The Mexican Sweeteners Market and Sugar Exports to the United States

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Abstract

This study analyzes the effect of a potential increase in sugar imports from Mexico on the U.S. sugar price, and its consequences for producers and consumers. Additional sugar imports would cause a substantial reduction of sugar prices in the United States and consequently an increase in consumption. Due to low commodity prices, acreage and total production of beet and cane sugar in the United States are expected to fall. Under these circumstances, social welfare in the United States may increase; however, welfare benefits may go to food processors rather than consumer households. By contrast, increases in sugar imports would substantially hurt sugar beet and cane producers.

Keywords: Mexican Sugar, HFCS, NAFTA, U.S. Sugar

Highlights

Under the North American Free Trade Agreement (NAFTA), beginning in 2008, Mexican sugar exports will receive duty-free, unlimited access to the U.S. market. Potential structural changes in the Mexican sweeteners industry, driven mainly by the substitution of sugar by high fructose corn syrup (HFCS) in soft drink production, have caused uncertainty and divided opinions about the volume of sugar that Mexico can export. The objective of this study is to analyze the effect of a potential increase in U.S. sugar imports from Mexico on world and U.S. sugar prices and the consequences for U.S. producers and consumers. The analysis was conducted using a global sugar policy simulation model, and includes the comparison of a base scenario with three alternative scenarios of U.S. sugar imports from Mexico at the levels of 500,000 short tons (ST), 1.0 million ST, and 1.5 million ST.

If the United States imports 500,000 ST of sugar from Mexico, the reduction in U.S. production would be less than 4 percent. Domestic sugar prices would decrease 7.8 percent for sugar beets (38.69 dollars per ST) and 10.6 percent for sugar cane (26.18 dollars per ST). The model projects a reduction in the wholesale sugar price to 23.58 cents per pound, a 10 percent decrease, and a reduction of 8.4 percent, to 38.91 cents per pound, for the retail sugar price.

If imports of Mexican sugar are 1.0 million ST, it is expected that the drop in production would be 7 percent for beet sugar and 5.4 percent for cane sugar. Sugar beet and sugar cane prices would decrease by 15.7 and 21.1 percent, respectively. Prices would be 35.40 dollars per ST for sugar beets and 23.09 dollars per ST for sugar cane. Similarly, the wholesale and retail sugar prices are expected to decrease to 20.95 and 35.35 cents per pound, a 20 percent and 17.4 percent decrease, respectively.

If shipments of Mexican sugar to the United States are 1.5 million ST, beet and cane sugar production would decrease by 10.4 and 8.1 percent, respectively. Price would be reduced to 31.72 dollars per ST for sugar beets and to 19.62 dollars per ST for sugar cane. These figures represent 24.4 percent and 33.0 percent declines for sugar beets and sugar cane, respectively. The wholesale price would be reduced by 31.3 percent, to 18.01 cents per pound, and the retail price would decrease to 31.37 cents per pound, a 26.1 percent decrease. Finally, it is expected that the Caribbean sugar price, which is used as a world price reference, would not be affected by any of the three import scenarios.

The total welfare change in the three cases is positive; however, the effect is significantly larger when sugar imports reach 1 and 1.5 million ST. Considering the characteristics of U.S. sugar consumption and the impact of increased sugar imports from Mexico under NAFTA, producers' welfare would be seriously affected, while most of the price benefits would be absorbed by food processors.

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Jose Andino, Richard Taylor, and Won Koo[*]

INTRODUCTION

Under the North American Free Trade Agreement (NAFTA) in 1994, Mexico was granted preferential access to the U.S. sugar market, with import tariffs being gradually reduced until total elimination by 2008. During the final stage of approval, governments exchanged "side-letters" that produced different versions of the original provisions, and therefore created conflict in the application of the treaty. Also, under NAFTA, the United States was given access to the Mexican high fructose corn syrup (HFCS) market. However, since 1998, the Mexican government has imposed anti-dumping taxes on HFCS imports from the United States.

Because of the high degree of substitutability between sugar and HFCS, the two issues are closely linked, and their importance is increasing as the date approaches for granting Mexican sugar duty-free access. In Mexico, HFCS products could replace a significant percentage of the sugar used in the production of soft drinks by 2008. If this occurs, U.S. exports of HFCS or corn to Mexico would increase; conversely, Mexico would have more sugar available to export to the United States. If substitution and increased sugar exports occur, they will create a challenge for U.S. sugar producers as additional sugar from Mexico could substantially reduce sugar prices in the United States.

There is uncertainty about the volume of sugar that Mexico will be able to export in 2008 (Haley, Jerardo, and Kelch, 2005; Abler, et al., 2005; Haley, 2000). Indeed, the magnitude of trade and its implications for the U.S. sugar industry have not been well documented.

The objective of this study is to analyze the effect of potential increases in U.S. sugar imports from Mexico on U.S. sugar prices and the consequences for producers and consumers. The analysis uses the Global Sugar Policy Simulation Model developed by Benirschka, Koo, and Lou (1996).

Previous research has evaluated the effects of trade liberalization policies on the U.S. sugar industry and world markets (Koo, 2002; Beghin et al., 2001; U.S. General Accounting Office, 2000; U.S. International Trade Commission, 1999; Devadoss and Kropf, 1996; Borrell and Pearce, 1999; Wohlgenant, 1999). These studies have reported an increase in world sugar price when major sugar traders adopt freer trade policies.

Haley (2000) analyzed the potential for Mexican sugar exports to the United States under conditions of low and high HFCS use by the soft drink and food processing industries in

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Mexico[1]. Haley concluded that Mexican sugar exports could increase to almost 1 million metric tons of raw value (MTRV) for the low-use scenario, and over 2 million MTRV under the high-use scenario. However, Haley argued that because of uncertainty about the efficiency of the Mexican sugar industry, sugar exports to the United States are likely to range between 124,000 and 904,000 MTRV.

Koo et al. (2003) evaluated the impact of increased U.S. sugar imports under the Central American Free Trade Agreement (CAFTA). This study concluded that increases of over 500,000 short tons (ST) in imports would erode sugar prices to a level at which U.S. domestic supply becomes more elastic and U.S. domestic sugar supply may decrease substantially as a result.

The remainder of this paper describes the sugar industry in Mexico, including the dispute between Mexico and the United States regarding trade of sugar and HFCS products. Following this section, the effects in the United States of increased sugar imports from Mexico are illustrated. The simulation model and the sugar import scenarios are then described, and the empirical results and their applications are discussed. Finally, the paper concludes with a summary of our findings.

THE SUGAR INDUSTRY IN MEXICO

Mexico produces sugar from sugar cane, which is one of the largest cultivated crops in the country, generating about one-half million jobs (Comité de La Agroindustria Azucarera, 2005). Currently, Mexico consumes most of its produced sugar through the soft drink industry, which heavily relies on Mexican sugar production. Surplus sugar is mainly exported to the United States under NAFTA.

The Mexican government has historically regulated the sugar industry by implementing controls on production, price, distribution, and imports. As a result, prices of refined sugar in Mexico are higher than those in the United States, which encourages production (Mitchell, 2004). During the 2004-2005 harvest, the wholesale and retail prices of refined sugar in Mexico averaged 0.28 and 0.42 U.S. dollars per pound, respectively (Comité de La Agroindustria Azucarera, 2005).

Supply, Demand, and Trade

In general, total sugar production in Mexico has followed a steadily increasing trend, with small reductions during the early 1980s and 1990s. Higher levels of production, which can be attributed to increases in planted area, yields, and better extraction rates, reached 5.3 million metric tons (MT) in 2004 (FAO Statistics, 2005).

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[1] Under the low-use alternative, the levels were 25 percent sugar substitution by HFCS in the soft drink industry and 20 percent substitution in the food processing industry. For the high-use alternative, the levels were 75 percent HFCS substitution and 30 percent substitution for the soft drink and the food processing industries, respectively.

Annual per capita sweetener consumption in Mexico is currently around 49 kilograms, and total sugar consumption reached 5.3 million MT in 2004. During the 1980s, sugar imports were reported, but they were very irregular and after a record peak in 1991 of 1.6 million MT, imports declined and have remained at levels below 300,000 MT (Economic Research Service (ERS) U.S. Department of Agriculture (USDA), PS&D Tables, 2005).

Mexican sugar exports to the United States were larger immediately after NAFTA was implemented, totaling 463,000 MT in 1995. However, exports have been declining since 2000 and were 19,700 MT in 2003. For fiscal year (FY) 2004/2005, the USDA estimates Mexican sugar production and consumption at 6.0 and 5.3 million MTRV, respectively. During the same period, the Mexican share of the U.S. sugar tariff rate quota (TRQ) was set at 10,212 MTRV. For this year, the quota amount was expected to exhaust projections of Mexican sugar exports, and additional sugar, from any increase of HFCS use, was expected to be absorbed by domestic manufacturers under the Temporary Import Program for Exporters (PITEX program) (Haley, Jerardo, and Kelch, 2005).

Sugar Issues

Before NAFTA was implemented, Mexico was a sporadic importer, and the implementation of the agreement in 1994 was expected to improve the efficiency of the Mexican sugar industry. However, the treaty failed to grant free access to Mexican sugar in the way that it was expected. The original NAFTA negotiations provided duty-free access of raw Mexican sugar in the United States at a minimum level of 7,258 MT during the first six years. Additional quantities could be exported if Mexico became a surplus producer (defined as domestic sugar production minus consumption) over a period of two years, with a maximum of 25,000 MT. After the seventh year, if Mexico met the surplus producer condition, the limit of the duty-free access was 150,000 MT, increasing 10 percent per year until unlimited free access in 2008 (U.S. ERS, Briefing Room, 2005). However, the closing negotiations of the treaty produced different versions of the agreement, mainly related to the method of determining Mexico's status as a surplus producer and the quota size for duty-free access (Kornis, 2001). The United States claimed that Mexico should be considered a net-surplus producer only if its sugar production exceeds consumption of both sugar and HFCS (current consumption of HFCS in Mexico is 300,000 MT) and that duty-free access is provided up to a maximum of 250,000 MT from 2001-2007 (ERS USDA, Briefing Room, 2005). However, Mexican authorities argued that Mexico was entitled to export all of its sugar surplus to the United States since 2001.

HFCS Issues

Another issue under dispute is the U.S. access to the Mexican HFCS market. In the 1990s, the U.S. corn industry began exporting significant amounts of HFCS to Mexico (Figure 1). Reasons for this trend include high Mexican sugar prices, expectations of a higher U.S. quota for Mexican sugar that led to increased imports and production of HFCS, excess production of HFCS in the United States, and increased consumption of soft drinks in Mexico (US FAS, 2004).

From 1990 through 2003, Mexican imports of HCFS came exclusively from the United States, except during 2000 and 2001, when Mexico purchased HFCS from other suppliers. The trend

for imports increased from 1990 to 1996 and averaged 21,180 MT. Imports in 2003 were 9,110 MT (Figure 1).

In 1998, Mexican authorities imposed antidumping duties on HFCS imports from the United States. NAFTA and WTO panels ruled against this action. However, the duties were replaced in 2002 by a 20 percent tax on products used to produce soft drinks and an additional 20 percent tax on the services related to the distribution of syrups was imposed (U.S. Office of Trade Representatives (USTR), 2005). As a result, U.S. exports of HFCS have declined substantially. Moreover, Mexican production of HFCS increased and reached 350,000 metric tons in 2001 (Farm Foundation, 2005).

Table 1 shows the quantities of sweetener products demanded, by industry, in Mexico in 1998. The production of soft-drinks demands the highest level of all categories of sweeteners. Also, large quantities of sweeteners are required for the production of candy, dairy, and bakery products. Since recent statistics for the demand of these products were not available, the demand figures for 2004 were projected using production indexes (Table 2).
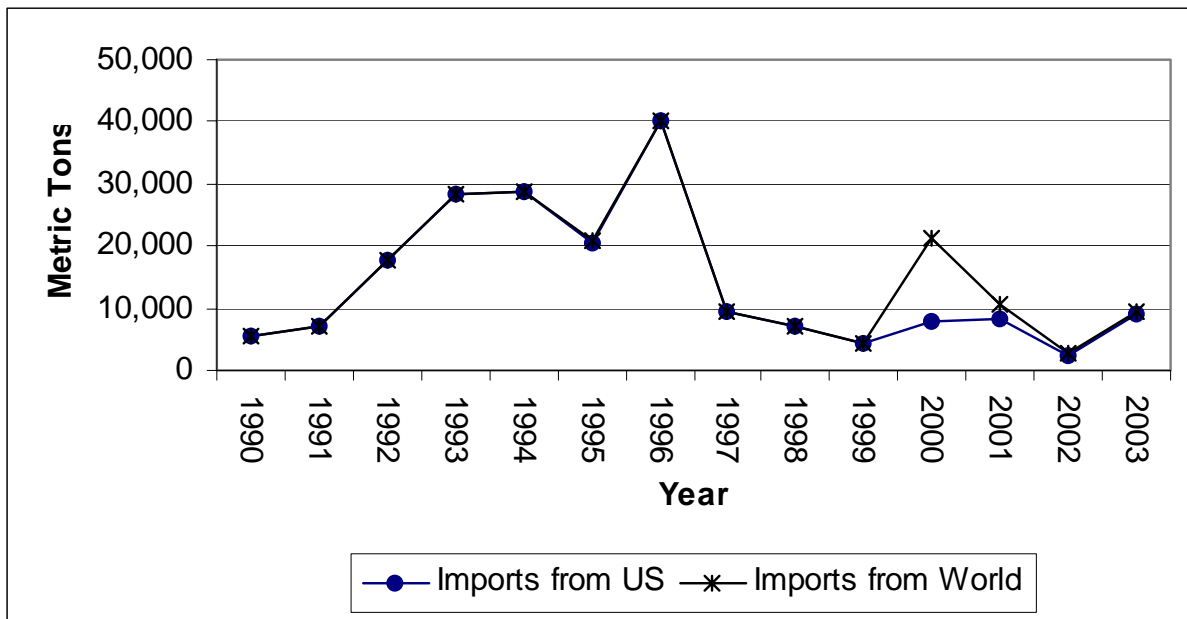
Figure 1. Trade Activity of High Fructose Corn Syrup (HFCS) in Mexico

Table 1. Industry Demand of Sweetener Products in Mexico in 1998 (Metric tons)[a]

Industry Type	Raw Sugar	Refined Sugar	Fructose	Glucose	Panela	Saccharin
Dairy products	231,801.9	2,369.0		6,787.6		
Fruit and Vegetables (Processed)	46,997.5		6,975.7	6,333.8	316.0	
Bakery Products	131,068.6	93,622.1				
Candy Industry	206,546.8	38,859.0		106,514.7		
Soluble Coffee	20,685.1	5,788.8				
Yeasts	6,619.8		1,639.7	14,674.0		
Mayonnaise and other Condiments	3,989.9					
Other Desserts	2,549.2	21,068.8		334.8		
Breakfast Cereals and Chips	2,766.1					
Other Products Human Consumption	3,684.7	4,348.7				
Alcoholic Beverages	14,868.1	1,518.1	7,607.8	800.2	4,964.3	
Soft Drinks	283,080.0	523,579.6	311,095.9			126,099.0
Total	954,657.6	691,154.2	327,319.1	135,444.9	5,280.3	126,099.0

[a] Source: Instituto Nacional de Estadística Geografía e Informática. 1999

Table 2. Estimated Demand of Sweetener Products in Mexico in 2004 (Metric tons)[a]

Industry Type	Raw Sugar	Refined Sugar	Fructose	Glucose	Panela	Saccharine
Fruit and Vegetables (Processed)	71,906.2		10,672.8	9,690.7	483.5	
Soluble Coffee	30,820.8	8,625.4				
Soft Drinks	356,680.8	659,710.3	391,980.9			158,884.7
Total	459,407.7	668,335.7	402,653.7	9,690.7	483.5	158,884.7

[a] Estimation was done using 1998 values and production indexes reported by Instituto Nacional de Geografía e Informática

Future Implications

Inefficiency in government programs has caused severe problems for the performance of the Mexican sugar industry, especially in mill operations. In 2001, 27 mills, which represented about 55 percent of the total production, were expropriated by the government due to financial problems. These mills, however, are being restructured, and there are plans to merge them with private investors in 2005 or 2006. This restructuring could increase Mexico's sugar production (Farm Foundation, 2005).

Another important reform being discussed concerns political initiatives implemented in January, 2005, to remove the "Cane Decree," which highly supports sugar cane producers. In general, if the decree is suspended or modified, it is expected that the price of sugar cane would be more market oriented (Haley, Jerardo, and Kelch, 2005).

In September 2005, the USDA decided to give Mexico a "surplus producer" status for the 2006 marketing year and, acting under the NAFTA provisions, set the Mexican quota at 250,384 MTRV. Following this decision, the Mexican government announced that it had determined to give access to U.S. exports of HFCS up to the level of 250,000 MT. For FY 2006, the USDA predicts production and consumption levels of sugar in Mexico will be 5.693 million MTRV and 5.108 million MTRV, respectively. Given this situation, Mexican sugar exports to the United States are projected to be 462,000 MTRV, which includes 250,384 MTRV of duty-free access under NAFTA, 208,655 MTRV of high-tier tariff sugar, and 2,954 MTRV under the refined sugar TRQ specifically allocated to Mexico (Haley, Kelch, and Jerardo, 2006).

IMPACT OF MEXICAN SUGAR EXPORTS ON THE U.S. SUGAR INDUSTRY

There are several important factors determining the volume of sugar exports from Mexico to the United States, such as the efficiency of the Mexican sugar industry, government programs, new investments, etc. However, the substitution of HFCS for sugar in Mexican beverages and other industries represents a key factor. Additionally, since most of the Mexican sugar exports go to the United States, the relation between Mexican and U.S. prices would highly determine if it is favorable for Mexico to export sugar to the United States (Haley, 2000).

Figure 2 shows how increased sugar exports from Mexico can affect the price, production, and consumption of sugar in the United States. The left plot of Figure 2 illustrates the U.S. sugar market, where the U.S. producer supply (S^{US}) and total demand (D^{US}) curves for sugar are represented. Price and quantity are on the vertical and horizontal axes, respectively. The supply curve includes domestic production only, and for simplicity of analysis, sugar from domestic stocks and additional sugar from the re-export program are not included. The supply curve is kinked to account for an inelastic region, above P^B, where producers become less sensitive to changes in market price. In this portion of the curve, it is assumed that producers make production decisions based on expectations of price rather than market information (Haley 2000). Below price P^B, producers are more sensitive to changes in price. In this region of low prices, some producers may not be able to cover variable costs; therefore, U.S. production is reduced. At prices P^A and lower, domestic production of sugar in the United States is zero. The
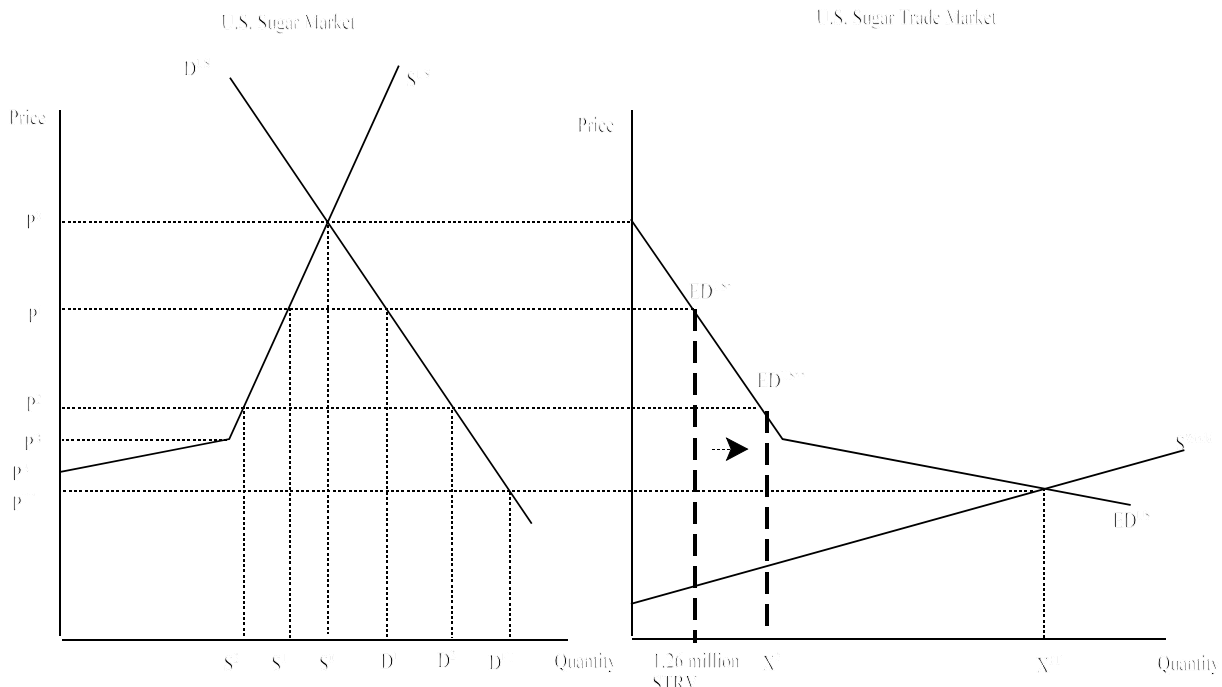
Figure 2. Impact of Increased Market Access of Mexican Sugar in the U.S. Sugar Supply, Demand, and Price

sugar demand curve represents the aggregation of sugar consumption in the United States. Equilibrium price (P^0) and quantity (S^0) in the United States are estimated at the point where both curves intersect.

The U.S. sugar trade market is represented on the right plot of Figure 2. The U.S. sugar excess demand (ED^{US}) is presented, along with estimated world supply of sugar (S^W) . The world sugar supply is net production after domestic consumption and represents sugar available for exports. The excess demand curve is the difference between supply and demand curves from the left plot, resulting in a kinked excess demand curve at the price P^B. The intersection point of the excess demand and world supply curves (X^{FT}) would be the amount of sugar exported to the United States from world producers, if free access were given to sugar exports to the United States. Under this situation, the U.S. market price corresponding to a level of imports, D^{FT}, would be price P^{FT}, where all the sugar consumed in the United States would be supplied from world markets.

$ED^{US`}$ represents the U.S. excess demand curve under the current TRQ 1.26 million STRV. At this TRQ level of imports, the U.S. price, quantity supplied, and quantity demanded are P^1, S^1, and D^1, respectively. The new price and quantity supplied are lower than the equilibrium price (P^0) and quantity (S^0); however, quantity demanded is higher.

The effect of increased sugar imports from Mexico can be explained by the modified demand curve $ED^{US``}$.  With additional market access granted to Mexico, the U.S. excess demand curve shifts from $ED^{US`}$ to $ED^{US``}$; therefore, total sugar exports from the world increase to X^2. This

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situation erodes price and quantity supplied in the U.S. market to P^2 and S^2, respectively. In contrast, U.S. demand increases to D^2. Since the price reduction crosses the U.S. production supply curve in the inelastic region, declines in supply are expected to be smaller than the price change. However, if unlimited access is given to sugar from Mexico, the price change could reach levels below P^B in the United States. If this occurs, substantial reductions in domestic supply would be expected as prices reach the region where U.S. producers and processors are not able to cover variable costs.

THE SUGAR POLICY SIMULATION MODEL AND SCENARIOS

The sugar simulation model developed by Benirschka, Koo, and Lou (1996) econometrically estimates supply and demand equations for major sugar producing and consuming countries. Therefore, it accounts for the stochastic nature of some of the variables in the world market. The model includes 17 countries and regions: Australia, Brazil, Cuba, the EU-25, South Africa, and Thailand as major exporters; and Algeria, Canada, China, Indonesia, Egypt, India, Japan, Mexico, the former Soviet Union, the United States, and a Rest of the World region as major importers. For each country, the model estimates behavioral equations for area harvested, domestic consumption, and carry-out stocks.

Model Structure

Sugar supply or production ($qp_{i,t}$) is estimated as the product of the area harvested and the yield per hectare, where the area harvested ($a_{i,t}$) is expressed as a function of expected prices of sugar (p_{t-1}) and alternative crops (p^c_{t-1}), policy parameters (g_t), and a lagged dependent variable ($a_{i,t-1}$) which is included to account for dynamics related to producers' cropping decisions. The i subscript indexes cane sugar or beet sugar.

$$a_{i,t} = f\ (a_{i,t-1},\ p_{t-1},\ p^c_{t-1},\ g_t) \tag{1}$$

The model calculates total consumption of sugar (qd_t) as the product of per capita consumption and population. Per capita consumption (fd_t) depends on the price of sugar (p_t), per capita disposable income (cy_t), and a time trend variable (t) to provide for changes in tastes and preferences of consumers:

$$fd_t = g\ (p_t,\ cy_t,\ t). \tag{2}$$

Carry-out stocks equations (qs_t) are calculated as function of domestic production (qp_t), price (p_t), and carry-in stocks (qs_{t-1}). These stocks protect against unexpected reductions in production, and therefore depend on the level of domestic production and the opportunity cost of storing sugar (Koo, 2002):

$$qs_t = h\ (qs_{t-1},\ qp_t,\ p_t). \tag{3}$$

The sum of domestic production (qp_{t-1}) and carry-in stocks (qs_{t-1}) represents domestic supply, and the sum of domestic consumption (qd_t) and carry-out stocks (qs_t) is total demand. Net exports (qx_t) are then estimated as the difference between total domestic supply and total demand, and a market equilibrium condition is expressed as:

$$\sum_{n=1}^{N} qx_t^n = 0 \, , \, n = 1,2,...,17. \tag{4}$$

From this equilibrium condition, the equilibrium world price of sugar is simulated and expressed in domestic price for each region using official exchange rates. Finally, the sugar wholesale price in each region is computed as a function of the world market price in domestic currency and expressed in real terms (Benirschka, Koo, and Lou, 1996).

The Base and Alternative Scenarios

A base and three alternative scenarios are developed to evaluate the impact of increased sugar imports from Mexico on the U.S. sugar industry and world price. The base and alternative models are presented as follows.

Under the base scenario, average climate conditions and historical rates of technological change are assumed. Current agricultural policies are continued in all countries. Finally, the expected sugar imports from the Central American Free Trade Agreement (CAFTA), totaling 107,000 MT per year (Koo, Taylor, and Mattson, 2003), and zero imports from Mexico are included.

The sugar import scenarios were determined based on three levels of HFCS substitution for sugar in the Mexican soft drink industry.

Scenario 2 represents low level of sugar substitution. Under this situation, the United States imports sugar from Mexico at a level of 500,000 short tons (ST), while sugar policies in other countries remain constant.

Scenario 3 assumes an intermediate level of sugar substitution. In this case, the United States imports sugar from Mexico at a level of 1.0 million ST and sugar policies in other countries remain unchanged.

Scenario 4 is a complete substitution of sugar by HFCS in the Mexican beverage industry. Under this scenario, U.S. sugar imports from Mexico account for 1.5 million ST, and policies in other countries remain constant.

EMPIRICAL RESULTS

Table 3 presents the results of the alternative scenarios for production, consumption, and price in the United States, and the Caribbean price, which is a reference to the world price. During 2004, U.S. sugar production was 4.4 and 4.1 million ST from beet sugar and cane sugar, respectively. Total consumption was 9.9 million ST, and net imports accounted for 1.4 million ST. Prices in 2004 were 40 and 27 dollars per ST of sugar beets and sugar cane, respectively, and the wholesale and retail sugar prices were 26.15 and 42.40 cents per pound, respectively. The Caribbean price was 8.4 cents per pound in 2004. When the base scenario is compared to 2004 levels, the model projects an increase in sugar production to 4.8 and 4.4 million ST for beet sugar and cane sugar, respectively, representing an increase of 9.5 percent for beet sugar and 7.5 percent for cane sugar from the 2004 values. Total sugar consumption is expected to increase by 6.9 percent, while net imports are expected to decrease by 4.1 percent. This latter result is mainly because sugar from Mexico is not available to be exported to the United States. The volume of consumption is projected to be 10.6 million ST, and total imports 1.4 million ST. Increased sugar consumption is expected as a result of increased demand (population growth). Sugar beets and sugar cane prices are expected to increase by 4.9 and 8.4 percent, to 41.98 and 29.28 dollars per ST, respectively. However, the wholesale and retail sugar prices in the United States are expected to remain unchanged. Despite increased prices of sugar beets and sugar cane, the increased efficiency of U.S. sugar processing plants during the last few years may explain the low variability in wholesale sugar prices. The Caribbean sugar price in the base scenario is expected to be 8.6 cents per pound, which is 1.8 percent higher than the price in 2004.

Impact of U.S. Sugar Imports of 500,000 ST

Under this scenario, the United States imports 500,000 ST of sugar from Mexico under NAFTA, while sugar policies in other countries remain unchanged. The model projects a reduction in the U.S. production of beet sugar by 3.3 percent, and cane sugar by 2.6 percent, to 4.6 and 4.3 million ST, respectively. This result is mainly because Mexican sugar replaces some of the domestic production. It is expected that total consumption increases to 10.8 million ST, a 2 percent increase from the base scenario. Net imports are expected to increase to 1.9 million ST, and because additional sugar is available in the market, this scenario is expected to decrease sugar beet and sugar cane prices to 38.69 and 26.18 dollars per ST, respectively. These values are 7.8 and 10.6 percent lower than the prices from the base scenario. The wholesale price is expected to decrease by 10 percent, to 23.58 cents per pound. Also, the retail sugar price is expected to decrease by 8.38 percent, to 38.91 cents per pound. The Caribbean price is projected to remain unchanged at 8.55 cents per pound.

Table 3. Sugar Price, Production, Consumption, and Net Imports under the Base and Alternative U.S. Sugar Imports from Mexico

Region	Category	Units	Actual 2004 Levels	2013 Projections of U.S. Sugar Import Scenarios			
				Base Scenario	Scenario 2 500,000 ST [a]	Scenario 3 1 million ST	Scenario 4 1.5 million ST
United States							
	Beet Sugar Production	1,000 ST	4,358	4,772	4,615	4,439	4,276
	Cane Sugar Production	1,000 ST	4,120	4,431	4,318	4,190	4,072
	Total Consumption	1,000 ST	9,905	10,584	10,791	10,983	11,249
	Net Imports	1,000 ST	1,429	1,370	1,870	2,370	2,870
	Sugar Beets Price	Dollars/ST	40	41.98	38.69	35.4	31.72
	Sugar Cane Price	Dollars/ST	27	29.28	26.18	23.09	19.62
	Wholesale Sugar Price	Cents per Lb	26.15	26.2	23.58	20.95	18.01
	Retail Sugar Price	Cents per Lb	42.4	42.47	38.91	35.35	31.37
World	Price	U.S. Cents per Lb	8.4	8.55	8.55	8.55	8.55

[a] ST stands for short tons

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Impact of U.S. Sugar Imports of 1 Million ST

In this scenario, the United States imports 1.0 million ST of sugar from Mexico under NAFTA and sugar policies in other countries remain constant. Under this level of imports, sugar beet production is reduced by 7 percent and sugar cane production decreases by 5.4 percent, to 4.4 and 4.2 million ST, respectively. As sugar production is replaced by sugar imports from Mexico, domestic consumption is expected to increase by 3.8 percent, to 11.0 million ST. Net imports are projected to be 2.4 million ST. Increased imports of sugar are expected to reduce sugar beet and sugar cane prices by 15.7 and 21.1 percent, respectively. Prices are expected to be 35.40 dollars per ST for sugar beets and 23.09 dollars for sugar cane. The wholesale sugar price is projected at 20.95 cents per pound, 20 percent lower than the base scenario, and the retail sugar price is expected to be 35.35 cents per pound, a 17.4 percent decrease. The Caribbean price is expected to remain constant at 8.55 cents per pound.

Impact of U.S. Sugar Imports of 1.5 Million ST

In this scenario, Mexico is able to export 1.5 million ST of sugar to the United States, assuming that other producing countries maintain their sugar policies. In this case, U.S. sugar production is expected to decrease by 10.4 and 8.1 percent for beet sugar and cane sugar, respectively. Production levels are projected at 4.3 million ST for beet sugar and 4.1 million ST for cane sugar. Total consumption would be 11.3 million ST, 6.3 percent higher than the base scenario. Net imports are expected to more than double from the base scenario, to 2.9 million ST. As a result of this level of imports, domestic prices are expected to decrease by 24.4 percent for sugar beets and 33 percent for sugar cane, to 31.72 dollars per ST and 19.62 dollars per ST, respectively. The wholesale and retail prices are expected to decrease to 18.01 and 31.37 cents per pound, respectively. These prices correspond to a 31.3 percent decline for the wholesale price and a 26.1 percent for the retail price. The Caribbean sugar price is expected to be 8.55 cents per pound, unchanged from the base.

In general, these results are very similar to a study conducted by Abler et al., (2005), which evaluated the viability of alternative U.S. sugar programs under increased levels of sugar imports. They found that under the condition of a limited displacement of sugar in the Mexican soft drinks industry, imports to the United States from Mexico would average 218,000 ST and the New York (NY) spot price for raw sugar would decrease to 20 cents per pound. With a substantial replacement of sugar by HFCS in the production of soft drinks in Mexico, U.S. sugar imports would average 1.4 million ST and the NY spot raw sugar price would decline to 18.73 cents per pound.

Welfare Effects

In order to evaluate the welfare effects, changes in consumer and producer surpluses were estimated for the three Mexican sugar import scenarios. Because of differences in the price elasticity of supply between sugar beet and sugar cane growers (Koo, 2002; Benirshka, Koo, and Lou, 1996), producer surpluses for sugar beet and cane are presented separately (Table 4).

Table 4. Changes in Consumer and Producer Surplus Under Alternative U.S. Sugar Imports from Mexico

	Scenario 2 500,000 ST	Scenario 3 1.0 Million ST	Scenario 4 1.5 Million ST
	1,000 of Dollars		
Consumer Surplus	68,628	136,702	222,987
Producer Surplus	-29,026	-56,702	-86,501
Beet Producer	-15,449	-30,158	-45,817
Cane Producer	-13,576	-26,544	-40,684
Total	39,602	80,000	136,486

Previous results showed a reduction in U.S. prices for sugar beets, sugar cane, and wholesale and retail sugar prices under the three alternative sugar import scenarios. Therefore, it is expected that consumer surplus should increase as the quantity of sugar imported from Mexico rises, while the opposite occurs for the producer surplus. When compared to the base scenario, the value of consumer surplus increases by 68.6 million dollars, 136.7 million dollars, and 223 million dollars when sugar imports from Mexico are 500,000 ST, 1.0 million ST, and 1.5 million ST, respectively. In contrast, the value of producer surplus decreases by 29 million dollars when sugar imports from Mexico are 500,000 ST, by 56.7 million dollars for sugar imports of 1.0 million ST, and by 86.5 million dollars when sugar imports are 1.5 million ST. The total welfare change from the three scenarios is positive, suggesting that social welfare in the United States may increase; however, increased consumer surplus would not be reflected in benefits to consumer households. Most sugar in the United States is used to produce processed food, including candy, chocolate, and other sweetened commodities. Prices of these products are not sensitive to reductions in the price of sugar, mainly because the value of sugar included in these processed foods is relatively small compared to the value of the food item. Therefore, considering the characteristics in sugar consumption and the impact of increased sugar imports from Mexico under NAFTA, producers' welfare would be seriously affected, while most of the positive benefits would go to the food processing industry, rather than households in the United States.

As explained by Koo (2002), the magnitude of welfare changes presented in Table 4 may vary as other factors are included to determine total welfare. For instance, Koo described how as a consequence of reduced sugar prices, production of sugar substitute crops is expected to increase. Consequently, prices of these crops would decrease, causing further welfare changes for producers and consumers. In our results, the simulation model projects a decrease in the area harvested of sugar beets and sugar cane by 47,000 acres and 26,000 acres, respectively, when imports are 500,000 ST. When imports are 1 million ST, area harvested declines by 100,000 acres for sugar beets and 56,000 acres for sugar cane. At the import level of 1.5 million ST, decreases in harvested area are 148,000 acres and 83,000 acres for sugar beets and sugar cane, respectively.

Another possible source of variation in the U.S. welfare is a result of the fact that additional sugar at a lower price in the United States could displace some HFCS in the sweetener market, causing losses to corn producers. However, this loss is expected to be compensated by increased Mexican imports of HFCS or corn from the United States, as the soft drink industry in Mexico demands more HFCS to replace sugar. However, it is uncertain if the benefits to corn producers can overcome producer surplus losses from sugar producers. Also, our estimated producer surplus would change if lower sugar prices promote the use of sugar for other industrial uses, such as ethanol production, which would directly affect corn producers (Abler et al., 2005). It is important to mention that the magnitude of the impact on U.S. sugar prices from free trade of sugar can be determined by policies that regulate the level of sugar production in the United States. If U.S. sugar production is adjusted in response to increased imports of sugar, domestic price reductions in the United Sates may not be substantial.

Finally, the producer surplus of world exporters may also be affected. Although additional Mexican sugar exports to the United States do not affect the world price of sugar, depressed U.S. sugar prices will decrease revenues from foreign sugar exports.

SUMMARY AND CONCLUSION

Under NAFTA, Mexican sugar exports will receive duty-free, unlimited access to the U.S. market in 2008. Potential structural changes in the Mexican sweeteners industry, driven mainly by the substitution of sugar by HFCS in soft drink production, have caused uncertainty and divided opinion about the volume of sugar that Mexico can export beginning in 2008. There is substantial concern about the magnitude of potential trade and its implications for the United States. This study analyzed the effect of a potential increase in sugar imports from Mexico on the U.S. sugar price and its consequences for producers and consumers. The analysis was conducted using a global sugar policy simulation model, and included the comparison of a base scenario with three alternatives of U.S. sugar imports from Mexico at the levels of 500,000 ST (scenario 2), 1.0 million ST (scenario 3), and 1.5 million ST (scenario 4).

For the base scenario, it was assumed that current agricultural policies would continue in all countries. When projections for the year 2013 are compared to levels that occurred during 2004, the model predicts an increase in the production of beet sugar and cane sugar by 9.5 and 7.5 percent, respectively. Net sugar imports would decrease by 4 percent, and consumption is expected to increase by 6.9 percent. Producer prices are projected to increase by 4.9 percent for sugar beets and 8.4 percent for sugar cane. The U.S. wholesale and retail sugar prices are expected to remain unchanged.

Additional sugar imports from Mexico would cause a substantial reduction in sugar prices in the United States. Due to low prices, acreage and total production of beet and cane sugar in the United States are expected to fall. However, producers' changes in production are smaller than the changes in price, mainly because of an inelastic supply curve (Figure 2).

If the United States imports 500,000 ST of sugar from Mexico, the decline in production would be less than 4 percent. Price reduction would be 7.8 percent for sugar beets and 10.6 percent for

sugar cane, lowering prices to 38.69 and 26.18 dollars per ST. Results indicate that wholesale sugar price decreases to 23.58 cents per pound, a 10 percent change, and that there is a reduction in retail sugar prices of 8.38 percent, down to 38.91 cents per pound.

If imports of Mexican sugar are 1.0 million ST, it is expected that production would decline 7 percent for beet sugar and 5.4 percent for cane sugar. Sugar beet and sugar cane prices would decrease by 15.7 and 21.1 percent, respectively. Prices would be 35.40 dollars per ST for sugar beets and 23.09 dollars for sugar cane. Similarly, wholesale and retail sugar prices are expected to decrease to 20.95 and 35.35 cents per pound, or a decline by 20 percent and 17.4 percent, respectively.

If shipments of Mexican sugar to the United States are 1.5 million ST, beet and cane sugar production would decrease by 10.4 and 8.1 percent, respectively. Price would be 31.72 dollars per ST for sugar beets and 19.62 dollars per ST for sugar cane. These decreases correspond to 24.4 percent and 33.0 percent for sugar beets and sugar cane, respectively. The wholesale price would be reduced by 31.3 percent, to 18.01 cents per pound, and the retail price would decrease to 31.37 cents per pound, a 26.14 percent decrease. Finally, it is expected that the Caribbean sugar price, which is used as a world price reference, would not be affected by any of the three import scenarios.

U.S. consumer and producer surplus changes were estimated for the three scenarios. The total welfare change in the three cases is positive; however, the effect is significantly larger when sugar imports reach 1 and 1.5 million ST. Under these circumstances, social welfare in the United States may increase. However, most of the increases in social welfare may go to food processors rather than consumer households. On the other hand, increases in sugar imports would hurt sugar beet and cane producers substantially.

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