14	0.12	0.62	0.08	0.08	0.00	0.00
	LR	0.20	0.11	0.58	0.26	0.46	0.22	0.45	0.45	0.76	0.76	0.30	0.30	0.00	0.00
EFTA	SR	0.11	0.11	0.15	0.15	1.00	0.30	0.01	0.01	0.13	0.16	0.06	0.06	0.00	0.00
	LR	0.79	0.79	1.00	1.00	1.00	0.30	0.04	0.04	0.68	0.16	0.19	0.19	0.00	0.00
Japan	SR	0.20	0.06	0.2	0.02	0.06	0.03	0.10	0.10	0.49	0.47	0.03	0.03	0.00	0.00
	LR	1.00	0.25	1.00	0.12	0.55	0.12	0.24	0.24	0.63	0.86	0.08	0.08	0.00	0.00
New Zealand	SR	0.20	0.20	0.20	0.36	0.90	0.90	0.77	0.51	0.10	0.10	1.00	1.00	0.60	0.50
	LR	0.49	0.49	0.60	0.60	0.90	0.90	0.78	0.63	0.20	0.20	1.00	1.00	0.70	0.70
Spain & Portugal	SR	0.18	0.18	0.35	0.35	0.25	0.25	0.24	0.24	0.32	0.50	0.14	0.14	0.06	0.07
	LR	1.00	1.00	0.49	0.49	0.71	0.71	0.69	0.69	1.00	0.50	0.41	0.41	0.90	1.00
United States	SR	1.00	1.00	1.00	1.00	0.82	0.71	0.60	0.21	1.00	1.00	0.07	0.06	0.10	0.10
	LR	1.00	1.00	1.00	1.00	1.00	1.00	0.61	0.53	1.00	1.00	0.36	0.18	0.48	0.48
USSR	SR	0.05	0.05	0.02	0.02	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.02	0.02
	LR	0.45	0.45	0.17	0.17	0.30	0.30	0.20	0.20	0.20	0.20	0.13	0.13	0.04	0.04
Other E. Europe	SR	0.05	0.05	0.02	0.02	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.02	0.02
	LR	0.45	0.45	0.17	0.17	0.30	0.30	0.20	0.20	0.20	0.20	0.13	0.13	0.04	0.04
Egypt	SR	0.00	0.00	0.13	0.13	0.10	0.10	0.10	0.10	0.01	0.01	0.11	0.11	0.15	0.15
	LR	0.00	0.00	0.20	0.20	0.50	0.50	0.17	0.17	0.20	0.20	0.11	0.11	0.47	0.47
Nigeria	SR	0.23	0.23	0.31	0.31	0.22	0.22	0.18	0.18	0.40	0.40	0.30	0.34	0.05	0.05
	LR	0.64	0.64	0.53	0.53	0.52	0.52	0.42	0.42	0.60	0.60	0.40	0.40	0.30	0.30
South Africa	SR	0.50	0.50	0.90	0.90	0.70	0.70	0.80	0.80	0.90	0.90	0.30	0.30	0.30	0.30
	LR	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.90	0.90	0.90	0.50	0.50	0.50	0.50
Other Sub-Saharan Africa	SR	0.20	0.20	0.30	0.30	0.20	0.20	0.18	0.18	0.40	0.40	0.34	0.34	0.05	0.05
	LR	0.60	0.60	0.50	0.50	0.60	0.60	0.42	0.42	0.60	0.60	0.40	0.40	0.30	0.30
Other N. Africa & Middle East	SR	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.02	0.02	0.10	0.10	0.15	0.15
	LR	0.00	0.00	0.00	0.00	0.50	0.50	0.20	0.20	0.20	0.20	0.25	0.25	0.50	0.50
Bangladesh	SR	0.24	0.24	0.60	0.60	0.71	0.13	0.38	0.38	0.30	0.30	0.13	0.08	0.00	0.00
	LR	1.00	1.00	0.85	0.85	0.74	0.19	0.60	0.60	0.60	0.60	0.23	0.23	0.00	0.00
China	SR	0.44	0.05	0.54	0.05	0.35	0.05	0.48	0.05	0.17	0.05	0.10	0.05	0.19	0.05
	LR	0.60	0.60	0.87	0.70	0.58	0.40	0.66	0.50	0.25	0.22	0.16	0.12	0.23	0.20
India	SR	0.15	0.15	0.14	0.14	0.17	0.17	0.15	0.15	0.15	0.15	0.15	0.15	0.09	0.09
	LR	0.90	0.90	0.80	0.80	0.26	0.26	0.40	0.40	0.60	0.60	0.25	0.25	0.20	0.20
Indonesia	SR	0.09	0.09	0.47	0.46	0.20	0.05	0.05	0.05	0.05	0.20	0.05	0.02	0.02	0.02
	LR	1.00	1.00	0.94	1.00	0.60	0.40	0.40	0.40	0.40	0.40	0.20	0.20	0.20	0.20
Korea	SR	0.17	0.50	0.14	0.14	0.00	0.00	0.07	0.07	0.34	0.32	0.02	0.02	0.02	0.02
	LR	0.35	1.00	0.38	0.39	0.00	0.00	0.29	0.29	0.76	1.00	0.06	0.06	0.20	0.20

Table 15 continued

		Wheat		Coarse grain		Rice		Ruminant meat		Nonruminant meat		Dairy products		Sugar	
		P	C	P	C	P	C	P	C	P	C	P	C	P	C
Pakistan	SR	0.05	0.05	0.52	0.52	0.31	0.11	0.13	0.13	0.13	0.13	0.15	0.15	0.20	0.35
	LR	0.07	0.07	0.70	0.70	0.58	0.13	0.60	0.60	0.60	0.60	0.23	0.23	0.40	0.39
Philippines	SR	0.53	0.53	0.33	0.37	0.07	0.06	0.05	0.05	0.08	0.08	0.01	0.01	0.31	0.31
	LR	0.60	0.60	0.69	0.50	0.15	0.08	0.20	0.20	0.16	0.16	0.20	0.10	0.41	0.41
Taiwan	SR	0.09	0.42	0.40	0.91	0.24	0.22	0.54	0.08	0.43	0.20	0.01	0.01	0.51	0.51
	LR	0.60	1.00	0.43	1.00	1.00	1.00	0.93	0.62	0.53	0.32	0.20	0.20	0.73	0.73
Thailand	SR	0.40	0.40	0.85	0.85	0.49	0.31	0.17	0.17	0.18	0.18	0.01	0.01	0.24	0.24
	LR	0.60	0.60	1.00	1.00	0.74	0.58	0.30	0.30	0.50	0.50	0.20	0.20	1.00	1.00
Other Asia	SR	0.05	0.05	0.40	0.30	0.20	0.15	0.15	0.20	0.32	0.20	0.00	0.20	0.20	0.20
	LR	0.20	0.20	0.80	0.50	0.80	0.50	0.60	0.20	0.60	0.20	0.00	0.20	0.40	0.20
Argentina	SR	0.80	0.80	0.70	0.70	0.56	0.56	0.58	0.77	0.43	0.66	0.34	0.34	0.00	0.00
	LR	1.00	1.00	0.80	0.80	0.56	0.56	0.63	0.90	0.46	0.80	0.35	0.35	0.00	0.00
Brazil	SR	0.42	0.42	0.57	0.35	0.16	0.26	0.44	0.44	0.72	0.72	0.54	0.54	0.24	0.24
	LR	0.79	0.79	1.00	0.42	0.46	0.32	0.60	0.60	0.77	0.77	0.54	0.54	0.90	0.90
Cuba	SR	0.00	0.00	0.11	0.11	0.02	0.02	0.00	0.00	0.24	0.24	0.00	0.00	0.00	0.00
	LR	0.00	0.00	0.30	0.30	0.20	0.20	0.00	0.00	0.24	0.24	0.00	0.00	0.00	0.00
Mexico	SR	0.25	0.25	0.31	0.21	0.37	0.37	0.13	0.13	0.50	0.50	0.10	0.10	0.00	0.00
	LR	0.61	0.61	1.00	0.23	0.47	0.47	0.34	0.34	0.50	0.50	0.20	0.20	0.00	0.00
Other Latin America	SR	0.50	0.50	0.50	0.50	0.60	0.60	0.50	0.50	0.50	0.60	0.02	0.20	0.00	0.00
	LR	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.90	0.20	0.30	0.00	0.00

*SR and LR refer to short run and long run elasticities (with a Nerlovian geometric lag structure connecting them); P and C refer to domestic producer and consumer prices, respectively.

response by China and the USSR to other countries' trade liberalization policies—it is not a model of free trade in sugar.

Theory

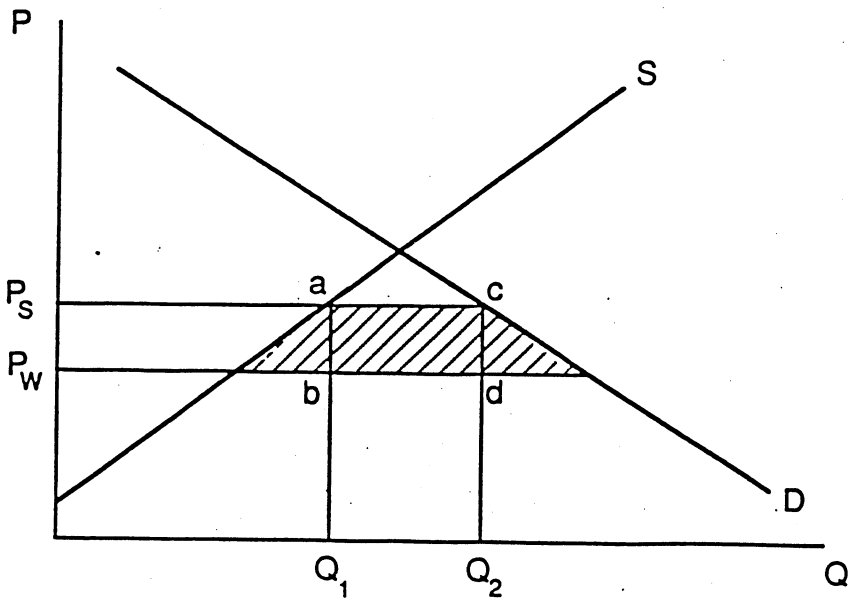
The costs and benefits of the U. S. sugar program depend critically on the level of world prices. The lower the world price relative to the internal support price, the larger the net cost of the U. S. sugar program. The appropriate border price depends on the extent of unilateral or multilateral sugar policy reform and trade liberalization. For example, is the appropriate border price the present distorted price or the price that would exist under multilateral free trade, as proposed in GATT?

The sensitivity of the calculated costs and benefits of the U. S. sugar program to the choice of border price is made clear in Figure 3, where S is the supply curve of U. S. sugar and D is demand. Given the world price of P_W, a quota restricts imports to Q_1Q_2. In this model, exporters obtain a quota rent of bacd, and there is a welfare loss to the United States of the crosshatched area.[9]

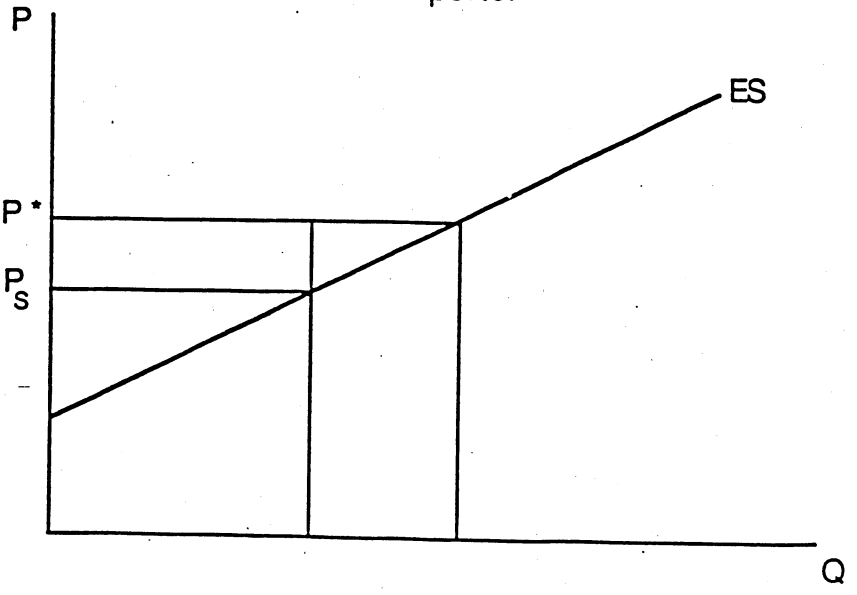
However, this loss is predicated on the world price of P_W, which is presently distorted by the sugar policies of other countries. What would be the effect of present U. S. policy if the world sugar price were undistorted? This is an entirely different issue than that of estimating the effects of the quota, given the present distorted world prices. According to the empirical estimates discussed later, the world price under free trade would be higher than the present distorted world price. In other words, it is argued that domestic policies in sugar producing countries have depressed world market prices.

Figure 3

United States



Other Exporter

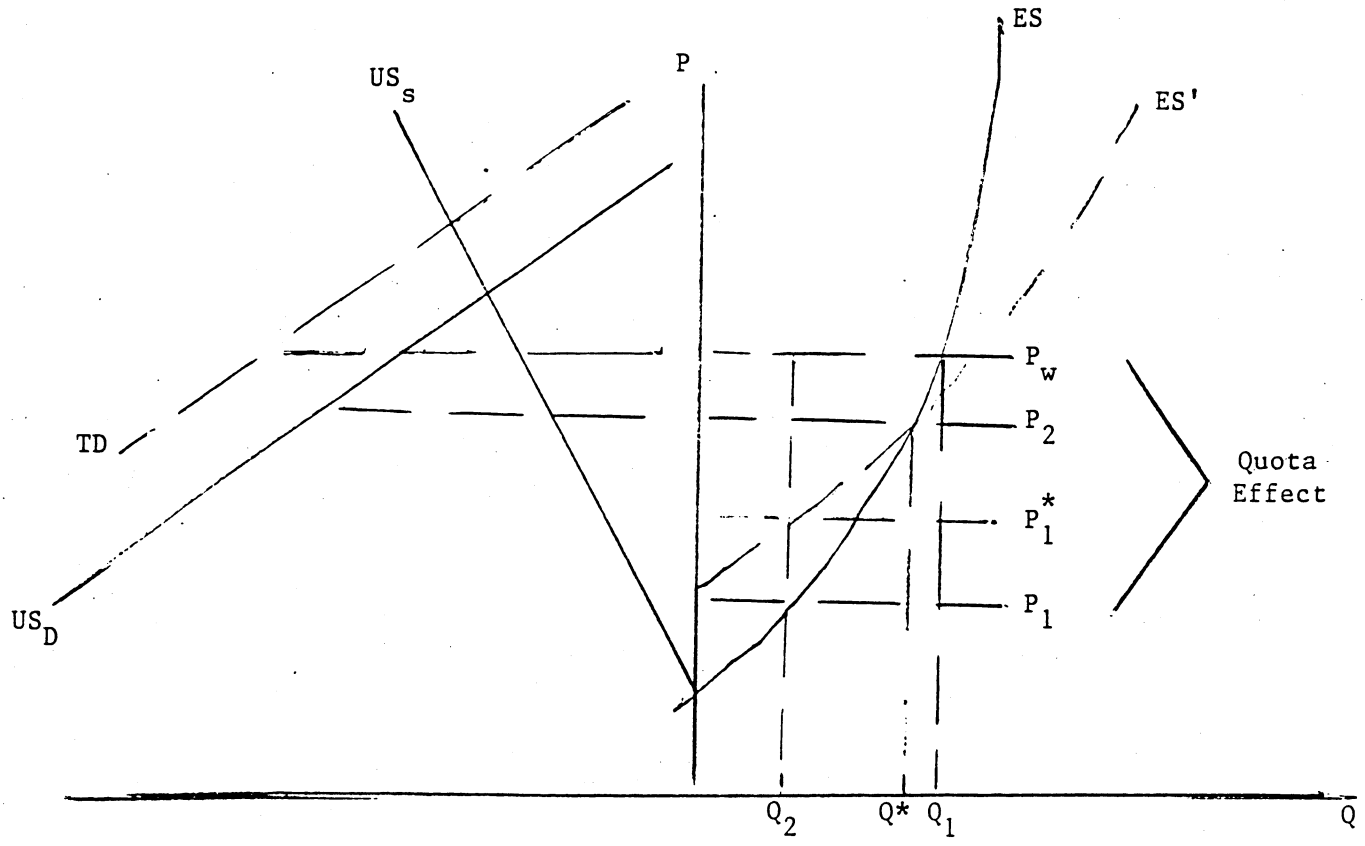


To highlight the importance of the choice of the border price to use in estimation, suppose that the free market price in Figure 3 is P_S. Further, suppose that exporters subsidize production at price P*, driving world prices from P_S to P_W. Now assume that the United States responds with a quota of Q_1Q_2 in reaction to exporters' subsidies. The quota in this case merely reestablishes for the United States a status equivalent to that of free trade. In this case, if a return to free trade in sugar were achieved (through GATT, for example), there would be no impact on the United States either in terms of trade or producer prices. Therefore, quotas need not be trade distorting when measured against a free-trade solution, even though they are clearly distorting if measured against a distorted world price. It is true that U. S. quotas, as illustrated, are inefficient given existing world prices, but it does not follow that multilateral free-trade, which is efficient, would alter U. S. sugar production, prices, or imports (Schmitz and Vercammen, 1990). Clearly, with reference to Figure 3, if P_W were the free-trade price, then quotas, if removed, would improve net U. S. welfare and trade would expand; but in the case where P_W is a distorted price, it does not follow that the volume of trade would be affected by moving to multilateral free trade.

The effect on world price of U. S. quotas imposed in response to an already distorted world price is illustrated in Figure 4. The U. S. supply curve is US_S and U. S. demand is US_D. Total demand, U. S. excess demand plus other countries' excess demand for sugar, is TD. The aggregate excess supply curve is ES which shows the volume of sugar which will be exported as a function of prices.

Under free trade, the world price is P_W; the U. S. imports Q_2 of sugar and the rest of the world imports Q_2Q_1. Suppose the rest of the world subsidizes domestic production such that they no longer import any of the commodity. The relevant demand becomes US_D. As a result of subsidies, price falls to P_2 and U. S. imports increase to Q*.

Figure 4



What if the United States responds to the subsidies by introducing quotas which fix imports at Q_2, the free-trade level. Exports to the United States are restricted to Q_2. Note that the export price now becomes P_1. The difference between the world price and the U. S. price becomes P_1P_W. This difference is due to U. S. quotas imposed in response to other countries' subsidies, i.e., in response to deviations from free trade.

The importance of elasticities to the effect on world price of U. S. quotas is illustrated by comparing ES with ES', where ES' is more price elastic. If ES' existed rather than ES, the world price drop due to U. S. quotas would have only fallen to price P_1^* rather than to price P_1. When the excess supply curve is highly price inelastic, a small change in the size of U. S. quotas can have a significant impact on world price.

Market shares also play an important role in determining the impact of quotas. The smaller the U. S. import market share of world imports, the less will be the price impact of U. S. quotas given a specified excess supply curve. As before, the more inelastic the excess supply curve, the greater will be the price impact of imposing quotas.

From the theory, free trade can lead to world prices which are above internal U. S. prices with import quotas in place. This is possible in cases where the quota becomes a policy instrument used to respond to low world prices brought about by price supports used by competitors. In this model, import quotas do not cause world prices to fall. Rather, policies of other countries cause world prices to fall and quotas are used in response to these policies.

Simulation Results

The following are results of our simulation model where we compute a free-trade price along with prices that result from only partial trade liberalization. An important result is that the effect of removing U. S. quotas is much less significant than the effect of removing EC price supports.

I

Table 16 gives the base results for this section. The model developed has four sectors: The United States, the EC, China and the USSR combined, and the rest of the world. All elasticities are set at 0.5, including the excess supply elasticity for the rest of the world.[10] The prices are as follows: (1) United States, 20 cents per pound; (2) Eastern Bloc, 30 cents per pound; (3) EC producers, 30 cents per pound; (4) the world price, 10 cents per pound. This results in a tariff equivalent for the United States of 100 percent and for the EC of 200 percent. In the model, EC consumers are allowed to buy sugar at the world price. (The above assumptions are relaxed in later models.)

Free Trade

For comparison, Table 17 gives the free-trade results. In this model adjustments are also allowed for China and the USSR. Under free trade, production would decrease and consumption would rise. The effect of free trade is to raise both the internal U. S. price and the world price while the price for the EC and producers in China and the USSR falls. The price in the United States rises by 2.4 cents per pound while the world price rises by 12.4 cents per pound.

Table 16

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 0 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0.2	0.2
US imports	1530	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.200	5828	7358	1530	0.00%	100.0%	0.000
EC	0.300	17260	11880	-5380	0.00%	200.0%	0.000
EAST	0.300	13700	22200	8500	0.00%	200.0%	0.000
ROW	0.100			-4650	-0.00%		

Table 17

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 100 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0	0.2
US imports	730	1530
Eastern imports	13032	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.224	6182	6912	730	11.44%	0.0%	0.149
EC	0.224	10723	4500	-6223	-28.90%	0.0%	-0.377
EAST	0.224	11971	25003	13032	-28.90%	0.0%	-0.377
ROW	0.224			-7539	76.64%		

U. S. Liberalization

Table 18 shows the effect of a 25 percent reduction in U. S. protection only. Tables 19 and 20 show the effects of a 50 percent reduction and a 100 percent reduction. The results show that if only the United States liberalized the effect on world price is small. The world price increases by only 1.16 cents per pound which is less than 15 percent. This result is consistent with some of the earlier models on trade liberalization (e.g. Roningen and Dixit).

EC Liberalization

Tables 21 and 22 show the effect of a 50 percent reduction and a 100 percent reduction in protection by only the EC. Note in Table 22 that the EC liberalization alone will cause world prices to rise substantially—100 percent. The world price equals the EC and the United States prices. Note two important points: (1) In this case the U. S. quotas are no longer needed or effective to maintain a 20 cent per pound price as a slightly higher price is obtained from the market.and (2) the effect of EC liberalization on trade is much greater than the effect of U. S. liberalization. The latter is opposite to the result by Roningen and Dixit. This may be in part due to assumed differences in levels of protection by the EC relative to the United States.

Joint EC and U. S. Liberalization

Table 23 shows the effects if both the United States and EC liberalize. Note that the result is identical to that if only the EC liberalized. World prices rise and the U. S. price remains roughly at the 20 cent per pound level.

Table 18

US Policy Goal - % reduction in US Tariff Equivalent 25 %

EC Policy Goal - % reduction in EC Tariff Equivalent 0 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0.2	0.2
US imports	2145	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.181	5556	7701	2145	-9.78%	75.0%	-2.737
EC	0.304	17574	11664	-5910	1.21%	193.0%	0.337
EAST	0.300	13700	22200	8500	0.00%	189.5%	0.000
ROW	0.104			-4735	3.58%		

Table 19

US Policy Goal - % reduction in US Tariff Equivalent 50 %

EC Policy Goal - % reduction in EC Tariff Equivalent 0 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0.2	0.2
US imports	2805	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.161	5264	8069	2805	-21.41%	50.0%	-2.944
EC	0.308	17911	11432	-6480	2.48%	186.0%	0.342
EAST	0.300	13700	22200	8500	0.00%	178.9%	0.000
ROW	0.108			-4825	7.27%		

Table 20

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 0 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0.2	0.2
US imports	4287	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.116	4609	8896	4287	-52.87%	0.0%	-3.504
EC	0.316	18668	10911	-7758	5.30%	171.9%	0.351
EAST	0.300	13700	22200	8500	0.00%	157.9%	0.000
ROW	0.116			-5029	15.09%		

Table 21

US Policy Goal - % reduction in US Tariff Equivalent 0 %

EC Policy Goal - % reduction in EC Tariff Equivalent 50 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0.1338	0.2
US imports	1530	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.200	5828	7358	1530	0.00%	49.5%	0.000
EC	0.268	14465	9871	-4594	-11.41%	100.0%	-0.395
EAST	0.300	13700	22200	8500	0.00%	124.2%	0.000
ROW	0.134			-5436	28.92%		

Table 22

US Policy Goal - % reduction in US Tariff Equivalent 0 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0	0.2
US imports	1470	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.202	5855	7325	1470	0.91%	0.0%	0.013
EC	0.202	8786	5833	-2953	-39.14%	0.0%	-0.580
EAST	0.300	13700	22200	8500	0.00%	48.7%	0.000
ROW	0.202			-7017	67.46%		

Table 23

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0	0.2
US imports	1470	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.202	5855	7325	1470	0.91%	0.0%	0.013
EC	0.202	8786	5833	-2953	-39.14%	0.0%	-0.580
EAST	0.300	13700	22200	8500	0.00%	48.7%	0.000
ROW	0.202			-7017	67.46%		

II

The results below are based on different elasticities. Table 24 shows free-trade results if the excess supply elasticity is 1 rather than 0.5. Under free trade, prices for the rest of the world and the United States rise. The U. S. price rises by 1.4 cents per pound while the world price goes up by 11.4 cents per pound, which is greater than a 100 percent rise.

Table 25 illustrates the effects of a 100 percent reduction in protection by both the United States and the EC. World prices almost double to 19 cents per pound while the U. S. price falls, but by less than 1 cent per pound.

Table 26 gives results when two changes are made relative to the earlier results: (1) the EC consumer price is identical to the EC producer price and (2) the initial EC degree of protection is reduced to 150 percent tariff equivalent. With these changes, the effect of free trade also is significant (Table 27). World prices rise to 24.1 cents per pound—a greater than 100 percent increase. The U. S. price rises by 4.1 cents per pound.

Table 28 shows that, if only the United States liberalized, the world price would rise by only 1.7 cents per pound. On the other hand, total liberalization by only the EC causes world prices to roughly double (Table 29). The U. S. price is roughly the same without quotas as with quotas in the presence of EC protectionism.

Note, for example, from Table 28 that with U. S. trade liberalization the degree of protection by the EC as measured by tariff equivalents actually falls (from 150 percent to

Table 24

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 100 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	1

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0	0.2
US imports	1065	1530
Eastern imports	13639	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.214	6034	7099	1065	6.81%	-0.0%	0.094
EC	0.214	9849	5101	-4747	-33.41%	0.0%	-0.460
EAST	0.214	11739	25378	13639	-33.41%	-0.0%	-0.460
ROW	0.214			-9957	72.66%		

Table 25

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	1

(EC: consumer price = world price)

	Trial	Base
EC Subsidy	0	0.2
US imports	1815	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.191	5702	7517	1815	-4.42%	0.0%	-0.070
EC	0.191	7878	6458	-1420	-44.26%	0.0%	-0.706
EAST	0.300	13700	22200	8500	0.00%	56.8%	0.000
ROW	0.191			-8895	62.68%		

Table 26

US Policy Goal - % reduction in US Tariff Equivalent 0 %

EC Policy Goal - % reduction in EC Tariff Equivalent 0 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = producer price)

	Trial	Base
EC Subsidy	0.15	0.15
US imports	1530	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.200	5828	7358	1530	0.00%	100.0%	0.000
EC	0.250	17260	11880	-5380	0.00%	150.0%	0.000
EAST	0.300	13700	22200	8500	0.00%	200.0%	0.000
ROW	0.100			-4650	-0.00%		

Table 27

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 100 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = producer price)

	Trial	Base
EC Subsidy	0	0.15
US imports	194	1530
Eastern imports	12059	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.241	6418	6612	194	18.40%	0.0%	0.223
EC	0.241	16441	12105	-4336	-3.87%	0.0%	-0.047
EAST	0.241	12342	24401	12059	-22.01%	0.0%	-0.267
ROW	0.241			-7917	82.53%		

Table 28

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 0 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities	
- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	1

(EC: consumer price = producer price)

	Trial	Base
EC Subsidy	0.15	0.15
US imports	4255	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.117	4624	8879	4255	-52.10%	-0.1%	-3.254
EC	0.267	18762	11466	-7296	6.73%	127.8%	0.420
EAST	0.300	13700	22200	8500	0.00%	155.5%	0.000
ROW	0.117			-5459	16.01%		

Table 29

US Policy Goal - % reduction in US Tariff Equivalent 0 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities	
- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	1

(EC: consumer price = producer price)

	Trial	Base
EC Subsidy	0	0.15
US imports	1380	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.205	5894	7274	1380	2.25%	0.0%	0.033
EC	0.204	13333	12961	-371	-20.03%	0.0%	-0.292
EAST	0.300	13700	22200	8500	0.00%	46.7%	0.000
ROW	0.204			-9509	68.63%		

127.8 percent) even though the absolute price difference of 15 cents per pound is maintained between the internal EC price and the world price.

When only the United States liberalizes, EC exports are actually increased because internal EC prices rise. (The price spread of 15 cents between the internal price and the world price is maintained.) Note that, in this case even though the absolute difference is the same between the world and EC price both before and after U. S. liberalization, the EC tariff equivalent has decreased to 127.8 percent. When only the EC liberalizes, on the other hand, EC exports drop sharply. These exports have to be replaced by the rest of the world exporters. Exports fall because internal EC prices fall.

Table 30 clearly shows that, if both the EC and the United States liberalize, the effects are the same as if only the EC liberalized. When the EC liberalizes, the U. S. quotas become nonbinding as the U. S. price equals the world price. Removing protectionism by the EC essentially removes any effective protectionism on the part of the United States.

Table 31 is based on elasticities for the United States and the EC used by Roningen and Dixit. The free-trade model shows that prices would rise in the United States by 5.5 cents per pound.

A 100 percent reduction in protection by the United States alone causes world price to rise by roughly 25 percent (Table 32). On the other hand, a 100 percent reduction by the EC alone causes world prices to rise by more than 100 percent to 22.6 cents per pound. The U. S. price rises to 22.6 cents per pound—an increase of 2.6 cents per pound. Table 33 shows what happens if both the EC and the United States liberalize. The effect is the same as if only the EC liberalized. U. S. price rises above the 20 cent quota price.

Table 30

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.5
- EC Supply	0.5
- EC Demand	0.5
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	1

(EC: consumer price = producer price)

	Trial	Base
EC Subsidy	0	0.15
US imports	1380	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.205	5894	7274	1380	2.25%	0.0%	0.033
EC	0.204	13333	12961	-371	-20.03%	0.0%	-0.292
EAST	0.300	13700	22200	8500	0.00%	46.7%	0.000
ROW	0.204			-9509	68.63%		

Table 31

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 0 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.24
- EC Supply	0.17
- EC Demand	0.48
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = producer price)

	Trial	Base
EC Subsidy	0.2	0.2
US imports	3293	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.125	4730	8023	3293	-46.41%	0.0%	-2.117
EC	0.325	17982	11412	-6571	7.88%	160.5%	0.360
EAST	0.300	13700	22200	8500	0.00%	140.7%	0.000
ROW	0.125			-5222	21.92%		

Table 32

US Policy Goal - % reduction in US Tariff Equivalent 0 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.24
- EC Supply	0.17
- EC Demand	0.48
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = producer price)

	Trial	Base
EC Subsidy	0	0.2
US imports	910	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.226	6214	7124	910	12.43%	0.0%	0.160
EC	0.226	15100	13279	-1821	-27.96%	0.0%	-0.361
EAST	0.300	13700	22200	8500	0.00%	32.5%	0.000
ROW	0.226			-7589	77.45%		

Table 33

US Policy Goal - % reduction in US Tariff Equivalent 100 %

EC Policy Goal - % reduction in EC Tariff Equivalent 100 %

Eastern Goal - % reduction in East Tariff Equivalent 0 %

Elasticities

- U.S. Supply	0.5
- U.S. Demand	0.24
- EC Supply	0.17
- EC Demand	0.48
- Eastern Supply	0.5
- Eastern Demand	0.5
- World X-Supply	0.5

(EC: consumer price = producer price)

	Trial	Base
EC Subsidy	0	0.2
US imports	910	1530
Eastern imports	8500	8500

Endogenous Variables

	Price	Supply	Demand	Imports	% change in price	Tarriff Equiv	Transm'n Elastic
US	0.226	6214	7124	910	12.43%	0.0%	0.160
EC	0.226	15100	13279	-1821	-27.96%	0.0%	-0.361
EAST	0.300	13700	22200	8500	0.00%	32.5%	0.000
ROW	0.226			-7589	77.45%		

Note an important result from the above models. Even though initially the United States and the EC are assumed to have varying degrees of protection as measured by tariff equivalents, U. S. prices rise under a free-trade situation or in the case when only the EC liberalizes. Thus, measures of protection, taken as a base estimate of world price, can be very misleading. In our model, the world price is itself endogenous. As a result, in a world of distortions, a positive protection (PSE) attached to a country does not necessarily imply that this country is distorting trade from a free-trade perspective. In fact, under a policy response model, as developed above, this country merely responded to other nations' trade distorting policies, causing it to have a positive PSE measure when in fact its productions and prices with free trade would be above those with distortions. *A positive tariff equivalent tied to a country's industry does not imply that prices for that nation would fall under free trade!*

Concluding Remarks

Table 34 gives the effects of maintaining U. S. sugar quotas. The effects are much smaller than many other researchers have reported on this topic. There is a net gain of removing quotas of $150 million in 1989 and $242 million in 1988. These estimates, as are others, are based on a world price below the U. S. internal price. The world price one selects is crucial in estimating the effects of quotas. If world prices rise above the U. S. price in a more liberalized sugar market, then U. S. quotas are no longer binding. As a result, when comparing free trade with existing quotas rather than quotas compared to distorted world price, the effects of quotas are zero since under free trade U. S. prices can be above existing prices in the context of quotas. Actually, the effect of free trade can improve producer welfare over existing protection but makes consumers worse off due to higher prices under free trade. The net effect is a cost from free trade as the gains to

Table 34

The economic welfare effects of removing the quotas on sugar and sugar containing products, 1988-89
(In millions of dollars)

Item	1988	1989
Consumer benefit:		
On purchases of the domestic market	997	894
On purchases of the imported market:		
Quota rents recovered	157	137
Deadweight loss recovered	126	74
Total consumer benefit	1,280	1,105
Producer subsidy cost	-1,038	-955
Net welfare gain	242	150

Source: Estimated by the staff of the U.S. International Trade Commission.

The price and quantity effects of removing the quotas on sugar and sugar-containing products, 1988-89
(In percent)

Item	1988	1989
Price effects:		
Domestic product	-30.7	-24.9
Imported product	-46.2	-35.6
Quantity effects:		
Domestic product	0.0	0.0
Imported product	56.0	40.9

Source: Estimated by the staff of the U.S. International Trade Commission.

The downstream economic effects of removing the quotas on sugar and sugar-containing products, 1988-89

Item	1988	1989
Chocolate and cocoa products:		
Economic rents accruing to		
Labor (million dollars)	12	10
Capital (million dollars)	22	20
Price effect (percent)	-1.1	-0.9
Quantity effect (percent)	1.1	0.9
Employment effect (percent)	1.5	1.2
Flavoring extracts and syrups, n.e.c.:		
Economic rents accruing to		
Labor (million dollars)	26	24
Capital (million dollars)	66	59
Price effect (percent)	-2.3	-1.9
Quantity effect (percent)	2.3	1.9
Employment effect (percent)	3.2	2.6
Blended and prepared flour		
Economic rents accruing to:		
Labor (million dollars)	3	3
Capital (million dollars)	3	3
Price effect (percent)	-1.2	-1.0
Quantity effect (percent)	1.2	1.0
Employment effect (percent)	1.5	1.2

Source: Estimated by the staff of the U.S. International Trade Commission. USITC Publication 2314, September, 1990.

producers are less than the costs to consumers. Thus, it is possible that quotas have an associated cost to the United States but then so could free trade. The producers gain in either case while the consumers lose in either case.

What is badly needed to refine the empirical estimates on the effect of trade liberalization are data on the *actual price* received by sugar producers who are major participants. It is often implied that the majority of exporters produce sugar at the world price. In the presence of existing government programs this is highly unlikely. It may well be that producer prices for sugar producers are well above world prices. (This is especially the case for those countries trading with the Soviet Union and for those receiving U. S. and EC quota rents under trade treaties.) The same may be true for major consumers. As our study shows, given the cost of production data available, it appears impossible for producers to produce at the world price especially during those times when prices inch below 5 cents per pound. Given market distortions, the price elasticities become more inelastic than if free market conditions existed.

FOOTNOTES

[1]They use the 1979-1981 period as a basis for comparison. It is difficult to comprehend a significant effect of U. S. quotas when, essentially, U. S. quotas were not binding in that period.

[2]Obviously, nonquota holding exporters certainly lose.

[3]There is an interesting issue raised concerning multinationals. For example, the Fanjuls have more sugarcane acreage in the Dominican Republic than in Florida. Thus, while they gain on their U. S. holdings due to U. S. quotas, they may lose on their foreign holdings. This raises the question of optimal lobbying tactics by these types of corporations. Obviously, they would like to lobby for the optimal tariff solution given that quota rents go to exporters. Given the data, it appears as if U. S. quota rents are too limiting to achieve this outcome.

[4]As calculated by Stephen Marks in a personal communication.

[5]Lopez (1989) found the price elasticity of demand to be -0.111 in the short run and -0.597 in the long run. Carman and Thor (1979) estimated the demand elasticities for all sweeteners to be -0.05 and -0.27 in the short and long run, respectively. Lopez and Sepulveda (1985) estimated nonindustrial demand for all sweeteners at -0.16, and industrial demand at -0.15 before the introduction of HFCS55, and at -0.04 afterwards. Gemmill (1976) found the own-price elasticity to be -0.07, while George and King (1971) found it to be -0.24.

[6]Some of the individual country studies other than that conducted by Gemmill (1976) include: Choudhury (1967), Ilag (1970), Fan (1967), and Hughes (1971).

[7]These regions in 1988-89, produced roughly 14.3 million metric tons of sugar, more than twice the U. S. production of sugar.

[8]In 1975, the EC raised its sugar intervention price and domestic quotas in response to the worldwide shortage of the early 1970s. Prior to this time, the EC had been a net importer of sugar. Since 1977, however, the EC has exported sugar, and it is presently the world's largest net exporter of sugar.

EC net exports peaked in 1982 at 3.97 million metric tons raw value. It was in 1981 that the costs of subsidizing these exports forced the EC to tighten internal quotas and impose levies on EC producers. Since that time, net exports have been fairly stable at 2.5 to 3 million metric tons. However, the annual excess demand of the EC has declined approximately 4.5 million metric tons over the period. By comparison, annual U. S. imports have declined 3-3.5 million metric tons in the 1980s.

[9]However, one can easily derive the theoretical result that, even though the United States pursues a quota policy for sugar, it could be optimal from the joint standpoint of U. S. producers and foreign exporters; that is, the combined rents according to domestic producers and foreign exporters could be greater than the free-trade rents. In the standard optimal tariff case, the importer receives tariff revenues. However, in the case of sugar quotas, one could have an essentially identical solution to that of optimal tariffs, but with the rents going to exporters rather than to importers.

[10]In these models the excess supply schedule only includes exports to the regions included. It is not the aggregate excess supply schedule. Exports to either region have been netted out.

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