United States Department of Agriculture

SSS-237-01

September 2003

Outlook

Electronic Outlook Report from the Economic Research Service

www.ers.usda.gov

Measuring the Effect of Imports of Sugar-Containing Products on U.S. Sugar Deliveries

Stephen Haley[1]

Abstract

After experiencing strong and steady growth during the 1990s, U.S. demand for sugar has stagnated since 1999. Although there have been no comprehensive explanations for the decline in sugar and overall sweetener consumption, one hypothesis is that sugars contained in imported products have increased sufficiently to negatively affect domestic sugar deliveries. This paper develops and tests this hypothesis by answering three questions. First, what have been the trends in domestic sugar deliveries? Second, how much sugar has entered the United States in imported products, and how much has left in exported products? Third, how have increases in imported sugar-containing products affected deliveries to industrial endusers? Regression analysis strongly supports the hypothesis that imports of sugar-containing products have been an important factor explaining reduced sugar deliveries to all industrial endusers except for baking and cereal manufacturers. Nonetheless, imports of sugar-containing products do not explain the precipitous drop-off in industrial sugar deliveries starting in 2000. More satisfactory explanations may include reduced activity in the U.S. economy and a drop-off in demand for baked goods and cereal products attributable to other factors.

Keywords: Sugar, sugar-containing products, imports, sugar deliveries.

Acknowledgments

The author gratefully acknowledges the reviews of Joy Harwood and Daniel Pick of the Economic Research Service, USDA; John Love of USDA's World Agricultural Outlook Board; Devry Boughner of the Office of the U.S. Trade Representative; Carol Goodloe of USDA's Office of the Chief Economist; Barbara Fecso of USDA's Farm Service Agency; and Ron Lord of USDA's Foreign Agricultural Service. Excellent support was provided by the editor, Martha Evans, and the designer, Wynnice Pointer-Napper.

[1]Haley is an agricultural economist with the Market and Trade Economics Division of the Economic Research Service, USDA.

Trends in Domestic Sugar Deliveries

After experiencing strong and steady growth during the 1990s, U.S. demand for sugar has stagnated since 1999. Sugar deliveries for domestic food and beverage use for 2000 were estimated at 9.977 million short tons, raw value (STRV), representing no growth from 1999 (9.996 million STRV). Deliveries for 2001 were estimated at 9.913 million STRV and 9.818 million STRV for 2002. The 2002 deliveries are 1.8 percent less than those for 1999.

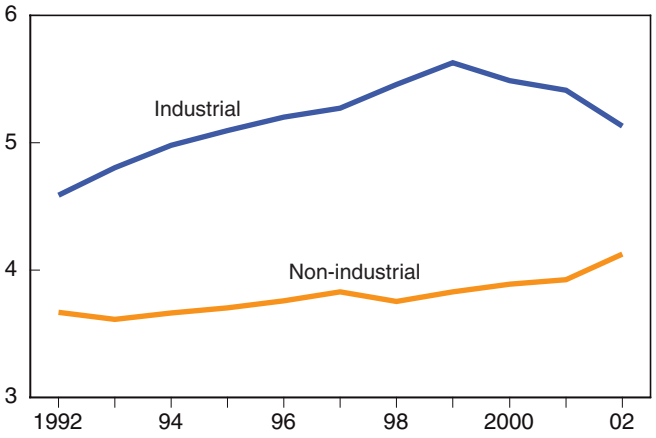
Figure 1 shows sugar deliveries to industrial and non-industrial users since 1992. Yearly growth from 1992 to 1999 averaged 134,000 tons for industrial endusers and 31,000 tons for non-industrial endusers. Although growth for non-industrial deliveries has continued since 1999, it has fallen off for industrial users—it decreased by 140,000 tons in 2000; 77,000 tons in 2001; and 281,000 tons in 2002. Comparing 2002 with 2001, deliveries are down substantially for the largest three industrial enduse sectors: bakery and cereal—9.0 percent; confectionery industry—7.2 percent; and the multiple-use category—8.9 percent.

There have been no comprehensive explanations for the decline in sugar and overall sweetener consumption. The decline coincided with a drop in U.S. economic activity, suggesting that aggregate disposable income and sweetener consumption may be related. Since 1999, consumption of flour-based products has been lower as well. Per capita sweetener deliveries increased by 18.4 pounds from 1991 to 1999, in part reflecting a switch from foods high in fat content to foods higher in carbohydrates (including sugar). The decline since 1999, modest in relation to the growth since 1991 (3.9 pounds or 21.2 percent), may be reflective of a reassessment of dietary habits.

Another explanation is that sugars contained in imported products have increased sufficiently to negatively affect domestic sugar deliveries. A simple motivation is that sugar is often less expensive outside the United States because the U.S. sugar program has the effect of pricing domestic and imported sugar above world levels. Some products containing sugar are manufactured outside the United States and then brought into the United States subject to tariff classifications that may not take account of the sugar contained in them (see appendix tables 1-4 for duty rates on certain sugar-containing products). Effectively, more sugar enters the United States than explicitly allowed under the U.S. raw and refined sugar tariff-rate quotas.

Figure 1
U.S. sugar deliveries to industrial and non-industrial endusers

Mil. short tons



Source: Economic Research Service, USDA.

Although the issue of sugar in imported products has been around for years, it is more of a concern now because these imports directly affect domestic sugar producers and processors. Prior to 2000, whenever there was a threat of excess sugar supply, the quantity of imports could usually be limited by adjusting the sugar tariff-rate quota downward. However, the United States bound itself under the terms of the Uruguay Round Agreement on Agriculture (URAA) to make available a minimum level of sugar imports equaling 1.256 million STRV. By fiscal year (FY) 1999, sugar imports were being allocated close to minimum access levels. In addition, under the North American Free Trade Agreement (NAFTA), Mexico was given additional access above the total agreed to under the terms of the URAA, up to a maximum of 276,000 STRV a year starting in FY 2001. All this implies that excess sugar supply in the U.S. market cannot be directly or easily rebalanced by reducing imports. The effect will be felt through lower prices that could lead to forfeitures under the U.S. sugar loan program or reduced marketing allotments as set out in the 2002 Farm Act.

Estimated Sugar Contained in Imported Products

Sugar enters (and exits) the United States in a large number of products. There is no exact agreement as to which products contain sugar and the amount of sugar contained in individual products. Studies like those of the U.S. International Trade Commission (USITC), (1993) and Gray and Lord (1989) relied, at least partially, on survey data from manufacturers. While these studies published partial listings of sugar contained in certain imported products, they have not been extensively updated. In addition, product codes have changed or new ones have been introduced, as in the U.S. Harmonized Tariff Schedule (HTS).

This study gathered a listing of products organized by HTS codes that is used by U.S. Department of Agriculture's (USDA's) Foreign Agricultural Service (FAS) in tracking products that contain sugar. In this study, sugar content is estimated by multiplying quarterly product imports from the U.S. Census Bureau starting in the first quarter of 1992 by sugar-content coefficients corresponding to the HTS codes under which the imports (or exports) are classified. Coefficient ranges are reported in appendix table 1 for sugar confectionery (HTS chapter 17.04), appendix table 2 for cocoa and cocoa preparations (HTS chapter 18), appendix table 3 for cereal preparations and bakers' wares (HTS chapter 19), and appendix table 4 for miscellaneous edible preparations (HTS chapter 21). Coefficient ranges are estimates based on examination of prior studies (i.e., Gray and Lord and USITC, mentioned previously), and on article descriptions in the Harmonized Tariff Schedule of the United States (2002). Although the true value of a particular coefficient is unknown, it is assumed to lie between the lower and upper ranges reported in the appendix tables.

In this study, two sets of sugar content are estimated. The first is stochastic, meaning that it is derived from underlying estimates of parameters. It is called the base series. It is derived by generating a 1,000-fold set of sugar estimates in individual products, based on a randomized selection of coefficient values distributed uniformly between the reported lower and upper ranges (described above), multiplied by quarterly imports of products. Quarterly averages for each product grouping (i.e., sugar confectionery, cocoa preparations, cereal preparations and bakers' wares, miscellaneous edible products, and the total) are calculated. The second series is deterministic (meaning that it is derived from a parameter that is assumed to be known). The second series is intended to provide a lower-end limit on the amount of sugar in the products, and as such, uses the lower value of the product coefficients in the appendix tables for determining the amount of sugar contained in the products.

Table 1 shows the estimated ranges of sugar contained in imported products on an annual basis from 1992 through 2002. Yearly base series values average about 30 percent higher than the lower-limit series. There is not much evidence of growth in either series between 1992 and 1994. Significant growth starts after 1994 and

Table 1—Estimated ranges of sugar in certain imported sugar-containing products

Year	Sugar confectionery (HTS chapter 17.04)		Cocoa preparations (HTS chapter 18)		Cereal preparations and bakers' wares (HTS chapter 19)		Miscellaneous edible preparations (HTS chapter 21)		Total	
	Base	Lower-limit	Base	Lower-limit	Base	Lower-limit	Base	Lower-limit	Base	Lower-limit
					Short tons					
1992	123,149	105,694	30,219	24,176	4,781	3,214	44,326	24,498	202,475	157,581
1993	115,476	99,117	29,474	23,607	5,797	3,885	44,897	25,052	195,644	151,661
1994	128,408	110,213	32,552	26,719	9,139	6,097	27,041	20,058	197,140	163,087
1995	156,002	133,876	39,773	26,278	21,573	12,836	69,863	41,334	287,211	214,324
1996	167,587	143,502	47,734	31,741	30,548	18,669	59,933	37,609	305,801	231,521
1997	182,149	155,958	58,999	39,543	42,619	27,570	65,329	39,006	349,096	262,076
1998	204,545	175,909	61,762	41,756	55,351	36,141	85,720	56,455	407,378	310,260
1999	239,685	206,213	69,088	47,370	61,064	38,993	115,580	77,856	485,417	370,432
2000	255,717	220,013	75,501	51,176	64,629	41,476	114,402	72,135	510,248	384,800
2001	277,706	239,021	83,491	58,392	61,576	38,618	128,835	83,148	551,608	419,180
2002	318,418	274,003	91,825	76,192	46,175	32,440	150,069	98,323	606,488	480,958

Source: Economic Research Service, USDA.

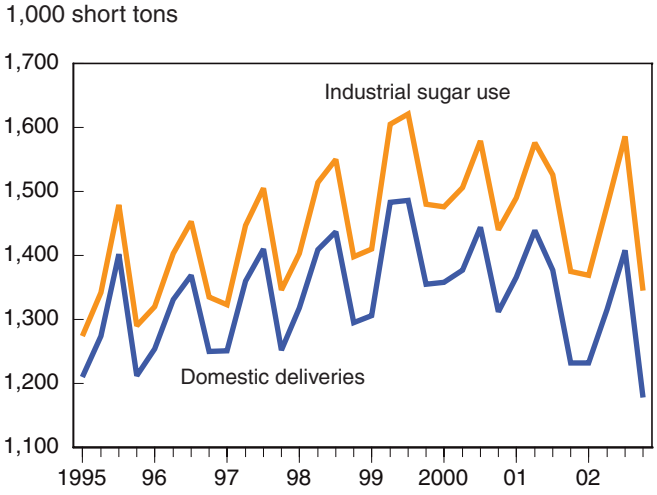
continues unabated through 2002. Yearly growth for the base series is 48,000 tons a year and 38,500 tons a year for the lower-limit series. Between 1995 and 2002, sugar in product imports grew from 111 to 124 percent. Growth for individual enduse sectors are: 105 percent for sugar confectionery; between 131 and 190 percent for cocoa preparations; between 114 and 153 percent for cereal preparations and baker's wares; and between 115 and 138 percent for miscellaneous products.

Table 2 shows the estimated sugar content of imported products by year. The proportion of sugar in confectionery products held steady during the time period—between 60 (lower-limit series) and 70 percent (base series). This result is expected because little deviation is assumed in individual sugar coefficient values in HTS chapter 17.04. Average sugar content in cocoa preparations dropped from 42-52 percent in 1992-94 to 25-37 percent in 1995-2002. This indicates a marked increase in imports of products with less sugar compared with products in the earlier period. The changes in the other product categories are relatively smaller increases between 1992-94 and 1995-2002.

These average sugar content estimates can be compared with earlier period estimates from the Gray and Lord study. They estimated a sugar content for imported confectionery products of 56 percent during 1983-87, somewhat lower than estimated in this study for either 1992-94 or 1995-2002. Their estimate of 51 percent for imported cocoa preparations is within this study's range for 1992-94. Their estimate of 24.5 percent for imported cereal preparations and bakers' wares is close to this study's base series result for 1992-94. The same is the case for imported miscellaneous edible products, where their result of 32.8 percent is close to the base series of 33.2 percent for 1992-94.

Figure 2 shows quarterly sugar use in the United States between 1995 and 2002. The bottom series plotted in the figure shows domestic sugar deliveries to industrial endusers, and the top series adds in the sugar contained in imported products (base series). The general pattern of the two series is similar but the gap between the two has been consistently growing. There does not seem to be a single point where the two series radically diverge.

Figure 2
Industrial U.S. sugar use, by quarters, 1995-2002



Source: Economic Research Service, USDA.

Table 2—Estimated average sugar content in certain imported sugar-containing products

Year	Sugar confectionery (HTS chapter 17.04)		Cocoa preparations (HTS chapter 18)		Cereal preparations and bakers' wares (HTS chapter 19)		Miscellaneous edible preparations (HTS chapter 21)		Total	
	Base	Lower-limit	Base	Lower-limit	Base	Lower-limit	Base	Lower-limit	Base	Lower-limit
					Percentage					
1992	69.91	60.00	51.37	41.10	26.24	17.64	32.04	17.71	51.71	40.25
1993	69.90	60.00	51.35	41.13	26.11	17.49	35.29	19.69	52.59	40.77
1994	69.91	60.00	54.39	44.64	28.94	19.31	31.79	23.58	54.73	45.28
1995	69.89	59.98	35.55	23.49	29.04	17.28	32.28	19.10	45.90	34.25
1996	70.07	60.00	36.41	24.21	29.72	18.16	31.68	19.88	46.18	34.96
1997	70.06	59.98	36.41	24.40	32.03	20.72	33.09	19.76	46.39	34.83
1998	69.76	60.00	36.63	24.77	32.57	21.27	38.95	25.65	47.83	36.42
1999	69.74	60.00	37.63	25.80	31.66	20.22	40.92	27.57	48.42	36.95
2000	69.73	60.00	37.20	25.22	31.67	20.32	38.35	24.18	47.60	35.89
2001	69.71	60.00	38.85	27.17	31.00	19.44	37.21	24.02	47.63	36.19
2002	69.72	60.00	36.46	30.25	22.32	15.68	37.76	24.74	46.20	36.64

Source: Economic Research Service, USDA.

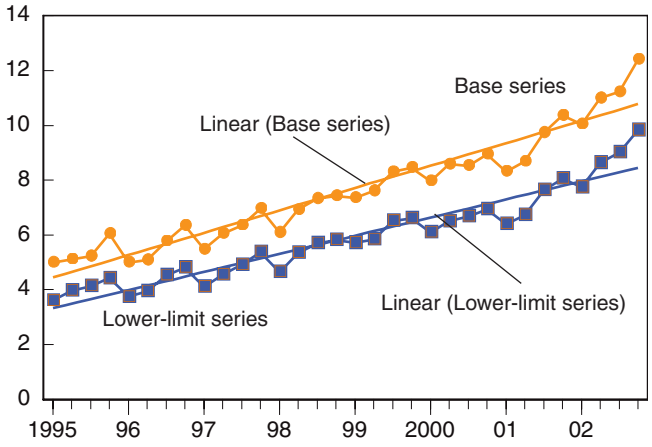
Figure 2 indicates two interesting periods, however. The first is the second quarter of 2000. The second-quarter pattern for previous years had been for strong increases relative to the preceding first quarter. For 1999, the increase had been 195,000 tons, shared between domestic deliveries of 177,000 tons and sugar in imported products of 18,000 tons. The second-quarter increase in 2000 was much less: 30,000 tons, shared between domestic deliveries of 19,000 tons and sugar in imported products of 11,000 tons. Most of the decrease occurred in domestic deliveries, although imported sugar-containing products decreased as well but not nearly as much in percentage terms. The second interesting period is the third quarter of 2001. The pattern before 2000 was for an increase over the already-high second-quarter total. The second quarter 2001 increase was 85,000 tons, shared between domestic deliveries of 72,000 tons and sugar in imported products of 13,000 tons. The next quarter saw a decrease of 50,000 tons instead of the expected increase. Domestic deliveries fell by 62,000 tons while sugar in imported products increased by 12,000 tons. Events in these two periods suggest that adjustment volatility is occurring in domestic deliveries, with the trend of increased sugar in imported products not severely affected.

Figure 3 shows the percentage of industrial sugar use contributed by imports of sugar-containing products, for the base and lower-limit series. The two series suggest that in 1995, sugar from imported products constituted between 4 to 5.3 percent of total industrial sugar use. The growth of the import-product share has been very consistent through 2002, where the share is estimated to be between 8.8 and 11.2 percent. Shares in the last three-quarters of 2002 are noticeably above trend growth.

Figure 4 shows the growth in sugar content from 1995 to 2002 for product imports from Canada, Mexico, and all other countries. Period growth for Canada was 115 percent, and corresponding growth for Mexico was 291 percent. Canada's yearly share of the sugar-containing exports to the United States has fluctuated from 43 to 51 percent, and Mexico's share has increased from 12 percent in 1995 to 21 percent in 2002.

Figure 3
Percentage of industrial sugar use attributed to sugar-containing product imports

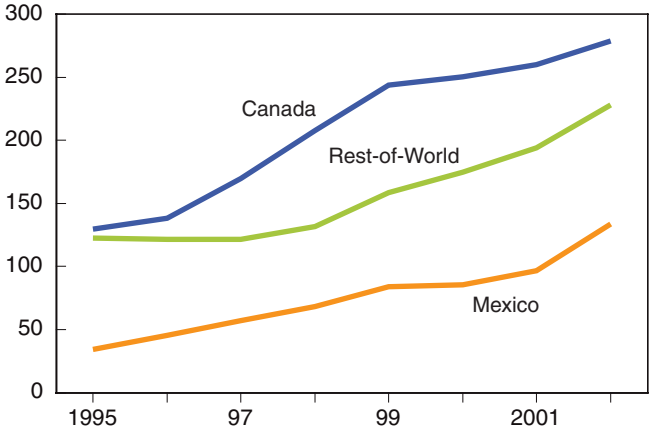
Percent



Source: Economic Research Service, USDA.

Figure 4
Estimated sugar in sugar-containing products from Canada, Mexico, and Rest-of-World

1,000 short tons



Source: Economic Research Service, USDA.

Estimated Sugar in Exported Products

The same procedure used to calculate sugar in imported products can be applied to U.S. exports of like-products. Although the price of U.S. sugar is above world levels, sugar in many other countries is priced higher than in the United States. Also, the sugar contained in exported products may constitute a relatively small portion of the total value of the product being exported; that is, other factors may favor the U.S. export of the product and outweigh the negative effect of higher-priced U.S. sugar contained in the product. Also, there is a Sugar-Containing Products Re-export Program, administered by the USDA, which allows U.S. refiners to import world-priced raw sugar, provided that an equivalent amount of refined sugar is exported in products within an 18-month period.

Table 3 shows estimated sugar contained in exported products, organized by product category. Yearly growth of sugar contained in exported products through 2001 is estimated between 16,250 tons (lower-limit series) and 21,800 tons (base series). This growth is only about 43 percent of the corresponding growth in sugar in imported products. Product exports in 2002 fell to 1996 levels for the base series.

Most product-exported sugar has been contained in cereal preparations and bakers' wares—about 40 percent. Sugar exported in miscellaneous edible preparations was the next highest—between 23 and 25 percent. Sugar exported in confectionery is estimated at about 20 percent of the total, and sugar in cocoa preparations, between 14 and 17 percent.

Sugar contained in exports in 1992-94 is estimated to have been between 12 to 34 percent higher than sugar contained in imported products. Imports of sugar-containing products began their growth after 1994. By 1998, sugar in imported products exceeded sugar in exported products. In 2001, sugar in imported products is estimated to have been between 23 and 33 percent higher than sugar in exported products. Corresponding figures in 2002 are estimated between 79 and 86 percent.

Table 3—Estimated ranges of sugar in certain exported sugar-containing products

Year	Sugar confectionery (HTS chapter 17.04)		Cocoa preparations (HTS chapter 18)		Cereal preparations and bakers' wares (HTS chapter 19)		Miscellaneous edible preparations (HTS chapter 21)		Total	
	Base	Lower-limit	Base	Lower-limit	Base	Lower-limit	Base	Lower-limit	Base	Lower-limit
	Short tons									
1992	51,740	44,227	39,727	28,900	98,213	47,334	51,527	38,943	241,207	159,404
1993	60,843	52,013	58,289	45,200	111,748	55,731	47,897	34,827	278,778	187,771
1994	67,295	57,536	52,133	40,783	120,203	61,801	38,988	27,804	278,619	187,924
1995	63,604	54,376	43,035	32,588	129,739	68,629	78,248	59,952	314,626	215,546
1996	66,359	56,729	44,015	32,600	137,920	78,304	85,761	65,734	334,055	233,367
1997	79,806	68,227	44,919	34,572	165,290	92,862	90,925	69,295	380,940	264,955
1998	75,979	64,952	43,328	32,069	170,244	93,888	91,314	69,832	380,865	260,742
1999	74,891	64,020	43,488	32,808	163,231	95,181	96,911	73,576	378,521	265,586
2000	85,002	72,658	63,660	49,107	183,321	105,507	106,073	80,590	438,056	307,862
2001	87,671	74,937	78,579	66,035	179,198	105,806	104,199	78,176	449,647	324,954
2002	54,937	47,016	69,792	48,221	96,897	74,704	116,268	88,032	337,895	257,973

Source: Economic Research Service, USDA.

Implications for Calculated Per Capita Sweetener Consumption

A closely-watched data series maintained by the USDA is per capita sweetener consumption. It includes estimates of consumption of refined sugar, high fructose corn syrup, other corn syrups, honey, maple syrup, and other edible syrups. These consumption series are derived from delivery, production, and trade data series collected and maintained by the USDA and the U.S. Customs Service. It is not the practice to make adjustments based on trade in products that contain these basic sweeteners. Other than sugar, however, it is unlikely that such adjustments would matter very much. This study allows a consideration of the effect of trade in sugar-containing products on per capita sweetener consumption.

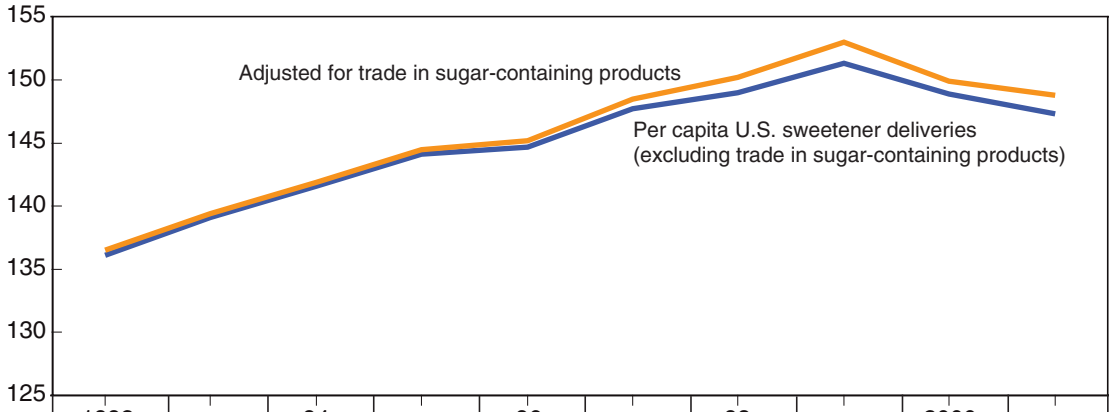
The current procedure for calculating per capita consumption is based on total deliveries of sugar for domestic food and beverage use, collected by USDA's Farm Service Agency and measured in short tons, raw value. It is converted into refined value by dividing the total by 1.07. Sugar delivered to food manufacturers as part of USDA's Products Re-export Program is not counted because it is intended for export and not domestic consumption. However, sugar contained in recorded exports include this sugar plus sugar not covered in any program. In order not to double-count, the sugar delivered in the Products Re-export Program should be added to the amount delivered for domestic food and beverage use before making any traded product adjustments.

Before 1998, sugar in exported products exceeded sugar in imported products. For example, in 1992 exported sugar in products was equivalent to 1.9 pounds per capita, compared with 1.6 pounds in imported products. The net adjustment was a negative 0.3 pound. After 1992, sugar in exported products started increasing: from 2.1 pounds per capita to 2.8 pounds in 1997 and 3.2 pounds in 2001. Sugar in imported products was equal to 1.5 pounds per capita in 1993 and 1994, and then started growing—to 2.6 pounds in 1997 and 3.9 pounds in 2001. The net adjustment to per capita sweetener consumption in 2001 was 0.7 pound.

Figure 5 shows per capita sweetener consumption with and without the adjustment for trade in sugar-containing products. The two series are close, with actual per capita consumption higher than the series that excludes the sugar in product trade. Both series show per capita consumption peaking in 1999. Including sugar from traded products reveals only a slight upward revision to the overall decline from 1999. The implication is that the recent decline in sugar deliveries cannot be solely explained by increased product imports.

Figure 5

Per capita U.S. sweetener deliveries



Per capita sweetener deliveries	136.1	139.1	141.6	144.1	144.7	147.7	149.0	151.3	148.9	147.3
Adjusted for SCP	136.5	139.4	141.9	144.5	145.2	148.5	150.2	153.0	149.9	148.8

Source: Economic Research Service, USDA.

Estimating the Effect of Sugar in Imported Products on Deliveries

It is hypothesized that the increase in imports of sugar-containing products has contributed to a decline in domestic sugar deliveries to industrial endusers. Evidence presented in previous sections suggests that the displacement effect has been steady since 1994; that is, the recent downturn in industrial deliveries is probably explained by other factors.

In order to test this hypothesis, quarterly industrial sugar deliveries are initially assumed to be a function of seasonal factors (Q_1, Q_2, and Q_3), an underlying trend, population, real per capita gross domestic product (GDP), and sugar in imported products. Added to these factors is a variable representing the recent time period that has the effect of capturing unexplained recent events upon industrial sugar deliveries. Formally, a regression equation as follows can be estimated over the period from the first quarter of 1995 through the fourth quarter of 2002:

$$\begin{aligned}\text{Log}(\textit{Industrial sugar deliveries}) &= \alpha_0 + \alpha_1 * Q_1 + \alpha_2 * \\ Q_2 + \alpha_3 * Q_3 + \alpha_4 * \textit{trend} + \beta_0 * D(2001:q3 - 2002:q4) &\\ + \beta_1 * \text{Log}(\textit{Population}) + \beta_2 * \text{Log}(\textit{GDP per capita}) &\\ + \beta_3 * \textit{Sugar content ratio} + \varepsilon &\end{aligned}$$

where:

$$\textit{Sugar content ratio} = \frac{\textit{Sugar in imported product}}{\textit{Sugar in imported product} + \textit{industrial sugar deliveries}}$$

The sugar content variable is calculated using the base series values estimated earlier. (Sensitivity of the results using the lower-limit series is examined later.) The Q_i represent the first three quarters of the calendar year. The 'D' variable is assigned a value of 0 except for the recent period where deliveries have been down, where a value of 1 is assigned. The coefficient on the D variable captures the effect of unexplained recent events. The quarters that are assigned the value 1 are chosen on the basis of improving the fit of the equation, or alternatively, minimizing out-of-sample forecast error variance. The criterion used to measure this aspect is called the Schwarz Information Criterion. This criterion is also used to examine competing equation specifications. When examining alternatives, the equation with the lowest Schwarz criterion value represents the best equation for making out-of-sample predictions for the dependent variable (i.e., industrial sugar deliveries).

Equation results are shown in table 4 for three alternative specifications. The first equation has the lowest valued Schwarz criterion (1a), followed by the equation with the next lowest value (1b), and followed by the remaining equation (1c). The first equation omits population as an explanatory variable, retaining the others. The second equation contains real per capita GDP and population. The third equation omits real per capita GDP and keeps population. In all three specifications, the coefficient on the sugar content variable is significantly negative, as hypothesized. The sugar content coefficient in the first equation has the largest t-statistic compared with the same coefficient in the other two equations. There is some evidence that unexplained events occurring after the second quarter of 2001 may have been significant in explaining the decrease in industrial sugar deliveries. However, the evidence is the weakest in the case of the first equation (the one with the best predictive characteristics).

A problem with an ordinary regression analysis is that it is difficult to directly compare coefficient values because the equation variables are scaled in different units with differing variances. However, it is possible to rescale variables such as sugar deliveries, real per capita GDP, and the sugar content ratio to make direct comparison of estimated coefficients (called "beta" coefficients) possible. These variables are normalized by subtracting each observation by their respective mean and then by dividing the difference by their respective standard deviation. In the subsequent regression, a beta coefficient of "y.xx" means that a 1-standard deviation change in the explanatory variable leads to a "y.xx" standard deviation change in the industrial sugar deliveries.

Table 5 shows the resulting beta coefficients. The dependent variables (i.e., industrial sugar deliveries) in the table 5 equations are expressed in per capita terms rather than actual delivery totals in order to minimize factors associated with population growth. Also, the analysis disaggregates deliveries into various categories to see whether differing sorts of product imports have had differing effects on the differing components

Table 4—U.S. sugar deliveries: Estimating the effect of seasonality, population, per capita GDP, and imported sugar-containing products[1]

Equation number	Constant	Coefficient values [2]						Ratio of sugar in imported products [3]	Summary statistics		
		1st quarter	2nd quarter	3rd quarter	2001:3q-2002:4q	Log of U.S. population	Log of per capita GDP		Adjusted R^2	Durbin-Watson	Schwarz Criterion
Log of sugar deliveries to industrial endusers											
Eq. No. 1a	--	--	0.071	0.112	-0.026	--	1.380	-0.027	0.883	1.581	-4.467
			(7.567)	(11.979)	(1.649)		(633.178)	(8.649)			
Eq. No. 1b	--	--	0.071	0.112	-0.047	0.171	1.052	-0.019	0.885	1.650	-4.411
			(7.645)	(12.055)	(1.986)	(1.182)	(3.794)	(2.374)			
Eq. No. 1c	-38.713	--	0.069	0.112	-0.090	2.724	--	-0.021	0.882	1.506	-4.385
	(3.306)		(7.137)	(11.769)	(6.206)	(4.509)		(2.156)			

[1] Observation period: First quarter of 1995 (1995:1) through fourth quarter of 2002 (2002:4).
[2] T-statistics are in parentheses below coefficient values.
[3] For deliveries to industrial endusers, the ratio equals the percentage of sugar in imported products divided by the sum of sugar in imported products and deliveries to industrial endusers.
Source: Economic Research Service, USDA.

of industrial sugar deliveries. These components include deliveries to: the confectionery industry, baking and cereal manufacturers, the processed food industry, and multiple-product industries.

Equations 2a and 2b are alternative equations, having per capita sugar deliveries to industrial endusers as the dependent variable. Equation 2a includes the variable for the last four quarters, and 2b excludes it. Comparison of Schwarz criterion values in the last column reveals that 2a has better predictive characteristics (its criterion value is lower). In that equation, the coefficient on the recent time period is significantly negative. The coefficient on the sugar content variable is significantly negative as well. Both equations indicate the coefficients on sugar content and real per capita GDP are equal in magnitude although opposite in sign, suggesting that both variables affect industrial sugar deliveries about the same in size but opposite in direction.

The next four equations show per capita sugar deliveries to the confectionery industry, baking and cereal industry, processed food industry, and industries comprising the multiple-use category, respectively. Only in equation 2d, where deliveries to the baking and cereal manufacturers are being analyzed, is the coefficient on the recent time period significant. In the other equations, its value cannot be significantly differentiated from zero. Also in equation 2d, the coefficient on sugar content is significantly positive. In the other equations, the sugar content coefficients are significantly negative. In equation 2c (confectionery industry) and 2f (multiple-use category), the magnitude of the sugar content coefficient in absolute terms is larger than the corresponding coefficient value on per capita GDP.

In summary, these equations support the hypothesis that imports of sugar-containing products have negatively affected sugar deliveries to the confectionery industry, processed food industry, and the multiple-use industries. Changes in sugar-containing product imports have been more important in explaining changes in sugar deliveries to the confectionery and multiple-use industries than have changes in per capita GDP. The opposite is true for the processed food industry, where also a negative trend growth factor has been in evidence. Analysis does not support the hypothesis of sugar-containing product imports affecting deliveries to the baking and cereal industry. Although per capita GDP has been important, events in the last two quarters of 2001 and over 2002 have been important as well for the baking and cereal industries.

Lastly, table 6 compares results from the table 5 equations with similarly specified equations, but using sugar content implied by the lower-limit series instead of the base series. The results (i.e., coefficient values, significance levels, adjusted R^2, Durbin-Watson statistic) are nearly similar. In all equations except the one for bakery and cereal, the Schwarz criterion values are lower for the equations with the base sugar content variable, suggesting better prediction properties than those using the series with the lower-limit sugar content.

Table 5—U.S. sugar deliveries to industrial endusers: Estimating the effect of sugar contained in imported products[1]

Equation Number	Dependent Variable [2]	Coefficient values [3]								Summary statistics		
		Constant	Seasonality coefficients			2001:3q-2002:4q	Trend	Beta coefficients [4]			Adjusted R^2	Durbin-Watson	Schwarz Criterion
			1st quarter	2nd quarter	3rd quarter			Per capita sugar contained in products [5]	Per capita GDP in real 1996 dollars	Auto-regressive term			
2a	Per capita sugar deliveries to industrial endusers	-0.540 (5.094)		1.096 (7.500)	1.762 (12.061)	-0.932 (2.668)		-0.605 (2.289)	0.586 (3.091)	--	0.887	1.570	1.101
2b	Per capita sugar deliveries to industrial endusers (alternative)	-0.711 (7.635)	--	1.096 (6.770)	1.749 (10.820)	--	--	-1.215 (8.286)	0.950 (6.498)	--	0.861	1.467	1.235
2c	Per capita sugar deliveries to confectionery industry	--	-0.744 (4.107)	--	0.919 (5.197)	--	--	-1.283 (6.704)	0.494 (2.670)	--	0.771	1.718	--
2d	Per capita sugar deliveries to baking and cereal mfg. industries	--	0.572 (1.666)	0.885 (2.574)	1.995 (5.771)	-1.447 (4.375)	-0.020 (2.148)	0.785 (4.877)		--	0.641	1.565	--
2e	Per capita sugar deliveries to processed food industries	--	--	1.295 (9.843)	1.844 (11.124)	--	-0.028 (9.578)	-0.285 (3.003)	0.450 (5.787)	--	0.916	1.681	--
2f	Per capita sugar deliveries to industries comprising USDA's multiple use category [6]	--	--	--	0.270 (1.635)	--	--	-1.236 (5.469)	0.507 (2.130)	0.288 (2.120)	0.767	1.701	--

[1] Observation period: First quarter of 1995 (1995:1) through the fourth quarter of 2002 (2002:4).
[2] Dependent and independent variables are normalized by subtracting the variables by their means and dividing the result by their estimated standard deviations.
[3] T-statistics are in parentheses below coefficient values.
[4] Beta coefficient interpretation: A one-standard deviation change in the independent variable (sugar in imported product or per capita GDP) leads to a standard deviation change in the dependent variable (sugar deliveries) equal to the value of the beta coefficient.
[5] The range of imported sugar-containing products differs across equations: Eq. 2a and 2b: All products shown in appendix. Eq. 2c: Products listed in appendix tables A-1 (HTS chapter 17.04) and A-2 (HTS chapter 18). Eq. 2d: Products listed in appendix table A-3 (HTS chapter 19). Eq. 2e: Products listed in appendix table A-4 (HTS chapter 21). Eq. 2f: All products shown in appendix.
[6] Indicator variable for the second quarter of 1998 entered into the equation: Coefficient value equal to 1.873, with t-statistic equal to 4.015.

Source: Economic Research Service, USDA.

Table 6—Comparison of regression results for sugar-containing products: Base series and lower-limit series

	Alternative equations for dependent variables:									
	Deliveries to:									
	industrial endusers[1]		Confectionery ind.		Baker and cereal mfg.		Processed food ind.		Multiple use	
	Alternatives based on sugar-containing products series: Base and lower-limit:									
	Base	Lower	Base	Lower	Base	Lower	Base	Lower	Base	Lower
	Short tons									
Regression statistics:										
Beta coefficient:	-0.605	-0.532	-1.283	-1.232	0.785	0.764	-0.285	-0.234	-1.236	-1.227
Sugar-containing product [1/ 2/]	(2.289)	(2.048)	(6.704)	(6.446)	(4.877)	(5.079)	(3.003)	(1.882)	(5.469)	(5.134)
Beta coefficient:	0.586	0.534	0.494	0.442	--	--	0.450	0.430	0.507	0.482
Per capita GDP	(3.091)	(2.876)	(2.670)	(2.393)			(5.787)	(3.705)	(2.130)	(1.893)
Regression coefficient: Indicator	-0.932	-1.009	--	--	-1.447	-1.329	--	--	--	--
variable for 2001:3 - 2002:4	(2.668)	(2.891)			(4.375)	(4.141)				
Adjusted R^2	0.887	0.883	0.771	0.759	0.641	0.655	0.916	0.912	0.767	0.761
Durbin-Watson	1.570	1.574	1.718	1.723	1.565	1.615	1.681	2.066	1.701	1.764
Schwarz Criterion	1.101	1.135	1.665	1.713	2.255	2.215	0.727	0.848	1.754	1.778

[1] Standardization is accomplished by subtracting the variable by its mean and dividing the difference by its standard deviation.

[2] T-statistic are in parentheses below the coefficient value.

Source: Economic Research Service, USDA.

Conclusions

Since 1999, there has been a decline in industrial sugar deliveries, especially to bakery and cereal manufacturers, the confectionery industry, and the multiple sugar use industries. Increases in the imports of sugar-containing products may have affected these and other industrial use deliveries. The sugar contained in imported products increased from 111 to 124 percent between 1995 and 2002. Yearly increases during this period have been between 38,500 and 48,000 tons. Total sugar in imported products has exceeded that in exported products since 1998. In 1995 sugar contained in imported products constituted between 4.0 and 5.3 percent of total sugar in industrial uses. By 2002, this range had increased to between 8.8 and 11.2 percent.

Estimated per capita consumption of sugar contained in imported products has grown from 2.1 pounds in 1995 to 3.9 pounds in 2001. Regression analysis strongly supports the hypothesis that imports of sugar-containing products have been an important factor for explaining reduced sugar deliveries to all industrial endusers except for baking and cereal manufacturers. Nonetheless, imports of sugar-containing products do not explain the precipitous drop-off in industrial sugar deliveries starting in 2000. More satisfactory explanations may include reduced activity in the U.S. economy and a drop-off in demand for baked goods and cereal products attributable to other factors.

References

Gray, Fred, and Ron Lord, "U.S. Imports of Sugar-Containing Products, 1977-88." *Sugar and Sweetener Situation and Outlook Report*. USDA, ERS, SSR14 N3, September 1989

U.S. International Trade Commision, *Certain Articles Containing Sugar*. USITC Publ. 2626, April 1993.

Appendix Tables

Appendix table 1—HTS codes and duty rates for sugar-containing products and coefficient range for sugar content: Chapter 17.40

HTS code	Sugar content coefficients		General duty	Mexico (NAFTA)
	Low	High		
(1704100000) CHEWING GUM, WHETHER OR NOT SUGAR COATED	0.60	0.80	4%	Free
(1704901000) CANDIED NUTS READY FOR CONSUMPTION	0.60	0.80	4.50%	Free
(1704902000) CONFECTIONS/SWEETMEATS READY FOR CONSUMPTION NESOI	0.60	0.80		
(1704902005) CONFECTION READY FOR CONSUMPTION,NESOI,RETAIL SALE	0.60	0.80		
(1704902010) CONFECTIONS READY FOR CONSUMPTION,NESOI,NOT RETAIL	0.60	0.80		
(1704902500) COUGH DROPS	0.60	0.80	Free	
(1704903505) CONFECTION READY FOR CONSUMPTION,NESOI,RETAIL SALE	0.60	0.80	5.60%	Free
(1704903510) CONFECTIONS READY FOR CONSUMPTION,NESOI,NOT RETAIL	0.60	0.80		
(1704903520) CONFEC. FOR CONSUMPTION, CONTN PEANUTS, RETAIL SALE	0.60	0.80		
(1704903550) CONFECTION READY FOR CONSUMPTION,NESOI,RETAIL SALE	0.60	0.80		
(1704903590) CONFECTIONS READY FOR CONSUMPTION,NESOI,NOT RETAIL	0.60	0.80		
(1704905200) SUGR CONFECTNRY NO COCOA,NESOI,SEE GENERAL NOTE 15	0.60	0.80	12.20%	Free
(1704905400) SUGAR CONFECTIONERY,DAIRY PRODUCT,ADDTL U S NTE 10	0.60	0.80	12.20%	
(1704905800) SUGAR CONFECTIONERY,DAIRY PRODUCT,NESOI	0.60	0.80	40 cents/kg+10.4%	Free
(1704906400) SUGAR CONFCTNRY,NESOI,>65% SUGAR,ADDTL U S NOTE 7	0.65	0.90	12.20%	
(1704906800) SUGAR CONFCTNRY,NESOI,CONTNG >65% SUGAR,NESOI	0.65	0.90	40 cents/kg+10.4%	Free
(1704907400) SUGAR CONFCTNRY,NESOI,>10% SUGAR,ADDTL U S NOTE 8	0.10	0.40	12.20%	
(1704907800) SUGAR CONFCTNRY,NESOI,CONTNG >10% SUGAR, NESOI	0.10	0.40	40 cents/kg+10.4%	Free
(1704909000) SUGR CONFECTNRY NT CNTG COCOA NT RETAIL SALE NESOI	0.60	0.80	10.40%	Free

Sources: U.S. International Trade Commission (duty rates), and Economic Research Service, USDA (sugar content coefficients).

Appendix table 2—HTS codes and duty rates for sugar-containing products and coefficient range for sugar content: Chapter 18

HTS code	Sugar content coefficients		General	Mexico
	Low	High	duty	(NAFTA)
(1806100500) GEN NOTE 15 COCOA POWDR SWTN CNTN<65% SUGAR BY WT	0.40	0.65	Free	
(1806101000) ADDTL NOTE 1 COCOA POWDR SWTN CNTN<65% SUGAR BY WT	0.40	0.65	Free	
(1806101500) COCOA PWDR SWTND CNTN<65% BY DRY WT OF SUGAR NESOI	0.40	0.65	21.7cents/kg	Free
(1806102200) GEN NOTE 15 COCOA PWDR SWTN >65% <90% BY WT SUGAR	0.65	0.90	10.0%	Free
(1806102800) COCOA PWDR SWTN>65% SUGR ADDTL NOTE 2-CHAP17 NESOI	0.65	0.90	33.6cents/kg	Free
(1806103400) ADDTL NOTE 1 COCOA PWDR SWTN >65% <90% DRY WT SUGR	0.65	0.90	10.0%	
(1806103800) COCOA PWDR SWTN OV 65% BT LSS THAN 90% SUGAR NESOI	0.65	0.90	33.6cents/kg	Free
(1806104300) GEN NOTE 15 COCOA PWDR SWTND CNTN 90%> DRY WT SUGR	0.90	0.95	10.0%	Free
(1806105500) ADDTL NOTE 2-CH17 COCOA PWDR SWTNED 90%>SUGR NESOI	0.90	0.95	33.6cents/kg	Free
(1806106500) ADDTL NOTE 1 COCOA POWDER SWEETEND CONT 90%OR MORE	0.90	0.95	10.0%	
(1806107500) COCOA POWDER SWEETEND CONT 90% OR MORE SUGAR NESOI	0.90	0.95	33.6cents/kg	Free
(1806202200) GEN NOTE 15 CHOCOLATE BULK FORM NESOI CNTN BTRFAT	0.30	0.50	5.0%	Free
(1806202400) ADDTL NOTE2 CHOCOLATE BULK FORM NESOI>5.5% BTTRFAT	0.30	0.50	5.0%	
(1806202600) CHOCOLATE BLK FRM NESOI>5.5% BUTTRFAT,<21%MLK SLID	0.30	0.50	37.2cents/kg+4.3%	Free
(1806202800) CHOCOLATE BULK FORM NESOI OVER 5.5% BUTTRFAT NESOI	0.30	0.50	52.8cents/kg+4.3%	Free
(1806203400) ADDTL NOTE 3 CHOCOLATE BULK NESOI NOV 5.5% BTTRFAT	0.30	0.50	5.0%	
(1806203600) CHOCOLATE BULK FORM NESOI<5.5% BTTRFT<21% MLK SLDS	0.30	0.50	37.2cents/kg+4.3%	Free
(1806203800) CHOCOLATE BULK FORM NESOI NOV 5.5% BUTTRFAT NESOI	0.30	0.50	52.8cents/kg+4.3%	Free
(1806205000) CHOCOLATE BULK NESOI NOT CNTN BFAT/MLK SLDS, NESOI	0.30	0.50	4.3%	Free
(1806206000) CONFECTIONERS COATINGS/PRODS 6.8% COCOA SOLID BULK	0.40	0.60	2.0%	Free
(1806207100) ADDTL NOTE 7-CH 17 COCOA PREP BULK NESOI,>65% SUGR	0.65	0.90	10.0%	
(1806207300) ADDTL US NOTE 2-CH17 COCOA PREP BULK NESOI>65%SUGR	0.65	0.90	30.5cents/kg+8.5%	Free
(1806207500) ADDTL NOTE 8-CH17 COCOA PREP BULK NESOI,>10% SUGAR	0.10	0.40	10.0%	
(1806207800) COCOA PREP BULK NESOI 65%/MORE SUGAR NESOI	0.65	0.90	8.5%	Free
(1806207900) GEN NOTE 15 COCOA PREPS NESOI, IN BULK FORMS	0.10	0.40	10.0%	Free
(1806208100) COCOA PREP(DAIRY)BULK NESOI<65%SUGR ADDTL NTE4-CH4	0.50	0.65	10.0%	
(1806208200) COCOA PREP(DAIRY)BULK NESOI<21% MLK SOLD AD NT-CH4	0.10	0.40	37.2cents/kg+8.5%	Free
(1806208300) COCOA PREP(DAIRY)BLK NESOI<65%SUGAR,ADTL NOTE4-CH4	0.50	0.65	52.8cents/kg+8.5%	Free
(1806208700) COCOA PREP(LOW FAT CHCLT) BULK NESOI<21% MLK SOLDS	0.10	0.40	37.2cents/kg+8.5%	Free
(1806208900) COCOA PREP(LOW FAT CHCLT CRMB) BULK NESOI<65% SUGR	0.50	0.65	52.8cents/kg+8.5%	Free
(1806209400) COCOA PREP(BLND SYRPS)BULK NESOI<65% SUGR AD4-CH17	0.50	0.65	37.2cents/kg+8.5%	Free
(1806209500) COCOA PREP BULK NESOI <65% >10%SUGR ADD NTE 8-CH17	0.10	0.65	10.0%	
(1806209800) COCOA PREP BULK NESOI <65% >10% SUGR ADDTL 3-CH 17	0.10	0.65	37.2cents/kg+8.5%	Free
(1806209900) COCOA PREP BULK NESOI 65% OR LESS SUGAR, NESOI	0.50	0.65	8.5%	Free
(1806320100) CHCLT BARS ETC NT BULK UNFILLD GEN NOTE 15	0.40	0.60	5.0%	Free
(1806320400) CHCLT BARS NT BULK UNFLLD >5.5% BTTERFAT ADTL NOT2	0.40	0.60	5.0%	
(1806320600) CHCLT BARS ETC NT BULK UNFLLD<21% MLK SOLDS GEN 15	0.40	0.60	37.2cents/lb+4.3%	Free
(1806320800) CHCLT BARS ETC NT BLK UNFLLD >5.5% BUTERFAT NESOI	0.40	0.60	52.8cents/lb+4.3%	Free
(1806321400) CHCLT BARS ETC NT BLK UNFLLD<5.5%BTTRFT ADTL NOTE3	0.40	0.60	5.0%	
(1806321600) CHOCOLATE BARS ETC NT BULK UNFILLD <21% MILK SOLSD	0.40	0.60	37.2cents/lb+4.3%	Free
(1806321800) CHOCOLATE BARS ETC NT BULK UNFILLD < 5.5% BUTTERFT	0.40	0.60	52.8cents/lb+4.3%	Free
(1806323000) CHOC/COCOA PREP BAR ETC NTOV2KG EXC FILLD/CNFCTNRY	0.40	0.60	4.3%	Free

Appendix table 2—HTS codes and duty rates for sugar-containing products and coefficient range for sugar content: Chapter 18--Continued

HTS code	Sugar content coefficients		General duty	Mexico (NAFTA)
	Low	High		
(1806325500) COCOA PREPS, NESOI, BAR ETC, UNFILLD, GEN NOTE 15	0.40	0.60	7.0%	Free
(1806326000) COCOA PRPS(DAIRY)NESOI BAR ETC UNFLLD ADD/NOT1-CH4	0.40	0.60	7.0%	
(1806327000) COCOA PREPS UNFLLD DAIRY<21%MLK SOLDSL ADDTL 1-CH4	0.40	0.60	37.2cents/kg+6%	Free
(1806328000) DAIRY PRDUCTS NESOI BAR ETC UNFLLD US ADD NTE1/CH4	0.40	0.60	52.8cents/kg+6%	Free
(1806329000) CHOC/COCOA PREP BAR NOT OVER 2KG NESOI EXCPT FILLD	0.40	0.60	6.0%	Free
(1806900100) COCOA PREPS NESOI NT BULK NT RETAIL GENERAL NOTE15	0.40	0.60	3.5%	Free
(1806900500) COCOA PRPS NESOI NT BLK NT RETAIL ADDTL NOTE10-CH4	0.10	0.40	3.5%	
(1806900800) COCOA PRPS(DAIRY)<21%MLK SLDS NESOI ADTL NTE10-CH4	0.40	0.60	37.2cents/lb+6%	Free
(1806901000) COCOA PREPS NESOI NT BLK NT RETAIL ADDTL NTE10-CH4	0.40	0.60	52.8cents/kg+6%	Free
(1806901500) COCOA PRPS NESOI NT BLK/RETAIL>5.5%BTTRFT ADTL NT2	0.40	0.60	3.5%	
(1806901800) COCOA PRPS NESOI NT BLK/RETAIL < 21% MILK SOLIDS	0.40	0.60	37.2cents/lb+6%	Free
(1806902000) COCOA PREPS NESOI NT BULK NT RETAIL <5.5%BUTTERFAT	0.40	0.60	52.8cents/kg+6%	Free
(1806902500) COCOA PRPS NESOI NT BLK/RETAIL>5.5%BTTRFT ADD NTE3	0.40	0.60	3.5%	
(1806902800) COCOA PREPS NESOI NT BULK NT RETAIL <21% MLK SOLDS	0.40	0.60	37.2cents/kg+6%	Free
(1806903000) COCOA PREPS NESOI NT BULK NT RETAIL NESOI	0.40	0.60	52.8cents/kg+6%	Free
(1806903900) COCOA PRPS(SYRPS)NESOI NT BLK/RETAIL ADD NTE4-CH17	0.40	0.60	37.2cents/lb+6%	Free
(1806904900) COCOA PRPS NESOI NT BLK/RTL>65%SUGR ADTL NTE2-CH17	0.65	0.90	37.2cents/lb+6%	Free
(1806905500) COCOA PEPS NESOI NT/BLK/RTL>10%SUGR ADDT NTE8-CH17	0.10	0.40	3.5%	
(1806905900) COCOA PRPS NESOI NT BLK/RTL>10%SUGR ADD NOTE8-CH17	0.10	0.40	37.2cents/lb+6%	Free
(1806909000) COCOA PREPS, NESOI, NOT FOR RETAIL, NESOI	0.10	0.40	6.0%	Free
(1806909010) COCOA PREPS, NESOI, NOT FOR RETAIL, CONFECTIONERY	0.10	0.40		
(1806909019) COCOA PREPS, NESOI, NOT FOR RETAIL, CONFECTIONERY	0.10	0.40		
(1806909090) COCOA PREPS, NESOI, NOT FOR RETAIL, NESOI	0.10	0.40		

Sources: U.S. International Trade Commission (duty rates), and Economic Research Service, USDA (sugar content coefficients).

Appendix table 3—HTS codes and duty rates for sugar-containing products and coefficient range for sugar content: Chapter 19

HTS code	Sugar content coefficients		General	Mexico
	Low	High	duty	(NAFTA)
(1901100500) PRPS INFANT USE RETAIL > 10% MLK SOLSD GEN NOTE 15	0.10	0.20	17.5%	Free
(1901101500) INFNT FRMUL CNTN OLIGOSSACCHARIDES>10%MLK SLDS AD2	0.10	0.20	17.5%	
(1901103000) INFANT PRPS CNTN OLIGOSACCHARIDES > 10% MILK SOLID	0.10	0.20	$1.035/kg+14.9%	Free
(1901103500) PRPS INFNT RETAIL SALE>10% MLK SOLDS ADD NTE10-CH4	0.10	0.20	17.5%	
(1901104000) INFANT PRPS RETAIL>10% MLK SOLDS ADDTL NOTE 1-CH4	0.10	0.20	$1.035/kg+14.9%	Free
(1901104500) PREPS FOR INFANT USE RETAIL > 10% MILK SOLID NESOI	0.10	0.20	14.9%	Free
(1901105500) PRPS FOR INFNT USE FOR RETAIL SALE NESOI GEN NTE15	0.10	0.20	17.5%	Free
(1901106000) INFNT PRPS RETAIL CNTN OLIGOSACCHARIDES ADDTL NTE2	0.10	0.20	17.5%	
(1901107500) INFNT PRPS RETAIL SALE CNTN OLIGOSACCHARIDES NESOI	0.10	0.20	$1.035/kg+14.9%	Free
(1901108000) INFNT PRPS(DAIRY) RETAIL SALE ADDTL NOTE 10-CH 4	0.10	0.20	17.5%	
(1901108500) PREPS INFNT USE RETAIL SALE DAIRY ADDTL NOTE1-CH4	0.10	0.20	$1.035/kg+14.9%	Free
(1901109500) PREPS FOR INFANT USE, FOR RETAIL SALE, NESOI	0.10	0.20	14.9%	Free
(1901200200) MIX/DOUGH OF 1905 >25% BUTRFT N/RETL, GEN NOTE 15	0.20	0.40	10.0%	Free
(1901200500) MIX/DOUGH PREP>25%BUTRFT, N/RETL ADDTL NOTE 10-CH4	0.20	0.40	10.0%	
(1901201500) MIX/DOUGH>25%BUTRFT,N/RETL,>65%SUGR,ADDTL NTE1-CH4	0.65	0.85	42.3cents/kg+8.5%	Free
(1901202000) MIX/DOUGH>25%BUTRFAT,N/RETL,>65% SUGR AD NTE7-CH17	0.65	0.85	10.0%	
(1901202500) MIXES/DOUGH OF 1905, >25% BUTRFAT N/RETAIL, NESOI	0.20	0.40	42.3cents/kg+8.5%	Free
(1901203000) MIX/DOUGH OF 1905 >25% BUTRFAT N/RETL, ADDTL NOTE3	0.20	0.40	10.0%	
(1901203500) MIXES/DOUGH,>25%BUTRFAT N/RETAIL,ADDTL NOTE 1-CH19	0.20	0.40	42.3cents/kg+8.5%	Free
(1901204000) MIXES/DOUGH OF 1905, >25% BUTRFAT N/RETAIL, NESOI	0.20	0.40	8.5%	Free
(1901204200) MIX/DOUGH FOR PREP OF 1905 NESOI, GEN NOTE 15 DRY	0.20	0.40	10.0%	Free
(1901204500) MIX/DOUGH PREP OF1905,NESOI,DAIRY,ADTL NOTE 10-CH4	0.20	0.40	10.0%	
(1901205000) MIX/DOUGH PREP OF 1905,DAIRY,NESOI,ADDTL NOTE1-CH4	0.20	0.40	42.3cents/kg+8.5%	Free
(1901205500) MIXES/DOUGH OF 1905 NESOI,>65%SUGR,ADDTL NTE7-CH17	0.65	0.85	10.0%	
(1901206000) MIXES/DOUGH 1905,>65% SUGAR,ADDTL NTE 2-CH17,NESOI	0.65	0.85	42.3cents/kg+8.5%	Free
(1901206500) MIXES/DOUGH OF 1905 NESOI DRY FORM, ADDTL NOTE 3	0.20	0.40	10.0%	
(1901207000) MIXES/DOUGH OF 1905, ADDTL NOTE 1 TO CHAP 19,NESOI	0.20	0.40	42.3cents/kg+8.5%	Free
(1901208000) MIXES/DOUGH FOR PREP OF BAKERS WARES OF 1905 NESOI	0.20	0.40	8.5%	Free
(1901901000) MALT EXTRACT, FLUID	0.10	0.20	3.2cents/liter	Free
(1901902000) MALT EXTRACT, SOLID OR CONDENSED	0.10	0.20	9.6%	Free
(1901902500) PUDDINGS READY TO EAT WITHOUT FURTHER PREPARATION	0.60	0.80	Free	
(1901902800) DRY MIX<31%BURRFT>17.5NACAS,BUTRFT,WHEY,>5.5%....	0.50	0.80	.37cents/kg	Free
(1901903200) CAJETA NOT MADE FROM COWS MILK	0.05	0.15	11.2%	Free
(1901903300) MARGARINE CHEESE: DESCRIBE IN GENERAL NOTE 15	0.05	0.15	10.0%	Free
(1901903400) MARGARINE CHEESE: ADDTL US NOTE 23 TO CHAPTER 4	0.05	0.15	10.0%	
(1901903600) MARGARINE CHEESE: NESOI	0.05	0.15	$1.128/kg	Free
(1901903800) MALTED MILK CONTAINING > 10 % MLK SLDS GEN NOTE 15	0.40	0.65	16.0%	Free
(1901904200) MALTED MLK CNTNNG >10 % MLK SLDS ADDTL NOTE 10-CH4	0.40	0.65	16.0%	
(1901904300) MALTED MILK CONTAINING > 10 % MILK SOLIDS, NESOI	0.40	0.65	$1.035/kg+13.6%	Free
(1901904400) MLK/CREAM PREPS CNTNG >10% MILK SOLIDS GEN NOTE 15	0.40	0.65	16.0%	Free

Appendix table 3—HTS codes and duty rates for sugar-containing products and coefficient range for sugar content: Chapter 19--Continued

HTS code	Sugar content coefficients		General duty	Mexico (NAFTA)
	Low	High		
(1901904600) MLK/CREAM PREP CNTNG>10% MLK SLDS,GEN NOTE 10-CH 4	0.40	0.65	16.0%	
(1901904700) MILK/CREAM PREPS, CONTNG >10% MILK SOLIDS, NESOI	0.40	0.65	$1.035/kg+13.6%	Free
(1901904800) MALTED MILK, NESOI, DESCRIBED IN GENERAL NOTE 15	0.40	0.65	10.0%	Free
(1901905200) ARTICLES OF MLK/CREAM,NESOI,CNTNG ADDTL NOTE7-CH17	0.40	0.65	10.0%	
(1901905400) ARTICLES MLK/CREAM,NESOI,>65%SUGR,ADDTL NOTE2-CH17	0.65	0.90	23.7cents/kg+8.5%	Free
(1901905600) ARTICLES OF MILK OR CREAM, NESOI,ADDTL NOTE 8-CH17	0.40	0.65	10.0%	
(1901905800) ARTICLES MLK/CREAM,NESOI,>10% SUGR ADDTL NTE3-CH17	0.10	0.40	23.7cents/kg+8.5%	Free
(1901907000) FOOD PREPS >5.5% BUTRFT NT PCKGD FR RETAIL, NESOI	0.10	0.40	10.2%	Free
(1901909060) FOOD PREP FLOUR/STARCH/DAIRY NESOI FR RETAIL QUOTA	0.10	0.40		
(1901909082) CORN-SOYA MILK BLENDS	0.10	0.40		
(1901909085) FOOD PREPS, NESOI, WHEAT-FLOUR-SOYA BLENDS	0.10	0.40		
(1901909095) FOOD PREPARATIONS OF FLOUR/STARCH/DAIRY ETC, NESOI	0.10	0.40		

Sources: U.S. International Trade Commission (duty rates), and Economic Research Service, USDA (sugar content coefficients).

Appendix table 4—HTS codes and duty rates for sugar-containing products and coefficient range for sugar content: Chapter 21

HTS code	Sugar content coefficients		General duty	Mexico (NAFTA)
	Low	High		
(2101123200) PREPS BASIS OF COFFEE EXTRACT/ETC, GENERAL NOTE 15	0.05	0.10	10.0%	Free
(2101123800) PREP BASIS COFFEE/EXTRCT/ETC,BLENDED SYRUPS, NESOI	0.05	0.10	30.5cents/kg+8.5%	Free
(2101124800) PREPS BASIS OF COFFEE EXTRACT/ESSENCE/CONCTR NESOI	0.05	0.10	30.5cents/kg+8.5%	Free
(2101125400) PREPS BASIS COFFEE EXTRCT >10% SUGAR,CH.17-NOTE 8	0.10	0.65	10.0%	
(2101125800) PREPS BASIS COFFEE EXTRACT, CONTN>10% SUGAR, NESOI	0.10	0.65	30.5cents/kg+8.5%	Free
(2101129000) PREPS BASIS OF COFFEE EXTRACT/ESSENCE/CONCTR NESOI	0.05	0.10	8.5%	Free
(2101202000) TEA AND MATE EXTRACTS, ESSENCES AND CONCENTRATES	0.05	0.10	Free	
(2101203200) PREP BASE TEA/MATE ETC,DESCRIBD IN GENERAL NOTE 15	0.05	0.10	10.0%	Free
(2101203400) PREPS BASIS TEA/MATE,BLEND SYRUP,SEE CH. 17-NOTE 9	0.05	0.10	10.0%	
(2101203800) PREP BASE TEA/MATE,BLEND SYRUP(CH. 17-NTE 4),NESOI	0.05	0.10	30.5cents/kg+8.5%	Free
(2101204400) PREPS BASIS TEA/MATE,>65% SUGAR,SEE CH.17 - NOTE 7	0.65	0.85	10.0%	
(2101204800) PREP BASE TEA/MATE ETC, CONTNG >65% SUGAR, NESOI	0.65	0.85	30.5cents/kg+8.5%	Free
(2101205400) PREPS BASE TEA/MATE,>10% SUGAR,SEE NOTE 8-CHAP. 17	0.10	0.65	10.0%	
(2101205800) PREP BASE TEA/MATE ETC, CONTAIN >10% SUGAR, NESOI	0.10	0.65	30.5cents/kg+8.5%	Free
(2101209000) OTHER PREPARATIONS WITH A BASIS OF TEA/MATE, NESOI	0.05	0.15	8.5%	Free
(2103907200) MIXED CONDIMENT/SEASONING, SEE GENERAL NOTE 15	0.30	0.50	7.5%	Free
(2103907400) MIXED CONDIMENT/SEASONING,SEE U S NOTE 8(A) -CH.17	0.30	0.50	7.5%	
(2103907800) MIXED CONDIMENTS/SEASONINGS (NOTE 3-CH. 21), NESOI	0.10	0.30	30.5cents/kg+6.4%	Free
(2103908000) MIXED CONDIMENTS/SEASONINGS, NESOI	0.10	0.30	6.4%	Free
(2105000500) ICE CREAM, DESCRIBED IN GENERAL NOTE 15	0.40	0.60	20.0%	Free
(2105001000) ICE CREAM, SEE ADDTL U. S. NOTE 5 TO THIS CHAPTER	0.40	0.60	20.0%	
(2105002000) ICE CREAM, WHETHER OR NOT CONTAINING COCOA, NESOI	0.40	0.60	50.2cents/kg+17%	Free
(2105002500) EDIBLE ICE,DAIRY PRODUCT,DESCRBD IN GENERAL NTE 15	0.40	0.60	20.0%	Free
(2105003000) EDIBLE ICE,DAIRY PRODUCT,U S ADDTL NOTE 10 -CHAP 4	0.40	0.60	20.0%	
(2105004000) EDIBLE ICE, DAIRY PRODUCTS (CHAP.4-NOTE 1), NESOI	0.40	0.60	50.2cents/kg+17%	Free
(2105005000) EDIBLE ICE EXCEPT ICE CREAM, NESOI	0.40	0.60	17.0%	Free
(2106900300) FOOD PREP,NESOI<5.5% BFAT,>16% MLK SOLID,GNL NTE15	0.30	0.50	2.9cents/kg	Free
(2106900600) FOOD PREP,<5.5% BFAT,>16% MLK SOLID,CHAP 4-NOTE 10	0.30	0.50	2.9cents/kg	
(2106900900) FOOD PREPS,<5.5%BTRFAT,>16% MILK SOLIDS,BULK,NESOI	0.30	0.50	86.2cents/kg	Free
(2106902200) BUTTER SUBST,>10% MILK,>45% BUTRFT,GENERAL NOTE 15	0.10	0.30	15.4cents/kg%	Free
(2106902400) BUTTER SUBST,>10% MLK,>45% BUTRFT,SEE NOTE 14-CH.4	0.10	0.30	15.4cents/kg%	
(2106902600) BUTTER SUBSTITUTE >10% MLK SOLID >45% BUTRFT NESOI	0.10	0.30	$1.996/kg	Free
(2106902800) BUTTER SUBST, >15% BTRFAT, >10% MILK SOLIDS, NESOI	0.10	0.30	13.1cents/kg	Free
(2106903200) BUTTER SUBSTITUTE,NESOI,>45% BTRFT,GENERAL NOTE 15	0.10	0.30	15.4cents/kg%	Free
(2106903400) BUTTER SUBSTITUTE,NESOI,>45% BUTRFT,CH. 4- NOTE 14	0.10	0.30	15.4cents/kg%	
(2106903600) BUTTER SUBSTITUTE, NESOI, >45% BUTTERFAT, NESOI	0.10	0.30	$1.996/kg	Free
(2106903800) BUTTER SUBSTS LIQ/SLD OV 15% BTR/MLK FAT/OIL NESOI	0.10	0.30	13.1cents/kg	Free
(2106904200) SYRUP,FROM SUGAR CANE/BEET,CONT COLR,GENERAL NTE15	0.60	0.80	3.6606cents/kg(sugar)	Free
(2106904400) SYRUP,FRM SUGAR CANE/BEET,CONT COLOR,NOTE 5-CH. 17	0.60	0.80	3.6606cents/kg(sugar)	Free

Appendix table 4—HTS codes and duty rates for sugar-containing products and coefficient range for sugar content: Chapter 21--Continued

HTS code	Sugar content coefficients		General duty	Mexico (NAFTA)
	Low	High		
(2106904600) SYRUP DERV FRM CANE/BEET SUGAR COLOR/NO FLVR NESOI	0.60	0.80	35.74cents/kg	17.665 cents/kg (sugar)
(2106905830) FOOD PREP OF GELATIN, FOR RETAIL CONT SUGAR	0.70	0.90	4.8%	Free
(2106905870) FOOD PREP OF GELATIN, EX/RETAIL, CONT SUGAR	0.70	0.90	4.8%	Free
(2106906200) FOOD PREPS,>10% MILK SOLID,GENERAL NOTE 15, NESOI	0.40	0.80	10.0%	Free
(2106906400) FOOD PREP NESOI,>10% MILK(DAIRY) CH.4-NOTE10,NESOI	0.40	0.80	10.0%	
(2106906600) FOOD PREPS NESOI,>10% MLK SOLID-DAIRY PRODCT,NESOI	0.40	0.80	70.4cents/kg+8.5%	Free
(2106906800) FOOD PREP NESOI,>10% MLK,BLND SYRP,NTE9-CH17,NESOI	0.40	0.80	10.0%	
(2106907200) FOOD PREPS NESOI,>10% MLK SOLID,BLEND SYRUP, NESOI	0.40	0.80	70.4cents/kg+8.5%	Free
(2106907400) FOOD PREP NESOI,>10% MLK>65% SUGR,NTE 7-CH17,NESOI	0.65	0.85	10.0%	
(2106907600) FOOD PREPS NESOI, >10% MILK, >65% SUGAR, NESOI	0.65	0.85	70.4cents/kg+8.5%	Free
(2106907800) FOOD PREP NESOI,>10% MLK,>10% SUGR,NTE8-CH17,NESOI	0.10	0.65	10.0%	
(2106908000) FOOD PREPS NESOI,>10% MILK SOLID,>10% SUGAR, NESOI	0.10	0.65	70.4cents/kg+8.5%	Free
(2106908200) FOOD PREPS NESOI, >10% MILK SOLIDS, NESOI	0.10	0.20	6.4%	Free
(2106908300) FOOD PREP NESOI,CONTNG 10% OR LESS MLK SOLID,NESOI	0.10	0.20	10.0%	Free
(2106908500) FOOD PREP NESOI,10% OR < MLK(DAIRY)NTE10-CH4,NESOI	0.10	0.20	10.0%	
(2106908700) FOOD PREP,NESOI,10% OR < MLK,OTH DAIRY PRDCT,NESOI	0.10	0.20	28.8cents/kg+8.5%	Free
(2106908900) FOOD PREP NESOI,10%< MLK,BLND SYRP,NTE9-CH17,NESOI	0.40	0.60	10.0%	
(2106909100) FOOD PREP,CONTNG 10% OR < MILK,BLEND SYRUP,NESOI	0.40	0.60	28.8cents/kg+8.5%	Free
(2106909200) FOOD PREP NESOI,10%<MLK,>65% SUGR,NTE 7-CH17,NESOI	0.65	0.90	10.0%	Free
(2106909400) FOOD PREPS, NESOI, 10% OR < MILK,>65% SUGAR, NESOI	0.65	0.90	28.8cents/kg+8.5%	Free
(2106909500) FOOD PREPS NESOI,10%<MLK,>10% SUGR,NTE8-CH17,NESOI	0.10	0.65	10.0%	
(2106909700) FOOD PREP, NESOI, CONTNG 10% OR LESS MILK, NESOI	0.05	0.25	28.8cents/kg+8.5%	Free
(2106909972) PREPS FOR MFG BEVERAGE, NESOI, CONTAINING SUGAR	0.40	0.60	6.4%	Free
(2106909973) PREPARATIONS FOR MANUFACTURE OF BEVERAGES NESOI	0.10	0.40	6.4%	Free
(2106909975) COFFEE WHITENERS, NON-DAIRY, NESOI	0.50	0.70	6.4%	Free
(2106909980) CREAM OR MILK SUBSTITUTES, NESOI	0.50	0.70	6.4%	Free
(2106909987) HERBAL TEAS/INFUSIONS OF MIXED HERBS, NESOI	0.05	0.15	6.4%	Free
(2106909990) FOOD PREPARATIONS, NESOI, CANNED	0.10	0.25	6.4%	Free
(2106909995) FOOD PREPARATIONS, NESOI, FROZEN	0.10	0.25	6.4%	Free
(2106909997) .FOOD PREPS NESOI CNTG SUGAR OF CANE/BEETS NT CN/F	0.50	0.70	6.4%	Free
(2106909998) FOOD PREPARATIONS NESOI, NOT CANNED OR FROZEN	0.10	0.25	6.4%	Free
(2106909999) FOOD PREPARATIONS NESOI, NOT CANNED OR FROZEN	0.1	0.25	6.4%	Free

Sources: U.S. International Trade Commission (duty rates), and Economic Research Service, USDA (sugar content coefficients).