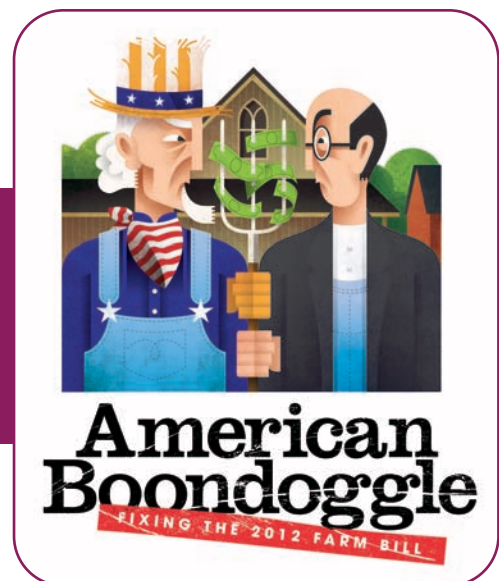


Sweets for the Sweet

The Costly Benefits of the US Sugar Program

by Michael K. Wohlgenant



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Introduction

The US sugar industry receives enormous government support and protection from foreign competition. The sugar program has changed over time, becoming a complex set of rules developed to promote sugar production primarily at the expense of domestic consumers. The program has also affected foreign producers and consumers through import restrictions that have significantly reduced the world sugar price. Since the mid-1970s, as a result of the sugar program, the price of sugar in the United States has been almost twice as high as the price of sugar on the world market in most years.

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The resulting estimated costs to US consumers have averaged \$2.4 billion per year, with producers benefiting by about \$1.4 billion per year. So the net costs of income transfers to producers have averaged about \$1 billion per year. Distortions due to the sugar program have also led to the development of the high-fructose corn syrup (HFCS) industry and extensive use of HFCS as a substitute for sugar in soft drinks and other sweetened products. In addition, in most years, the sugar program has caused world market prices to be about 8.5 percent lower than they would otherwise be, with concomitant adverse effects on the incomes of some of the world's poorest farmers.

The 2008 Farm Bill shifted the conservation focus from land-retirement to working-land programs. The traditional reliance on voluntary approaches to solving environmental problems was reaffirmed by the use of a consolidated set of financial-assistance programs supported by research and education.

The current sugar program, which relies on a tariff rate quota system that raises domestic prices and restricts imports, has been in place for many years and is a costly way of transferring income to producers. Alternate income-transfer policies such as straightforward loan-rate programs or direct cash-transfer payments are costly to taxpayers and, especially in the current climate, politically infeasible. Another option is a buyout program through which producers receive a one-time payment and the program is discontinued. That would also likely be an expensive option, involving multiple billions of taxpayer dollars. Given the current high world prices for sugar and near-record returns and incomes for sugar-beet and sugar-cane farmers, many elements of the sugar program currently do not come into play. Now may be the right time for Congress to end the program.

The purpose of this paper is to review the structure of the US sugar industry, trace the evolution of government intervention in sugar, and quantify the costs of the sugar program. In addition, indirect costs associated with the distortions of the program are discussed, including the effects of the

program on the mix of sweeteners and mix of sugars. Policy recommendations are provided in the conclusion.

Structure of the US Sugar Industry

Sugar in the United States is produced using both sugar cane and sugar beets. Historically, sugar-beet production was slightly greater than sugar-cane production, and the trend has moved slowly in favor of sugar beets over time. Technological change due to improved plant varieties and improved harvesting and processing methods has led to increased yields. Trends in sugar-beet and sugar-cane production are shown in figure 1 over the period 1975–2008. Figure 2 shows trends in real prices (1982–84 constant dollars) of sugar cane and sugar beets. The trends move downward, reflecting technological improvements over time.

Sugar-beet production is concentrated in eleven states encompassing the upper Great Plains, upper Midwest, and far West. Minnesota and North Dakota account for about 55 percent of all sugar-beet acreage. Of sugar-beet acreage, Michigan accounts for about 12 percent; the upper Great Plains states (western North Dakota, Montana, Wyoming, Colorado, and Nebraska) account for 14 percent; Idaho, Washington, and Oregon account for almost 15 percent; and California accounts for the remaining 4 percent.¹

Sugar beets are generally produced on relatively small farms. In 2007, the average farm size was 312 acres. The number of farms has decreased over time as average farm size has increased, yet there are still about four thousand sugar-beet farms.²

Sugar-cane production is limited to subtropical and tropical areas of the country: (in order of output) Florida, Louisiana, Texas, and Hawaii. Sugar-cane production has been growing the fastest in Louisiana, with substantial growth also in Florida and Texas. Hawaiian production has declined significantly over time due to the high opportunity cost of land for other nonagricultural uses.³ The growth of sugar-cane production in Florida has

slowed in recent years due to pollution problems. In 2008, Florida proposed a buyout of sugar-cane production to improve water quality in the Everglades. The planned buyout of all sugar production and milling for \$1.75 billion devolved into a partial buyout of just \$175 million.⁴

Like sugar-beet farms, sugar-cane farms have also increased in average size. Sugar-cane production is concentrated in the largest farms. The share of production for farms larger than 2,000 acres is almost 60 percent. The share of production for farms greater than 500 acres is over 90 percent. Farms smaller than 250 acres account for only 3 percent of sugar-cane production.⁵

A major difference between sugar cane and sugar beets is that sugar cane is a perennial crop that requires less management. Sugar-cane harvesting occurs continually, as needed by mills for processing, while beet harvesting in the northern United States occurs in September and October to avoid the beets freezing in the ground.

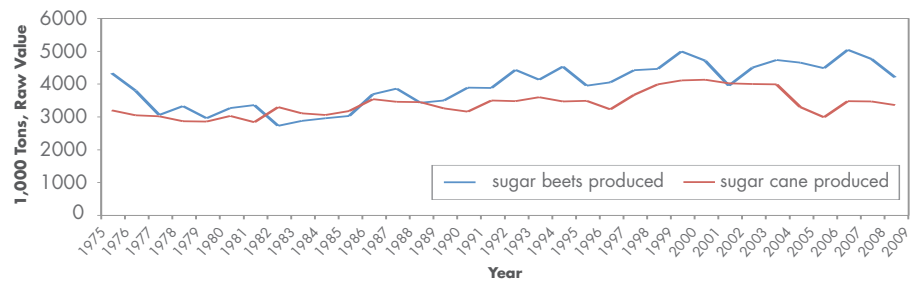
Both sugar beets and sugar cane must be processed into refined sugar (sugar beets) and raw sugar (sugar cane) soon after harvesting. Sugar beets can be stored for a short time after harvest before being refined into sugar. This means the number and location of sugar-processing plants are critical to sugar production. Without sugar-beet refineries and sugar-cane mills, sugar beets and sugar cane have little or no economic value.⁶

The number of sugar refineries has declined significantly over time. This is due in large part to the sugar program, in which HFCS has substituted for sugar as a sweetener.⁷ Sugar is processed not only

into refined sugar but also into a range of products containing sugar, including bakery products, beverages (canned, frozen, and bottled), confections, and dairy.⁸

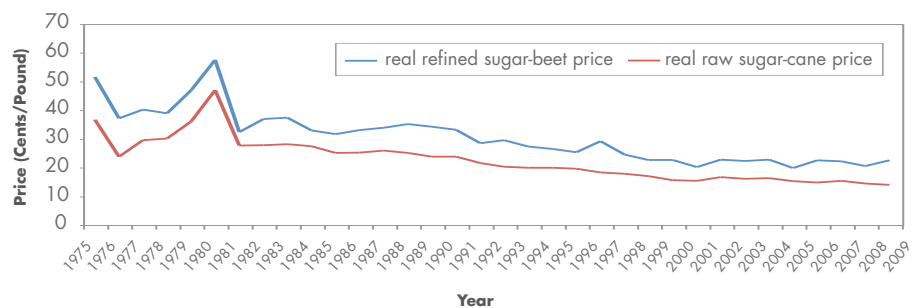
As figure 3 shows, the US sugar industry has faced competition from HFCS in the last several decades. In fact, the industry came into existence largely because of high sugar prices resulting from the sugar program. The HFCS industry has grown, and now HFCS represents over 50 percent of all sweeteners. The relationship between sugar prices and HFCS prices is apparent in figure 4. In the 1970s and 1980s, the high relative sugar price induced substitution of HFCS for sugar. Since about 1990, there has not been much movement in the relative sugar price. Consequently, only small substitution of HFCS for sugar has occurred. In recent years, the real price of HFCS has increased, largely due to increases in demand for ethanol. This trend, if sustained, may lead to substitution of sugar for HFCS.⁹

Figure 1: Trends in US Sugar Beets and Sugar Cane, 1975–2008



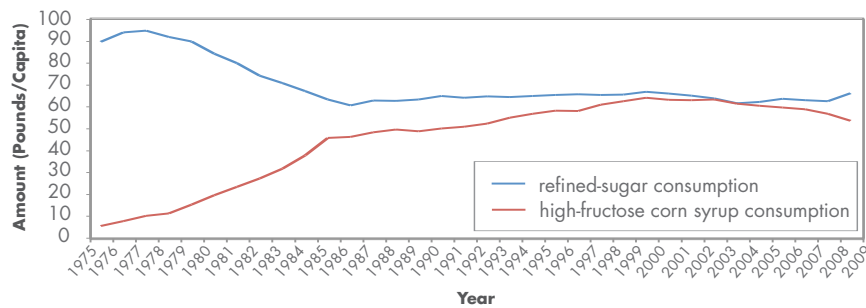
SOURCE: US Department of Agriculture (USDA), "Sugar and Sweeteners: Background," www.ers.usda.gov/Briefing/Sugar/Background.htm (accessed May 2, 2011).

Figure 2: Real US Sugar-Beet and Sugar-Cane Prices, 1975–2008



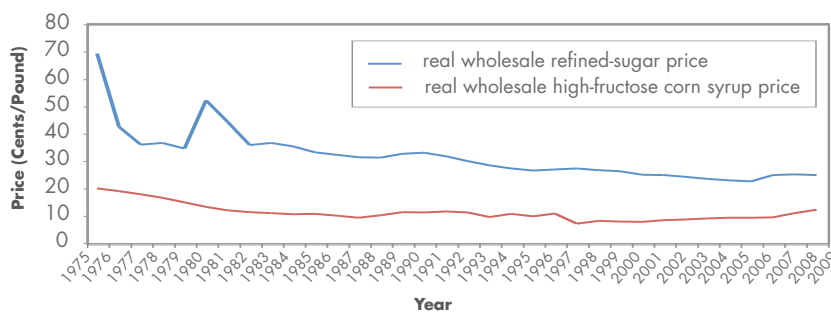
SOURCE: USDA, "Sugar and Sweeteners: Background," www.ers.usda.gov/Briefing/Sugar/Background.htm (accessed May 2, 2011).

Figure 3: Sugar and High-Fructose Corn Syrup Consumption, 1975–2008



SOURCE: USDA, "Sugar and Sweeteners: Background," www.ers.usda.gov/Briefing/Sugar/Background.htm (accessed May 2, 2011).

Figure 4: Real Refined Sugar and High-Fructose Corn Syrup Prices, 1975–2008



SOURCE: USDA, "Sugar and Sweeteners: Background," www.ers.usda.gov/Briefing/Sugar/Background.htm (accessed May 2, 2011).

The United States accounts for approximately 6 percent of total world sugar consumption, and it produces slightly less than 6 percent of all sugar. Because of the sugar program, the US sugar price has exceeded the world sugar price by about twofold over the last four decades (see figure 5). Two notable exceptions are 1980 and 1981, when the program was not in effect.

Government Intervention in Sugar

There is a long history of government intervention in the US sugar industry, dating back to the beginning of our country in 1789. Initially, protection came in the form of a tariff on foreign sugar to obtain revenue for the US government. Between 1789 and 1930, thirty different acts of Congress dealt with

sugar, including a special act of 1842 enacting a tariff to protect domestic refining of sugar. The first federal sugar program was developed during the Roosevelt administration.¹⁰

The first Sugar Act, the Jones-Costigan Act, became law on May 9, 1934. It was superseded by legislation from 1937 through 1974, when the Sugar Act expired. The many previous acts used policy instruments such as tariffs, quotas, fees, taxes on processors, payments to producers, and minimum-wage provisions.¹¹ The major reason for the expiration of the Sugar Act at the end of 1974 was a commodity price boom, which included sugar, caused by the energy crisis, inflation, and global commodity shortages.¹²

The main effects of the expiration included significant changes in US domestic and foreign sugar policies, including the elimination of import restrictions on refined sugar, of acreage and production allotments, and of excise taxes on domestic and imported refined sugar.¹³

However, when lower sugar prices returned, there were renewed calls for government support of domestic sugar prices. The secretary of agriculture started an interim price-support program in 1977 under the authority of the Agricultural Act of 1949.¹⁴ The Food and Agriculture Act of 1977 and subsequent acts instituted price support through loan and repurchase programs. Aside from 1980 and 1981, when sugar prices were high, this program with its price-support provisions remained in effect until the Food Security Act of 1985.¹⁵

The Food Security Act of 1985 essentially left unchanged the main provisions of the previous act. However, special attention was given to instituting a no-cost program by restricting sugar supplies. This

program remained in effect from 1986 through 1990 with a loan rate of no less than eighteen cents per pound.¹⁶

The 1990 Farm Bill, which covered the 1991–96 sugar crop years, had almost the same provisions as the 1985 act with one particularly important change—the establishment of a two-tiered tariff scheme known as the Tariff Rate Quota (TRQ) system. A minimum import quota of 1.25 million tons, raw value, with a two-tiered tariff system, was established with marketing controls on domestic sugar for imports falling below 1.25 million tons.¹⁷ The 1996 and 2002 Farm Bills retained the same main provisions as the 1990 Farm Bill. The loans were changed to recourse loans when the TRQ was below 1.5 million tons and nonrecourse when the TRQ exceeded 1.5 million tons. While the import quota system remained the same, marketing controls were removed.¹⁸

An explanation of the TRQ system is crucial to understanding how the federal government supports domestic sugar prices. There are two tariffs: an in-quota tariff (currently 0.625 cents per pound) and an over-quota tariff (currently 15.36 cents per pound for raw sugar and 16.21 cents per pound for refined sugar). In practice, the in-quota tariff is waived under World Trade Organization and US free trade agreements.¹⁹ Effectively, then, the over-quota tariff—*together with production controls*—sets the price floor for US domestic sugar. Commodity credit corporate (CCC) loans are made to sugar processors. These loan rates have not been in effect in recent years because of high domestic sugar prices, but they provide a price floor for sugar.

The 2008 Farm Bill is essentially a continuation of the 2002 Farm Bill, with some changes for sugar. The first addition is the Feedstock Flexibility Program, which allows diversion of excess sugar consumption to ethanol production. Although not explicit, one apparent reason for this provision is to offset increased imports coming from Mexico, which now ships sugar to the United States duty free under the North American Free Trade Agreement.²⁰

Another provision of the 2008 act is to provide loans to sugar processors of domestically produced

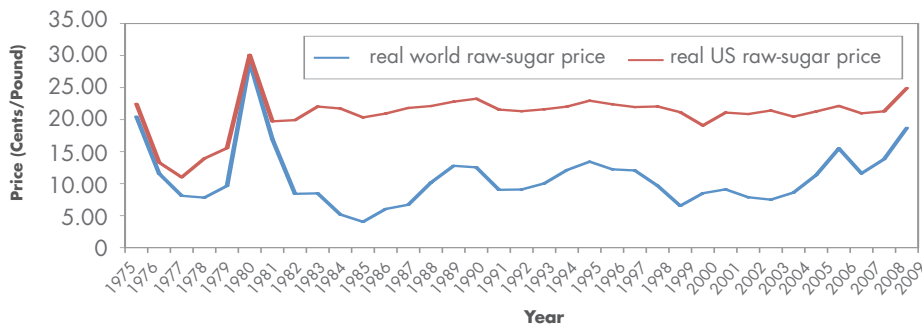
sugar cane and sugar beets at fixed loan rates for fiscal years (FY) 2009–2013. These loans are made to processors instead of producers directly because sugar in raw form is perishable and too bulky. For the benefits of price support to be passed back to producers, processors are required to make payments to producers in proportion to the value of the loans received for sugar cane and sugar beets.²¹ The loans are nonrecourse. Rates for 2009–2013 established for raw cane sugar were 18 cents for FY 2009, 18.25 cents for FY 2010, 18.50 cents for FY 2011, and 18.75 cents for FY 2012–13. For refined beet sugar, the loan rates established were 22.9 cents for FY 2009 and 128.5 percent of the loan rate for raw cane sugar for FY 2010–13.²²

The estimated cost of the sugar program to US consumers is \$2.978 billion per year.

Some additional minor provisions were also established in the 2008 act regarding allocation of the overall allotment quantity between refined beet sugar and raw cane sugar. In addition, a number of contingencies were established to allow reassignments of allotments in the crop year. The 2008 act, to ensure supply restrictions, also requires that sugar forfeited to the CCC under nonrecourse loans to processors count against processors' allotments in that marketing year. It gives the federal government the authority to sell CCC sugar for ethanol production and the ability to buy back certificates of quota entry to reduce TRQ imports.²³

The Uruguay Round Agreement on Agriculture of the World Trade Organization stipulates that the United States must allow for minimum access of imports to particular countries each year. The amount is currently 1.256 million tons of sugar, raw value (including a minimum of 24,251 tons of refined sugar). Additional provisions on import access are specified on a variety of sugar-containing products.

Figure 5: Real Global and US Sugar Prices, 1975–2009



SOURCE: USDA, "Sugar and Sweeteners: Background," www.ers.usda.gov/Briefing/Sugar/Background.htm (accessed May 2, 2011).

Finally, the secretary of agriculture has the authority to change existing quantitative restrictions on sugar if he believes there is excess demand at "reasonable prices," but import quantities cannot be below those established under the Uruguay Round Agreement.²⁴

Producers in some developing countries—African, Caribbean, and Pacific countries and small island states—would be affected by changes in the US sugar program. These countries as a whole, however, would have offsetting gains from an increase in the world sugar price to counter losses from preferential treatment.²⁵

In summary, the current sugar program effectively restricts imports through a TRQ system that imposes a prohibitive tariff for imports in excess of the quota amount subject to a low tariff. When the sum of domestic production plus imports that occur under the quota is large, the government operates a price-support scheme through a loan-rate program that guarantees sugar processors and producers a minimum price. Effectively, because world prices are typically much lower than the price at which the domestic market clears with the quota in place, the quota (combined with the loan-rate program) typically establishes a domestic sugar price that is much higher than the world price.

Quantifying the Cost of the US Sugar Program

The most significant cost of the US sugar program is the cost imposed on consumers from higher sugar

prices. I estimate the effects of the sugar program in two ways. The first estimates are based on the assumption that changes in US sugar imports have no effect on world prices (the "small country" assumption, as it is known in the international economics literature). The second estimates account for the possibility that

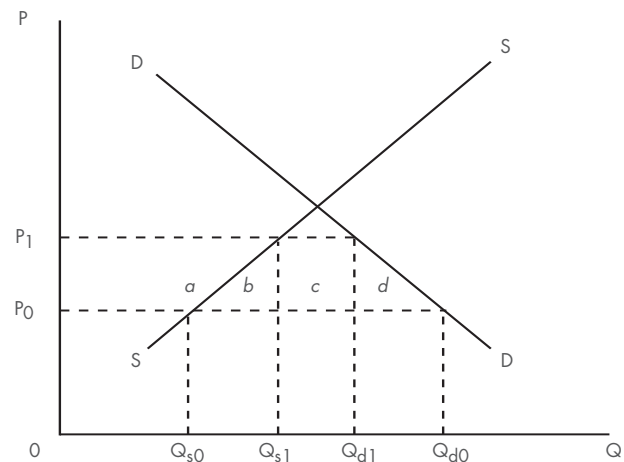
increases in US sugar imports increase world prices because the United States is a large enough player in the world market. These "large country" estimates of the sugar program's impact (the large-country case) result in somewhat lower adverse effects on consumers because of smaller increases in the prices they pay for sugar. The large-country estimates are perhaps more realistic because increases in US imports do have the potential to increase world prices by stimulating world demand (therefore, these are the estimates of consumer costs reported in the introduction).

Figure 6 portrays the US market for sugar with and without the sugar program, under the simplifying assumption that changes in US imports have no effect on world prices. In the absence of the program, the market would be in equilibrium at price P_0 with domestic production equal to Q_{s0} and domestic consumption equal to Q_{d0} . The quantity of sugar imported would be equal to the amount $Q_{d0} - Q_{s0}$. With the TRQ system in effect, the domestic price rises to P_1 , quantity produced increases to Q_{s1} , quantity consumed decreases to Q_{d1} , and imports decrease to $Q_{d1} - Q_{s1}$. Consumers lose the areas $a+b+c+d$ and producers gain the area a . The area c in figure 6 would be tariff revenue to the government if all imports were taxed at the difference between P_1 and P_0 . However, as indicated above, the TRQ system has both in-quota and over-quota tariffs so that only a portion of the area represents tariff revenue. Deadweight loss therefore equals the sum of areas b and d plus that portion of area c not collected as tariff revenue.

To estimate the costs of the sugar program, demand and supply elasticities of sugar are required. There have been several studies of the US sugar industry, which estimate that price elasticity of demand for sugar ranges from -0.1 to -0.6 and elasticity of supply from 0.1 to 0.7.²⁶ To provide more precise estimates of the costs of the sugar program, I have estimated demand and supply parameters using recent data available from the US Department of Agriculture (USDA) Economic Research Service. The demand and supply equations estimated are shown in the appendix. The demand elasticity derived from the demand equation is -0.2 with a standard error of 0.07. Although demand for sugar was estimated with demand for HFCS to account for substitutability between the two sources of sweetener, the cross-price elasticity between sugar and HFCS is only 0.02 and statistically insignificant. This finding is consistent with Rendelman and Hertel and Beghin et al.²⁷ One explanation is that the HFCS market is currently decoupled from the sugar market. Specifically, sugar prices are no longer linked to HFCS prices because the soft-drink industry, the major consumer of HFCS, has relied on competition among HFCS processors to minimize sweetener costs.²⁸ An alternative explanation is that relative prices between the two sweeteners have not varied enough in recent years to capture substitutability between them (see figure 4). At any rate, it is hard to believe that if sugar prices declined enough to again become competitive with HFCS in soft-drink manufacturing, soft-drink producers would not substitute sugar for HFCS.

Over the period 1975–2008, the ratio of the US raw-sugar price to the world raw-sugar price was approximately two.²⁹ This suggests that the domestic price of sugar was approximately twice the world price, or that it would have to fall by about one-half to equal the world price.³⁰ Figure 6 suggests that the area $a+b+c+d$ depends not only on how much the price changes but also on the shape of the demand

Figure 6: US Market for Refined Sugar

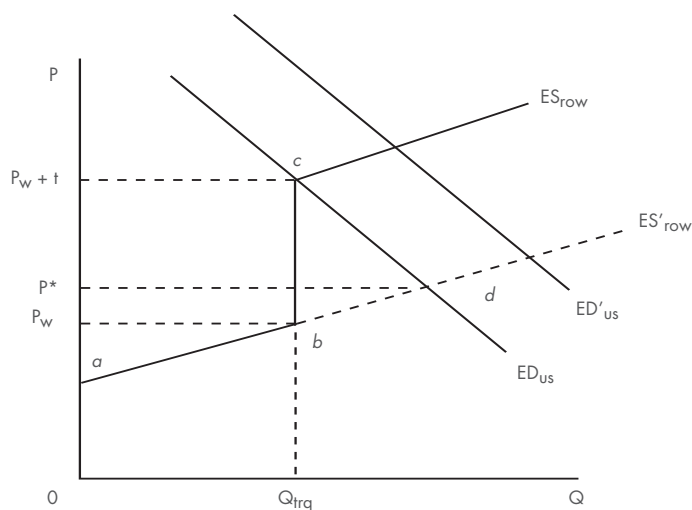


SOURCE: Author's calculations.

curve for sugar. The empirical estimates seem most consistent with a constant elasticity demand curve, so I have estimated the change in consumer surplus with the formula assuming the demand curve exhibits a constant elasticity.³¹ For the change in surplus calculation, I also require base values of price and quantity. Consistent with a recent study by Kennedy and Schmitz,³² I have used demand and supply estimates for raw sugar in crop year 2004–2005.³³ Domestic demand that year was about 10 million tons, domestic production was 7.9 million tons, and total imports were 2.1 million tons. The average price of raw sugar was 20.54 cents per pound in crop year 2004–2005. The consumer price index for all items increased 13.6 percent between 2004 and 2009, so the 2004–2005 price of raw sugar in current dollars is approximately 23.33 cents per pound. The total value of 2004–2005 raw sugar in current dollars is approximately \$4.666 billion. Converting to refined sugar yields a value of \$5.604 billion.³⁴

With the above information, the estimated cost of the sugar program to US consumers is \$2.978 billion per year with a standard error of \$0.069 billion,³⁵ which is the sum of losses incurred by final consumers and sugar processors. If the full effect of the increase in price is not passed on to final consumers, then the loss incurred by final consumers is somewhat less than \$2.978 billion.³⁶

Figure 7: Effect of the Sugar Program on the World Sugar Market



SOURCE: Author's calculations.

The cost to consumers has in large part come in the form of transfers to domestic producers. I have estimated supply equations for both sugar beets and sugar cane, and then converted the supply estimates to supply of refined sugar to estimate how much producers have gained from the sugar program (see the appendix). The supply elasticity of sugar was estimated to be 0.3 with a standard error of 0.12. Like the estimated change in consumer surplus, the estimated change in producer surplus (shown by area *a* in figure 6) depends on both the size of the change in price and the shape of the supply function. In this case, both supply functions estimated are linear, so the formula for producer surplus using a linear supply curve is used.³⁷ The total value of refined sugar for 2004–2005 production in current dollars is \$3.681 billion. The gain to producers from the sugar program is estimated at \$1.703 billion with a standard error of \$0.055 billion.

The above calculations are based on the assumption that the United States is a price taker in the world market (the small-country assumption). Figure 7 shows the effect of relaxing this assumption on the calculation of the price change. The excess supply curve is *abcES_{ROW}*, which shows how much the rest of the world is willing to supply to the United States at different prices. The in-quota tariff is in effect until imports of *Q_{trq}* are reached. After that level, a tariff of

amount *t* is applied, and the US price is equal to the fixed tariff plus the world price. While excess demand could intersect the vertical segment *bc*, it will effectively intersect the segment at point *c* because of the domestic support price established by the loan-rate program.³⁸ In the absence of a tariff, the excess supply curve would become *abdES_{ROW}'*. The US and world prices would converge at price *P**. The increase in world price from *P_w* to *P** (with a fixed per-unit tariff) would take away from the reduction in US price. The incidence of the tariff therefore depends on the relative elasticities of excess supply and excess demand curves.

To determine how much the world price would increase if the sugar program were eliminated, we can use the formula,

$$\frac{\Delta P}{P} = \frac{E_d}{E_s - E_d} \Delta t,$$

where *E_d* is the elasticity of import demand by the United States, *E_s* is the elasticity of export supply of the rest of the world to the United States, and Δt is the change in tariff. With the above information on domestic demand and supply elasticities, the elasticity of import demand can be estimated with the formula

$$E_d = \frac{\eta}{k_d} - \frac{\epsilon k_s}{k_d} = \frac{-0.2}{(0.21)} - \frac{0.3(0.79)}{(0.21)} = -0.95 - 1.13 = -2.08,$$

where η is the domestic demand elasticity for sugar, ϵ is the domestic supply elasticity of sugar, *k_d* is the share of imports in total demand, and *k_s* is the total share of production in total demand. I have not estimated the elasticity of export supply but have used the estimate provided by Beghin et al. of 10.17.³⁹ Using these elasticity estimates, as well as assuming a decline in tariff of 0.5, the price change from eliminating the sugar program would be:

$$\frac{\Delta P}{P} = \frac{E_d}{E_s - E_d} \Delta t = \frac{-2.08}{10.17 - (-2.08)} (-0.5) = 0.085.$$

Estimates of Cost to Consumers of the Sugar Program (2009 Billion Dollars)

Study	Cost to Consumers	Gain to Producers	Net US Economic Loss ¹
Wohlgenant	\$2.441 (0.045)	\$1.433 (0.038)	\$1.008
GAO (2000)²	\$2.562	\$1.383	\$1.179
Leu, Schmitz, and Knutson (1987)³	\$3.810	\$1.245	\$2.565

NOTES: 1. Difference between first and second column; it includes losses to foreigners and deadweight (efficiency) losses; estimate does not include any tariff revenue and therefore slightly overstates loss. 2. US General Accounting Office (GAO), *Sugar Program: Supporting Sugar Prices Has Increased Users' Costs While Benefiting Producers*, GAO/RCED-00-126 (2000). Same results as reported in J. C. Beghin, B. El Osta, J. R. Cherlow, and S. Mohanty, "The Cost of the US Sugar Program Revisited," *Contemporary Economic Policy* 21 (January 2003): 106–116. 3. G. J. M. Leu, A. Schmitz, and R. D. Knutson, "Gains and Losses of Sugar Program Policy Options," *American Journal of Agricultural Economics* 69 (August 1987): 591–602. Results are for price quota premium of 16.05 cents per pound, elasticity of excess supply curve of 2.37, and no substitution.

Therefore, if the US sugar price were allowed to fall to the world price, the world price would increase by 8.5 percent. The US price would fall by 41.5 percent (50–8.5).

The above table shows the cost to consumers and the gain to producers from the sugar program, accounting for the effect on world sugar prices. The first row shows the effects calculated in this study (where numbers in parentheses are standard errors). The second and third rows contain estimates from the two previous comprehensive studies of the cost of the US sugar program. The costs estimated to consumers are similar in the present study compared to the two previous studies shown in the table. I estimate gains to producers similar to those in the previous studies.

Indirect Costs of the Sugar Program

The cost to consumers is the main cost of the sugar program, but there are additional costs related to its effect on the mix of sweeteners and mix of sources of sugar. The program has led to substantial growth of the HFCS industry. As indicated previously (see figure 3), HFCS consumption now nearly exceeds sugar

consumption. Although less significant, sugar-beet production has increased relative to sugar-cane production over time (see figure 1).

HFCS has been linked to obesity in scientific research, to obesity and insulin resistance by Elliott et al., and to possible liver scarring by a study at Duke University in 2010.⁴⁰ Certainly, deregulation of the sugar program, by reducing domestic sugar prices dramatically, would likely reduce the proportion of HFCS in our diets and increase consumption of sugar from sugar beets and sugar cane.

Another likely effect of deregulation would be an increase in the proportion of sugar from sugar cane relative to sugar beets. This is because deregulation would lead to a substantial increase in imports, most of which would likely come from lower-cost producers of sugar who are mainly sugar-cane producers. The increase in imports with a price decrease of 41.5 percent would cause imports to almost double from 2.1 million tons to 3.9 million tons.⁴¹

Conclusions and Policy Recommendations

While the sugar program has increased returns to sugar producers, this has come at a great cost to

consumers of \$2.4 billion per year on average with a net cost of transfer of \$1 billion for producers to gain \$1.4 billion. Of course, the added cost is not obvious because the majority of sugar is in products containing refined sugar, not in purchases of refined sugar alone. The sugar industry often stresses that the sugar program is no cost, meaning it does not lead to any direct cost to the taxpayer. Yet taxpayers are consumers, and the cost to consumers is not trivial.

In addition, as mentioned above, I estimate that the world price of sugar would be about 8.5 percent higher if the sugar program were eliminated. Sugar is a major source of income for many poor countries, and an effect of this magnitude could make a significant difference in income for producers and consumers in these countries.⁴²

The sugar program has also led to the existence and growth of the HFCS industry. HFCS has displaced sugar beets and sugar cane as the main source of sugar in soft drinks, as well as a range of other bakery and processed products. Increasingly, questions have been raised about its health effects, including possible effects on obesity, diabetes, and liver damage.

Finally, the sugar program has led to growth in sugar-beet production relative to sugar cane. With more competition internationally, we would expect an increase in the share of sugar cane because it is the lowest-cost source of sugar internationally.⁴³

While it may seem obvious that such a program has come at great cost to benefit so few, the sugar program in one form or another has existed longer than any other farm program. Indeed, the government has supported this industry from the beginning of the country. The political economy of the program stems in part from the fact that a large number of states produce either cane or beet sugar. Each state has two US senators, so it is not hard to see how it derives so much support—even though most of the sugar-beet states have smaller populations, so not as much support could be expected in the House of Representatives. But we have the classic problem where benefits are highly concentrated and costs are greatly disbursed. The small added cost per person

per year of less than ten dollars is simply not enough to get the attention of many consumers. On the other side of the ledger, producers gain enormously from the program. While returns seem uniformly disbursed among sugar-beet producers, only a handful of large producers receive the bulk of the returns from sugar-cane production.

**Deregulation of the sugar program
would reduce domestic sugar
prices dramatically and likely
reduce the proportion of high-fructose
corn syrup in our diets.**

Alternatives to the present TRQ system do not seem attractive. Changing the current program to resemble the standard crop program and eliminating import restrictions would likely add new problems related to significant government costs through direct payments.⁴⁴ Even a Canadian-style supply-management system suggested by Kennedy and Schmitz⁴⁵ would have many difficulties, not least of which would be the allocation of production quotas among producers.

Another possible alternative would be to buy out sugar producers, similar in some respects to the tobacco buyout program. As indicated previously, Florida has attempted to buy out the sugar-cane industry with only mixed success. The cost of the buyout would be significant. In the case of sugar beets, equity shares in sugar-processing companies have varied over time but typically range from \$200 per acre to \$1,000 per acre depending on the region where beets are produced. Unit retains of producers add another \$750 per acre to producers' investments. With approximately 1.2 million acres in sugar-beet production, the total investment in sugar production would be between \$1.14 billion and \$1.75 billion. Sugar-beet production accounts for about 55 percent of total production, making total

investment in sugar production between \$2.1 billion and \$3.18 billion. Even if producers accept a smaller amount of, say, 50 percent (to account for the fact that investments are risky), the buyout amount would still be between about \$1 billion and \$1.6 billion.⁴⁶

One problem with a proposed buyout is that lobbyists and other groups with a vested interest in maintaining the sugar program would not support it. Moreover, there are equity issues; in particular, it seems unethical to reward the same people who have imposed such large costs on US consumers for so long. Finally, the federal government is facing a severe budget deficit, and Congress is unlikely to consider spending more on farm programs at such a time.

The time for totally eliminating the sugar program may be now. Sugar prices have been above support levels in the past few years, and even futures prices through 2012 indicate continued high prices.⁴⁷

Eliminating the program now would have little effect on current prices. There is also a precedent for eliminating the sugar program. As indicated above, the Sugar Act was not renewed at the end of 1974 due to a commodity boom. The problem was that after lower sugar prices returned, pressure was put on Congress to renew price supports, which it did. While the political economy of the sugar industry makes it extremely difficult to eliminate the sugar program, eliminating it would not only reduce costs to consumers but also free up resources now inefficiently used in sugar production and rent seeking on the part of producers and processors to retain or change the program to their benefit.

Appreciation is expressed to Gary Brester, Pat Westhoff, Vincent Smith, and Henry Olsen for valuable comments. Any remaining errors belong to the author.

Appendix

Econometric Estimates of Demand for Sugar

The model estimated was the Rotterdam model, consisting of demand for sugar and HFCS with annual data from 1975 to 2008 obtained from the USDA.¹ The equations were estimated with a seemingly unrelated regression method using SAS version 9.1, with correction for first-order autocorrelation in demand for sugar:

$$\bar{w}_{\text{sugar}} \Delta \ln Q_{\text{sugar}} = -0.05324^* - 0.16038^{***} \Delta \ln P_{\text{sugar}} + 0.012692 \Delta \ln P_{\text{hfcs}} - 0.45138 \Delta \ln INC + 0.002346^* t$$

$$\bar{w}_{\text{hfcs}} \Delta \ln Q_{\text{hfcs}} = 0.031817^{***} + 0.012692 \Delta \ln P_{\text{sugar}} - 0.04118^* \Delta \ln P_{\text{hfcs}} - 0.162062 \Delta \ln INC - 0.00131 t$$

where \bar{w}_{sugar} is the average budget share between two adjoining time periods, $\Delta \ln Q_{\text{sugar}}$ is the change in natural log of per-capita consumption of refined sugar from one year to the next, $\Delta \ln P_{\text{sugar}}$ is the change in natural log of the real wholesale refined-sugar price, $\Delta \ln P_{\text{hfcs}}$ is the change in natural log of real wholesale HFCS price, $\Delta \ln INC$ is the change in natural log of real per-capita disposable personal income, and t is a linear time trend. Asterisks above numbers indicate 10 percent (*), 5 percent (**), and 1 percent (***) statistical significance, respectively.

The own-price and cross-price elasticities of demand for sugar were obtained by dividing the parameters of sugar price and HFCS price by the sample average budget share of sugar:

Own-Price Elasticity of Demand for Sugar

$$- \frac{0.16038}{0.8158072} = -0.19659$$

Cross-Price Elasticity of Demand for Sugar

$$\frac{0.012692}{0.8158072} = 0.015557$$

Econometric Estimates of Supply of Sugar

The supply equations for sugar beets and sugar cane estimated with annual data from 1975 to 2008 are as follows:

$$Q_{\text{beet}} = 2010.023^{**} + 32.87306^{**} P_{\text{beet},1} - 31.5013^{***} P_{\text{fert},1} + 22.41646^{***} P_{\text{fert},2} + 88.4195^{***} t$$

$$Q_{\text{cane}} = 1756.638^{**} + 0.421389^{**} Q_{\text{cane},1} + 16.38494^* P_{\text{cane},2} - 20.1297^{***} P_{\text{fert},1} \\ + 13.23564^{**} P_{\text{fert},2} + 21.40909195^{**} t$$

where the second subscript on price variables denotes lag (for example, $P_{\text{beet},1}$ is the one-year lagged price of the real beet price), and subscripts *beet*, *fert*, and *cane* denote sugar beets, fertilizer, and sugar cane. All price variables are deflated.

Price elasticities of supply for beets are obtained by multiplying the price coefficient on the lagged beet price by the ratio of sample mean price to sample mean quantity:

Price Elasticity of Supply of Beets

$$32.87306(37.4029412/3902.09) = 0.3151$$

The price elasticity of the supply of sugar cane is a long-run elasticity obtained by dividing the coefficient of the two-year lagged price of sugar cane by one minus the coefficient multiplying lagged quantity of cane produced:

Price Elasticity of Supply of Sugar Cane

$$(16.38494/(1 - 0.421389))(27.2705882/3364.95) = 0.229495$$

To obtain the aggregate supply elasticity of refined sugar, I first convert the average quantity of sugar cane to the refined-sugar equivalent. Next, I multiply the price of sugar cane by 1.285 to convert from raw to refined value. I also divide the elasticity of sugar cane by the value share of raw sugar in refined sugar (1.285/1.07) to convert to the elasticity of sugar cane in refined form. Finally, I multiply each elasticity by its quantity share in production of refined sugar and add together to obtain the aggregate elasticity:

$$\text{Aggregate Elasticity} \quad 0.297874$$

NOTE: 1. USDA, Economic Research Service, "Sugar and Sweetener Yearbook Tables," www.ers.usda.gov/Briefing/Sugar/data.htm#yearbook (accessed May 6, 2011).

Notes

1. USDA, "Sugar and Sweeteners: Background," www.ers.usda.gov/Briefing/Sugar/Background.htm (accessed May 2, 2011).
2. Ibid.
3. Ibid.
4. Craig Pittman, "Florida's Everglades Buyout Shrinks to Fraction of Promised Restoration," *St. Petersburg Times*, October 13, 2010, www.tampabay.com/news/environment/wetlands/floridas-everglades-buyout-shrinks-to-fraction-of-promised-restoration/1127824 (accessed May 2, 2011).
5. Stephen Haley and Mir Ali, *Sugar Backgrounder* (Washington, DC: USDA, 2007), www.americanbakers.org/portals/1/memonly/CommitteeIssues/documents/USDAAnalysisoftheSugarProgram.pdf (accessed May 2, 2011).
6. Ibid.
7. Ibid.
8. S. L. Haley, "Modeling the US Sweetener Sector: An Application to the Analysis of Policy Reform" (working paper #98-5, International Agricultural Trade Research Consortium, St. Paul, MN, 1998).
9. H. Marzoughi, P. L. Kennedy, and B. Hilbin, "Impact of Corn Based Ethanol on the US High Fructose Corn Syrup (HFCS) and Sugar Markets" (selected paper presented at the Southern Agricultural Economics Association Annual Meeting, Dallas, TX, 2008).
10. J. Alvarez and L. C. Polopolous, "The History of US Sugar Protection" (EDIS document SC 019, Department of Food and Resource Economics, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL, 2002).
11. Ibid.
12. H. Crawford, "Sugar: Many Questions Face the Congress," *Food Update* 9 (1978): 16–19; and J. Alvarez and L. C. Polopolous, "The History of US Sugar Protection."
13. J. R. Corley, "Effects of the Sugar Act's Expiration," USDA Extension Service Foreign Trade Newsletter, February 1975; and J. Alvarez and L. C. Polopolous, "The History of US Sugar Protection."
14. J. Alvarez and L. C. Polopolous, "The History of US Sugar Protection."
15. Ibid.
16. Ibid.
17. Ibid.
18. Ibid.
19. USDA, "Sugar and Sweeteners: Policy," www.ers.usda.gov/Briefing/Sugar/Policy.htm (accessed May 2, 2011).
20. Ibid.
21. Ibid.
22. Ibid.
23. Ibid.
24. Ibid.
25. I estimate that the total value of transfers to these countries from the United States and the European Union are about 27 to 31 percent of their export earnings. The bulk of the transfers comes from the European Union. See Michael K. Wohlgenant, *Effects of Trade Liberalization on the World Sugar Market* (Rome, Italy: Sugar and Beverages Group, Raw Materials, Tropical and Horticultural Products Service, Commodities and Trade Division, Food and Agriculture Organization of the United Nations, 1999).
26. P. L. Kennedy and A. Schmitz, "Production Response to Increased Imports: The Case of US Sugar," *Journal of Agricultural and Applied Economics* 31 (December 2009): 777–89.
27. C. M. Rendelman and T. W. Hertel, "Do Corn Farmers Have Too Much Faith in the Sugar Program?" *Journal of Agricultural and Resource Economics* 18 (1993): 86–95; and J. C. Beghin, B. El Osta, J. R. Cherlow, and S. Mohanty, "The Cost of the US Sugar Program Revisited," *Contemporary Economic Policy* 21 (January 2003): 106–116.
28. J. C. Beghin, B. El Osta, J. R. Cherlow, and S. Mohanty, "The Cost of the US Sugar Program Revisited."
29. Based on a regression of the ratio of the US raw-sugar price to the world sugar price, the average estimate was 2.13 with a standard error of 0.32. In estimating the mean price ratio, the years 1980 and 1981 were deleted because the sugar program was not in effect then. Also, correction was made for autocorrelation in the residuals to obtain a consistent estimate of the standard error.
30. This assumes no effect on world sugar price. See below for more explanation.
31. The formula used for calculation is $\Delta CS = -P_0 Q_0 (e^{(1+\eta)(\ln P_1 - \ln P_0)} - 1)/(1+\eta)$. For comparison, I also estimated the change in consumer surplus with the formula for a linear demand curve, $\Delta CS = -P_0 Q_0 [(P_1 - P_0)/P_0] [1 + 0.5(Q_1 - Q_0)/Q_0]$, and obtained very similar results.
32. P. L. Kennedy and A. Schmitz, "Production Response to Increased Imports: The Case of US Sugar."
33. These years were chosen as somewhat representative of conditions that have prevailed over the period 1975–2008 to arrive at an estimate of the annual average cost of the US sugar program. In the last two years, world and US sugar prices have increased sharply, so the cost of the sugar program is much less now than it was. However, there is no way of knowing for sure if these events are transitory. Based on past occurrences, sugar-price spikes were transitory (1974–75; 1980–81). Therefore, I have not estimated the cost based on observations that I believe are less representative of the overall costs of the program.
34. To obtain the value of sugar in refined form, I multiply the price by 1.285 (see USDA, "Sugar and Sweeteners: Policy") and then divide the quantity by 1.07 to convert from raw to refined form (USDA, "USDA's Domestic Sugar Program and Reporting Glossary Terms," www.apfo.usda.gov/Internet/FSA_File/sugar_glossary.pdf [accessed May 2, 2011]).

35. Consistent with the price and quantity data used in the welfare calculations, the surplus changes are more correctly viewed as changes from removal of the program.

36. J. C. Beghin, B. El Osta, J. R. Cherlow, and S. Mohanty, "The Cost of the US Sugar Program Revisited."

37. The formula for change in producer surplus used is $P_0Q_0 [(P_1 - P_0)/P_0][1 + 0.5(Q_1 - Q_0)/Q_0]$.

38. J. C. Beghin, B. El Osta, J. R. Cherlow, and S. Mohanty, "The Cost of the US Sugar Program Revisited."

39. Ibid.

40. M. E. Bocarsly, E. S. Powell, N. M. Avena, and B. G. Hoebel, "High-Fructose Corn Syrup Causes Characteristics of Obesity in Rats: Increased Body Weight, Body Fat, and Triglyceride Levels," *Pharmacology, Biochemistry, and Behavior*, February 2010; Sharon S. Elliott, Nancy L. Keim, Judith S. Stern, Karen Teff, and Peter J. Havel, "Fructose, Weight Gain, and the Insulin Resistance Syndrome," *American Journal of Clinical Nutrition* 79, no. 4 (April 2004): 537-43; and "High Fructose Corn Syrup Linked to Liver Scarring, Research Suggests," *Science Daily*, March 23, 2010, www.sciencedaily.com/releases/2010/03/100322204628.htm (accessed May 2, 2011).

41. Calculated using an import demand elasticity of -2.08 and a percent price change of 41.5 percent.

42. Many of the small, developing countries affected include those in the Caribbean, Africa, South America, and Southeast Asia. For details, see Michael K. Wohlgenant,

Effects of Trade Liberalization on the World Sugar Market. Some of these countries benefit from preferential treatment under the TRQ system. However, the proportion of sales in these countries combined is small.

43. LMC International and Oxford Policy Management indicate that sugar production costs for many African and South American countries are three to four times lower than sugar production costs for many of the Caribbean sugar producers. See D. C. Mitchell, "Sugar Preferences—More Harm Than Good?" *International Development Magazine*, December 2005, <http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1100792545130/MitchellSugarPreferences.pdf> (accessed May 2, 2011). In turn, these countries are limited in the quantities they may export to the United States because they also are lower-cost producers than the United States. All these countries produce sugar from sugar cane.

44. D. Abler, J. C. Beghin, D. Blandford, and A. Elobeid, "Changing the US Sugar Program into a Standard Crop Program: Consequences under the North American Free Trade Agreement and Doha," *Review of Agricultural Economics* 30 (2007): 82-102.

45. P. L. Kennedy and A. Schmitz, "Production Response to Increased Imports: The Case of US Sugar."

46. I thank Gary Brester for suggesting this analysis.

47. I thank Pat Westhoff for bringing this point to my attention.

Sweets for the Sweet

The Costly Benefits of the US Sugar Program

by Michael K. Wohlgenant

US families pay nearly twice the world price for sugar and other sweeteners because of federal government policies intended to protect domestic beet and cane sugar producers from cheaper foreign competitors. This paper examines the economic effects of these policies and proposes a dramatic reversal of course. The highlights include:

- 1) The US price for sugar has been double that in the rest of the world for over thirty years:** Between 1975 and 2008, sugar consumers in the United States paid about twice the world price.
- 2) The sugar program costs US consumers about \$2.4 billion per year:** This costs a family of four about \$40 per year in higher food costs.
- 3) The sugar program's cost has created the high-fructose corn syrup (HFCS) industry:** Since the current sugar program was started in 1977, production of HFCS has skyrocketed. As a result, the average American now eats nearly 120 pounds of sugar and HFCS per year, about 20 percent more than in 1975. During this time, the rate of obesity has also skyrocketed. Many doctors believe HFCS is more likely to contribute to obesity and insulin resistance than sugar.
- 4) The sugar program should be repealed:** Alternatives to the sugar program, such as a Canadian-style supply-management program, would still artificially boost sugar prices. Buying out sugar producers, as was done to end tobacco production controls in the 1990s, would be expensive, costing taxpayers between \$1 billion and \$1.6 billion. The only reasonable policy is no policy: the sugar program should be repealed.



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