Liberalizing International Sugar Trade: The Impact of U.S. Tariff Rate Quota Changes

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Abstract

A dynamic partial equilibrium model of the world sugar economy is used to examine the impact of U.S. tariff rate quota liberalization. Simulation results indicate that U.S. sugar prices fall significantly and that imports gain U.S. market share. However, declines in U.S. sugar production will be modest.

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Introduction

In most years, over 70 percent of world sugar production is consumed domestically, implying that only a small proportion of production is traded internationally. A significant share of this trade takes place under bilateral long-term agreements or on preferential terms such as under the U.S. sugar quota or the European Union's Lome Agreement.

Since only a small proportion of world production is traded freely, small changes in production or government policies tend to have large effects on world sugar markets, and sugar prices are among the most unstable in international trade. Often, protectionist sugar policies insulate domestic producers and consumers from world market price changes. Since price signals are not transmitted to domestic markets, domestic supply and demand and, thus, sugar stocks and trade do not respond to changing world market conditions. In addition to increasing world market instability, such policies alter the global distribution of sugar production. The net effect of these policies is that world market prices are lower than they would be in the absence of protective measures and trade flows often reflect domestic sugar policies rather than comparative advantages in sugar production.

While such policies achieve their goal of protecting U.S. sugar producers, they have negative side effects on sugar exporting countries. Particularly, less developed countries often depend on sugar as a source of revenue and employment. As a group, these countries are the major exporters of sugar. From 1993/94 to 1995/96, 55 percent of world sugar exports came

from less developed countries (USDA, PS&D View). Since many of these countries have an apparent comparative advantage for sugarcane production and could export sugar at low cost, sugar policies have serious foreign policy implications and are a source of international disputes.

The sugar market has been studied extensively. Uri and Hafi and Roberts assess the impact of the sugar program on the U.S. economy. Boyd et al. examine the removal effect of the U.S. sugar import quota in a general equilibrium framework. Devadoss et al. study NAFTA's impact on U.S.-Mexico trade. Wong examines international sugar trade reform, while Haley et al. focus on U.S. and E.U. sugar policy reform. A recent GAO report summarizes the results of several studies and concludes that it may become necessary to modify the U.S. sugar program. However, the 1996 Federal Agricultural Improvement and Reform Act, while significantly changing U.S. agricultural policy, makes only minor modifications in the sugar program (USDA 1996).

While the sugar program survived recent efforts to reform agricultural policy, there can be no doubt that the program will change eventually. In this study, we use a dynamic partial equilibrium model of the world sugar economy to examine various modifications of the tariff rate quota for sugar. The policy changes we study are an annual 10 percent increase of the tariff rate quota over the next 10 years, a 5 cents/pound reduction of the above quota tariff, and the elimination of the tariff rate quota in 2003/04.

Model

Simulation results in this study are based on a dynamic, partial equilibrium, net trade model[1] that distinguishes 18 countries and regions: Algeria, Australia, Brazil, Canada, China, Cuba, Egypt, the European Union, the former Soviet Union, India, Indonesia, Japan, Mexico,

South Africa, South Korea, Thailand, the United States, and a "Rest of the World" region. Sugar is assumed to be a homogenous commodity, i.e., the model does not differentiate between raw sugar and refined sugar. All refined sugar quantities are expressed in raw sugar equivalents. The model is designed to simulate production, consumption, stocks, and trade for sugar over a 10- to 15-year period.

Sugar supply and demand functions for each region are estimated econometrically. However, sometimes estimation was difficult because of data problems, while at other times estimated equations performed poorly in simulations. Therefore, some tuning of the model was necessary, and the final simulation model is a hybrid between an econometric model and a synthetic model. Empirical estimates were used whenever possible, but selected parameters are based on expert advice and personal judgment. All behavioral equations of the model are calibrated to the 1990/91 to 1992/93 base period by computing the intercept terms such that base period values are generated for the endogenous variables if the exogenous variables are set to base period values.[2]

The country submodels include behavioral equations for area harvested, yield, production, domestic per capita consumption, and carry-out stocks. Acreage and yield equations for sugar beets and sugarcane are used to model the supply of sugar.[3] Sugar beet area and sugarcane area depend on expected prices of sugar and alternative crops. As a proxy variable for price expectations, lagged prices are included in the acreage equation. In addition to commodity prices, the acreage equations include lagged acreage and a trend variable. In the European Union, the acreage equation also includes a policy parameter, the lagged sugar quota.

Total cane or beet production is the product of area harvested and yield, and sugar

production is assumed to be proportional to the amount of cane and beet produced. While sugar beet and sugarcane yields depend on lagged yields and a time trend, the sugar extraction rates are exogenous variables.

Sugar demand comprises demand for domestic consumption, carry-out stocks, and net exports. The model specifies behavioral equations for domestic per capita sugar consumption and for carry-out stocks, while net exports are the difference between domestic sugar supply and demand. Per capita sugar demand is a function of the sugar price, income, and a time trend. Carry-out stocks are a function of carry-in stocks, domestic consumption, and sugar price.

If available, domestic sugar beet, sugarcane, and sugar wholesale prices were used to estimate the behavioral equations. World market prices are converted into domestic currency using the official exchange rate, and domestic wholesale prices are linked to the world market price with a price linkage equation that includes specific and ad valorem tariffs (subsidies) for the simulation of alternative trade policies. All prices are converted to real prices using the GDP deflator. For some countries, such as Cuba and the former Soviet Union, nominal U.S. dollar prices are used rather than real prices in domestic currency.

The model is solved by finding an equilibrium price such that total demand equals total supply, i.e., the sum of world net exports equals zero.

Data

The IMF's *International Financial Statistics CD-ROM* provides historical data for macroeconomic variables, such as real GDP, GDP deflator, and exchange rate, while WEFA supplies projected growth rates over the next decade for these variables. FAO's *FAOSTAT*

database, USDA's *PS&D View* database, F.O. Licht's *World Sugar Statistics*, and ISO's *Sugar Year Book* are the sources for historical data on sugar supply, utilization, and prices. Various USDA and E.U. publications were used to obtain historical data for substitute crops (e.g. cotton and wheat) and products (e.g. HFCS) and information on sugar policies in various countries. The *FAPRI 1997 International Agricultural Outlook* and the *FAPRI 1997 U.S. Agricultural Outlook* supplied the baseline projections for substitute crops and products[4].

Tariff Rate Quota

The United States uses a tariff rate quota to limit imports and protect domestic sugar producers. With such a regime, the tariff applied to imports depends on the quantity imported. Up to a certain level of imports, a low tariff is applied. Once this quota is filled, imports are subject to a higher tariff rate.

Figure 1 illustrates the mechanics of the tariff rate quota. The horizontal line P_W indicates the world market price for sugar. World market supply is assumed to be perfectly price elastic. The U.S. tariff on sugar imports equals T_L if imports are smaller than the quota quantity Q_M^0, but it is T_U if imports exceed Q_M^0. Thus, U.S. importers face a discontinuous supply curve with a discrete jump of the import price at the import quantity Q_M^0. The U.S. import price is $P_L = P_W + T_L$ if imports are smaller than Q_M^0, but it is $P_U = P_W + T_U$ if imports are greater than Q_M^0.

The downward sloping line MM is the U.S. import demand function for sugar. The demand function intersects the supply function at Q_M^0, i.e., the point where the tariff jumps from

T_L to T_U. Thus, the U.S. imports Q_M^0 units of sugar at the price P_D^0. The U.S. import price is P_D^0 is greater than the world market price P_W, and exporting countries earn a quota rent equal to $Q_m^0 \, (P_D^0 \, - \, P_L)$.

The tariff rate quota may be liberalized either by reducing the tariff T_U or by increasing the quota quantity Q_M^0 that is subject to the low tariff T_L. First, consider an increase in the quantity that can be imported at the low tariff. A quota increase by ΔTRQ increases U.S. imports from Q_M^0 to Q_M^1, while it decreases the U.S. import price from P_D^0 to P_D^1. The quota rent of exporting countries decreases by $Q_M^0 \, (P_D^0 \, - \, P_D^1)$, and it increases by $(Q_M^1 \, - \, Q_M^0)(P_D^1 \, - \, P_L)$.

Next, consider a reduction in the above quota tariff. A tariff decrease by ΔT increases U.S. imports from Q_M^0 to Q_M^1, while it decreases the U.S. import price from P_D^0 to P_D^1. The quota rent of exporting countries decreases by $Q_M^0 \, (P_D^0 \, - \, P_D^1)$, and it increases by $(Q_M^1 \, - \, Q_M^0)(P_D^1 \, - \, P_L)$.

Thus, a ΔTRQ quota increase and a ΔT tariff decrease can have similar effects. In both cases, the net change of the quota rent depends on which of the effects dominates, the $Q_M^0 \, (P_D^0 \, - \, P_D^1)$ decrease or the $(Q_M^1 \, - \, Q_M^0)(P_D^1 \, - \, P_L)$ increase. In turn, this depends on the slope of the import demand function.

Since the U.S. price falls, U.S. sugar producers are worse off, while U.S. consumers gain if the quota increases or the tariff decreases. In figure 1, world market supply to the U.S. is assumed to be perfectly price elastic, there is no change in the world market price. This “small country” assumption simplifies the graphical analysis, but it may not reflect the actual situation. If

it is relaxed, increased exports to the U.S. are likely to raise the world market price of sugar P_W . Thus, in the rest of the world, producer's welfare increases, while consumer's welfare decreases.

Baseline Solution

The baseline solution for the period from 1996/67 to 2006/07 uses WEFA and FAPRI projections for the exogenous variables. In the Uruguay Round of GATT negotiations, the U.S. agreed to import 1.256 million short tons of sugar under a low duty. However, the Secretary of Agriculture has authority to increase the amount of sugar that can be imported at the low duty. For instance, in 1994/95, the quota was increased and the U.S. imported 2.25 million short tons of quota sugar. The current tariff rate quota allocation for the 1996/97 fiscal year is 1.9 million short tons. However, additional quota quantities will be allocated during the year if the stocks-to-use ratio remains below or equal to 15.5 percent (Johnson). Lord provides U.S. sugar tariff projections for the simulation period, and we assume for the baseline scenario that the sugar import quota increases annually by 2.0 percent during the simulation period.

In the baseline simulation, the Caribbean raw sugar price increases from 10.7 cents/lb. in 1996/97 to 14.6 cents/lb. in 2006/07. The U.S. import price remains throughout this period at about 25 cents/lb. Due to the annual 2 percent increase in the sugar import quota, U.S. sugar imports are projected to reach 3,182 thousand short tons in 2006/07. Compared to 1995/96, when the U.S. imported 2,860 thousand short tons, this is only a modest increase. However, this figure appears to be rather high relative to typical U.S. imports before 1995. During the simulation period, U.S. sugar consumption is projected to increase. However, this increase is caused only by population growth. Per capita sugar consumption is projected to decline slightly,

but remains above 71 lbs. in 2006/07.

Total world production increases by 17 percent from 1996/97 to 2006/07. Most of the increase in world sugar consumption is due to population growth. Per capita sugar consumption increases only by 0.38 kilograms.

Annual 10 Percent Quota Increase

This scenario increases the import quota annually by 10 percent rather than the modest 2 percent increase in the baseline projection. As a result U.S. import prices decrease by 16.3 percent and U.S. sugar imports increase by 32 percent. The quota is binding only until 2002/03. In subsequent years, U.S. imports are smaller than the quota and the U.S. import price equals the Caribbean raw sugar price. Over the simulation period, U.S. per capita consumption of sugar increases by 4.7 percent.

In response to the decrease in price U.S. producers reduce sugar production by 2.7 percent. Beet sugar production declines by 4.4 percent, while cane sugar production declines by 0.6 percent. This result is due to the fact that, in our model, beet acreage is more price elastic than cane acreage. Thus, the fall in sugar beet and sugarcane prices causes a greater decline in beet acreage than in cane acreage.

The effect of increased sugar imports on the world market is small. The Caribbean raw sugar price increases by 1.4 percent, while world production and consumption change by less than 0.1 percent. Exporting countries with U.S. quota allocations are worse off because their quota rent decreases by 12.4 percent.

Reduction of the Above Quota Tariff by 5 cents

A 5 cent reduction of the above quota tariff reduces the U.S. import price by 3.4 percent and increases U.S. imports by 7.7 percent. With this regime the above quota tariff is not high enough to constrain imports to the quota level and throughout the simulation period imports are subject to the above quota tariff.

The reduction in the tariff rate by 5 cents increase U.S. per capita consumption by 1.1 percent. Sugar production falls by 0.8 percent, with beet sugar production declining by 1.2 percent and cane sugar production declining by 0.2 percent.

The impact on the world market is negligible. The Caribbean raw sugar price rises by 0.3 percent. World sugar production and consumption change by less than 0.01 percent. Quota rents of exporting countries with U.S. quota allocations decrease by 0.002 percent.

Elimination of all Tariffs and Quotas in 2003/04

Not surprisingly, eliminating all tariffs and import restrictions in has a significant impact on sugar imports and import prices. From 2003/04 to 2006/07, net imports increase by 67.4 percent, while import prices decline by 42.7 percent. The decline in prices increases U.S. sugar consumption with per capita consumption increasing by 8.8 pounds (12.2 percent).

Despite the steep decline in U.S. sugar prices, U.S. sugar production declines only by 5.9 percent. Sugar beet acreage declines by 9.0 percent, while cane acreage declines by 1.2 percent.

While the elimination of import constraints has a significant impact on the U.S. sugar economy, the effect on the world market is rather small. The Caribbean raw sugar price increases only by 3.1 percent and world production and consumption of sugar change by less than 0.1 percent. Quota rents of exporting countries decrease by 100 percent.

Summary and Conclusion

Liberalizing the U.S. import regime for sugar will have a significant impact on the U.S. sugar economy. Prices are likely to decline dramatically, and imports will capture an increased share of the U.S. market. Per capita consumption of sugar will increase, suggesting that competing sweeteners may lose some market share.

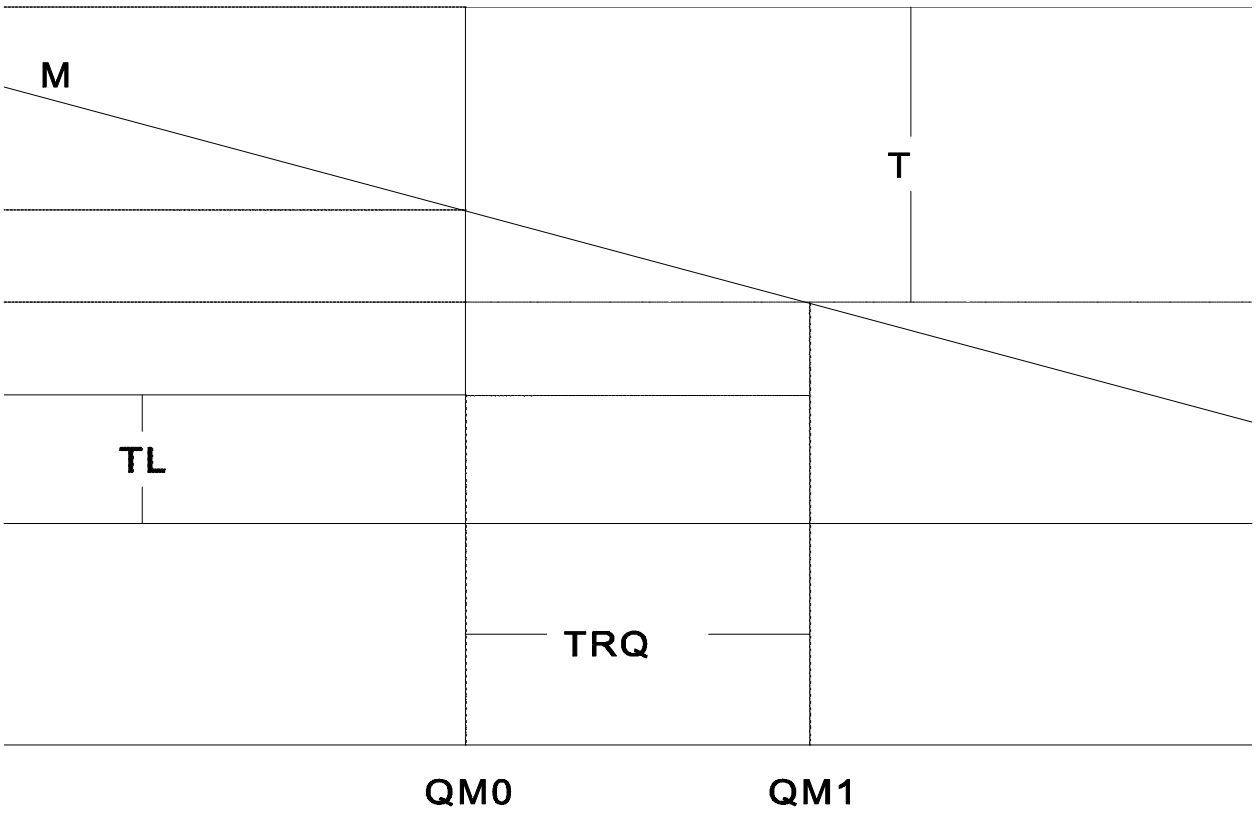
The decline in U.S. sugar production in response to trade liberalization will be modest, and beet production declines more than cane production. This result is driven by the relatively low price elasticities of beet and cane acreage, with beet acreage being more responsive to price changes than cane acreage. Since the elasticities were estimated using historical data, this result must be taken with a grain of salt. The U.S. sugar industry enjoyed considerable levels of protection and the estimated elasticities may be biased toward zero because of this.

However, one can find arguments for a slow decline in sugar production. Many existing processing plants are likely to be able to cover the variable costs of production even at reduced price levels. Perhaps more importantly, falling prices may not have much impact on the relative profitability of crops within regions since the cost of producing sugar crops is likely to fall.

Farmers can produce sugar crops only if they can deliver to a processing plant. Currently, these delivery rights have a high value because sugar prices are high. However, one can view these delivery rights as a factor of production. Falling sugar prices will reduce the value of these rights and thus the cost of production. Therefore, the relative profitability of different crops within regions may not change significantly, and farmers may keep producing sugar even if sugar trade is liberalized.

Footnotes

Figure 1: Tariff Rate Quota



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1. See xxxxxxxxxx et al. for a detailed description of the simulation model and the parameter estimates.

2. In some equations, intercept terms and trend coefficients were adjusted to obtain a more reasonable baseline solution. For instance, Cuba's sugar production is now much lower than it was during the 1990/91 to 1992/93 base period. Thus, we adjusted the intercept terms in the Cuban acreage and yield equations to reflect this change.

3. In some countries, sugarcane acreage and sugar production are not closely related because a significant proportion of the sugarcane harvested is used for purposes other than centrifugal sugar production. For instance, in Brazil, substantial amounts of sugarcane are

used to produce ethanol. Similarly, India consumes substantial amounts of non-centrifugal sugar. For these countries, sugar production is a function of lagged sugar production, lagged sugar price, and a time trend.

4. These FAPRI reports will be published in 1997. In this study we use the preliminary projections of the 1997 baseline meltdown meeting, November 17-22, 1996, in Ames, Iowa.