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International Agricultural Trade
Research Consortium

The Effect of Sugar Price Policy on U.S.
Imports of Processed Sugar-containing foods

by

Cathy L. Jabara*

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Executive Summary

Since the United States imposed a restrictive import quota on raw sugar imports in May, 1982, U.S. imports of sugar-containing products have increased by over 120 percent in value. This increase in imports has been attributed to the differential between U.S. and world price sugar. However, rising consumer income and other U.S. trade programs, such as the Generalized System of Preferences, can also influence U.S. imports of manufactured goods. This paper examines the effects of sugar protection, as well as the effects of these other factors, on U.S. demand for imports of sugar-containing products.

The paper also addresses two major issues: (1) whether substitution of alternative sweeteners has allowed U.S. food manufacturers to reduce the competitive advantage provided to foreign manufacturers by U.S. sugar policies, and (2) which countries -- developed or developing -- have been able to increase their exports of sugar-containing products to the United States. Import demand functions for four categories of sugar-containing processed foods -- canned fruits, confectionery, sweetened cocoa and chocolate, and bakery products are examined.

Results indicate that the differential between U.S. and world sugar prices has contributed to increased U.S. imports of sugar-containing products, but that growth in U.S. disposable income has played a larger role. The availability of cheaper substitute sweeteners has reduced the impact of the price differential on some products. The developed countries appear to have disproportionately benefitted from the U.S.-foreign sugar price differential. Thus, in addition to reducing their exports of raw sugar, the U.S. sugar program has resulted in increased competition for the developing countries in exporting sugar-containing products to the United States.

The Effect of Sugar Price Policy on U.S.
Imports of Processed Sugar-containing Foods

Since May, 1982, when the United States imposed a restrictive import quota on raw sugar imports, U.S. imports of miscellaneous sugar-containing products (sugar blends, mixtures, confectionery, bakery, and edible preparations) have increased by over 150 percent in volume and by over 120 percent in value -- from \$677 million in 1982 to over \$ 1.5 billion in 1986. The increase in imports of these products has been largely attributed to the price differential between domestic U.S. and cheaper, world price sugar (USDA Sugar and Sweetener Outlook and Situation, Washington Post). However, the extent to which increased imports of sugar-containing products have indeed been caused by government intervention in the sugar market, rather than by other market factors, has yet to be examined. Rising consumer income and other U.S. trade policies and programs, such as the Generalized System of Preferences, also influence the level of U.S. imports of manufactured goods. The objective of this paper is to examine the effects of sugar protection, as well as the effects of these other factors, on U.S. demand for imports of sugar-containing products.

Among the questions the paper will address is whether substitution of alternative sweeteners has allowed U.S. food manufacturers to reduce the competitive advantage provided to foreign manufacturers by U.S. sugar policies. The paper will also examine which countries -- developed or developing -- have benefitted from artificially high U.S. sugar prices by increasing their exports of sugar-containing products to the United States. For instance, Zeitz and Valdes have documented the adverse impact of the U.S.

sugar program on developing countries' sugar exports, but they did not examine whether or not the developing countries have been able to offset some of their losses in raw sugar exports through increased exports of value-added, processed foods.

U.S. import demand for four categories of sugar-containing processed foods -- canned fruits, confectionery, sweetened cocoa and chocolate, and bakery products will be examined. These categories of sugar-containing products accounted for approximately \$930 million in imports in 1986.

Importance of the Problem

The data in Table 1 show the decline in U.S. raw sugar imports which occurred during the 1980's, the rising trend in U.S. imports of four sugar-containing product categories, and the share of these imports captured by developed and developing countries. The developing countries, particularly the Caribbean countries, Brazil, the Philippines, and Thailand, have suffered the greatest loss in sugar export revenues, but some developed countries, such as Australia, also export sugar to the United States. Although the U.S. government intervened in the sugar market continuously during the 1970-86 period, either through quotas, tariffs, and/or fees, U.S. prices were much higher in relation to world prices in the 1980's, averaging about 3 times the level of world prices in the 1981-1986 period, as compared to 1.5 times the world price in the 1970-1980 period.

The value of imports of all of the sugar-containing products shown in Table 1 rose over the 1970-1986 period.^{1/} In nominal terms, the increase in U.S. imports of these products since implementation of the 1982 sugar program appears to be part of a larger trend of rising imports continued from the

Table 1--U.S. imports of raw sugar and selected sugar-containing products, total and from developing and developed countries, 1970, 1980, and 1986

Commodity	Imports			Import Shares		
	1970	1980	1986	1970	1980	1986
	1000 \$			percent		
Canned Fruits ^{1/}	51,019	174,935	265,785	100.0	100.0	100.0
DC's	17,652	32,569	62,031	32.6	18.6	23.4
LDC's	33,367	142,366	203,754	65.4	81.4	76.6
Confectionery ^{2/}	51,064	129,717	315,455	100.0	100.0	100.0
DC's	49,198	115,798	277,941	96.3	89.3	88.1
LDC'	1,866	13,919	37,514	4.7	10.7	11.9
Sw. Cocoa and Chocolate ^{3/}	1,584	25,439	98,087	100.0	100.0	100.0
DC's	1,509	22,309	76,605	95.3	87.7	78.1
LDC's	75	3,130	21,482	4.7	12.3	21.9
Bakery ^{4/}	27,631	96,707	249,855	100.0	100.0	100.0
DC's	27,493	87,429	226,038	99.5	90.4	90.5
LDC's	138	9,278	23,817	.5	9.6	9.5
Raw Sugar	729,116	1,987,730	669,745	100.0	100.0	100.0
DC's	40,458	206,755	59,119	5.5	10.5	8.8
LDC's	688,658	1,780,975	610,626	94.4	89.5	91.2

1/ TSUSA import numbers 146.0000 to 150.0000, preserved and prepared fruits.

2/ TSUSA import numbers 156.3020, 157.1005, 157.1010, 157.1045, and 157.1050.

3/ TSUSA import numbers 156.2500, 156.3045, 156.3050, 156.3065, 156.4500, and 156.4700.

4/ TSUSA import number 182.2000.

Source: U.S. Department of Commerce (various years).

1970's. However, in real terms, U.S. imports of these products rose at a much faster annual average rate in the 1981-86 period, about 14%, as compared to an average annual rate of increase of 3.6% in the 1970-80 period.

The decline in U.S. sugar imports of about \$1 billion from 1980 to 1986 was twice as large as the increase in imports of the four sugar-containing product categories shown. Because the developing countries' share in these imports is relatively small, as compared to their share in U.S. sugar imports, these countries have only been able to offset some of their sugar export losses from increased exports of these products. However, to the extent these industries are infant industries associated with externalities, then the gains to the developing countries may be greater.

Determinants of Import Demand

Clifton and Chmura explained U.S. demand for imports of manufactured goods by examining changes in industry-specific real exchange rates. These industry exchange rates were represented by the relative prices of domestic and imported goods which, in turn, are functions of the relative costs of imported and domestic goods to the domestic market. Consistent with these studies, U.S. import demand for the j^{th} sugar-containing product, I_j , is assumed to be a function of the relative cost of domestic production of the j^{th} sugar-containing product to imported substitutes, as represented by the relationship between U.S. and world sugar prices. It is thus assumed that the relation between U.S. sugar prices and world sugar prices determines the overall cost structure and international competitiveness of the j^{th} sugar-containing product industry.

This specification also makes the simplifying assumption that movements

in relative sugar prices are exogenous to the industry. Imports of sugar-containing manufactured products are also regarded as imperfect substitutes for domestic production due to differences in quality, delivery time, credit arrangements, as well as other factors. U.S. imports of sugar-containing products from different countries and country groupings are also considered to be imperfect substitutes for each other for the same reasons.

The import demand equations can be written as

$$I_{jt} = F(RS_t, Y_t, DG_t, Z_{jt}) \quad (1)$$

where I_{jt} is the value in millions of U.S. imports of the j^{th} sugar-containing product in period t , deflated by an index of changes in the unit value import price of the j^{th} sugar-containing product (1970 = 100); RS_t is the ratio between the U.S. wholesale price of refined sugar (Northeast) to the duty-inclusive, world raw sugar price, f.o.b. Caribbean ports, adjusted for transportation to New York and for processing costs, in period t ; Y_t is U.S. per capita disposable income, deflated by the consumer price index (CPI) in period t ; DG_t is a dummy variable to reflect the introduction in 1976 of the Generalized System of Preferences (GSP) for manufactured goods imported by the United States; and Z_{jt} represents a vector of import demand shifters specific to product j in period t . Total import demand is further separated into two categories, demand for imports from developed countries, IO_j , and demand for imports from developing countries, ID_j .

Government intervention that maintains U.S. prices for sugar higher than equivalent foreign prices would be expected to act as an export subsidy for those foreign manufacturers who have access to cheaper foreign sugar. This subsidy should cause the demand for imports of sugar-containing products to

rise, ceteris paribus, and the demand for the similar domestic product to decline (shift inward) as consumers substitute lower priced imports for domestic goods. It is expected that RS_t will be positively related to I_j .

Real disposable income per capita, Y_t , is included to capture the effects of changes in real purchasing power and, to some extent, to allow for the economy's movement through the business cycle. It is expected to be positively related to I_j for a normal good.

U.S. imports of sugar-containing products from many developing countries benefit from temporary, duty-free tariff preferences under the GSP program. According to Baldwin and Murray, granting tariff preferences to manufactured imports from certain beneficiary countries will result in an increase in total imports of the eligible products as imports from beneficiary countries rise, and a corresponding decline in domestic production -- the trade creation effect. Thus we would expect to see a positive relationship between DG and I_j , and between DG and ID_j . However, there will also be a tendency for domestic consumers to substitute lower-priced imports from preferred sources for the imports from non-preferred sources -- a trade diversion effect. Thus a negative relationship is expected between DG and IO_j , the real value of imports from the developed countries.

Z_{jt} represents a vector of real prices for product-specific ingredients that would be expected to shift the U.S. import demand schedule for the j^{th} sugar-containing product. Included in Z_{jt} are the real prices of alternative sweeteners, glucose and high fructose corn syrups, and the real price of cocoa. An increase (decrease) in the price of an alternative sweetener can lead to its decreased (increased) use in product formulas and affect the competitiveness of the product vis a vis sugar-containing substitutes (Carmen). Thus a positive relationship is expected between these prices and

I_j . Similarly, a change in cocoa prices will affect both importers and domestic producers alike, since cocoa is not produced in the United States, but it can also affect import demand for some sugar-containing products as domestic manufacturers substitute other ingredients for imports that are cocoa-intensive. We would expect an increase (decrease) in the cocoa price to result in reduced (increased) import demand for cocoa-intensive, sugar-containing imports.

Results

Equation (1) was estimated using regression analysis for four broad groups of sugar-containing products -- canned fruits, confectionery (confectionery containing chocolate and not containing chocolate), sweetened cocoa and chocolate, and bakery -- using time series data from 1970 to 1986. Import data were taken from U.S. Department of Commerce, Bureau of the Census, U.S. Imports for Consumption, various years. Total import demand equations were estimated using ordinary least squares (OLS). Zellner's seemingly unrelated technique (SUR) was used in estimating import demand equations for developed and developing countries' imports (IO_j and ID_j), for confectionery and sweetened cocoa and chocolate, and for the two confectionery equations.

A. Total Import Demand

Estimated results for total import demand, I_j , support the underlying hypothesis that changes in real income, as well as the relative prices of U.S. and foreign sugar, have affected U.S. import demand for four categories of sugar-containing products (Table 2). More specifically, the results indicate

that increased U.S. disposable income has been the most significant factor affecting the level of U.S. imports of all of these products. Thus, as the U.S. economy continues to grow, imports of these products will rise, all else held constant, regardless of the level of the U.S. sugar price. The weighted average income elasticity for the real value of U.S. imports of all of these products, evaluated at the means, is approximately 2.9. This suggests that if real disposable income grows at the rate of the last two years, about 2.5% per year, and all other factors are held constant, then the real value of U.S. imports of these products will increase by about 7.3% per year.

The relative prices of U.S. and foreign sugar have had the greatest impact in increasing U.S. imports of sweetened cocoa and chocolate (elasticity of .66), followed by confectionery containing chocolate (.59), and bakery and canned fruits (.22). The estimated weighted average elasticity with respect to this price ratio for all of these products, evaluated at the means, is .25. Since the average annual increase in the U.S.-foreign sugar price differential over the 1981 to 1986 period was about 22%, this elasticity suggests that the current U.S. sugar program has been responsible for an increase in U.S. imports of these products of about 5% per year during this period. The annual average increase in the real value of U.S. imports was about 17% during the 1981-86 period.

Due to substitution, changes in the real price of corn syrup (GL) are more important than relative sugar prices in affecting imports of confectionery not containing chocolate. This substitution has made confectionery imports less sensitive to the differential between world and U.S. sugar prices. The price of high fructose corn syrup also appears to have affected U.S. imports of canned fruits in a similar manner.

The results also suggest that the GSP program has been responsible for

Table 2--Import demand equations for
sugar-containing products, 1970-86

1. Canned fruit

$$\begin{aligned} \text{ICF} = & -70.9 + 8.5^* \text{RS} + 25.7^* \text{Y} + 20.6^* \text{DG} + 2.2 \text{HF} \\ & (-2.86) \quad (2.30) \quad (3.60) \quad (3.37) \quad (2.04) \end{aligned} \quad \begin{aligned} \bar{R}^2 &= .92 \\ \text{DW} &= 1.79 \\ p &= .29 \end{aligned}$$

2. Confectionery

$$\begin{aligned} \text{IC} = & -141.5 + 7.5^* \text{RS} + 43.8^* \text{Y} - 13.3^* \text{DG} + 358.7 \text{GL} \\ & (-6.47) \quad (3.36) \quad (8.93) \quad (-3.70) \quad (2.11) \end{aligned} \quad \begin{aligned} \bar{R}^2 &= .91 \\ \text{DW} &= 2.49 \end{aligned}$$

$$\begin{aligned} \text{ICC} = & -44.4 + 7.3^* \text{RS} + 12.7^* \text{Y} - 10.7^* \text{DG} - 61.0 \text{GL} \\ & (-3.53) \quad (8.55) \quad (6.57) \quad (-7.93) \quad (-.91) \end{aligned} \quad \begin{aligned} \bar{R}^2 &= .95 \\ \text{DW} &= 2.36 \\ p &= -.50 \end{aligned}$$

$$\begin{aligned} \text{INC} = & -108.7 + .1 \text{RS} + 31.4^* \text{Y} - 4.0 \text{DG} + 359.8^* \text{GL} \\ & (-7.23) \quad (.01) \quad (9.31) \quad (-1.59) \quad (3.08) \end{aligned} \quad \begin{aligned} \bar{R}^2 &= .86 \\ \text{DW} &= 2.04 \end{aligned}$$

3. Sweetened cocoa and chocolate products

$$\begin{aligned} \text{ICH} = & -74.0 + 2.9^* \text{RS} + 18.5^* \text{Y} + 1.6 \text{DG} - 8.1^* \text{CO} + 123.8^* \text{GL} \\ & (-10.38) \quad (3.70) \quad (12.01) \quad (1.41) \quad (-3.49) \quad (2.30) \end{aligned} \quad \begin{aligned} \bar{R}^2 &= .96 \\ \text{DW} &= 2.52 \end{aligned}$$

4. Bakery products

$$\begin{aligned} \text{IB} = & -138.0 + 4.9^* \text{RS} + 44.9^* \text{Y} - 6.3 \text{DG} \\ & (-8.45) \quad (2.27) \quad (8.84) \quad (-1.76) \end{aligned} \quad \begin{aligned} \bar{R}^2 &= .94 \\ \text{DW} &= 1.62 \end{aligned}$$

Notes: I_j denotes U.S. import demand for the j^{th} sugar-containing product; CF denotes canned fruit; C, all confectionery; CC confectionery containing chocolate; NC confectionery not containing chocolate; CH, chocolate products; and B, bakery.

RS = ratio of the U.S. wholesale refined sugar price to the world raw sugar price, adjusted for processing and transportation costs.

Y = U.S. per capita disposable income, deflated by the consumer price index (CPI).

DG denotes U.S. GSP program; =1 1976 - 1986; = 0 all other periods.

CO = world cocoa price, c.i.f. New York, deflated by the U.S. wholesale price index (WPI).

GL = price of corn syrup, deflated by the WPI.

HF = price of high fructose corn syrup, deflated by the WPI.

* indicates coefficients are statistically different from zero using a .05 level two-tailed t-test;

increasing the overall level of U.S. imports solely in the case of canned fruits, the only product analyzed in which developing countries provide the largest share of U.S. imports. The positive coefficient estimated for DG in the canned fruit equation suggests a real, annual trade creation effect of \$21 million. The negative coefficients estimated for DG in the confectionery and bakery equations must be treated with caution, as DG may be picking up the effect of an omitted variable in these equations. Specifically, the negative coefficients may represent declines in imports as developed country exporters move production to the United States once their products become established in the U.S. market (see Table 3).

B. Developing Countries

Although the U.S.-foreign sugar price differential has contributed to increased U.S. imports of sugar-containing products, the results of Table 3 suggest that the developed countries have been the primary beneficiaries of U.S. sugar policy with regard to increased imports of these products. While the developing countries' exports have been more responsive with respect to an increase in this price ratio in the case of sweetened cocoa and chocolate products (elasticity of 1.3 as compared to .6 for the developed countries), exports from the developed countries have been more responsive for the other products. This result helps to explain the decline in the developing countries' share of U.S. imports of canned fruits and bakery products, and the slow growth in their market share for confectionery from 1980 to 1986 (see Table 1).

The reasons for the greater responsiveness of the developed countries in supplying these imports is not clear from Table 3. However, in the case of

Table 3--Estimated import demand equations for
sugar-containing products, developing and developed
country groups, 1970-86

1. Canned fruit

$$\text{IOCF} = -21.7 + 5.4^* \text{RS} + 8.8^* \text{Y} - 5.1^* \text{DG} \quad \bar{R}^2 = .76$$

(-2.13) (3.91) (2.78) (-2.28) $\text{DW} = 2.21$

$$\text{IDCF} = -42.7 + 1.7^* \text{RS} + 20.0^* \text{Y} + 23.9^* \text{DG} + 1.7^* \text{HF} \quad \bar{R}^2 = .84$$

(-3.03) (.72) (3.98) (5.51) (2.18) $\text{DW} = 1.89$
 $p = .21$

2. Confectionery

$$\text{IOC} = -111.8 + 7.2^* \text{RS} + 36.5^* \text{Y} - 13.9^* \text{DG} + 255.3^* \text{GL} \quad \bar{R}^2 = .90$$

(-5.72) (3.61) (8.34) (-4.31) (1.68) $\text{DW} = 2.56$

$$\text{IDC} = -29.1 + .3^* \text{RS} + 7.1^* \text{Y} + .5^* \text{DG} + 100.0^* \text{GL} \quad \bar{R}^2 = .92$$

(-9.15) (.85) (10.02) (.98) (4.04) $\text{DW} = 2.12$

3. Sweetened cocoa and chocolate products

$$\text{IOCH} = -71.1 + 1.8^* \text{RS} + 12.5^* \text{Y} + 1.6^* \text{DG} - 6.3^* \text{CO} + 50.0^* \text{GL} \quad \bar{R}^2 = .97$$

(-11.39) (3.74) (13.53) (2.41) (-4.70) (1.52) $\text{DW} = 2.27$
 $p = -.51$

$$\text{IDCH} = -23.5 + 1.4^* \text{RS} + 5.1^* \text{Y} + .1^* \text{DG} - 1.7^* \text{CO} + 63.8^* \text{GL} \quad \bar{R}^2 = .89$$

(-6.37) (3.44) (6.39) (.11) (-1.34) (2.30) $\text{DW} = 2.12$

4. Bakery products

$$\text{IOB} = -116.2 + 5.0^* \text{RS} + 38.5^* \text{Y} - 8.3^* \text{DG} \quad \bar{R}^2 = .93$$

(-9.14) (2.95) (9.76) (-2.99) $\text{DW} = 1.87$

$$\text{IDB} = -23.5 + .5^* \text{RS} + 7.5^* \text{Y} + 1.7^* \text{DG} \quad \bar{R}^2 = .92$$

(-9.29) (1.40) (8.85) (2.56) $\text{DW} = 2.11$
 $p_1 = .56$
 $p_2 = -.46$

Notes: O denotes developed countries; D developing countries.
All other variables are defined as in Table 2.

confectionery, it most likely stems from the types of confectionery exported by the developing countries — confectionery not containing chocolate, imports of which have not been promoted by the U.S.--foreign sugar price differential. The developing countries' lower responsiveness may stem from inefficiencies in production, lower sugar intensity of products exported, or from interference in sugar pricing undertaken by the developing countries themselves. It should be noted that countries that are large exporters of these products and that also maintain high domestic sugar prices, such as the European Community and Japan, cannot use export subsidies to expand their exports of these sugar-containing products because they are processed products. However, it is clear that the differential between U.S. and world price sugar during the 1980's has helped to offset some of the other factors, such as the GSP program (canned fruits and bakery products), and larger import income elasticities (confectionery and bakery products), that had been contributing to a greater share of the developing countries in U.S. imports of these sugar-containing products.

Conclusions

Results of econometric estimation indicate that the differential between U.S. and world sugar prices maintained by government intervention in the U.S. sugar market has contributed to increased U.S. imports of some sugar-containing products, but that growth in U.S. disposable income has played a larger role. In addition, the availability of cheaper, substitute sweeteners appears to have reduced the impact of the U.S.-foreign sugar price differential on imports of some types of confectionery and, to a smaller extent, on imports of canned fruits, products in which these sugar substitutes are widely used.

The results also suggest that, with the exception of sweetened cocoa and chocolate products, sugar-containing product imports from the developed countries have disproportionately benefitted from the U.S.-foreign sugar price differential. This differential has provided an umbrella under which the developed countries have been able to expand their exports of confectionery, bakery products, and canned fruits to the United States while the developing countries' share has declined or stagnated. For these products, the price differential has helped the developed countries to overcome some of the factors, such as the GSP program, that had been working to increase U.S. imports from the developing countries. The results suggest that in addition to reducing their exports of raw sugar to the United States, the U.S. sugar program has resulted in some increased competition for the developing countries from the developed countries in exporting sugar-containing products to the United States.

Endnotes

1. Emergency import quotas were placed on imports of blended syrups and other sugar-containing products with a content of sugar derived from beet or cane of over 65% by dry weight in June, 1983. Of the products examined in this paper, these quotas briefly affected imports of sweetened cocoa, which is a very minor component of the sweetened cocoa and chocolate products group.

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