

TRADE LIBERALIZATION FOR BRAZILIAN SUGAR EXPORTERS: NORTH OR SOUTH?

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ABSTRACT. We measure the gains to Brazilian sugar producers when *either* the United States or India remove trade barriers to their domestic markets. Our simulation model makes a number of simplifying assumptions to derive supply and demand functions for refined sugar under current policies before relaxing the trade barriers of either the US or India to find new equilibria.

Under four US liberalization scenarios, we find that Brazilian producers sell 0.4 to 1.1 million metric tons (1.5 to 4.2 percent) more sugar, increasing their total revenue by 196 to 575 million dollars (3.3 to 9.8 percent). When India liberalizes, Brazilian producers sell 0.8 mmt (3 percent) more sugar and increase total revenue by 416 million dollars (7.1 percent). Post-liberalization world refined sugar prices rise by 1.7 to 5.4 percent. Results are fairly robust to sensitivity analysis.

Developing countries may have as much to gain from liberalizing trade among themselves as from developed country liberalization. Since developing countries share similar levels of market development, liberalization may be easier from a political economic perspective. Thus, from a benefit-cost perspective, developing countries might consider putting more effort into South-South trade liberalization.

Anderson and Martin (2005); Tokarick (2005) find—using general equilibrium models of world trade—that South-South trade liberalization can be as effective as North-South liberalization.¹ To test this hypothesis on a smaller scale where micro-motivations are clearer, we

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¹By “South” and “North”, we mean “Developing” and “Developed” countries, respectively. This popular shorthand does not correlate 100 percent with geographic location, e.g., for Russia or Australia.

examine the gains to Brazilian sugar producers when *either* the United States or India remove trade barriers to their domestic markets. Our model makes a number of simplifying assumptions to derive supply and demand functions for sugar² under current policies before relaxing the trade barriers of either the US or India to find new equilibria.

1. MOTIVATION

The returns to liberalizing trade between developed and developing countries are large, but negotiation is difficult. Although the gains from South-South liberalization might be smaller, trade liberalization may be easier because developing country producers produce under similar legal, financial and technological constraints; their markets are at similar levels of competitiveness; and they have a history of cooperation in other, geopolitical fora, e.g., Brazil and India belong to the G20 club of developing countries seeking agricultural free trade, seek permanent seats on the UN Security Council, and participated in the Nonaligned Movement—India as a founder, Brazil as an observer. Since many of them also have the frail institutions of post-colonial independence, they can sympathize and cooperate in building institutional capacity compatible with market development.

If Southern producers are less-threatened by the prospect of free trade with other developing countries, negotiators can reach agreement faster. If the benefits of liberalization are similar to liberalization with developed countries, then the benefit-cost ratio favors South-South negotiation.

²Throughout this paper, “sugar” means refined sugar—unless we say raw sugar.

Interestingly, we feel that many politicians, business leaders and economists [except those we cite here] may overlook South-South liberalization because of history (North-South trade descends from colonial trade) or institutional bias (most people studying and negotiating trade live in the North). We hope to shift their focus to a liberalization scenario with great potential.

2. THEORY

Benefits could be as much from south-south as from south-north trade reform. Trade reform by developing countries is almost as important economically to those countries as is reform by developed countries, including from agricultural liberalization. Hence choosing to delay their own reforms or reforming less than developed countries, and thereby holding back south-south trade growth, could reduce substantially the potential gains to developing countries. (Anderson and Martin, 2005, p. 11)

Tokarick (2003) uses a general-equilibrium model to find that developing country liberalization produces bigger gains for India and Brazil than developed country liberalization. (See Table 1.)

TABLE 1. Tokarick (2003, p. 38) suggests that developing country liberalization of agricultural policy can have large benefits—especially for developing countries.

% Increase in GDP for:	Brazil	USA	India	World
Developed Liberalize	0.31	0.08	0.04	0.34
Developing Liberalize	0.38	0.02	0.13	0.08
Both Liberalize	0.72	0.10	0.17	0.44

We explore this result by focusing on a particular industry (sugar) and particular countries from the North (United States) and South (India) that protect their domestic sugar markets. (See Figure 1.) All three countries are in the top five in world production and consumption

of sugar, so our topic is also meaningful (USDA Foreign Agricultural Service, 2003).³

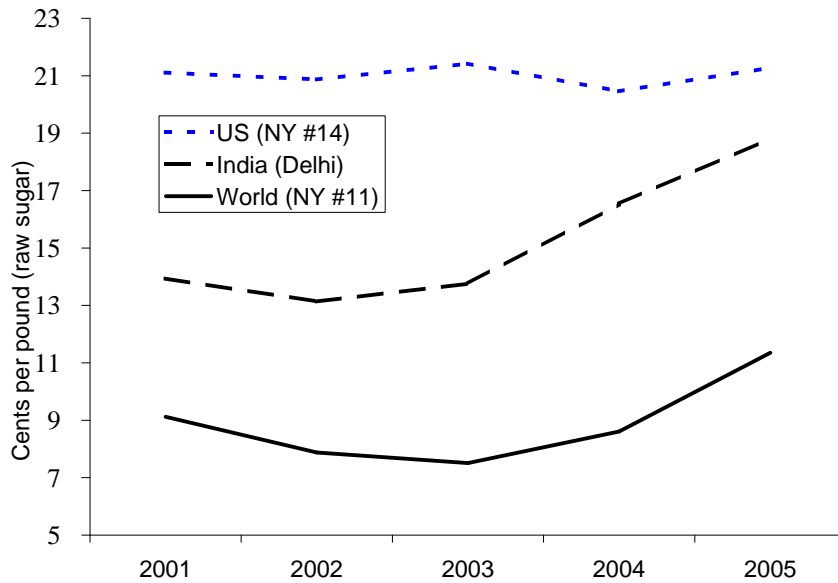


FIGURE 1. Raw sugar prices in the US and India are much higher than world prices. Sources: US price (New York Contract 14) and world price (NY Contract 11) from USDA Economic Research Service (2004, Table 3 and 4). India price from Delhi wholesale market, as cited in USDA Foreign Agricultural Service (2004a, Table 5).

Our theoretical model is simple: The greater the protection of a domestic producer, the larger the gains from trade liberalization to foreign producers—through both higher exports and prices. (See Figure 2 on the next page.) We look at the gain to exporters because they, not consumers, are often the driving force behind trade liberalization.⁴ If

³Appendix A on page 12 has background information on sugar.

⁴Although the producers in protected markets lose and consumers gain, the net benefit to a country is positive when these positions are added together (Tokarick, 2003; Elliott, 2005). Elobeid and Beghin (2004) note that consumers in previously-free markets will face higher prices if protected countries liberalize trade in sugar. Brazilian consumers will transfer wealth to producers when liberalization increases prices, but their inelastic demand means that deadweight losses are small. This

the benefits from free trade are similar for two markets, but negotiation effort differs, then the benefit-cost ratio favors negotiation with the more-willing partner.

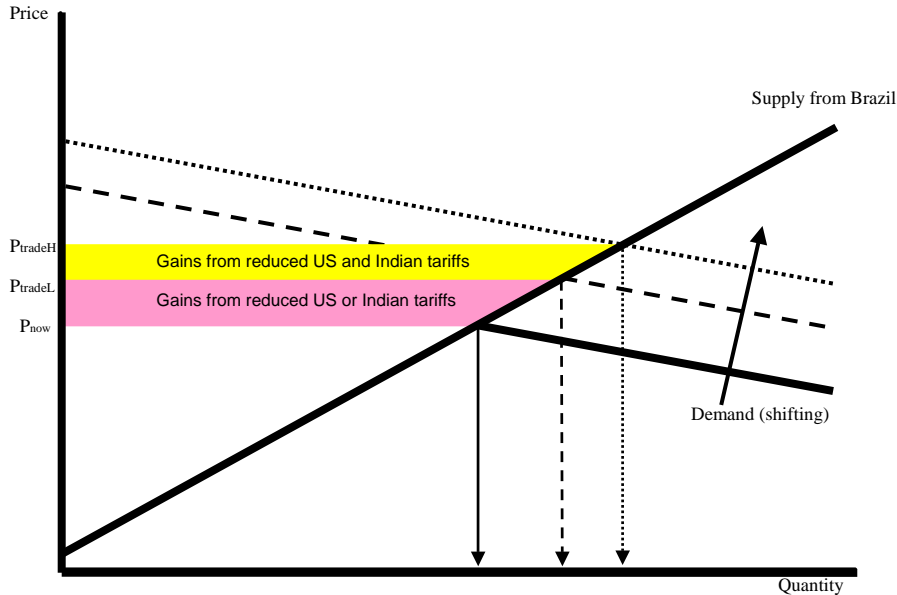


FIGURE 2. Most trade scenarios assume that all countries remove trade barriers (e.g., the US and India). We look at the case where *either* a North or a South country does. Our hypothesis is that the gains may be similar, but that South-South liberalization may be easier—tilting the negotiating benefit-cost ratio in its favor.

2.1. US and Indian Protectionism. Most of the protection of US sugar producers comes from two programs: the Tariff Rate Quota (TRQ) import system and the price support loan program. The TRQ limits imports by imposing a high tariff on imports greater than a statutory quantity—currently about 1.14 million metric tons (mmt) (USDA Foreign Agricultural Service, 2006). The US government allocates the TRQ among countries based on their historical exports to the US.

negative result may be offset by positive general equilibrium effects if reduced trade distortion leads farmers to switch to optimal crops (Tokarick, 2003).

Under the price support loan program, the US government provides loans to sugar processors and must accept sugar as payment if prices are low. To limit the cost, the US government determines the “Overall Allotment Quantity” (OAQ; 7.3 mmt in 2004; USDA (2004)) each crop year for states and processors based on historical production and current prospects (USDA Economic Research Service, 2005). In our simulations, we remove TRQ and OAQ (“total”) or TRQ alone (“partial”).

India has many policies on sugar (USDA Foreign Agricultural Service, 2004a, IN3028). Among those, major policies are the 60 percent *ad valorem* tariff, a USD19.5/mt tax, and a “levy sugar” program that requires sugar mills to supply 10 percent of their production to the government below market prices for distribution to the poor. In our simulation, we remove the *ad valorem* tariff and tax.

3. SIMULATION

Our model of liberalization uses current data and stylized elasticities to calculate linear supply and demand functions, then shifts these functions to account for the removal of trade barriers and merging of formerly protected markets with world markets. We calculate benefits as the change in total revenue to Brazilian producers and varied elasticities to check for sensitivity.

3.1. Simulation Details.

- (1) We define linear supply and demand for sugar in Brazil, India and the United States plus the Rest of the World (RoW) using long-term supply elasticities of 0.8 (Brazil) and 1.5 (US and

India) and demand elasticities of -0.5 (US), -0.6 (Brazil) and -0.8 (India).⁵

- (2) We combine elasticities with 2003 prices and quantities to calibrate our model to a baseline that includes current barriers to trade. (See Section 2.1 on page 5.) We assume the US government resells OAQ sugar on the open market.
- (3) We liberalize trade in one Indian and four US scenarios: total or partial (keeping the OAQ program), with or without High Fructose Corn Syrup (HFCS). In Appendix B on page 14, we describe HFCS. We add HFCS demand to sugar demand (to get sweetener demand) when prices drop below USD250 per metric ton (mt).
 - (a) India Total: Remove all trade barriers to all countries.
 - (b) US Total Sugar: Remove all trade barriers to all countries.
 - (c) US Partial Sugar: Remove TRQ only, not OAQ.
 - (d) US Total Sweetener: Add HFCS demand to Total Sugar.
 - (e) US Partial Sweetener: Add HFCS demand to Partial Sugar.

Figure 3 on the next page gives a simple example of how we construct post-liberalization scenarios. In Appendix C on page 15 we describe how we model and remove actual trade barriers in the five scenarios.

- (4) We leave other trade policies, commodities, technology, etc. equal (*ceteris paribus*) to observe changes in prices and quantities in the world sugar market. We ignore transportation costs.

⁵Elasticities in the literature range from 0.01 to 1.8, so we assumed these elasticities.

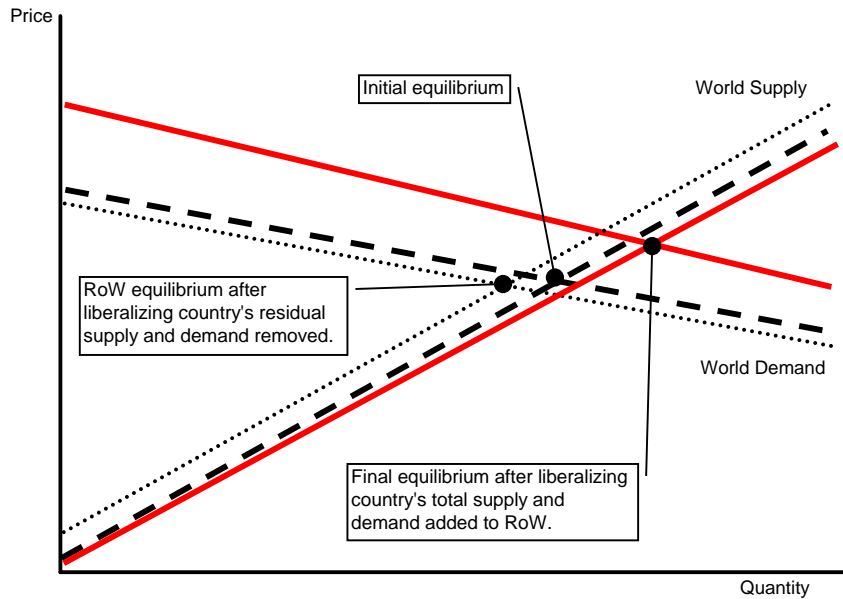


FIGURE 3. Dashed lines represent pre-liberalization (or status quo) world supply and demand. To get post-liberalization world supply and demand (red, solid lines), we first remove the liberalizing country's *residual* share of supply and demand currently trading in world markets to get RoW supply and demand (dotted lines) and then add the *total* supply and demand of the liberalizing country to RoW supply and demand.

- (5) We measure Brazil's benefit by comparing its total revenue in the world market before and after liberalization.⁶
- (6) In Appendix D on page 16, we vary supply elasticities to check for sensitivity (robustness) of our results. The ranking of results changes only once—moving India's liberalization from third to second best for Brazilian exporters.

⁶We do not subtract Brazil's lost profits from its TRQ quota. Using the average difference between US and world prices over the past 5 years, this rent is worth just over USD4 million, or its quota of 152 mt times the difference of USD26,700/mt.

4. RESULTS

When India totally liberalizes, Brazilian producers sell 0.8 mmt (3%) more sugar. Under US liberalization scenarios, Brazilian producers sell from 0.4 (1.5%) to 1.1 (4.2%) Million Metric Tons (mmt) more sugar. The most beneficial scenario of the five, measured by the change in total revenue to Brazil, is US total sweetener. Post-liberalization world sugar prices are 1.7 to 5.4 percent higher. (See Table 2.) Detailed results follow in Sections 4.1 to 4.4.

TABLE 2. Simulation results for five liberation scenarios comparing consumption (Q_{world}), price (P_{world}), Brazilian production (Q_{Brazil}), and Brazilian total revenue ($Revenue_{Brazil}$).

Scenario	Q_{world} mmt	P_{world} usd/mt	Q_{Brazil} mmt	$Revenue_{Brazil}$ usd bil	TR Chg. %
Base	140	224	26.1	5.846	–
India total	139	233	26.9	6.262	7.11
US total	139	235	27.1	6.368	8.92
US partial	142	228	26.5	6.042	3.35
	Including US HFCS Residual Demand				
US total	139	236	27.2	6.421	9.84
US partial	142	230	26.6	6.132	4.89

4.1. India—Total Liberalization. The Indian government removes the 60 percent *ad valorem* tariff and USD19.50/mt duty.⁷ Indian liberalization leads to an USD8/mt increase in world price, 1 mmt fall in world consumption, and 0.8 mmt increase in Brazilian production.

4.2. US—Total Liberalization. The US government removes the TRQ and OAQ and joins the world market as supplier and demander. Relative to the base scenario, US total liberalization leads to an

⁷We leave intact the levy program, which requires that ten percent of all sugar be sold below market price. We took 95% of the market price as the “effective price” for market participants.

USD11/mt increase in world price, 1.42 mmt fall in world consumption, and 1 mmt increase in Brazilian production.

4.3. US—Partial Liberalization. The US government removes the TRQ but retains the OAQ—encouraging US farmers to maintain current sugar production at a cost of USD1.9 billion.⁸ Without this program, US farmers produce about 2.2 mmt. Partial liberalization increases US consumption from 9.172 mmt to 11.97 mmt, and world price rises by USD4/mt.

4.4. US—Sweetener. The stylized residual demand from HFCS customers is only present when sugar prices are below USD250/mt. When we add it to US demand, we increase the effects of US liberalization and thus benefits to Brazil. With US total sweetener, Brazilian production rises 1.1 mmt and world prices rise by USD12/mt.

5. CONCLUSION

Although the gains from liberalization are largest with US total sweetener, Brazil's gain from Indian trade liberalization is in the middle of the range of gains from US trade liberalization.

EU and US opposition to agricultural free trade has stalled the Doha round of WTO negotiations (Economist, 2006a). US sugar producers are prime beneficiaries—Tokarick (2003, Table 12) calculates that price support alone is worth about USD1.3 billion to US farmers. A Wall Street Journal Editorial (2005) opines that trade liberalization may be difficult when Americans have “a U.S. sugar program that, pound for

⁸7.348 mmt*(USD487-228). US farmers produce 7.348 mmt. USD487/mt is the cost of the last unit US farmers produce in the base scenario while USD228 is the market clearing price.

pound, may be the most destructive policy in Washington. [...] one key to their success is their ability to dole out campaign contributions.”

Indian producer interests may not be as strong, and—for reasons we mention in Section 1 on page 2—it seems there is more space for agreement on trade liberalization.⁹ Until worldwide free trade arrives, it pays to maximize benefits at minimal cost. Our results suggest a closer examination of South-South trade liberalization.

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⁹Although Economist (2006b) notes that India’s WTO negotiation position is that developing countries need not liberalize until after developed countries do, this position does not rule out South-South liberalization as part of a WTO deal.

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APPENDIX A. THE WORLD OF SUGAR

Both beet and cane sugar are homogenous once they are processed into refined sugar. The US produces beet and cane sugar; India and Brazil produce cane sugar only. Cane is processed into raw then refined sugar, but beet is processed directly into refined sugar.

Between 1990 and 2002, Brazilian production grew by an annual average of 1.7 percent in the Northeast and 4.8 percent in the Center-South, or four percent nationally (Schmitz et al., 2002). Brazil is the largest sugar producer and exporter in the world—as well as being a major consumer. See Figures 4 to 5 on the next page.

A.1. Sugar in India and the United States. Despite the size of Indian and US domestic markets for sugar, their trade barriers limit Brazil's presence.¹⁰ See Table 3 on page 14 for 2003 imports by these

¹⁰In this section, US data are from USDA Economic Research Service (2004, 23c and 24). India data are from USDA Foreign Agricultural Service (2004a, Tables 1 and 8).

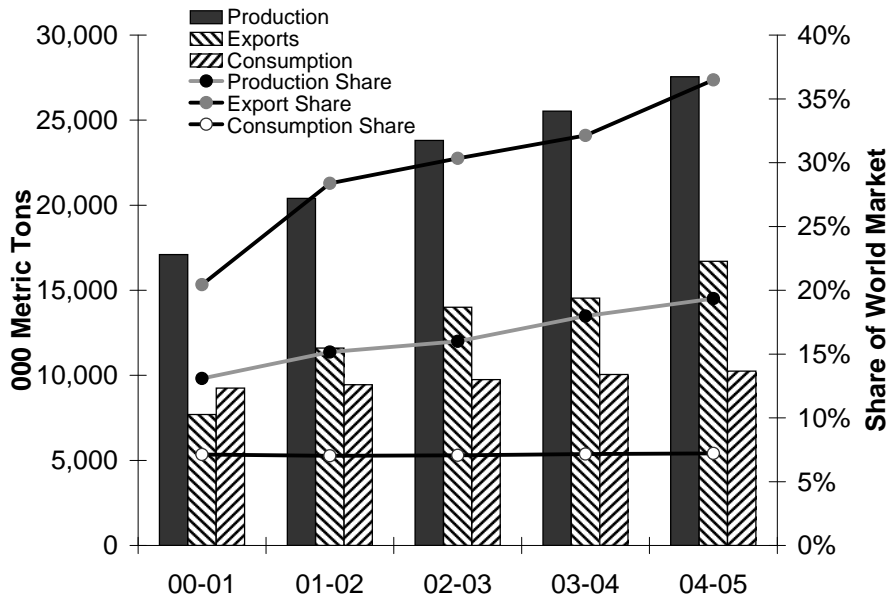


FIGURE 4. Brazilian production and exports have grown absolutely and as a share of world total. Domestic consumption is stable (USDA Foreign Agricultural Service, 2004b).

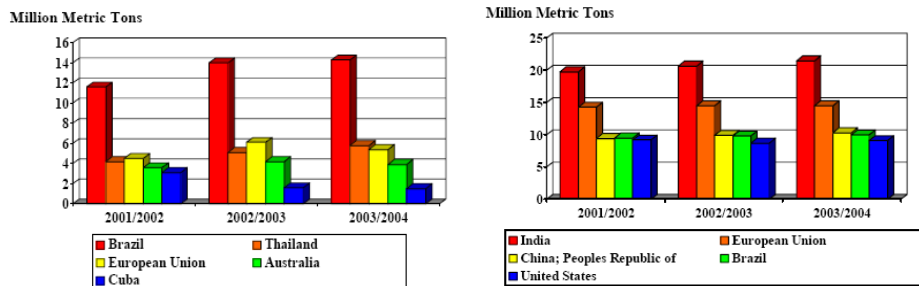


FIGURE 5. Brazil is a dominant sugar producer (left) and consumer (right) among countries in the world (USDA Foreign Agricultural Service, 2003, pp. 3–4).

countries. In 2004, Brazil exported far more sugar to India, with a 96.5% share of total imports that met 8% of Indian demand. After the Dominican Republic, Brazil is the second-largest exporter of Tariff Rate Quota (TRQ) sugar to the US. Brazil has a 15 percent share of imports to the US, but imports comprise less than 20 percent of US supply. US imports have not increased recently.

TABLE 3. India and the US imported little sugar in 2003.

	India	%	US	%
Beginning stocks	12,430	44	1,670	14
Domestic Production	15,180	54	8,649	72
Brazil	293	1	144	1
Other	257	1	1,606	13
Total Supply (mt)	28,160		12,070	

APPENDIX B. HIGH FRUCTOSE CORN SYRUP

The US market for High-Fructose Corn Syrup (HFCS), a close substitute for sugar, arose when trade barriers increased US sugar prices. HFCS is now cheaper than US sugar but more expensive than world sugar. (Figure 6 clearly shows this arbitrage opportunity. Source: http://www.sugaralliance.org/library/2004/27-ref_sug_hfcs_prices.pdf) Annual sugar and HFCS consumption are both about 19.7 kg/capita. 75 percent of HFCS goes into soft drinks.

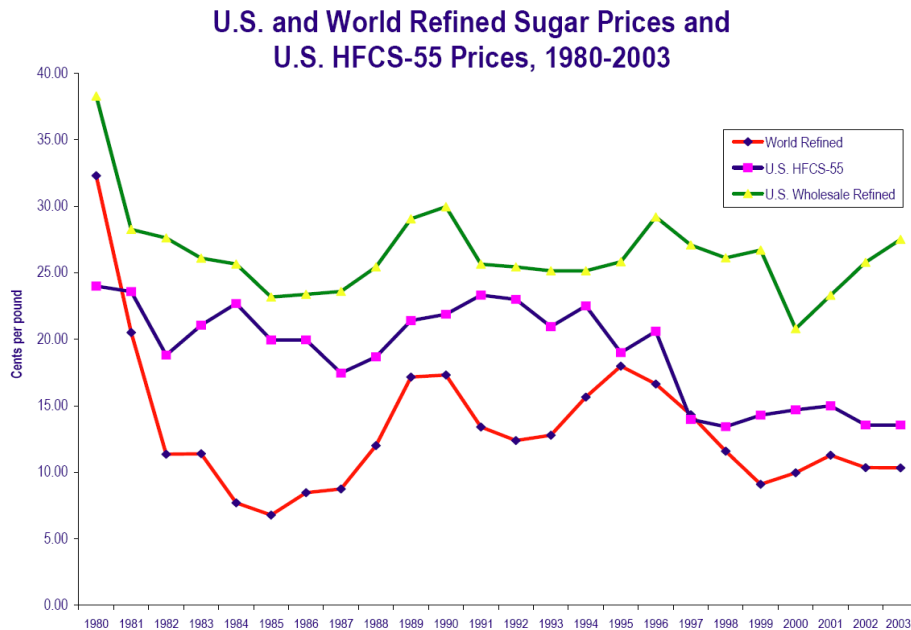


FIGURE 6. US barriers to sugar imports raise refined sugar prices to levels that make HFCS a viable substitute for sugar. HFCS is not competitive at world prices.

APPENDIX C. MODELS OF LIBERALIZATION

Each model begins with a status quo, aggregate supply function in equilibrium with the static, domestic demand function. The supply function is then redrawn to reflect RoW suppliers' improved access to the domestic market. New equilibria are always at a lower price and higher quantity. We begin with India in Figure 7.

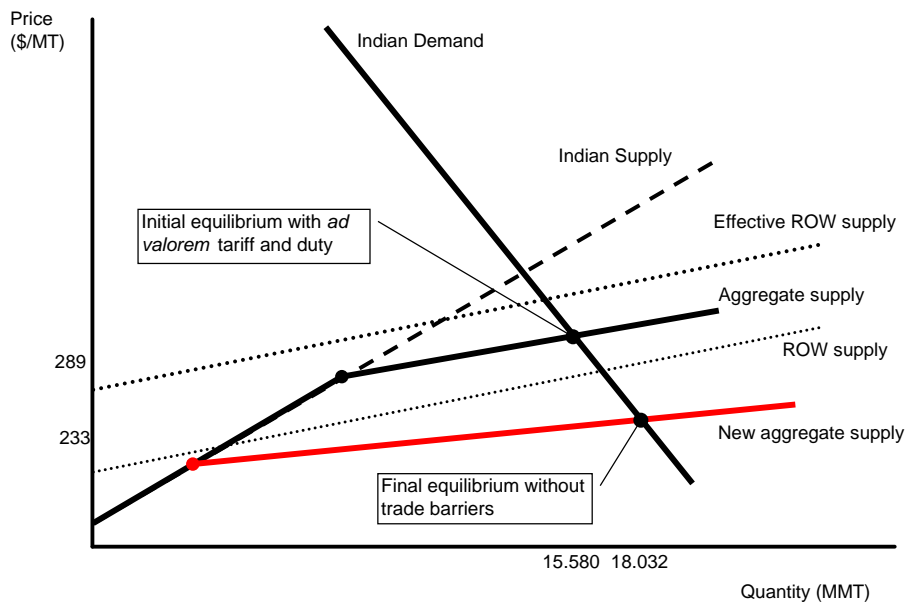


FIGURE 7. India's current trade policies shift RoW supply (small dotted line) upward to the effective supply function (larger dotted line). Indian consumers therefore face the solid supply function that combines dashed Indian supply with the effective RoW supply. Post-liberalization, the supply function kinks earlier, since the ad valorem tariff or tax does not distort RoW supply, so that the new equilibrium is at a lower price and higher quantity.

US liberalization takes place in four scenarios. The first two involve complete liberalization, with and without HFCS demand. See Figure 8 on the following page.

The next two, partial liberalizations, remove the TRQ but maintain the OAQ. See Figure 9 on page 17.

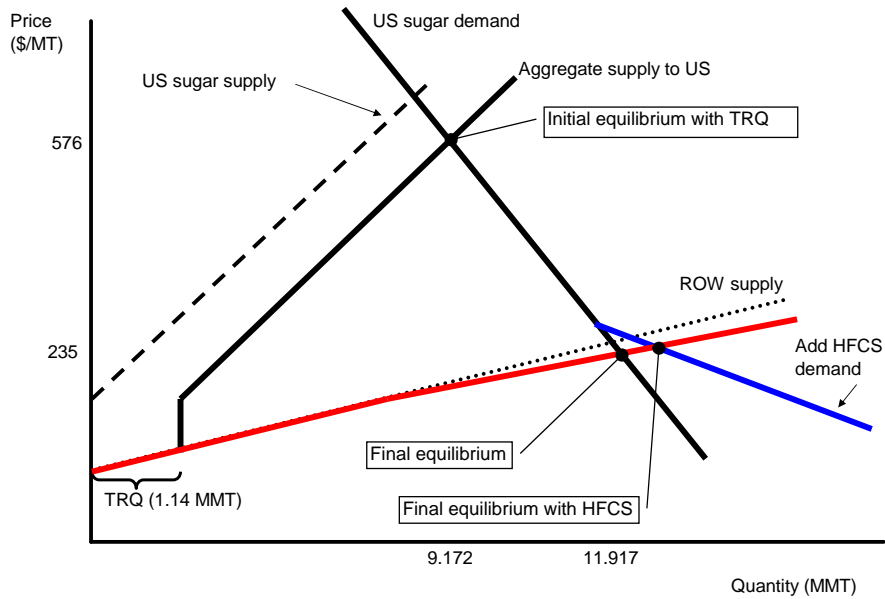


FIGURE 8. Pre-liberalization aggregate supply in the US begins with cheap, RoW supply until the TRQ limit, after which point it jumps up to equal the dashed US supply function. Post-liberation, the aggregate supply function kinks farther along RoW supply and has a more gradual slope, as US and RoW supplies mix together. If HFCS demand is included, the new price is slightly higher and quantity is larger.

APPENDIX D. SENSITIVITY ANALYSIS

Our initial supply elasticities of 0.8 for Brazil and 1.5 for US and Indian farmers gave a world supply elasticity of 0.66. With demand elasticities of -0.5 in the US, -0.6 in Brazil, and -0.8 in India, world demand elasticity was -0.63.

To check for robustness, we vary these supply elasticities. The results, in Table 4 on page 18, change our finding *only* in the case of a high Indian supply elasticity ($\varepsilon = 2.5$), when Indian suppliers cede an even greater market share to Brazil. The robust ranking results from US sugar producers being fairly uncompetitive.

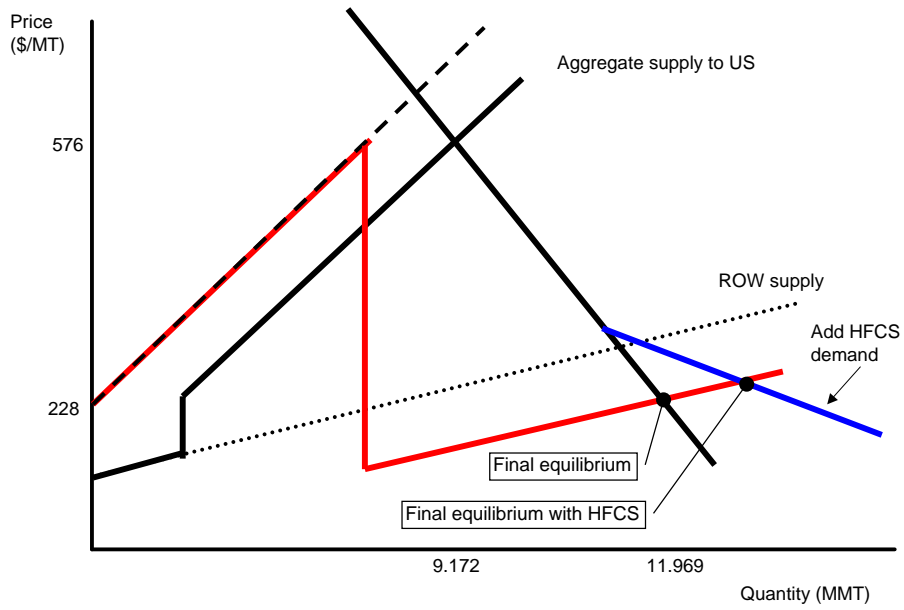


FIGURE 9. The partial-liberalization case is almost identical to the total liberalization case in final price and quantity. The difference is that US farmers, paid OAQ subsidies, supply far more quantity to market in the inframarginal portion of the aggregate supply function—reducing sales of RoW suppliers such as Brazil.

TABLE 4. Supply Elasticity Sensitivity Analysis (Base: $\varepsilon_{US} = 1.5$, $\varepsilon_{India} = 1.5$, $\varepsilon_{Brazil} = 0.8$). US Total Sweetener is robust at first; India is 3rd for 4 of 5 scenarios.

Scenario	Base	$\varepsilon_{US} = 2.0$	$\varepsilon_{India} = 2.5$	$\varepsilon_{India} = 1.0$	$\varepsilon_{Brazil} = 1.5$	$\varepsilon_{Brazil} = 2.5$
P_{world}	224	224	224	224	224	224
Q_{Brazil}	26.1	26.1	26.1	26.1	25.8	26.1
TR_{Brazil}	5846	5850	5846	5846	5782	5691
India Total Liberalization						
P_{world}	233	233	236	231	233	233
% Change	4	4	5	3	4	4
Q_{Brazil}	26.9	26.9	27.2	26.9	27.3	27.9
% Change	3	3	4	3	6	7
TR_{Brazil}	6262	6257	6412	6181	6360	6501
% Change	7	7	10	6	10	14
Sugar only—US Total Liberalization						
P_{world}	235	238	235	235	235	235
% Change	5	6	5	5	5	5
Q_{Brazil}	27.1	27.3	27.1	27.1	27.7	28.5
% Change	4	5	4	4	7	9
TR_{Brazil}	6362	6491	6362	6362	6500	6699
% Change	9	11	9	9	12	18
Sugar only—US Partial Liberalization						
P_{world}	228	228	228	228	228	228
% Change	2	2	2	2	2	2
Q_{Brazil}	26.5	26.5	26.5	26.5	26.5	26.6
% Change	2	2	2	2	3	2
TR_{Brazil}	6046	6045	6046	6046	6059	6078
% Change	3	3	3	3	5	7
Sweetener—US Total Liberalization						
P_{world}	236	239	236	236	236	236
% Change	5	7	5	5	5	5
Q_{Brazil}	27.2	27.4	27.2	27.2	27.9	28.9
% Change	4	5	4	4	8	11
TR_{Brazil}	6422	6540	6422	6422	6584	6817
% Change	10	12	10	10	14	20
Sweetener—US Partial Liberalization						
P_{world}	230	230	230	230	230	230
% Change	3	3	3	3	3	3
Q_{Brazil}	26.6	26.6	26.6	26.6	26.8	27.1
% Change	2	2	2	2	4	4
TR_{Brazil}	6132	6129	6132	6132	6179	6246
% Change	5	5	5	5	7	10
Change Ordering?	No	India: 3 → 2	No	No	No	No