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ABSTRACT

A side agreement to the North American Free Trade Agreement (NAFTA) enables Mexico to ship more duty-free sugar to the United States than under the pre-1994 restrictive country-specific, tariff-rate quota (TRQ) policy. However, U.S. and Mexican negotiators disagree over the issue of exactly how much sugar Mexico can actually export to the U.S. under the NAFTA side agreement. Their disagreement focuses on which version of the NAFTA side agreement governs this issue. The U.S. argues that a 1993 side letter limits Mexican sugar exports to the U.S. to 250,000 MT of Mexico's net surplus production. In contrast, Mexico insists that its version of the side letter does not take into account the consumption of HFCS as part of the net surplus formula, and does not limit exports to 250,000 MT. This study focuses on the U.S. interpretation of side letter.

A multi-region, open economy Global Trade Analysis Project (GTAP) model was used to simulate impacts of increased Mexican sugar exports to the U.S. Results indicate that as a result of U.S. sugar TRQ liberalization under NAFTA, U.S. producers will lose; processors and consumers will gain due to lower sugar prices. In the Mexican side, sugar producers/exporters will capitalize on higher U.S. sugar prices, while local consumers are likely to lose, due to slightly higher prices and reduced domestic supply. U.S. producer surplus decreased by \$7.5million, U.S. consumers gained \$8.5 million in surplus, while U.S. government will have to spend \$29.2 million to support domestic producers authorized in sugar program.

KEY WORDS: Sugar, U.S. – Mexico Trade, Tariff-rate Quotas, GTAP.

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U.S. Sugar Policies

No nation was ever ruined by trade.
Benjamin Franklin

Governments of sugar producing countries often interfere in their sweetener sector to protect their domestic producers and processors from volatile world sugar prices. Supply swings can impact producer prices, and consumer welfare. Historically, the United States has never been able to satisfy domestic demand, and thus it continues to be a net sugar importer even though the U.S. offers price protection to its producers. Starting in the 1930s, the United States has supported its sugar producers by insulating the domestic sugar market from world market forces of supply and demand.

The Sugar Acts of 1934, 1937, and 1948 required the U.S. Department of Agriculture (USDA), based on production forecasts, to allocate sugar quotas among U.S. growers and foreign countries, make authorized payments to producers when needed as a motivation to limit production, and to impose excise taxes on refined and processed sugar in the U.S. These policies were in force until 1974, when the U.S. offered relatively free trade to foreign sugar producers for a few years. Congress reintroduced mandatory price supports in 1977 and 1978, discretionary support in 1979, and included mandatory price support programs for domestic sugar in the Agricultural and Food Act of 1981 and the Food Security Act of 1985. Subsequently, the 1990 farm program, the 1993 Budget Reconciliation Act and the 1996 Farm Bill extended sugar program authority through FY2003 crop year (Jurenas, 2000).

The current sugar program, authorized through FY2003 by the Omnibus Farm Act (P. L. 104-127), better known as the Federal Agriculture Improvement and Reform Act of 1996 (FAIR Act of 1996), is designed to protect domestic sugarcane, sugar beet growers, and processors. The USDA accomplishes this by providing loans at minimum price levels to sugar

processors and by restricting sugar imports. The FY2001 loan rates are set at 18 cents/lb. for raw cane sugar, and 22.9 cents/lb. for refined beet sugar (Jurenas, 2000, p.4). The current sugar policy makes sure that the foreign sugar enters into the U.S. only to balance domestic demand, and results in a market price above the support level, which allows processors to pay off their support loans (Jurenas, 2000).

Mexican Sugar

Under the terms of the NAFTA agreement, beginning October 1, 2000, Mexico received the right to ship up to 250,000 metric tons of its *net production surplus* sugar each year to the United States. Previous Mexican sugar quotas were much lower at 25,000 metric tons per year (Haley, 2000). The amount of Mexican exports depends on the efficiency of Mexican sugar mills. The previous Mexican government, led by the long-ruling Institutional Revolutionary Party (PRI), used public funds to subsidize the country's inefficient cane growers and refiners, thus turning the sugar industry into a rural vote-buying mechanism (Fritsch, 2000). The government dictated the price that the mills must pay for sugar cane and other inputs while keeping refined sugar price low for consumers. In the late 1980s, when the PRI began free market-oriented reforms, the government lost most of its control over businesses, but they were able to retain control of prices in the sugar industry and prevent extensive tinkering with the PRI's politically sensitive social compacts. At the same time, U.S. exports of High Fructose Corn Syrup (HFCS) under NAFTA replaced sugar in the Mexican soft drink manufacturing industry, thus increasing Mexico's *sugar surplus* (Fritsch, 2000).

A side agreement to NAFTA enables Mexico to ship much more duty-free sugar to the United States than under the pre-1994 tariff-rate quota (TRQ) policy. But U.S. and Mexican negotiators disagree over the issue of exactly how much sugar Mexico can actually

export to U.S. under the NAFTA side agreement. Disagreement focuses on which version of the NAFTA side agreement governs the issue. The U.S. argues that a 1993 side letter limits Mexican sugar exports to 250,000 MT each year through 2008. In contrast, Mexico insists it is entitled to ship all of its net surplus sugar, currently 600,000 MT, to the United States. Consequently, Mexico has asked for a dispute-settlement panel to resolve the question under NAFTA (Jurenas, 2000).

Objectives

The objectives of this study are: (1) to analyze how the wider market access for Mexican sugar under the NAFTA side agreement impacts U.S. producer and consumer welfare, and (2) to discuss the political economy of wider access of Mexican sugar to the U.S. market. A TRQ liberalization scenario will be analyzed, depending upon the policy framework for handling the excess amount of sugar in the U.S. market. Particularly, the study will analyze the estimated welfare impact of additional Mexican sugar on the U.S. market, particularly changes in consumer and producer surpluses. In addition the U.S. government cost to store the excess sugar in order to support sugar prices under current sugar program will be discussed.

Political Economy of Sugar Policies

In recent years, economists have explained the origination of trade policies, in general and for protectionism in particular, in terms of the welfare interests of those who benefit from protection and those who lose. These models claim that legislators are restrained from yielding to demands for protection only by the opposing political demands of those who stand to lose the protection. The lawmakers act as intermediaries between those who seek protectionism

and the anti-protectionism interests of consumer advocates. The small but very strong groups of producers, who stand to gain a great deal from protection, have a strong incentive to lobby the government in order to adopt appropriate protectionism legislation. On the other hand, the consumers, who will most likely lose from protectionism policies, are not likely to organize effective resistance against protectionist legislation. For example, in the United States, the sugar policy increases individual expenditures by only a few dollars per person per year, while the sugar quota generates more than \$600 million for a few thousand sugar producers in the United States (Salvatore, 1993, p. 325).

The U.S. sugar program is one of the classical case studies for analyzing the political economy of agricultural policy making. Starting in 1789, the government of the United States intervened in the sugar industry by setting foreign and domestic quotas for imports and production, thus determining domestic sugar prices. As a result of U.S. intervention policies, sugar prices in the United States were historically higher than in the rest of the world. Starting in the late 1980s, U.S. sugar policies faced several challenges. The most significant impact was the development and adoption of sugar substitutes, such as high fructose corn syrup, which forced the U.S. government to adopt more restrictive import policies, reducing the import quotas by about 41% during the 1986-1987 period (Lopez, 1989).

The current U.S. tariff rate quotas (TRQ) originated in 1982 under the Presidential Proclamation No. 4941 of May 5, 1982. The new, country-by-country sugar quotas replaced the previous absolute quota system. Under the new regulations, the U. S. Trade Representatives Office (USTR) has the responsibility of making all sugar trade announcements and determinations concerning quota allocations to individual countries. Under the same Proclamation, the Secretary of Agriculture determines sugar quota periods and global quota amounts (Suarez, 1997).

Starting October 1, 1990, the United States replaced the old absolute quota system with a TRQ system. The new system established a limited amount of imports allowed to enter the United States under a low (first tier) tariff; any imports beyond that level are assessed a high (second tier) tariff, which is practically a prohibitive rate. The country allocation system remained the same. The U.S. uses the country-by-country allocation system for raw sugar cane imports only. Since FY1996 a new globalized, first come, first serve, system decreased the country-by-country allocations for the refined sugar TRQ. The specialty sugar TRQs were also globalized instead of establishing specific quotas for 23 countries. Beginning FY1998, under the terms of NAFTA, Canada and Mexico received individual allocations of refined sugar TRQs (Suarez, 1997).

Each year the U.S. Trade Representatives Office announces country-by-country TRQ allocations for raw cane sugar, refined sugar, and sugar containing products. The TRQ for raw cane sugar for Fiscal Year (FY) 2001 is 1,117,195 metric tons raw value. The minimum TRQ levels under the GATT Uruguay Round are allocated to forty countries. The list of countries and respective allocations are reported in the Table 1. The United States uses historical trade volumes to make yearly allocations.

Under NAFTA, a TRQ for 10,300 metric tons raw value is allocated to Canada, 2,954 metric tons raw value is allocated to Mexico. Under the NAFTA side agreement, USTR allocated an additional quantity of 105,788 metric tons raw value to Mexico. The remaining 38,000 metric tons raw value of refined sugar and 17,656 metric tons raw value reserved for specialty sugars will be allocated on a first-come, first-serve basis. A tariff-rate quota quantity of sugar containing products of 59,250 metric tons is allocated to Canada under the U.S.-Canadian free trade agreement. The remaining TRQ is available for other countries (Daly et al., 2000).

Table 1. U.S. Sugar Tariff Rate Quota, 2000/01 Allocations, Metric Tons Raw Value

Country	Quota Allocation
Raw Cane Sugar	
Argentina	45,283
Australia	87,408
Barbados	7,372
Belize	11,584
Bolivia	8,425
Brazil	152,700
Colombia	25,274
Congo	7,258
Cote d'Ivoire	7,258
Costa Rica	15,797
Dominican Republic	185,346
Ecuador	11,584
El Salvador	7,381
Fiji	9,478
Gabon	27,258
Guatemala	50,549
Guyana	12,637
Haiti	7,258
Honduras	10,531
India	8,425
Jamaica	11,584
Madagascar	7,258
Malawi	10,531
Mauritius	12,637
Mexico ^{1/}	7,258
Mozambique	13,690
Nicaragua	22,115
Panama	30,540
Papua New Guinea	7,258
Paraguay	7,258
Peru	43,177
Philippines	142,169
South Africa	24,221
Saint Kitts & Nevis	7,258
Swaziland	16,850
Taiwan	12,637
Thailand	14,743
Trinidad & Tobago	7,372
Uruguay	7,258
Zimbabwe	12,637
Subtotal Raw cane sugar ^{2/}	1,117,195
Refined Sugars	
Mexico (NAFTA)	105,788
Mexico (Sept. 1997 - 2001 allocation)	2,954
Canada (1997 - 2001)	10,300
Specialty sugar ^{3/}	17,656
Other refined sugars ^{3/}	7,090
Subtotal refined sugars	143,788
Grand Total	1,260,983

^{1/} Mexico's NAFTA allocation may be shipped either raw or refined, ^{2/} TRQ total may not add due to rounding, ^{3/} are on first-come-first-serve basis.

Source: Economic Research Service, USDA, SSS-231.

The FAIR Act of 1996 left the Harmonized Tariff Schedule (HTS) of the United States unaffected as amended by the Presidential Proclamation to implement the GATT Uruguay Round Agreement on Agriculture. The HTS gave the Secretary of Agriculture an authorization to limit the quantity of sugar imported at the lower of two alternative duty rates. The sugar TRQ system is very critical in setting the import levels, thus restricting the supply of sugar in the U.S. market and thereby supporting the U.S. sugar price (Lord, 1995).

NAFTA Provisions For Sugar Trade

The original NAFTA provisions for sugar were heavily opposed by the U.S. sugar industry. The reason for this opposition was the fact that increased exports of HFCS to Mexico would substitute for Mexican sugar, thus creating a huge amount of sugar surplus in Mexico to be exported to U.S. under NAFTA. In order to pass the Agreement in the U.S. Congress, U.S. and Mexican governments developed a side-letter to the original NAFTA agreement changing the original NAFTA provisions for U.S.-Mexico bilateral sugar trade. Since then, there has been a major trade dispute between U.S. and Mexico on the content and validity of the side-letter agreement.

The original provisions of NAFTA agreement limited Mexican sugar exports for the 15-year (1994-2009) NAFTA transition period to no more than Mexico's projected *net production surplus*, but not less than 7,258 MTRV of duty free sugar. For the first six years, duty free access was limited to 25,000 MTRV. In year seven, Mexico would receive the right to ship as much as 150,000 MTRV, and each subsequent year Mexico's duty-free access would increase by 10 percent. If Mexico achieved net production surplus status for two consecutive years, it could exceed the maximum amount.

The introduction of a side-letter changed the major provisions of the NAFTA agreement. In the revised agreement, the *net surplus* was calculated by taking into account both sugar and HFCS on the consumption side, which lowers the actual *net surplus* amount. In addition, the side-letter specified the annual maximum amount of exports to 250,000 MTRV for 2001-07 periods. This put an upper cap on Mexican unlimited duty-free access to U.S. market in case Mexico achieves *net producer surplus* status for two consecutive years. Currently, the Mexican government argues that its version of the side-agreement does not count HFCS consumption in the formula and does not limit exports to 250,000 MTRV during 2001-07 periods.

Under the NAFTA agreement, during the 15-year transition period, Mexico is subject to a high-tier tariff rate (low-tier tariff rate equals to zero). But this tariff rate will be gradually decreased during the 15-year transition period, reaching zero in year 2008. After this point, Mexico will be allowed to export unlimited amounts of sugar duty free to the U.S. The U.S. high-tier tariff scheme for raw cane and refined sugar is reported in Table 2 (Haley 1999).

Introduction to GTAP and GEMPACK

The Uruguay Round Agreement on Agriculture (URAA) introduced tariff rate quotas (TRQ) as a preferred new policy mechanism, ensuring both protections for domestic producers and market access for imports. TRQs convert operating non-tariff barriers such as restrictive quotas into tariffs. Tariff rate quotas have become the most commonly used mechanism to control the trade of agricultural commodities. A large number of TRQs are country specific and, most of the time includes politically sensitive commodities such as sugar.

TRQ administration is very important in agricultural trade and market access negotiations. In the current tendency towards globalization and market integration, the need

Table 2. U.S. High-Tier Tariffs for Sugar Imports from ROW and Mexico

	High-tier tariff (cents per pound)			
	Rest of World (ROW)		Mexico	
	Raw cane sugar	Refined sugar	Raw cane sugar	Refined sugar
Base	18.08	19.08	16.00	16.95
1995	17.62	18.60	15.20	16.11
1996	17.17	18.12	14.80	15.69
1997	16.72	17.65	14.40	15.26
1998	16.27	17.17	14.00	14.84
1999	15.82	16.69	13.60	14.42
2000	15.36	16.21	12.09	12.81
2001	15.36	16.21	10.58	11.21
2002	15.36	16.21	9.07	9.61
2003	15.36	16.21	7.56	8.01
2004	15.36	16.21	6.04	6.41
2005	15.36	16.21	4.53	4.81
2006	15.36	16.21	3.02	3.20
2007	15.36	16.21	1.51	1.60
2008	15.36	16.21	0.00	0.00

Source: Haley 1999.

for quantitative analysis of policy issues on a global basis becomes critical. After the GATT Uruguay Round, the interest in estimating the impact of the Agreement and related bilateral and multilateral policies on individual countries or regions, international trade, and world welfare increased.

The Global Trade Analysis Project (GTAP) was founded in 1992 at Purdue University. The aim of the project is to decrease the cost and efforts of quantitative analysis in international economic issues in an economy-wide framework. GTAP is a fully documented, publicly available standard modeling framework.

The GTAP database covers almost all major regions and commodities in the world trade. The database contains bilateral trade, transportation, and protection data characterizing economic linkages among regions, together with individual country input-output databases that account for inter-sectoral linkages within each region. The GTAP database is subject to annual upgrades to ensure consistency and provide current information (Hertel 1998).

The authors of GTAP model developed a standard modeling framework to operate the large database with more efficiency. The standard GTAP model is a multi-region, computable general equilibrium (CGE) model, with perfect competition and constant returns to scale. Bilateral trade is handled via the Armington assumption. The Armington approach to modeling import demand was proposed by Paul Armington in 1969. The approach assumes that imported intermediates are separate from domestic intermediate inputs, i.e. firms determine the optimal mix of imported and domestic goods based on the information available on imports in the form of source and price. Although the Armington approach has often been criticized, it is common in trade modeling because it accommodates cross hauling of similar goods and tracking bilateral trade flows (Hertel 1998, p. 41). The theory of GTAP

multi-region, applied general equilibrium model is fully and detailed discussed by Hertel (1998).

The GTAP model is implemented using Release 6.0 of GEMPACK software. GEMPACK is a suite of general-purpose economic modeling software. It is designed primarily for general and partial equilibrium models. It is used by over 300 organizations in more than 50 countries. The main characteristic of the software is that it provides a powerful tool in solving large systems of non-linear equations. Upon specification of the model equations using algebra-like notations, modelers are free from computing details of the solution process.

GEMPACK is established at the Center of Policy Studies (CoPS) at Monash University, Australia. GEMPACK is well documented. Details and extensive documentation is possible to find at the GEMPACK website (www.monash.edu.au/policy/gempack.htm). More extensive and detailed explanations of GTAP and GEMPACK can be found in the GTAP manual (Hertel 1998) and Technical Paper No. 18 by Elbehri and Pearson (2000).

U.S. Sugar Policy Liberalization Towards Mexico Under Terms of the NAFTA

The analysis in this research is based on a previous study conducted by Elbehri and Pearson (2000). They have developed a TRQ model within a general equilibrium multi-regional context. Their model allows for bilateral tariff rate quotas and can handle binding prices and quantity constraints as well as quota rent reallocations. Also it provides a comprehensive tool for analyzing interactions with other aspects of multilateral and bilateral trade agreements. Their model is completely documented in Technical Paper No. 18, which serves as a reference for this research. With the technical paper, the authors provided a ZIP

format file containing a package of software and files for carrying out TRQ applications with GTAP.

To meet the objectives of this research, this study differs from the one conducted by Elbehri and Pearson in the following areas: different sets of commodities and country aggregations are used, different closure specifications are used, different shock levels based on the NAFTA provisions are utilized, and several modifications in input files for consistency are implemented.

Data

The study uses the Version 4 GTAP database for the analysis. The database contains detailed bilateral trade, transportation and protection data characterizing economic linkages among regions, linked together with individual country input-output databases, which account for inter-sectoral linkages among 50 sectors within each of 45 regions. All monetary values of the data are in \$US millions and the base year for Version 4 is 1995.

The source of GTAP trade data is the United Nations (UN) D-series trade statistics. Statistical database is registered and maintained by UN statistical Office under the name COMTRADE, which stands for COMmodity TRADE. This database is one of the most complete and comprehensive databases in existence in terms of commodity and country coverage. The Economic Research Service of USDA assisted in filling the missing data and estimates in the COMTRADE database. A detailed overview of GTAP database and data sources is found in GTAP manual (Hertel 1998).

The policy analysis starts with the aggregation of the standard GTAP database. The aggregation is done in two directions – commodity and country aggregation. The TRQ applications in the thesis are based on a 4-commodity, 6-region aggregation of version 4 of the

GTAP data. The commodity side of the aggregation involves four commodity groups: sugar, other agriculture, manufacturing, and services. Regional aggregation has six regions: U.S., EU, Asia, Latin America (excluding Mexico), Mexico, and Rest of World. The commodities and countries in the aggregated groups are listed in Table 3.

This analysis uses files and software programs supplied with Technical Paper No. 18. Standard GTAP data files are replaced by those created using GTAPAgg software. Extra data files required in addition to standard GTAP data files for TRQ applications are modified manually.

Policy Application: U.S. Sugar Policy Liberalization under NAFTA

The analysis simulates the U.S. view of scheduled changes in U.S. TRQ provisions for Mexican sugar imports for the 2000/01 marketing year. Under the U.S. interpretation of NAFTA provisions and a side letter on sugar, changes in TRQ rules for Mexican sugar imports for 2000/01 are as follows:

1. The Mexican sugar TRQ is increased from 25,000 MT to the lower of a) Mexico's *net production surplus* or b) 250,000 MT.
2. The over quota tariff rate for Mexican sugar is decreased from 16.11 cents per pound to 11.21 cents per pound.

USDA calculated that Mexico's *net production surplus* for 2000/01 was 105,788 MT and set Mexico's TRQ at that level for 2000/01 (USDA, SSS-231, p. 62). Mexico disputes both the formula used to calculate net surplus production and the 250,000 MT TRQ limit claimed by the U.S. and argues that they should be permitted to export 600,000 MT of sugar into the U.S. market in 2000/01.

Table 3. Regional and Commodity Aggregation

Regional Aggregation	Commodity Aggregation
1. United States (USA)	1. Sugar (Sugar) Sugar cane; sugar beet
2. European Union (E_U)	Sugar
3. Asia (ASI)	2. Other primary production (Athag) Paddy rice; Wheat;
4. Latin America (LAM) All of Latin America except Mexico	Cereal grains nec; Vegetables, fruits, nuts; Oils seeds; plant-based fibers; Crops nec; raw milk; forestry;
5. Mexico (MEX)	Cattle, sheep and goats, horses; Coal; gas; Oil; Minerals nec;
6. Rest of World (ROW)	Dairy products; Food products nec; Beverages and tobacco products; Animal products; Wool, silk-worm cocoons; Fishing; Bovine cattle, sheep and goat, horse meat products; Meat products nec; Vegetable oils and fats; Processed rice;
	3. Shoe polish and other manufact (Mnfc) Textiles; Wearing apparel; leather products; Wood products; paper products; Petroleum, coal products; Chemical, rubber, plastic products; Mineral products; Metals nec; Metal products; Motor vehicles and parts; Transport equipment nec; Electronic equipment; Machinery and equipment nec; Manufactures;
	4. Services and activities NES (Svces) Electricity; Gas manufacture, distribution; water; Construction; Trade, transport; Financial, business, recreational services; Public admin and defense, education, health; Dwellings

Initial Simulations

Before beginning the actual TRQ policy simulation, a production/output increase for Mexico is simulated to normalize the base data up to the 2000 level. This was accomplished by imposing a 32% shock on Mexican sugar output p_qo("sugar", "MEX").

The standard GTAP assumes that all the rent accrues to the importing region. The U.S. gives the sugar exporters the right to control exports by allocating the quotas to the governments of individual countries (Skully 1998, p. 17). Because the government of exporting country has the right to allocate the export licenses among its producers and exporters, it receives all the rents associated with the quota allocation. This is the reason that in this research all of the quota rent is allocated to the exporting regions. Before proceeding to the TRQ liberalization application, the quota rent from the U.S. sugar TRQ was reallocated from the U.S. to the exporting countries. Updated logical GTAPDATA, TRQDATA, and QRSHAREX data files were used as a starting point for TRQ policy liberalization application.

TRQ Policy Liberalization Application in GTAP

This scenario assumes an increase in the Mexican TRQ from 25,000 MT to 105,788 MT and a decrease in the high-tier tariff rate from 16.11 cents per pound to 11.21 cents per pound. This scenario was simulated using the standard closure specifications. Shocks in the amount of 323% for the U.S./Mexican sugar import quota increase and 30.42% for over-quota tariff cut for Mexican sugar exports were simulated.

As a result of simulation, Mexican sugar exports to the U.S. increased by the full 323% allowed. Considering the change and the fact that Mexico exports cane sugar, increased exports in dollar terms are \$32 million $([105,788 \text{ MT} - 25,000 \text{ MT}] * 2204 * 0.18)$. This was according to our expectations, since Mexican producers would prefer to export their sugar to a higher priced market. Because Mexico ships more sugar to the U.S. market, its exports to

other regions decline. Due to the increased exports at preferential prices, sugar prices in Mexico increased by 0.59%. Because the excess sugar was allowed directly into the market, U.S. sugar prices fell by 0.20%. In response to lower priced imports, U.S. sugar producers cut production by 0.62%. Applying the GTAP percentage change of U.S. sugar price and production to the U.S. production data obtained from Economic Research Service (ERS) (USDA, SSS-231, p. 54) and the weighted average sugar price (\$0.206/lb.) calculated using cane and beet support loan rates of \$0.18/lb. and \$0.229/lb., respectively, 0.62% change in U.S. sugar production accounts for 50,852 MT or \$23.2 million decrease in total U.S. sugar production. The 323% increase in U.S. sugar imports from Mexico may seem a large number, but compared to the total U.S. production of 7,775,480 MT in 2000/01 (USDA, SSS-231, p. 54), 0.62% decline in production due to the Mexican imports appear reasonable. Encouraged by preferential access to U.S. market, Mexican producers increase sugar output by 3.45% compared to the base simulation. It appears that sugar imports displace U.S. production in this scenario.

Due to the absence of low-tier tariffs on Mexican sugar export to the U.S., and the fact that Mexican exports are not over-quota, there is no tariff revenue for the U.S. collected on Mexican sugar imports. Increased TRQ for Mexican exports decreased Mexican sugar quota rents by \$7.69 million. This is explained by decrease in second-tier tariff rate. As a result of policy, the net social welfare effect shows a net gain for U.S. of \$31.37 million. The net social welfare gain for U.S. can be mostly attributable to the reallocation of production resources from U.S. sugar producers to more efficient users and gains in consumer surplus due to the lower sugar prices.

The changes of this policy liberalization are shown in dashed lines in Figure 1. The loss in producer surplus is represented by the *area a* above P'_{US} and below P_{US} , efficiency gain

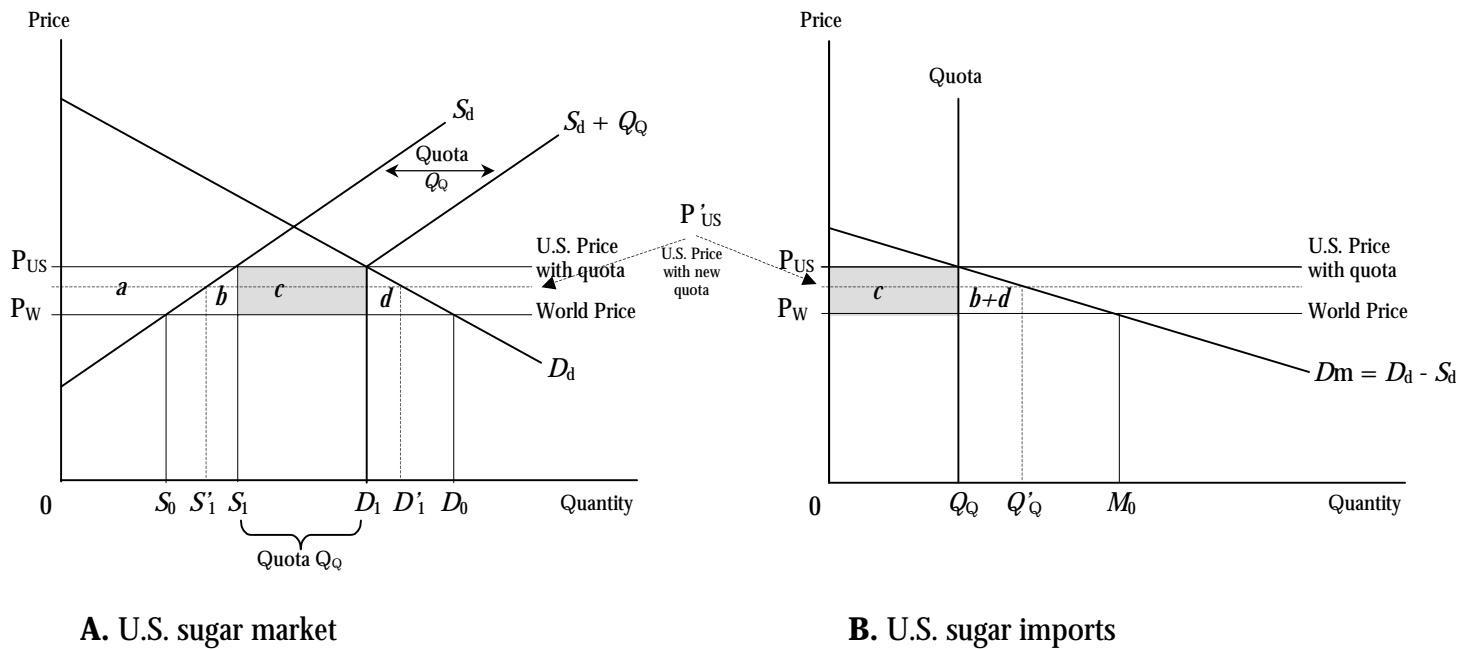


Figure 1. Welfare Aspects of Import Quotas in Competitive Environment

Source: Pugel and Lindert 2000, p. 144.

due to the resource transfers from less efficient sectors to more efficient ones is represented by *area b* above P'_{US} and below P_{US} , and gains in consumer surplus is represented by *areas a* through *d* above P'_{US} and below P_{US} in Figure 1. U.S. sugar price and production percentage changes reported in GTAP were applied to the production volumes posted by ERS and U.S. sugar support loan rates to estimate the effects of policy liberalization on U.S. consumer and producer surplus, and efficiency changes. The estimation assumes linear supply and demand curves. The price change of 0.20% applied to the weighted average price of sugar (\$0.206/lb.) obtained from ERS yields only a change of \$0.0004/lb.

Estimation yields a gain in U.S. consumer surplus of \$8.5 million (areas a, b, c, d), an efficiency gain of \$23,196 (area b) attributable to the transfers of production resources from sugar sector to more efficient sectors, and a loss in producer surplus of \$7.5 million (area a) due to decreased production at lower prices.

As a result of U.S. sugar TRQ liberalization under NAFTA, U.S. producers will lose, U.S. processors and consumers will gain, due to lower sugar prices. On the Mexican side, sugar producers/exporters will capitalize on higher U.S. sugar prices, while Mexican consumers are likely to lose, due to slightly higher prices and reduced domestic supply.

The Cost of Government Support

The U.S. government supports its sugar industry through fixed loan rates authorized by the sugar program. In order to keep its program in effect the U.S. government sometimes intervenes by purchasing sugar to reduce sugar supply in the U.S. A recent intervention was in mid-May 2000 when the USDA purchased some of the domestic sugar to restore the market price and supply. U.S. cannot further reduce market access provided to other countries under the commitments of WTO. If the USDA decides to utilize its authority to support U.S. sugar producers according to the provisions of the sugar program, it will have to purchase the

additional Mexican sugar, in which case the excess imports will not affect the market equilibrium. The cost to the federal government, same as to the taxpayers, will be the dollar amount of the purchased and stored sugar less revenue generated from disposal, if any. The calculations show that the USDA will have to spend about \$29.2 million ($[105,788 \text{ MT} - 25,000 \text{ MT}] \times \$0.18/\text{lb.}$) to purchase the additional Mexican sugar, assuming that Mexico exports only cane sugar. Taking into consideration the welfare impacts of the TRQ change on consumer and producer surpluses (positive \$8.5 million and negative \$7.5 million, respectively) and the amount U.S. government would need to spend to avoid these effects by purchasing the increased imports of Mexican sugar (\$29.2 million), it is obvious that U.S. will be better off without any intervention.

Summary and Implications

Trade theory suggests that if the U.S. liberalizes its sugar policy by giving wider access to Mexico, domestic producers are most likely to lose their market share, and domestic consumers and processors are likely to gain because more low cost sugar enters the market causing the U.S. market price to decline. The overall welfare change depends on the scope of producer and consumer welfare changes.

The policy liberalization towards Mexico simulated in this study utilized the work conducted by Elbehri and Pearson (2000). Those authors developed a general equilibrium, multi-region TRQ model within GTAP. Several modifications to the model were conducted to suit the objectives of this research. Country and commodity aggregation was done using GTAPAgg software. Extra TRQ data files were manually modified to meet the objectives of the research. The entire simulation involved five separate steps, which were automated in a TRQmate program.

The policy liberalization increases Mexican sugar imports by the full 323% allowed, or \$32 million, replacing Mexican exports to other regions. Supply decline in the Mexico increases domestic sugar prices by 0.59%. Increased sugar supply in the U.S. forced sugar prices in U.S. to decline by 0.20%. As a result of increased supply and lower domestic prices, U.S. sugar producers cut their sugar output by 0.62%, or \$23.2 million. Preferential rights on market access give incentives to Mexican sugar producers to increase their sugar production. The simulation showed sugar output increase in Mexico by 3.45%. The net social welfare effect shows a net gain for U.S. of \$31.37 million, which can be explained by gains in U.S. consumer surplus as a result of lower prices and by transferring the U.S. production resources from sugar production to more efficient sectors. U.S. producer surplus decreased by \$7.5 million, while U.S. consumers gained \$8.5 million in surplus. To eliminate such changes in the domestic market, the U.S. government would have to spend about \$29.2 million (authorized in FAIR Act of 1996) to purchase the additional Mexican sugar. It is clear that government intervention will cost U.S. taxpayers much more.

Although current simulation results show small changes in percentage terms, these can be explained by the fact that 105,788 MT might be a large number for the Mexican side, but in the U.S. it accounts for an insignificant portion of the sugar market. The most significant NAFTA impact will accrue when Mexico becomes eligible to ship all of its sugar without a constraint to trade, which will occur after the 15-year transition period is phased out in 2009. Currently, Mexico claims that it has at least 600,000 MT sugar ready to be exported. USDA forecasts that by 2003 HFCS will account for 75% of the sweeteners used in soft drinks, and 30% in food processing. Taking into account such sharp reductions in sugar demand in Mexico, USDA projects Mexico's sugar export potential in 2009 to range from 1,000,000 MT to 2,200,000 MT (Haley, 2000).

Larger amounts can be a direct threat to the security of the U.S. sugar industry. It will result in the loss of U.S. producer surplus and U.S. consumer and Mexican exporter surplus gain. At that point, U.S. legislators will have to decide which interests to protect: producers or consumers? It is not an easy task due to the political nature of sugar trade and powerful lobbying efforts from both sides.

Model Limits and Suggestions for Future Research

Although the GTAP model and GEMPACK are well documented and there are hundreds of studies using the GTAP and GEMPACK in their modeling, further improvements are necessary. There were several problems faced during the research. The GTAP database is very comprehensive, however the commodities and countries are not as disaggregated as would be desirable for some types of research. The biggest limitation of GTAP for this research is that HFCS is not disaggregated so it could not be directly modeled in this research.

In the rapidly changing world trade, even the previous two to three year's base data may not be suitable for the analysis. Another serious problem encountered during the research was the levels of shocks. In case the research demands large shocks, the GTAP and GEMPACK may not be able to handle those shocks properly. For example, if this research needed to analyze the impact of wider Mexican sugar access in the amount of 250,000 MT or 900% shock in this case, it would have been difficult to simulate such high shocks.

This research addressed a very important topic in U.S. agricultural trade policies. The results of this study and other authors confirm that such policies and trade disputes undoubtedly will have an impact on the economies of countries engaged in the dispute, as well as on their political relations. There definitely remains a need for further research, as the U.S.-

Mexico sugar dispute remains open and continues to grow, changing its scope and opening new conflicts, such as the disagreement over U.S. exports of HFCS products. There is a genuine opportunity to conduct future research determining the interaction of HFCS and the sugar industries in the U.S. and worldwide, and of their impact on producer and consumer welfare, as well as the political economy of trade.

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