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INTERNATIONAL AGRICULTURAL TRADE AND DEVELOPMENT CENTER

SUGAR: THE FREE TRADE MYTH AND THE REALITY OF EUROPEAN SUBSIDIES

By
Andrew Schmitz

IW95-20 December 1995

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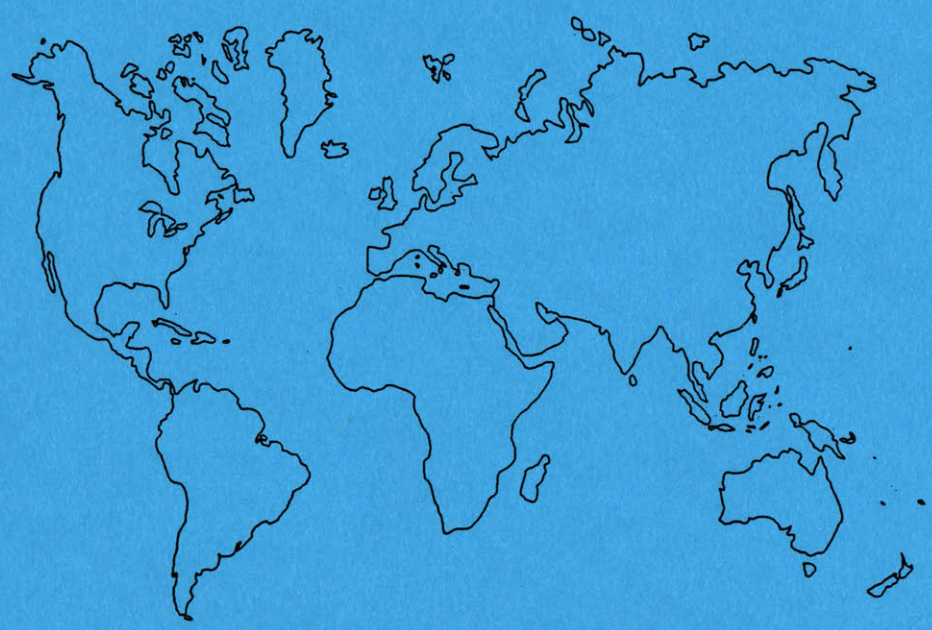

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SUGAR: THE FREE TRADE MYTH AND THE REALITY OF EUROPEAN SUBSIDIES

Summary

Prof. Andrew Schmitz

- Numerous studies have been conducted on the costs and benefits of the U.S. sugar program. Over time, the estimated costs have fallen sharply partly because world sugar prices have increased. For example, the GAO calculated the net cost to be roughly $200 million -- much less than that calculated in many of the earlier studies. However, even so, this study failed to take into account, for example, the impact of the sugar program on corn prices. When this was factored into the GAO analysis, there was a net gain from the sugar program that amounted to a high of $635 million in 1991 and a low of $550 million in 1990.
- The GAO report has been criticized by the U.S. Department of Agriculture.
- When estimating the effects of the sugar program, several important points have to be kept firmly in mind: (a) The dynamic effects must take into account both the sugar sector and the corn sweetener sector, because gains from the sugar program accrue to sugar producers, HFCS manufacturers and corn producers. (b) There is no automatic guarantee that lower sugar prices result in lower consumer goods prices. (c) The U.S. sugar program brought about significant increases in the production of both sugar and HFCS, because investment in new equipment and improved technology was made possible due to of the certainty added by the program. (d) Between 1975 and 1990, U.S. corn sweetener production increased by roughly 700% from 1mmt to 7mmt. U.S. sugarcane production also showed significant increases. Between 1982 and 1993, the average increase was 37,000 tons per year. U.S. sugar beet production increased at

a faster rate and averaged 147,000 tons every year over the same period. (e) Real U.S. support prices for sugar dropped sharply over the past 5 years. (f) Wholesale sugar prices declined and, since 1985, U.S. sugar consumption increased. (g) A significant amount of employment has been generated by the total U.S. sweetener industry. (h) Retail sugar prices in the U.S. have been well below the average prices for developed countries. (i) From the political economy perspective, there has been strong political support for the U.S. sugar program. This has been, in part, because the majority of the states have one or all of the following; sugarcane and sugar beet production, corn sweetener production, sugarcane and sugar beet processing.

- There are three basic kinds of sugar markets. (a) The market for sugar within sugar producing countries that accounts for roughly 75% of all world sugar produced. (b) International agreements between certain importers and certain exporters that constitute roughly 10% of world production. These agreements include import quotas under the U.S. program, agreements of various countries with the European Union (EU)[1] and bilateral agreements with Cuba and the former Soviet Republics. (c) The residual free market that accounts for roughly 15% of production.
- Sugar production in Cuba has declined by roughly one-half since 1990. The fastest growth in production has occurred in India followed closely by Brazil. India increased its production from roughly 10mmt in 1988/89 to roughly 14mmt in 1994/95. Over the same period, Brazil increased production from roughly 8mmt to roughly 10mmt. Government policy influenced these production trends, because significant government support was given to sugar production

[1] In this paper, European Union (EU) and European Community (EC) are used interchangeably.

in India and Brazil. In the absence of such policies, production in these countries would have been significantly less.

- In the EU the per capita consumption of sweeteners is much less than the per capita consumption of sweeteners in the United States. In part, this is because of the high price of sugar in the EU relative to the United States.
- Producers in the EU are supported by a common support base. The Total EC quotas for sugar are referred to as Quota A sugar and Quota B sugar. In addition there is another category called C sugar. Support is provided especially for quota A sugar, however, even C sugar can be profitable for producers. EU sugar producers are supported by government to a much greater extent than are U.S. sugar producers.
- Free trade in sugar would cause significant world wide price increases for sugar.
- Unilateral reduction of sugar supports by the United States would cause world prices to increase much less than if there was a unilateral reduction by the EU. Elimination of programs by both countries could cause world prices to rise at least to the current U.S. levels.
- EU sugar policy costs the general EU public roughly $900 million per year.
- Several studies have concluded that the U.S. sugar program has benefited foreign interests.

SUGAR: THE FREE TRADE MYTH AND THE REALITY OF EUROPEAN

SUBSIDIES

Professor Andrew Schmitz, Eminent Scholar
Ben Hill Griffin Jr. Endowed Chair

Introduction

The U.S. sugar program is arguably the most criticized of all U.S. farm programs -- the dairy program being the only possible exception. Criticism of the sugar program centers on its alleged high net domestic cost, its increasingly deleterious effect on third world exporters and its depressing effect on world market prices. In this paper, a variety of conceptual and empirical issues are examined that suggest that recent estimates of both the domestic and foreign effects of the program must be treated with caution. There are other major players, such as the EU, that also affect world sugar prices.

We discuss, in order, the following topics: U.S. Sugar Policy; Legislators and Regional Representation; Effects of the U.S. Sugar Program; Static vs Dynamic Effects of Quotas; General Agreement on Tariffs and Trade (GATT) and North American Free Trade Agreement (NAFTA); U.S. Sugar Program and World Sugar Trade; and The EU Sugar Regime.

Among our conclusions are: (1) The costs associated with the U.S. sugar program are overstated. In many of the cost/benefit analyses, the benefits derived from the availability of High Fructose Corn Syrup (HFCS) are overlooked; (2) The impact of the U.S. sugar program varies substantially by region. Those within the United States that are net sweetener exporters gain from the program. Because of the geographical distribution of sugar production and

processing, in conjunction with that of corn production and HFCS processing, there has been broad regional support for the sugar program; (3) The world sugar price is distorted by the policies of many nations and is depressed downward relative to a free trade equilibrium price. Multilateral sugar policy reform and trade liberalization would not necessarily have substantial effects on U.S. sugar trade, prices, production or consumption. In other words, if viewed as a response to the policies of other industrial market economies that depress the world sugar price, the U.S. import quota program could restore the market price that would prevail in the United States under free trade. EU policies, for example, depress world market prices to a much greater degree than does the U.S. sugar policy.

U.S. Sugar Policy

The United States is a net sugar importer. The means by which the government supports the U.S. sugar producers differ significantly from the support measures used for the other farm commodities. This is because most of the other farm commodities are exported. The government has been directly involved in the sugar market as part of national policy as far back as 1789 (Bates and Schmitz). Since that time, a variety of mechanisms have been used as instruments of U.S. sugar policy. These include foreign import quotas, import tariffs, domestic acreage restrictions, support prices, subsidies and special loan and purchase programs.

The U.S. sugar policy originated in the 1700s. From 1789 to 1890, tariffs were imposed on sugar as a means to generate governmental revenue. Domestic production grew over the years, and in 1890 the U.S. Treasury removed the tariffs. This resulted in a large inflow of low priced world sugar. Because of the influx of sugar, U.S. refiners and processors were given a

bonus of 2¢/lb on sugar produced. In 1894, a 40% tariff was imposed on sugar imports in lieu of the bonus. Charges were introduced in the early 1930s in response to a rapid expansion of world sugar production that drove prices to extremely low levels. Thus, the ad valorem tariff rate, established in 1894, was no longer sufficient to support the industry. In 1934, the Jones-Costigan Act was passed, establishing the basic sugar policy instruments of import quotas and marketing allotments in order to restrict supply and support domestic prices. The Jones-Costigan Act was followed by the Sugar Act of 1937. This represented a refinement of policies set out by the previous acts, and revised the quota allocation process primarily to provide preferential treatment for Cuba. In 1948, another Sugar Act was introduced and was extended, with minor amendments, in 1951, 1962, 1965, and 1971.

In 1974, shortages in the world market resulted in an approximate tripling of sugar prices. Thus, when the Sugar Act of 1948 came up for renewal in 1974, it was allowed to expire because Congress no longer deemed it necessary. In May of 1977, due to the large production response to the price increases and the resulting decline in world prices, the President instituted a temporary price support program under the authority of the Agriculture Act of 1949 until new sugar legislation could be enacted. This Food and Agriculture Act of 1977 subsequently established special purchase and loan provisions for the 1977 and 1978 sugar crops. Under those provisions, the Commodity Credit Corporation (CCC) of the U.S. government lent to sugar processors an amount equal to a specified loan rate for each pound of sugar in storage. Processors had the option of repaying the loan (with interest) and marketing the sugar, or defaulting and forfeiting the sugar to the CCC. Processors, in turn, agreed to pay a minimum price for sugarcane and sugar beets. Thus, the loan rate established a minimum price for sugar

in a manner similar to that of the wheat and feed grain programs. Import duties and fees were imposed under Section 22 of the Agricultural Adjustment Act of 1933 in order to support the domestic price at a level that would discourage forfeiture to the CCC.

The price support and loan programs were maintained for the 1979 crop under discretionary presidential authority, but the world price spike of 1980 obviated the need for price supports in 1980 and most of 1981 (Barry et al). As world sugar prices turned downward, however, the Agriculture and Food Act of 1981 formally established a loan purchase program that included domestic price supports for the years 1982 through 1985. Sugarcane loan rates graduated from 16.75¢/lb for raw sugar in 1981 to 18¢/lb in 1985. To minimize the risk of the CCC acquiring sugar, the U.S. Department of Agriculture (USDA) introduced the market stabilizing price (MSP) as its policy price objective. The MSP represented the minimum raw sugar price for which commercial sales were more profitable than forfeiture of sugar used as collateral for CCC loans. In addition to the loan rate, it included interest on the loan, estimated freight and marketing costs and an incentive factor.

As world prices continued to drop, the statutorily limited tariffs and fees became insufficient to support the MSP. The Reagan administration chose to reintroduce import quotas in 1982, under the President's authority in the headnote to the Tariff Schedule of the United States. The quotas remain in effect to this day. The total quota level was set on the basis of USDA estimates of U.S. domestic consumption and production with the MSP as the market price. Initially, quotas were allocated to 41 countries, based on their share of the U.S. market from 1975 to 1981, when imports were relatively unrestricted. Tariffs have also been in place. However, since 1981, duties played only a minor role and, in 1989, were only 0.625¢/lb.

The Food Security Act of 1985 provided protection for the 1986 through 1990 crops. It specified a minimum national nonrecourse loan rate of 18¢/lb for raw cane sugar, while sugar beets were supported at a level of 21.54¢/lb. This remained consistent with the historical relationship between beet and cane sugar prices. For the 1990 fiscal year, the MSP was 21.95¢/lb.

In 1985, the announcements by the U.S. government of unexpectedly large import quotas for the 1985/86 market year, resulted in sugar forfeitures to the CCC (Maskus). This affected negotiations on the 1985 Farm Bill, and was responsible for the inclusion of the Dole Amendment that required the sugar program to be conducted at no net cost to the federal government. This provision effectively eliminated the possibility of further CCC forfeitures, and forced the use of the import quota mechanism to support high domestic sugar prices.

Amendments to the 1990 Farm Bill that would have lowered the sugar loan rate were defeated in both houses of Congress, and the nominal loan rate remained at 18¢/lb. In real terms, monetary support for the program eroded. The United States continued to import sugar to supplement its domestic production.

The U.S. Sugar Act, implemented in 1934, supported and regulated this industry. The program expired in 1974, but regulations and support were reinstated for 1977/79 and again in later farm bills. The Sugar Program, still in effect as the 1995 Farm Bill is debated, includes a combination of nonrecourse loans, tariff-rate quotas, specific import quotas and, when necessary, sugar marketing allotments. A loan rate of 18¢/lb for raw cane sugar was provided in the 1985 and 1990 Farm Bills. The outcome of the 1995 Farm Bill is uncertain.

The essence of the U.S. sugar program was outlined by Johnson and Ortego, p.74.

Price support for raw cane sugar has been constant at 18¢ per pound since 1985. The refined beet sugar loan rate, which was 23.6¢ in 1993, has increased slightly based on an increasing ratio of the returns to cane growers. Price support is achieved through the Commodity Credit Corporation (CCC) nonrecourse loans available to sugar processors. Current legislation specifies that the loan program be operated at no cost to the federal government. To ensure no forfeitures of sugar to the CCC, sugar imports are restricted through a tariff-rate quota (TRQ) to comply with the Uruguay Round of GATT. The quota is set to ensure that domestic prices remain above the loan price plus interest. The TRQ replaced an absolute quota which regulated the entry of sugar into the United States from 1982 to 1990.

The TRQ is a two-tiered duty. The lower tier of imports is subject to a nominal or zero duty for quantities that balance domestic supply with projected sugar use at the supported price. This amount is allocated on a country-by-country basis. The allocation of import quotas among countries is based on historical imports, but quotas have occasionally been changed to achieve foreign policy objectives. Sugar imported above the low duty quantities is subject to a second-tier duty of 16¢/lb, raw basis. The high-tariff duty will be reduced under the Uruguay Round agreement of 14.45¢/lb by the end of the century. This lowered duty will still price U.S. sugar imports above the 18¢/lb raw sugar loan rate.

The 1990 farm bill established provisions for marketing allotments to processors of domestic sugar whenever imports were estimated to fall below 1.25 million short tons. On June 30, 1993, USDA announced sugar marketing allotments for fiscal 1993. The allotments limited domestic processor sugar marketings based on their sales history. Marketing allotments have not been needed for fiscal year 1994, but sugar imports are so close to the 1.25 million ton minimum that marketing allotments remain a probability in future years.

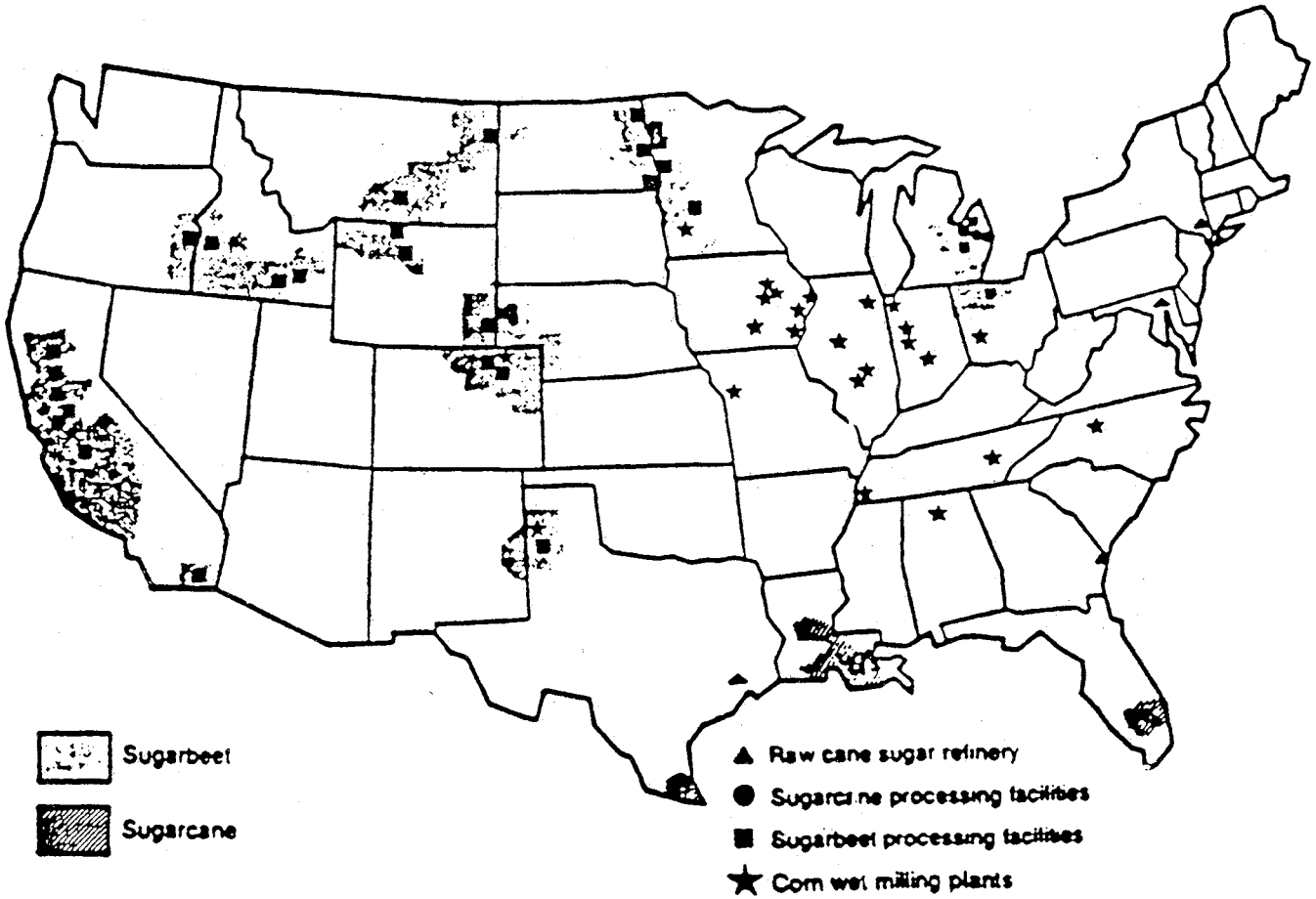
The North American Free Trade Agreement (NAFTA) gives Mexico duty-free access to the U.S. sugar market beyond the present quota if Mexico has net surplus production. A side agreement defines net surplus production such that Mexico production must exceed consumption of both sugar and HFCS for Mexico to be considered a net surplus producer. The chances of Mexico's becoming a net surplus producer using this definition is unlikely.

Legislators and Regional Representation

With the growth of the corn sweetener industry, there is a wide geographical dispersion of sugar and sweetener producers and refiners (Figure 1). The sugar program, therefore, may

Figure 1

The Geographical Dispersion of Sugar and Sweetener Producers and Refiners



Source: Schmitz, Schmitz and Vercammen

be an example of a policy for which legislators, representing regions deriving net benefits, comprise a majority of Congress. If congressional representatives and senators equally weight the welfare of sweetener consumers, producers and processors in their constituency, then the sugar program will receive support from legislators representing net exporting regions where the loss to consumers from sugar quotas is less than the gain enjoyed by producers and processors. Since policy is determined by a simple majority in each house of Congress, the sugar program could be sustained even without the interference of special interest groups if legislators from net exporting regions outnumber legislators from net importing regions. (Schmitz and Christian 1993, 1995).

In this section, the author summarizes the Schmitz and Christian studies where the results reported were based on evidence prior to discussions of the 1995 Farm Bill: 1) States that were net exporters of sweeteners and, therefore, net beneficiaries of the sugar program are identified in order to determine if their legislative representatives comprise a majority of Congress. 2) The voting records of legislators representing net exporting states are contrasted with those representing net importing states. This was done to determine if their votes were correlated with the sugar program's economic impact on their respective states.

Net Sweetener-Exporting States

Sweeteners are produced from one of three commodities; sugarcane, sugar beets and corn. Sugarcane is produced in four states; Hawaii, Florida, Louisiana and Texas. Except for Texas, all were estimated by Schmitz and Christian to be net exporters of sugar. Each of the three remaining states annually produces at least twice as much sugar as its population consumes.

Sugar beets are produced in 13 states; California, Oregon, Idaho, Montana, Wyoming, New Mexico, Colorado, Nebraska, Texas, North Dakota, Minnesota, Michigan and Ohio. Six of these states were estimated by Schmitz and Christian to be net exporters of sugar; Idaho, Montana, Wyoming, Nebraska, North Dakota and Minnesota.

High domestic sugar prices, supported by quotas on sugar imports, fostered the development and growth of the corn sweetener industry. After 1980, corn sweetener's share of total sweetener deliveries increased significantly. Corn producers and corn sweetener refiners were also beneficiaries of the sugar program. Based upon their corn production, at least six states were estimated by Schmitz and Christian to be net exporters of sweeteners; Illinois, Indiana, Iowa, Kansas, South Dakota and Wisconsin. Presumably Minnesota, Nebraska and North Dakota and perhaps Idaho, Montana and Wyoming were also net exporters of corn-based sweeteners. Several states produced or refined more than one type of sweetener. For example, California gained dual benefits from the current sugar program based upon its own sugar beet production and its refining of Hawaiian cane sugar. Colorado and Michigan, as producers of both sugar beets and corn, were also net exporters of sweeteners.

In total, 18 states were estimated to be net exporters of sweeteners. From 1982 through 1992, senators from these states comprised 36% of the Senate and the 168 representatives from these states comprised nearly 39% of the House. Thus, although these states provided a strong foundation of support for the sugar program, they did not comprise the legislative majority needed to enact sweetener support legislation on the basis of regional economic benefits alone.

Evidence from Voting Records

Eight congressional votes on amendments to sugar legislation recorded between September, 1981, and July, 1990, are summarized in Table 1. (Schmitz and Christian 1993, 1995). Five votes occurred in the Senate, and three votes occurred in the House of Representatives. These voting records were correlated with estimates of the sugar program's regional effects.

Legislators, representing the 18 states estimated to be net exporters of sweeteners, were expected to have supported the sugar program. Support, for the sugar program by legislators representing the sugar producing states, was particularly strong. In all five Senate ballots, only two votes by senators from sugar exporting states were cast against legislation favorable to sugar.

In the House, each sugar program vote received support from more than 75% of the sugar state representatives. Support of sugar legislation by corn sweetener exporting states was less strong, particularly in the early votes. However, support from these states increased between 1981 and 1990, as evidenced, for example, by the votes of the Illinois, Wisconsin and Ohio House delegations. This voting behavior was consistent with the dramatic increase in the corn sweetener consumption over this period: Corn sweetener's share of total sweetener deliveries increased from less than 20% in 1980 to over 50% in 1989. Finally, additional support for sugar legislation in the House was evident from areas where sweetener production and/or refining was important to local economies. The delegations from Ohio, Tennessee, Texas, Missouri and North Carolina, states in which HFCS refining and corn production were significant, showed mixed support. Interestingly, after opposing earlier programs, House

TABLE 1

Senate Votes on Proposed Sugar Legislation, By State
(see footnote for description of proposed legislation)

(votes for policy favorable to sweetener industries to votes against)
(vacancies, absences, and note votes in parentheses)

	Vote 1	Vote 2	Vote 3	Vote 4	Vote 5
Probable Supporters					
Net Exporters of Sugar					
California	1 - 0 (1)	1 - 0 (1)	2 - 0	2 - 0	2 - 0
Colorado	1 - 0 (1)	1 - 0 (1)	2 - 0	1 - 1	1 - 1
Florida	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
Hawaii	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
Idaho	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
Louisiana	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
Michigan	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
Minnesota	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
Montana	2 - 0	2 - 0	1 - 0 (1)	2 - 0	2 - 0
North Dakota	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
Wyoming 2 - 0	2 - 0	1 - 0 (1)	2 - 0	2 - 0	
Net Exporters of Corn Sweeteners					
Illinois	1 - 1	0 - 2	1 - 1	2 - 0	2 - 0
Indiana	0 - 2	0 - 2	1 - 1	2 - 0	2 - 0
Iowa	2 - 0	2 - 0	2 - 0	2 - 0	1 - 1
Kansas	2 - 0	2 - 0	2 - 0	2 - 0	0 - 2
Nebraska	2 - 0	2 - 0	2 - 0	1 - 0 (1)	2 - 0
South Dakota	2 - 0	2 - 0	2 - 0	2 - 0	1 - 0 (1)
Wisconsin	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
Probable Opponents					
Alabama	1 - 1	2 - 0	0 - 1 (1)	2 - 0	2 - 0
Alaska	2 - 0	1 - 0 (1)	2 - 0	2 - 0	1 - 1
Arizona	2 - 0	2 - 0	1 - 1	1 - 0 (1)	1 - 1
Arkansas	1 - 0 (1)	2 - 0	0 - 2	2 - 0	2 - 0
Connecticut	1 - 1	1 - 1	0 - 0 (2)	0 - 1 (1)	1 - 1
Delaware	0 - 2	0 - 2	1 - 1	0 - 2	0 - 2
Georgia	1 - 1	1 - 1	0 - 2	1 - 1	1 - 1
Kentucky	2 - 0	2 - 0	2 - 0	2 - 0	1 - 1
Maine	2 - 0	2 - 0	0 - 2	0 - 2	0 - 2
Maryland	0 - 2	1 - 1	2 - 0	0 - 2	1 - 1
Massachusetts	0 - 2	0 - 1 (1)	1 - 1	0 - 2	0 - 2
Mississippi	1 - 0 (1)	2 - 0	2 - 0	2 - 0	2 - 0
Missouri	0 - 2	0 - 2	1 - 1	0 - 2	0 - 2
Nevada	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
New Hampshire	0 - 2	0 - 2	0 - 1 (1)	0 - 2	0 - 2
New Jersey	0 - 1 (1)	0 - 1 (1)	0 - 2	0 - 2	0 - 2
New Mexico	1 - 1	0 - 2	1 - 0 (1)	1 - 0 (1)	0 - 2
New York	0 - 2	0 - 2	0 - 1 (1)	0 - 2	1 - 1
North Carolina	2 - 0	2 - 0	2 - 0	1 - 0 (1)	2 - 0
Ohio	0 - 2	1 - 1	2 - 0	0 - 1 (1)	0 - 2
Oklahoma	1 - 1	1 - 1	1 - 1	1 - 1	1 - 1
Oregon	0 - 2	0 - 2	2 - 0	1 - 1	0 - 2
Pennsylvania	0 - 2	0 - 2	0 - 2	0 - 0 (2)	0 - 2
Rhode Island	0 - 2	0 - 2	0 - 2	0 - 2	0 - 2
South Carolina	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
Tennessee	2 - 0	2 - 0	1 - 0 (1)	2 - 0	2 - 0
Texas	2 - 0	2 - 0	2 - 0	2 - 0	2 - 0
Utah	2 - 0	2 - 0	0 - 2	2 - 0	1 - 0 (1)
Vermont	1 - 0 (1)	1 - 0 (1)	0 - 2	0 - 2	1 - 1
Virginia	1 - 1	1 - 1	1 - 1	2 - 0	0 - 2
Washington	1 - 1	2 - 0	2 - 0	0 - 2	1 - 1
West Virginia	2 - 0	2 - 0	1 - 1	2 - 0	2 - 0

Vote 1: To table amendment to eliminate sugar program; passed 61-33; September 17, 1981
Vote 2: To table amendment to reduce sugar loan rate; passed 64-30; September 17, 1881
Vote 3: To table amendment to reduce sugar loan rate; passed 60-31; September 23, 1982
Vote 4: To table amendment to allow reduction in sugar loan rate; passed 60-32; November 22, 1985
Vote 5: To table amendment to reduce sugar loan rate; passed 54-44; July 24, 1990

(continued)

TABLE 1 (continued)

House of Representatives Votes on Proposed Sugar Legislation, By State
(see footnote for description of proposed legislation)

	Vote 1	Vote 2	Vote 3
	(votes for policy favorable to sweetener industries to votes against) (vacancies, Absences, and no votes in parentheses)		
Probable Supporters			
New Exporters of Sugar			
California	26 - 10 (7)	34 - 7 (4)	33 - 12
Colorado	4 - 1	4 - 1 (1)	5 - 1
Florida	10 - 3 (2)	13 - 4 (2)	12 - 5 (2)
Hawaii	2 - 0	2 - 0	1 - 0
Idaho	1 - 0 (1)	2 - 0	2 - 0
Louisiana	8 - 0	8 - 0	8 - 0
Michigan	11 - 6 (2)	16 - 1 (1)	13 - 4 (1)
Minnesota	6 - 2	8 - 0	7 - 1
Montana	2 - 0	2 - 0	2 - 0
North Dakota	1 - 0	1 - 0	1 - 0
Wyoming	1 - 0	0 - 1	1 - 0
Net Exporters of Corn Sweeteners			
Illinois	0 - 23 (1)	10 - 6 (6)	13 - 9
Indiana	3 - 8	3 - 6 (1)	4 - 6
Iowa	5 - 1	6 - 0	5 - 1
Kansas	5 - 0	4 - 1	3 - 2
Nebraska	3 - 0	3 - 0	3 - 0
South Dakota	2 - 7	1 - 0	1 - 0
Wisconsin	2 - 7	5 - 3 (1)	6 - 3
Mixed[1]			
Missouri	8 - 2	9 - 0	7 - 2
North Carolina	8 - 1 (2)	11 - 0	11 - 0
Ohio	4 - 19	10 - 10 (1)	9 - 12
Tennessee	5 - 3	5 - 4	4 - 4 (1)
Texas	17 - 6 (1)	19 - 7 (1)	21 - 6
Probable Opponents			
Alabama	5 - 6 (1)	4 - 2 (1)	7 - 0
Alaska	1 - 0	1 - 0	1 - 0
Arkansas	3 - 0	3 - 0 (1)	3 - 1
Arizona	3 - 1	2 - 1 (2)	1 - 4
Connecticut	0 - 4 (2)	0 - 6	0 - 5 (1)
Delaware	0 - 1	0 - 1	0 - 1
Georgia	1 - 7 (2)	8 - 1 (1)	8 - 2
Kentucky	6 - 1	6 - 1	6 - 1
Maine	0 - 2	0 - 2	0 - 2
Maryland	2 - 6	1 - 7	7 - 0 (1)
Massachusetts	0 - 10 (2)	1 - 9 (1)	1 - 10
Mississippi	5 - 0	5 - 0	5 - 0
Nevada	0 - 0 (1)	1 - 1	2 - 0
New Hampshire	2 - 0	0 - 2	0 - 2
New Jersey	0 - 12 (3)	2 - 12	2 - 11 (1)
New Mexico	2 - 0	3 - 0	3 - 0
New York	1 - 36 (2)	7 - 25 (2)	15 - 18 (1)
Oklahoma	5 - 1	6 - 0	3 - 2 (1)
Oregon	2 - 2	4 - 0 (1)	5 - 0
Pennsylvania	4 - 20 (1)	9 - 13 (1)	9 - 13 (1)
Rhode Island	0 - 2	0 - 2	0 - 2
South Carolina	3 - 1 (2)	6 - 0	5 - 1
Utah	1 - 1	1 - 1 (1)	0 - 2 (1)
Vermont	1 - 0	1 - 0	1 - 0
Virginia	4 - 6	5 - 4 (1)	7 - 2 (1)
Washington	4 - 2 (1)	7 - 1	4 - 3 (1)
West Virginia	3 - 1	4 - 0	4 - 0

Vote 1: Amendment to eliminate sugar program; passed 213-190; October 15, 1981
Vote 2: Amendment to reduce sugar loan rate; defeated 263-142; September 26, 1985
Vote 3: Amendment to reduce sugar loan rate; defeated 271-150; July 24, 1990

[1] States in which sweetener production and/or i\refining important to local economies.

Source: Schmitz and Christian, 1993 and 1995.

delegations representing Georgia and Maryland supported the 1990 sugar legislation. That legislation included a minimum import provision that protected sugar cane refiners located in those states. Similarly, the New York delegation's previously strong opposition to the sugar program weakened considerably in 1990.

To test the hypothesized relationships regarding legislators' support or opposition to the program, cross-tabulations of the eight roll call votes by legislators' hypothesized positions on the sugar program are presented in Table 2. (Schmitz and Christian 1993, 1995). The chi-square statistics for the House votes range from 21.8 to 62.8 with six degrees of freedom. All are significant at the 1% level, indicating a rejection of the null hypothesis that legislators' voting behavior is independent of the presence of sugar program beneficiaries in the state. In the Senate, the chi-square statistics range from 13.0 to 21.4 with four degrees of freedom. Four of the statistics are significant at the 1% level, and the fifth is significant at the 2.5% level. This implies a strong association between voting behavior and the economic impact of the sugar program on regional economies. The above should be interpreted in light of the economic importance of the industry. The entire U.S. sweetener industry (Table 3) is large by any standard (Landell Mills).

From the above, additional arguments are presented as to why strong political support for the U.S. sugar program existed in the past. Even if one accepted (for example, the U.S. General Accounting Office [GAO] report) that the U.S. sugar program resulted in net societal costs, such a policy still may be adopted by Congress even in the absence of pressure from special interest groups. This could happen if legislators were to weight equally the welfare of their constituent interest groups and the policy was to redistribute wealth in such a way that a

TABLE 2

Cross-Tabulations of Senate Votes on Proposed Sugar Legislation, By State
(see Table 1 for description of proposed legislation)

Senate Vote 1

	Proponents		Opponents	Total
	Cane or Beets	Corn		
Supported	20	9	32	61
Opposed	0	5	28	33
No Vote	2	0	4	6
	22	14	64	100

chi square (4 dof) = 15.250 (1%)

Senate Vote 2

	Proponents		Opponents	Total
	Cane or Beets	Corn		
Supported	20	8	36	64
Opposed	0	6	24	30
No Vote	2	0	4	6
	22	14	64	100

chi square (4 dof) = 12.961 (2.5%)

Senate Vote 3

	Proponents		Opponents	Total
	Cane or Beets	Corn		
Supported	20	9	31	60
Opposed	0	5	26	31
No Vote	2	0	7	9
	22	14	64	100

chi square (4 dof) = 15.332 (1%)

Senate Vote 4

	Proponents		Opponents	Total
	Cane or Beets	Corn		
Supported	21	9	30	60
Opposed	1	4	27	32
No Vote	0	1	7	8
	22	14	64	100

chi square (4 dof) = 16.262 (1%)

(continued)

TABLE 2 (continued)

Cross-Tabulations of Senate Votes on Proposed Sugar Legislation, By State
(see Table 1 for description of proposed legislation)

Senate Vote 5

	Proponents		Opponents	Total
	Cane or Beets	Corn		
Supported	21	6	27	54
Opposed	1	7	36	44
No Vote	0	1	1	2
	22	14	64	100

chi square (4 dof) = 21.410 (1%)

House Vote 1

	Proponents		Mixed	Opponents	Total
	Cane or Beets	Corn			
Supported	72	20	42	56	190
Opposed	22	39	31	121	213
No Vote	12	1	3	16	32
	106	60		76	435

chi square (6 dof) = 62.752 (1%)

House Vote 2

	Proponents		Mixed	Opponents	Total
	Cane or Beets	Corn			
Supported	90	32	54	87	263
Opposed	14	16	21	91	142
No Vote	8	8	2	12	30
	112	56	77	190	435

chi square (6 dof) = 50.414 (1%)

House Vote 3

	Proponents		Mixed	Opponents	Total
	Cane or Beets	Corn			
Supported	85	35	52	99	271
Opposed	23	21	24	82	150
No Vote	4	0	1	9	14
	112	56	77	190	435

chi square (4 dof) = 50.414 (1%)

Source: Schmitz and Christian, 1993 and 1995.

Table 3

U.S. Sweetener Industry - Economic Impact and Jobs, by Sector

	Direct Economic Value (million $)	Direct & Indirect Economic Impact (Million $)	Direct Jobs (Full-time Equivalent)	Direct & Indirect Jobs (Full-time Equivalent)
Beet Growing	1,080.8	2,701.9	26,692	66,729
Beet Processing	1,349.4	3,373.6	8,585	21,463
Beet Total[1]	**2,430.2**	**6,075.6**	**35.510**	**88,775**
Cane Growing & Harvesting	848.3	2,120.8	22,488	56,221
Cane Milling	733.5	1,833.7	6,268	15,669
Cane Refining	716.3	1,790.8	4,231	10,577
Cane Total[1]	**2,298.1**	**5,745.3**	**33,229**	**83,072**
Sugar Total	**4,728.3**	**11,820.8**	**68,739**	**171,847**
Corn Growing for Sweetener	1,626.5	4,066.3	90,537	266,343
Corn Processing for Sweetener	4,132.1	10,330.3	8,549	21,371
Corn Sweetener Total	**5,758.7**	**14,396.6**	**99,086**	**247,715**
GRAND TOTAL	**10,487.0**	**26,217.5**	**167.825**	**419,562**

Notes: [1] Including other types of employment (e.g., Company HQ, Regional Sales Offices).

Source: Landell Mills.

majority of legislative districts could enjoy net benefits. Schmitz and Christian analyzed the regional effects of the U.S. sugar policy and correlated these effects with congressional voting records on eight amendments intended to weaken the sugar program. They found that legislators representing regions benefiting from the sugar program, did not comprise a majority of Congress, but that they did constitute a sizable minority of over one-third in each house. Furthermore, voting behavior appeared to be consistent with the sugar program's net economic impact: Legislators who represented net sweetener exporting regions -- the beneficiaries of U.S. sugar policy -- tended to be strong supporters of the sugar program; support for the sugar program from corn growing and refining regions increased between 1980 and 1990 and was consistent with the growth of HFCS market share; and legislators, who represented states that refined imported cane sugar, switched from opposing the sugar program to supporting it

following the introduction of a minimum import provision in the 1990 sugar legislation. Based purely on positive regional effects, a strong foundation of support for the sugar program existed although the Congressional majority to sustain it was not present. Some legislators, who presumably would oppose the program on the basis of its deleterious impact on their constituencies, would have to be persuaded to vote in favor of the sugar program. For example, Lopez argued that legislators were more likely to support the sugar program because taxpayers' costs were zero. Nevertheless, the broad base of support for sugar legislation, generated by the relatively large number of beneficiary regions, suggested that sweetener interest groups could either obtain a given level of support with less lobbying than other commodity interest groups or, for a given level of lobbying, increase the level of support. However, several implications of our approach appear to contrast with the findings of other recent studies. For example, Gardner found that a commodity's support level decreased as the dispersion of its producers increased. He concluded that the increased cost of organizing an effective political lobby of geographically dispersed producers was greater than the potential benefits of having producers spread across many congressional districts. Our analysis suggested that it was how producers were dispersed that was important, not simply the degree of dispersion. More specifically, dispersion was found to be advantageous to producers if there were large numbers of localities in which benefits would outweigh the costs borne by local consumers.

In a study of House votes on proposed amendments to farm legislation in 1985/86, Abler found that sugar proponents joined in a vote trading coalition with rice, cotton and peanut proponents. He concluded that sugar was one of the commodities that received the greatest amount of support from proponents of other commodities. Stratmann, studying some of the

same 1985 House votes, reached the similar conclusion that there was mutual logrolling between peanut and sugar proponents. These findings seemingly contradict our implication that sugar is less dependent on logrolling than are most other commodities. Indeed, Abler stated that one would certainly expect a group with limited representation in Congress to make more use of vote trading and/or campaign contributions, which implied that vote trading by sugar proponents was an indication of relatively weak congressional representation. However, both Abler and Stratmann assumed independence between the issue being voted upon and the outcome of the vote. They analyzed the vote outcomes as if they were unrelated to the level of support being voted upon. In fact, given the relatively high level of support enjoyed by the sweetener industries, it may be that the vote trading and logrolling observed by past researchers were manifestations of sugar proponents parlaying their strong base of support into rejection of even a marginal reduction (5.5%) in the sugar support price.

This approach helps explain the form of past sugar programs. For example, when sugar import quotas were reimplemented in 1981, there was no provision for limiting domestic production of sugar as there had been in previous programs. This policy reflected the sweetener environment of the time: The quantity of imported sugar was substantial; the geographical distribution of domestic production was in transition; and perhaps most importantly, the corn sweetener industry was in its infancy. Given the rapidly changing production pattern within the sugar industry, there was little or no resistance to limiting imports but there was strong opposition to limiting domestic production. By 1990, however, the situation had changed dramatically. Imports of sugar had fallen precipitously, from over 5 million short tons raw value (STRV) in 1979 to approximately 1.25 million STRV in 1989. In addition, corn-derived

sweeteners, primarily HFCS, had captured over half the domestic caloric sweetener market and threatened to capture substantially more upon the imminent development of a crystalline HFCS. Reflecting this new reality, proposed 1990 legislation provided for a minimum level of imports (1.25 million STRV), quotas on domestic production of cane and beet sugar if necessary and a 200,000 ton limit on marketing of crystalline fructose. These minimum import provisions preserved strong congressional support for the sugar program, since they extended the number of congressional supporters to include those representing additional refiners.

Usually, national policy does not affect equally all regions of a country. Consequently, opposition or support for a proposed policy is likely to vary by region, and its adoption or rejection will depend on how these regions are represented in the policymaking body. In the United States, the result may be adoption or continuation of a policy regardless of its net economic effect on society at large, simply because a majority of legislators represent constituencies that enjoy a net benefit. The U.S. sweetener industry generates such benefits partly because of the particular geographical dispersion of sugar production and processing together with corn production and HFCS processing. It is important to keep in mind that the entire sweetener industry (not just sugar) is a significant part of the U.S. agricultural sector.

Effects of the U.S. Sugar Program

GAO Report

A heated debate continues on the costs and benefits of the U.S. sugar program. In one of the more recent studies, the General Accounting Office (GAO) concluded that:

(1) Sweetener users bear the cost of supporting sweetener producers. The sugar program costs sweetener users approximately $1.4 billion annually.

(2) From the program, growers and processors gain $561 million annually. Of this, growers generally receive 60% and processors receive 40%.

(3) Manufacturers of HFCS annually receive an additional $548 million from the program.

(4) The U.S. sugar loan rate should be lowered.

A summary of the GAO findings on the effects of the U.S. sugar program are provided in Table 4. The net costs of the program are quite small. Over the 1989/91 period net costs averaged $110 million. However, the GAO estimated that the consumer costs exceeded $1.0 billion. The USDA contends that the GAO estimates of the cost to consumers is grossly overstated. As reported in The Orlando Sentinel on November 1, 1995,

> The Agriculture Department has turned against a much quoted study that concludes the government sugar program jacks up prices $1.4 billion each year. Once terming the GAO report 'reasonable', the department now considers the study of the sugar program to be seriously flawed. The GAO reported that the domestic sugar program costs sweetener users $1.4 billion a year by making U.S. produced sugar more expensive than sugar from other countries.

Other Studies

The results of other studies that estimated the effects of the U.S. sugar policy are found in Table 5. These studies were conducted using different methodologies and time periods. Generally, the costs of the program were higher in the earlier 1980s than in the later 1980s. Except for those costs estimated by Maskus and Marks for 1985/86 through 1989/90, the annual

net losses were less than 350 million. For example, Mehra reported net losses as low as $166 million for 1987/88.

There are several points to keep firmly in mind when interpreting the findings in Tables 4 and 5. These are discussed below.

User or Consumer Costs.

Table 4 refers to user costs as a result of the sugar program while Table 5 refers to consumer costs. If the benefits of lower sugar prices were not passed on to consumers in the form of lower product prices, then user costs is the correct terminology. There is considerable debate over how much consumers would actually benefit if the program were removed. For example, Polopolus contended that lower sugar prices would not be passed on to consumers.

Table 4

Estimates of Producer Gains, Foreign Exporter Gains, Deadweight Loss, and User Costs

	Dollars in Millions				
Year	User Costs	Sugar Producer Gains	HFCS Manufacturer Gains	Exporter Gains	Deadweight Loss
1989	1378	$597	$551	$116	$114
1990	1718	650	677	241	150
1991	1058	435	417	141	65
Average	1,388	$561	$548	$166	$110

Source: GAO analysis of USDA data.

Table 5

Estimates of Consumer Losses, Producer Gains, and Net Losses

1991 Dollars in Millions				
Author and Date	Period of Data	Consumer Losses	Producer Gains	Net Losses
Gemmill, 1977	174	859	599	86
Federal Trade Commission, 1984	1983	987	556	338
Dardis and Young, 1985	1983 (FY)	2,520[3] to 3,230	1,050 to 1,190	1,310 to 1,880
Langley and Zellner, 1986	1977-84	1,130	597	254
Leu, Schmitz, and Knutson, 1987	1983	499[b] to 2,150	227 to 776	272 to 1,320
Maskus, 1989	1986/87	1,520 to 2,340	818 to 982	538 to 1,320
Rekha Mehra, 1990	1984/85	887	612	275
	1985/86	761	558	203
	1986/87	993	800	193
	1987/88	1,050	883	166
Borrell, Sturgiss, and Wong, 1987	1981/82	3,990	1,790	1,130
	1982/83	4,360	1,800	1,210
	1983/84	4,380	1,570	1,280
	1984/85	4,200	1,650	1,010
	1985/86	3,010	1,450	314
Lord, 1988	1987	1,130[c] to 3,740	765 to 2,410	370 to 1,330
Neff and Josling 1991	1982-1987 Average	1,660	904	754
Dept. of Commerce, 1988	1987	3,510		
U.S. International Trade Commission, 1990	1989	1,193	1,070	162
Australian Bureau of Agricultural and Resource Economics, 1990	1982-88 Average	2,890[d] to 3,620	1,130-1,380	968 to 979

(continued)

Table 5 (continued)

1991 Dollars in Millions

Author and Date	Period of Data	Consumer Losses	Producer Gains	Net Losses
Federal Trade Commission, 1990 (CGE Model)	1987	540		
Marks, 1991	1984/85 to 1988/89 Average	3,180	2,440	743

Note: These estimates of consumer losses, producer gains, and net economic losses from the economic studies cited here were derived using differing methodological frameworks, base years of study (different world prices), and assumptions. We adjusted estimates to real 1991 dollars using the Gross Domestic Product-Implicit Price Deflator.

[a] The smaller number for consumer loss, producer gain, and net loss for Dardis and Young assumes a change in world price.

[b] This range of estimates of consumer loss, producer gain, and net loss from Leu et al. is with HFCS substitution.

[c] These estimates of consumer loss, producer gains, and net loss are with HFCS substitution.

[d] These figures represent lower and upper bounds of consumer loss, producer gains, and net loss.

Source: U.S. General Accounting Office.

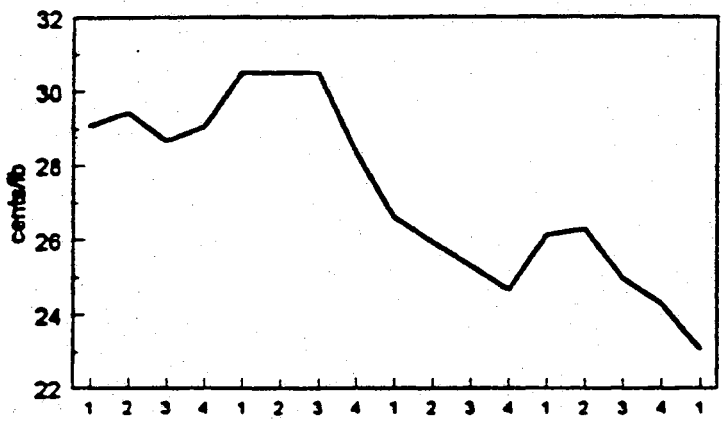
He argued that sugar prices and those of other sweeteners were actually decreasing from 1989 through 1993 (Figure 2), even though prices of consumer products containing sugar actually rose (Figure 3).

According to Polopolus, p.8:

> The fundamental flaw in the GAO report has to do with the concentration upon sweetener "users" and not sweetener "consumers". In our mixed capitalistic society, the consumer is the ultimate arbiter of resource allocation. Since the bulk of America's sweeteners (sugar and corn syrups) are utilized in other foods and beverages, the real question is whether or not sweetener input costs of food and beverage manufacturers are properly reflected in consumers prices of sweetener containing products. The GAO bypasses this critically important issue. Moreover, the GAO report places considerable emphasis on the point that the sugar program has increased costs to sweetener users in recent years.
>
> Let us look at the facts regarding recent trends in wholesale sugar prices and trends in retail prices of sugar containing products. In doing so, it will be concluded that the sugar program has not increased prices of sugar at the

Figure 2

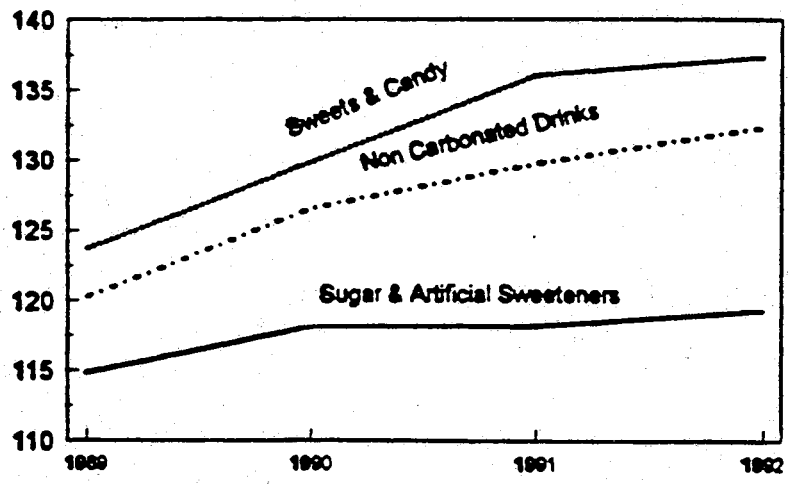
Wholesale Refined Beet Sugar Prices
Mid West Market, By Quarters 1989-1993



Source: Milling and Baking News.

Figure 3

Index of Retail Prices: U.S. Consumer Price
for Sugar & Artificial Sweeteners, Sweets (Including Candy) and
Non-Carbonated Drinks, 1989-1992



Source: U.S. Department of Labor, Bureau of Labor Statistics.

wholesale level in nominal or real prices. Also, the loan rate for raw sugar has declined in recent years in terms of real prices. However, retail prices of sugar containing products have increased in recent years. Thus, the federal sugar program is not placing a burden or extra cost on consumers. The cause of increased prices for sugar containing products may be difficult to discern, but the federal sugar program is certainly not the culprit.

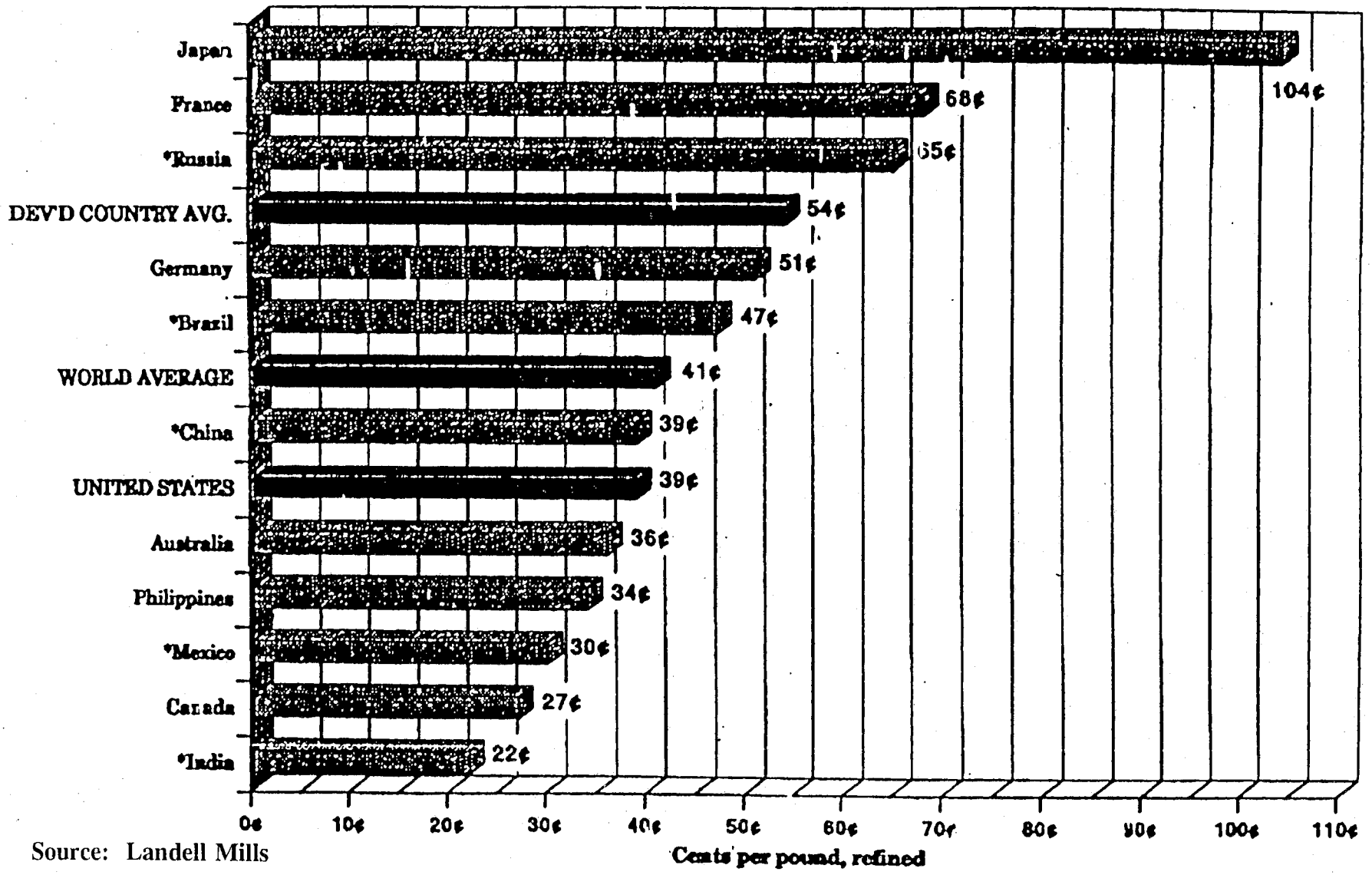
In contrast to the jargon of the GAO report, prices of sugar and other sweeteners are not increasing, but actually decreasing. How does this market environment create "additional" burdens for sweetener users? If anything, the current sugar program, with its fixed loan rate and stable or declining wholesale price for sugar, is creating adverse financial pressures for sweetener producers, with the benefits going to sweetener users.

With respect to the above, it is interesting to compare U.S. retail sugar prices (Figure 3) with those worldwide (Figure 4). They average 39¢/lb for the United States and that is below the world average of 41¢/lb. Note also, in Figure 4, that the average sugar price for developed countries is 54¢/lb.

Sugar vs Corn Sweetener Prices.

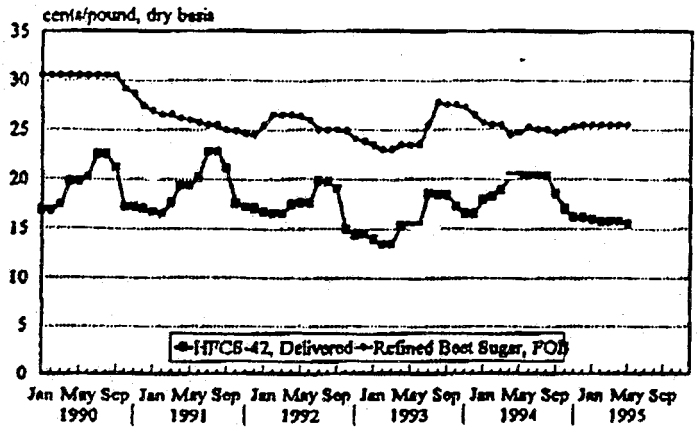
According to Abel, Daft, Early and Ward the sugar program today, unlike previously, may have little or no impact on corn sweetener prices, demand or production. The wide disparity between sugar and HFCS prices is shown in Figure 5. As a result of this disparity, Abel et al argued that changes in the program would not cause sugar prices to fall far enough to affect the corn sweetener market. If this were the case, then the consumer and/or user costs of the Sugar Program would be grossly overstated because over 50% of sweetener usage is HFCS based. As a result, more than 50% of consumption would be unaffected by the lower prices caused by changes in the program. However, the relationship between sugar prices and HFCS prices needs further examination.

Figure 4
Global Retail Sugar Price Comparisons
1994



Source: Landell Mills

Figure 5
Sugar vs. Corn Sweetener Prices, 1990 to 1995



Source: Milling and Baking News.

HFCS prices are in part determined by corn prices which have skyrocketed in the late 1995 and early 1996 period. This price increase will cause an upward pressure in the price of all major sweeteners including sugar.

Partial vs. General Equilibrium Analysis.

A major problem with many of the studies on the effects of the U.S. sugar program is that they are of a partial equilibrium nature. They do not capture, for example, the effects of sugar import quotas on the dynamics of total sweetener supply response. From theory, it is well known that results from partial models tend to overstate the costs of import quotas. This overstatement is emphasized by the results in Table 5 in which the 1990 findings of the Federal Trade Commission (FTC) are represented. This study, unlike others, used a computable general equilibrium model. Note that the FTC found consumer losses for 1987 to be only $540 million.

This is contrary to the 1987 and 1988 U.S. Department of Commerce studies, that found consumer costs were $3.5 billion -- a wide discrepancy indeed!

Corn Producers

The GAO results did not reflect the benefits to corn producers from the increased demand for corn that was needed for the increased production of HFCS. Roughly 8 million tons of HFCS are now produced. According to the USDA, corn sweetener manufacturers, and particularly HFCS manufacturers, benefit from the U.S. sugar program. The sugar program provides a price floor for sugar that is higher than the cost of producing liquid HFCS, and thus guarantees that sugar cannot be price competitive with HFCS. The sugar program's guarantee of a price floor for sugar (and thus indirectly HFCS) spurs investment in HFCS facilities, which leads to an increase in the HFCS share in the U.S. sweetener market. Further, higher HFCS revenues fund substantial research and development in the corn wet-milling industry, indirectly benefiting other products such as fuel ethanol.

The expansion of HFCS production increases the demand for corn. The amount of corn used in HFCS production increased from 165 million bushels in 1981 to 440 million bushels in 1994. The amount of corn used in all corn sweeteners increased from 321 million bushels in 1981 to 660 million bushels in 1994. During 1992/94, about 8% of the U.S. corn crop was used by the wet-milling industry to produce corn sweeteners.

According to Texas A&M's AGSTM econometric model (updated by the University of Illinois), a 500-million bushel shift in corn demand has price impacts of 25¢/bu in the short run and 15-20¢/bu in the long run. To the GAO calculations, the author added the benefits to the corn sector from the U.S. Sugar Policy. However, rather than using the Texas A & M result of 25¢/bu, a much more conservative impact of 10¢/bu was used affecting an assumed 7-billion

bushel corn crop. As can be seen from Table 6, when this benefit was added on to the GAO calculations, there were net benefits associated with the sugar program -- not net costs.

Table 6

Sugar Program Effects

Year	User Costs*	Sugar* Producer Gains	HFCS* Manufacturer Gains	Exporter* Gains	Corn Producers Gains**	Deadweight Loss**
1989	1,378	$597	$551	$116	$700	-$586
1990	1,718	650	677	241	700	- 550
1991	1,058	435	417	141	700	- 635
Average	1,388	$561	$548	166	$700	- 590

* GAO estimates.
** Author's estimates.

U.S. Program and World Price Effects

The effect of the U.S. sugar program on world prices is an empirical question. As with estimates of the effects of the U.S. program on user costs, estimates of the impact of the U.S. sugar program on world prices also vary considerably.

Estimates by Marks on the effects of the U.S. program on world prices are presented in Table 7. Between 1984/85 - 1986/87, prices were depressed by roughly 15% per year. However this dropped to 9% by 1988/89. The study by Borrell, Sturgiss and Wong found

Table 7

U.S. and World Free-Market Raw Sugar Prices With and Without U.S. Import Restrictions, 1984/85 to 1988/89 (U.S. cents per pound)

	1984/85	1985/86	1986/87	1987/88	1988/89
U.S. Raw Sugar Price	20.80	20.75	21.53	22.02	22.58
World Free-Market Price	4.42	5.38	6.49	9.02	11.92
World Price in Absence of U.S. Import Restrictions	5.23	6.34	7.70	10.36	13.05
Effect of U.S. Restrictions on World Price (percent)	-15.5	-15.1	-15.7	-12.9	-8.7

Source: Marks.

that larger price effects ranged from 11% to 50% over the years examined. In a more recent study by the Australian Bureau of Agricultural and Resource Economics, Hafi, Connell and Roberts found that world raw sugar prices would have been 56% higher or 4.8¢/lb over the 1992/93 period (Table 8). They estimated that world sugar prices would have been 34% higher or 2.9¢/lb if the HFCS industry had not developed.

Table 8

Estimated Effect of U.S. Sugar Policies on World Raw Sugar Price

			World Price with Full U.S. liberalization			
		Scenario 1	*Scenario 2*		*Scenario 3*	
	World Market Price	Baseline World Price	Without HFCS Substitution		With HFCS Substitution	
			Price	Change from Baseline	Price	Change from Baseline
	U.S.¢/lb.	U.S.¢/lb.	U.S.¢/lb.	U.S.¢/lb.	U.S.¢/lb.	U.S.¢/lb.
1982	10.4	12.9	13.6	0.7	13.9	1.0
1983	7.6	6.3	7.2	0.9	8.3	2.0
1984	6.7	3.8	4.7	0.9	6.8	3.0
1985	3.7	5.3	7.3	2.0	12.2	6.9
1986	6.0	4.4	7.3	2.9	11.4	7.0
1987	6.2	8.1	15.0	6.9	19.3	11.2
1988	9.0	7.0	11.2	4.2	11.7	4.7
1989	11.6	9.7	14.0	4.3	14.9	5.2
1990	13.9	12.9	16.4	3.5	17.7	4.8
1991	9.3	13.6	17.5	3.9	17.8	4.2
1992	9.2	8.9	11.0	2.1	11.4	2.5
1993	9.6	10.1	13.2	3.1	14.9	4.8
Average	8.6	8.6	11.5	2.9	13.4	4.8

Source: Hafi, Cornell and Roberts.

Loan Rates

Even with the program in place, the loan rate has fallen sharply. According to Polopolus, pp 9-10:

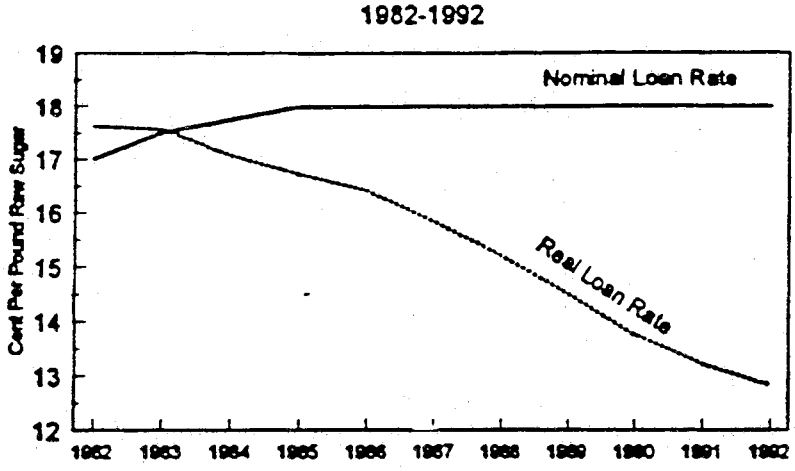
> It is interesting that the GAO report would pounce on the loan rate and suggest that it be lowered over time to prevent sugar prices from increasing even further. In reality, the loan rate, which is intended to be a safety net of minimum prices for domestic producers, has been fixed at 18 cents per pound

for raw sugar each year since 1985. Loan rates were increased gradually prior to 1985 or from 17.0 cents per pound in 1982 to 17.75 cents per pound in 1984.

When adjusted for inflation, the sugar loan rate has progressively declined since 1982 or from a real loan rate of 17.62 cents per pound in 1982 to a real loan rate of 12.83 cents per pound in 1992 (Figure 6). Under the provisions of the current sugar program, the Secretary of Agriculture has the authority to increase the loan rate over time, but has chosen to keep it fixed at the minimum rate of 18 cents per pound. It is difficult to understand how the GAO's recommendation of lowering the loan rate would prevent sugar prices from rising, when the loan rate itself is fixed in nominal prices and declining in real prices.

Figure 6

Comparisons of Nominal (Actual) Loan Rates for Raw Sugar with Real Loan Rates for Raw Sugar



Source: USDA and Bureau of Labor Statistics

Foreign Effects

The empirical results do not necessarily support the notion that all foreign interests are hurt by the program. Sturgiss, Field and Young estimated that, as a result of the Sugar Program, for the 1982/88 period, an average gain for the rest of the world was between $277

and $467 million. Marks estimated an average gain of $331 million over the 1984/85 - 1988/89 period.

Trade Overview

Trade data for leading world sugar exporters and importers are given in Table 9. For the 1984/85 - 1994/95 period, exports ranged between 27 million metric tons and 33 million metric tons. For the same period, HFCS production in the United States was approximately 8 million tons -- roughly 25% of the world sugar trade. Hafi, Connell and Roberts estimated that if this growth in HFCS production had not occurred, world sugar prices and U.S. sugar imports would have been above current levels.

Static vs. Dynamic Effects of Quotas

Past studies of the effects of the U.S. sugar program essentially used a static partial equilibrium analysis (see the earlier models). These models have many shortcomings, for example, they ignore the impact of the U.S. import quota on demand substitution and on the dynamics of total supply response of all sweeteners. The focus has to extend beyond sugar. Studies have been conducted on the growth of demand of total sweeteners and on the substitution that exists between sugar and non-sugar sweeteners (e.g., Leu et al and Maskus). Also, work has been done on the factors affecting the supply of sugarcane and sugar beets (Schmitz and Christian 1993) from which traditional price elasticities have been estimated.

Supply of Total Sweeteners

What does the supply curve for total sweeteners look like? Has this supply been affected by import quotas? Also, what does the supply curve for the final product look like given the

Table 9

World Sugar Trade, by Leading Sugar Exporters and Importers

Country or area	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95
					Million metric tons, raw value						
Sugar exporters:											
Cuba	7.3	7.05	6.53	6.62	7.44	7.07	6.80	6.10	3.80	3.20	2.50
European Union[1]	4.3	5.08	5.38	5.10	5.36	5.51	5.58	4.87	5.65	6.41	5.09
Ukraine	NA	NA	NA	NA	NA	NA	3.45	1.50	2.00	1.80	1.90
Australia	2.7	2.86	2.66	2.80	2.86	2.93	2.82	2.35	3.48	3.49	3.82
Thailand	1.8	2.06	1.96	1.89	3.00	2.61	2.74	3.66	2.33	3.00	3.30
Brazil	3.4	2.56	2.09	2.13	1.37	1.50	1.30	1.61	2.43	2.56	2.80
China	0.1	0.27	0.46	0.31	0.28	0.62	0.3	1.42	2.10	1.05	0.30
Total leading exporters	19.70	19.88	19.08	18.85	20.31	20.24	22.69	21.51	21.79	21.51	19.71
World Total	28.97	28.87	27.46	27.08	28.67	28.65	32.54	30.77	29.55	29.73	27.87
					Percent						
Leading exporter's share of global exports	68	69	69	70	71	71	70	70	74	72	71
					Million metric tons, raw value						
Sugar importers:											
Russian Federation	NA	NA	NA	NA	NA	4.55	3.58	3.85	3.50	3.15	3.10
European Union[1]	2.3	2.26	2.21	2.21	2.43	2.23	1.88	1.89	2.01	2.00	2.01
United States[2]	2.1	2.05	1.50	1.14	1.75	2.35	2.62	2.07	1.83	1.60	1.67
Japan	1.9	1.86	1.70	1.85	1.91	1.79	1.76	1.80	1.77	1.63	1.62
China	1.9	1.22	1.51	3.70	2.46	1.13	1.06	1.23	0.51	0.68	1.50
Canada	1.1	1.15	1.12	0.93	0.71	0.82	1.11	0.96	1.01	1.21	1.21
Korea, Republic of	0.9	0.97	1.10	1.11	1.11	1.11	1.23	1.26	1.23	1.26	1.24
Total leading importers	10.07	9.51	9.14	10.94	10.37	13.98	13.24	13.06	11.85	11.52	12.35
World Total	29	29	27	27	29	29	33	31	30	30	28
					Percent						
Leading importer's share of global imports	35	33	33	40	36	49	41	42	40	39	44

NA = Not available.
[1] Excludes intra-EU trade, includes Unified Germany. Does not include Finland, austria, and Sweden.
[2] Based on offshore receipts and includes sugar imports for re-export.

Source: USDA, Foreign Agricultural Service.

significant technological changes in, for example, sugarcane refining? As we show, once the dynamics of the total sweetener supply (including HFCS) are taken into account, a different light is shed on the effects and consequences of the U.S. sugar program.

We explore these dynamic issues with reference to Figure 7. The U.S. demand for sugar is given by D* and S* is the U.S. supply curve. The excess supply curve is given by ES*. The free trade price is P_w and the U.S. imports Q* of sugar from abroad. Consider just the case of no production of HFCS.

No Production of HFCS

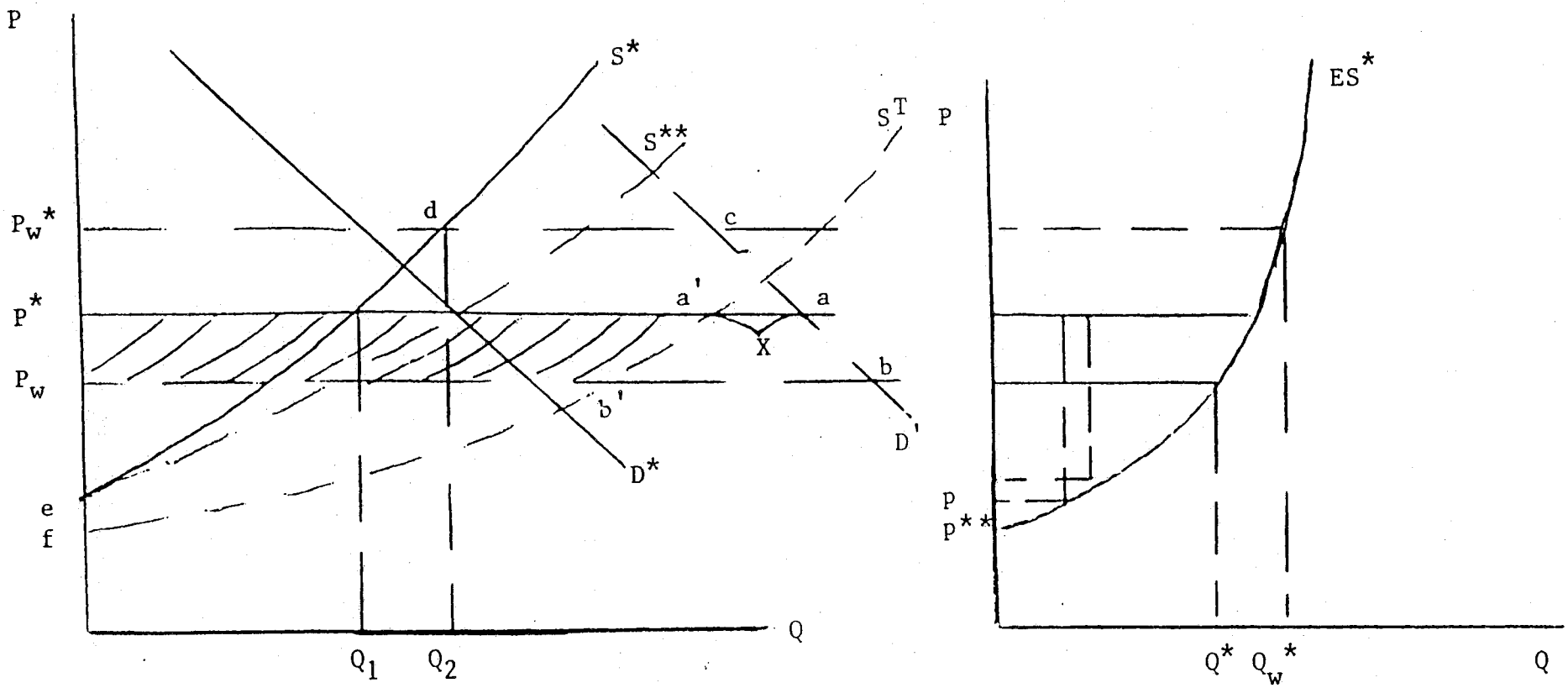
If the United States were to implement an import quota of Q_1Q_2, the U.S. price would rise to P* and the world price would fall to p. From a static perspective, quotas impose costs. However, the effects of the quota over time have to be considered. To do this, we return to the free trade case as a point of comparison. Let us assume that the demand by the United States for sugar roughly doubles (i.e. demand shifts from D* to D^1). In this case, the U.S. and world price both rise to P_w*. The United States now imports Q^*_w from abroad.

Production of HFCS

Contrast this to a case where sugar demand is D* and a quota of Q_1Q_2 is put in place. The consumption of all sweeteners grows to D^1. Sweeteners now include HFCS. (For the moment it is assumed that the growth of the HFCS industry is due to the quota.) The U.S. supply of all sweeteners is S^T and contains sugar beets, sugarcane and corn sweeteners. Note that both the demand and supply for all sweeteners has increased. In this scenario, for an internal U.S. quota of a^1a (the external price is P**), the U.S. consumers pay a lower price for sweeteners than they do in the absence of quotas. Thus, they pay price P* instead of P_w*.

Figure 7

The Dynamics of Effects Quotas



Source: Author

In this model, the supply schedule of all sweeteners is a function not only of prices, but also of the reduced uncertainty brought about by the import quota that causes the supply curve of sugar to shift to the right (e.g., S**). This is due to several factors that include technological change in production and processing. In addition, the quota provides incentives for the corn sweetener industry to develop. The corn sweetener industry was developed in the United States, in large part, because of the increase in sugar price due to the quota and because of the reduced price uncertainty. In a recent study by Hafi et al on U.S. sugar policies:

> The maintenance of high domestic sugar prices encouraged the development and use of alternative sweeteners, principally high fructose corn syrup... The growth in alternative sweeteners, which has occurred under the protective umbrella of U.S. sugar policies, has been the main source of the adverse impacts of U.S. sugar policies on the world market. The depressing effect on world sugar prices would have been less if the U.S. sugar policies had not induced such a high rate of substitution of high fructose corn syrup for sugar. Also adding to the total supplies of sweeteners was the improvement in recovery rates.

For a U.S. price of P* and an import quota of X there is a welfare gain from removing the quota. The world free trade price is P_w (for demand D^1, supply is S^T and excess supply is ES*). The U.S. consumers gain P^*abP_w and the sweetener producers lose the cross-hatched area of $P^*a^1b^1P_w$. On net there is a cost of the program of abb^1a^1. This cost includes those areas that, in many of the previous studies, were empirically estimated and that formed the basis of the heated debate on the costs and benefits of the U.S. sugar program.

When viewed from a different perspective, the U.S. sugar policy could have generated significant benefits. In terms of Figure 7 and in the absence of the program, the consumer costs would be $P^*acP_w^*$ and the sweetener producers' costs would be (P^*a^1f - P_w^*de). There would have been additional costs to corn growers, not accounted for here, had the corn sweetener industry not developed.

The above results clearly depend on several factors that include the price elasticity of the excess supply curve of sugar and the factors that affect total sweetener supply. Concerning the former, the more inelastic the excess supply curve the larger will be the dynamic gains of the U.S. sugar program. In terms of sweetener supply response, if firms are risk averse there are well-known theoretical and empirical results which show that when price is increased and is also made stable output responds positively. (Just, Hueth and Schmitz).

The above dynamic model raises important questions concerning innovation, technological change and adoption. It parallels many of the debates surrounding Schumpeter's theory concerning technological change and growth. Firms need capital to invest in new products, new technologies etc. In addition, there is the well-known result of the positive impact of risk aversion (in the presence of import quotas) on production response dynamics. It appears that the sugar program provided short term rents that were used by the industry for the expansion of the production of both sugar and corn sweeteners. Static analysis does not take this element into account.

Empirical Evidence

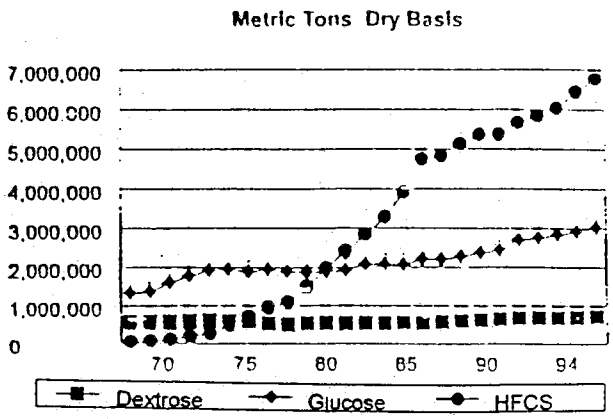
U.S. corn sweetener production from 1970 to 1994 is graphed in Figure 8. Note that HFCS production increased by roughly 3.5 times since 1980 from 2 million metric tons to 7 million metric tons.

The increase in sugar production is illustrated in Figures 9 and 10. Since the early 1980s, U.S. sugarcane production increased at an annual rate of 37,000 tons/yr (Figure 9).

Beet production is shown in Figure 10. The annual increase during the 1980s was even greater than for sugarcane -- 140,000 tons/yr.

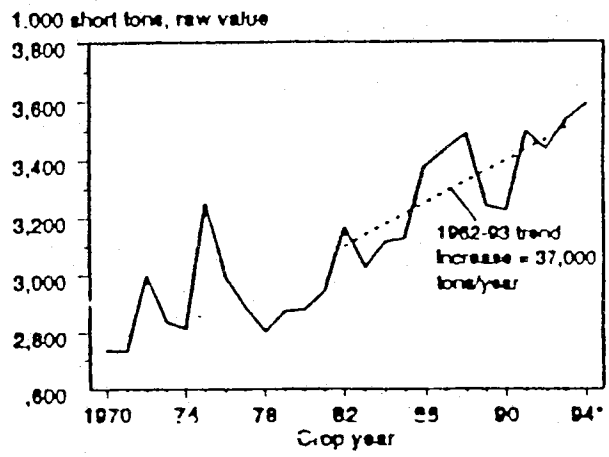
As an example of technological change, Figure 11 illustrates recovery rates for sugar beets. Note that, since 1980, the recovery rate increased from 12.5% to 15.5% -- more than a 20% increase.

Figure 8
U.S. Corn Sweetener Production



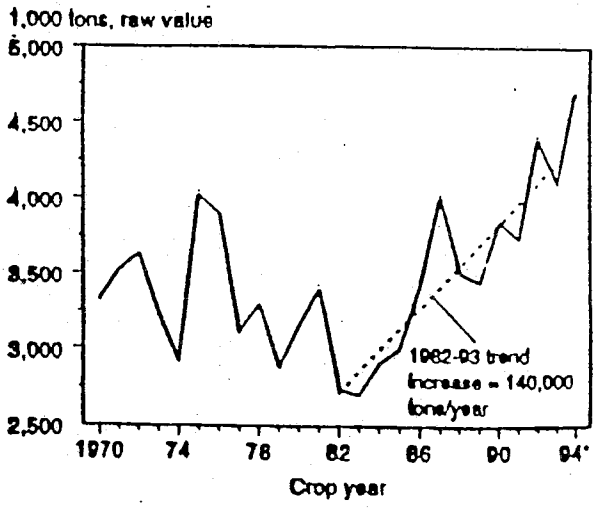
Source: USDA

Figure 9
U.S. Cane Sugar Production



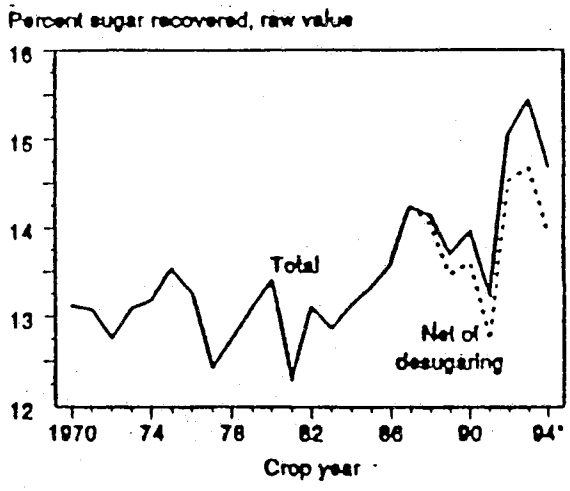
Source: USDA

Figure 10
U.S. Beet Sugar Production



Source: USDA

Figure 11
Beet Sugar Recovery Per Ton of Sugar Beets



Source: USDA

Production of both sugarcane and sugar beets, along with imports, is shown in Table 10. U.S. domestic sugar production increased while imports fell.

Table 10
Production of Sugar in the United States

Raw sugar equivalents

	Beet	Cane	Total	Imports[a]
	Mt	Mt	Mt	Mt
1980/81	2.93	2.57	5.50	3.36[b]
1981/82	3.01	2.44	5.45	3.01[c]
1982/83	2.44	2.91	5.36	2.71
1983/84	2.57	2.70	5.27	2.73
1984/85	2.64	2.65	5.29	1.99
1985/86	2.71	2.76	5.47	1.67
1986/87	3.31	2.93	6.25	1.11
1987/88	3.47	3.02	6.48	0.79
1988/89	3.08	3.01	6.09	1.25
1989/90	3.14	2.86	6.01	1.77
1990/91	3.50	2.77	6.26	2.08
1991/92	3.49	3.08	6.57	1.35
1992/93	3.98	3.07	7.05	1.21
1993/94	3.67	3.14	6.81	1.02

a Quota sugar imports. An import quota was applied under U.S. sugar policy for most of the 1970s and 1980s. The import quotas were temporarily removed from the 1979-80 crop year until 4 May, 1982. b Net import quotas applied. c Net imports. Includes 0.53 million tons quota imports made after the reimposition of quotas on 5 May, 1982.

Source: U.S. Department of Agriculture.

Consumption of caloric sweeteners in the United States is shown in Table 11. In total, sweetener consumption sharply increased from 11.8 million tons in 1980/81 to 16.2 million tons in 1993/94 -- roughly 40%. The largest growth was in HFCS consumption. However, note from Figure 12 that U.S. sugar consumption bottomed in 1985/86 and since then has increased by 169,000 tons/yr -- roughly 20%.

Additional data on the U.S. consumption of caloric sweeteners is given in Table 12. Between 1980 and 1994, U.S. total consumption of caloric sweeteners increased roughly 40% from 14.1 million tons to 19.5 million tons.

Table 11

Consumption of Caloric Sweeteners in the United States

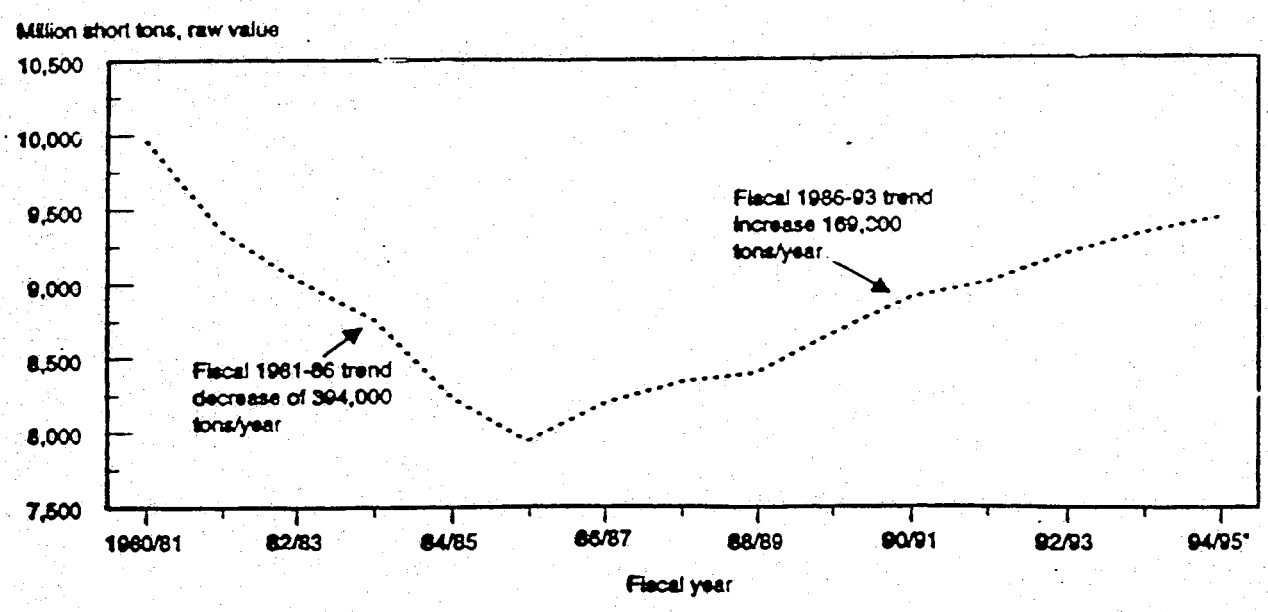
Raw Sugar Equivalents

	Aggregate				Per Person		
			Sugar and HFCS				
	Sugar	HFCS	Total	Share of Sugar	Sugar	HFCS	Sugar and HFCS
	Mt	Mt	Mt	%	kg	kg	kg
1980/81	8.9	2.9	11.8	75	38.8	11.2	50.0
1981/82	8.4	3.2	11.6	72	36.1	12.3	48.3
1982/83	8.1	3.9	11.9	68	34.4	14.6	49.0
1983/84	7.8	4.6	12.4	63	32.9	17.3	50.2
1984/85	7.3	5.8	13.1	56	30.7	21.3	52.0
1985/86	7.0	6.1	13.1	54	29.3	22.2	51.5
1986/87	7.2	6.3	13.6	53	29.9	23.0	52.9
1987/88	7.4	6.6	14.0	53	30.2	23.8	54.0
1988/89	7.5	6.6	14.0	53	29.9	23.2	53.1
1989/90	7.7	6.8	14.5	53	30.9	24.0	54.9
1990/91	7.9	6.9	14.8	53	31.3	24.3	55.6
1991/92	8.0	7.4	15.3	52	31.3	25.4	56.7
1992/93	8.1	7.7	15.8	51	31.3	26.4	57.7
1993/94	8.2	8.0	16.2	51	31.4	27.1	58.5

Source: U.S. Department of Agriculture, 1994.

Figure 12

U.S. Sugar Consumption



Source: USDA

Table 12

U.S. Total Consumption of Caloric Sweeteners, 1980-94[1]

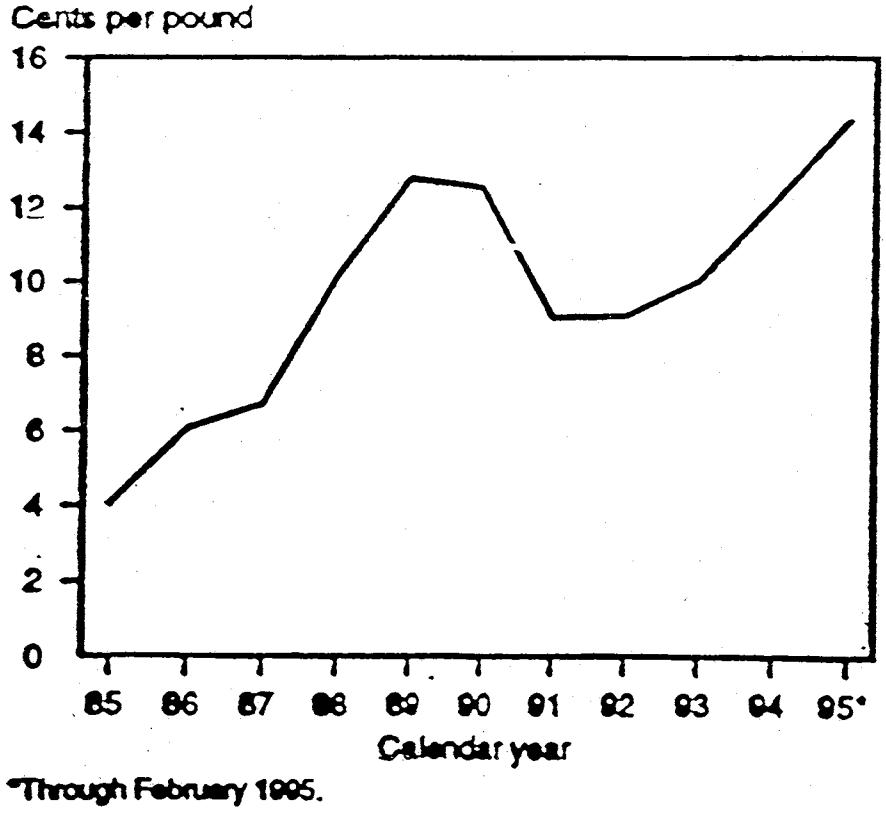
Calendar Year	Sugar[2]		Corn Sweeteners				Pure Honey	Edible Syrups	Total Caloric Sweeteners[3]
	Raw Value	Refined Basis	HFCS	Glucose Syrup	Dextrose	Total			
	1,000 short tons, dry basis								
1980	10,189	9,522	2,159	1,908	433	4,500	94	50	14,166
1981	9,769	9,130	2,625	1,940	442	5,007	96	50	14,283
1982	9,153	8,554	3,090	2,011	459	5,560	104	50	14,268
1983	8,812	8,236	3,657	2,066	474	6,197	111	50	14,594
1984	8,428	7,877	4,404	2,110	487	7,001	104	50	15,032
1985	8,003	7,479	5,396	2,157	497	8,050	107	50	15,686
1986	7,731	7,225	5,508	2,197	508	8,213	117	50	15,605
1987	8,103	7,573	5,808	2,240	517	8,565	133	50	16,321
1988	8,136	7,604	6,015	2,287	525	8,827	115	50	16,596
1989	8,304	7,761	5,986	2,348	538	8,872	124	50	16,807
1990	8,615	8,051	6,227	2,433	557	9,217	126	50	17,444
1991	8,615	8,051	6,401	2,558	570	9,529	128	50	17,758
1992	8,827	8,250	6,682	2,700	573	9,955	124	50	18,379
1993	8,873	8,293	7,114	2,811	584	10,509	126	50	18,978
1994[4]	9,015	8,425	7,418	2,900	600	10,918	125	50	19,518

[1] Totals may not add due to rounding.
[2] Does not include Puerto Rico, or sugar imported in blends and mixtures.
[3] Total includes sugar, refined basis.
[4] Forecast.
Source: USDA, Economic Research Service.

The highly volatile world sugar prices are plotted in Figure 13. Note that there have been sharp price increases since 1985. Also, but not shown in Figure 13, the difference between the world and U.S. internal price has been narrowing. As discussed earlier, world price levels affect the cost/benefit analysis of the U.S. sugar program. For example, if the world price were 15¢/lb (and one adds USDA adjustment factors to make U.S. and world prices comparable) there would be little or no effect of the U.S. program.

Figure 13

World Raw Sugar Prices at 5-Year High



Source: Coffee, Sugar and Cocoa Exchange, Inc.

Table 13 gives data on loan rates for both raw cane sugar and refined beet sugar. Since 1985/86, the raw cane sugar loan rate remained unchanged at 18¢/lb although, in real terms prices dropped sharply. However, even in nominal terms, wholesale prices (Table 14) and

Table 13

U.S. National Average Cane and Beet Sugar Loan Rates

Fiscal Year	Raw Cane Sugar Loan Rate	Beet/cane Returns Ratio[1]	Fixed Marketing Expenses[2]	Refined Beet Sugar Loan Rate	Ratio, Beet to Cane Loan Rate
	Cents/lb.	Ratio	-------- Cents/lb. --------		Ratio
1977/78	13.50	1.10	0.73	15.57	1.15
1978/79	14.73	1.10	0.80	16.99	1.15
1979/80	13.00	1.10	0.85	15.15	1.17
1980/81[3]	NA	NA	NA	NA	NA
1981/82[4]	16.75	1.13	0.77	19.70	1.18
1982/93	17.00	1.13	0.94	20.15	1.19
1983/84	17.50	1.13	1.08	20.86	1.19
1984/85	17.75	1.12	0.88	20.76	1.17
1985/86	18.00	1.12	0.90	21.06	1.17
1986/87	18.00	1.12	0.93	21.09	1.17
1987/88	18.00	1.12	1.00	21.16	1.18
1988/89	18.00	1.13	1.03	21.37	1.19
1989/90	18.00	1.13	1.20	21.54	1.20
1990/91	18.00	1.16	1.05	21.93	1.22
1991/92	18.00	1.21	1.07	22.85	1.27
1992/93	18.00	1.23	1.19	23.33	1.30
1993/94	18.00	1.23	1.12	23.62	1.31
1994/95[5]	18.00	1.23	1.29	23.43	1.30

NA = Not applicable.
[1] Prior to 1985/86, based on a 10-year weighted average of the ratio of the raw sugar price to the net returns for beet sugar. After 1985/86, calculated as the 10-year weighted average of beet-to-cane grower returns, on a cents-per-pound basis. Beginning 1991/92, is on basis of a 5-year weighted average ratio.
[2] Beet process marketing expenses that would be incurred regardless of whether sugar is forfeited or not.
[3] No loan rate in effect.
[4] Purchase program in effect December 1981 - May 1982 only.
[5] Announced January 26, 1995.

Source: USDA.

retail prices (Table 15) actually fell. For example, the prices of HFCS-55 fell, in the early part of 1995, to roughly 18.5¢/lb (Table 16).

Major changes have taken place in the world markets. Most notably the EU became a sugar exporter (Figure 14). In addition to the EU becoming a sugar exporter, since 1991/92 Cuban exports fell significantly while those from the EU, Australia and Brazil rose significantly (Figure 15). Phenomenal increases in the production of sugar in India took place since

Table 14

U.S. Wholesale Refined Beet Sugar Prices, Midwest Markets, Monthly, Quarterly, and by Calendar and Fiscal Years

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.:	1stQ.	2ndQ.	3rdQ.	4thQ.:	Cal.:	Fiscal
									Cents per pound									
1990	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	29.13	28.60	27.38:	30.50	30.50	30.50	26.37:	29.97:	30.14
1991	26.88	26.50	26.50	26.13	26.00	25.75	25.50	25.50	25.00	24.94	24.60	24.50:	26.63	25.96	25.33	24.68:	25.65:	26.57
1992	25.40	26.50	26.50	26.50	26.40	26.00	25.00	25.00	25.00	24.90	24.13	23.90:	26.13	26.30	25.00	24.31:	25.44:	25.53
1993	23.25	23.00	23.00	23.50	23.50	23.50	25.50	27.75	27.50	27.50	27.25	26.50:	23.08	23.50	26.92	27.08:	25.15:	24.45
1994	25.75	25.50	25.50	24.50	24.75	25.25	25.00	25.00	24.70	25.00	25.38	25.50:	25.58	24.83	24.90	25.29:	25.15:	25.60
1995	25.50	25.50																

Source: Milling & Baking News.

Table 15

U.S. Retail Refined Sugar Prices, Monthly, Quarterly, and by Calendar and Fiscal Years

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.:	1stQ.	2ndQ.	3rdQ.	4thQ.:	Cal.:	Fiscal
									Cents per pound									
1990	41.80	41.90	42.70	42.80	43.00	42.70	42.70	43.30	43.40	43.20	42.90	42.90:	42.13	42.83	43.13	43.00:	42.78:	42.17
1991	43.40	43.00	43.40	43.30	43.10	43.20	43.50	42.80	42.20	42.00	41.90	41.80:	43.27	43.20	42.83	41.90:	42.80:	43.08
1992	42.50	42.40	41.90	41.70	41.70	41.50	41.50	41.10	41.00	41.20	41.20	40.60:	42.27	41.63	41.20	41.00:	41.53:	41.75
1993	41.20	41.00	40.60	40.80	40.80	40.30	40.20	40.60	40.40	40.50	40.30	39.80:	40.93	40.63	40.40	40.20:	40.54:	40.74
1994	40.70	40.50	40.10	40.10	40.10	39.70	40.00	39.70	40.30	40.20	39.50	39.20:	40.43	39.90	40.00	39.63:	39.99:	40.13
1995	39.70	39.90																

Source: Bureau of Labor Statistics.

Table 16

U.S. Wholesale List Prices for HFCS-55, Midwest Market, Monthly, Quarterly, and by Calendar and Fiscal Years 1/

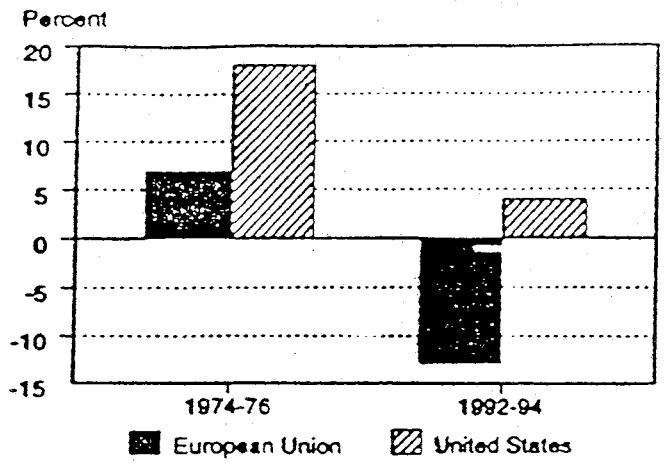
Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.:	1stQ.	2ndQ.	3rdQ.	4thQ.:	Cal.:	Fiscal
									Cents per pound, dry weight 2/									
1990	19.50	19.50	19.50	22.50	22.50	22.50	25.50	25.50	25.50	20.00	20.00	20.00:	19.50	22.50	25.50	20.00:	21.88:	21.75
1991	20.00	20.00	20.00	23.00	23.00	23.00	27.00	27.00	27.00	23.00	23.00	23.00:	20.00	23.00	27.00	23.00:	22.25:	22.50
1992	23.00	23.00	23.00	23.00	23.00	23.00	26.00	26.00	26.00	20.00	20.00	20.00:	23.00	23.00	26.00	20.00:	23.00:	23.75
1993	20.00	20.00	19.38	18.30	19.50	19.50	23.50	23.50	23.50	23.50	20.33	20.10:	19.79	19.10	23.50	21.31:	20.93:	20.60
1994	20.25	20.70	21.73	24.80	24.80	24.80	24.80	24.80	23.87	20.13	20.13	18.83:	20.89	24.80	24.49	19.70:	22.47:	22.87
1995	18.51	18.51																

1/ In tank cars (jumbos to West coast). These are delivered prices, with a 2-percent cash discount.
2/ To convert to commercial (wet) weights, multiply by 0.77.

Source: Milling & Baking News.

Figure 14

U.S. and EU Net Imports as Share of Total World Imports 1/

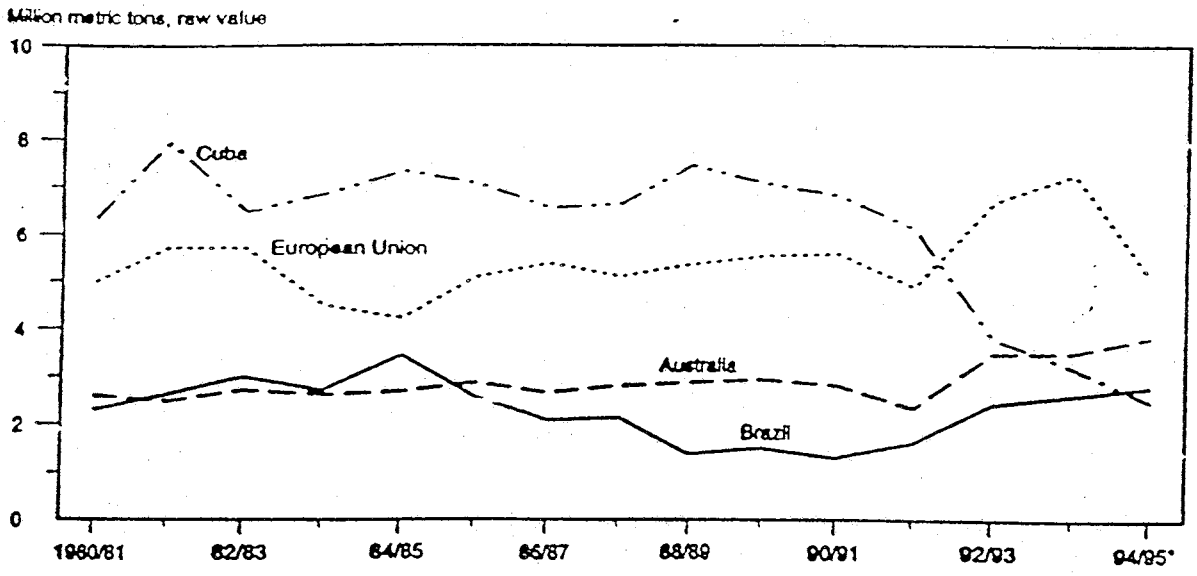


1/ Net imports defined as total imports minus total exports; if negative, country is a net exporter.

Source: USDA.

Figure 15

Exports by Selected Countries

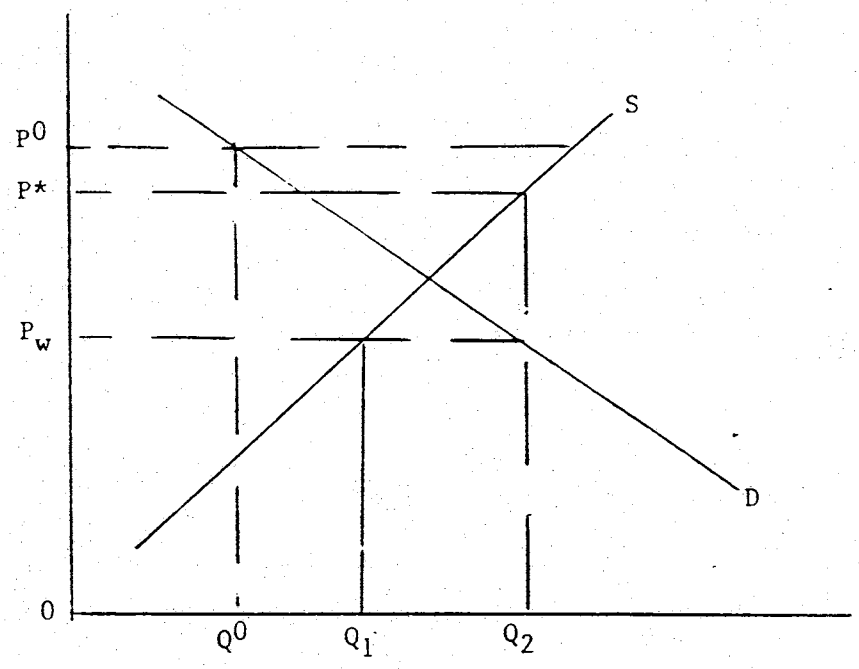


Source: USDA

1985/86. Between 1985/86 and 1991/92, production there roughly doubled (Figure 16). Because of this increase in sugar production, India's output in 1994/95 approximated that of the EU. All of these developments were influenced significantly by governmental policies.

Figure 16

Production in Selected Countries



Source: USDA

GATT and NAFTA

Of the three major areas of reform under the Uruguay Round General Agreement on Tariffs and Trade (GATT), only tariff reduction will affect U.S. sugar policies. Current

domestic support and minimum import access provisions of the U.S. sugar policy are already consistent with GATT provisions. As a result, GATT will have little impact on the U.S. sugar price. According to Lord, p.30, "The UR is likely to raise the world price by 2%-5% by the year 2000, largely because of worldwide income gains which will increase sugar consumption. However, this small increase in the world price is not likely to have much impact on the U.S. sugar market."

Under GATT, the United States agreed to maintain a minimum annual low duty on import levels of 1.139 million metric tons, raw value, a level similar to the minimum estimated import level provided for in the 1990 Farm Bill. Of the total, 22,000 metric tons will be reserved for refined sugar. The current low duty of 0.625¢/lb raw value, will continue to apply to quota imports. Most countries will still have the low duty waived under such programs as the Caribbean Basin Initiative.

The high duty on raw sugar applies to sugar imports above the tariff-rate quota level. Beginning January 1, 1995, the high duty was 17.62¢/lb, and will be lowered about 0.46¢/lb each year until it reaches 15.36¢/lb in the year 2000, Lord p.30:

> Section 22 quotas on sugar-containing products have been converted to tariff-rate quotas, with low-tariff quota amounts set at approximately the same levels as the previous quotas. The new tariffs on over-quota amounts are based on 1986-88 tariff-equivalents, and will be lowered by 15 percent over 6 years. Most of these over-quota tariffs will probably remain prohibitive. By the year 2000, the U.S. tariff of 15.36 cents a pound, given transportation costs of 1.5 cents, would protect a U.S. raw sugar market price of 22 cents a pound at a world price above 5 cents a pound.

The North American Free Trade Agreement (NAFTA) became effective on January 1, 1994. It promoted a phase out of most trade barriers between Canada, Mexico, and the United States over the next 15 years. However, NAFTA did not address the sugar trade between the United States and Canada.

In years 1-6 under NAFTA sugar provisions, Mexico will have duty-free access for sugar exports to the United States in the amount of its net surplus production, up to a maximum of 25,000 metric tons, raw value. (A formula defines net production at roughly equal to projected sugar production minus projected consumption.) If Mexico were not a net surplus producer, however, it would still have duty-free access for 7,258 metric tons, or the "minimum boatload" amount authorized under the U.S. tariff-rate quota, Lord p.31:

> In years 7-15, Mexico will have duty-free access to the U.S. sugar market for the amount of its net surplus production, up to a maximum of 250,000 metric tons, with minimum duty-free access still at the "boatload" amount.
>
> Sugar tariffs between the United States and Mexico are scheduled to decline by 15 percent over the first 6 years and to zero by year 15. By the end of year 6, Mexico will install a tariff-rate quota system, with a second-tier tariff applicable to all other countries that is equal to the U.S. second-tier tariff.
>
> U.S. cane sugar refiners shipping sugar to Mexico under the Re-export Program will be guaranteed Most-Favored-Nation treatment, but NAFTA will not provide lower tariffs for the re-exported sugar since refining does not confer origin on the sugar. NAFTA does allow for reciprocal duty-free access between the United States and Mexico for sugar that is refined from raw sugar produced in the other country.
>
> The Mexican tariff on U.S. HFCS, initially 15 percent, is scheduled under NAFTA to decline to zero over 10 years: for 1995 it was 12 percent. Barriers to sugar-containing products are converted to tariffs and likewise will decline to zero over 10 years. U.S. manufacturers of sugar-containing products are optimistic that the reduction in tariffs will open market opportunities in Mexico.
>
> Given that NAFTA is reciprocal, the same barriers for Mexican sugar access to the U.S. market also apply to U.S. sugar access into the Mexican market. Since the United States is not likely to attain "net surplus producer" status, especially with a GATT-bound minimum import level, U.S. sugar will not have duty-free access (except for a boatload quantity) to the Mexican market until the year 2008.
>
> Mexico currently produces no HFCS but is expected to slowly develop capacity. The substitution of HFCS for sugar in Mexico will, if left to market forces, depend upon relative prices. If the Mexican sugar price level approximates the U.S. sugar price, then HFCS use in Mexico will likely grow. However, HFCS will not likely attain as high a market share as in the United States for a variety of reasons. Mexico is not competitive in corn production, and

so will have to import either the HFCS or corn, resulting in increased transportation costs. The distribution system within Mexico will also likely continue to be higher cost, and the smaller market will prevent some economies of size. HFCS would become competitive in southern Mexico only if transportation costs fall and its price relative to sugar continues to fall.

Whether or not HFCS substitution results in Mexico becoming a major surplus sugar producer, NAFTA will limit Mexican access to the U.S. sugar market until the end of the 15-year phase-in period when the second-tier tariff falls to zero.

The U.S. Sugar Program and World Sugar Trade

It is common to divide the market for sugar into three distinct markets:

(1) The market for sugar within sugar-producing countries. Since most sugar is produced with the intention of being domestically marketed, this market is the biggest and is approximately 75% of all world sugar production.

(2) The market for the various international agreements between certain importers and certain exporters. These agreements include the import quotas under the U.S. program, the bilateral agreements between Cuba and the former Soviet Republics and the agreements of various countries (and groups of countries) with the EU. This market makes up about 10% of world production.

(3) The market for the residual "free market" in world sugar is the remaining 15% of overall world production.

From the discussion in previous sections, the costs and benefits of the U.S. sugar program depend critically on the level of world prices. The price used in cost/benefit analyses is the border price that is referred to above as the residual market. However, there remains the

question of the appropriate border price which, in turn, depends on the impact of unilateral and/or multilateral trade liberalization. In other words, is the appropriate border price the distorted price that is affected by sugar policies around the world or the price that would exist under multilateral free trade?

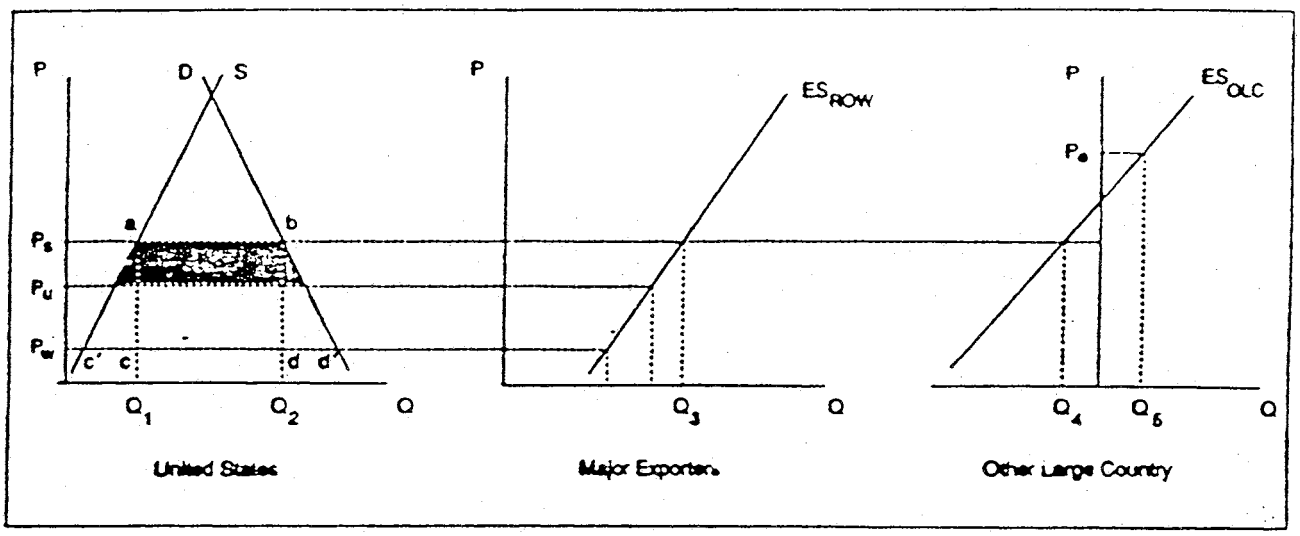
The importance of this question is made clear in Figure 17, which draws upon Schmitz, Schmitz and Vercammen (1991). S is the supply curve and D is the demand curve for sugar in the United States. ES_{OLC} is the excess supply curve of another large country, and ES_{ROW} is the excess supply curve of the major exporters of the rest of the world. In a free-trade regime, price P_s prevails. The United States imports $Q_2 - Q_1$, while the other large country imports Q_4. Both are supplied by exports of Q_3 from the rest of the world.

Now suppose that the other large country subsidizes its sugar production at price P_c. Rather than importing sugar, it now exports Q_5. The price in the rest of the world, including the United States, is driven down to P_u, causing U.S. imports to rise. If the United States responds to the imposition of the foreign subsidies with a quota of $Q_2 - Q_1$, the price in the United States rises back to P_s, while the price in the rest of the world falls to P_w. Foreign exporters to the United States obtain a quota rent of cabd.

What is the net cost to the United States from the imposition of sugar quotas? If the United States is assumed to be a small country, the costs are given by area c′abd′. If the large-country assumption is used and correctly incorporated so that price P_u rather than P_w is used, the quota costs are given by the shaded area. However, use of the small-country assumption is incorrect, and grossly overstates costs. Equally important, however, is the free-trade result: When compared to a free-trade regime in which other countries do not subsidize sugar

Figure 17

U.S. Sugar Quotas in a World Trading Context



Source: Schmitz and Christian 1995.

production, the net cost to the United States from the imposition of sugar quotas is zero, since the quotas have merely reestablished for the United States a status equivalent to free trade. Therefore, if a return to free trade in sugar was achieved (through the GATT, for example), there might be no impact on the United States in terms of either the quantity traded or the price. That is, a quota need not be trade distorting for a nation when measured against the free-trade solution, even though it is clearly distorting if measured against a distorted world price. It is true that the U.S. quota, as illustrated, is inefficient for the United States given the present distorted world price. However, it does not follow that a free-trade solution, which is globally efficient, would alter U.S. sugar production, prices, or imports, or make the United States any better off on net.

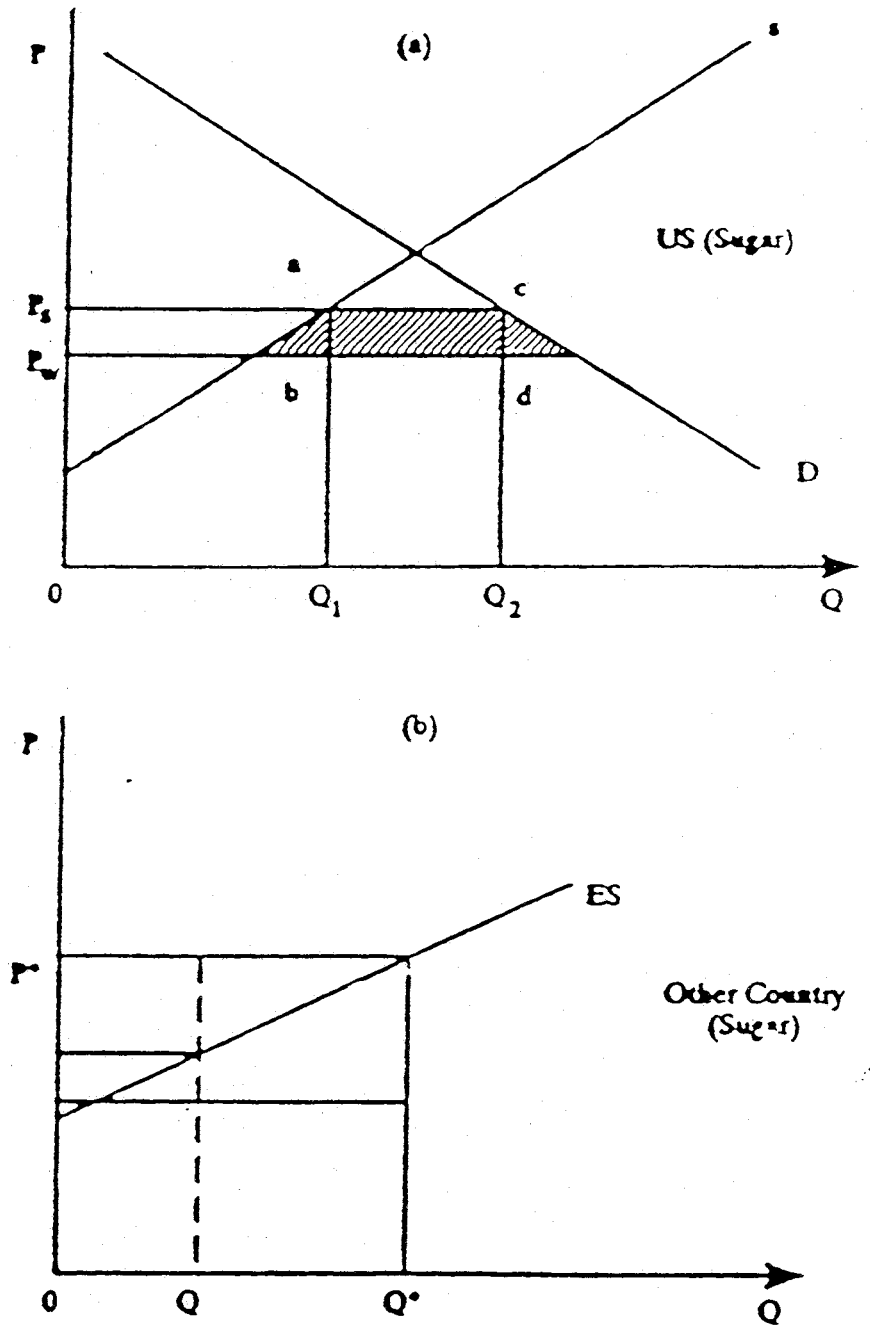
Several recent studies have analyzed the effects of moving to freer trade in sugar. Some of the studies include those by Brown, Zietz and Valdés, Tyers and Anderson, Johnson et al, Kirby et al, Roningen and Dixit, and Wong, Sturgiss, and Borrell. Virtually all of the studies found that the world sugar price rises following trade liberalization. However, the degree of price increase varies with the model used.

Brown simulated the effects of full trade liberalization by the industrial market economies (IMEs). He found that liberalization by the EU would raise the world sugar price by 3%, and the gain would be 1% if either the United States or Japan liberalized trade. Tyers and Anderson found that the world price would increase by as much as 22% if all IMEs liberalized. Zietz and Valdes reported price gains of roughly 65%. Roningen and Dixit found a price increase in the neighborhood of 50 to 55%. They also found that, among the IMEs, the policies of the EU had the most depressing effect upon the world price.

One problem in interpreting these results is that the conclusions depend on the base-year price. For example, the implications are far different if one applies these price increases to early 1990, rather than to 1984/85, when world prices were significantly lower. If world prices had increased by 50% to 60% above their levels in early 1990, then the U.S. border price would have equaled or even exceeded U.S. producer prices at the time. This outcome is consistent with the scenario pictured in Figure 18 -- that the distortionary effects of sugar policies around the world have driven the world price to P_w from P_5, while U.S. sugar policy maintains P_J for domestic producers. There is evidence that, in recent years, the U.S. import quotas have merely protected U.S. producers from a downwardly distorted world sugar price. If so, even if trade liberalization were achieved in sugar, it does not follow that there would be any major effect on the U.S. sugar industry. In fact, Schmitz, Schmitz, and Vercammen (1991) use the USDA

Figure 18

Trade Distortions With Two Large countries



Source: Author

SWOPSIM model to show empirically that free trade in sugar may not necessarily result in a lower sugar price for U.S. producers.

It is important to note that, because the world price is distorted by other countries' policies, it is not the appropriate price to use as a base upon which to measure efficiency (Schmitz and Vercammen, 1995). The major problem with using the world price, P_w Figure 18a, as a reference point when making trade distortioning and efficiency calculations can be shown in a dynamic context. Referring to Figure 18a and 18b, suppose the true free-trade price is P_s but exporters (i.e., the other countries) subsidize production by using a support price, P*, thereby driving the world price from P_s to P_w as output expands from Q to Q*. (Note that P_w is no longer the free-trade price.) The United States may impose an import quota of Q_1Q_2 in reaction to foreign exporter subsidies. However, this quota would merely reestablish the free-trade level of imports for the United States and exporters would have to restrict production to Q. Clearly, if the world returned to free trade in sugar, there would be no impact on the United States in terms of trade volumes or producer prices. In this example, import quotas, given a distorted price of P_w, need not be trade distorting if measured relative to the free-trade solution.

To support this assertion, Schmitz, Schmitz and Vercammen (1991) found, in a separate study using reasonable elasticity estimates, that the free-trade sugar price may indeed approximate the current U.S. sugar price of 20¢/lb. Alternatively stated, they showed that unilateral liberalization by the EU may result in the world price rising to the level of the current U.S. price. It is possible that the U.S. import quota would not be binding under a complete EU phase-out.

There is a problem with both the PSE and efficiency measures when they are based on the distorted price, P_w, rather than on a free-trade price. It is true that current quotas may be

inefficient, given existing world prices. However, it does not automatically follow that a free-trade solution would alter U.S. sugar production, prices, or imports.

In recent years, it has been argued that sugar receives relatively more protection than corn or wheat, for example, and that the sugar program is relatively inefficient. However, even if the sugar program were relatively less efficient than programs governing corn or wheat (when measured using the current world price), it does not follow that trade liberalization would affect the trade volumes of sugar relatively more than it would for corn or wheat. Removing sugar programs worldwide may well affect changes in trade volumes less than analogous removals of the corn or wheat programs. (Schmitz and Vercammen 1995).

From a policy perspective:

(1) the producer subsidy equivalent (PSE) measures are inconsistent as a measure in ranking commodity programs according to decreasing efficiency (or equivalently, increasing trade distortion).

(2) estimates of the efficiency of an import quota, and the trade distortion resulting from it, will generally be biased unless an adjusted reference price is used. In particular, if a depressed world price rather than the free-trade price were used as a reference, efficiency aspects of the import quota would be understated and the size of the trade distortion would be overstated.

The EU Sugar Regime

A region which has had a significant impact on the world sugar market is the EU. EU policies have contributed to low world sugar prices and have influenced the so-called residual market.

History and Policy

The European sugar beet industry had its beginning with Napoleon. It suffered many difficulties but was regimented by the imposition of a high duty on colonial sugar by France. By 1830 the industry flourished. "Over the next several decades, continental European countries supported their beet sugar industries through competitive and costly export bounties in addition to import barriers, and their domestic sugar production surged," (Harris and Tangermann). With the aid of these subsidies, by 1889 beet sugar accounted for more than 60% of sugar output worldwide (Albert and Graves).

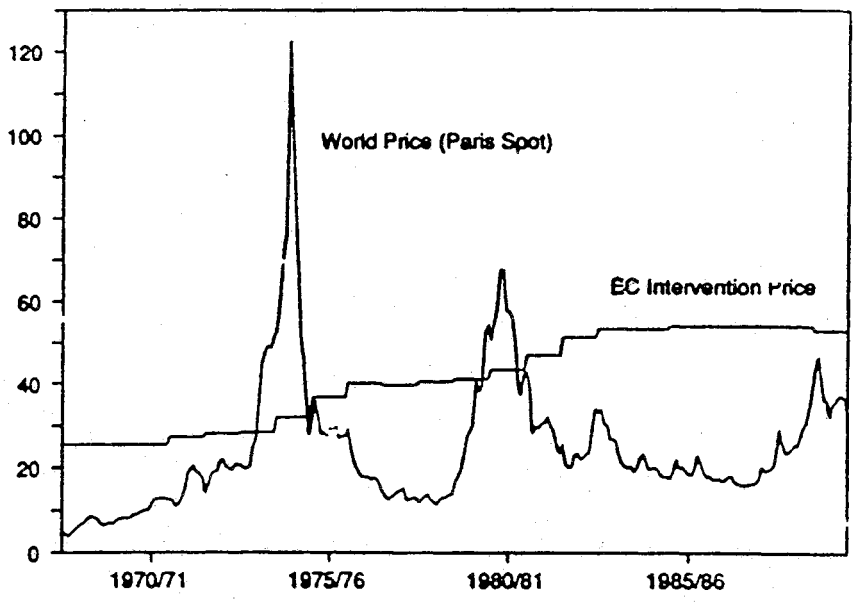
The EU sugar market system came into full effect in 1968. It has not been altered substantially since that time, except for the introduction of a more complete producer financing scheme in 1981. Producers are supported by a common support price which is set close to the high support prices that applied in Italy and Germany prior to the introduction of the EU sugar regime. Production quotas are used to limit the EU's financial liability.

The EU uses both variable import levies as well as variable export subsidies. Through these instruments, the EU is able to block imports when world prices are below EU levels (the normal situation). At the same time, the EU can export surplus quota sugar to the world market. Additionally, the EU uses two institutional support prices. The intervention price (a floor price) and the threshold price (a minimum import price) form a domestic price band. The threshold price ensures that domestic market prices can rise toward a target price without being undercut by third country imports.

The world sugar prices and EC intervention prices from 1968/69 to 1989/90 are given in Figure 19. The intervention price rose at an annual average rate of 6.7%, while the world price rose at 7.3%.

Figure 19

Monthly world market price and EC intervention price for white sugar, 1968/69-88/89 (ecu/100kg)



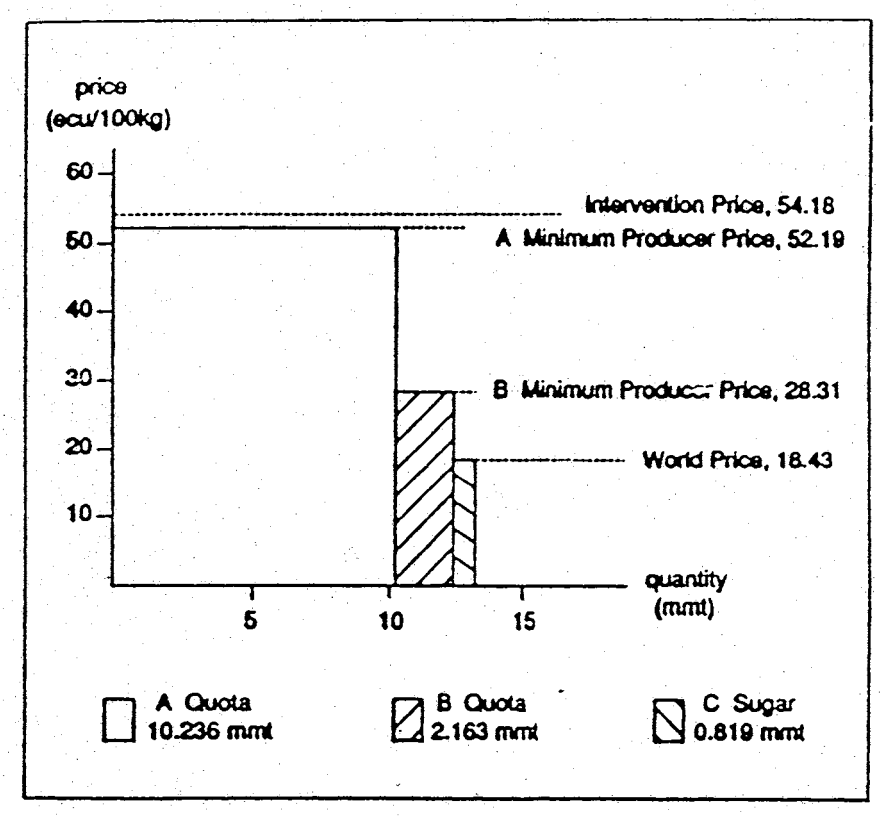
Source: Harris and Tangermann.

The total EC quotas for sugar are referred to as A Quota and B Quota. In addition, there is C sugar. Figure 20 gives a graphical representation of the three sugar categories for 1987/88. Quota A generated roughly 87% of the revenue in 1987/88. According to Harris and Tangermann, even C sugar can be profitable for producers because fixed costs are covered by within quota production. As a result, C sugar is implicitly subsidized. The majority of C sugar production in the EU comes from France, Germany, the Netherlands, and the United Kingdom.

Minimum producer prices for A and B sugar, along with production of all classes of sugar, are given in Table 17. Quota A sugar represents, by far, the largest component of sugar output.

Figure 20

EC sugar production and minimum producer prices, 1978/88 (white sugar equivalents)



Source: Harris and Tangermann

EC production grew rapidly during the 1970s. The worldwide sugar shortage of 1974 led to a 53% increase in the maximum quota (A quota plus B quota) for the EC-9 between 1973/74 and 1975/76 (Table 18).

Table 19 shows that consumption for the EC-9 peaked in 1973/74. This added to the later surplus situation.

Table 17

Producer Prices and Quantities for A, B, and C Sugar, 1979/80 to 1989/90

(ecu/100kg wse, unless otherwise noted)

Marketing Year	White Sugar Prices		Minimum Produce Prices[c]	
	Intervention[a]	World[b]	A Quota	B Quota
1979/80	41.09	32.32	41.0900	29.0600
1980/81	43.27	53.58	43.2700	39.8000
1981/82	46.95	30.82	46.0110	31.9260
1982/83	51.41	24.07	50.3818	31.1030
1983/84	53.47	26.14	52.4006	32.3493
1984/85	53.47	19.92	52.4006	32.3493
1985/86	54.18	19.88	53.0964	32.7789
1986/87	54.18	17.31	51.9639	23.7484
1987/88	54.18	18.43	52.1948	28.3085
1988/89	54.18	28.04	52.0930	26.2994
1989/90	53.10	37.66	51.3267	39.1595

Marketing Year	Sugar Production (1,000 metric tone use)		
	A Quota	B Quota	C Sugar
1979/80	9,005	1.792	1,446
1980/81	8,910	2,111	1,191
1981/82	9,382	2,135	2,531
1982/83	9,366	2,053	2,425
1983/84	9,268	1,660	951
1984/85	9,270	1,916	779
1985/86	9,300	1,926	1,222
1986/87	10,343	2,182	1,312
1987/88	10,236	2,163	819
1988/89	10,296	2,205	1,593
1989/90	10,239	2,235	2,273

[a] Common level.
[b] Paris spot market.
[c] Common white sugar intervention price net of producer levies.

Source: Harris and Tangermann.

Concerning GATT and EU sugar, the rules covering the production and the sale of sugar in the EU for the next six years were agreed to by the Ministers in April 1995. The agreement produced few surprises and the production quotas and price system, that dated to the origins of the regime in 1968, continue largely unchanged. Some modifications were made to allow for changes in order to meet the EU's commitments to GATT but these changes will not make any marked difference to sugar production within the EU.

There is no change in sugar support prices under GATT, because the required reduction in domestic support is covered by the reduction of prices in the cereals sector (Table 20).

Table 18

EC Production Quotas for Sugar and Isoglucose (million metric tons, Wse[a])

Marketing Year	Quota Type	EC Total[b]	ACP Protocol	Isoglucose[c]
1968/69-1972/73	A Quota	6.480		
	Maximum Quota	8.530		
1973/74	A Quota	7.820		
	Maximum Quota[d]	8.685		
1974/75	A Quota	7.820		
	Maximum Quota[e]	10.751		
1975/76	A Quota	9.136	1.305	
	Maximum Quota[e]	13.250		
1976/77-1977/78	A Quota	9.136	1.305	
	Maximum[d]	12.335		
1978/79-1979/80	A Quota	9.136	1.305	0.1471
	Maximum Quota[f]	11.648		0.1876
1980/81	A Quota	9.136	1.305	0.1471
	Maximum Quaota[f]	11.648		0.1876
1981/82-1985/86	A Quota	9.516	1.305	0.1576
	B Quota	2.242		0.0404
	Maximum Quota	11.758		0.1980
1986/87-1990/91	A Quota	10.540	1.305	0.2407
	B Quota	2.289		0.0503
	Maximum Quota	12.829		0.2910
1991/92-1992/93	A Quota	11.187	1.305	0.2407
	B Quota	2.488		0.0503
	Maximum Quota	13.675		0.2910

[a] White sugar equivalent.
[b] The data are for the EC-6 for marketing years 1968/69 to 1972/73, the EC-9 for 1973/74 to 1980/81, the EC-10 for 1981/82 to 1985/86, the EC-12 for 1986/87 to 1990/91, and the EC-12 with a unified Germany from 1991/92.
[c] Isoglucose is the EC term for high fructorse corn syrup. Figures are given on a dry basis.
[d] The B quota was a maximum of 35 percent of the A quota.
[e] The B quota was a maximum of 45 percent of the A quota.
[f] The B quota was a maximum of 27.5 percent of the A quota.

Source: Commission of the European Community Worksheets.

Additionally, no changes in imports are necessary because the EU currently imports in excess of 10% of domestic consumption and the requirement under GATT is to import at least 5% by the year 2000. However, the EU may have to cut its subsidized exports by the end of the

century, because there is a significant surplus built into the quota system that has to be exported to the world market.

Table 19

Basic EC Sugar Statistics, 1968/69 to 1988/89 (million metric tons, wse)

Marketing Year[a]	Total Production	Total Consumption	Total Imports[c]	Total Exports[b,c]	Net Exports[d]	Self-Sufficiency Ratio[e]
EC-6						
1968/69	6.817	6.306	0.067	0.615	0.548	108.1
1969/70	7.435	6.410	0.065	0.562	0.497	116.0
1970/71	7.055	6.750	0.063	0.776	0.713	104.5
1971/72	8.081	6.325	0.046	1.348	1.302	127.7
1972/73	7.650	6.541	0.046	1.147	1.101	116.9
EC-9						
1973/74	9.516	10.414	1.418	0.979	-0.439	91.4
1974/75	8.570	9.561	1.718	0.097	-1.621	89.6
1975/76	9.703	9.535	1.429	1.405	-0.024	101.8
1976/77	10.003	9.036	1.444	1.666	0.222	110.7
1977/78	11.536	9.481	1.338	3.434	2.096	121.7
1978/79	11.774	9.544	1.266	3.231	1.965	123.4
1979/80	12.289	9.414	1.330	3.767	2.437	130.5
1980/81	12.088	9.246	1.162	4.592	3.430	130.7
EC-10						
1981/82	15.028	9.597	1.372	5.183	3.811	156.6
1982/83	13.942	9.474	1.333	5.207	3.874	147.1
1983/84	11.003	9.314	1.389	4.062	2.673	118.1
1984/85	12.500	9.555	1.368	3.832	2.464	130.8
1985/86	12.720	9.391	1.316	4.204	2.888	135.5
EC-12						
1986/87	14.096	10.907	1.562	4.506	2.944	129.2
1987/88	13.212	10.847	1.613	4.281	2.668	121.8
1988/89	13.915	10.885	1.561	4.749	3.188	127.8
1989/90	14.272	11.271	1.615	4.838	3.223	126.6

[a] 1968/69 through 1972/73 are July/June years; since 1973/74 the years are October/September.
[b] Sugar as such (excludes sugar in processed food products).
[c] "Free Circulation" sugar with export refunds plus C sugar "not blocked".
[d] Total exports less total imports.
[e] Total production divided by total consumption, multiplied by 100.

Source: Commission of the European Communities Worksheets.

Under the GATT accord, subsidized exports have to be cut by 21% in volume and by 36% in expenditure terms by the year 2001. For sugar, the budgetary restraint is more likely to have an impact than the volume restraint because EU exports fell from the amounts exported in the mid 1980s, the years that were used as the base period.

The cost of exports is more difficult to predict because it depends, not only on the amount of sugar to be exported, but also on the level of the refunds required. The refunds are dependent on the world market price for sugar and the value of the U.S. dollar compared to the

Table 20

1995 changes to the EU Sugar Regime

* No change in current quotas for sugar, isoglucose or inulin
* The introduction of a system that would allow the Commission to reduce supported sales on an annual basis, if necessary, to meet the GATT commitments
* The introduction of import quotas to meet the needs of the cane refining industry
* Provisions to allow the Commission to increase the production refund paid on sugar used in the chemical and related industries
* Changes to the Italian and Spanish national aids

Source: Vuilleumier.

ECU. The weaker the dollar, the larger the refund needs to be. A weak dollar and a low sugar price increase the levels of export refund required and could give rise to difficulties for the EU in meeting its GATT commitments.

To allow EU exporters to compete on the world market, the levels of restitution must be maintained. If world prices and the dollar are weak, export volumes may have to be cut in order to come within the GATT maximum spending limits unless internal prices are reduced to allow for a reduction in the level of the refund.

According to Harris and Tangermann, if the EU wants to avoid cutting sugar prices, the European Commission may be forced to use the tools it now has to cut subsidized production in three or four years time (if world sugar prices and the U.S. dollar stay within the current trading range). This would give impetus to a squeeze on internal sugar production.

Data on tariffs resulting from GATT are given in Table 21. Note that, for sugar, the ad valorem base tariff for the EC was 268.7% compared to the U.S. tariff of 157.6%.

Table 21

Tariffs Resulting from the URA, Selected Countries and Products

	ad valorem Equiv. Base	Final	Rate of Reduction	Percent Point Reduction	ad valorem Equiv. Base	Final	Rate of Reduction	Percent Point Reduction
	Common Wheat				White Sugar			
Australia	0.0%	0.0%	0%	0.0	0.0%	0.0%	0%	0.0
Canada	90.0%	76.5%	15%	13.5				
EC	160.2%	102.2%	36%	58.1	268.7%	214.9%	20%	53.8
Hungary					80.0%	68.0%	15%	12.0
Korea	10.0%	1.8%	82%	8.2	250.2%	225.2%	10%	25.0
Japan	262.8%	222.4%	15%	40.4	136.7%	116.2%	15%	20.5
New Zealand	0.0%	0.0%	0%	0.0	0.0%	0.0%	0%	0.0
Poland	261.3%	167.2%	36%	94.1	120.0%	96.0%	20%	24.0
Switzerland								
USA	0.8%	0.4%	55%	0.5	157.6%	134.0%	15%	23.7
	Beef Carcasses, Fresh or Chilled				Butter			
Australia	0.0%	0.0%	0%	0.0	7.6%	1.0%	87%	6.6
Canada	31.1%	26.5%	15%	4.6	351.4%	304.6%	13%	46.8
EC	237.3%	151.8%	36%	85.4	314.1%	201.1%	36%	113.0
Hungary	112.0%	71.7%	36%	40.3	159.0%	101.8%	36%	57.2
Korea	44.5%	40.0%	10%	4.5	99.0%	89.0%	10%	10.0
Japan	93.0%	50.0%	46%	43.0	126.7%	104.8%	17%	21.9
New Zealand	0.0%	0.0%	0%	0.0	10.0%	6.4%	36%	3.6
Poland	402.7%	257.6%	36%	145.2	160.0%	102.0%	36%	58.0
Switzerland	29.5%	25.1%	15%	4.4	204.9%	174.1%	15%	30.7
USA	31.1%	26.4%	15%	4.7	138.1%	117.4%	15%	20.7

Source: Josling and Tangermann.

Effects on World Markets

Results of economic modeling on the effects of EU sugar policy differ considerably among models and authors. In recent years, studies have been conducted on a complete multilateral liberalization of all agricultural policies in the IMEs. Various estimates of the effects of such liberalization on the world sugar price are given in Table 22. Roningen and Dixit, using the SWOPSIM model of the U.S. Department of Agriculture, estimated that the

Table 22

The Effect on World Sugar Prices of Multilateral Liberalization

Study	Base Period	% Change in World Sugar Price	Model[a]
Martin, et al. (1990)	1980-83	60	RUNS
OECD (1987)	1979-81	10	MTM
Huff and Moreddu (1990)	1982-85	25	Updated MTM
Anderson and Tyers (1989)	1980-82	30	GLS
Roningen and Dixit (1989)	1986-87	53	SWOPSIM
Wong, Sturgiss and Borrell (1989)	1985	14	SUGABARE[b]

[a] The SUGABARE model is a detailed partial equilibrium model of the world sugar sector. The others are general equilibrium models of agriculture.
[b] Assumes partial liberalization of OECD sugar markets only. In a separate computation of the effects of partial liberalization of OECD sugar and wheat markets, there was no change estimated in the world sugar price.

Source: Compiled by author.

world sugar price increased by 52.7% over the 1986/87 base. Anderson and Tyers estimated a 30% increase in the world sugar price for 1995 from the 1980/82 base. Similarly, Huff and Moreddu using the updated MTM model of the Organization for Economic Cooperation and Development (OECD), estimated a 25% increase in the world market price relative to the 1982/85 base, as well as a 2.5% increase for a 10% reduction of PSE rates in the IMEs. (A

major reason for the differences in these findings is the variation of the base years, given the well-known price volatility of the world sugar market.)

In addition, Roningen and Dixit examined the effects of unilateral reform of EC and U.S. agricultural policies on the world market price of sugar. They estimated an 18.6% increase in the EC case and a 22.8% increase if the U.S. alone liberalized. For 1995, Anderson and Tyers also examined unilateral liberalization. They estimated a 22% increase in the EC case and a 4% increase for only U.S. sugar trade liberalization.

In comparing the effects of U.S. sugar quotas on prices with EC sugar policy on world prices, the result clearly depends on market distortions in both regions. On the consumption side there is an important difference. The U.S. per capita consumption of combined sugar and HFCS far exceeds EC per capita consumption. Also EC consumption is low relative to countries such as Australia and Mexico.

Data for several countries on per capita sugar consumption are given in Table 23. Per capita sugar consumption for the EC countries roughly equals the U.S. sugar consumption. However, in terms of total sweeteners there is a marked difference. For total sweeteners, U.S.

Table 23
Per Capita Sugar Consumption, Selected Countries
1990/91 - 1994/95 (kilograms refined)

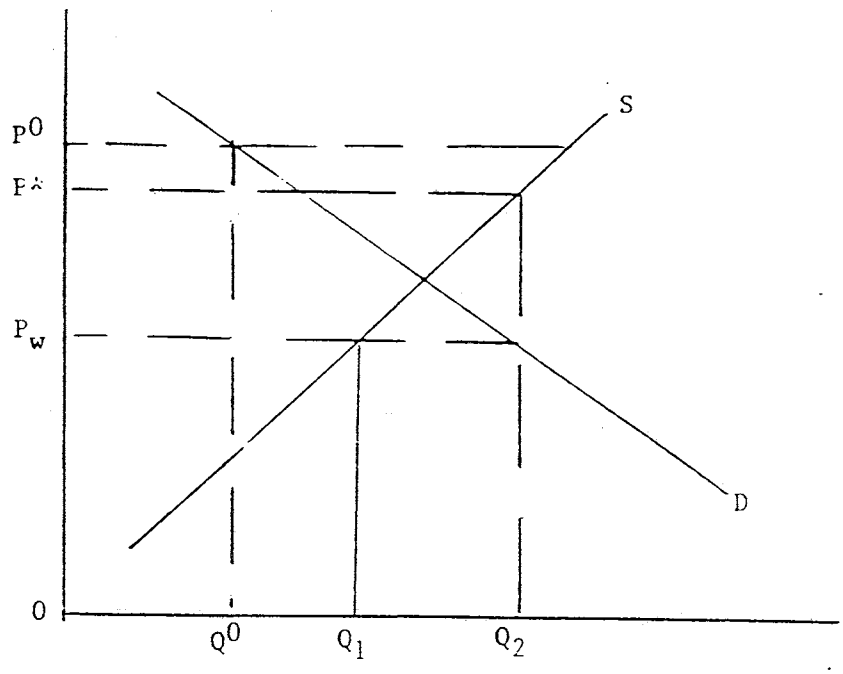
Country	1990/91	1991/92	1992/93	1993/94	1994/95
France	33.5	35.8	36.8	35.0	34.7
Germany	33.7	33.8	33.4	33.4	33.4
Italy	28.2	28.3	28.4	28.3	28.3
U.S.	29.4	29.5	29.8	30.0	30.0
Australia	46.8	47.1	49.2	49.6	48.5
Mexico	45.8	45.5	44.4	43.2	43.4

Source: USDA Sugar and Sweetener Situation and Outlook Report: March 1995.

consumption is much greater. The United States' per capita consumption of combined sugar and HFCS is roughly 60 kg per capita. This is significantly above the levels for France and Germany and, in part, is due to high sugar prices in the EC that prevent consumption from rising.

Consider the implications of high consumer prices (Figure 21) where the world free trade is P_w and imports are Q_1Q_2. Given a price support of P*, output increases to Q_2. If the consumer price were allowed to adjust, the price would fall to P_w. The country would be neither an importer nor an exporter.

Figure 21
Implications of High Consumers Prices



Source: Author's Estimates.

Suppose, however, that the producer support price was P* and consumer prices were set at P^0. In this case, the country exports Q^0Q_2 at a cost of (P^*-P_w) (Q^0Q_2) - (P^0-P^*) $(O\ Q^0)$ to the treasury (assuming world price P_w remains unchanged). However, if world price were affected by the increased production from price supports, costs would be even higher. When analyzing policy change, both consumption and production distortions would have to be taken into account.

To put the above in perspective, measures of protection are given for U.S. sugar and EC sugar. The PSEs are given in Table 24 and the consumer subsidy equivalents (CSEs) are given in Table 25.

Both the PSE and the CSE are lower for U.S. sugar compared to those of EC sugar. In 1993, for example, the U.S. PSE was 51% compared to the EU PSE of 67%. The gross PSE for the EC was three times the gross PSE for the United States. Similarly, the PSE in the United States was 43% and, in the EC, it was 61%.

Schmitz, Schmitz and Vercammen (1991) constructed a model of the effects of EC sugar policy and found results similar in one important aspect to those reported by Anderson and Tyers. The similarity was that the effect on world sugar prices by U.S. trade liberalization was less than under EU liberalization. However in the Schmitz et al results, the effect of EC liberalization on world prices was greater than that found in previous studies.

Their model consisted of four regions; United States, EC, Eastern block countries and the rest of the world. Elasticity estimates for sugar supply and demand within the United States and the EC along with the corresponding production, consumption, and trade data were used to generate supply and demand curves (Schmitz, Schmitz and Vercamman 1991). The U.S. and EC supply and demand elasticities were taken from Gardner, Roningen and Dixit, and Leu et al. Three alternative estimates of the world excess supply elasticity were used.

Table 24

Producer Subsidy Equivalents

UNITED STATES and EC

U.S.	Units	1979-86 (avg.)	1987	1988	1989	1990	1991	1992(e)	1993(p)
Sugar (refined equivalent)									
Gross total PSE	U.S.$ mn	737	1,304	1,023	845	846	1,089	1,110	1,009
Gross Unit PSE	U.S.$/t	147	212	171	146	158	180	175	161
Gross percentage PSE	%	46	68	54	44	41	55	55	51
Producer NAC		1.76	2.79	2.01	1.69	1.63	2.07	2.07	1.90
EC									
Sugar (refined equivalent)									
Gross total PSE	ECU mn	1,909	3,038	2,715	1,951	2,406	2,773	3,150	3,010
Gross unit PSE	ECU/t	146	230	195	137	151	189	197	196
Gross percentage PSE	%	54	78	68	46	53	68	72	67
Producer NAC		2.02	3.60	2.72	1.76	1.99	2.67	2.97	2.63

Source: OECD, 1995

Table 25
Consumer Subsidy Equivalents

UNITED STATES and EC

U.S.	Units	1979-86 (avg.)	1987	1988	1989	1990	1991	1992(e)	1993(p)
Sugar (refined equivalent)									
Total CSE	U.S.$ mn	-946	-1,335	-1,027	-853	-956	-1,140	-1,135	-1,041
Unit CSE	U.S.$/t	-121	-194	-149	-121	-131	-156	-152	-137
Percentage CSE	%	-37	-62	-47	-37	-34	-48	-48	-43
Consumer NAC		1.59	2.63	1.88	1.57	1.52	1.93	1.93	1.77
EC									
Sugar (refined equivalent)									
Total CSE	ECU mn	-1,457	-2,623	-2,197	-1,658	-1,732	-2,257	-2,278	-2,370
Unit CSE	ECU/t	-149	-246	-204	-147	-146	-190	-191	-199
Percentage CSE	%	-51	-73	-63	-44	-48	-62	-64	-61
Producer NAC		2.05	3.78	2.80	1.82	1.95	2.68	2.91	2.66

Source: OECD, 1995.

The base level price wedge for the United States (i.e., the difference between the U.S. producer price and the world price) was specified using a U.S. PSE of 30%. The price wedge in the EU was varied as part of the sensitivity analysis. The policy instrument in the United States, responsible for the price wedge, was an import quota. The EU policy consisted of supporting the producer price, which effectively implied an export subsidy. The EC consumer price was set equal to the EC producer price. An import quota was also specified for the Eastern block countries.

The liberalization simulation in the Schmitz et al (1991) model consisted of

(i) unilateral liberalization by the United States,

(ii) unilateral liberalization by the EC, and

(iii) multilateral liberalization by the United States and the EC.

The empirical results are given in Tables 26 - 28. Production, consumption, and trade data for 1989 were taken from various issues of the *Sugar and Sweetener: Situation and Outlook Report*. For a world excess supply elasticity of 0.5, a U.S. PSE of 50% and an EC PSE of 67% (i.e., bottom right-hand corner of Table 26), liberalization by the United States alone resulted in a relatively small increase in the world sugar price (i.e., $0.10/lb to $0.125/lb). However, unilateral liberalization by the EC resulted in a much larger price increase (i.e., $0.10/lb to $0.226/lb).

Note that liberalization by the EC alone had identical effects on the world price as did joint liberalization by the United States and the EC. Interestingly, unilateral EC liberalization or joint liberalization resulted in the world price rising above the U.S. quota price that was assumed in the model to be $0.20/lb. In this case the U.S. price rose from $0.20/lb to $0.226/lb.

Table 26

The Price Effects of U.S.-EC Sugar Trade Liberalization

(World X-Supply Elasticity = 0.5)

	Base EC PSE = 33% Liberalization By:			Base EC PSE = 50% Liberalization By:		
	US	EC	BOTH	US	EC	BOTH
US Price	.12	.20	.15	.122	.20	.178
EC Price	.17	.137	.15	.222	.171	.178
ROW Price	.12	.137	.15	.122	.171	.178
Final US PSE	0%	31%	0%	0%	15%	0%
Final EC PSE	31%	0%	0%	45%	0%	0%

	Base EC PSE = 60% Liberalization By:			Base EC PSE = 67% Liberalization By:		
	US	EC	BOTH	US	EC	BOTH
US Price	.124	.203	.203	.125	.226	.226
EC Price	.274	.203	.203	.325	.226	.226
ROW Price	.124	.203	.203	.125	.226	.226
Final US PSE	0%	0%	0%	0%	0%	0%
Final EC PSE	55%	0%	0%	62%	0%	0%

Elasticities: US Supply = 0.5 US Demand = 0.24
EC Supply = 0.17 EC Demand = 0.48

Original Prices: (EC Consumer Price = Producer Price)

Base US PSE = 50%
Rest of the World Price = .10

Source: Schmitz, Schmitz and Vercammen.

Table 27

The Price Effects of U.S.-EC Sugar Trade Liberalization

(World X-Supply Elasticity = 1.0)

	Base EC PSE = 33% Liberalization By:			Base EC PSE = 50% Liberalization By:		
	US	EC	BOTH	US	EC	BOTH
US Price	.117	.20	.142	.118	.20	.164
EC Price	.167	.13	.142	.218	.155	.164
ROW Price	.117	.13	.142	.118	.155	.164
Final US PSE	0%	35%	0%	0%	23%	0%
Final EC PSE	30%	0%	0%	46%	0%	0%

	Base EC PSE = 60% Liberalization By:			Base EC PSE = 67% Liberalization By:		
	US	EC	BOTH	US	EC	BOTH
US Price	.12	.20	.183	.12	.202	.202
EC Price	.27	.18	.183	.32	.202	.202
ROW Price	.12	.18	.183	.12	.202	.202
Final US PSE	0%	10%	0%	62%	0%	0%
Final EC PSE	56%	0%	0%	0%	0%	0%

Elasticities: US Supply = 0.5 US Demand = 0.24
EC Supply = 0.17 EC Demand = 0.48

Original Prices: (EC Consumer Price = Producer Price)

Base US PSE = 50%
Rest of the World Price = .10

Source: Schmitz, Schmitz and Vercammen.

Table 28

The Price Effects of U.S.-EC Sugar Trade Liberalization

(World X-Supply Elasticity = 1.5)

	Base EC PSE = 33%			Base PSE = 50%		
	Liberalization By:			Liberalization By:		
	US	EC	BOTH	US	EC	BOTH
US Price	.115	.20	.136	.115	.20	.154
EC Price	.165	.125	.136	.215	.145	.154
ROW Price	.115	.125	.136	.115	.145	.154
Final US PSE	0%	37%	0%	0%	27%	0%
Final EC PSE	30%	0%	0%	47%	0%	0%

	Base EC PSE = 60%			Base EC PSE = 67%		
	Liberalization By:			Liberalization By:		
	US	EC	BOTH	US	EC	BOTH
US Price	.116	.20	.17	.117	.20	.185
EC Price	.266	.164	.17	.317	.182	.185
ROW Price	.116	.164	.17	.117	.182	.185
Final US PSE	0%	18%	0%	0%	9%	0%
Final EC PSE	54%	0%	0%	63%	0%	0%

Elasticities: US Supply = 0.5 US Demand = 0.24
EC Supply = 0.17 EC Demand = 0.48

Original Prices: (EC Consumer Price = Producer Price)

Base US PSE = 50%
Rest of the World Price = .10

Source: Schmitz, Schmitz and Vercammen.

As indicated in Table 27 and assuming a world excess supply elasticity of 1.0, this general result still holds. The U.S. price, with either joint or unilateral EC liberalization, roughly equaled the U.S. price in the presence of quotas and no liberalization. In Table 28 an excess supply elasticity of 1.5 was used. In this case the world price under liberalization was only slightly below the U.S. internal support price.

The results, as indicated in Tables 26 - 28, depended on the relative PSE measures. For example from Table 22, if the EC PSE were set at 33%, which was below the U.S. PSE of 50% (i.e., top left-hand corner), joint liberalization would result in a world price below the U.S. quota price. However, if the EU PSE were set at 60% relative to the U.S. PSE of 50%, our earlier results (that the world price rises above the U.S. quota price) would prevail.

As the results of earlier data indicated, PSEs for the EC were above those for the United States. Using those estimates, the earlier results indicated that the world price under liberalization roughly equaled the existing U.S. quota price. However, it is important to note that in the early modeling by the USDA (e.g., Roningen and Dixit), an EC PSE was incorporated that was lower than the U.S. PSE. In particular, an estimated PSE of 79% for the United States and 47% for the EU was used. These are the reverse of the OECD calculations.

Note that when one used a PSE for the EC above that for the United States, liberalization by the EC had a greater impact than did liberalization by the United States. This was found to be the case, not only in our study, but also in Anderson and Tyers' study in modeling world trade.

The PSE measures for sugar changed over time, implying that the results were dependent on the base period of analysis. The PSE measures were dependent, for example, on exchange rate movements. Since 1986, due to currency appreciation, the EC prices measured in U.S. dollars rose sharply. This implied that EC PSE measures (in many studies, they were measured

in U.S. dollars) rose sharply relative to the United States. The gap between the U.S. and the EC PSEs also widened. In that case, the above results and those by Tyers and Anderson, understated the difference in the relative impact of unilateral liberalization.

The results below are taken from the USDA SWOPSIM model that show how the change in the world sugar price from liberalization depends on the relative PSE measures used (Table 29). Note how much more the world price rose from joint liberalization as the EC degree of protection rose. For example, given a relative PSE estimate of 12% for the EC and 30% for the United States, the world sugar price rose by 11%. However, if the relative PSE were changed, such that the EC would be 48% and the United States would remain at 30%, the world price would rise by 38%.

In their model, the USDA base world price was $282/tonne. From Table 29, scenario C yielded a world price increase of 26% when the EC PSE was initially 36%. This implies that the resulting world price is $355/tonne, which is roughly the same as the assumed USDA quota price of $357/tonne before liberalization. Interestingly, the PSE ratio in scenario C, using the USDA SWOPSIM model, was the same as the PSE ratio in our model (Table 18) which also generated the result that, upon liberalization, the world price would rise to the U.S. quota price. In fact, this ratio was also consistent with the ratio of the OECD PSE estimates for the EU and the United States.

If one were to use scenario D, then the world price would rise well above the internal U.S. quota price. However, as noted above, scenario C (with a much lower EC PSE) also gave this result.

The above models generally ignored differences in the CSEs between the United States and the EU. Given the estimates that the EC had higher CSEs relative to the United States, the

Table 29

1989 USDA U.S.-EC Trade Liberalization Results for Sugar

	Scenario A	Scenario B	Scenario C	Scenario D*
EC PSE	+ 12 %	+ 24 %	+ 36 %	+ 48 %
World Price Change	+ 11 %	+ 17 %	+ 26 %	+ 38 %
Producer Price:				
US	- 22 %	- 18 %	- 12 %	- 8 %
EC	- 2 %	- 18 %	- 38 %	- 62 %
Change in Supply:				
US	- 11 %	- 9 %	- 5 %	+ 1 %
EC	+ 0.2 %	- 2.4 %	- 6.3 %	- 12.1 %
Change in Demand:				
US	+ 3.0 %	+ 2.4 %	+ 1.6 %	- 0.4 %
EC	+ 3.3 %	+ 7.4 %	+ 13.3 %	- 21.1 %

*Results for scenario D are based on our own extrapolation of the USDA SWOPSIM data mentioned below.

Original Prices: Base US Sugar Price = $357/tonne
Base World Sugar Price = $282/tonne
Base US PSE = 30%

Source: Roningen and Dixit.

important result was strengthened. Liberalization by the EC alone had a greater impact on sugar prices than did liberalization by the United States alone.

Conclusions

This study suggests that there is strong support for the U.S. Sugar Program. One of the reasons for this strong support is that sweetener production and processing are widely dispersed throughout the U.S. Viewed in this context, many regions are net exporters of sweeteners (derived from cane, beets and corn) and hence gain from the Sugar Program. Also, our study points out that many cost/benefit analyses of the U.S. Sugar Program contain major shortcomings. Some of these are highlighted in this report. For example, had the GAO report included the effects of the sugar program on corn prices, their results would have suggested net positive gains from the program.

Most sugar-producing countries are affected by government policies that support sugar production. World sugar prices would rise significantly under multilateral trade liberalization. Most empirical results support such a conclusion. Unilateral trade liberalization models, including those developed by the USDA (when the OECD measures of PSEs were included), show that the impact of EC policies on world sugar prices is far greater than the impact of U.S. sugar policy. Also, studies show that on net, foreign countries may well benefit from the U.S. sugar program. Many exporters of sugar to the U.S. receive the internal U.S. price for their exports rather than the world price.

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