

GAO

Report to the Honorable  
Charles E. Schumer, House of  
Representatives

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April 1993

# SUGAR PROGRAM

## Changing Domestic and International Conditions Require Program Changes



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United States  
General Accounting Office  
Washington, D.C. 20548

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**Resources, Community, and  
Economic Development Division**

B-251529

April 16, 1993

The Honorable Charles E. Schumer  
House of Representatives

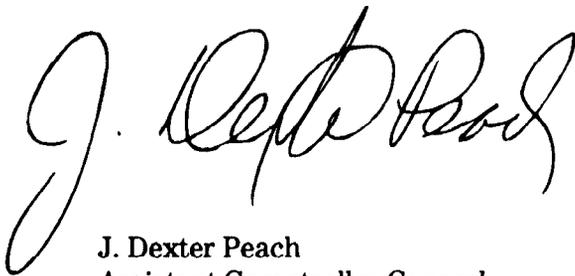
Dear Mr. Schumer:

This report responds to your request that we review the U.S. Department of Agriculture's sugar program. The report examines what the program's impact is on sweetener users and producers and how changing domestic and international conditions are likely to affect the program's future. The report contains a recommendation to the Congress that the loan rate for sugar be lowered.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies to appropriate House and Senate Committees and Subcommittees; interested Members of Congress; the Secretary of Agriculture; and the Director, Office of Management and Budget. Copies will also be made available to others upon request.

This work was performed under the direction of John W. Harman, Director, Food and Agricultural Issues, who may be reached at (202) 512-5138 if you or your staff have any questions. Other major contributors are listed in appendix VI.

Sincerely yours,



J. Dexter Peach  
Assistant Comptroller General

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# Executive Summary

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## Purpose

The sugar program, administered by the U.S. Department of Agriculture (USDA), guarantees producers (growers and processors) a minimum price for domestic sugar that is typically twice the world market price. The program was designed to insulate domestic producers from lower and potentially volatile world prices, but it has increased costs to sweetener users—consumers and manufacturers of sweetener-containing products.

Representative Charles E. Schumer asked GAO to analyze the sugar program's effects on sweetener users and producers, the potential impact of changes in domestic sweetener production and consumption, and the effect of pending international trade agreements on the program's operation.

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## Background

The U.S. sweetener market was transformed about 20 years ago by the introduction of a process to mass-produce high fructose corn syrup (HFCS). At that time, sugarcane and sugarbeets were the dominant sweetener sources in the United States. Despite increases in sugar production, sugar's importance as a sweetener has diminished. HFCS and other corn sweeteners now account for more than one-half of the caloric sweeteners consumed in this country.

For over 200 years, the United States has intervened in the sugar market, first by levying tariffs on imported sugar to raise revenue. However, the Agriculture and Food Act of 1981, as amended, provides the basis for the current sugar program. The program has two basic components: (1) a domestic commodity loan program that sets a support price (loan rate) for sugar and (2) an import quota system. Because the United States has had to import sugar to meet its domestic needs, USDA has been able to use an import quota to restrict the supply of foreign sugar. This allows USDA to keep prices high enough to support growers and to prevent processors from defaulting on their loans. USDA must use all available authority to prevent loan defaults to meet a provision that the program operate at no net cost to the government.

While the United States continues to need imported sugar to meet domestic demand, the level of imports entering the nation has fallen dramatically over the past 20 years in response to increases in domestic sweetener production and decreases in sugar consumption. In 1991 the United States imported less than 2 million tons of raw sugar, compared with almost 6 million tons in 1972.

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## Results in Brief

The program protects domestic sugar producers from lower world prices but has increased domestic sugar prices, thereby costing sweetener users an average of \$1.4 billion annually. Higher domestic prices provide support to an estimated 1,705 sugarcane farms in 4 states and an estimated 13,731 sugarbeet farms in 14 states.<sup>1</sup> Forty-two cane mills and 36 beet processing factories extract sugar from cane and beets.

Producers receive about 40 percent—or \$561 million—of the average annual \$1.4 billion in user costs. The benefits are distributed among a relatively small percentage of farms. GAO estimates that 42 percent of the sugar grower benefits went to 1 percent of all sugar farms in 1991. Although cane and beet sugar each represent approximately one-half of the domestic sugar market, the cane industry's benefits are more concentrated than those of the beet industry—17 cane farms received about 58 percent of the estimated cane grower benefits in 1991.

Some of the \$824 million of the remaining user costs go to HFCS manufacturers and foreign countries that export their quota sugar to the United States. The rest is considered a net loss to society that results from program incentives, which leads to an inefficient allocation of productive resources. HFCS manufacturers benefit indirectly because they can charge higher prices to compete with the supported price of sugar. Benefits for HFCS manufacturers, which average \$548 million annually, are also concentrated: Four firms accounted for 87 percent of production in 1990. Foreign countries that export their quota sugar to the United States receive the supported domestic price, which is higher than the price these countries could receive on the world market.

Current trends in domestic sweetener production and consumption, as well as pending trade agreements, may prevent the sugar program from continuing to operate as it does today. Recognizing that increases in domestic sugar production were outpacing consumption, the Congress passed legislation in 1990 requiring that once estimated import needs fall below 1.25 million tons, USDA would have to limit the amount of domestic sugar that producers can sell. Also, pending international trade agreements, which could reduce protectionist policies to promote a freer market, may eventually lower the domestic price for sugar as lower-priced foreign sugar is allowed more access to the domestic market.

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<sup>1</sup>A grower may own more than one farm.

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## Principal Findings

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### Sugar Program Has Cost Sweetener Users Billions of Dollars

Sweetener users bear the cost of supporting sweetener producers. Some studies have estimated a high cost by comparing the supported domestic price of sugar with the prevailing world price, resulting in a cost to domestic users of over \$3 billion annually. However, recognizing that the world price would go up significantly in the long run if the United States and other countries purchased more sugar on the world market, GAO chose a more conservative approach. Using a long-run world price for refined sugar, and including program-related HFCS user costs, GAO estimates that the program costs sweetener users approximately \$1.4 billion annually. This is an average based on 1989, 1990, and 1991 cost estimates.

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### Sugar Program Provides Concentrated Benefits to Few Sugar Farms

Growers and processors share the \$561 million in benefits, with growers generally receiving about 60 percent and processors 40 percent. Benefits that go to sugar growers are concentrated among a relatively small percentage of farms. GAO estimates that in 1991 42 percent of these benefits went to about 150—1 percent—of all sugar farms. Cane growers and beet growers each receive about one-half of the total benefits, even though there are about eight beet farms for every cane farm. The cane sugar industry is especially concentrated, with 17 farms receiving over one-half of all cane grower benefits. The beet sugar industry is less concentrated, with about 2,000 farms receiving one-half of the beet grower benefits. Benefits are further concentrated because, in both the cane and beet industries, some growers are also processors.

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### Sugar Program Provides Benefits to Manufacturers of HFCS

Since the sugar program keeps domestic sugar prices higher than they would otherwise be, manufacturers of sugar's main competitor—HFCS—can keep their prices higher as well. GAO estimates that manufacturers of HFCS receive an additional \$548 million annually as a result of the sugar program. HFCS manufacturer benefits are also concentrated: Four HFCS firms accounted for 87 percent of domestic production in 1990. This concentration of benefits occurs largely because of the substantial investment required to produce HFCS, which makes it difficult for new firms to enter the market.

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### Sugar Program's Future Is Uncertain

Current trends in domestic sweetener production and ongoing international trade negotiations may prevent the sugar program from

operating in the future as it does today. Increasing domestic production, encouraged by technology improvements and the price incentives built into the sugar program, led the Congress to pass farm legislation in 1990 that provided for a minimum level of foreign sugar imports. This law could require USDA to impose future limits on the amount of domestic sugar that producers can sell. Such action would exacerbate the economic distortions that have already resulted from the program.

Additionally, international trade agreements currently under consideration may require a future departure from the current sugar program. Under the conditions of the proposed North American Free Trade Agreement (NAFTA) and the proposed new agreements under the General Agreement on Tariffs and Trade (GATT), import quotas on all agricultural commodities could eventually be eased and their support prices reduced. NAFTA has not received final approval, and current GATT negotiations have not been concluded. Nevertheless, a movement toward a freer market would eventually require changes in the current program.

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## Recommendation to the Congress

Because of the additional user costs of the sugar program and the probability that it will not operate in the future as it does today, the Congress needs to consider legislation to move the sugar industry toward a more open market. As part of this transition, the market price for sugar should be lowered. To achieve a lower market price, GAO recommends that the Congress gradually lower the loan rate for sugar and direct USDA to adjust import quotas accordingly. Reducing the loan rate gradually would allow producers time to make orderly adjustments.

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## Agency Comments

In commenting on a draft of this report, USDA said that, overall, this is a reasonable report with no major data problems. USDA agreed that upcoming trade agreements are likely to make the current program inoperable at a future date but stated that there will be no near-term effects on the ability of the United States to shield its domestic sugar producers from increasing imports. GAO has included additional information on current GATT negotiations and NAFTA to clarify this point. Also, where appropriate, GAO has incorporated USDA's comments into the body of this report. USDA's other comments appear in their entirety in appendix V, along with GAO's detailed responses to them.

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**Abbreviations**

ASCS	Agricultural Stabilization and Conservation Service
CCC	Commodity Credit Corporation
EC	European Community
ERS	Economic Research Service
GATT	General Agreement on Tariffs and Trade
GAO	General Accounting Office
HFCS	high fructose corn sweetener
LDC	less developed country
MAIE	marketing allotment import estimate
NAFTA	North American Free Trade Agreement
USDA	United States Department of Agriculture



# Introduction

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Sugar is only one component of a complex and changing sweetener industry. Today's U.S. sugar producers are influenced not only by growing conditions and sugar prices but also by a number of developments in the sweetener industry. One such important change is increased use of alternative caloric sweeteners—most importantly high fructose corn syrup (HFCS). The market for HFCS has grown at the expense of sugar.

The United States is the fifth largest sugar producer in the world; however, it still relies on sugar imports to meet total domestic demand. U.S. raw sugar use for fiscal year 1992 was estimated by the U.S. Department of Agriculture (USDA) at 8.9 million short tons.<sup>1</sup> Between 1991 and 1992, sugar production accounted for about 81 percent of domestic sugar use, and imported sugar for about 19 percent. Nearly all U.S. sugar is grown in 4 sugarcane-producing and 14 sugarbeet-producing states.

The United States has traditionally protected domestic sugar producers from lower and potentially volatile world prices. Currently, USDA administers a sugar program that is the key determinant of the domestic sugar price. The law requires USDA to support domestic sugar prices with a loan program that guarantees a minimum price for sugar. A tariff-rate quota is used to restrict foreign supply in order to raise the domestic market price.

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## Sugar Is Produced Worldwide

Sugar comes from sugarcane and sugarbeet plants. The cane plant, a perennial grass that probably originated in the South Pacific, is cultivated in countries with tropical climates. The beet plant, an annual crop that probably originated in the Mediterranean region, is cultivated in temperate zone countries. Both sugarcane and sugarbeets must undergo processing to extract the sugar.

Sugar is produced in about 110 countries and is used in a wide variety of foods throughout the world. Most countries protect their sugar industries to encourage production and ensure domestic supplies. Governments use a variety of methods to regulate production levels, imports, factory and field workers' wages, and, often, prices at various stages of distribution.

Nearly all of the world's sugar-producing nations subsidize production, and 70 nations export sugar. This protection encourages production that might not otherwise take place and lowers world prices. Lower world market prices encourage continued protection as governments attempt to

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<sup>1</sup>A short ton is 2,000 pounds.

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insulate their producers from the world market. These lower world prices have benefited countries that buy sugar on the world market and harmed the development of export markets for efficient producers.

Although many countries attempt to shield their sugar producers from potentially erratic world prices, according to USDA, several factors have reduced world price volatility in recent years. These factors include (1) developed countries' purchases of world imports have fallen by half, reducing the chance for world prices to be "bid up" because less-developed countries do not have the financial resources of developed countries; (2) the number of substitutes for sugar have increased; (3) most of the world sugar trade occurs at the world price, rather than at premium prices under special agreements; (4) sugar production may be more responsive to price signals because of increased privatization; and (5) some countries, such as Australia, are liberalizing their sugar trade policies.<sup>2</sup>

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## Domestic Sweetener Production and Consumption Has Changed

The U.S. sweetener market was transformed about 20 years ago by the introduction of a process for mass-producing HFCS. From a clearly commanding position, sugar has moved to one of shared importance with HFCS. HFCS has gained market share because of its competitive pricing and its near-perfect substitutability for sugar in many liquid sweetener uses. Greater HFCS use has come primarily at the expense of sugar imports: Domestic sugar production has increased even as increased use of this substitute caused sugar consumption to decline.

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## The Domestic Sugar Industry

Both cane and beet sugar are produced in the United States, each accounting for approximately one-half of domestic production. Sugarcane is grown on an estimated 1,705 farms in Florida, Louisiana, Texas, and Hawaii. Beets are grown on approximately 13,731 farms in 14 states. Sugar from the cane and beets is extracted by 42 cane mills and 36 beet-processing factories. Some cane sugar millers grow their own cane, and it is common for farming cooperatives in both sugar sectors to grow and process their own sugar. Beet sugar is transformed directly into refined sugar by the beet processor. Sugarcane is typically milled into raw

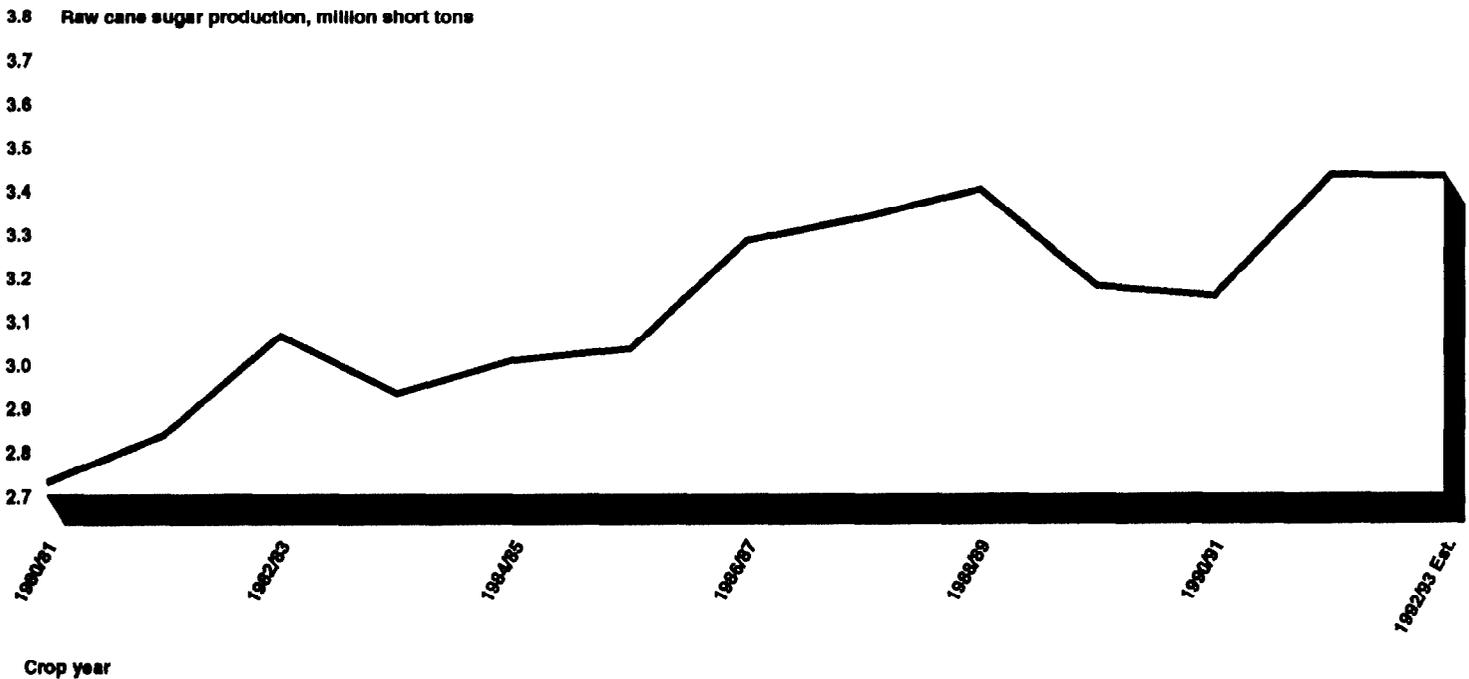
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<sup>2</sup>USDA noted that the coefficient of variation for sugar prices (a measure of variability that ranges from 0 to 1) has fallen from 0.78 between 1960 to 1981 to 0.34 between 1982 and 1991. USDA stated that the variability of the world sugar price in the last decade was lower than the variability of the world prices of corn, rice, soybeans, and wheat between 1960 and 1981.

sugar then sent to one of 12 refineries where it is further processed into refined sugar ready for consumption.<sup>3</sup>

Cane sugar production in the United States increased about 26 percent, from about 2.7 million short tons in the 1980/81 crop year to about 3.4 million short tons in the 1991/92 crop year (see fig. 1.1). Over the same period, harvested acreage increased more than 24 percent, and USDA expects 1992/93 acreage to be more than 10 percent higher than it was in 1989/90.

Figure 1.1: Domestic Raw Cane Sugar Production, Crop Years 1980/81 to 1992/93 (Est.)



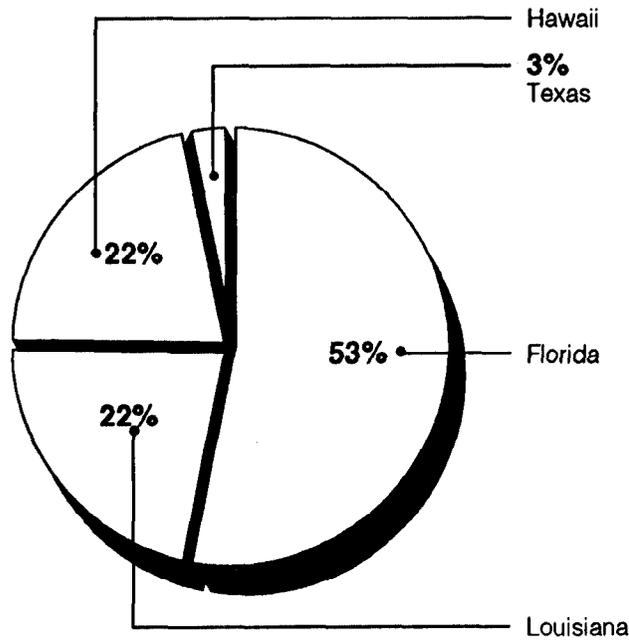
Source: USDA data.

Florida and Louisiana have expanded acreage and production, while Hawaiian production, which accounts for relatively little acreage, is

<sup>3</sup>Some sugarcane is partially refined by washing it in a centrifuge under sanitary conditions, rather than being sent to a refinery. This is known as turbinado sugar.

declining because of high production costs. Figure 1.2 shows an analysis of raw cane sugar production, by state, for the 1992 crop year.

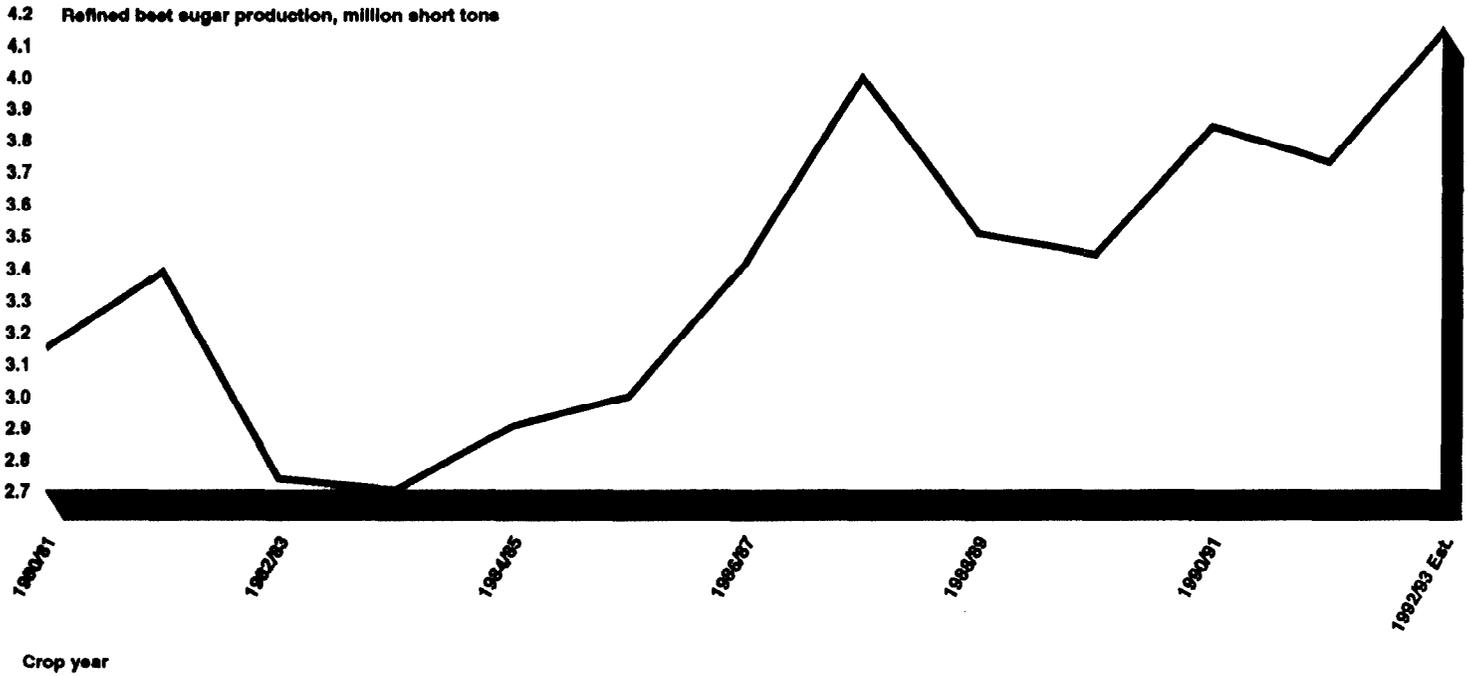
Figure 1.2: Raw Cane Sugar Production by State, 1992 Crop Year



Source: USDA data.

Beet sugar production also increased about 19 percent from about 3.1 million short tons in the 1980/81 crop year to more than 3.7 million tons in the 1991/92 crop year (see fig. 1.3). Over the same period, harvested acreage increased nearly 17 percent, and USDA expects 1992/93 acreage to be more than 9 percent higher than it was in 1989/90. Additional production increases are likely as new technology to increase beet sugar recovery rates during processing become more widely available. Increases have not been uniform across all beet-producing states.

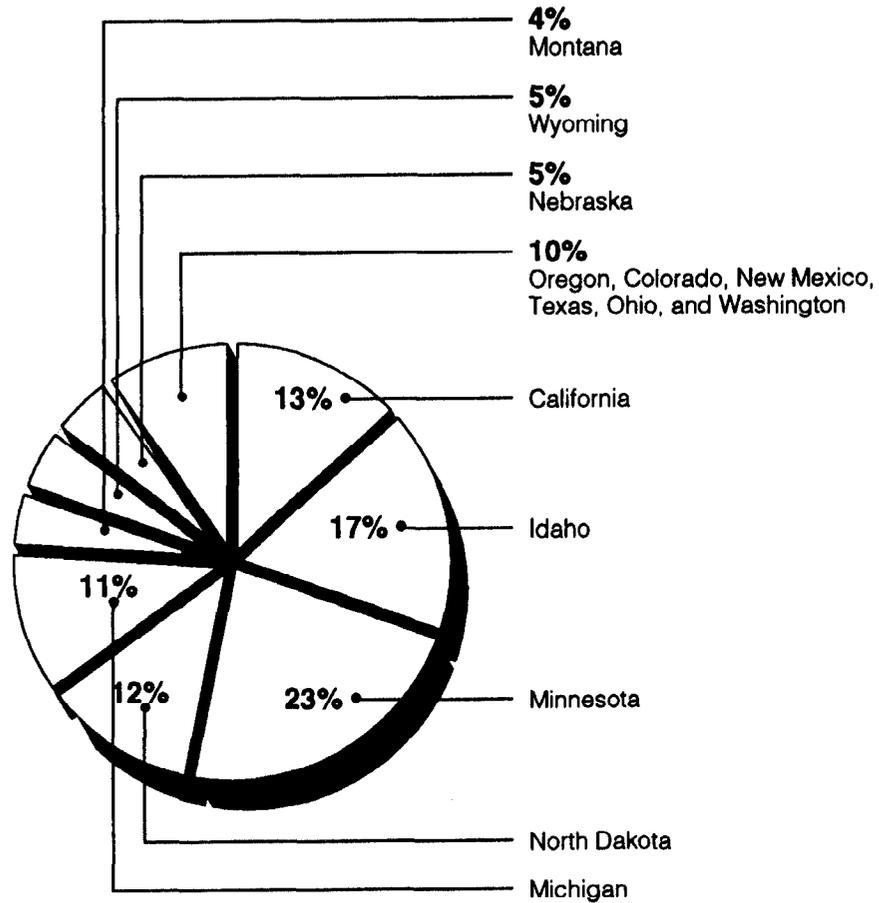
Figure 1.3: Domestic Beet Sugar Production, Crop Years 1980/81 to 1992/93 (Est.)



Source: USDA data.

California's production has fallen in recent years, while production in the Red River Valley of Minnesota and North Dakota has increased sharply. Figure 1.4 shows an analysis of refined sugarbeet production, by state, for the 1992 crop year.

Figure 1.4: Sugarbeet Production by State, 1992 Crop Year



Source: USDA data.

### Corn Sweetener's Importance Has Grown

HFCS is a liquid corn sweetener whose sweetness is nearly identical to that of sugar. When its production costs declined while sugar prices rose, HFCS became a viable substitute for sugar and replaced liquid sugar in many products—particularly in soft drinks. USDA estimates that HFCS displaced nearly 6.6 million tons of refined sugar in 1992.

New uses for HFCS must be found if it is to take more of the sugar market. Because HFCS is a liquid sweetener, its use in major food products is

limited to liquid products, primarily soft drinks. Also, HFCS does not have the same baking properties as sugar. However, in 1987 a crystalline fructose was introduced for industrial use in some "niche" products such as flavored breakfast drinks. USDA officials told us that further development of the product could cause sugar to lose more market share.

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**Low-Calorie Sweetener  
Use Is Increasing**

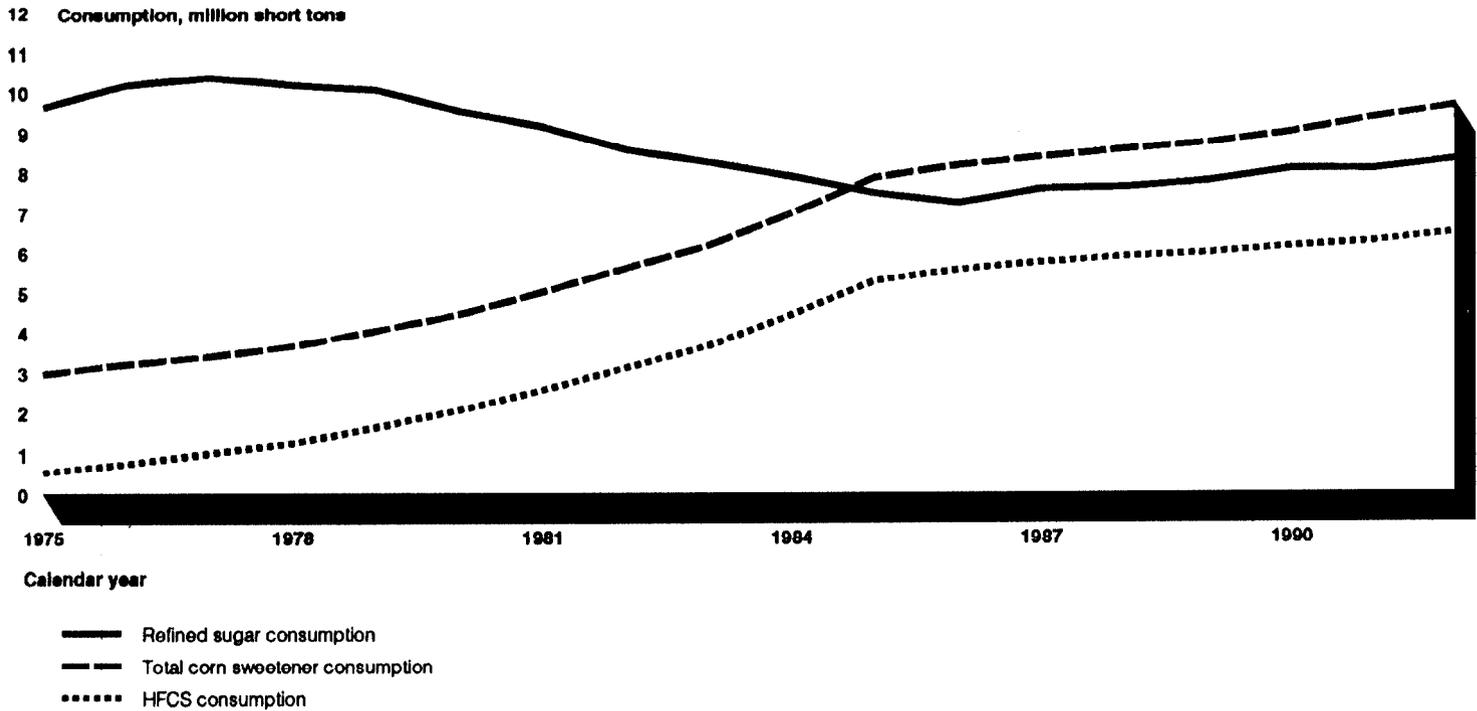
The consumption of low-calorie sweeteners (such as aspartame and saccharine) has increased since 1981. Consumption of low-calorie sweeteners, on a sugar-equivalent basis, increased from about 6 percent of total U.S. sweetener consumption in 1980 to nearly 15 percent in 1991. In addition, sucralose, a new artificial sweetener pending Food and Drug Administration approval, has some characteristics more like sugar than existing artificial sweeteners. Sweetener analysts, however, do not consider low-calorie sweeteners to be direct substitutes for sugar because low-calorie sweetener use is dictated more by dietary preferences than by price.

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**Sugar Consumption**

Refined sugar sales peaked in 1973 at 11.5 million short tons. As shown in figure 1.5, refined sugar use averaged about 10 million tons between 1975 and 1980, and then dipped to 9 million tons in 1981. Thereafter, consumption steadily declined for several years as corn sweeteners, particularly HFCS, displaced sugar. As losses to HFCS slowed, sugar consumption rose to 7.6 million short tons in 1987 from a low of 7.2 million in 1986, largely because of population and income growth (see fig. 1.5). Consumption in 1992 is estimated at 8.9 million short tons and is expected to continue to rise slowly.

Figure 1.5: Refined Sugar and Corn Sweetener Consumption, 1975-92



## Sugar Imports Have Fallen

With increased sugar production and decreased total demand for sugar, imports fell as USDA restricted foreign supplies to maintain domestic prices. Imports for domestic use fell approximately 77 percent from a high of 6.1 million short tons in 1977 to a tariff-rate import quota of about 1.4 million short tons in fiscal year 1993.

According to USDA, this decline in imports has been a major contributing factor to the decline of the U.S. cane refining industry. Ten refineries, representing 35 percent of the U.S. refining capacity have closed since the implementation of the current sugar program, according to USDA.

## U.S. Sugar Policy

Except for several periods of reduced government intervention from 1975 to 1981, the United States has been involved in the domestic sugar market since the 1700s. At that time, tariffs on imported sugar were used to

supplement the federal treasury. Since then, the United States has used various programs to protect the domestic sugar industry, but raising revenue through import tariffs is no longer a goal of the program.

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### **Current Program Established in 1981**

Today's sugar program was established by the Agriculture and Food Act of 1981, and modified by the Food Security Act of 1985 and the Food, Agriculture, Conservation, and Trade Act of 1990. Designed to operate at no net cost to the government, the sugar program provides USDA with three tools to support the domestic sugar industry: a nonrecourse loan program, a tariff-rate import quota, and domestic marketing allotments. Cane and beet processors also pay a marketing assessment to the Commodity Credit Corporation (CCC) for the sugar they process.

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### **The Loan Program Provides a Price Floor for Sugar**

The sugar program supports producers by using a loan program intended to guarantee producers a minimum U.S. market price for their sugar. However, the loan program is supposed to operate without a cost to the government. Raw cane sugar and refined beet sugar are used as the collateral for loans obtained from USDA. The processors that borrow the money pay growers for their cane and beets upon delivery to the processing facility. Growers generally receive 60 percent of the loan at that time, but individual arrangements vary by contract. After the processor has sold the sugar, it makes a final payment to the grower on the basis of the price at which the sugar was sold.<sup>4</sup>

Loans may be taken out for up to 9 months to allow processors to pay the growers and store the processed sugar rather than sell it in the market at harvest. The loans are a low-interest source of operating capital that allow processors to hedge against low market prices by storing sugar rather than selling it. When the sugar is sold, the processor repays the loan to USDA.

Most important to producers, the loan program sets a guaranteed minimum price because processors can simply forfeit their sugar—which is the loan collateral—to the USDA as full satisfaction of the obligations of the loan. The loan rate is the minimum support price for sugar. Processors would have an economic incentive to forfeit their sugar rather than repay

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<sup>4</sup>Many processors do not take out CCC loans. Those that do not are not obligated to pay growers the statutory minimum price for sugarbeets or sugarcane. However, growers do ultimately receive about 60 percent of total receipts from the sale of sugar, and processors about 40 percent. According to USDA, this is a "world-wide phenomenon," which typically reflects the relative costs of growing and processing sugarbeets and sugarcane. Even if processors do not take out loans, they still benefit from the price floor that the loan program sets.

the loan if the market price is not sufficient to recover loan interest payments and the additional costs involved in selling the sugar. Because of the program's no-net-cost provision, USDA has to use all available authority to keep prices high enough to prevent forfeitures. The import quota has been the tool to accomplish this.

Currently, cane millers can borrow an average of 18 cents per pound for raw cane sugar, while beet processors can borrow an average of 23.3 cents per pound for refined beet sugar. Legislation requires that USDA support sugarbeets at a level that is "fair and reasonable" in relation to the loan rate for sugarcane.

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### Import Restrictions Allow USDA to Support Prices and Prevent Loan Losses

To prevent loan forfeiture, which risks a cost to the government, USDA uses a tariff-rate import quota to restrict the supply of foreign raw cane sugar. By restricting imports of lower-priced sugar, USDA supports domestic sugar prices. A tariff-rate quota permits a limited level of imports at a low tariff level. Any imports beyond that level are assessed a second-tier tariff. Under the tariff-rate quota, foreign countries may exceed their quota, but they must pay a 16-cents-per-pound tariff on additional sugar sold in the U.S. The tariff is high enough that USDA expects less than 1,000 tons of additional sugar imports.

Each year USDA estimates the domestic production and demand for sugar and the level of supply that would keep domestic prices at a level that discourages producers from forfeiting sugar to USDA. USDA consults with the Sugar Working Group to determine how much sugar to import. The Sugar Working Group is composed of representatives of various executive agencies with an interest in the sugar program.<sup>5</sup> USDA uses this input to establish a final import quota. The United States Trade Representative then allocates individual quotas to traditional foreign suppliers, largely on the basis of their percent share of U.S. imports in the 1975-81 period.

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### Marketing Allotments May Be Necessary to Support Prices

Under the 1990 farm legislation, foreign sugar producers and domestic cane refiners are assured that estimated imports will not fall below 1.25 million short tons of sugar. If estimated import requirements are less than 1.25 million short tons for the fiscal year, USDA is required to activate

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<sup>5</sup>The group consists of officials from the Office of the United States Trade Representative, Office of Management and Budget, Council of Economic Advisors, White House Economic Policy Council, National Security Council, and from the Departments of the Treasury, Commerce, State, and Agriculture.

marketing allotments.<sup>6</sup> The allotments would permit imports to enter the United States at the minimum 1.25 million ton level without lowering domestic prices. USDA will assign marketing rights to cane millers and beet processors on the basis of historical production, production capacity, and ability to market sugar. Marketing allotments—which have not yet been used—will restrict the amount of domestically produced sugar and crystallized high fructose corn syrup that each processor can sell.

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### Processors Pay a Marketing Assessment

The Omnibus Budget Reconciliation Act of 1990 requires that a nonrefundable marketing assessment of 0.18 cents per pound of raw cane sugar, and 0.193 cents per pound of refined beet sugar be collected from cane millers and beet processors on each pound of sugar they market. Using USDA's Economic Research Service (ERS) estimate of 1991/92 production, this assessment would have resulted in a collection of approximately \$12.5 million from cane millers and \$14.4 million from beet processors in fiscal year 1992.

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### Objectives, Scope, and Methodology

In response to a request from Congressman Charles E. Schumer, we analyzed the sugar program's effects on sweetener users and producers, the potential impact of changes in domestic sweetener production and consumption, and the effect of pending international trade agreements on the program's operation.

To understand the program and the industry, we spoke with representatives of USDA's Agricultural Stabilization and Conservation Service (ASCS), ERS, and Foreign Agricultural Service. We spoke with officials from the Office of the United States Trade Representative, the International Trade Commission, and the World Bank.

To assess the impact of the sugar program on sweetener users, we identified and analyzed economic studies of the U.S. sugar program. These studies were conducted by various universities, agricultural research institutions, and ERS or other government agencies. Because these studies covered earlier time periods, we also performed our own analysis for more recent years, using techniques similar to those used in the economic studies that measured the welfare effects of the sugar program. As necessary, we interviewed researchers who had conducted some of the studies we used. In our analysis, we estimated the cost to the buyers of

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<sup>6</sup>USDA will use the Marketing Allotment Import Estimate (MAIE) contained in the 1990 act to make its estimate of the import requirement level. The formula for the estimate is as follows: MAIE = (reasonable ending stocks + consumption) - (beginning stocks + production).

raw cane sugar, refined beet sugar, and HFCS. A discussion of how we measured the welfare gains and losses from the program and how we incorporated information from various studies into our analysis is included in appendix I. Appendix II lists the economic studies we reviewed.

To further determine the program's impact on domestic sugar users, we spoke with four large manufacturers of sugar-containing products and the Sweetener Users Association, which represents the interests of large sugar users. We also reviewed relevant economic literature.

To obtain sweetener producers' perspectives, we spoke with the United States Beet Sugar Association, the American Sugarbeet Growers Association, the California Sugarbeet Growers Association, the Hawaiian Sugar Planters' Association, the American Sugar Cane League, the Florida Sugar Cane League, and the Rio Grande Valley Sugar Growers, as well as with cane growers and millers in Louisiana, Florida, Hawaii, and Texas. We spoke with beet growers and processors in California and representatives of the American Crystal Sugar Company in Minnesota. We spoke with representatives of the California and Hawaiian Sugar Company, which is a cooperative refining company and marketing association owned proportionately by its 12 member sugar companies in Hawaii. We also spoke with representatives of the Corn Refiners Association. We could not obtain the views about the program from domestic cane refiners since their representatives in the Cane Sugar Refiner's Association declined to meet with us.

To determine the impact on producers, we obtained information from ASCS on all sugar producers that are eligible to participate in the sugar program. Each producer that participates in the program reports total farm acreage and the number of acres in sugar production to ASCS. However, Hawaiian producers generally do not participate in the loan program and consequently do not provide farm data to ASCS. Therefore, we obtained data on Hawaiian producers from the Hawaiian Sugar Planters' Association's 1992 Sugar Manual. We multiplied the farm acreage by ERS data on average sugarcane or sugarbeet yield per acre (by state or region where applicable) to determine the estimated total sugarcane or sugarbeet yield per farm. Next, we used ERS statistics on sugar recovery rates (by state or region where applicable) and multiplied those rates by the total sugarbeet or sugarcane yield per farm.<sup>7</sup> However, we did not independently

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<sup>7</sup>Sugar recovery rates are the percentage of refined beet sugar or raw cane sugar derived from sugarcane and sugarbeets.

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verify the accuracy of ASCS's, ERS's or the Hawaiian Sugar Planters' Association's data.

We estimated that the average per-pound benefit of the sugar program is 5 cents. We determined this 5-cent benefit using an average market price of 22 cents, minus 2 cents for transportation, compared with an estimated adjusted world price of 15 cents under liberalized conditions.<sup>8</sup> (See app. I for the methodology used to estimate this figure.) The difference, then, between the average U.S. market price and a world price in liberalized conditions is 5 cents. Although this analysis uses the 15-cent world-liberalized price that we selected for our overall welfare analysis, it does not employ the same methodology. Our welfare analysis determined total costs and benefits to sweetener users and producers, including HFCS. Our analysis of concentration of benefits, however, determined the concentration of benefits among sugar producers, as well as the estimated benefits to a few of the larger producers.

Since growers and processors share returns on their sugar on a 60/40 basis, we used that ratio to determine individual farm benefits.<sup>9</sup> We then used information on individual growers in each state and determined the concentration of benefits on a state-by-state basis. We only considered cane farms that had individual benefits of \$6,000 or greater and beet farms that had individual benefits of \$1,200 or greater. Using these criteria, we included 1,705 cane farms and 13,731 beet farms in our analysis.

To assess the program's future under changing domestic and international conditions, we reviewed analyses of the potential effects of proposed new agreements under the General Agreement of Tariffs and Trade (GATT) and the yet-to-be-ratified North American Free Trade Agreement (NAFTA). We also attended International Trade Commission hearings and interviewed knowledgeable representatives from USDA, the Office of the U.S. Trade Representative, and private industry.

We adjusted figures as necessary in this report to 1991 dollars to more accurately compare prices and costs over time. For this adjustment, we used the gross domestic product implicit price deflator on a crop-year basis, with 1991 being equal to 1.00.

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<sup>8</sup>The domestic market price of 22 cents per pound is for raw cane sugar.

<sup>9</sup>This 60/40 sharing of returns is not required for participation in the program. Although this is the general level of sharing, the ratio varies according to the terms of individual contracts.

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**Chapter 1  
Introduction**

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**We conducted our work from September 1991 through November 1992 in accordance with generally accepted government auditing standards.**

# Sugar Program Increases Costs to U.S. Sweetener Users

We estimate that the U.S. sugar program costs sweetener users an average of \$1.4 billion annually. (This average is based on estimates for 1989, 1990, and 1991 and accounts for users' consuming less while paying more for sweeteners than would occur in the absence of the program.) Although the sugar program is considered a no-net-cost program because the government does not make payments directly to producers, it places the cost of the price supports on sweetener users—consumers and manufacturers of sweetener-containing products—who pay higher sugar and sweetener prices.

A wide spread between world and domestic sugar prices makes it more difficult for domestic manufacturers of sugar-containing products to compete against imports that contain sugar purchased at the world market price. This has led to an increase in imports of these products. However, U.S. manufacturers of sugar-containing products can still be competitive in the export market by using a program provision that allows them to buy sugar from the world market as long as it is used in products that are exported.

## Users Pay for Producers' Benefits

The sugar program, like many other commodity programs, has the goal of supporting producers' incomes and stabilizing prices. In some other commodity programs, however, such as those for wheat and corn, the funds used to support producers come directly from the U.S. Treasury. For these commodities, the difference between the target price (what the Congress says farmers should receive) and the higher of either the support price or market price is paid directly to farmers in the form of deficiency payments. In contrast, the sugar program places the cost of supporting sugar producers on U.S. sweetener users through the higher prices created by restricting the supply of low-priced world market sugar on the U.S. market.

## Determination of Benefits

Under the sugar program, producers' incomes are supported primarily through higher prices that users pay for sugar. The price support is implemented through a loan program and import restrictions.

To operate the program at no cost to the government, USDA attempts to keep market prices high enough to dissuade producers from defaulting on their loans and forfeiting sugar to the government. USDA maintains that to prevent defaults, the market price must be high enough for producers to recover the (1) basic loan rate, (2) cost of transporting raw cane sugar to a

refiner (marketing expense), and (3) interest expense for sugar placed under loan. According to USDA, prices must be high enough to prevent forfeiture in the areas with the highest costs. As a result, all other areas are also protected from the risk of forfeiture. Hypothetically, as illustrated in table 2.1, if a Florida cane miller wanted to put raw cane sugar under loan for 9 months, the market price 9 months later would have to be about 2.4 cents per pound higher than the loan rate to prevent the miller from defaulting on the loan.<sup>1</sup>

**Table 2.1: Hypothetical Default Calculation for Raw Florida Cane Sugar**

<b>Factors of price</b>	<b>Cents per pound</b>
Florida cane loan rate	17.99
Interest expense (9 months at Jan. 1993 CCC rate)	0.51 (17.99 x 3.75% x 9/12)
Transportation expense, estimated	1.90
Required price 9 months later	20.40

To prevent domestic prices from falling below the forfeiture level, USDA estimates the domestic demand and supply for sugar at a price that avoids forfeitures and then uses the tariff-rate quota to restrict foreign supplies and keep domestic prices above the forfeiture level.

**Annual Average Cost to Users Is \$1.4 Billion**

We reviewed a number of economic studies to determine how much the sugar program increased the cost of sweeteners for U.S. users. Using a methodology similar to those of several other studies measuring the welfare effects of the sugar program, we estimated the program cost to users between 1989 and 1991.<sup>2</sup> Our analysis indicates that the user cost over the period ranged from approximately \$1.1 billion to \$1.7 billion annually (in 1991 dollars), as shown in table 2.2. This cost includes both the cost of supported sugar and HFCS, whose price is also protected from world market sugar prices because it is a substitute for sugar. In addition to costs resulting from purchasing higher-priced sweeteners, these estimates include social welfare losses that occur because of the reduced consumption of sweeteners resulting from the program's price supports. Chapter 3 contains information on how those costs are distributed to producers.

<sup>1</sup>Since other factors, such as sugar storage costs, may influence the processor's decision to default, the default price in this example must be considered a hypothetical one.

<sup>2</sup>Apps. I and II discuss the methodology we used in our analysis and the studies we reviewed.

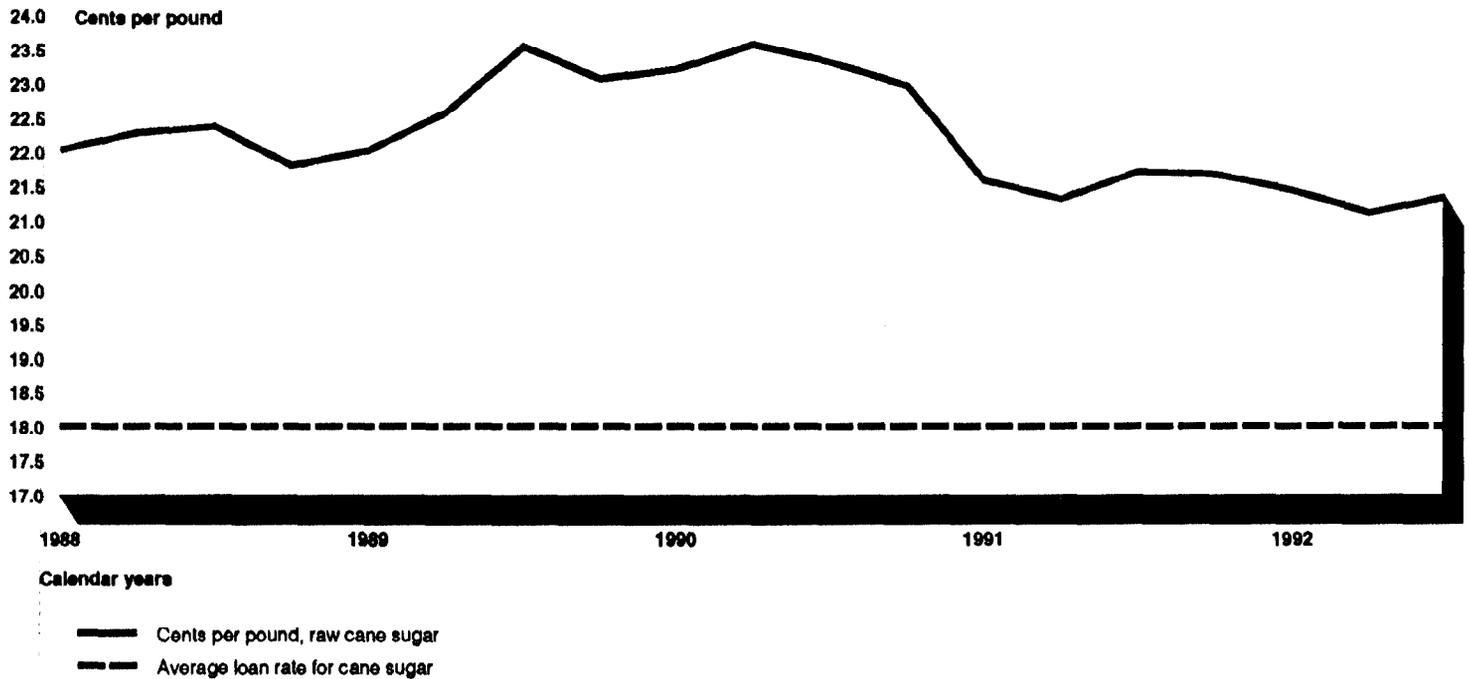
**Chapter 2  
Sugar Program Increases Costs to U.S.  
Sweetener Users**

**Table 2.2: Estimates of User Cost**

Dollars in billions	
Year	User costs
1989	\$1.38
1990	1.72
1991	1.06
1989-91 average	\$1.39

Figures 2.1 and 2.2 show recent raw cane and refined beet sugar prices. Figure 2.1 shows that between 1988 and 1992 monthly prices for raw cane sugar ranged from 5.6 cents per pound above the average loan rate in the second quarter of 1990 to 3.1 cents in the second quarter of 1992.

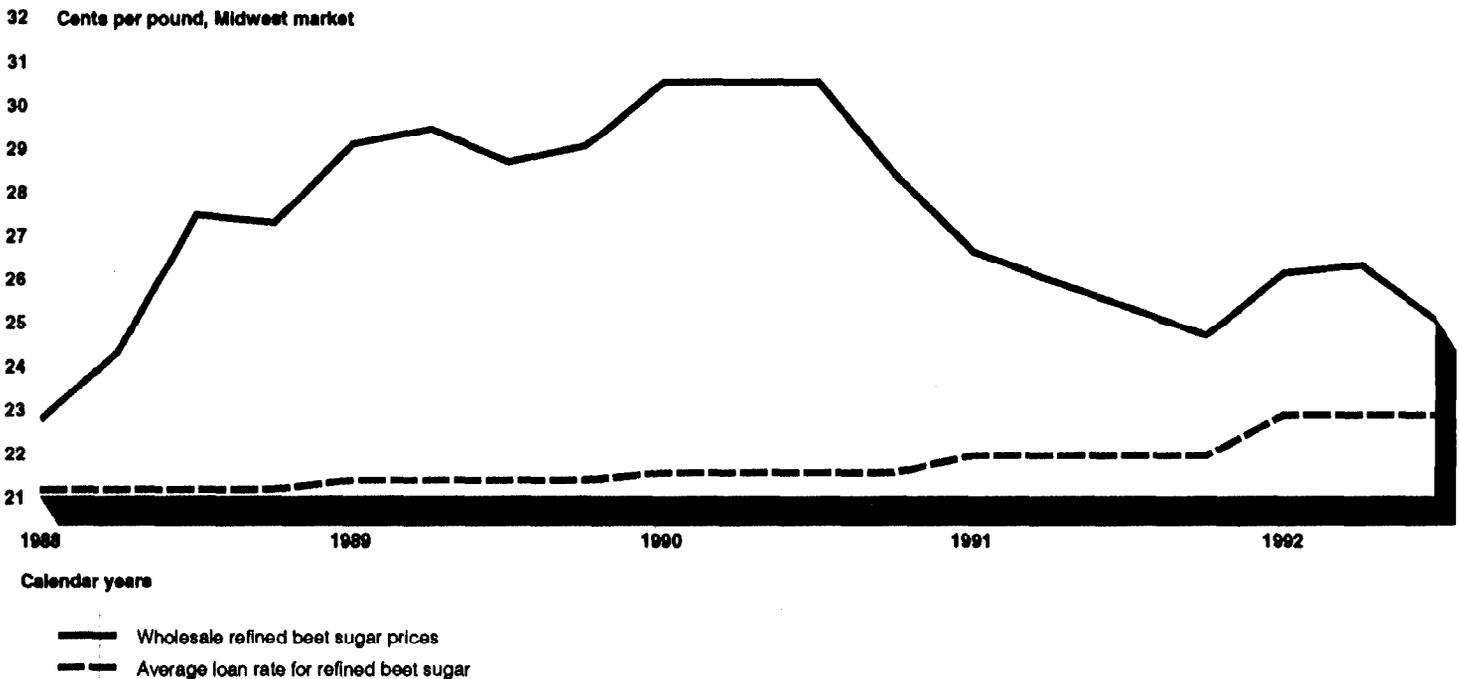
**Figure 2.1: Raw Sugar Prices and Loan Rates, Quarterly Data, Fiscal Years, 1988-92**



Source: USDA reported quarterly raw cane prices, duty-paid, New York.

Figure 2.2 shows that, over the same period, monthly refined beet sugar prices ranged between 9 cents above the average loan rate in the third quarter of 1990 to 2 cents above the average loan rate in the third quarter of 1992. Some industry analysts maintain that lower prices during 1992 occurred because USDA had allowed supplies to increase with tariff-rate import quotas that were larger than necessary. USDA attributed the declines to the recession's impact on sugar use, trade expectations that production might be higher than estimated, a surge in arrivals of quota sugar, and an apparent increase of sugar blends from Canada.

**Figure 2.2: Wholesale Refined Beet Prices and Loan Rates, Quarterly Data, Fiscal Years 1988-92**



Periods of higher domestic prices provided an additional source of support to sugar producers but contributed to the user cost of the program. Our economic analysis reflects a decline in user costs and producer benefits when the gap between the forfeiture level and the

domestic market price narrowed between 1990 and 1991 as domestic market prices fell.

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## **Program Limits Domestic Competitiveness of Manufacturers of Sugar-Containing Products**

Sweeteners are used in a wide array of products, not only as sweetening agents but also as preserving or fermenting agents in processed foods. Because of sugar's use in many food products, such as candy, confections, and bakery goods, the price of sugar is an input cost. Therefore, domestic manufacturers of sugar-containing products generally oppose the supply restrictions imposed by the domestic sugar program. The program denies them access to world-priced sugar, which has been cheaper than domestic sugar throughout the life of the current program. Between 1988 and 1992, annual average U.S. raw sugar prices were between 10 and 12.5 cents per pound higher than world raw sugar prices. For example, for every 10-cent U.S. sugar price premium, a foreign product containing 30-percent sugar would have a cost advantage of 3 cents per pound of product.

Many factors, including the price of sugar, affect the cost of sugar-containing products. Supported sugar prices place domestic manufacturers of sugar-containing products at a competitive disadvantage against those foreign-made products sold in this country. We reported in 1988 that although import restrictions were imposed on certain sugar-containing products, imports of other types of sugar-containing products had increased substantially since the start of the sugar program.<sup>3</sup> In addition, we reviewed economic studies that show greater imports of sugar-containing products are associated with domestic sugar prices that are high relative to world sugar prices.

Two of the four manufacturers of sugar-containing products we spoke with said that the sugar program provided some beneficial price stability, but that given a choice, they would endure greater price instability in return for a lower average cost of sugar. None of the manufacturers we spoke with believed that the program provided improved access to better quality sugar. While each of these manufacturers told us they have tight quality requirements for sugar, they also said that domestic refiners have been able to meet the needs of manufacturers regardless of their source of raw sugar.

To allow U.S. manufacturers to stay competitive in the world markets, the Secretary of Agriculture initiated the Sugar-Containing Products

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<sup>3</sup>Sugar Program: Issues Related to Imports of Sugar-Containing Products (GAO/RCED-88-146, June 22, 1988).

Re-Export Program in 1984. The expressed purpose of the re-export program is to ensure the competitiveness of U.S. sugar-containing products in the world market by permitting manufacturers of these products to purchase sugar from the world market outside of the quota and without a 16-cent tariff as long as the product is re-exported within 18 months. According to USDA's Foreign Agriculture Service, without the re-export program, U.S. exports of sugar-containing products would generally not be competitive with foreign products that use world-priced sugar.

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## **Conclusions**

While sugar prices have fallen over the last several years, the loan program has continued to operate at no net-cost to the government. However, even with lower prices, there was still a \$1.4 billion cost to sweetener users. Part of the cost of the sugar program is borne by domestic manufacturers of products that contain sugar. Higher sugar prices place manufacturers of certain products at a competitive disadvantage with overseas manufacturers that can buy sugar from the world market and ship sugar containing products to this country. A re-export program was initiated so that domestic manufacturers of these products could be competitive in export markets.

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## **Agency Comments**

In commenting on a draft of this report, USDA said that the costs and benefits derived using assumptions of hypothetical policy alternatives are well within the range of most research. Further, USDA stated that the basic methodology for obtaining welfare estimates is sound, as are the data. Finally, USDA noted that the equilibrium price of 20.5 cents per pound is also reasonable.

# Sugar Program Provides Concentrated Benefits to Few Sweetener Producers

By keeping the domestic price of sugar higher than it would otherwise be, the U.S. sugar program provides sugar producers (growers and processors) with an average of \$561 million in benefits annually. This is less than one-half of the \$1.4 billion in user costs. Some of the remaining user costs go to HFCS manufacturers or foreign countries that export their quota sugar to the United States. The rest of the user cost is considered a net loss to society that results from program incentives that lead to an inefficient allocation of productive resources (deadweight loss).

The benefits that go to growers are concentrated among a relatively few large farms. Because benefits do not come from tax dollars, sugar program beneficiaries are not subject to payment limitations as many other USDA commodity programs are. Table 3.1 shows the producer and exporter benefits and the deadweight loss of the sugar program.

**Table 3.1: Estimates of Producer Gains, Foreign Exporter Gains, and Deadweight Loss**

Dollars in millions				
Year	Sugar producer gains	HFCS manufacturer gains	Exporter gains	Deadweight loss
1989	\$597	\$551	\$116	\$114
1990	650	677	241	150
1991	435	417	141	65
Average	\$561	\$548	\$166	\$110

Source: GAO analysis of USDA data.

## Sizeable Benefits Go to Few Sugar Farms

Growers and processors share the \$561 million in benefits, with growers generally receiving 60 percent and processors receiving 40 percent. The benefits that go to growers are concentrated among a relatively few farms. We estimate that in 1991, 42 percent of the grower benefits went to 1 percent of all sugar farms. The cane sugar industry is especially concentrated, with 17 of the estimated 1,705 cane farms—or about 1 percent—receiving 58 percent of all cane grower benefits in 1991. The beet sugar industry is less concentrated. Still, about 10 percent of the estimated 13,731 farms received 41 percent of the beet grower benefits in 1991.

Because producers include both growers and processors that split the program benefits generally on a 60/40 basis, we separated growers from processors to calculate average farm-level benefits and to show the

distribution of those benefits. These are conservative estimates because many large cane growers own their own mills and many beet growers are members of processing cooperatives. Producers that are vertically integrated realize greater program benefits. We only considered cane farms with individual benefits of \$6,000 and above, and beet farms with individual benefits of \$1,200 and above.

Table 3.2 shows that in all sugar-producing states, the benefits received by the top 20 percent of farms range from 47.3 percent in Ohio to 86.8 percent in Florida. The distribution figures show how each state's benefits are shared among that state's farms.<sup>1</sup> New Mexico and Washington are not listed even though they are beet-producing states. Since there are so few farms in these two states, USDA includes their production in an "other" category to avoid disclosure of individual operations.

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<sup>1</sup>The concentration calculations are also conservative (i.e., they understate the true degree of concentration) because they do not account for the fact that some growers operate more than one farm.

**Chapter 3  
Sugar Program Provides Concentrated  
Benefits to Few Sweetener Producers**

**Table 3.2: Distribution of Sugar Program's Benefits Among Farms in Sugar-Producing States, Crop Year 1991.**

	Upper 1%	Upper 5%	Upper 10%	Upper 20%
United States	41.7%	54.1%	63.2%	74.7%
Cane total	58.4%	78.8%	83.8%	89.1%
Beet total	9.9%	27.3%	40.7%	58.4%
Florida cane	35.2%	65.8%	76.3%	86.8%
Hawaii <sup>a</sup> cane				
Texas cane	17.4%	34.5%	45.3%	60.7%
Oregon beet	15.8%	30.1%	41.7%	57.7%
Idaho beet	12.4%	31.9%	46.0%	63.1%
California beet	10.3%	26.7%	39.3%	55.9%
Nebraska beet	9.9%	24.8%	35.9%	51.8%
Louisiana cane	9.0%	25.9%	39.4%	57.8%
Michigan beet	8.2%	26.0%	40.5%	59.3%
Colorado beet	8.5%	21.6%	32.6%	47.4%
Ohio beet	7.8%	20.4%	31.3%	47.3%
Texas beet	7.6%	20.0%	31.2%	47.4%
Montana beet	6.9%	21.4%	33.4%	50.6%
Minnesota beet	6.4%	19.9%	32.0%	49.8%
Wyoming beet	6.1%	19.1%	30.6%	47.4%
North Dakota beet	5.3%	16.9%	31.1%	49.0%

<sup>a</sup>In 1991, 12 companies and 1 cooperative in Hawaii produced about 724,000 tons of sugar, or about 21 percent of all domestic cane sugar. The six largest producers accounted for 72 percent of Hawaii's production.

## No Limit to Size of Program Benefits

Unlike USDA commodity programs that provide direct payments to producers, the sugar program does not subject beneficiaries to payment limitations. For example, we estimate that one farm received over \$30 million in benefits from the sugar program in 1991. The 33 largest farms—all in Florida or Hawaii—received over \$1 million each in estimated benefits from the program that year. These 33 farms, which represent 0.2 percent of all sugar-producing farms, received approximately one-third of the entire estimated farm-level benefits from the program.

The Congress set the payment limitation on most other program crops in 1981 because of concerns about large payments to farm operators and the overall cost of federal farm programs. Sugar producers, however, are not subject to payment limitations because they do not receive a direct payment from the government. Because there is no limit on program

benefits, some individual producers realize annual benefits of millions of dollars.

Table 3.3 shows the distribution of benefits for sugar farms according to the size of the benefit. Appendix III shows a state-by-state distribution of benefits by the benefit level.

**Table 3.3: Distribution of Benefits  
According to Size of Benefit**

	<b>Number of farms</b>	<b>Percent of all farms</b>	<b>Percent of total benefits</b>
<b>Cane benefits</b>			
Less than \$50,000	1,336	8.7%	4.5%
\$50,000-\$100,000	212	1.4	3.2
\$100,001-\$500,000	106	0.7	4.2
\$500,001-\$1 million	18	0.1	2.7
Over \$1 million	33	0.2	34.0
<b>Cane total</b>	<b>1,705</b>	<b>11.0%</b>	<b>48.6%</b>
<b>Beet benefits</b>			
Less than \$50,000	12,877	83.4	35.5
\$50,000-\$100,000	690	4.5	10.2
\$100,001-\$500,000	163	1.1	5.5
\$500,001-\$1 million	1	0.01	0.2
Over \$1 million	0	0	0
<b>Beet total</b>	<b>13,731</b>	<b>89.0%</b>	<b>51.4%</b>
<b>Grand total</b>	<b>15,436</b>	<b>100.0%</b>	<b>100.0%</b>

Note: Totals may not add due to rounding.

We estimate that in 1991 the mean farm benefit from the program was \$130,000 for cane farms. The benefits for beet farms ranged from a mean of \$6,000 in Ohio to \$36,000 in California. These benefits are the amounts growers can earn beyond the amount they would earn without a sugar program and do not necessarily represent profits.

### **Higher Costs of Producing Sugar in Some States Reduce Returns**

The benefits from the sugar program are not necessarily profits; profits depend on costs of production and efficiency. The cost of producing sugar varies from cane to beet, from one region of the country to another, and from producer to producer. Producers that have lower costs of production and are more efficient realize greater profits than others that are inefficient and have higher costs of production.

**Chapter 3  
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According to USDA's ERS, the average cost of producing and processing cane sugar in Texas was 23.84 cents per pound between 1986 and 1990. Using an average market price (1986-90) of 22.2 cents per pound, Texas producers, on average, lost money.<sup>2</sup> However, producers in Florida, whose costs of production over that same period were, on average, 19.07 cents per pound, realized positive returns. By selling their sugar for 3 cents per pound above their estimated costs of production, Floridians had an average profit margin of 16 percent. As shown in table 3.4, the 5-year average (1986-90) profit margin for wholesale refined beet sugar was 23.6 percent, while the average return for raw cane sugar was 12.3 percent. This table also shows average costs of production and average returns on sales for cane and beet, and individual averages for each of the four cane-producing states.

**Table 3.4: Average Costs of Production, Average Market Prices, and Returns on Sales for U.S. Cane, U.S. Beet, and Cane-Producing States**

	Average cost of production (1986-90) <sup>a</sup>	Average market price (1986-90)	Return on sales
U.S. raw cane average	19.75¢/lb.	22.19¢/lb.	12.35%
U.S. refined beet average	21.49¢/lb.	26.56¢/lb.	23.59%
Florida raw cane	19.07¢/lb.	22.19¢/lb.	16.36%
Hawaii raw cane	22.15¢/lb.	22.19¢/lb.	0.18%
Louisiana raw cane	18.74¢/lb.	22.19¢/lb.	18.41%
Texas raw cane	23.84¢/lb.	22.19¢/lb.	-6.9%

<sup>a</sup>These costs-of-production figures represent the full economic cost of producing (growing and processing) sugar, i.e., the fixed, variable, and administrative costs and include credits for byproducts such as molasses and pulp. See app. IV for a detailed listing of the cost-of-production component items.

Although cost and returns estimates may reveal how much producers are earning above their costs, these figures are not a basis for determining support prices. Less efficient production is encouraged when the support price remains high enough to make that production feasible. For example, in an unprotected market, many of the 139 Texas cane farms that accounted for about 2 percent of total domestic sugar production in 1991 may not be able to stay in business because their costs are higher than other domestic producers' costs. However, most Florida growers, which grow sugar on 140 farms and accounted for about 26 percent of total domestic sugar production in 1991, would probably be able to stay in

<sup>2</sup>Some Texas cane sugar producers may have been able to cover their variable costs but not their full economic costs.

business since their costs of production are comparatively low. (See app. III for a state-by-state distribution of producer benefits.)

Some sugar producers we spoke with said that it would be difficult for them to stay in business without a sugar program since the lower sugar prices they would receive in an open market would probably not cover their costs of production. The sugar producers that we spoke with generally support the current program.

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## **HFCS Manufacturers Receive Benefits From the Sugar Program**

Because the sugar program keeps domestic sugar prices higher than they otherwise would be, it also benefits HFCS manufacturers, whose product is a substitute for sugar. We estimate that the benefits to HFCS manufacturers are, on average, \$548 million annually. HFCS manufacturers do not pay a premium to corn growers for corn that will be manufactured into HFCS. However, some analysts estimate that HFCS production benefits corn growers because it increases the demand for corn.

The corn sweetener industry's share of the sweetener market has increased substantially since the current sugar program became operational in 1982. In that year, corn sweeteners accounted for 35 percent of U.S. sweetener consumption. By 1991, corn sweeteners' market share had increased to over 50 percent. HFCS is the most important corn sweetener, and it is the primary reason for the large increase in corn sweeteners' market share. The price of HFCS is typically lower than sugar, as is its cost of production. By providing a price floor for domestic sugar, the U.S. sugar program has contributed to the sizeable increase in HFCS's market share.

The benefits that manufacturers of HFCS realize from the sugar program are highly concentrated. In 1990 the four largest U.S. HFCS manufacturers accounted for 87 percent of all domestic HFCS production. This high concentration is due largely to the substantial investment required to manufacture HFCS, which discourages small firms from entering the market. In 1990 USDA's ERS estimated that the cost of producing HFCS was 14 cents per pound. Between 1986 and 1990, the average market price for HFCS-55 was 19.88 cents per pound, resulting in an estimated return on production costs of 42 percent for HFCS manufacturers.<sup>3</sup>

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<sup>3</sup>HFCS-55 refers to the percentage of fructose in HFCS and is an indication of its sweetness. HFCS-55 and HFCS-42 are the two major types of HFCS.

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## **Conclusions**

Relatively few sugar and HFCS producers receive the lion's share of the sugar program's benefits. In 1991, about 150 farms—1 percent of all domestic sugar farms—received 42 percent of the entire sugar grower benefits. Similarly, four manufacturers of HFCS shared 87 percent of the HFCS industry's indirect benefits from the sugar program. These indirect benefits to HFCS manufacturers, benefits to foreign countries that export to the United States, and the deadweight loss of the program account for over one-half of the \$1.4 billion in user costs of the program.

Since there is no limit to the amount of benefits that any one sugar producer or HFCS manufacturer can receive from the sugar program, some large sugar producers and HFCS manufacturers realize millions of dollars in program benefits each year.

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## **Agency Comments**

In commenting on a draft of this report, USDA indicated that the methodology we employed was reasonable.

# Changing Domestic and International Conditions May Require Program Changes

Current trends in domestic sweetener production and consumption may require changes in the way the sugar program is operated. If domestic production continues to increase, it will become difficult for USDA to keep prices high only by controlling imports. USDA may also have to limit the amount of domestic sugar sold in the United States in order to maintain a minimum level of imports and to continue to support domestic sugar prices. However, this may cause further problems in addition to those that have already resulted from the program, such as disruptions in supplies and stress on some domestic producers.

In addition, pending international trade agreements could eventually cause changes in the U.S. sugar industry. Under NAFTA and under proposed new agreements for GATT, import quotas that support the domestic sweetener industry could be ultimately eased. NAFTA has not received final approval, and negotiations under GATT are stalled because of disputes over certain issues, including liberalizing trade in agriculture products. According to USDA, the currently proposed agreements will not have any near-term effects on its ability to shield U.S. sugar producers from increasing imports. Nevertheless, an eventual movement toward a more open market would require changes in the domestic sugar industry in order for it to compete in the long term with increasing amounts of lower-priced imported sugar.

## Changes in Production and Consumption May Make Today's Program Design Outmoded

The minimum support price and financial liquidity provided by USDA's loan program, together with productivity improvements and less attractive prices for alternative crops, are contributing to increases in domestic sugar production. These increases, coupled with only slowly increasing sugar consumption, may prevent USDA from operating the program in the future as it does today. If domestic production continues to increase, USDA will need to further lower quota imports of raw cane sugar to keep sugar prices above the forfeiture level.

Because sugar producers face no limit on the amount of benefits provided, and because they are guaranteed a minimum price for every pound of sugar produced, some sugar growers may benefit by putting more land into production. In fact, despite a decline in both raw cane and refined beet sugar prices, USDA expects 1992/93 harvested cane and beet sugar acreage to be about 12 percent higher than in 1989/90.

A number of productivity advances are contributing to greater sugar production. For example, sugar planting and harvesting have become

much more mechanized, decreasing the labor costs of sugar production. Yields may increase as sugar producers use improved plant hybrids and employ new techniques in sugar extraction. In the beet industry, new molasses de-sugarization techniques are improving sugar-processing recovery rates. USDA estimates that during 1992/93 a total of 250,000 additional tons of sugar will be recovered using this new technology.

Sugar consumption steadily declined until 1986 as less expensive HFCS displaced sugar. As losses to HFCS slowed, sugar consumption rose to an estimated 8.29 million short tons in 1992 from a low of 7.35 million in 1986, largely because of population and income growth.

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### Production and Consumption Changes Created Need for Marketing Allotments

By 1990 the Congress began to anticipate some problems as domestic sugar production increased faster than consumption, such as (1) an erosion of imports, (2) losses to the cane refining industry because of fewer raw sugar imports, and (3) the possible inability to support prices merely by controlling imports. That year, the Congress established marketing allotments to limit the sale of domestically produced sweeteners under certain conditions. If USDA determines that anticipated fiscal year imports of sugar for U.S. consumption will be less than the minimum established level—1.25 million tons—the agency will use domestic marketing allotments to limit the amount of domestic sugar and crystalline HFCS that can be sold in the United States. These restrictions are designed to maintain a minimum supply of imported raw cane for manufacturing by the domestic cane refining industry and prevent sugar prices from falling below the forfeiture level.

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### Marketing Allotments May Cause Problems

Marketing allotments may disrupt the normal flow of sugar through the economy and may increase the delivered cost of sugar to industrial users. It is less clear what effect allotments will have on domestic sweetener producers. Administrative costs for both the sweetener industry and the federal government will increase if allotments are used.

A representative of the sweetener users industry told us that allotments will hurt industrial users because of the uncertainty allotments may create. He said that their transaction costs will increase because they will have a more difficult time forward-purchasing sugar. Some sweetener users said that costs could increase because their normal suppliers may not be able to sell all the sugar that they produce and may be prevented from meeting contractual commitments. They said that they could go to more distant

suppliers to purchase their sugar, but higher freight charges will increase costs.

It is not clear what effect marketing allotments will have on the domestic sweetener-producing industry. Some USDA officials have noted that the potential for allotments may dissuade new industry entrants and could affect the investment decisions of companies already in the sugar business. Allotments could particularly hurt companies that have invested in technical improvements that have increased capacity and efficiency. It is possible that less efficient producers would benefit from allotments because allotments could slow the production increases of more efficient producers. Since the amount of crystalline HFCS that is sold will also be restricted, the research and development of products that would use crystalline HFCS would be slowed.

Marketing allotments will increase administrative costs of the program to sweetener producers and the government. If allotments go into effect, USDA may have to spend more time monitoring supply and distribution data and spend time verifying compliance and enforcing allotments. Further, to implement allotments, the Congress has required an increase in supply and distribution information from the processing industry. Industry participants told us that much of the information is unnecessary and shifts personnel from their normal duties to data collection activities.

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## **Impending Trade Agreements May Prevent the Program From Operating as Designed in 1981**

As the United States enters into new international trade agreements such as NAFTA and expands GATT, it will not be able to insulate its farmers from competition as it has in the past. Many U.S. crops will have access to larger markets and greater sales. However, as sugar import barriers are eased in the long run, domestic sugar may not be as competitive with sugar sold in freer markets. NAFTA has not received final approval, and negotiations have not been completed on GATT because of disputes over certain issues. If these agreements do not receive final approval, USDA stated that it will still be able to shield U.S. sugar producers from increasing imports in the near term. Nevertheless, an eventual movement toward a more open market would require changes in the domestic sugar industry in order for it to compete in the long term with increasing amounts of lower-priced imported sugar.

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## **NAFTA Will Ease Trade Barriers and May Affect U.S. Sugar Industry**

The United States, Mexico, and Canada have signed the North American Free Trade Agreement. If formally approved by each nation, the agreement will allow greater trade among the three countries and is expected to

boost their economies over the long term. Under NAFTA, trade barriers would be removed gradually to allow countries to adjust to freer market conditions. The agreement will not have a near-term effect on U.S. sugar producers, according to USDA.

Under the current NAFTA proposal, the United States and Mexico will reduce barriers to sugar trade between the two countries gradually and harmonize their border protection with respect to the rest of the world. By the end of the 15-year NAFTA transition period, all tariffs, quotas, and licenses that act as barriers to agricultural trade between the United States and Mexico will be eliminated.

During the transition period, any additional duty-free access of sugar to the U.S. market beyond Mexico's current quota will be conditional on Mexico's becoming a net surplus producer of sugar. For the first 6 years of the agreement, duty-free access may not be more than 25,000 metric tons, raw value. If Mexico were to increase its exports to the United States from the 1992 level of 7,878 tons, the overall U.S. import level would not necessarily increase; rather, individual quota levels for other countries exporting to the United States would be lowered. In year 7 of the agreement, if Mexico is a net surplus producer, duty-free access will be limited to 150,000 metric tons. In each subsequent year of the transition period, access will increase by 10 percent. This cap is replaced with Mexico's projected net surplus production after 6 years if Mexico achieves net producer surplus status for 2 consecutive years.

It is unclear how Mexico's sugar production and consumption will affect U.S. sugar producers. Mexico is a sugarcane-producing country that also relies on imports to meet domestic demand. According to a September 1992 USDA report on the Mexican sugar industry, both expansion and contraction of Mexican sugar production are possible. Sugar production costs are higher in Mexico than they are in the United States; however, Mexico has land on which to expand sugarcane acreage, and costs could decline through economies of scale and improved technologies, which will increase yields.

According to the report, as Mexican wealth increases, sweetener consumption is expected to expand. An increase in Mexican sugar consumption could limit the ability of Mexico to become a net exporter. However, if HFCS displaces sugar in some products, as it has in this country, consumption of sugar could fall and Mexico could require less

sugar to meet domestic demand. This could contribute to Mexico's shifting from a net importer of sugar to a net exporter.

Over the long run, Mexico's production trends and ability to export to the United States will depend on the relative profitability of sugar compared with other crops. The USDA report noted that Mexico could increase its own imports to 2.7 million tons under a low production-high consumption scenario. Alternatively, Mexico could have an exportable surplus of 500,000 tons in 1996 under a high production-low consumption scenario. However, USDA analysts said that the likelihood of Mexico becoming a net exporter of sugar over the next 5 years is quite low.

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### **Proposed GATT Agreements Could Reduce Import Barriers on Sugar**

During the Uruguay Round of GATT, the United States called for more open trading conditions. Agreement on this accord is still questionable, in large part because of disputes between the United States and the European Community over farm subsidies. As of April 1993, the proposed agreement to bring current GATT negotiations to closure provides that reductions in internal farm supports be measured on a total basis, rather than commodity by commodity. Consequently, even if a new GATT agreement based on the current proposal is adopted, USDA will still be able to provide considerable support for individual products such as domestic sugar, at least in the short-term. However, a movement toward a more open market could make the current program inoperable at some future date.

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### **Conclusions**

Changes in domestic and international conditions may prevent the sugar program from operating as it does today. Three trends have occurred in response to supported domestic sugar prices that may make it difficult for the sugar program to continue to operate as it currently does:

- (1) lower-cost corn sweeteners have displaced demand for sugar;
- (2) domestic sugar consumption has increased only slowly, largely with population growth; and
- (3) domestic sugar production has continued to increase despite lower prices over the past 2 years.

The recent improvements in beet sugar production and the potential for improved sugar substitutes will exacerbate these trends. Because of these factors, USDA may determine anticipated fiscal year imports of sugar to be less than 1.25 million tons. This would cause USDA to use marketing allotments to restrict the amount of domestic sugar that can be sold in this country. While it is too soon to tell, international trade agreements may cause program modifications over the long term, since they would require a gradual easing of trade barriers and a reduction of internal support prices.

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**Recommendation to  
the Congress**

Because of the additional user costs of the sugar program and the possibility that it will not operate in the future as it does today, the Congress needs to consider legislation to move the sugar industry toward a more open market. As part of this transition, the market price for sugar should be lowered. To achieve a lower market price, we recommend that the Congress gradually lower the loan rate for sugar and direct USDA to adjust import quotas accordingly. Reducing the loan rate gradually would allow producers time to make orderly adjustments.

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**Agency Comments  
and Our Evaluation**

USDA agreed that upcoming trade agreements are likely to make the current program inoperable at a future date but stated that there will be no near-term effects on the ability of the United States to shield its domestic sugar producers from increasing imports. We have included additional information on GATT and NAFTA to clarify this point. Also, where appropriate, we have incorporated USDA's comments into the body of this report. USDA's comments appear in their entirety in appendix V, along with our detailed responses to them.



# GAO's Technical Economic Analysis of the Sugar Program

This appendix discusses how GAO measured the welfare gains and losses from the U.S. sugar program that were reported in the body of this report. Under the program, producers' incomes are supported primarily through transfers (in effect a tax) from users to producers in the form of higher prices for sugar. The U.S. Department of Agriculture (USDA) keeps domestic prices above sugar forfeiture levels by restricting the supply of lower-priced foreign sugar on the U.S. market through a tariff-rate import quota.

According to our estimates, between 1989 and 1991, the program resulted in average annual consumer losses of approximately \$1.4 billion and average total producer gains of over \$1 billion. During this period, we estimate rents to foreign exporters averaged \$166 million annually, while average deadweight losses were \$110 million. We calculated all gains and losses for the caloric sweetener market, which includes high fructose corn syrup (HFCS).<sup>1</sup> Manufacturers of HFCS benefit from the sugar program because they can charge higher prices for a commodity that competes directly with sugar. The consumer loss and producer benefits for the total sweetener market give a more accurate picture of the entire effects of the sugar program.

In the first section, we explain the theoretical framework that we used to examine the welfare consequences of the U.S. sugar program. Second, we discuss the data and data sources employed to obtain our estimates. Third, we present the results of the welfare analysis of the sugar program.

## Theoretical Framework for Sweetener Welfare Estimates

To estimate the change in consumer surplus, producer surplus, and net welfare loss from the U.S. sugar program, we employed a partial equilibrium model of the U.S. sweetener market.<sup>2</sup> We estimated gains and losses by calculating the difference in welfare, starting from the current U.S. program position and going to a position of essentially free markets in sugar. We used standard Marshallian measures (holding money income constant) of producer and consumer welfare in this analysis since sweeteners are generally a small part of total consumer purchases. Our analysis employed mathematical integration to determine the areas of consumer loss and producer gains. In addition, the losses in this analysis

<sup>1</sup>USDA includes glucose syrup, dextrose, honey, and edible syrups in its estimates of total caloric sweeteners. However, we do not include them in this analysis because they have very specific and limited uses, are not as substitutable as HFCS and sugar, and account for a relatively small share of the caloric sweetener market.

<sup>2</sup>The theoretical framework we use is based on "Gains and Losses of the U.S. Sugar Program," unpublished draft by Rehka Mehra while at Economic Research Service, USDA, 1990.

aggregated HFCS and sugar losses.<sup>3</sup> We calculated welfare gains and losses using elasticity estimates developed in the literature.

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### Changes in Consumer Surplus and Producer Surplus

In order to calculate changes in consumer and producer surplus, we assumed an exponential form of the constant elasticity demand and supply equations:<sup>4</sup>

$$(1) Q_d = e^{\alpha} p^{\eta}$$

$$(2) Q_s = e^{\beta} p^{\epsilon}$$

where,

$Q_d$  = Quantity demanded

$Q_s$  = Quantity supplied

$e = 2.71828$  ( $e$  is the base of the natural logarithmic function)

$\alpha$  = a demand shifter, when linearized represents the intercept term for the demand equation

$\beta$  = a supply shifter, when linearized represents the intercept term for the supply equation

$p$  = price

$\eta$  = the price elasticity of demand

$\epsilon$  = the price elasticity of supply

In figure I.1, the change in consumer surplus by going to a "no program" situation is the area under the sweetener demand curve and between the domestically supported sweetener price,  $P_D$ , and a long-run equilibrium

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<sup>3</sup>Other analysts have shown that these total losses are less than if sugar were the only caloric sweetener available for consumption.

<sup>4</sup>A constant-elasticity functional form is one in which the elasticity of supply or demand is assumed to be a constant parameter over the relevant range of the function.

world sweetener price,  $P_w$ .<sup>5</sup> Thus, we measured consumer surplus loss from higher domestic prices by integrating over the area  $-P_D abP_w$  in figure I.1. The definite integral, which represents this area is:

$$(3) \Delta CS = \int_{P_w}^{P_D} e^{\alpha} P^{\eta} dP$$

Evaluating from  $P_D$  to  $P_w$ :

$$(4) \Delta CS = (e^{\alpha}/\eta + 1) * [P_D^{\eta+1} - P_w^{\eta+1}].$$

We measured gains to sweetener producers by calculating the area between the two prices,  $P_D$  and  $P_w$ , and to the left of the supply function. In figure I.1, this area is  $P_D dcP_w$ . We calculated the change in producer surplus by integrating over this area using the definite integral:

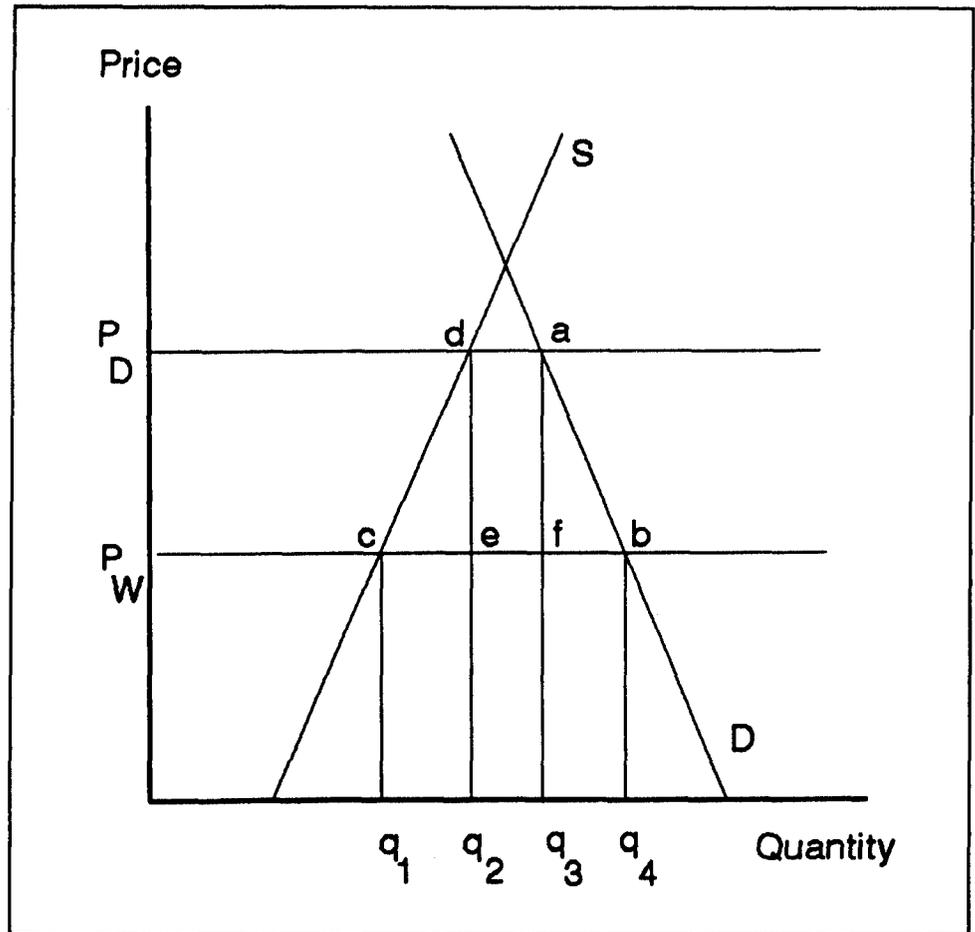
$$(5) \Delta PS = \int_{P_w}^{P_D} e^{\beta} P^{\epsilon} dP$$

Evaluating from  $P_D$  to  $P_w$ :

$$(6) \Delta PS = (e^{\beta}/\epsilon + 1) * [P_D^{\epsilon+1} - P_w^{\epsilon+1}].$$

<sup>5</sup>A long-run equilibrium world sweetener price is a global price that would occur under free market conditions after all adjustments have taken place. Under these conditions, world price would be higher than the current world price due to 1.) greater import demand from countries that now support domestic sugar and 2.) a reduced quantity of sugar produced and exported by countries with high support prices.

Figure I.1: Effect of the Sugar Program  
 on the Domestic Sweetener Market



- $P_D$  = Domestic market support price for total sweeteners
- $P_W$  = World long-run wholesale refined price of sugar
- $q_4 - q_1$  = Quantity of sugar imported at free trade price
- $q_3 - q_2$  = Quantity of quota imports
- cdab = Net national loss
- edaf = Quota rents to foreign exporters
- abf = Consumption deadweight loss
- cde = Production deadweight loss

**Calculation of Net National  
Loss, Quota Rents, and  
Deadweight Loss**

Figure I.1 also shows the net national loss, which consists of that amount not represented by a transfer from domestic consumers to domestic producers. Net national loss includes two portions: that which is lost to foreign exporters and deadweight loss.<sup>6</sup> In figure I.1, net national loss is area **cdab**. In order to calculate net national loss (NNL), we subtracted the change in producer surplus ( $\Delta PS$ ), area  $P_DdcP_w$  in figure I.1, from the change in consumer surplus ( $\Delta CS$ ), area  $P_DabP_w$ .

$$(7) \text{ NNL} = \Delta CS - \Delta PS$$

or graphically,

$$\text{area } cdab = \text{area } P_DabP_w - \text{area } P_DdcP_w.$$

Rents or gains to foreign quota holders are represented in figure I.1 by the area **edaf** with a quota quantity equal to  $q_3 - q_2$ . We calculated these gains as the difference between the domestically supported price and the long-run world liberalized price times the amount of the quota imports (see table I.4).

Total deadweight loss is the sum of the areas **cde** and **abf** in figure I.1. The area **cde** is a production deadweight loss and represents the cost of shifting resources to pay for more expensive domestic production rather than to import additional sugar. Area **abf**, the consumption deadweight loss, represents the loss to consumers in the importing nation resulting from a reduction in total sugar consumption. Without the quota, consumers could have purchased quantity  $q_4$  of sugar at the world price. We calculated total deadweight loss (DWL) by subtracting rents to foreign quota holders (QR) from the net national loss (NNL).

$$(8) \text{ DWL} = \text{NNL} - \text{QR}$$

or graphically:

$$\text{Areas } abf + cde = \text{area } cdab - \text{area } edaf.$$

<sup>6</sup>Some sugar analysts note that these foreign quota rents are a desirable part of the program and actually provide a form of foreign aid to sugar-producing countries. Others say that this is an inefficient transfer at best and at worst has actually hurt sugar-producing countries by severely reducing the sugar quota. The government is actually capturing a small portion of these rents in the form of a tariff of 0.625 cents per pound under the tariff-quota. However, many countries that export sugar to the United States are beneficiaries of the Generalized System of Preferences or the Caribbean Basin Initiative and pay zero duty.

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## Data Sources for Data Elements

We used data on sweetener demand and supply elasticity estimates, U.S. sweetener quantity and price data, and the shift parameters in the welfare calculations. U.S. price and quantity data are from USDA sugar and sweetener publications. Finally, using information on U.S. demand and supply elasticities and price and quantity data, we calculated the shift parameters needed in the welfare analysis.

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## Demand and Supply Elasticities Used

We obtained estimates for the elasticities of supply and demand from a range of estimates gathered from a literature review of sweetener welfare models and sweetener supply and demand models. These are listed in table I.1. A large range of demand elasticities were found in the literature,  $-0.05$  to  $-0.62$ , depending upon whether the elasticity was for industrial or household use, or short run or long run. The smaller elasticities (in absolute value) represent the shorter-term or single commodity goods, while the larger elasticities (in absolute value) represent longer-term elasticities or combined goods (i.e., sugar and sweeteners). Also, household demand is more inelastic, while industrial demand is more elastic. For overall sweeteners, the demand elasticity is quite inelastic. We used  $-0.05$  for our total sweetener demand elasticity estimate because this elasticity was found in several studies, and we focused on the total sweetener market for this analysis.

The range for the supply elasticities is much larger—from  $0.1$  to over  $2.0$ —depending again upon short-run and long-run elasticities. Beet sugar is more supply-responsive than cane sugar because of cane's land and water constraints. For this study, we used the full range of supply elasticities in our analysis as taken from the literature. The sources are listed at the end of this appendix.

**Appendix I**  
**GAO's Technical Economic Analysis of the**  
**Sugar Program**

**Table I.1: Range of Demand and Supply Elasticities**

<b>Author</b>	<b>Demand elasticity</b>	<b>Supply elasticity</b>
Jesse and Zepp, 1977		0.10
Carman, 1982	-0.05 (SR) <sup>a</sup> caloric sweeteners	
Vroomen et al, 1986	-0.114	
FTC, 1984	-0.20	
Huang, 1985	-0.052 (household)	
Langley and Zellner, 1986	1967-76 -0.08 1977-84 -0.31	0.14
Sudaryanto, 1987	-0.62 (industrial) -0.09 (household)	beet 0.70 (SR) cane 0.17 (SR) beet 2.29 (LR) <sup>b</sup> cane 0.74 (LR)
Lin and Novick, 1988	-0.05 (SR) (sweeteners)	
Lord, 1988		0.20
Lopez, 1989	-0.111 (SR) -0.597 (LR)	beet 0.479 (SR) cane 0.231 (SR) beet 1.201 (LR) cane 0.579 (LR)
Roningan and Dixit, 1989	-0.24	0.5
ABARE, 1990 <sup>c</sup>	-0.05 caloric sweeteners	0.6 sugar
Marks, 1991	-0.122 (LR) caloric sweeteners	beet 1.701 (LR) cane 0.289 (LR)
Haley, Vivien, and Sigua, 1992	-0.473 (refined)	beet 0.37 cane 0.20

Note: All elasticities are for sugar except where noted otherwise

<sup>a</sup>Short-run elasticity

<sup>b</sup>Long-run elasticity

<sup>c</sup>Australian Bureau of Agricultural Resource Economics, Sturgiss, Field, and Young.

**Quantity Data Used in the Model**

For the total caloric sweetener market, we used USDA estimates of U.S. sugar and HFCS consumption figures for 1989, 1990, and 1991 (table I.2). In order to obtain total domestic sweetener supply, we subtracted the refined equivalent of the raw sugar quota as well as net HFCS imports for these

years. In order to translate to the refined sugar equivalent, we divided raw sugar quantities by the conversion factor, 1.07, because approximately 7 percent of raw sugar is lost in the refining process.

Product in thousands of short tons, dry weight

Table I.2 Total Caloric Sweetener Consumption and Supply

Year	Sweetener consumption <sup>a</sup>		Total sweetener consumption <sup>b</sup>	Sugar quota imports <sup>a</sup>	Net HFCS imports <sup>a</sup>	Total sweetener supply <sup>b</sup>
	HFCS	Sugar				
1989	6,022	7,761	13,783	1,162	98	12,523
1990	6,130	8,051	14,181	1,999	16	12,166
1991	6,260	8,050	14,310	1,918	8	12,384

<sup>a</sup>Data from Sugar and Sweetener Situation and Outlook Report, Sept., 1992, tables 50, 43, and 36; pp. 50, 47, and 44. Sugar quota imports were divided by 1.07 to obtain a refined level.

<sup>b</sup>These estimates of sweetener consumption and supply were calculated by GAO using the above USDA figures.

## Price Data Used in the Model

We calculated the quota price premium for the total caloric sweetener market as the difference between a U.S. domestic sweetener price and an estimated long-run world refined price for sweeteners. More specifically, the quota price premium for the total caloric sweeteners market was the difference between the average of the U.S. price of HFCS-42 and HFCS-55 and wholesale refined sugar (weighted by consumption) and the estimated long-run world refined price for these commodities.<sup>7</sup> Both domestic and world prices were adjusted by the Gross Domestic Product-Implicit Price Deflator using 1991 dollars.

For the domestic sweetener price, we used an average, weighted by consumption, of HFCS-42, HFCS-55, and wholesale refined sugar prices for 1989, 1990, and 1991. HFCS-42 and HFCS-55 prices are wholesale list prices, based on the Midwest market annual averages. The U.S. wholesale refined sugar price is also the Midwest market average. Both domestic HFCS and sugar prices are taken from USDA Situation and Outlook documents.

In order to calculate a world refined price, we assumed a long-run equilibrium world raw sugar price of 15 cents per pound, which was suggested by several experts in the field as well as by USDA documents. A transportation rate of 1.5 cents per pound was added to this price for a

<sup>7</sup>HFCS-55 refers to the percentage of fructose in HFCS and is an indication of its sweetness. HFCS-55 and HFCS-42 are the two major types of HFCS.

landed price of 16.5 cents per pound. To this price, we added a refining spread of 4 cents per pound.<sup>8</sup> This brought the estimated world long-run wholesale refined price to 20.5 cents per pound. We assumed that with a free market in sugar, HFCS would match this price.

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### Calculation of Shift Parameters

The last piece of information that we needed in order to calculate consumer and producer surplus changes were the shift parameters,  $\alpha$  and  $\beta$ . These parameters, when linearized, are the intercept terms for the demand or supply equations. We calculated the shift parameters by using estimates of the elasticities of supply and demand, and quantities demanded and supplied at the U.S. price. In order to proceed, we transformed the demand equation into a linear form, using natural logarithms:

$$(9) \ln Q_d = \alpha(\ln e) + \eta(\ln P)$$

And, since  $\ln(e) = 1$ ,

$$(10) \ln Q_d = \alpha + \eta(\ln P)$$

Solving for  $\alpha$ :

$$(11) \alpha = \ln Q_d - \eta(\ln P), \text{ assuming } \eta \text{ is negative.}$$

We solve for the shift parameter for the supply equation,  $\beta$ , in a similar fashion. The equation for  $\beta$  is:

$$(12) \beta = \ln Q_s - \epsilon(\ln P)$$

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### Welfare Model Results

Incorporating the information on elasticities, price and quantity data, and shift parameters, we estimated consumer loss and producer gain by mathematically integrating over the appropriate areas (expressions 4 and 6). As explained above, we calculated net national losses as the difference between consumer surplus loss and producer gains (expression 7). Quota rents to foreign exporters equals the price differential between the domestic and world refined sweetener price times the amount of the quota imports for the year. To obtain deadweight losses for each year, we subtracted quota rents to foreign exporters from net national losses (expression 8).

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<sup>8</sup>Both the transportation rate and the refining spread were from USDA documents.

**Estimates of Producer Gains and Consumer Losses**

Estimates of consumer loss range from a high of \$1.7 billion in 1990 to over \$1.1 billion in 1991. Average consumer losses for the 3 year period—1989, 1990, and 1991—were approximately \$1.4 billion.

We apportioned the producer gains between HFCS and sugar by their percent of production. Over this period of analysis, the percentage of production between HFCS and sugar was divided into approximately 50 percent for each. As table I.3 shows, average gains to sugar producers from 1989 to 1991 represent about half of average total gains to all sweetener producers. Between 1989 and 1991, average gains represented less than one-half, or 40 percent, of the \$1.4 billion average yearly costs to sweetener users. Average gains to total sweetener producers were \$1.1 billion. Gains to HFCS producers averaged \$548 million, 40 percent of average total consumer loss.

**Table I.3: Producer Gains and Consumer Losses for the Total Sweetener Market**

1991 dollars in millions				
Year	Sweetener	Producer gain	Total producer gain ( $\epsilon=0.1 - 2.0$ )	Total consumer loss ( $\eta = -0.05$ )
1989	Sugar	\$597	\$1,031-\$1,234	\$1,378
	HFCS	551	1,148 Avg.	
1990	Sugar	650	1,165-1,448	1,718
	HFCS	677	1,327 Avg.	
1991	Sugar	435	780-904	1,058
	HFCS	417	852 Avg.	
Average, 1989-91	Sugar	561	1,109	1,385
	HFCS	548		

**Estimates of Net National Loss, Quota Rents to Exporters, and Deadweight Loss**

Estimated net national loss, quota rents for the tariff-rate quota, and deadweight loss for the years 1989, 1990, and 1991 are shown in table I.4. Net national loss, composed of gains to foreign exporters and deadweight losses, represented approximately 20 percent of total losses from the program. Of the \$276 million, 3-year average net national loss, 60 percent was transferred to foreign quota holders, while approximately 40 percent was sheer domestic deadweight loss.

**Table I.4 Net National Loss, Quota Rents, and Deadweight Losses, 1989-91**

1991 dollars in millions

Year	Net national loss	Quota rents	Deadweight loss
1989	\$230	\$116	\$114
1990	391	241	150
1991	206	141	65
3-year average	276	166	110

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# Summary of Economic Studies Reviewed by GAO

**Table II.1: Estimates of Consumer Losses, Producer Gains, and Net Losses for the Economic Studies Reviewed**

1991 dollars in millions

Author and date	Period of data	Consumer losses	Producer gains	Net losses
Gemmill, 1977	1974	859	599	86
Federal Trade Commission, 1984	1983	987	556	338
Dardis and Young, 1985	1983 (FY)	2,520 <sup>a</sup> 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 <sup>b</sup> to 2,150	227 to 776	272 to 1,320
Maskus, 1989	1986/87	1,520 to 2,340	818 to 982	538 to 1,520
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 <sup>c</sup> 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 <sup>d</sup> - 3,620	1,130- 1,380	968 to 979

(continued)

**Appendix II  
Summary of Economic Studies Reviewed by  
GAO**

1991 dollars in millions

<b>Author and date</b>	<b>Period of data</b>	<b>Consumer losses</b>	<b>Producer gains</b>	<b>Net losses</b>
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 and listed at the end of this appendix 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.

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

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

‡These estimates of consumer loss, producer gains, and net loss are with HFCS substitution.

§These figures represent lower and upper bounds of consumer loss, producer gains, and net loss.

## **Studies That Measure Gains and Losses From the U.S. sugar Program**

Australian Bureau of Agricultural and Resource Economics. 1990 and US Sugar Policy Reform. Discussion Paper 90.4. Canberra, Australia: 1990.

Borrell, Brent, Robert Sturgiss, and Gordon Wong. Global Effects of the US Sugar Policy. Discussion Paper 87.3. Bureau of Agricultural Economics. Canberra, Australia: 1987.

Dardis, Rachel and Carol Young. "The Welfare Loss from the New Sugar Program." The Journal of Consumer Affairs, Vol. 19, No. 1 (1985).

Aggregate Costs to the United States of Tariffs and Quotas on Imports: General Tariff Cuts, and Removal of Quotas on Automobiles, Steel, Sugar, and Textiles. David G. Tarr and Morris E. Morkre. Bureau of Economics Staff Report, Federal Trade Commission. Dec. 1984.

Effects of U.S. Import Restraints on Agricultural and Other Products: General Equilibrium Results. Posthearing Submission to United States International Trade Commission. Investigation No. 332-262. Bureau of Economics, Federal Trade Commission. May 1990.

Gemmill, Gordon. "An Equilibrium Analysis of U.S. Sugar Policy." American Journal of Agricultural Economics, (Nov. 1977), pp. 609-618.

Langley, Suchada V., and James A. Zellner. "Government Intervention and Technological Change in the Sweetener Industry: A Welfare Analysis." Paper prepared for the Southern Agricultural Economics Association conference, Orlando, Florida, Feb. 2-5, 1986.

Leu, Gwo-Jiun M., Andrew Schmitz, and Ronald D. Knutson. "Gains and Losses of Sugar Program Policy Options." American Journal of Agricultural Economics, (Aug. 1987), pp. 591-602.

Lord, Ronald C. Estimation of Welfare Effects of U.S. Sugar Policy with Time-Varying Parameters. Ph.D. Dissertation, Oklahoma State University, Dec. 1988.

Marks, Stephen V. "A Reassessment of Empirical Evidence on the U.S. Sugar Program." Paper presented at the U.S. State Department Conference on "Sugar Markets in the 1990s," May 23, 1990.

Maskus, Keith E. "Large Costs and Small Benefits of the American Sugar Programme." World Economy, Vol. 12, No. 1 (1989), pp. 85-104.

Mehra, Rekha. Gains and Losses From the U.S. Sugar Program. Unpublished Draft, 1990.

Neff, Stephen A. and Timothy E. Josling. Economic Effects of Removing U.S. Dairy and Sugar Import Quotas. Discussion Paper Series No. FAP 92-01. Resources for the Future, Washington, D.C. Oct., 1991.

U.S. Department of Commerce. International Trade Administration. United States Sugar Policy: An Analysis. Prepared by Ralph Ives and John Hurley. Apr. 1988.

U.S. International Trade Commission. The Economic Effects of Significant U.S. Import Restraints, Phase II: Agricultural Products and Natural Resources. USITC Publication 2314. Sept. 1990.

# State-By-State Distribution of Program Benefits

Table III.1 shows the distribution of sugar program benefits by state. For example, 84.2 percent of the farms in Louisiana have benefits of less than \$50,000, while 15 percent of the farms in Florida have benefits of over \$1 million. The total number of farms is listed in parentheses after the state name. These are conservative estimates since many large cane growers own mills and many beet growers are members of processing cooperatives. Producers that are vertically integrated realize greater program benefits. Table 3.2 of this report shows the distribution of benefits among growers for the upper 1, 5, 10, and 20 percent of farms.

**Table III.1: Percentage Distribution of Benefits by State and Benefit Level, 1991**

State (number of farms)	\$50,000- \$100,000	\$100,001- \$500,000	\$500,001- \$1 mil	Over \$1 mil
Fla. (140)	22.9%	20.0%	30.7%	15.0%
La. (1,413)	84.2	11.8	3.9	0
Hawaii (13) <sup>a</sup>	0	0	7.7	92.3
Tex. Cane (139)	82.0	12.2	5.0	0
Calif. (808)	80.7	13.7	5.4	0
Colo. (827)	99.3	0.6	0.1	0
Ida. (2,082)	91.2	6.2	2.5	0
Mich. (2,130)	97.9	1.9	0.2	0
Minn. (2,011)	87.2	11.1	1.7	0
Mont. (825)	97.6	2.2	0.2	0
N.D. (1,201)	88.8	9.9	1.3	0
Nebr. (1,279)	98.3	1.3	0.4	0
Ohio (400)	99.8	0.3	0	0
Oreg. (401)	97.8	1.5	0.7	0
Tex. Beet (686)	98.7	1.2	0.1	0
Wyo. (1,081)	99.0	1.0	0	0

Note: Totals may not add due to rounding.

<sup>a</sup>12 companies and 1 grower-owned cooperative produce sugar in Hawaii.

# Costs of Sugar Production

<b>Raw cane sugar</b>	<b>Refined beet sugar</b>
<b>Production costs</b>	<b>Production costs</b>
<b>Variable cash expenses</b>	<b>Variable cash expenses</b>
seed	seed
fertilizer	fertilizer
chemicals	chemicals
custom	custom
operations	operations
fuel	fuel
repairs	repairs
hired labor	hired labor
noncash benefits	noncash benefits
purchased irrigation water	purchased irrigation water
miscellaneous	miscellaneous
hauling allowance	hauling allowance
<b>Fixed cash expenses</b>	<b>Fixed cash expenses</b>
general farm overhead	general farm overhead
taxes and insurance	taxes and insurance
interest	interest
<b>Capital replacement</b>	<b>Capital replacement</b>
<b>Returns to owned inputs</b>	<b>Returns to owned inputs</b>
operating capital	operating capital
nonland capital	nonland capital
net land return	net land return
unpaid labor	return to coop share unpaid labor
<b>Processing costs</b>	<b>Processing costs</b>
<b>Variable cash expenses</b>	<b>Variable cash expenses</b>
cane transportation	beet acquisition
processing labor, fuel, and supplies	processing labor, fuel, and supplies
repairs and maintenance	repairs and maintenance
labor benefits	labor benefits
marketing	marketing
interest	interest
<b>Fixed cash expenses</b>	<b>Fixed expenses</b>
depreciation	depreciation
taxes and insurance	taxes and insurance
interest	interest

(continued)

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**Appendix IV  
Costs of Sugar Production**

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<b>Raw cane sugar</b>	<b>Refined beet sugar</b>
General and administrative	General and administrative
labor	labor
nonlabor	nonlabor
	Pulp drying and marketing

---

Note: These are the component items ERS uses to calculate raw cane sugar and refined beet sugar.

# Comments From the U.S. Department of Agriculture

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



DEPARTMENT OF AGRICULTURE  
OFFICE OF THE SECRETARY  
WASHINGTON, D.C. 20250

MAR 26 1993

Mr. John W. Harman  
Director, Food and Agriculture Issues  
U.S. General Accounting Office  
Washington, DC 20548

Dear Mr. Harman:

I appreciate being able to provide your office with the Department's comments on the proposed GAO report, Sugar Program: Changing Domestic and International Conditions Require Program Changes.

Overall, this is a reasonable report with no major data problems. The costs and benefits, derived using assumptions of hypothetical policy alternatives, are well within the range of most research.

The report emphasizes a view that upcoming international agreements are likely to make the sugar program inoperable in its current form at some future date. As a general statement that is probably a fair conclusion.

However, the specifics of the Dunkel Text, as modified by the Blair House Agreement, and of the NAFTA text will not have a near-term effect on the U.S. Government's ability to shield the domestic market from increasing imports.

In its current status (post Blair House), the proposed GATT agreement on agriculture would require no reduction in the loan rate and no change in the administration of the tariff-rate quota for sugar (contrary to what is stated on page 44). The Blair House Agreement provides that internal support will be measured on a total basis, rather than commodity by commodity. Because of the credit we already have from previous cuts for various products, we would not have to make any cuts in internal support for sugar. Regarding the tariff-rate quota, our position is that it is a tariff barrier not subject to tariffication. Our obligations thus are limited to a minimum 15 percent reduction of the tariffs on sugar (from 16 cents a pound to 13.6 cents for the high-tier tariff) and sugar-containing products, and tariffication of the Section 22 quotas on sugar-containing products. It is possible that the level of high-tier tariffs on these quotas might allow some leakage into the U.S. market.

The NAFTA has a provision to cap duty-free imports from Mexico at 25,000 metric tons for the first 6 years of the agreement (less if Mexico is not a net surplus producer) and at 150,000 metric tons with 10 percent annual increases thereafter. This cap is replaced with Mexico's projected net surplus

See comment 1.

Appendix V  
Comments From the U.S. Department of  
Agriculture

Mr. John W. Harman

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production after 6 years if Mexico achieves net producer surplus status for 2 consecutive years. At the end of 15 years there will be free-trade in sugar between the two countries. If Mexico were to become a major net surplus producer, then there would likely be repercussions for the domestic program.

A set of page-specific and general technical comments is enclosed.

Sincerely,



MIKE ESPY  
Secretary

Enclosure

Appendix V  
Comments From the U.S. Department of  
Agriculture

U.S. Department of Agriculture  
Comments on

**SUGAR PROGRAM: Changing Domestic and International Conditions  
Require Program Changes (GAO/RCED 93-94)**

Comments on specific pages:

See comment 2.

**Executive Summary, page 1:** For over 200 years the U.S. has intervened in sugar trade, but raising revenue is now incidental to the sugar program.

See comment 3.

**Executive Summary page 2, and page 11:** The correct industry composition is 40 cane processing companies (42 mills) and 12 beet processing companies (36 factories).

See comment 4.

**Executive Summary, page 5:** The phrase "...direct the USDA to adjust import quotas accordingly" implies a potential directive which might be inconsistent with other program provisions. Current sugar program authorities allow actions on both foreign and domestic supply, but the room for USDA discretion in setting the import quota could be limited. For example, the "no-cost" provision could conflict with any directive to "adjust quotas accordingly."

See comment 5.

**Executive Summary page 5, and page 45:** The word "transition" seems awkward as a verb. Perhaps "prepare" or "phase in" would be better.

See comment 6.

**Page 16:** It should be noted, perhaps in a footnote, that many processors do not take out loans, and therefore the phrase "Growers generally receive 60 percent of the loan at that time..." would not apply to them. Furthermore, by not taking out loans from USDA, the processor would not be obligated to pay growers the statutory minimum price for sugarbeets (or sugarcane). Regardless of when growers are paid, growers do ultimately receive about 60 percent of total receipts from the sale of sugar, and processors about 40 percent. These shares are a world-wide phenomenon, and reflect the relative costs of growing and processing, respectively.

See comment 7.

**Page 21:** The per-pound benefit of 5 cents is reasonable. However, it is not clear from the footnote whether it is refined or raw sugar, or a "blend." It should be made clear to the reader that since no HFCS is involved here, the analysis of the distribution of producer benefits involves a different methodology from the estimation of overall costs and benefits, which does include HFCS. The reference to Appendix II probably means Appendix I.

See comment 8.

**Page 24:** If Hawaii is used as a hypothetical case, table 2.1 on page 25 should read "Hypothetical Default Calculation for Raw Hawaiian Cane." An alternative would be to present the realistic

case for Florida, with a loan rate 17.99 cents a pound, interest 0.51 cents, transportation 1.90 cents, and required price 20.40 cents.

**Page 38:** The third paragraph largely repeats the first paragraph.

**Pages 40, 45:** Reference is made to the trigger for marketing allotments. It should be clarified that the Marketing Allotment Import Estimate (MAIE) is made through a formula in the 1990 Farm Act which requires the Secretary to impose allotments if he determines that import requirements will be less than 1.25 million short tons. The formula for the estimate of the import requirement level is: MAIE = (reasonable ending stocks + consumption) - (beginning stocks + production).

**Page 41:** Sentences in the second paragraph should read "If allotments go into effect, USDA may have to spend more time monitoring supply and distribution data, and... spend time in verifying compliance and enforcing allotments.... Congress has required an increase in supply and distribution information..."

**Page 44:** Sentence near the bottom should read "...despite lower prices over the past two years."

**Page 55:** The footnote should follow footnote 3 (page 37) which is clearer and more accurate.

General comments:

The basic methodology for obtaining welfare estimates is sound, as are the data. Most of the other studies cited did not combine sugar and HFCS, but given the nature of the substitution observed between the two sweeteners, the GAO approach is reasonable. The elasticities also seem reasonable.

The resulting estimate of \$1.4 billion annual average consumer cost during 1989-91 is well within the range of other empirical estimates, when adjusted for the time period covered. The hypothetical "free trade" world refined sugar (sweetener) price equilibrium of 20.5 cents a pound (page 56), the base against which the U.S. price is compared, seems reasonable.

The world sugar price (the No. 11 contract of the New York Coffee, Sugar & Cocoa Exchange) has historically been volatile, and this volatility has been cited by many countries as sufficient justification for insulating their domestic sugar industries from the world market. However, several factors have reduced the volatility in recent years:

- a. The share of world imports taken by "developed" countries has fallen by half, from about two-thirds 2 decades ago to

See comment 9.

See comment 10.

See comment 11.

See comment 12.

See comment 13.

Appendix V  
Comments From the U.S. Department of  
Agriculture

3

one-third today. Now, when world supplies are short, the price is not bid as high, because less-developed countries do not have the financial resources of the developed countries. In prior years higher-income buyers could bid world sugar prices much higher than today's lower-income buyers.

- b. There are more substitutes for sugar today than there were in the past, constraining sugar price increases. More substitutes are likely to be developed in the future.
- c. In the mid-1980s, about one-third of the 27 million tons of sugar traded was under special premium-priced arrangements (i.e., did not trade at world market prices). The collapse of the former Soviet Union has eliminated several such arrangements. Premium-priced imports into the EC and the United States total somewhat less than 3 million tons, and today most of the remaining 90 percent of world sugar trade is based on world prices.
- d. A trend toward privatization of sugar industries is occurring around the world. This trend could raise the responsiveness of sugar production to price signals, lowering price volatility.
- e. Some countries are liberalizing their sugar trade policies and making producers and consumers face world price movements. For example, Australia has done this in the last few years. These policy changes tend to lower world sugar price volatility.

For 1960-81, the coefficient of variation (a measure of variability which ranges from 0 to 1) of the average annual world sugar price was 0.78, almost twice the level of 0.41 for wheat. But for the last decade, 1982-91, the coefficient of variation for sugar prices was 0.34, very close to the level of 0.28 for wheat. In fact, the variability of the world sugar price in the last decade was lower than the variability of the world prices of corn, rice, soybeans and wheat over the two prior decades, 1960-81.

The historical period on which the U.S. sugar import quotas are based is 1975-81. As this base period recedes further into the past, the specific pattern of the quota allocations (to 40 countries, in fixed percentages) becomes less and less connected to current realities. Many quota-holding countries have switched from net-exporter to net-importer status, and in some, sugar production is declining to the point where the countries may not be able to meet their U.S. quota. The economic inefficiencies of this rigid import pattern will almost certainly grow over time.

**Appendix V  
Comments From the U.S. Department of  
Agriculture**

See comment 14.

4

The report's discussion of effects of the program on sugar users does not mention its impact on U.S. refiners. Ten U.S. refineries, representing 35 percent of U.S. cane refining capacity, have closed since the implementation of the current sugar program in 1982. While not all of this decline in industrial activity can be attributed to the sugar program, the program's limitation on imports of raw cane sugar is a major contributing factor.

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The following are GAO's comments on the U.S. Department of Agriculture's letter dated March 26, 1993.

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## **GAO's Comments**

1. We have included more current information on the proposed GATT and NAFTA agreements on the basis of USDA's statement that there will be no near-term effects on the ability of the United States to shield domestic sugar producers from increasing imports. We also reemphasize that the current GATT negotiations are ever-changing, that it is difficult to predict their outcome, and that NAFTA still requires formal approval.
2. We changed the sentence on page 1 to read "For over 200 years the United States has intervened in the sugar market, first by levying tariffs on imported sugar to raise revenue." We also added information in chapter 1 to explain that raising revenue is not a goal of the current program.
3. We changed the description in our report to reflect the number of beet factories and cane mills, rather than beet-processing companies and cane-processing companies.
4. In our estimation, if the Congress only lowers the loan rate, USDA may not necessarily reduce the import quota amount to achieve lower market prices. If this is the case, the goals of gradually moving the sugar industry toward a more open market situation and reducing sweetener user costs may not be met. Therefore, we recommend that the Congress also direct USDA to adjust import quotas in accordance with a lower loan rate. In our estimation, USDA could still meet the no-net-cost provisions of the act.
5. We changed the wording in the recommendation to "move the sugar industry toward a more open market situation."
6. We have noted in chapter 1 that many processors do not take out CCC loans and would not therefore be obligated to pay growers the statutory minimum price for sugarbeets or sugarcane. However, processors that do not obtain loans still benefit from the price floor that the loan program establishes. Also, as USDA stated, growers ultimately receive about 60 percent of total receipts and processors about 40 percent, regardless of whether or not they participate in the CCC loan program.
7. In the objectives, scope, and methodology section of chapter 1 we added language to emphasize that our welfare analysis of the total costs and benefits of the program is separate from our methodology to calculate the

concentration of benefits. We also clarified the point that the 22-cent-per-pound domestic market price is for raw cane sugar.

8. Although in the report body we had noted that the Hawaiian default calculation was hypothetical, we took USDA's suggestion to use Florida as our example. This is more realistic since Hawaiian millers rarely take out ccc loans. We state that the Florida default calculation is still a hypothetical one because, even if the market price falls below the default level, other factors may determine when a processor will default on the loan.

9. We have added the Marketing Allotment Import Estimate (MAIE) formula in chapter 1, where we first discuss the mechanics of marketing allotments.

10. We changed the language in the report to reflect USDA's suggestions.

11. We changed the sentence in chapter 4 to explain that domestic production has continued to increase despite lower prices over the past "2" years, rather than the past "few" years.

12. We changed the footnote describing HFCS 42 and HFCS 55 in appendix 1 to be consistent with our earlier footnote in chapter 3.

13. In chapter 1 we include USDA's comments that world sugar prices may no longer be as volatile as they once were. We state that the five factors that USDA provided have reduced the world price's volatility in recent years.

14. In chapter 1 we included USDA's information about the program's impact on the U.S. cane refining industry. However, as noted by USDA, the report does not discuss the effects of the program on cane refiners. We were unable to obtain views about the program from the refining industry because the Cane Sugar Refiners Association declined to meet with us.

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