Conceptual Overview of the U.S. Sugar Baseline: Incorporating the Effects of the North American Free Trade Agreement

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Abstract: The U.S. Department of Agriculture (USDA) releases its U.S. sugar baseline projections at the Agricultural Outlook Forum in February. This article presents a conceptual overview of a new approach for making U.S. sugar projections. The new approach is necessary because it is now recognized that price-sensitive Mexican imports are and will be very important sources for sugar in the U.S. market. The price-sensitive imports are the high-tier tariff imports through fiscal year 2007 and the unconstrained duty-free imports thereafter. Their importance is heightened because of the minimum access level of the U.S. sugar tariff-rate quota (TRQ) that is part of the trading rules of the World Trade Organization. The minimum access requirement restricts the USDA's ability to offset the effects of the high-tier tariff imports. Additionally, restrictions on the USDA to respond begin in the early stages of the baseline period because of projected record U.S. sugar production levels that drive the sugar TRQ to the minimum access level.

Keywords: baseline, economic model, NAFTA, side letter agreement to NAFTA, sugar.

The U.S. Department of Agriculture (USDA) releases its U.S. sugar baseline projections at the Agricultural Outlook Forum in February. A central feature of the new baseline is that price-sensitive Mexican imports are very important in determining the course of U.S. sugar baseline projections. Their importance is heightened because the USDA is likely to be very constrained in its ability to limit sugar tariff-rate quota (TRQ) imports because of U.S. World Trade Organization (WTO) minimum access commitments, coupled with projected rising U.S. sugar production.

The purpose of this article is to discuss the conceptual underpinnings of the new USDA approach to making sugar baseline projections. Most of the analysis relies on graphical tools to emphasize an intuitive understanding of the theoretical underpinnings. The key to the analysis is the market for price-sensitive Mexican sugar in the United States. Implicit is the ability to project Mexican export potential and emphasize the factors that determine the destination of the exports. How the United States is affected must be addressed to provide policymakers an accurate basis for developing policy options.

Factors Affecting the U.S. Sugar Baseline

In recent years production and deliveries projections for the baseline have been made independently of each other. USDA would contact individuals familiar with sugar developments in both production and consumption who could add to the Department's established base of technical expertise in making projections. After production and deliveries projections were developed, the level of the sugar tariff-rate quota was specified such that the ending stocks projection was at a level consistent with USDA's target for the ending stocks-to-use ratio. In recent years this target has been 14.5 percent, a level deemed consistent with the Department's charge to make sure adequate sugar supplies are available to the U.S. public.

The USDA approach to making baseline projections must now change. Three factors are combining to force a new approach. First, U.S. production is increasing to record levels. In the November 1999 World Agricultural Supply and Demand Estimates (WASDE) report, U.S. sugar production for fiscal year (FY) 2000 is projected at 8.905 million short tons, raw value (STRV). This level is 646,000 STRV, or 7.8 percent, higher than the projected level published in the February 1999 baseline for FY 2000 (table A-1). The second factor is the combined minimum level of the raw and refined sugar TRQs (1.256 million STRV) that the United States agreed to maintain as a result of the Uruguay Round Agreement (URA), now part of the trading rules administered by the WTO. The November 1999 WASDE shows the allocated portion of the FY 2000 sugar TRQ, less anticipated shortfall, at 1.252 million STRV, a level very close to the WTO minimum. Although the sugar TRQ minimum has

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Table A-1--Comparison of FY 2000 U.S. sugar projections from February 1999 Baseline and November 1999 WASDE 1/

Item	Units	Baseline	November 1999 WASDE	Difference
Sugarbeets planted	1,000 acres	1,506	1,560	54
Harvested	1,000 acres	1,476	1,525	49
Yield	Tons/acre	20	22	2
Production	Mil. short tons	30	33	3
Sugarcane harvested	1,000 acres	910	951	41
Yield	Tons/acre	34	38	3
Production	Mil. short tons	31	36	5
Supply:				
Beginning stocks	1,000 short tons	1,700	1,638	-62
Production	1,000 short tons	8,259	8,905	646
Beet sugar	1,000 short tons	4,424	4,650	226
Cane sugar	1,000 short tons	3,836	4,255	419
Total imports	1,000 short tons	1,899	1,720	-180
TRQ	1,000 short tons	1,449	1,225	-224
Other imports	1,000 short tons	450	490	40
Total supply	1,000 short tons	11,858	12,262	404
Use:				
Domestic disappearance	1,000 short tons	10,182	10,250	68
Exports	1,000 short tons	175	175	0
Miscellaneous	1,000 short tons	0	0	0
Total use	1,000 short tons	10,357	10,425	68
Ending stocks	1,000 short tons	1,502	1,837	336
Stock/Use ratio	Percent	14.50	17.63	3.13

1/ WASDE = World Agricultural Supply and Demand Estimates Report.

been factored into past baseline projection exercises, it is the first time that it has been projected as early as November of the fiscal year that only the minimum amount would likely be allocated. Therefore, rising production coupled with the WTO minimum access make it impossible for the USDA to project an ending stocks-to-use ratio close to 14.5 percent.

Ending stocks are 336,000 STRV higher than projected in the February 1999 baseline. Also, in FY 2001, duty-free imports from Mexico permitted under terms of the side letter agreement to the North American Free Trade Agreement (NAFTA) will increase from 25,000 metric tons, raw value (MTRV) to as much as 250,000 MTRV, further adding to total supply.[2] Unless production adjusts downward dramatically, the 14.5 percent target for ending stocks-to-use ratios will be even harder to reach in FY 2001 and the next few fiscal years. Increasing stocks would imply the lowering of sugar prices, suggesting that the baseline must be designed to deal with price-induced supply reductions and the possibility of forfeitures to the USDA for non-recourse loans made under terms of section 156 of the Federal Agriculture Improvement and Reform Act of 1996 (1996 Farm Act).

[2]Under the terms of the side letter agreement, Mexico will have duty-free access to the U.S. market from FY 2001 to FY 2007 for the amount of its net production surplus, up to a maximum of 250,000 MTRV. The net production surplus is equal to Mexican sugar production less Mexican consumption of sugar and high fructose corn syrup. In FY 2008, Mexico will have duty-free access with no quantitative restrictions.

The third factor forcing a new approach to making sugar baseline projections is the declining NAFTA high-tier tariff schedule for sugar imports from Mexico. For FY 2000, the raw sugar tariff is 12.09 cents a pound, and the refined sugar tariff is 12.81 cents a pound. The raw sugar tariff drops about 1.5 cents each year, and the refined sugar tariff drops about 1.6 cents a year. Both rates reach zero in FY 2008.

The high-tier tariff constitutes an element in the definition of a threshold pricing level important for determining whether it is advantageous for Mexico to ship sugar into the U.S. market. The threshold is equal to the sum of the world price of sugar, the high-tier NAFTA tariff rate, unit marketing costs, plus any marketing premium deemed desirable by the Mexican Government. The economic incentive for Mexico to export high-tier tariff sugar exists if the pricing threshold is less than or equal to a comparable U.S. sugar price. Given the declining tariff schedule, high-tier tariff imports further threaten the USDA's ability to target particular levels of ending stocks-to-use ratios in creation of long term forecasts.

U.S. Sugar Supply

The components of U.S. sugar supply are: (1) beginning stocks held by cane processors, cane refiners, and beet processors; (2) U.S. cane and beet sugar production; (3) the raw and refined sugar TRQ whose minimum allocation levels have been bound in the WTO; (4) duty-free sugar from Mexico whose maximum levels have been bound by the side

letter agreement to the NAFTA through FY 2007; (5) imports of sugar syrups entering under HTS 1702.90.4000 from which the sugar is extracted; (6) high-tier tariff sugar; and (7) sugar imports entering under the Refined Sugar and Sugar-Containing Products Re-export Programs, and under the Polyhydric Alcohol Program.

Figure A-1 isolates several supply components important for analysis. The U.S. price of sugar is measured on the vertical axis, and sugar quantity on the horizontal. Production represents the largest source of U.S. sugar supply. It is shown as the right-most curve in the left panel. Except in the low price range, the production curve is drawn as very inelastic, reflecting that most production decisions are made prior to the marketing year on the basis of expected prices rather than actual prices. The upward shape of the production curve the in low price range allows for sugar prices that are sufficiently low such that producers' and/or processors' variable costs cannot be covered, and less sugar is produced through acreage abandonment or reduced factory activity.

The sugar TRQ and duty-free sugar from Mexico are shown as relatively inelastic curves defined above the world price. Sugar syrup imports from which the sugar is recovered are shown as a price elastic curve. Because the syrups are profitable to import only because of high domestic prices relative to world levels, the curve is defined only in the region of high domestic prices. Sugar entering under the Re-export and Polyhydric Programs are omitted because they do not consistently affect domestic U.S. prices. Stockholding activity is explained below.

The U.S. sugar supply curve is shown in the right panel as the horizontal summation of the individual curves in the left panel. Except at prices close to world levels, the supply curve is very inelastic, i.e., unresponsive in the short run to changes in same-period prices. The supply curve is redrawn in the left panel of figure A-2, simplifying somewhat the contour by emphasizing the price-inelastic nature above the world price. Added to the left panel in figure A-2 is a downward sloping demand curve. This curve represents the aggregation of sugar demand by end users, including food processors, beverage industries, non-food sugar users, and non-industrial users.

Stockholding activity is implicit in the diagrams. Differences between beginning and ending stocks represent dynamic adjustments to changes in supply-demand fundamentals and are difficult or confusing to portray in a static equilibrium framework. An accumulation of stocks can be thought of as

Figure A-1
Supply of sugar in the United States

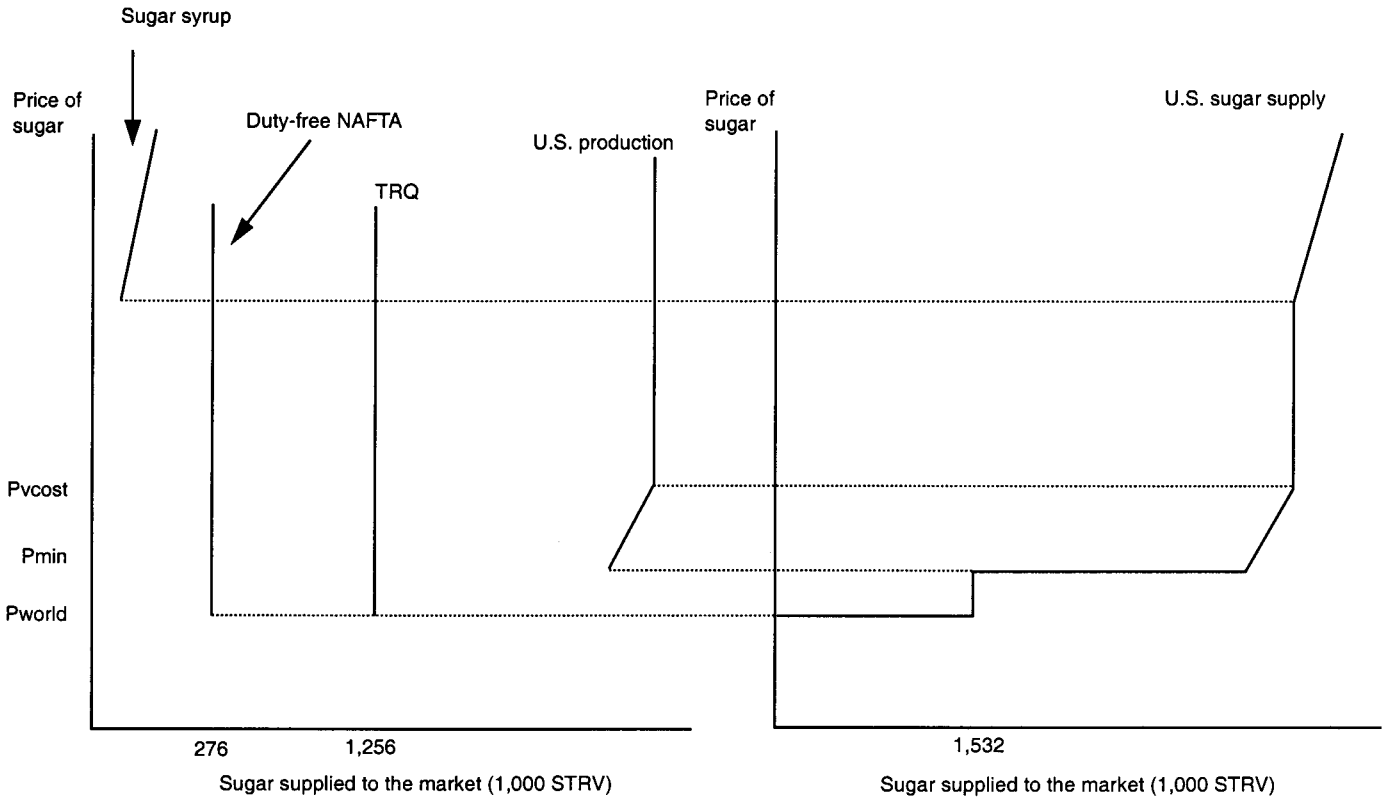
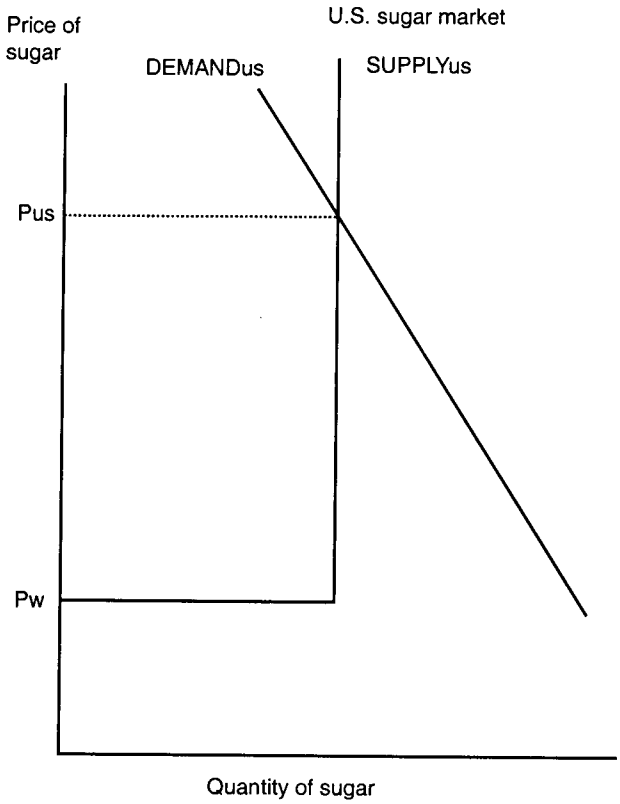
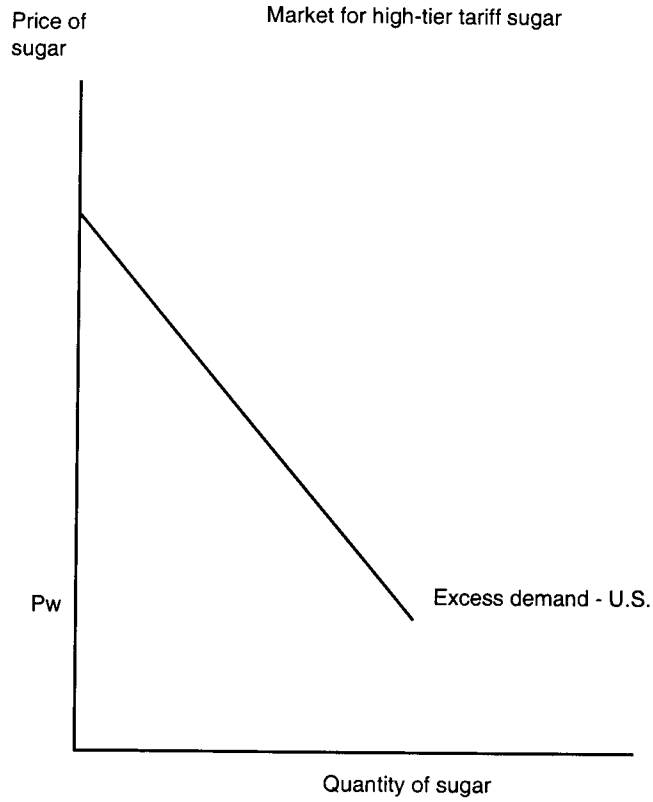


Figure A-2
U.S. market for sugar





an increase in the length of time that sugar remains in inventory before being sold and delivered. Because stockholding is an activity whose costs increase over the time of the holding, stock accumulation puts downward pressure on prices that help restore the supply-demand equilibrium.

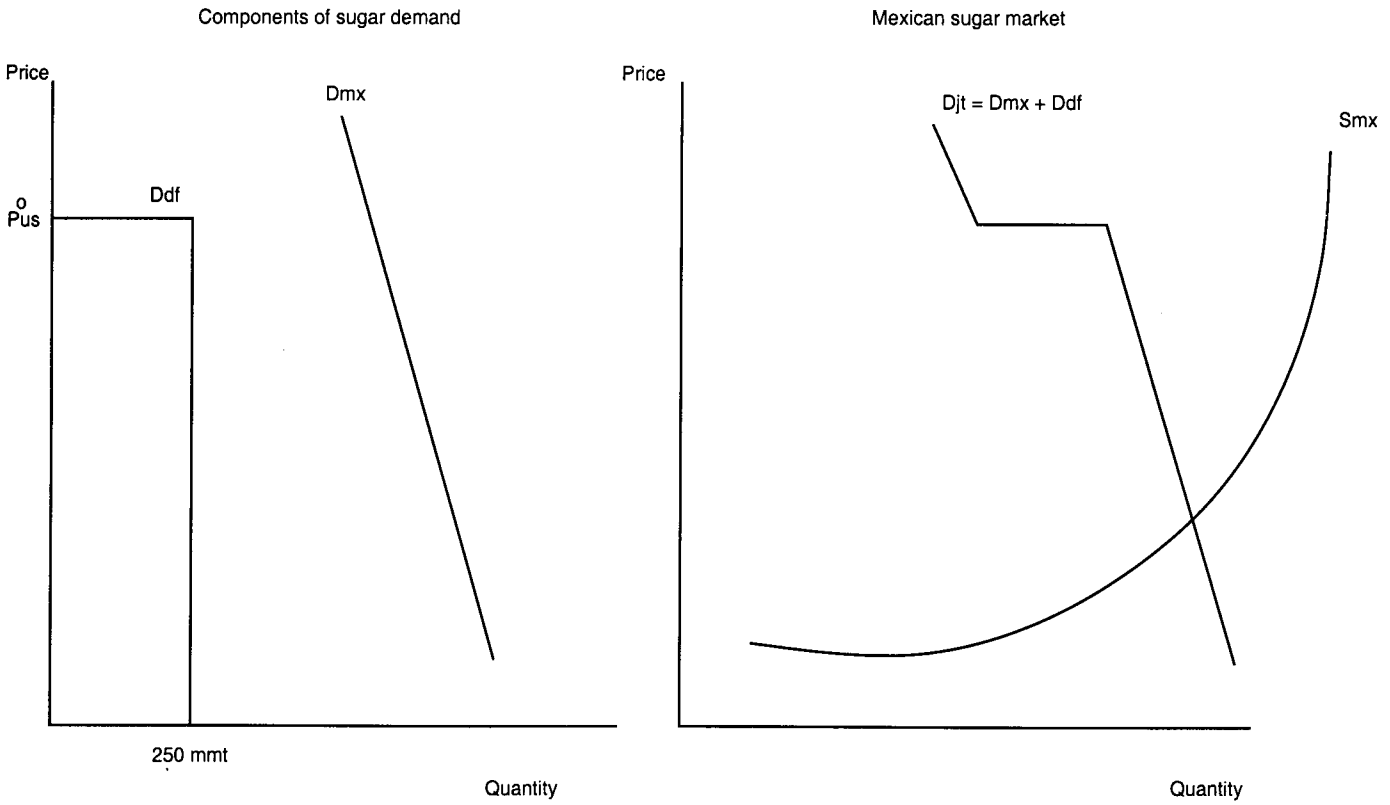
The demand for high-tier tariff imports is shown in the right panel of figure A-2. It is the excess of demand over supply at prices lower than the price associated with the intersection of the supply and demand curves in the left panel. Until recently it has been the case that high-tier tariffs have been set at prohibitively high levels so that any supply curve represented in the right panel would always lie above the U.S. excess demand curve for high-tier imports. Also, the positioning of the excess demand curve was directly manipulatable by the USDA. The size of the sugar TRQ could be adjusted to counteract supply changes emanating from production, duty-free NAFTA imports, sugar syrup imports, or unanticipated stock changes. Setting the sugar TRQ on the basis of attaining an ending stocks-to-use ratio of 14.5 percent was deemed sufficient to provide adequate U.S. sugar supplies. However, as explained above, large sugar production increases, along with the anticipated ten-fold increase in the duty-free NAFTA import allocation, has pushed the sugar TRQ to the WTO minimum, thus depriving the USDA of a crucial policy instrument.

The NAFTA specifies a high-tier tariff schedule that declines yearly until FY 2008 when duties on raw and refined sugar reach zero. In order to understand how high-tier tariff imports and unconstrained duty-free imports affect the U.S. sugar situation, it is necessary to develop a conceptual framework for sugar in Mexico.

Sugar in Mexico

The left panel of figure A-3 shows a representation of demand for Mexican sugar. It combines two elements. First is the domestic demand that Mexican end users have for sugar. The second element is the sugar eligible to enter the United States duty free under the terms of the side letter agreement to NAFTA. It is shown in the figure at 250,000 MTRV, which presumes that Mexico is a net surplus producer as defined in the side letter in excess of 250,000 MTRV. The two curves are jointed in the right panel (Djt), and an upward sloping Mexican sugar supply curve is included. The horizontal difference between the Mexican supply and demand curves defines excess supplies available for export if no trade distorting policies are used.

Figure A-3
Demand for sugar in Mexico

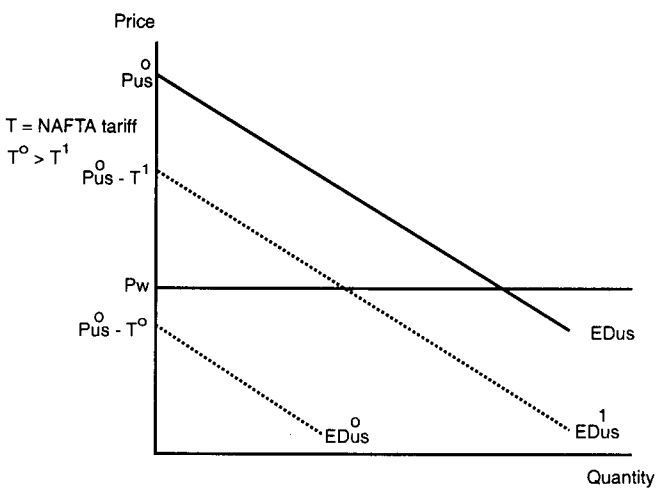


International demand for sugar from Mexico in figure A-4 is shown to come from the United States and the rest-of-the-world (ROW). The downward sloping curve (EDus) represents U.S. excess demand for high-tier tariff sugar that was derived in figure A-2. The alternative destination is the ROW at price Pw, drawn as a horizontal line reflecting that Mexico is a price-taker in the world market.

As drawn, EDus does not incorporate the high-tier tariff on Mexican sugar. T^O in the diagram represents an initially high tariff level whose vertical downward displacement from EDus is shown as $EDus^O$. (Marketing costs and price premiums are currently ignored for ease of exposition.) On this effective demand schedule, the world price is always higher than the net return to be gained by selling into the U.S. market. As the tariff becomes smaller (T^1), the EDus curve shifts upward by (T^1 - T^O) to $EDus^1$. The point where EDus1 intersects the Pw line is where Mexico is indifferent between selling into the U.S. or ROW markets. To the left of this intersection point, Mexico would ship only into the U.S. market. At points to the right, Mexico would ship into the United States and the ROW.

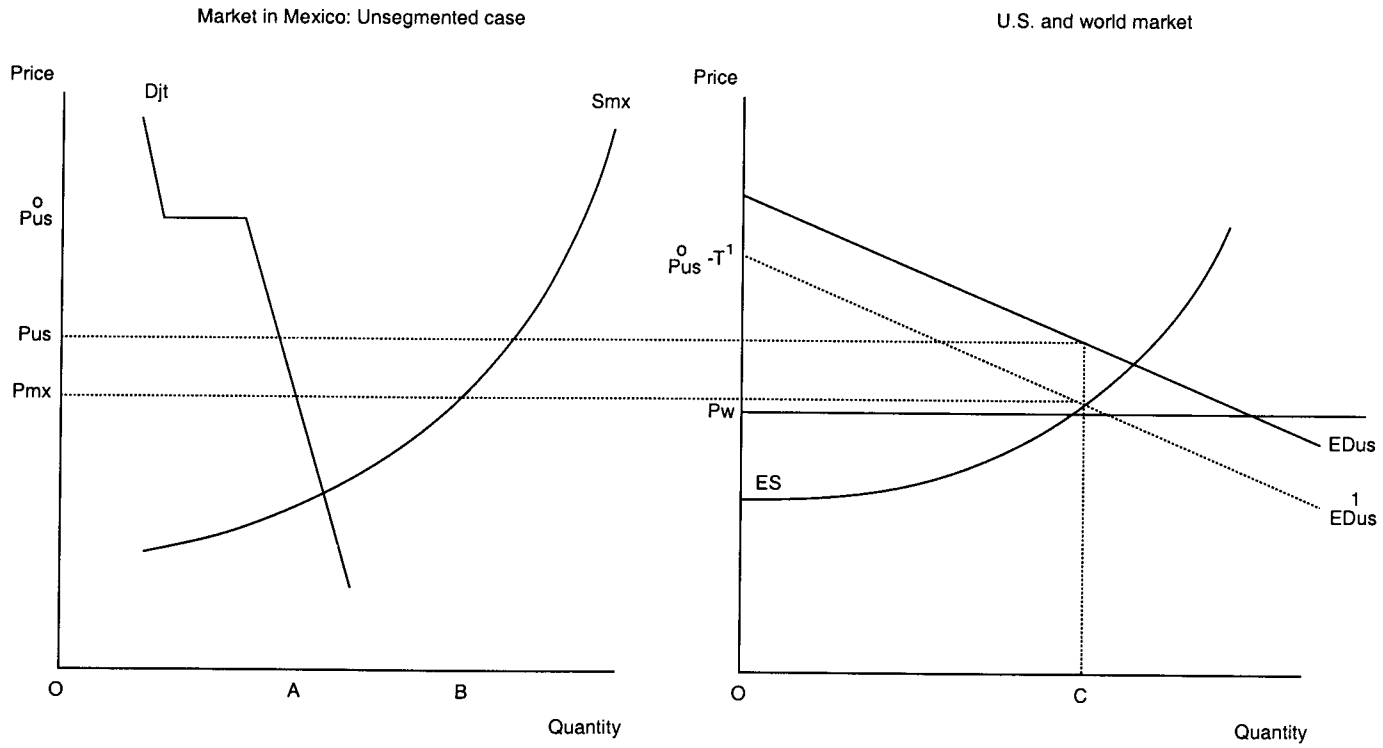
Figure A-5 joins the right panel of figure A-3 with figure A-4. This figure does not show any policy distortions in

Figure A-4
International demand for sugar from Mexico



Mexico - it serves as a reference standard to be compared with a more realistic depiction below. Exports to the United States occur where the Mexican excess supply curve (ES) intersects $EDus^1$. Total exports OC represented in the figure are shipped only into the U.S. market. The effective selling

Figure A-5
Market for sugar from Mexico



price in the United States (Pus) is the price sold in Mexico's domestic market (Pmx) plus the tariff T^1.

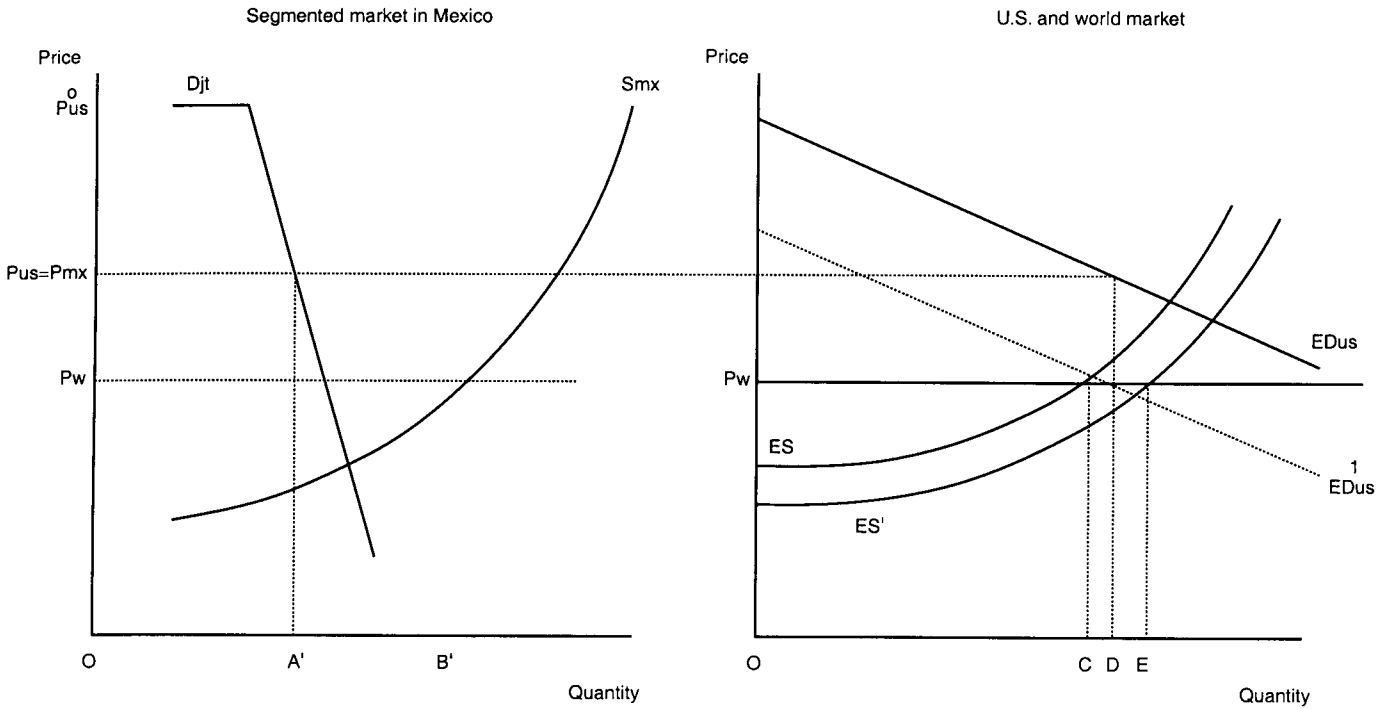
A more realistic representation must consider sugar policies that distort the internal Mexican supply and demand balance. First, Mexico maintains import policies that support domestic sugar prices. The Most Favored Nation (MFN) tariff rates bound in the WTO for all products under the 1701 tariff heading are decreasing only modestly, from U.S.$400 per mt (18.14 cents per pound) in 1995 to US$360 per mt (16.33 cents per pound) in 2004. Although Mexico has a minimum access commitment bound in the WTO, the category of items covered under the commitment is wider than sugar alone, thus permitting Mexico to have no imports of world-priced sugar. Additionally, under NAFTA, Mexico is required by FY 2000 to have in place a tariff-rate quota system with rates applied to third countries at the same levels as maintained by the United States. Therefore, Mexico, like the United States, is able to isolate its sugar industry from world market prices.

A second distortion arises from marketing quotas enforced by the Mexican Government. After a domestic consumption level has been targeted, the Mexican Government and the sugar industry agree on marketing quotas to be assigned to all individual sugar factories in the nation. Production above the amount allowed into the domestic market must be exported or held in stocks. Because the grower price of sugarcane is tied to the level of sugar prices in the domestic market, producers have an interest in seeing that processors adhere to the quota marketing scheme.

Figure A-6 shows the effect of domestic marketing quotas. A reduced quantity of sugar (OA' compared with OA in figure A-5) is consumed domestically at an increased price. The difference is shown as adding to exportable supplies by shifting the excess supply curve in the right panel from ES to ES'. Exports are increased from OC to OE, with OD being shipped into the U.S. market, and DE to the ROW. Additional exports to the United States imply a lower price in the U.S. market in order to absorb the additional sugar as compared with the level illustrated in figure A-5.

Implicit in the diagram are two policy parameters that could be used to maximize returns to the Mexican sugar industry. First, the level at which marketing quotas are set becomes a variable to obtain higher than competitive returns in the domestic market. Second, the Mexican Government can regulate the level of exports to the United States by finding a mechanism such as selectively issuing "certificates of origin" that are required for entry of sugar into the United States. Restricting exports can cause U.S. prices to be higher than otherwise and could conceivably become an instrument for extracting rents from U.S. consumers.

Figure A-6
Market for sugar from Mexico



Mexican Sugar in the United States

Apart from the sugar TRQ, U.S. imports of sugar sourced outside of Mexico are likely to be small or confined to specialty types. Whereas figures A-4 through A-6 have shown the international market from the perspective of Mexico, figure A-7 focuses on the U.S. perspective of the high-tier tariff sugar market. In the figure, Mexico's excess supply appears as perfectly elastic up to the point where its exportable supply is exhausted. At that point, the excess supply curve is perfectly inelastic. The elastic portion of the curve corresponds to the threshold price that is the sum of the world price, marketing costs, the NAFTA high-tier tariff, and the price premium desired by the Mexican Government.

Over time the excess supply curve exhibits downward movement as the NAFTA high-tier tariff decreases. The top curve ESo shows the tariff as sufficiently high to preclude high-tier tariff imports. The U.S. price Pus^o lies below $Pthr^o$ and is determined in the U.S. market where the demand and supply curves intersect.

The ES1 curve reflects a lower high-tier tariff and intersects the U.S. excess demand curve along its perfectly elastic range. This implies that Mexico ships to both the U.S. and ROW markets. The U.S. price Pus^1 is equal to the threshold price $Pthr^1$, which is lower than Pus^o. In this situation, the U.S. sugar price is directly linked to the world sugar price.

The ES2 curve shows the high-tier tariff at zero and for simplicity, assumes that marketing costs and the price premium are zero, implying that $Pthr^2 = Pw$. As shown, the U.S. price Pus^2 is higher than the world level because the U.S. excess demand curve intersects ES2 along its vertical or inelastic range. Mexico ships all exportable sugar into the U.S. market and does not have enough sugar to meet U.S. sugar demand at a U.S. price equal to $Pthr^2$. Because Mexico does not ship to the ROW, the world price linkage to both the Mexican and U.S. sugar markets is severed. Sugar pricing in the United States becomes a direct function of Mexican export potential. The larger is the potential, the lower is the U.S. price, with a lower constraint being the world price.

Mexican Sugar Export Potential

The primary conclusion of this article is that in order to project a U.S. sugar baseline, one has to project a Mexican sugar baseline as well. Due to NAFTA and the terms of the side letter agreement, the sugar and sweetener sectors of both countries are bounded together and the bond becomes stronger over time.

Table A-2 shows a hypothetical Mexican sugar baseline projection through 2011. It is calibrated on the USDA projection for Mexican sugar supply and disappearance in 2000 that was published in November 1999. It assumes a 1-percent yearly growth in acreage and assumes yearly productivity increases measured in terms of sugar per harvested hectare consistent with recent trends. Sweetener consump-

Figure A-7
Imports of high-tier tariff Mexican sugar into the United States

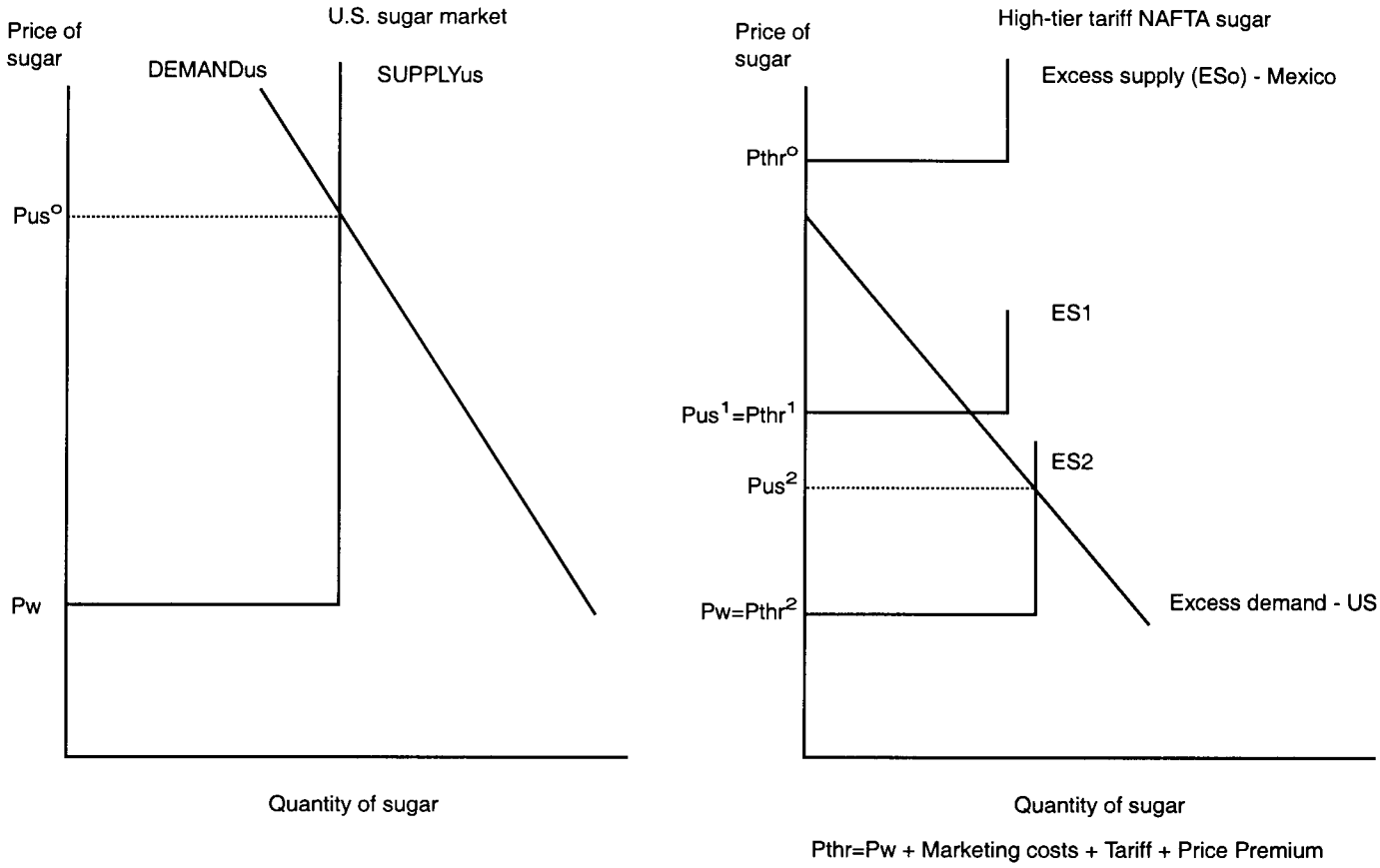


Table A-2--Mexican sugar: Projected supply and disappearance

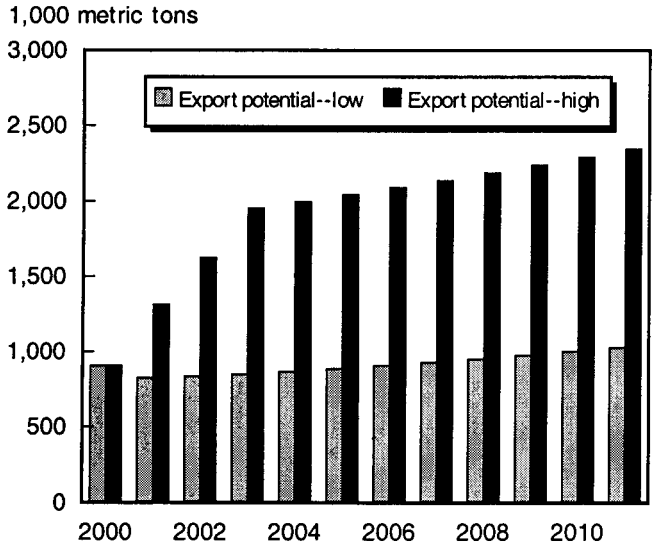
Items	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Beginning stocks	1,000 m. tons	844	744	752	770	788	807	826	845	864	884	903	924
Area	1,000 hectares	630	636	643	649	656	662	669	675	682	689	696	703
Sugar yield	M. ton/hectare	8	8	8	8	9	9	9	9	9	9	9	9
Sugar production	1,000 m. tons	5,200	5,258	5,383	5,510	5,639	5,770	5,903	6,038	6,175	6,315	6,456	6,600
Imports	1,000 m. tons	0	10	10	10	10	10	10	10	10	10	10	10
Supply	1,000 m. tons	6,044	6,012	6,145	6,290	6,437	6,587	6,738	6,893	7,049	7,208	7,370	7,534
Domestic demand	1,000 m. tons	4,400	4,402	4,506	4,615	4,725	4,836	4,947	5,059	5,171	5,285	5,399	5,515
Exports	1,000 m. tons	900	858	869	887	905	925	947	970	994	1,020	1,046	1,075
Ending stocks	1,000 m. tons	744	752	770	788	807	826	845	864	884	903	924	944
Stocks-to-use	Percent	14.0	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3

tion varies proportionally with population and real per capita income growth. It is assumed that consumption of high fructose corn syrup (HFCS) is constrained over the entire projection period to no more than 25 percent of sweetener demand by the Mexican soft drink industry and to no more than 20 percent of sweetener demand of the Mexican food processing industry.

Figure A-8 shows Mexican export potential from table A-2 and compares it with a case where Mexican HFCS consumption is assumed to be higher. Specifically, the alternative scenario assumes that the Mexican soft drink and food processing industries begin switching in 2001 a significant portion of their sweetener demand from sugar to HFCS. The transition period lasts 3 years, and by 2003 HFCS constitutes 75 percent of sweeteners used in soft drinks and 30 percent used in food processing. The reduction in demand increases Mexican export potential on a one-to-one basis. Export potential rapidly increases to over 2 million MTRV a year and is more than twice the level of the other scenario where HFCS consumption is less. Implications for U.S. sugar would be greater downward pricing pressure.

Figure A-8

Mexican sugar export potential



Source: Economic Research Service, USDA.

Other scenarios are possible. It may be the case that the Mexican sugar industry may not perform as well as assumed in table A-2. Garcia and others (1999) have argued that longer term prospects of the Mexican sugar industry are not as robust as those shown in table A-2. They assert that 14 sugar mills accounting for about 20 percent of Mexican production have a multiplicity of problems (low production capacities, low sugarcane yields, low recovery rates, etc.) that make them high-cost producers. Also, because much of the Mexican sugar industry is heavily indebted, many necessary capital improvements are unlikely to be made. Acreage associated with failed mills are unlikely to be able to be used to produce for other mills. Exportable supplies may only be between 124,000 and 904,000 MTRV.

Certainly more research on the Mexican sweetener sector is in order.

Conclusion

The U.S. sugar sector will face unprecedented challenges in the early 21st century. The USDA sugar baseline must reflect these challenges to policymakers, sugar program administrators, sugar consumers, and others interested in U.S. sugar. This article has surveyed the sourcing of the challenges and how construction of the sugar baseline has been modified.[3] The work is ongoing, implying conceptual frameworks should be flexible to account for new and possibly unforeseen problems. Future articles in the *Sugar and Sweetener Situation and Outlook* series will provide updates to this process.

References

Garcia, Luis R., Thomas H. Spreen, Gretchen Greene. "Structural Reform and Implications for Mexico's Sweetener Market," presentation made at the conference entitled *Sweetener Markets in the 21st Century*, organized by the Food and Resource Dept. (FRED) and Institute of Food and Agricultural Sciences (IFAS), both of the University of Florida, Gainesville, November 14-16, 1999, Miami, Fl.

[3]The U.S. sugar baseline will be released as part of *USDA Agricultural Baseline Projections to 2009* on February 24, 2000.