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GAO

Report to Congressional Requesters

June 2000

SUGAR PROGRAM

Supporting Sugar Prices Has Increased Users' Costs While Benefiting Producers

GAO

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Abbreviations

ASA	American Sugar Alliance
CARD	Center for Agricultural and Rural Development at Iowa State University
EV	equivalent variation
HFCS	high-fructose corn syrup
NAFTA	North American Free Trade Agreement
SIC	standard industrial classification
TRQ	tariff-rate quota
USDA	U.S. Department of Agriculture

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

Resources, Community, and
Economic Development Division

B-285072

June 9, 2000

The Honorable Dianne Feinstein
United States Senate

The Honorable George Miller
The Honorable Dan Miller
House of Representatives

The sugar program, administered by the U.S. Department of Agriculture (USDA), guarantees domestic cane sugar and beet sugar producers (growers and processors) a minimum price for sugar, which at times during the past year was about three times the world market price. The sugar program supports domestic sugar prices by offering loans to sugar processors at a rate established by law: 18 cents per pound for raw cane sugar and 22.9 cents per pound for refined beet sugar, with the sugar serving as collateral for these loans. (See app. I.) The program has allowed processors to forfeit their sugar to the federal government instead of repaying their loans—which some processors might do if domestic sugar prices fall below the level of the loan rate plus certain costs that processors would no longer incur if they forfeited. To minimize the likelihood of forfeitures, a direct cost to taxpayers, the sugar program has maintained artificially high sugar prices by restricting the amount of sugar that can be imported at a low tariff rate.

Our April 1993 report,[1] requested by then Representative Charles E. Schumer, estimated that the sugar program cost the domestic users of sugar and other sweeteners about $1.4 billion (in 1991 dollars) annually from 1989 through 1991 and found that the program primarily benefited U.S. sugar producers and manufacturers of high-fructose corn syrup (HFCS), a sweetener primarily used in soft drinks. We recommended that the Congress gradually lower the loan rate for sugar and direct USDA to adjust import quotas accordingly to achieve a lower U.S. market price. The 1996 Farm Act did not revise the sugar program along the lines that we had recommended.

[1] *Sugar Program: Changing Domestic and International Conditions Require Program Changes* (GAO/RCED-93-84, Apr. 16, 1993).

To account for changing conditions in U.S. and world sweetener markets in recent years, you requested that we update the analysis in our 1993 report. Specifically, you asked us to estimate the U.S. sugar program's (1) costs to domestic sweetener users, (2) benefits to domestic sugar and HFCS producers, and (3) net effects on the U.S. economy—that is, the differences between the costs to users and the benefits to producers that result from artificially high sweetener prices.

Because USDA does not have a comprehensive economic model of the U.S. and world sweetener markets, we developed a model for analyzing the costs, benefits, and net effects of the U.S. sugar program. Our model used data on sweetener prices and quantities for the U.S. and world markets and estimated sugar prices for both markets in the absence of the U.S. sugar program. (See apps. II and III for descriptions of the model's U.S. and world markets.) Specifically, we used our model to compare—for both 1996 and 1998—the domestic and world prices for sugar, HFCS, and other corn sweeteners with estimated domestic and world prices if there were no sugar program.[2] Our model then used these price comparisons to estimate the program's costs, benefits, and net effects. As in any modeling effort, there is uncertainty associated with the estimates that we developed because of uncertainty about the model's structure, data, and assumptions. These estimates, therefore, should be interpreted as indicative of the order of magnitude of benefits and costs, rather than as precise estimates. Despite this uncertainty, we believe that the process for developing our model has been rigorous and that our model is both comprehensive and methodologically sound. As agreed with your offices, we did not analyze how the gradual reduction of U.S. tariffs for Mexican sugar through 2008 under the North American Free Trade Agreement might affect domestic sugar prices. However, our model could be used for this analysis as well as for other types of analyses in the future.

This letter summarizes our findings. More detailed information on our model's results is presented in appendix II.

[2]To estimate the effect of no sugar program, we simulated the elimination of USDA's loan program for sugar processors and the tariff-rate quota for both raw sugar and refined sugar imports. (The tariff-rate quota is the amount of sugar that can be imported during a fiscal year at a low tariff rate.) The most current year for which sweetener price and quantity data are available is 1998.

Sugar Program Increases Users' Costs

We estimate that the sugar program cost domestic sweetener users about $1.5 billion in 1996 and about $1.9 billion in 1998.[3] Sweetener users included (1) sugarcane refiners that bought raw cane sugar, (2) food manufacturers that bought refined sugar and other sweeteners, and (3) final consumers who bought sweeteners and sweetener-containing products. The program's costs to U.S. sweetener users depend on the world price of sugar and can vary from year to year—they will be higher, other things being equal, when the difference between the domestic and the world price is greater. In 1998, for example, the program's costs to users were higher than in 1996 because the world price dropped while the domestic price remained about the same.

If the sugar program were eliminated and the domestic price of sugar fell, it would be difficult to predict the extent to which and the speed with which sugar refiners and manufacturers of sugar-containing foods would pass their cost reductions through to final consumers. This would depend on, among other things, the degree of competition in their markets. For example, the market for table sugar is likely to be more price-competitive than the markets for sugar-containing foods for several reasons, including that table sugar varies little from brand to brand while most sugar-containing foods have greater product differentiation. As a result, sugar refiners that market table sugar might be more likely than manufacturers of sugar-containing foods (such as candy makers) to lower their prices, and this pass-through might occur more quickly. Assuming that, in absence of a sugar program, competition among sugar refiners had caused them to pass all of their cost reductions for table sugar through to consumers and the manufacturers of sugar-containing foods had not passed through any of their cost reductions, we estimate that final consumers could have benefited generally by about $800 million using 1998 data and by about $600 million using 1996 data. If both sugar refiners and the manufacturers of sugar-containing foods passed through all of their cost reductions, the maximum annual benefit to final consumers would be about $1.9 billion using 1998 data and about $1.4 billion using 1996 data. Table 6 in appendix II provides additional information on the benefits accruing to all sweetener users (refiners, food manufacturers, and final consumers) under these alternative assumptions about the degree to which cost reductions are passed through.

[3]All estimates are in 1999 dollars. See app. II for our assumptions about short-run and longer term supply elasticities.

Sugar Program Benefits Producers

The primary beneficiaries of the sugar program's higher prices are domestic sugar beet and sugarcane producers who, we estimate, received benefits of about $800 million in 1996 and about $1 billion in 1998.[4] About 70 percent of the benefits went to sugar beet growers and processors. Sugarcane producers received about 30 percent of the benefits.

HFCS producers received little, if any, benefit from the sugar program in either 1996 or 1998, according to our current model's estimates. This result contrasts with our finding in 1993. At that time, HFCS cost a few cents per pound less than domestic sugar, and both products cost about twice as much as sugar on the world market. Thus, if the domestic price of sugar had fallen in 1993, HFCS producers would have had to reduce their prices to remain competitive. Since 1993, the price of HFCS has fallen, and today it is much lower than the wholesale price of sugar in the United States. Furthermore, the possibilities for substitution between sugar and HFCS are more limited than in prior years because technological advances have improved HFCS products and created more specialized sweetener markets. As a result, even if the sugar program were removed and the price of domestic sugar fell substantially, the impact on the price of HFCS would be limited—HFCS producers might no longer need to lower their prices to remain competitive. Executives from the Corn Refiners' Association, which represents HFCS manufacturers, agreed with our model's results as they pertained to HFCS, stating that HFCS producers do not benefit from the sugar program because domestic HFCS prices are no longer linked to sugar prices.

Net Losses to the U.S. Economy Were Sizeable

We estimate that the sugar program resulted in net losses to the U.S. economy of about $700 million in 1996 and about $900 million in 1998. Our net loss estimates include economic inefficiencies and transfers to foreign producers. Economic inefficiencies occurred, for example, when the sugar program's artificially high domestic prices encouraged farmers to grow sugar beets instead of another crop, such as wheat, that, without the sugar program, might have been relatively more profitable. Inefficiencies also occurred when artificially high sugar prices discouraged consumers from

[4]Producers include both growers and processors. According to USDA's 1997 census of agriculture, 973 farms grew sugarcane and 7,097 farms grew sugar beets. USDA's Farm Service Agency, using a different definition of a farm, estimated that 11,800 farms grew sugar beets in 1997.

purchasing sugar. The cost of these inefficiencies totaled about $300 million in 1996 and about $500 million in 1998. Transfers from the U.S. economy to foreign producers occurred because foreign producers received artificially high prices for the raw sugar they exported to the United States. (See app. V.) We estimate that these transfers amounted to about $400 million in both 1996 and 1998. The transfers were about the same in each year despite the larger difference between domestic and world prices in 1998 because the United States imported less sugar in 1998.

Agency Comments and Our Evaluation

We provided the U.S. Department of Agriculture; the American Sugar Alliance, which represents sugarcane and sugar beet growers; and the U.S. Cane Sugar Refiners' Association with a draft of this report for review and comment.

The U.S. Department of Agriculture stated that our model's results were suspect and should not be quoted authoritatively, citing three broad areas of concerns. First, the Department stated that the report's methodology was not adequately developed or justified. We disagree. We took several actions to help ensure that our model was methodologically sound. Initially, we contracted with a well-known expert in modeling the international trade of agricultural commodities and with a prominent agricultural economist to work with us in developing the model. Then, in December 1999, we sent our proposed model to four outside academicians who specialize in agricultural economics and international trade economics and revised the model in response to their comments. We also sent the proposed model to the Department at that time, but the Department did not provide comments. Finally, our process for obtaining agency comments on draft reports served as a last check of our methodology. In response to these comments, we adjusted our model to more fully account for certain transportation costs in our final estimates. Second, the Department stated that documentation of the economic model was inadequate. We disagree. We included two appendixes in the draft report that provided detailed information about the model. While we believe that our model was adequately documented, the Department suggested some useful clarifications that we incorporated. Third, the Department stated that in numerous places the model's results are inconsistent with our description of the model or alternative data sources. For example, the Department disagrees with our model's finding that HFCS producers would experience few economic losses if the sugar program were eliminated. We continue to believe that this finding is accurate. Recent price data show that while HFCS producers benefited from the

sugar program in the 1980s and early 1990s, the domestic HFCS and sugar markets have since been decoupled because of domestic price, cost, and market conditions. After thoroughly examining this and each of the Department's other concerns about our model's results and discussing them with experts outside GAO, we continue to believe that the model's results are reasonable. See appendix VI for the Department's written comments and our responses.

The American Sugar Alliance also disagreed with the draft report's analysis. Its concerns also fell into three general areas. First, the Alliance stated that our methodology for estimating the sugar program's cost to users was flawed because our model used world prices of raw sugar that did not reflect each country's cost of production—the Alliance asserted that our model's world prices were distorted by, among other things, subsidies provided by other countries and differences in labor and environmental standards. We believe that our methodology is appropriate. Our model estimated the impact of the U.S. sugar program in the world as it exists today—not in a hypothetical "free market" environment, as the Alliance suggested. To isolate the sugar program's effects, we made the analytical assumption that all factors, other than the U.S. sugar program, would remain unchanged. Second, the Alliance stated that our model incorrectly assumed that food manufacturers and retailers would pass through 100 percent of their savings to final consumers if the sugar program were eliminated. In fact, the draft report noted that the extent to which cost reductions would be passed through to consumers would depend on the degree of competition in their markets. We revised the report, however, to further clarify the different assumptions we used in discussing the extent to which final consumers could benefit if the sugar program were eliminated. Third, the Alliance stated that we did not sufficiently assess the benefits and costs of the sugar program, noting among other things that rural areas would suffer if the sugar program were eliminated. As stated in our study objectives, this report focuses on the U.S. sugar program's (1) costs to domestic sweetener users, (2) benefits to domestic sugar and HFCS producers, and (3) net effects on the U.S. economy. The American Sugar Alliance also provided comments to clarify what it perceived to be misleading statements and analytical errors in the draft report. We address each of these comments in appendix VII, which contains the American Sugar Alliance's complete written comments and our responses.

The U.S. Cane Sugar Refiners' Association stated that we had done a thorough job of illuminating the very significant impact of the sugar program on different interests. The Association also provided comments to

improve the report's technical accuracy, which we incorporated as appropriate. See appendix VIII for the written comments of the U.S. Cane Sugar Refiners' Association.

Scope and Methodology

Estimating the total cost of the sugar program to users is controversial because the total cost is not a simple difference between the current U.S. and world sugar prices. Instead, the cost estimate depends in part on assumptions about how much the world price would rise if the United States did not have a sugar program. In developing our model, we:

- Contracted with Professor John C. Beghin, who heads the Trade and Agricultural Policy Division at Iowa State University's Center for Agricultural and Rural Development, to work with our staff economists to integrate an economic model of the U.S. sweetener market with the Center's international trade model for agricultural commodities. Professor Beghin is a recognized expert in agricultural trade policy and has extensive experience in developing econometric models of the U.S. and world markets for agricultural commodities. We also contracted with Professor Bruce Gardner, of the University of Maryland and a former USDA Assistant Secretary for Economics, to consult with Professor Beghin and our economists in developing our model, assessing the reasonableness of its results, and responding to comments from outside consultants and organizations.
- Provided our proposed model for review and comment in December 1999 to Professor James Anderson of Boston College, Professor Andrew Schmitz of the University of Florida, Professor Daniel Sumner of the University of California at Davis, and Professor Michael Wohlgenant of North Carolina State University. We incorporated many of their comments as we revised the proposed model. We also provided our proposed model to USDA for review and comment in December 1999. However, USDA did not provide comments.
- Obtained extensive data on sweetener prices and quantities for the U.S. and world markets in 1996 and 1998. These included data on (1) production and prices for sugar, HFCS, and other corn sweeteners and (2) the use of sweeteners by U.S. industries, disaggregated to the fourth level of the U.S. Bureau of the Census' Standard Industrial Classification. We obtained these data from USDA's Economic Research Service; the Bureau of the Census and the Bureau of Economic Analysis, within the Department of Commerce; the Bureau of Labor Statistics, within the Department of Labor; and private industry organizations. We selected 1998 because it is the most current year for which price and

quantity data were available when we developed our model and 1996 because it was a recent year that provided a contrast in the world price of sugar and the U.S. prices of corn, wheat, and other crops.

- Used the model to estimate the effect of terminating the U.S. sugar program on (1) the U.S. and world prices of sugar and (2) U.S. sweetener producers and users. The U.S. sweetener part of the model is the U.S. component of the CARD world sugar model, extended on the supply side to include linkages with the corn, HFCS, and wheat markets. In addition, Professor Beghin, in collaboration with our economists, extended the demand side of the CARD domestic sweetener model to include the demand for sweeteners from food processors, as well as the direct demand for sweeteners by final consumers. We interpreted the sugar program's estimated costs in 1996 and 1998 as the opposite of estimated benefits that would be derived by the program's elimination. While our model primarily examined the short-run effects of eliminating the sugar program, we also assessed longer-term effects by using alternative elasticities for the supply of sweeteners.[5]
- Obtained the comments of Professor Gardner and Professor Wohlgenant on the final design of our model and its preliminary results before we provided a draft of our report to USDA for comment.

We conducted our work between August 1999 and May 2000 in accordance with generally accepted government auditing standards. We did not independently verify the data that we obtained from USDA, Commerce, Labor, or industry sources and used in our economic model. However, these are the best data available on U.S. and world prices and production. The estimates in this report apply only to the 2 years that we analyzed. Estimates for other years might be larger or smaller than our 1996 and 1998 estimates, depending on the difference between the domestic and world prices of sugar.

We are sending copies of this report to the Senate Committee on Agriculture, Nutrition, and Forestry; the House Committee on Agriculture; and other appropriate congressional committees; the Honorable Dan Glickman, Secretary of Agriculture; the Honorable Jacob Lew, Director, Office of Management and Budget; and other interested parties. We will also make copies available to others upon request.

[5]These elasticities measured the extent to which the quantity of sugar supplied would respond to changes in price.

Please contact me at (202) 512-5138 if you or your staff have any questions about this report. Key contributors to this report are listed in appendix IX.

Robert E. Robertson
Associate Director, Food
and Agriculture Issues

The U.S. Sugar Program and Recent Price and Production Trends

The United States was the fifth largest producer and the fourth largest consumer of sugar in the world in 1998. Historically, the United States and other countries have protected their domestic growers and processors of cane sugar and beet sugar[1] from lower world prices through quotas and/or high tariffs that restrict sugar imports.

The U.S. Sugar Program

The U.S. sugar program guarantees domestic sugar producers (growers and processors) a minimum price for sugar by (1) offering loans to sugar processors at a rate established by law and (2) using a tariff-rate quota (TRQ) to restrict the supply of sugar that can be imported at a low tariff rate. The Agriculture and Food Act of 1981 allowed sugar processors to obtain loans from the U.S. Department of Agriculture's (USDA) Commodity Credit Corporation by pledging their sugar as collateral.[2] The act also gave processors the option to forfeit the sugar that secures their loans to the federal government rather than repay their loans in cash, effectively establishing the loan rate as a floor for domestic sugar prices. Since 1990, USDA has used a TRQ for raw sugar to restrict low-priced imports and maintain domestic prices at levels that are high enough to prevent producers from forfeiting on their sugar loans.[3] Under the TRQ, imported sugar up to the quota is either assessed no tariff or a 0.63-cent-per-pound tariff, while imports above the quota are assessed a 15.82-cents-per-pound tariff, making them prohibitively expensive.[4] In 1994, the United States agreed to set the TRQ for imported sugar at 1.26 million tons or more each year and to administer the TRQ in a manner consistent with its commitments under the World Trade Organization Agreement on Agriculture. USDA normally sets the size of the TRQ at the beginning of a fiscal year. The U.S. Trade Representative then allocates shares of it among

[1]Sugar comes from sugarcane and sugar beet plants, both of which are processed to extract the sugar. Sugarcane typically is milled into raw cane sugar and is then sent to a refinery, which further processes it into refined sugar for consumption. Beet sugar is transformed directly into refined sugar by beet processors. Almost all sugar imported into the United States is raw cane sugar.

[2]Sugar processors are required to pay growers a government-specified minimum price, equivalent to about 60 percent of the loan.

[3]USDA also administers a TRQ for imported refined sugar of at least 30,900 tons each year. The refined sugar TRQ was set at 66,000 tons for fiscal year 2000.

[4]Under the North American Free Trade Agreement, the tariff for Mexican sugar imported outside the TRQ will gradually be reduced from 15.6 cents per pound in 1994 to zero cents per pound in 2008. The high-tier tariff for Mexican sugar is 12.1 cents per pound in 2000.

40 designated countries on the basis of their exports to the United States from 1975 through 1981.

The Federal Agriculture Improvement and Reform Act of 1996, commonly known as the 1996 Farm Act, modified the sugar program by (1) legislatively establishing USDA's loan rate at 18 cents per pound for raw cane sugar and 22.9 cents per pound for refined beet sugar, (2) assessing a 1-cent penalty on each pound of raw cane sugar and a 1.07-cent penalty on each pound of refined beet sugar forfeited to the government, (3) eliminating a requirement that the sugar program operate at no net cost to U.S. taxpayers, (4) limiting processors' opportunities to forfeit their sugar to the Commodity Credit Corporation by not allowing such forfeitures if the TRQ is 1.5 million tons or less, (5) eliminating USDA's authority to impose marketing allotments for sugar, and (6) increasing the assessment on processors to 0.2475 cents per pound for of raw cane sugar and 0.2654 cents per pound for beet sugar.[5]

USDA has established a TRQ greater than 1.5 million tons each year since the 1996 Farm Act was enacted. As a result, processors that have obtained Commodity Credit Corporation loans have had the option to forfeit their pledged sugar instead of repaying their loans. This option becomes important to processors if domestic sugar prices drop below USDA's loan rate plus transportation and interest costs but minus the 1-cent-per-pound penalty. If sugar is forfeited, USDA can choose to immediately resell the sugar on the domestic market, sell it for such restricted uses as ethanol manufacture, store it, or donate it for humanitarian purposes.

Sugar Prices and Production

Table 1 shows that, since 1985, the sugar program has resulted in U.S. raw sugar prices that have been more than 8 cents per pound higher than world raw sugar prices.[6] In 1998, the U.S. raw sugar price was more than 10 cents per pound higher than the world price.

[5]The Agriculture Appropriations Act for fiscal year 2000 suspended the sugar marketing assessment for fiscal years 2000 and 2001.

[6]The basis point for world raw sugar prices is a Caribbean port, including Brazil, while the basis for domestic prices is New York City. To compare these prices, we added 1.5 cents per pound to the world price to cover transportation costs from the Caribbean.

Table 1: U.S. and World Prices for Raw and Refined Sugar, 1985-98

Prices in cents per pound

Year	U.S. raw cane sugar[a]	U.S. wholesale refined beet sugar	U.S. retail refined sugar	World raw sugar[b]	World refined sugar[c]
1985	20.34	23.18	35.34	4.04	6.79
1986	20.95	23.38	35.08	6.05	8.47
1987	21.83	23.60	35.28	6.71	8.75
1988	22.12	25.44	36.60	10.17	12.01
1989	22.81	29.06	40.03	12.79	17.16
1990	23.26	29.97	42.78	12.55	17.32
1991	21.57	25.65	42.80	9.04	13.41
1992	21.31	25.44	41.53	9.09	12.39
1993	21.62	25.15	40.54	10.03	12.79
1994	22.04	25.15	39.99	12.13	15.66
1995	22.96	25.83	39.83	13.44	17.99
1996	22.40	29.20	41.79	12.24	16.64
1997	21.96	27.09	43.26	12.06	14.33
1998	22.06	26.12	42.98	9.68	11.59

Note: U.S. and world prices are in nominal dollars.

[a]U.S. prices are based on futures contract prices for number 14 raw cane sugar on the New York Coffee, Sugar, and Cocoa Exchange.

[b]World prices are based on bulk spot contracts for number 11 raw cane sugar on the New York Coffee, Sugar, and Cocoa Exchange (free on board stowed Caribbean port, including Brazil). To compare the world and U.S. prices, 1.5 cents per pound needs to be added to the world price to account for the cost of transporting raw sugar from the Caribbean to New York.

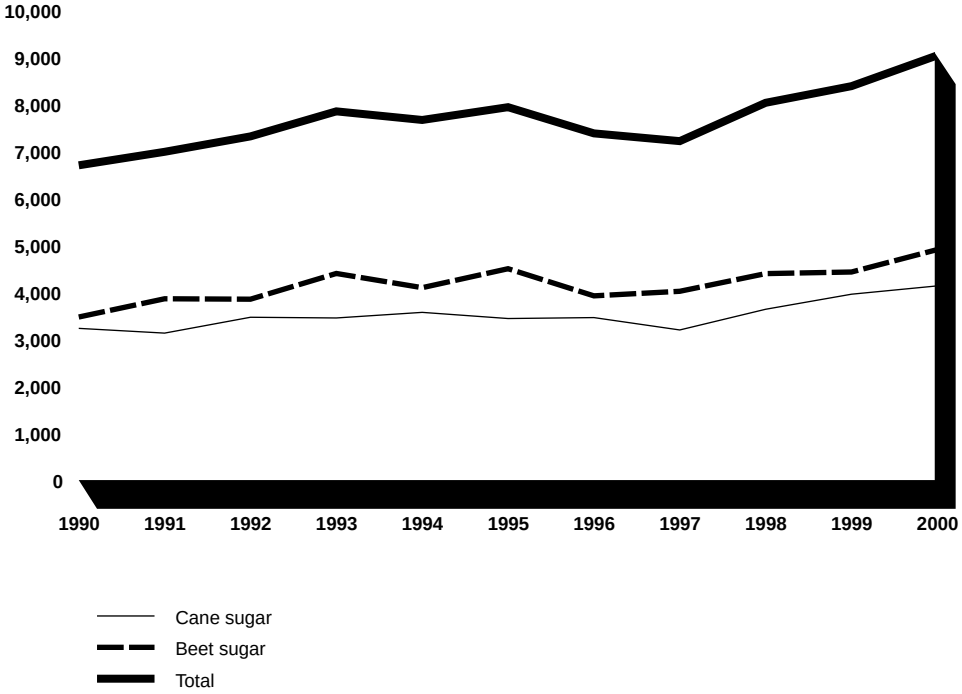
[c]World prices are based on spot contracts for number 5 refined sugar, London Daily Price (free on board Europe).

Source: *Sugar and Sweetener Situation and Outlook*, Economic Research Service, USDA (Sept. 1999), and the New York Coffee, Sugar, and Cocoa Exchange.

Figure 1 shows that domestic sugar production has grown by about 25 percent in recent years—from 7.2 million tons in fiscal year 1997 to a projected 9 million tons in fiscal year 2000.[7]

[7]All ton measurements in this report are short tons—a short ton equals 2,000 pounds.

Figure 1: U.S. Sugar Production (in thousands of short tons), Fiscal Years 1990-2000



This growth reflects an 8-percent increase in the estimated acres of sugarcane and sugar beets harvested in 2000 compared with the actual acres harvested in 1997. (See table 2.) Many farmers have increased the size of their sugarcane and sugar beet crops because these crops have offered better returns than cotton, wheat, or other crops that the farmers grew in the past. In addition, sugarcane and sugar beet farmers have increased their crop yields per acre, and sugarcane farmers, in particular, have improved their sugar-per-acre recovery rates.

Table 2: Acres of Sugarcane and Sugar Beets Harvested, by State, Crop Years 1995-99

State	1995	1996	1997	1998	1999
Sugarcane					
Florida	417,000	417,000	421,000	426,000	436,000
Hawaii	48,500	42,900	32,000	30,300	32,600
Louisiana	368,000	335,000	380,000	400,000	441,800
Texas	41,200	34,600	27,300	32,000	30,700
Subtotal	**874,700**	**829,500**	**860,300**	**888,300**	**941,100**
Sugar beets					
California	114,000	82,000	99,000	100,000	105,000
Colorado	41,100	51,100	66,400	57,300	67,900
Idaho	197,000	184,000	197,000	203,000	210,000
Michigan	188,000	130,000	160,000	173,000	187,000
Minnesota	420,000	438,000	446,000	458,000	469,000
Montana	55,500	57,500	58,300	62,400	61,800
Nebraska	72,300	51,200	60,300	47,400	66,800
New Mexico	[a]	900	1,600	0	0
North Dakota	204,200	225,300	227,500	242,600	253,000
Ohio	15,300	4,600	900	1,100	1,200
Oregon	17,800	16,300	17,400	17,500	19,700
Texas	19,300	12,600	15,000	0	0
Washington	[a]	13,000	18,000	36,000	27,000
Wyoming	61,500	56,800	60,900	53,300	57,000
Subtotal	**1,406,000**	**1,323,300**	**1,428,300**	**1,451,600**	**1,525,400**
Total	**2,280,700**	**2,152,800**	**2,288,600**	**2,339,900**	**2,466,500**

Note: USDA's World Agricultural Outlook Board estimates that 939,000 acres of sugarcane and 1,527,000 acres of sugar beets will be harvested in crop year 2000.

[a]In 1995, the acreage harvested in New Mexico and Washington was included in 14,100 acres listed as other states.

Source: *Sugar and Sweetener Situation and Outlook*, Economic Research Service, USDA (Sept. 1999).

In November 1999, USDA announced that the TRQ for raw sugar imports in fiscal year 2000 would be slightly higher than 1.5 million tons, giving sugar processors that obtained USDA loans the option to forfeit their sugar to the government if domestic prices drop below the loan rate plus certain costs that processors would no longer incur if they forfeit.[8] In February 2000, U.S. raw sugar prices on the New York Coffee, Sugar, and Cocoa Exchange dropped to 16.5 cents per pound as a result of the increasing supply of sugar. As of May 1, 2000, raw sugar prices had recovered to about 19.7 cents per pound[9]—around the minimum price necessary to provide an economic incentive to U.S. sugar processors to repay their USDA loans rather than forfeit the sugar that secures their loans to the government.[10]

In May 2000, USDA announced that it would seek to purchase 150,000 tons of domestic sugar to reduce the cost of expected sugar program loan forfeitures later this fiscal year. While data on the total amount of USDA loans to sugar processors in 2000 were not available, table 3 shows that sugarcane processors substantially increased their use of USDA loans in 1999, as compared with 1997. U.S. sugar processors have not forfeited sugar to the government since 1994, when small amounts were forfeited.

[8]USDA also announced plans to allow 1.25 million tons of raw sugar to be imported during fiscal year 2000, sufficient to fulfill its trade agreement obligations.

[9]World raw sugar prices similarly recovered to about 6.53 cents per pound as of May 1, 2000, after dropping below 5 cents per pound in Feb. 2000.

[10]See *Sugar Program: Changing the Method for Setting Import Quotas Could Reduce Cost to Users* (GAO/RCED-99-209, July 26, 1999).

Table 3: Cane Sugar and Beet Sugar Production and USDA Loans, by State, Crop Years 1997 and 1999

Sugar production in short tons (raw value)

			USDA loans made for 1997			USDA loans made for 1999	
State	**Farms[a]**	**Estimated 1997 production**	**Production covered by loans**	**Dollar value**	**Estimated 1999 production**	**Production covered by loans**	**Dollar value**
Cane sugar							
Florida	152	1,925,000	56,000	$20,000,000	2,125,000	470,000	$167,798,000
Hawaii	13	363,000	0	0	380,000	0	0
Louisiana	705	1,262,000	126,000	46,171,000	1,615,000	354,000	129,975,000
Texas	103	80,000	18,000	5,851,000	100,000	24,000	8,659,000
Subtotal	**973**	**3,630,000**	**200,000**	**$72,022,000**	**4,220,000**	**848,000**	**$306,432,000**
Beet sugar							
California	449	436,000	0	$0	450,000	0	$0
Colorado	530	192,000	0	0	203,000	0	0
Idaho[b]	921	765,000	422,000	189,506,000	734,000	320,000	142,302,000
Michigan	1,182	446,000	175,000	83,245,000	465,000	146,000	69,237,000
Minnesota	1,622	1,212,000	0	0	1,361,000	180,000	82,008,000
Montana	415	180,000	0	0	201,000	0	0
Nebraska	367	149,000	0	0	183,000	0	0
New Mexico	5	7,000	0	0	0	0	0
North Dakota	873	618,000	0	0	752,000	18,000	8,201,000
Ohio	33	2,000	0	0	3,000	0	0
Oregon	167	73,000	0	0	68,000	0	0
Texas	119	40,000	0	0	0	0	0
Washington	58	87,000	0	0	119,000	28,000	12,499,000
Wyoming	356	182,000	0	0	162,000	0	0
Subtotal	**7,097[c]**	**4,389,000**	**597,000**	**$272,751,000**	**4,701,000**	**692,000**	**$314,247,000**
Total	**8,070**	**8,019,000**	**797,000**	**$344,773,000**	**8,921,000**	**1,540,000**	**$620,679,000**

Note: USDA loans are in nominal dollars.

[a]USDA's 1997 census of agriculture estimate of the farms that grew sugarcane and sugar beets. In contrast, USDA's Farm Service Agency estimated that about 11,800 farms grew sugar beets nationwide in 1997. The census of agriculture uses a more restrictive definition of a farm that, for example, counts as a single farm land that has been subdivided into several smaller units that, in some cases, are operated by different family members.

[b]USDA loans were with a sugar beet processor that has its corporate headquarters in Utah and processing facilities mainly in Idaho.

[c]Subtotal excludes two farms in Illinois and three farms in Kansas that USDA's 1997 census of agriculture identified because sugar beet production data for these states were not available.

Source: USDA's 1997 census of agriculture, Economic Research Service, and Farm Service Agency.

HFCS Prices and Production

High-fructose corn syrup (HFCS) competes with sugar for leadership in the U.S. sweetener market. Each year from 1985 through 1994, the weighted average HFCS price was consistently at least 3 cents per pound lower than the wholesale refined beet sugar price. Since 1992, the weighted average HFCS price dropped from 22 cents per pound to 12.4 cents per pound in 1998—13.7 cents per pound less than the wholesale refined beet sugar price. (See table 4; prices are in nominal dollars.) Because of this cost advantage, the domestic supply of HFCS grew by almost 40 percent, from 6.8 million tons (dry weight) in 1992 to 9.5 million tons (dry weight) in 1999. HFCS now accounts for more than half of the total U.S. sweetener output, with approximately 75 percent of the entire HFCS supply going to the beverage industry. However, HFCS represented only about 6 percent of total U.S. corn usage in 1998.

Table 4: U.S. Prices for HFCS, 1985-98

Prices in cents per pound (dry weight)

Year	HFCS-42[a]	HFCS-55[b]	Weighted average HFCS price	U.S. wholesale refined beet sugar price
1985	17.75	19.95	19.18	23.18
1986	18.07	19.96	19.30	23.38
1987	16.50	17.46	17.11	23.60
1988	16.47	18.68	17.80	25.44
1989	19.24	21.41	20.54	29.06
1990	19.69	21.88	20.99	29.97
1991	20.93	23.32	22.34	25.65
1992	20.70	23.00	22.03	25.44
1993	18.83	20.95	20.08	25.15
1994	18.77	22.51	21.01	25.15
1995	15.63	19.00	17.67	25.83
1996	14.46	20.60	18.28	29.20
1997	10.70	13.98	12.78	27.09
1998	10.58	13.43	12.40	26.12

Note: U.S. prices for HFCS and wholesale refined beet sugar are in nominal dollars.

[a]HFCS-42 is used in canned fruits, condiments, and other processed foods that need mild sweetness.

[b]HFCS-55 is used to make soft drinks, ice cream, and frozen desserts.

Source: GAO's analysis of data from USDA and the sweetener industry.

Estimating Economic Gains and Losses From the U.S. Sugar Program

The sugar program has used farm commodity and trade policy instruments to maintain domestic sugar prices at levels that exceed world prices without requiring the government to buy large quantities of domestic sugar. Our economic model analyzed the effects of eliminating the sugar program on prices and production by linking a multimarket domestic sweetener model to a multicountry world sweetener model. We estimated the economic welfare[1] effects of the program—the gains and losses to the most heavily affected producer and consumer groups—by interpreting the estimated welfare loss (gain) resulting from the elimination of the sugar program as an estimate of the gain (loss) accruing to each group from the presence of the program.[2] Our analysis included the markets for sugar beet and sugarcane production, corn and HFCS production, sugar refining, food processing, and the final consumption of sugar and food products containing sweeteners. In addition, we estimated the net loss to the U.S. economy (economic welfare gains minus losses) resulting from artificially high sweetener prices. This net loss includes economic inefficiencies (known as deadweight losses) and economic rent transfers to foreign sugar exporters.

This appendix provides (1) our model's estimates of the sugar program's costs and benefits; (2) an overview of our modeling process; (3) a description of the policy simulations used in our analysis; (4) a more detailed discussion of the theoretical economic framework of our U.S. sugar model, including the methods used to estimate welfare gains and losses for participants in the various affected markets; and (5) a description of the data and data sources used.

Our Model's Results

Our model estimated the costs and benefits of the sugar program by comparing—for both 1996 and 1998—the actual domestic and world prices

[1]Welfare analysis uses quantitative measures to analyze how an intervention in a market redistributes economic rents among various groups in the economy. In the context of agricultural markets, income redistribution to all or some farmers and processors could be measured as their gains in economic rents at the expense of losses to consumers' or taxpayers' incomes.

[2]Our primary estimates of the welfare effects of eliminating the program are based on supply elasticities of sugar that can be interpreted as short-run elasticities. We also estimated these effects using higher elasticities that can be interpreted as longer-term elasticities. These effects would show the welfare losses and gains after more time had passed for the economy to adjust to the lower sugar prices that would result from eliminating the program.

for sugar, HFCS, and other sweeteners with the estimated domestic and world prices if the sugar program were eliminated. Both the estimated costs of the sugar program to sweetener users and the estimated benefits to sugar beet and sugarcane producers were higher in 1998 when the difference between the domestic and world prices for sugar was greater.

Estimated Costs and Benefits of the Sugar Program

As shown in table 5, we estimated that the sugar program cost domestic sweetener users—sugarcane refiners, food manufacturers, and final consumers—about $1.5 billion in 1996 and about $1.9 billion in 1998. In our analysis, the distribution of these welfare losses resulting from the sugar program among the sweetener user groups depends on assumptions about the extent to which refiners' and manufacturers' cost reductions from eliminating the sugar program would be passed on to consumers.

Table 5: Estimated Economic Gains and Losses Resulting From the Sugar Program, 1996 and 1998

1999 dollars in millions

Category	1996	1998
Welfare gains accruing to producers	$788	$1,045
Sugarcane producers	241	307
Sugar beet growers	490	650
Sugar beet processors	58	89
HFCS manufacturers and corn growers	(1)	(1)
Welfare losses accruing to sweetener users	($1,471)	($1,938)
Net loss to the U.S. economy	($683)	($893)
Economic inefficiencies	(273)	(532)
Transfers to foreign suppliers	(410)	(361)

Note: Numbers in parentheses are economic losses.

We estimated that the total welfare gains by domestic sugar beet and sugarcane producers were about $800 million in 1996 and about $1 billion in 1998. About 70 percent of these benefits went to sugar beet growers and processors, while the remaining 30 percent went to sugarcane producers.

We estimated that HFCS producers did not receive welfare gains from the sugar program in either 1996 or 1998 primarily because (1) HFCS prices have been much lower than the wholesale price of sugar in the United States since 1995 and (2) the possibilities for substitution between sugar and HFCS are more limited than in prior years because technological advances have improved the HFCS product and created more specialized sweetener markets.[3] Thus, HFCS producers would not need to lower their price further to remain competitive if the sugar program were eliminated. In contrast, our 1993 model of the sweetener markets in the late 1980s and early 1990s—when the price of HFCS was considerably higher—found that a fall in the domestic price of sugar would have put pressure on HFCS producers to lower the price of HFCS to remain competitive. As a result, our 1993 model found that HFCS producers received substantial welfare gains from the sugar program. Executives from the Corn Refiners' Association, which represents HFCS manufacturers, agreed with our results as they pertained to HFCS. They told us that the domestic HFCS market was "decoupled" from the domestic sugar market—HFCS prices are no longer linked to sugar prices, and the soft drink industry has relied on competition among HFCS manufacturers to minimize its sweetener costs.

We estimated that the sugar program resulted in net losses to the U.S. economy of about $700 million in 1996 and about $900 billion in 1998 because total welfare losses exceeded gains. These net losses included (1) production and consumption inefficiencies of $300 million in 1996 and $500 million in 1998 and (2) transfers of $400 million in 1996 and in 1998 to foreign countries allocated a portion of the TRQ for sugar imports to the United States.

Estimated Gains to Final Consumers if the Sugar Program Were Eliminated

If the sugar program were eliminated, it would be difficult to predict the extent to which or the speed with which intermediate users of sweeteners would pass through lower sugar costs to final consumers. Table 6 presents two estimates of how the benefits of eliminating the sugar program might be distributed based on two different sets of pass-through assumptions.

[3]Edward A. Evans and Carlton G. Davis, "Dynamics of the United States High Fructose Corn Sweetener Market," presented at the Conference on Sweetener Markets in the 21st Century, Miami, Fla. (Nov. 1999).

Table 6: Estimated Distribution Among User Groups of Benefits of Eliminating the Sugar Program Under Different Pass-Through Assumptions, 1996 and 1998

1999 dollars in millions

	1996		1998	
Distribution of benefits	**Partial pass-through**	**Full pass-through**	**Partial pass-through**	**Full pass-through**
Final consumers	$587	$1,434	$769	$1,960
Food manufacturers	715	(60)	999	(85)
Sugarcane refiners	95	97	61	63
Total	**$1,397**	**$1,471**	**$1,829**	**$1,938**

Note: The partial pass-through results represent a full pass-through of cost reductions by sugar refiners and no pass-through by food processors to consumers with the elimination of the sugar program. The full pass-through results assume all cost reductions are passed through to final consumers. Numbers in parentheses are economic losses.

The first set of estimates is based on the assumption that (1) competition would lead sugar refiners to pass cost reductions associated with eliminating the sugar program through to final consumers in the form of lower prices for table sugar but (2) manufacturers of sugar-containing foods would retain their cost savings. Under this "partial pass-through" assumption, final consumers would have gained about $600 million using 1996 data and about $800 million using 1998 data if the sugar program had been eliminated.[4] We chose to present estimates based on this assumption because refined white sugar is more homogeneous than sweetener-containing food goods. With a homogeneous product such as sugar, each brand is almost perfectly substitutable for another. When substitutability between products is nearly perfect, it is more difficult for sellers to insulate their products from the price competition of rivals. In contrast, when products are highly differentiated, as many sweetener-containing food products are, firms may be less able to attract customers from competitors by offering lower prices, so there is less incentive to compete by lowering prices. Instead, firms may use other nonprice forms of competition, such as greater advertising. In addition, in sugar refining, the cost of raw sugar is a

[4]Our different pass-through assumptions also resulted in slightly different estimates of the total gains to sweetener users if the sugar program were eliminated, primarily because consumers would be expected to increase their sweetener consumption somewhat if manufacturers of sugar-containing foods lowered their prices. We estimated that the total welfare gains from eliminating the sugar program would have been about $1.4 billion in 1996 and $1.8 billion in 1998 if only sugarcane refiners had passed cost reductions through to consumers.

much larger share of the total cost of production compared with its share in the production of other food products. Therefore, a change in the cost of raw sugar would be likely to have a larger effect on the price of table sugar than on the prices of sugar-containing products.

Our second set of estimates is based on the assumption that competition among both food manufacturers and sugar refiners is such that all cost reductions that would result from eliminating the sugar program would be passed on to final consumers. This "full pass-through" assumption yields an upper bound to the potential savings to consumers. Under this assumption, we estimate that the benefits to final consumers of eliminating the sugar program would have been about $1.5 billion in 1996 and about $1.9 billion in 1998.

Other Modeling Results

Table 7 compares actual sugar prices and production in 1996 and 1998 with our model's estimates, which assume the termination of the sugar program. In particular, our model shows that if the sugar program had been eliminated, the domestic price of raw sugar would have dropped from about 22 cents per pound to about 14.9 cents per pound in 1996 and to about 12.5 cents per pound in 1998, with comparable declines in the wholesale price of domestic refined sugar. We estimated that raw sugar imports would have increased by about 1.1 million tons in 1996 and by about 1.6 million tons in 1998 if the sugar program had been eliminated, reflecting both the increased domestic demand for sugar and the decreased domestic production of sugar beets and sugarcane.

Table 7: Estimated Effect of Eliminating the Sugar Program on Prices and Production

Price in cents per pound and production and imports in millions of short tons (raw value)

	1996		1998	
	Actual	Without the sugar program	Actual	Without the sugar program
U.S. raw sugar price	22.40	14.91	22.06	12.46
World raw sugar price[a]	12.24	13.41	9.68	10.96
U.S. wholesale refined sugar price	29.20	21.77	26.12	16.12
World wholesale refined sugar price[b]	16.64	19.77	11.59	14.12
Sugarcane				
Acres harvested[c]	953,700	941,300	931,500	916,200
Production	29.1	28.7	30.0	29.5
Sugar beets				
Acres harvested[c]	1,420,100	1,350,300	1,428,300	1,338,600
Production	28.1	26.7	29.9	28.0
Raw sugar imports	2.2	3.3	1.7	3.3

Note: Our model's estimates of prices without the sugar program are expressed in 1999 dollars, while the acutal prices are expressed in nominal dollars.

[a]The world price for raw sugar is based on a Caribbean location. As compared with the U.S. price, the world price for raw sugar does not include 1.5 cents per pound in cost to transport the sugar to New York.

[b]As compared with the U.S. price, the world price for refined sugar does not include 2 cents per pound for transportation.

[c]Acreage harvested during the previous crop year.

Estimated Longer-Term Effects

Table 8 presents our estimates of the welfare changes that would have resulted from eliminating the sugar program in 1998, using larger supply elasticities than the ones we used to obtain our primary estimates to simulate shorter-term changes. Our supply elasticity estimates are arc elasticities evaluated for 1998 between historical and post-reform values. In particular, our short-run domestic supply elasticities were 0.05 for sugarcane and 0.10 for sugar beets, and our short-run import supply elasticity was 7.26. To obtain longer-term welfare estimates, we used a double Nerlovian domestic supply response with supply elasticities of 0.20 for cane and 0.26 for sugar beets and an import supply elasticity of 10.17. These larger elasticities can be interpreted as longer-term elasticities. Therefore, the resulting estimates from our simulation can be interpreted

as the welfare gains and losses after more time has passed for the economy to adjust to the lower sugar prices that would result from eliminating the sugar program.

Table 8: Estimated Longer Term Economic Gains and Losses if the Sugar Program Were Eliminated

Dollars in millions

Category	Gain or (loss)
Welfare losses accruing to producers	($1,017)
Sugarcane producers	(301)
Sugar beet growers	(530)
Sugar beet processors	(187)
HFCS manufacturers and corn growers	1
Welfare gains accruing to sweetener users	$1,947
Final consumer	1,953
Food manufacturers	(84)
Sugarcane refiners	78
Net gain to the U.S. economy	$930
Economic inefficiencies	572
Transfers to foreign suppliers	358

Note: These results assume a double Nerlovian supply response and a full pass-through of program costs to final consumers. Numbers in parentheses are economic losses.

Overview of the Economic Welfare Modeling Process

Estimating the welfare gains and losses from the U.S. sugar program requires several steps. First, we simulate the elimination of the program to determine price and production responses in both domestic and international sugar markets. This simulation involves specifying complete U.S. and world sweetener models in the presence of the U.S. sugar TRQ and commodity loan program. To do this, we used Iowa State University's Center for Agricultural and Rural Development (CARD) world sweetener model (see app. III), which contains the U.S. domestic sweetener economy as one of its component countries. However, we extended and modified the U.S. domestic sweetener model to include a more detailed, multimarket approach, including such markets as corn and feed, sugar, and HFCS. In the U.S. domestic model, we simulated the sugar program's elimination by removing the TRQ for raw and refined sugar and allowing more domestic demand to be satisfied by lower-priced world imports. Simultaneously, as the U.S. demand for sugar increased, the world sugar prices rose

somewhat. We also removed USDA's loan program for sugar processors and allowed the domestic market prices of sugar to fall below the loan rate levels. After these program changes, U.S. domestic raw sugar prices approximated the world prices.

On the supply side of the domestic market, we used the domestic component of the CARD sugar model to estimate the welfare changes due to the change in the price of sugar. The new U.S. raw sugar price filtered through the domestic U.S. sugarcane, sugar beet, corn, and HFCS markets, leading to new production quantities. For each of these producing industries, we measured the changes in realized quasi-profits, or producer surplus, that would result from a change in the quantity demanded and/or the price if the sugar program were eliminated.

Within the domestic sweetener model, we estimated welfare changes for a comprehensive demand sector, including sugar processors and refiners, sweetener-using industries, and the final consumer. We estimated the changes in realized quasi-profits resulting from higher sweetener prices for sweetener-using food industries, at the 4-digit Standard Industrial Classification (SIC)[5] level, using economic methods to derive industry cost and demand functions for sugar and HFCS. As part of this analysis, we integrated different assumptions about the market power of these industries.

[5]The SIC system classifies each industrial establishment according to its primary activity. This system, last revised in 1987, was established to promote more uniform and comparable data.

Furthermore, we developed two estimates of the welfare effects on consumers by using different assumptions about the extent to which the benefits of eliminating the sugar program would be passed along to the final consumers of sugar and sweetener-containing products. Consumers are directly affected by the sugar program's elimination through changes in the prices of both refined sugar and food items containing a significant amount of sweetener that they purchase. We applied an incomplete demand system approach called LINQUAD[6] and used an exact welfare measure, equivalent variation (EV),[7] to estimate changes in consumers' expenditures for these items.

Finally, we aggregated all welfare gains and losses from these groups by treating the welfare loss (gain) experienced from eliminating the sugar program as an estimate of the gain (loss) accruing to each group from the presence of the program. The difference between welfare gains and losses accruing from the program is the net loss to the U.S. economy, which consists of (1) transfers to foreign producers that resulted from artificially high prices for the raw sugar they exported to the United States and (2) economic inefficiencies, known as deadweight losses. These inefficiencies resulted from the use of higher-cost domestic resources to produce sweeteners (instead of importing lower-priced sugar) and reduced total sugar consumption. These losses did not redistribute income from consumers to producers.

Using this approach, we specified a subset of closely related agricultural markets—sugar, HFCS, and corn—that are important in estimating the welfare gains and losses from the sugar program. We also included the influence of wheat prices on planted sugar beet acreage. One possible limitation of our model is that a more general equilibrium approach of modeling the entire agricultural sector may have been able to give us more long-term effects by, for example, identifying what alternative crops would be produced in the absence of the program or how many producers would leave the industry entirely. However, general equilibrium models take a

[6]The LINQUAD is a functional form within the incomplete demand system approach that provides a practical model for estimation that reflects theoretically sound preference ordering. In particular, the LINQUAD quasi-expenditure function produces demand functions that are linear in deflated income and linear and quadratic in deflated prices.

[7]EV is the amount of money that, when paid to the consumer, allows the consumer to achieve the same level of utility before the change that the consumer would enjoy with the economic change. EV represents the minimum amount that a consumer would require to willingly forgo the change.

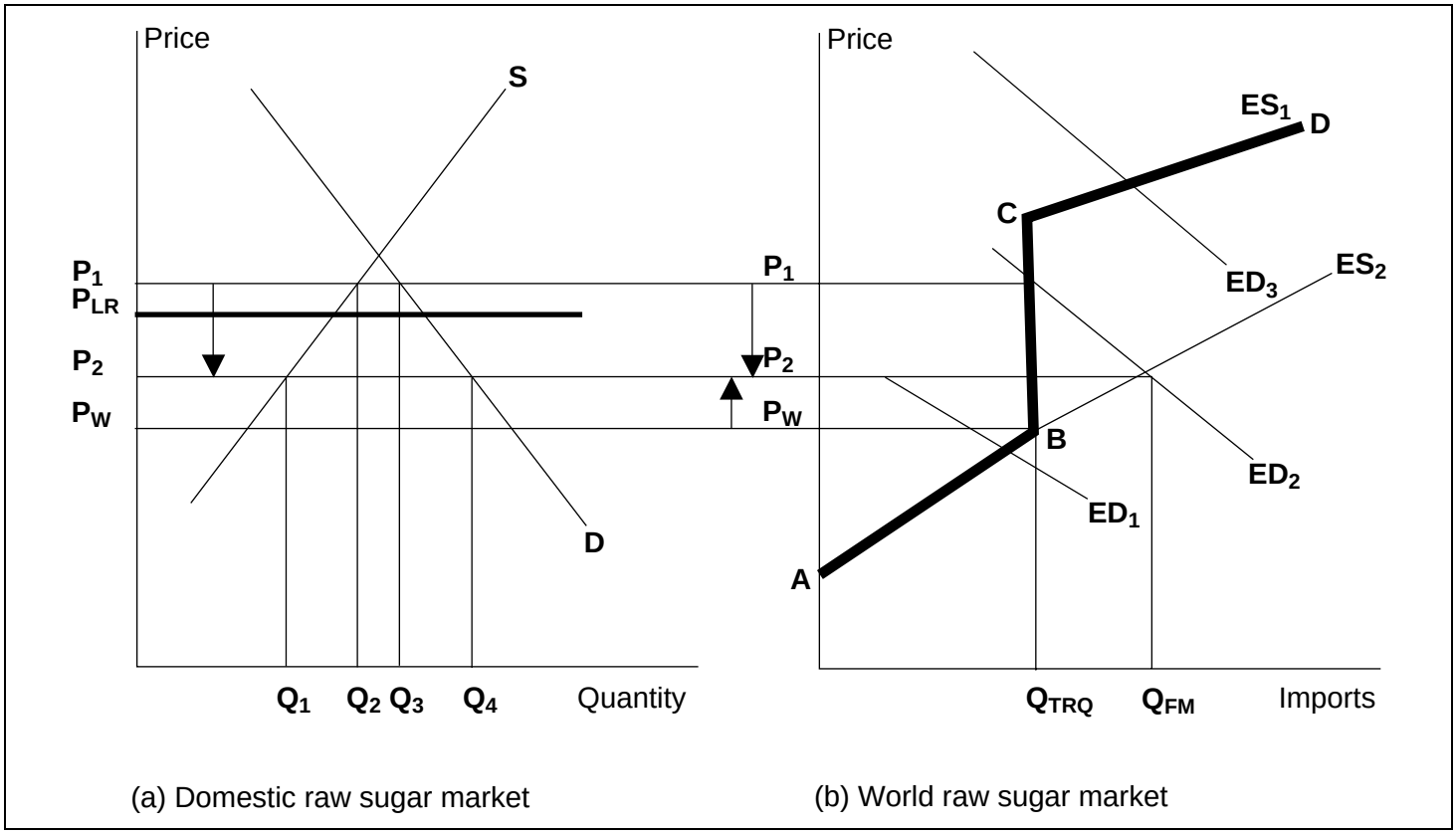
more broad-brushed approach, often leaving out important market details. Our approach is designed to represent the most important sweetener market relationships with the available data, while keeping the model tractable.

Policy Scenario Used in This Analysis

The policy scenario for this analysis removes the TRQs for imported raw and refined sugar and USDA's loan program for sugar processors that supports the price of domestic sugar (see app. IV for a discussion of the economics of the TRQ).[8] Figure 2 shows the effects of removing both the raw sugar TRQ and USDA's loan program: the first panel (a) represents the domestic raw sugar market, while the second panel (b) represents the world raw sugar market.

[8]Our presentation follows Moschini: (*Agricultural Economics* (5), 1991), Meike and Lariviere (International Trade Research Consortium, Mar. 1999), and Morath and Sheldon (MIMEO, Feb. 1999.)

Figure 2: Effects of Removing the TRQ and USDA's Loan Program on U.S. Prices and Quantities of Raw Sugar



In panel (b), we show two world excess supply situations, ES_1 and ES_2, corresponding to different trade scenarios. As discussed in appendix IV, in the presence of a TRQ, the United States faces a kinked world excess supply function, as in the bold line, ES_1. The vertical line segment, BC, on ES_1 represents the level of the TRQ, below and beyond which there is a supply response to price by foreign exporters. Moreover, at import levels below the quota, Q_{TRQ}, the in-quota tariff applies, and beyond that level, the out-of-quota tariff applies. The other excess supply curve, ES_2, corresponds to the world excess supply in the absence of import restrictions in the United States.

The effect of the TRQ on U.S. imports and prices depends on the location of the U.S. excess demand for imports relative to the excess supply. In panel (b), we display three potential U.S. import demand situations, ED_1, ED_2, and ED_3. The excess demand curve, ED_1, represents an import demand

schedule that intersects the excess supply schedule below the level of the TRQ, while the excess demand curve, ED_3, represents an import demand schedule that intersects the excess supply schedule above the level of the TRQ. With excess demand schedule ED_2, the TRQ is binding. Price and quantity reach equilibrium at the intersection of the U.S. excess demand curve, ED_2 and the kinked excess supply curve, ES_1, on its vertical segment, BC. With the removal of the TRQ, increased imports of raw cane sugar drive down domestic prices. With the same excess demand schedule, this situation corresponds to a new equilibrium level: the point where ED_2 intersects ES_2, the excess supply curve without import restrictions in the United States, with imports rising to demand of Q_{FM}.

Because of USDA's loan program for sugar processors, however, domestic prices would still not be free to drop to the world price level. Under the loan program, producers would still be eligible to forfeit their sugar to the government and receive the loan rate, P_{LR}. The loan rate mechanism provides a price floor for domestic sugar producers, maintaining domestic sugar prices at the loan level, P_{LR}, as in panel (a). However, with the simultaneous elimination of the TRQ and the sugar loan program, the domestic sugar price is free to fall below the loan rate level. In panel (b) of figure 2, this situation corresponds to a new price and trade equilibrium level. In the domestic market in panel (a), this corresponds to imports increasing from Q_2Q_3 to Q_1Q_4. These increased imports lead to a drop in the domestic price from P_1 to P_2. However, P_2 is higher than the original world price of P_W.

Similarly, we removed the TRQ for imported refined, or "white," sugar. World trade in refined sugar has increased because of policies in the European Community, the entry of toll refiners,[9] and a decrease in freight and refining costs. In general, removing the TRQ for refined sugar would have the same effect as removing the TRQ for raw sugar–the U.S. price for refined sugar would decrease with an increase in imports of refined sugar. A lower U.S. refined sugar price would then cause a decrease in the quantity of domestic refined sugar supplied and a decline in refiners' demand for domestic raw sugar.

[9]Toll refiners export refined sugar processed from imported raw sugar.

Theoretical Framework for Estimating Economic Gains and Losses From the U.S. Sugar Program

This section describes our framework for modeling the economic gains and losses to the various groups affected by the removal of the sugar program. First, we describe the agricultural markets that transform sugar beets and sugarcane into white sugar and corn into HFCS, an alternative to sugar in soft drinks and other food products. The removal of import restrictions under the TRQ would affect the raw cane and refined beet and cane sugar markets by allowing free imports in these domestic markets. Second, we estimate the welfare effects to sweetener processors, such as cane refiners, HFCS refiners, and beet processors. Since a lower price for refined sugar would increase the demand for it and could decrease the use of HFCS, the price of HFCS could also decrease. The lower price for refined sugar would also lead to a decrease in the quantity supplied by refiners, which in turn would decrease the demand for sugar beets and sugarcane and, thus, the price received by their producers. Third, lower prices for refined sugar and HFCS would, other things being equal, lower the cost of production to sweetener-intensive food goods industries. As a result, final consumers would gain from lower prices for these foods as well as a lower price for white table sugar.

Welfare Changes for Domestic Sugar Beet and Sugarcane Producers

Using the CARD sweetener model, we estimated the welfare effects to sugar beet producers by specifying the supply of sugar beets, BS, as a function of its price, P_b, the price of competing crops, P_g, and the price of an aggregate input, P_f. The CARD domestic sugar model simultaneously solves for sugar beet prices as well as acreage, yield, and production levels. Assuming a quadratic form for profit in beet production, we can obtain a linear sugar beet supply by taking the first derivative of profit with respect to the price of beets:

$$(1) \qquad BS=b_s+b_b(P_b/P_f)+b_g(P_g/P_f)=\lambda+\mu P_b,$$

with λ and μ summarizing the information on parameters b_i and prices P_g and P_f.[10]

[10]We have the following definitions: $\lambda=b_s+b_g(P_g/P_f)$ and $\mu=b_b/P_f$. If the price of a competing crop changes, then λ will change as well.

Similarly, the supply of cane, CS, is a function of the price of cane, P_c, and the price of an aggregate input, P_f. As in the case of beets, the extended CARD domestic sugar model simultaneously solves for sugarcane prices, acreage, yield, and production levels. Using these parameter estimates, we again assume quadratic profits in cane production, and we obtain a linear supply of cane:

$$(2) \qquad CS = c_s + c_c(P_c/P_f) = \alpha + \beta P_c.$$

If we assume a constant extraction margin a_{ce} and marginal cost pricing in cane extraction, the cost function of raw cane sugar production is $C_{rcs} = [(1/\gamma_c)P_c + a_{ce}]RCSS$, where RCSS equals raw cane sugar supply. Prices in raw cane sugar production, P_{rcs}, obey the following arbitrage condition to express marginal cost pricing in the extraction of raw sugar from cane, with γ_c denoting the exogenous extraction rate:

$$(3) \qquad P_{rcs} = (1/\gamma_c)P_c + a_{ce}.$$

We assume constant returns to scale in sugarcane processing, which implies that there will be no welfare changes to sugarcane processors from price changes due to an elimination of the program. Thus, we estimate changes in economic welfare by the changes in quasi-profit or producer surplus realized by cane and beet producers, $\Delta\Pi_c$ and $\Delta\Pi_b$, defined as:

$$(4) \qquad \Delta\Pi_c = \int_{p0}^{P^1} CS(P_c, P_f)\, dP_c = \int_{p0}^{P^1} (\alpha + \beta P_c) dP_c = [\alpha P_c + (1/2)\beta P_c^2]_{p0}^{p1} \text{ and}$$

$$(5) \qquad \Delta\Pi_b = \int_{p0}^{P^1} BS(P_b, P_v, P_f)\, dP_b = \int_{p0}^{P^1} (\lambda + \mu P_b)\, dP_b = [\lambda P_b + (1/2)\mu P_b^2]_{p0}^{p1}.$$

Parameter estimates of α, β, λ, μ, γ_c and a_{ce} are available from the CARD sugar model.

Welfare Changes for Domestic Corn Producers

With the lower price of sugar, the demand for corn might decrease if food processors replace HFCS with sugar in production. We assume that the

supply of corn, COS, is determined by the maximum of the loan rate for corn, LR_{corn}, or the market price of corn, P_{corn}:

$$(6) \qquad COS = \delta + \varkappa \, Max(LR_{corn}, P_{corn}).$$

If the market price were higher than the loan rate, as it was earlier in the 1990s, then corn farmers would respond to this price. If there were a decrease in the demand for corn caused by reduced HFCS production, corn farmers would lose through a decrease in corn price and production. Therefore, corn farmers would lose:

$$(7) \qquad \Delta\prod_{corn} = \int_{P^0}^{P^1} COS(P_{corn}) \, dP_{corn}.$$

However, when the loan rate is higher than the market price, as it currently is, the price signal perceived by corn farmers is the fixed loan rate. In this case, farmers are eligible to receive loan deficiency payments from the government.

Welfare Changes for Sugar Beet Processors

Domestic sugar beet processors would also experience changes in economic welfare from the extraction process. The domestic supply of white sugar, WSS, comes from two sources that are perfect substitutes in supply: beet sugar supply, WBS, and refined cane sugar supply. The supply of white sugar from beets is a totally inelastic derived demand that comes from the extraction of white sugar from sugar beets. With γ_b denoting the exogenous rate of extraction of sugar from beets, prices in beet production obey the following condition to express marginal cost pricing:

$$(8) \qquad P_{wbs} = (1/\gamma_b) \, P_b + a_{be} WBS$$

where a_{be} denotes the extraction margin parameter in beet sugar extraction.

Finally, the welfare change for beet processors is then estimated as:

$$(9) \qquad \Delta\prod_{wbs} = P^1_{ws} WBS^1 - P^0_{ws} WBS^0_i - \int_0^{WBS1} MC_{be}(P^1_b, WBS)\, dWBS + \int_0^{WBS0} MC_{be}(P^0_b, WBS)\, dWBS.$$

Welfare Changes for HFCS Producers

Because HFCS is an alternative to sugar in many foods, a change in the price of sugar may affect the demand for HFCS, and in turn the price of HFCS, translating into a change in economic welfare for HFCS producers. The supply of HFCS, HFCSS, comes from extracting fructose from corn production with an increasing marginal cost of extraction, $P_{hfcs}=(1/\gamma_{corn}) P_{corn}+a_{wm}HFCSS$, leading to the supply:

$$(10) \qquad HFCSS=[P_{hfcs}-(1/\gamma_{corn}) P_{corn}]/a_{wm},$$

with a_{wm} denoting the marginal margin parameter in HFCS extraction and γ being the actual extraction rate for HFCS from corn. Since we extended the CARD sugar model to include linkages to the corn and HFCS markets, we obtained all parameter estimates for these markets, as well as extraction rates and margin parameters, from CARD. Rendleman and Hertel[11] argue that because of feedback through by-product prices, HFCS supply is not very price responsive. Equation 11 estimates the change in the welfare of HFCS suppliers as captured by the change in the industry's producer surplus:

$$(11) \qquad \Delta\prod_{hfcss} = \int_{P_{corn}0}^{P_{corn}1} \int_{P_{hfcs}0}^{P_{hfcs}1} HFCSS(P_{hfcs}, P_{corn})\; dP_{hfcs} dP_{corn}.$$

Welfare Changes for Cane Sugar Refiners

Cane sugar refiners experience changes in economic welfare with the elimination of the TRQs for raw and refined sugar. Domestic refined cane sugar comes from refining domestic and imported raw cane sugar. For cane sugar refining, we assume that the supply of white cane sugar, WCS, is competitive. Assuming the cost of producing refined cane sugar increases

[11] C.M. Rendleman and T.W. Hertel. "Do Corn Farmers Have Too Much Faith in the Sugar Program?" *Journal of Agricultural and Resource Economics* Vol. 18 (1993), pp. 86-95.

in output, this cost consists of the cost of raw cane sugar and the refining cost characterized by the margin parameter, a_{rm}. We also assume a fixed proportion, γ_{rc}, between raw cane sugar and refined sugar. The marginal cost of refining is equated to the output price to obtain a supply schedule:

$$(12) \qquad WCS=(1/a_{rm})[P_{ws} -(1/\gamma_{rc})P_{rcs}].$$

There is competitive price arbitrage between domestic sources of white sugar, which equates the marginal cost of white cane sugar and beet sugar to the white sugar price. Using this arbitrage condition and equations (3) and (5), we have:

$$(13) \qquad P_{ws} =(1/ \gamma_{rc}) P_{rcs}+a_{rm} WCS=(1/ \gamma_{rc}) [(1/\gamma_c)P_c+ a_{cc}]+ a_{rm} WCS=(1/\gamma_b)P_b+a_{be}WBS.$$

Therefore, the welfare change for domestic cane sugar refiners is obtained by looking at the change in their quasi-profit, or producer surplus, $\Delta\Pi_{wcs}$, resulting from the change in policy via P_{rcs} (P^0_{rcs} to P^1_{rcs}), output price (from P^0_{ws} to P^1_{ws}), and output change (from WCS^0 to WCS^1):

$$(14) \qquad \Delta\prod_{wcs}= P^1_{ws}WCS^1- P^0_{ws}WCS^0_i - \int_0^{WCS1} MC_{wcs}(P^1_{rcs},WCS)\, dWCS+ \int_0^{WCS0} MC_{wcs}(P^0_{rcs},WCS)\, dWCS.$$

Welfare Changes for Sweetener-Using Food Processors

We then estimate the economic welfare effects from changes in sweetener prices for food-processing industries under two scenarios. The first scenario assumes a constant markup, and thus a full pass-through of benefits to consumers of lower input prices and thus output prices. The second scenario holds output prices constant but allows food processors to absorb the lower sweetener costs from eliminating the program in their marginal cost function and thus in their profit margin.

The derived demand for refined sugar comes from food-processing industries producing sweetener-intensive food goods. For food processing, we describe the total cost function of each industry i in food processing as:

(15) $C_{fgi} = \{A + \tilde{c}\ (P_S, P_{HFCS})\} * Q_{fgi}$

(15a) $\tilde{c} = a + b*(P_S^{\alpha_s} * P_{HFCS}^{\alpha_{hfcs}})$

where C represents total cost, $c^{\sim}$ represents the cost of a composite sweetener (sugar and HFCS), "a" is an intercept term, b is a scaling term, P_s is the price of white sugar, P_{HFCS} is the price of high-fructose corn syrup, Q_{fgi} is output produced by food sector i, and A represents information from the prices of other inputs. The derivative of the cost function of the composite sweetener (15), with respect to the price of sugar, is a nonhomothetic transformation of a Cobb-Douglas functional form[12] and represents the output-constant industrial white sugar demand:

$$(16) \qquad DDWS_i = \partial C_{fgi} / \partial P_s = (a + b\, \alpha_{Si} * (P_S^{\alpha_{s-1}}\ P_{HFCS}^{\alpha_{hfcs}}) * Q_{fgi}$$

for all i in sweetener-using food goods where "a" is an intercept term and b is a scaling factor to calibrate the own-price elasticity of demand between –0.1 and –0.2.[13] Similarly, the derivative of (15) with respect to HFCS in each food-processing industry represents HFCS demand, HFCSD:

$$(17) \qquad HFCSD_i = \partial C_{fgi} / \partial P_{HFCS} = (c + b * \alpha_{HFCSi}\ (P_S^{\alpha_s}\ P_{HFCS}^{\alpha_{hfcs-1}}) * Q_{fgi}$$

for all i in sweetener-using food goods where c is an intercept term and once again b is a scaling factor to calibrate the own-price elasticity of demand between –0.1 and –0.2.

[12]In the nonhomothetic transformation of a Cobb-Douglas functional form, the cost shares of inputs are not held constant.

[13]We assumed that the derived demand for sugar, as well as HFCS, is price inelastic and small. References to the price elasticities of demand for sugar and other agricultural inputs include Lopez and Sepulveda (*Northeastern Journal of Agricultural and Resource Economics,* Oct. 1985); Shui, Beghin, and Wohlgenant *(American Journal of Agricultural Economics*, Aug. 1993), Devadoss and Kropf (*Agricultural Economics,* Jan. 1996), and Wohlgenaut (FAO, 1999).

Using this type of specification implies constant returns to scale in the cost structure. Starting from each industry's cost function (15), we derive the marginal cost underlying supply decisions:

(18) $MC_{fgi} = d + \{(P_S * (\text{sugar use})) + (P_{HFCS} * (\text{HFCS use})) \} / Q_{FGI}$,

or, after substituting (16) and (17),

(18a) $MC_{fgi} = d+[a+b * \alpha_s *(P_S^{\alpha_{s-1}} P_{HFCS}^{\alpha_{hfcs}})] * P_S + [c+b * \alpha_{HFCSi} (P_S^{\alpha_s} P_{HFCS}^{\alpha_{hfcs-1}})] * P_{HFCS}$

where d is an intercept term that reflects the cost of other inputs.

From profit maximization with market power and conjectural variation,[14] food-processing firms set price above marginal cost with markup coefficient, θ, such that

(19) $\theta_i=(P_{fgi}-MC_{fgi})/P_{fgi}$.

Therefore, the price schedule of industry i is:

(20) $P_{fgi}=(1/(1- \theta_i)) MC_{fgi}$.

[14]Conjectural variation is a parameter that measures how firms with market power recognize their mutual interdependence. Specifically, it is the percentage change in all other firms' output that a firm expects in response to a 1 percent change in its own output. This variable can also be defined in terms of price behavior.

Equations (16), (17), (18), (19), and (20) determine the transmission of lower sweetener prices into lower prices P_{fgi} to consumers of sweetener-containing food goods. Several factors have a role in the price transmission: the cost share of sweeteners in the cost of food processing, the substitution possibilities within sweeteners (fructose and sugar) and between sweeteners and other inputs, and finally the markup and its evolution as prices change (McCorriston[15] et al.).[16] In equation (18), we calibrated to replicate a "historical" marginal cost for the industry using data from the Bureau of Economic Analysis on output price indexes for 4-digit SIC industries 2023 to 2099. The historical marginal cost is estimated to be the historical price divided by 1.2, or a constant 20-percent markup of price over marginal cost. We use a 20-percent markup of price over marginal cost as this figure is well within the estimates of other analysts for the food manufacturing sector.[17]

Trade in food industries is ignored because net trade is a very small share of total consumption or production in all food industries; these industries tend to produce differentiated products, which do not face a strict price discipline from the world market; and trade data are scarce and are only available up to 1994. Hence, the equilibrium condition in the food-processing markets is found by equating the price schedule (20) of each industry to the corresponding Marshallian demand (24) as:

$$(21) \qquad FGS_i = FGD_i(P_{ws}, P_{fgi}, M), \text{ for all } i.$$

The welfare effect of the sugar program on each food industry is estimated by the change in its profit, $\Delta\Pi_{fgi}$, resulting from the price and output

[15]S. McCorriston, C.W. Morgan, and A.J. Rayner, "Processing Technology, Market Power, and Price Transmission," *Journal of Agricultural Economics*, Vol. 49, No. 2 (Spring 1998), pp. 185-201.

[16]The parameter θ can be defined as the firm's conjectural variation elasticity divided by its own price elasticity of demand (see Bhuyan and Lopez (*American Journal of Agricultural Economics*, Aug. 1997)).

[17]See Bhuyan and Lopez (*American Journal of Agricultural Economics,* Aug. 1997) and Morrison (*NBER Working Paper #3355,* 1990).

changes induced by the policy reform (from P^1 to P^0 and from FGS^0 to FGS^1):

$$(22) \qquad \Delta\prod_{fgi} = P^1_{fg} FGS^1_i - P^0_{fg} FGS^0_i - C_{fgi}(P^1_{ws}, P^1_{hfcs}, FGS^1_i) + C_{fgi}(P^0_{ws}, P^0_{hfcs}, FGS^0_i).$$

Welfare Changes for the Final Consumer

We estimated the welfare cost to the final sugar and HFCS consumer by assuming a representative consumer with expenditure function E(**P**, U). In this expenditure function, **P** is a vector of relevant consumer prices and U denotes utility. We are interested in two types of goods: white sugar, WS, and a vector of sweetener-containing food goods, FG. In addition, we have a third aggregate, other goods, OG, for completeness. We use an incomplete demand system approach–LINQUAD–as specified in LaFrance[18] and Agnew.[19] This approach allows us to derive an exact welfare measure from an incomplete demand system. In addition, we impose restrictions on the structure of cross-price responses to reduce the number of parameters to be calibrated. The price vector **P** is decomposed into $\mathbf{P}=(P_{ws}, \mathbf{P_{fg}}, \mathbf{P_{og}})$, and income is denoted by M, with subscripts indicating the respective commodities. The subvector $\mathbf{P_{og}}$ is then dropped from the incomplete system. The Marshallian demands for the two types of goods of interest, white sugar and sweetener-containing food goods, denoted WSD and FGD, are:

$$(23) \qquad WSD(P_{ws}, \mathbf{P_{fg}}, M) = \xi_{ws} + \nu_{ws} P_{ws} + \chi_{ws} [M - \xi_{ws} P_{ws} - \boldsymbol{\xi_{fg}}' \mathbf{P_{fg}} - 0.5 \nu_{ws} P_{ws}^2 - 0.5 \textstyle\sum_{fg} \nu_{fgi}' P_{fgi}^2] \text{ and}$$

$$(24) \qquad FGD_i(P_{ws}, \mathbf{P_{fg}}, M) = \xi_{fgi} + \nu_{fgi} P_{fgi} + \chi_{fgi} [M - \xi_{ws} P_{ws} - \boldsymbol{\xi_{fg}}' \mathbf{P_{fg}} - 0.5 \nu_{ws} P_{ws}^2 - 0.5 \textstyle\sum_{fg} \nu_{fgi}' P_{fgi}^2]$$

[18]Jeffrey LaFrance, "The LINQUAD Almost Complete Demand Model," Unpublished manuscript, Department of Agricultural and Resource Economics, University of California, Berkeley.

[19]Gates Kennedy Agnew, *LINQUAD: An Incomplete Demand System Approach to Demand Estimation and Exact Welfare Measures*. Master's Thesis, Agricultural and Resource Economics, University of Arizona (1998).

for all i industries containing sweeteners. We use a system of consensus estimates of own- and cross-price responses and income responses based on Devadoss and Kropf,[20] Bhuyan and Lopez,[21] and Wohlgenant[22] to derive parameters ξ, ν and χ. We solve the following system of equations:

$\partial FGD_i/\partial P_{fgi} = \nu_{fgi} - \chi_{fgi}(\xi_{fgi} + \nu_{fgi}P_{fgi})$, $\partial FGD_i/\partial M = \chi_{fgi}$, $\partial WSD/\partial P_{ws} = \nu_{ws} - \chi_{ws}(\xi_{ws} + \nu_{ws}P_{ws})$, and $\partial WSD/\partial M = \chi_{ws}$.

Equations (23) and (24) lead to an equivalent variation, EV, equal to:

$$(25) \quad EV = \{[M - \xi_{ws}P^1_{ws} - \xi_{fg}'P^1_{fg} - 0.5\nu_{ws}(P^1_{ws})^2 - 0.5\textstyle\sum_{fg}\nu_{fgi}(P^1_{fgi})^2]\exp[-(\chi_{ws}P^1_{ws} + \textstyle\sum_{fg}\chi_{fgi}P^1_{fgi}) + (\chi_{ws}P^0_{ws} + \textstyle\sum_{fg}\chi_{fgi}P^0_{fgi})]\} - [M - \xi_{ws}P^0_{ws} - \xi_{fg}'P^0_{fg} - 0.5\nu_{ws}(P^0_{ws})^2 - 0.5\textstyle\sum_{fg}\nu_{fgi}(P^0_{fgi})^2].$$

Thus, we compute the change in expenditure, that would produce a change in utility equivalent to the price changes, with superscripts 0 and 1 denoting initial and final prices.

Total Welfare Gains and Losses From the Sugar Program

Finally, we list the welfare gains and losses from the presence of the sugar program accruing to the various groups represented in the model.

[20]Stephen Devadoss and Jurgen Kropf. "Impacts of Trade Liberalization Under the Uruguay Round on the World Sugar Market," *Agricultural Economics*, Vol. 15 (1996), pp. 83-96.

[21]Sanjib Bhuyan and Rigoberto A. Lopez, "Oligopoly Power in the Food and Tobacco Industries," *American Journal of Agricultural Economics* (Aug. 1997), pp. 1035-1043.

[22]Michael K. Wohlgenant, *Effects of Trade Liberalization on the World Sugar Market*, prepared for the Food and Agriculture Organization of the United Nations, Rome (1999).

Welfare Losses From the Presence of the Sugar Program

Losses to consumers (all prices higher as a result of the program):

$$(25)\quad EV = -\{[M - \xi_{ws}P^1_{ws} - \xi_{fg}'P^1_{fg} - 0.5\nu_{ws}(P^1_{ws})^2 - 0.5\textstyle\sum_{fg}\nu_{fgi}(P^1_{fgi})^2]\exp[-(\chi_{ws}P^1_{ws} + \textstyle\sum_{fg}\chi_{fgi}P^1_{fgi}) + (\chi_{ws}P^0_{ws} + \textstyle\sum_{fg}\chi_{fgi}P^0_{fgi})] - [M - \xi_{ws}P^0_{ws} - \xi_{fg}'P^0_{fg} - 0.5\nu_{ws}(P^0_{ws})^2 - 0.5\textstyle\sum_{fg}\nu_{fgi}(P^0_{fgi})^2]\}.$$

Net losses to sweetener-using food processors (higher sweetener input prices and higher output price):

$$(22)\quad \textstyle\sum_i \Delta\prod_{fgi} = -\{P^1_{fg}FGS^1_i - P^0_{fg}FGS^0_i - C_{fgi}(P^1_{ws}, P^1_{hfcs}, FGS^1_i) + C_{fgi}(P^0_{ws}, P^0_{hfcs}, FGS^0_i)\}.$$

Changes in quasi-profits to cane refiners (higher output price but significantly higher input prices):

$$(14)\quad \Delta\prod_{wcs} = -\{P^1_{ws}WCS^1 - P^0_{ws}WCS^0_i - \int_0^{WCS1} MC_{wcs}(P^1_{rcs}, WCS)\,dWCS + \int_0^{WCS0} MC_{wcs}(P^0_{rcs}, WCS)\,dWCS\}.$$

Welfare Gains From the Presence of the Sugar Program

Gains to beet producers (higher output price):

$$(5)\quad \Delta\prod_b = \int_{p0}^{P^1} BS(P_b, P_v, P_f)\,dP_b = \int_{p0}^{P^1} (\lambda + \mu P_b)\,dP_b = [\lambda P_b + (1/2)\mu P^2_b]^{P1}_{po}.$$

Gains to beet processors (higher white sugar price partly offset by higher beet input prices):

$$(9)\quad \Delta\prod_{wbs} = P^1_{ws}WBS^1 - P^0_{ws}WBS^0_i - \int_0^{WBS1} MC_{be}(P^1_b, WBS)\,dWBS + \int_0^{WBS0} MC_{be}(P^0_b, WBS)\,dWBS.$$

Gains to cane producers (higher output price):

$$(4)\quad \Delta\prod_c = \int_{p0}^{P^1} CS(P_c, P_f)\,dP_c = \int_{p0}^{P^1} (\alpha + \beta P_c)\,dP_c = [\alpha P_c + (1/2)\beta P^2_c]^{P1}_{po} \text{ and}$$

Net gains to HFCS producers (higher output price, net of slightly higher corn input price):

$$(11) \qquad \Delta\prod_{hfcss} = \int_{P_{corn}0}^{P_{corn}1} \int_{P_{hfcs}0}^{P_{hfcs}1} HFCSS(P_{hfcs}, P_{corn})\ dP_{hfcs} dP_{corn}.$$

Changes in quasi-profits to corn farmers:

$$(7) \qquad \Delta\prod_{corn} = \int_{p0}^{p1} COS(P_{corn})\ dP_{corn}.$$

Net gains to the foreign suppliers of raw sugar that have been given quota rights consist of the unit rent times the total amount of the TRQ:

$$(26) \qquad \Delta\prod_{fs} = (\text{Unit Rent}_{rcs}) * TRQ_{rcs}.$$

The net welfare loss is the difference between the additional costs of the sugar program to the users of sweeteners and the gains to domestic sweetener producers and processors:

$$(27) \qquad \text{Net welfare loss} = (EV + \sum_i \Delta\prod_{fgi} + \Delta\prod_{wcs}) - (\Delta\prod_{hfcss} + \Delta\prod_c + \Delta\prod_{wbs} + \Delta\prod_b + \Delta\prod_{corn}).$$

This net welfare loss that results from the sugar program consists of (1) production and consumption inefficiencies and (2) the transfer of rents to foreign suppliers.

Data and Data Sources Used in the Model

On the supply side, all data, parameters, and extraction rates used in the U.S. component of the world sugar model are from CARD. To estimate welfare effects for the food-processing industry, we identified a subset of 21 sweetener-using industries at the 4-digit SIC level (2023 to 2099). We took these industries from the major categories of (1) dairy and frozen desserts, (2) canned and preserved fruits and vegetables, (3) bread and bakery products, (4) confectionery and chocolate products, (5) beverages, and (6) miscellaneous food products industries. To calculate the demand and marginal cost for sweeteners from these industries, we used data on

the value of shipments for each industry, the price of sugar and HFCS, and the total quantities of sugar and HFCS sold for the years 1996 and 1998. For 1998 HFCS cost data, we scaled each industry proportionately, using 1997 Bureau of the Census data, to reproduce the exact total disappearance of HFCS in 1998. For 1996 HFCS data, we used cost data on corn sweeteners from the Bureau of Economic Analysis. We obtained price data for sugar, HFCS-42, and HFCS-55 from USDA and industry sources.

For the LINQUAD model of final consumer demand, we used producer price index data from the Bureau of Labor Statistics for each of our 21 4-digit SIC industries. We rebased the index numbers such that 1992=100. We then divided each index number by the consumer price index number for that year, also based with 1992=100, to capture how prices for each food group compared with prices in the overall economy. USDA provided data on total deliveries of sugar and HFCS. As previously noted, we obtained data on income elasticities and own- and cross-price elasticities from several sources in the economics literature.

Structure of the CARD International Sugar Model

The CARD International Sugar Model is a nonspatial, partial equilibrium econometric world sugar model consisting of 29 countries/regions, including a component for the rest of the world, to close the model.[1] Major sugar producing, exporting, and importing countries are included in the CARD International Sugar Model. The model specifies only raw sugar trade between countries/regions and does not disaggregate refined sugar trade from raw sugar trade. Consequently, importers are not categorized as refiners or toll refiners because the countries that specialize in these roles are well known and stable over time. The model covers the following countries/regions:

Algeria	Colombia	Guatemala	Mexico	South Korea
Argentina	Cuba	India	Morocco	Thailand
Australia	Eastern Europe	Indonesia	Pakistan	Turkey
Brazil	Egypt	Iran	Peru	Venezuela
Canada	European Union	Japan	Philippines	Rest of the World
China	Former Soviet Union	Malaysia	South Africa	

The general structure of the submodel for each country includes behavioral equations for the area harvested, yield, sugarcane and sugar beet production on the supply side, and per-capita consumption and ending stocks on the demand side. Equilibrium prices, quantities, and net trade are determined by equating excess supply and excess demand across countries and regions. The domestic price for each country or region is linked with a representative world price through exchange rates and other policy wedges, such as tariffs and transfer-service margins. Because of the overall scope of the model, it is not feasible to include the complete empirical model in the text of this report. The general framework for the submodel for each country consists of the following:

$$AH_t = f(AH_{t-1}, RSPP_{t-1}, RGP_{t-1}, \text{Trend}),$$

$$\text{Yield} = f(\text{Yield}_{t-1}, \text{Trend}),$$

$$\text{Cane and beet production} = f(\text{AH}, \text{Yield}),$$

[1]Our analysis replaced the U.S. sugar module of the CARD model with the model described in app. II.

Per-capita sugar consumption = f(RSP, PCRGDP), and

Ending stocks = f(ES_{t-1}, SC, RSP),

with AH denoting acreage, RSPP the cane or beet price, RGP the price of alternative crops, PCRGDP real income per capita, ES ending stocks, SC sugar consumption, and RSP the real raw sugar price. In many countries, beet or cane prices are set by policy and can be treated as predetermined. Because some countries lack information on the agricultural price, the model uses the raw cane sugar price, RSP, instead of the agricultural price in specifying the acreage response. In some countries, yield improvements are captured by a time trend.

Although the CARD model in general can be used in either a dynamic or static framework, we used its static version. In this way, the CARD international sugar model uses contemporaneous price responses in supply, consumption and inventory demand. Lagged acreage is fixed at the previous year level in the acreage equations. Short-term supply elasticities are based on the short-term price responses of the acreage equations, which reflect the cost of adjustment between desired acreage and actual acreage. Long-term responses are obtained by using the Nerlovian long-term response, which is the short-term response divided by the partial adjustment coefficient of the corresponding acreage equation. In addition, the elasticity values our analysis uses are arc elasticities evaluated for 1998 between the historical and post-reform levels.

We obtained data for the area harvested, yield, and sugarcane and sugar beet production from the Food and Agricultural Organization of the United Nations and data for sugar production, consumption, and ending stocks from USDA's Production, Supply, and Distribution database. Cane and beet production is tied to sugar production through the extraction rate. We obtained macroeconomic data, such as the real gross domestic product, consumer price index, population, and exchange rate from sources including the WEFA Group; Project Link; and S&P/DRI.

We estimated the model for the period 1980 through 1998. We used simple linear specifications and ordinary least squares in the estimation of these equations to save degrees of freedom, given the short time series used. This estimation approach overlooks the potential endogeneity of each country's domestic sugar prices and treats them as exogenous in estimating acreage response equations. The Caribbean raw sugar price is generally considered to be the world market price.

Most elasticities in the CARD model are comparable to those used by Devadoss and Kropf (1996),[2] Hafi et al. (1993),[3] and Wohlgenant (1999).[4] The lagged own-price supply elasticities for sugarcane for Australia (0.02), Brazil (0.07), Colombia (0.05), Cuba (0.01), Guatemala (0.02), Mexico (0.002), South Africa (0.005), and Thailand (0.014) are highly inelastic in the short run. This is consistent with the fact that these countries are large producers of sugarcane and exporters of sugar and can harvest several annual crops, called ratoons, from one planting of sugarcane. Therefore, there is limited acreage adjustment to price fluctuations in the short run. These low elasticities are largely the result of the historical policy of acreage allotment. The own-price supply elasticities for sugar beet production are generally not as inelastic as they are for sugarcane, except for the former Soviet Union (0.002).

The own-price demand and income elasticities reflect the fact that in many developing countries, sugar is considered a staple in the diet and consumers look to sugar to fulfill basic caloric requirements. The elasticities implied in the CARD model are very comparable to ones reported in the literature. For several countries, when more recent data were not available for the econometric estimation, we borrowed elasticities from Hafi et al. (1993) and from Devadoss and Kropf (1996).

The Added Raw/Refined Sugar Link for GAO's Analysis

Although the CARD international sugar model does not disaggregate raw and refined sugar, we complemented the existing model with an additional equation to endogenize the world price of refined sugar following the removal of the refined sugar TRQ in the United States. Consistent with Hafi et al. (1993), we specified a reduced form to approximate the rest-of-the-world supply faced by the United States. However, there is no explicit aggregation of excess supply in the various countries to derive this equation, as is the case for the raw sugar market. This equation is of the form

$$IWS_{row} = a(Pw_{ws})^{\alpha ws}\,(Pwrcs)^{\beta cs}$$

[2]S. Devadoss and J. Kropf. Cited in app. II.

[3]A. Hafi, P. Connell, and R. Sturgiss, "Market Potential for Refined Sugar Exports From Australia," Australian Bureau of Agricultural and Resource Economics Research, Report 93.17, Canberra, (1993).

[4]M.K. Wohlgenant. Cited in app. II.

where IWS is imports of white sugar and the elasticities of white sugar and raw cane sugar are $\alpha_{ws} = 0.83$ and $\beta_{cs} = -0.44$, respectively.

These elasticity values come from Hafi et al. (1993) and are medium-run estimates. Parameter a is chosen to calibrate the IWS to the existing refined sugar TRQ level in the United States, prior to the TRQ's removal.

This equation is treated as the rest-of-the-world supply, which underlies the import supply faced by the United States. The latter is then equated to the U.S. excess demand for white sugar to close the white sugar market in our analysis, once the TRQ is removed.

Economic Analysis of a Tariff-Rate Quota

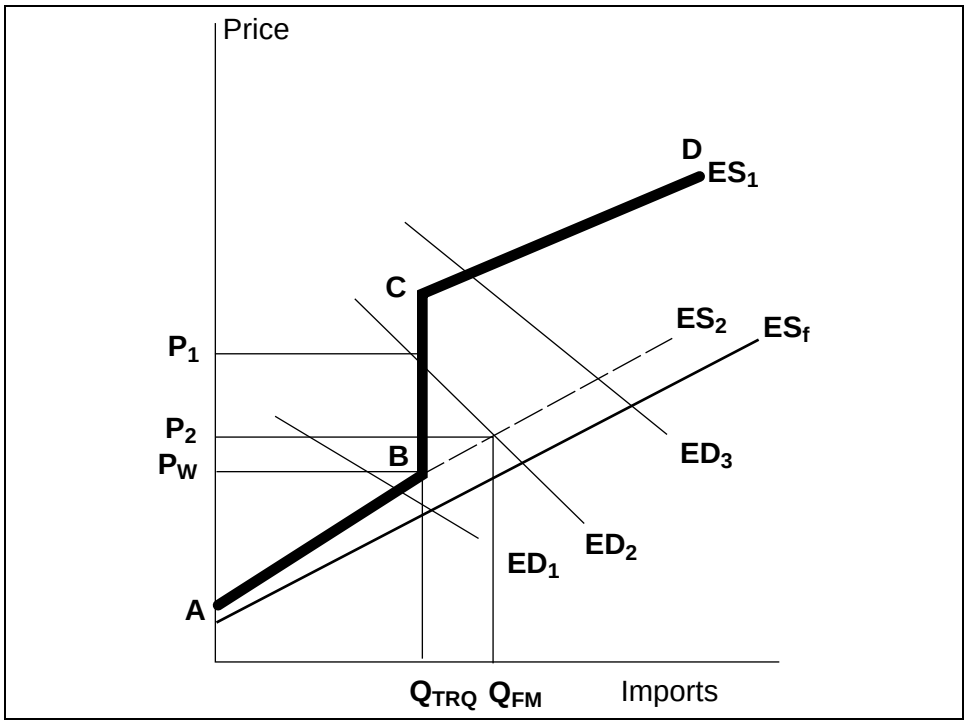
The sugar program includes the use of a TRQ to limit imports of raw and refined sugar that come into the United States. Under a TRQ, a lower, "in-quota" tariff applies to a limited quantity of imports, while a higher, often prohibitive, "over-quota" tariff applies to any imports that exceed the quota. Our model follows Moschini,[1] as well as Meilke and Lariviere,[2] in its representation of the import supply under a TRQ.

Figure 3 illustrates the effects of the TRQ on the excess supply curve and shows how this type of policy affects the incentive to import. Our model describes three excess supply conditions–ES_f, ES_1, and ES_2. ES_f represents the excess supply curve facing the United States if it did not have import restrictions, while ES_2 is the excess supply curve under the in-quota tariff. However, under the current U.S. sugar TRQ, producers from very few quota-holding countries pay the in-quota tariff and most pay none because of preferential arrangements. Therefore, without loss of generality, we will assume that ES_2 is actually the free trade excess supply curve facing the United States in the absence of import restrictions.

[1]G. Moschini, "Economic Issues in Tariffication: An Overview," *Agricultural Economics,* Vol. 5 (1991), pp. 101-120.

[2]Karl Meilke and Sylvain Lariviere, "The Problems and Pitfalls in Modeling International Dairy Trade Liberalization," Working Paper #99-3, International Agricultural Trade Research Consortium (Mar. 1999).

Figure 3: The TRQ's Effect on Imports



Overall, the TRQ introduces a discontinuity in the excess supply curve facing an importing country at the level of the quota, as shown in the bold curve ES_1.[3] As figure 3 illustrates, the TRQ can result in three potential trade and price outcomes, depending on the U.S. excess demand for foreign sugar. First, if the excess demand schedule intersects the segment AB on the lower portion of the excess supply curve, such as ED_1, then there is a supply response to shifts in the excess demand schedule and both quantity and price will change. In this area of the curve—the "in-quota" portion of excess supply—the domestic price equals the world price because the importing country is actually not imposing any border measures. Second, if the excess demand schedule intersects the excess supply schedule at the level of the TRQ, such as ED_2, the domestic price will equal P_1 and the world price P_W. Rents are generated for the holders of

[3]We employed the "large country" assumption in our analysis of excess supply under a TRQ, in the sense that changes in U.S. imports would be sufficient to affect international prices. Thus, the excess supply curve is upward sloping at import volumes in ranges other than where the TRQ is binding.

the quota rights corresponding to the binding TRQ. In this case, the quota rent will be equal to the difference between the domestic price and the world price. This situation corresponds to the current U.S. sugar import situation. Third, if the excess demand schedule intersects the excess supply schedule sufficiently beyond the TRQ, such as ED_3, both the price and the quantity of imports supplied will respond to shifts in the excess demand for the imports and the rest of the world will satisfy this demand.

Estimated Net Losses to the U.S. Economy Accruing to Foreign Sugar Importers, Fiscal Year 1998

Allocation and imports in short tons (raw value

Country	TRQ allocation[a]	Actual imports	Estimated economic loss
Argentina	72,300	72,200	$14,600,000
Australia	139,500	140,100	28,400,000
Barbados	8,600	0	0
Belize	18,500	18,500	3,800,000
Bolivia	13,400	12,600	2,600,000
Brazil	243,700	242,900	49,300,000
Colombia	40,300	37,200	7,500,000
Congo	8,000	8,000	1,600,000
Costa Rica	25,200	25,200	5,100,000
Cote d'Ivoire	8,000	30	6,000
Dominican Republic	295,800	294,500	59,700,000
Ecuador	18,500	18,500	3,800,000
El Salvador	43,700	44,000	8,900,000
Fiji	15,100	11,900	2,400,000
Gabon	8,000	0	0
Guatemala	80,700	80,400	16,300,000
Guyana	20,200	20,200	4,100,000
Haiti	8,000	0	0
Honduras	16,800	16,900	3,400,000
India	13,400	13,800	2,800,000
Jamaica	18,500	18,300	3,700,000
Madagascar	8,000	8,100	1,600,000
Malawi	16,800	13,200	2,700,000
Mauritius	20,200	20,400	4,100,000
Mexico	27,600	27,600	5,600,000
Mozambique	21,800	22,100	4,500,000
Nicaragua	35,300	35,400	7,200,000
Panama	48,700	48,700	9,900,000
Papua New Guinea	8,000	100	20,000
Paraguay	8,000	5,500	1,100,000
Peru	68,900	69,000	14,000,000
Philippines	226,900	222,800	45,200,000
St. Christopher-Nevis	8,000	8,000	1,600,000
South Africa	38,700	38,800	7,900,000

(Continued From Previous Page)

Allocation and imports in short tons (raw value

Country	TRQ allocation[a]	Actual imports	Estimated economic loss
Swaziland	26,900	27,000	5,500,000
Taiwan	20,200	20,200	4,100,000
Thailand	23,500	23,500	4,800,000
Trinidad-Tobago	11,800	12,100	2,400,000
Uruguay	8,000	8,200	1,700,000
Zimbabwe	20,200	20,100	4,100,000
Total	**1,763,700**	**1,706,030**	**$346,026,000**

Note: Each country supplying sugar to the United States under the TRQ is limited to exporting sugar that solely originated within that country.

[a]Allocations are based on countries' exports to the United States from 1975 through 1981.

Source: *Sugar and Sweetener Situation and Outlook*, Economic Research Service, USDA (Sept. 1999).

Comments From the U.S. Department of Agriculture

USDA

United States Department of Agriculture

Farm and Foreign Agricultural Services

Farm Service Agency

1400 Independence Ave, SW
Stop 0508
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Mr. Robert E. Robertson
Associate Director
Food and Agriculture Issues
Resources, Community, and
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United States General Accounting Office
Washington, D. C. 20548

MAY 16 2000

Dear Mr. Robertson:

The U.S. Department of Agriculture (USDA) has serious concerns about the U.S. General Accounting Office (GAO) draft report entitled: "Sugar Program: Supporting Sugar Prices Has Increased Users' Costs While Benefiting Producers."

See comment 1.

This report suffers in a number of regards relative to both the analytical approach used by GAO and the resulting conclusions. First, the cost/benefit evaluation methodology used in the report is not adequately developed or justified. Although static economic theory can be used to justify the approach taken, there are various assumptions that GAO omitted that obscure or distort the meaning and significance of the results. Second, the report provides poor to non-existent documentation of the economic model used in the analysis. The model description is confused and provides no basis for possible replication or validation. Third, there are a number of inconsistencies between the results presented and the modeling description or alternative data sources that undermine confidence in the results.

These observations suggest that GAO has not attempted to realistically model the U.S. sugar industry. The validity of the results are, therefore, suspect and should not be quoted authoritatively.

I. USDA Concerns About GAO's Analytical Approach

Inadequate Justification For Modeling Approach. Although not developed in the report, GAO implicitly bases their approach on the traditional gains-to-trade argument. The theory supports the proposition that trade is positive when trade gains are such that losers from a trade opening can be compensated for their losses and still have a net gain available to the nation. This argument is a result of static theory that ignores the level of pre-existing distortion in the world market for a commodity. According to the theory, welfare gains to a nation are achievable from two sources: a better allocation of world economic resources (theory of

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comparative advantage) and taking advantage of direct and indirect export subsidies offered by other trading nations.

See comment 2.

The GAO does not distinguish between the two sources of gain. World sugar trade is noted for its high level of distortions. The world price is significantly below estimates of costs of production for even the major world sugar exporters (Haley, 1998). For example, sugar exports from the European Community (EU) receive direct export subsidies and overall production is indirectly supported by extremely high EU consumer prices. Most developing sugar-producing nations pursue policies that simultaneously limit sugar imports (eliminating competition to their sugar producers), restrict domestic sales into their own markets (extract rents through high consumer prices), and then export the remainder into the world market (lower the world price of sugar).

See comment 3.

See comment 4.

The United States has pursued multilateral agricultural trade reform through the Uruguay Round Agreement of the General Agreement on Tariffs and Trade (GATT) and is committed to further reform through the World Trade Organization (WTO). If the United States were to successfully achieve reform in world sweetener markets in multilateral trade negotiations after having eliminated its own sugar policies, the world price could conceivably rise to levels close to current domestic levels (See Schmitz and Vercammen, and also Borrell and Duncan). However, because the sugar industry has very high fixed costs, it is unlikely that domestic sugar production could recover once processing facilities are closed. The welfare gains calculated by GAO would largely disappear and the net effect would be the replacement of domestically-produced sugar with foreign-sourced sugar.

See comment 5.

Now on p. 25.
See comment 6.
See comment 7.
See comment 8.

Poor Model Documentation And Structural Issues. The description of the GAO model is not well documented and has incomplete references. It is not clear which part of the model comes from the Iowa State University Center for Agriculture and Rural Development (CARD) model and which part was developed by GAO. It seems as though the U.S. portion of the CARD International Sugar Model was removed and a GAO developed module was inserted. However, CARD is at times referenced for parameter values for what seems to be the GAO portion of the overall model. Some supply elasticity values are mentioned (page 20, Appendix II) but do not relate directly to the linear equation structure presented in the report (equations 3 and 4). Appendix II mentions an import supply elasticity specification that does not seem consistent with the explicit inclusion of the sugar sectors of the countries mentioned in Appendix III. Because the CARD sugar model appears to be a dynamic model that emphasizes supply sector adjustments over a multi-year time frame, one wonders how it can be linked to a static model that

presumes instantaneous and costless adjustments within the United States. Although GAO presents equations (nos. 25-27) that describe the calculation of welfare results to various model participants, symbols are not really defined with reference to those previously described. A "LINQUAD" demand system is referenced to two unpublished sources. Given the serious nature of the GAO objective in this report, reliance on a less experimental or more fully documented approach is warranted.

Now equations 23-25.
See comment 9.
See comment 10.

Inadequate Treatment Of Sugar Processing. It is not clear that GAO understands the relationship between the sugar producing and processing sectors. No equations are presented that show how sugarcane and sugar beet acreage are affected by the economics of the processing industry. Refined sugar prices seamlessly influence raw sugar and primary crop prices simultaneously (equation 15) and primary crop production adjusts automatically through equations 3 (sugarbeets) and 4 (sugarcane). Large, discontinuous reductions in primary crop supplies that are typical in the industry when processing plants close because they cannot cover variable costs cannot be modeled, given the described GAO system. This inattention to detail may be the cause of the minimal primary crop supply response reported in Table 7 that seems completely unrealistic and also at odds with GAO-reported elasticity values between 1.89 and 7.4 for sugarcane and 4.5 and 11.6 for sugar beets.

See comment 11.

Now equations 13,1, and 2.
See comment 12.

See comment 13.

Equations 5 and 10 suggest that raw cane sugar and refined beet sugar prices are determined by sugarcane and sugar beet prices, respectively. It naively presumes that these primary crop prices exist, although it is well known that they are derived well after the harvest at the end of the sugar marketing year. Producers of these crops split the revenue received by the processor with the processor according to a contract. Producers are paid on the amount of sugar in the beets or cane delivered to the factory and the price the processor receives for the sugar. The model also does not reflect the fact that the sugarcane and sugar beet processing industries are dominated by producer-owned companies. The decision to grow sugarcane or sugar beets is influenced by these producers' investments in the processing plants.

Now equations 3 and 18.
See comment 14.

See comment 15.

It is also not clear that GAO understands that, as part of the U.S. sugar program, processor participation in the loan program requires minimum payments to sugar beet and sugarcane producers by the processors when nonrecourse loans are in effect. Although GAO explicitly models a sugar beet processing sector, it makes no mention of the corresponding sugarcane processing sector, and this sector is excluded from analysis (no welfare results).

See comment 16.

See comment 17.

See comment 18.

Misspecification Of U.S. Sugarcane And Sugar Beet Production. It is unclear from the documentation whether regional sugarcane and sugar beet areas are explicitly broken out. Cost structures vary significantly across growing regions as well as primary crops. Alternative crops that provide the basis for supply elasticity values differ considerably across regions. The implication is that supply adjustments due to lower prices are not likely to be a continuous process, averaged-out across cane and beet producing areas, as presumed by GAO. Certain high-cost areas will likely see their entire industries disappear, and other regions may face only marginal supply declines. Probably more important than the explicit modeling of the six sugar-using industries, GAO should have focused much more on the specification of production and emphasized this aspect much more explicitly in its documentation.

See comment 19.

See comment 20.

Inadequate Treatment Of Consumer Effects. The GAO has attempted to deal with the issue of whether reductions in refined sugar prices will be passed along to final consumers. In their modeling structure, they emphasize the effects of an oligopolistic market structure on price pass-through. Presumably, an intercept term in equation 20 (marginal cost equation) captures the notion of market power, but it is not obvious how that term adjusts for the notion of market power. Marginal cost is typically the basis for a firm's supply curve - on the face of it, it would seem that the effect of oligopolistic competition would enter on the demand side as limited competition changes a firm's perceived marginal revenue. As presented, the GAO adjustment seems arbitrary, and should be referenced to published research. The introduction of the jargon term "conjectural variation" does not illuminate the discussion.

See comment 21.

GAO references a paper by McCorriston and others (1998) that shows how price pass-through is affected by market structure, the role of marketing inputs, the retail price elasticity of demand, and other factors. Aside from market structure, it does not appear that any other of these effects are modeled by GAO, contrary to what is implied in the report.

See comment 22.
Now on pps. 29 and 48.

Incorrect Characterization Of The World Sugar Market. GAO erroneously refers to the world sugar market as a "free trade" situation (pages 24 and 38) . As a representative of LMC International has testified before Congress, every sugar producing country provides some type of government support for its sugar sector. The ES_2 supply curve in Figure 2 would certainly be shifted to the left in a free trade situation and the world price would be higher than presented in the analysis.

Most of the sugar traded on the "world" market, Contract #5 (refined sugar) and Contract #11 (raw cane sugar), is the residual sugar left after exporting countries meet all of their preferential domestic and international market commitments. Their average revenue and costs tend to be higher than the world price. Thus, it is possible that the domestic sugar industry could pursue an anti-dumping action under certain circumstances, which would significantly affect GAO's market price estimates under their no program scenario.

See comment 23.

Awareness of the distortions in the world market for sugar is the reason that USDA prefers total world market liberalization rather than unilateral disarmament. It is interesting to note that Schmitz and Vercammen modeled a more liberalized trade scenario, the results of which indicated raw cane sugar prices in the 21 to 22 cents per-pound range.

See comment 24.

Thus, for GAO to state that USDA has maintained "artificially high" sugar prices indicates that GAO may question the United States' objective of pursuing international trade reform and free world markets through trade negotiation.

See comment 25.

II USDA Concerns About GAO's Conclusions

Effect Of The Sugar Program Elimination On The High Fructose Corn Syrup (HFCS) Market. The GAO purports to show that HFCS producers would experience no economic losses if there were no sugar program. They argue that HFCS prices are already sufficiently low such that HFCS prices would be unaffected by the elimination of the sugar program. This conclusion is in error on several counts. Low HFCS prices have been largely influenced by over-expansion in the industry by both large existing firms and the entry of smaller concerns in the mid-1990s (Sugar and Sweetener Situation and Outlook, May 1998). Their hope is for domestic and international demand to expand over time, while trying to limit the number of plant closures in the short to medium term. Increased competition from world-priced refined sugar would limit their prospects for recovery and induce more industry retrenchment. The GAO characterization of the HFCS industry has not recognized this dynamic.

See comment 26.

The GAO argument that marginal changes in refined sugar prices have no bearing on the demand for HFCS seems inconsistent with its modeling structure. In GAO's discussion of the results, it seems to imply a linear transformation schedule between refined sugar and HFCS that would show no substitution away from HFCS unless the refined sugar prices were actually lower than HFCS prices. However, GAO's equations 17 and 17a

See comment 27.

Now equations 15 and 15a.

See comment 28.

show a Cobb-Douglas own-and cross-price elasticity relationship between refined sugar and HFCS. This specification would seemingly imply that quantities adjust to price changes to keep the share coefficients constant. This does not seem to be the result that GAO obtained. GAO reports after equation 19 that it introduced a scaling parameter to force demand elasticities in the range of -0.1 and -0.2. Justification for this rescaling is not presented, and seems to short-cut to a result without searching the literature for estimates of demand elasticities.

See comment 29.

Another source of puzzlement comes from a comparison of actual HFCS-55 prices for 1996 and 1998 with simulated refined sugar prices from the model. The actual HFCS-55 price for 1996 averaged 20.6 cents a pound (Table 4), which compares to a simulated refined sugar price of 20.5 cents a pound (Table 7). The corresponding numbers for 1998 are 13.4 cents a pound for HFCS-55 and 14.8 cents a pound for refined sugar. Even if GAO used an implied infinite elasticity of substitution (the linear transformation schedule specification, referred to above), sensitivity analysis would show potentially large changes in the distribution of welfare results. The importance of this result would be to show HFCS producers that they could be potentially affected by changes in the program, even though effects are not in the table.

See comment 30.

Effect Of The Sugar Program Elimination On Cane Refiners. The GAO shows that the U.S. refining industry gains from the elimination of the sugar program. This result should be subject to further analysis. GAO models the equilibrium relationship between raw and refined sugar prices as a function of technical coefficients involved in the refining process (equation 14). However, without the protection afforded by the refined sugar tariff rate quota (TRQ), the raw-refined margin relevant for the industry becomes the international margin. This margin is highly variable and in recent years has been below the average cost of refining sugar (around 3.5 cents a pound for the more efficient U.S. refiners). This intrinsic variability and low world refining margins will affect the industry and suggest that welfare gains shown by GAO should be interpreted very tentatively.

See comment 31.

The GAO has not adequately analyzed the increased competition that the domestic refining industry could face as a result of the elimination of the refined sugar TRQ. GAO presents an unnumbered, reduced-form equation in Appendix III that is meant to model U.S. imports of refined sugar. While this equation provides closure to the GAO model, it is doubtful that it could account for dynamic changes introduced by the elimination of the sugar program. The U.S. refining sector would likely find that elimination of the sugar program poses a definite risk relative to the competition it faces, with little assurance that

it could be protected from direct and indirect export subsidies of the refining and beet processing sectors of countries trying to capture additional value-added for their sugar industries.

See comment 32.

Effect of the Sugar Program Elimination on Consumers. The GAO estimates that the sugar program cost consumers $0.7-$1.7 billion in 1996 and $0.9-$2.2 billion in 1998 depending on the extent that sugar-containing product manufacturers pass through their cost reductions. GAO assumes that reductions in wholesale sugar prices are fully transmitted to table sugar retail prices. However, wholesale refined beet sugar prices have dropped over 20 percent during the last year, but retail refined sugar prices have decreased less than 0.7 percent for the year ending March 2000 (latest available data).

See comment 33.

See comment 34.

The role of marketing inputs should have been included in the GAO analysis. Analysis of the retail and wholesale sugar price data presented in Table 1 shows that the U.S. retail refined sugar price is a function of the 1-year lagged wholesale price (coefficient = 0.592) and a statistically positive growth trend (0.007). (Eighty-eight percent of the variation of the retail price series is explained by these two factors.) This is true even for a "homogenous" product like refined sugar, so that the amount of the pass-through certainly appears to be less than what GAO acknowledges. For example, the wholesale-retail price spread has increased from 12 cents per pound in 1985 to 17 cents per pound in 1999, and this spread is increasing. As of March 2000, the spread was 21.4 cents.

See comment 35.

Benefits Of The Sugar Program To Sugarcane And Sugar Beet Farmers. The GAO concludes that sugar beet growers' benefits from the sugar program totaled $732 million in 1998. This estimate clearly overstates program benefits to growers. The estimate of program benefits for sugar beet farmers, defined in the model discussion as the increase in profits, for 1998 would be 63.1 percent of the total value of the 1998 beet crop – $1,160 million. USDA estimates that total cash expenses for sugar beets for 1998 averaged $581 per planted acre, or $848 million in aggregate, leaving only $312 million for capital replacement, operating capital, nonland capital, land, coop share, and profit. Benefits for the sugarcane growers appear to be similarly unrealistic.

III Specific Comments

See comment 36.

1. Page 3, paragraph 1 - There is no certain level, certainly not fixed by the program, at which borrowers forfeit their loan collateral in lieu of repayment of their Commodity Credit Corporation loans. Borrowers have their own internal calculation, and in FY 2000

much sugar was sold by borrowers at levels even far below the loan rate.

See comment 37.

2. Page 3, paragraph 1 - Use of the phrase "artificially high" to describe domestic sugar prices is inflammatory and unprofessional. USDA has acted to keep domestic sugar prices from increasing by frequently increasing the sugar TRQ above WTO commitment without the declaration of shortages, which is required for all other commodity TRQ's.

See comment 38.

3. Page 3, paragraph 1 - The domestic sugar market has fundamentally changed since the period of GAO's analysis, FY 1996 and FY 1998. USDA has been expecting forfeitures of loan collateral in FY 2000 because sugar prices fell considerably below the loan rates. The recently announced purchase program decreases the likelihood of significant forfeited quantities. Regardless, no TRQ policy was available to avoid the reduction in domestic prices suffered by the domestic industry in FY 2000.

See comment 39.

The North American Free Trade Agreement is now significantly affecting the domestic sugar market as it has throughout the time GAO was preparing this report. The declining NAFTA high-tier tariff has already resulted in the importation of Mexican sugar above the TRQ. Further required reductions in the NAFTA high-tier tariff may result in larger quantities of Mexican imports above the TRQ. The access for Mexican sugar under the TRQ will increase significantly from the current 27,558 ton access and may expand up to 276,000 tons in FY 2001.

See comment 40.

4. Page 3, paragraph 2 - Former Under Secretary Moos referred to GAO's 1993 report as "over simplistic" in his testimony before Congress. GAO's report did not adequately consider the complexities and dynamics of the U.S. and global sugar markets. The report was flawed in its estimates. Some data were used incorrectly and important sugar market issues were not considered. Based on GAO's methodology, different welfare impacts can be obtained by selecting prices in different time periods. Furthermore, GAO's recommendation to Congress, which was for the United States to unilaterally lower the support price for sugar, is at variance with GAO's assumptions of multilateral trade liberalization for estimating costs under the program.

Specifically, the GAO:

- did not qualify, and likely underestimated, its assumed world free-market price of 15 cents a pound for raw cane sugar;

- failed to distinguish between unilateral and multilateral trade liberalization effects;
- selected a time period for estimating the welfare burden of the U.S. sugar program that exaggerated the program's cost;
- failed to clarify the difference between consumers and users of sugar in estimating impacts.

5. Page 4, paragraph 2 - In GAO's 1993 report, they compared U.S. domestic prices with an estimate of a "world-liberalized price." In this report, GAO compares U.S. domestic prices with a world price under a scenario of only the United States eliminating its sugar program. The world price under this latter scenario could be categorized as a dump market price by definition. The basic question becomes: why would GAO switch from their 1993 approach to an approach that uses a dump market price as a basis for comparisons?

See comment 41.

6. Page 9, paragraph 2 - The Agriculture and Food Act of 1981 no longer has any relevance to the sugar loan program. The paragraph could be written in past tense to give a historical perspective. The Federal Agriculture Improvement and Reform Act of 1996 is the current authority.

Now on p. 12.
See comment 42.

7. Page 9, footnote 3 - The footnote states that the refined sugar TRQ is 28,000 tons each year. This is in error. The WTO minimum is 28,000 metric tons. The actually announced TRQ levels have been exceeding that amount. For example, the FY 1998 and FY 1999 refined sugar TRQ's were set at 50,000 metric tons. For FY 2000, the refined sugar TRQ was set at 60,000 metric tons

Now on p. 12.
See comment 43.

8. Page 10, paragraph 2 - The last sentence should include: (6) increasing the sugar marketing assessment to 0.2475 cents per pound of raw cane sugar and 0.2654 cents per pound for beet sugar.

Now on p. 13.
See comment 44.

9. Page 10, paragraph 3 - The discussion of the calculation of a forfeiture price is inadequate. It would be simpler just to say that "...if domestic sugar prices drop to a level such that the borrower receives a higher return by forfeiting the loan collateral in lieu of repaying the loan." The calculation for determining a forfeiture level, or a processor's opportunity cost of selling on the market rather than forfeiting, is the loan rate, plus interest (not storage), plus transportation, minus the forfeiture penalty.

Now on p. 13.
See comment 45.

Now on p. 13.
See comment 46.

10. Page 10, paragraph 4 - The cost of transportation would create a difference even if there were no program but it is unclear if transportation costs were included in the analysis. It is impossible from the USDA review draft to determine what costs were included in the analysis.

Now on p. 20.
See comment 47.

11. Page 16, paragraph 1 - The first sentence is not true for FY 2000. It should be qualified by, "In the past,...."

Now on p. 21.
See comment 48.

See comment 49.

12. Page 17, Table 5 - Sugarcane and sugar beet grower benefits appear to be much too high (see previous comments). There should be a line for the Federal government's benefits due to the sugar marketing assessment. Sugarcane processors should have a line describing their benefits similar to the sugar beet processor estimates. GAO shows that the current sugar program results in a cost to HFCS manufacturers and corn growers, but this is not realistic.

Now on p. 21.
See comment 50.

13. Page 17, paragraph 3 - The last sentence is incorrect. For 1996, GAO's estimate for the wholesale refined sugar price under the no program scenario (Table 7) is below the 1996 HFCS-55 average price (Table 4).

Now on p. 22.
See comment 51.

14. Page 18, paragraph 2 - GAO attributes the loss to the U.S. economy from monetary transfers to foreign countries that are allocated a portion of the TRQ as being caused by the sugar program. These transfers are more of a foreign policy issue than a sugar program issue.

Now on p. 25.
See comment 52.

15. Page 20, Table 7 - GAO estimates that the 1996 world wholesale price under a no program scenario would be 20.50 cents per pound. Given its 13.61 cent raw sugar price, the refining margin would be 6.89 cents per pound, which is unrealistic under a no program scenario and even inconsistent with the information on world refining margins that GAO provides in Table 1. The data in that table showed a 14-year average refining margin of only 3.23 cents per pound. The 14-year high was 4.77 cents. During the last 3 years, 1997-1999, the average was only 2.25 cents with a high of only 2.56 cents in 1999.

See comment 53.

The no program scenario shows little effect on U.S. cane and beet production. That is inconsistent with GAO's supply elasticity estimates and unrealistic given published data on U.S. costs of production.

Now on p. 30.
See comment 54.

16. Pages 24 and 25. GAO states that a lower U.S. refined price would cause a decrease in the quantity of refined sugar supplied and a decline in the demand for raw cane sugar. This statement is not realistic unless one assumes decreasing refining margins.

Now on p. 32.
See comment 55.

17. Page 26, paragraph 1. GAO refers to the price of fruits and vegetables impacting on the supply of cane. GAO should report the price of these alternative crops under a no program scenario and what would happen to these prices if half the Florida cane production ceased, which is a more realistic result under this scenario.

Now on p. 38.
See comment 56.

18. Page 30, paragraph 2 - The 20-percent markup of price over marginal cost appears arbitrary and should be justified in the text.

We appreciate having had the opportunity to comment on the GAO draft report. If you have any questions, please contact Daniel Colacicco, Director of the Dairy and Sweeteners Group, Economic Policy and Analysis Staff, Farm Service Agency.

Sincerely,

Keith Kelly
Administrator

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GAO Comments

The following are GAO's comments on the U.S. Department of Agriculture's written response to our draft report dated May 16, 2000. Based on agency and industry comments, we adjusted our model to more fully account for certain transportation costs. As a result, cost and benefit estimates referenced in USDA's comments do not reflect those contained in the final report.

1. After thoroughly examining each of the Department's concerns and discussing them with experts outside GAO, we continue to believe that our analytical approach and model for estimating the costs and benefits of the sugar program are comprehensive and methodologically sound and that the estimates yielded by our model are reasonable. In developing the model, we took a number of actions to ensure that it was methodologically sound. First, we contracted with a well-known expert in modeling the international trade of agricultural commodities and with a prominent agricultural economist to work with us in developing the model. In December 1999, we sent our proposed model to four outside academicians specializing in agricultural economics and international trade economics and revised the model in response to their comments. We also sent our proposed model to USDA for review at that time. However, USDA did not provide any comments. Furthermore, we asked two of the agricultural economists to review our final model and results before we sent our draft report to USDA for comment.

2. Our approach is not strictly based on a traditional "gains-to-trade" argument, and its validity does not depend on world prices being free of market distortions. We did not distinguish between the effects of comparative advantage and export subsidies or other forms of market intervention in determining the price at which U.S. sugar users would be able to purchase sugar. To estimate the costs and benefits of the sugar program, our model compared baseline domestic and world prices for sugar in 1996 and 1998 with the domestic and world prices that we estimated would occur if the sugar program were eliminated, other things being equal. These estimated prices were higher than the baseline world prices because our model accounted for the impact on world prices of the higher U.S. sugar imports that would have occurred if the program had been eliminated. Comparing these estimated prices with the baseline prices was appropriate for estimating the effects of the sugar program because the estimated world prices reflect what domestic sugar users would have been expected to pay for sugar in

those years if the sugar program had been eliminated. This comparison remains appropriate regardless of whether the world price is influenced by subsidies by countries with surplus production.

3. While the world sugar price that would result from multilateral reform is uncertain, we believe that several elements of the Schmitz and Vercammen analysis (University of California, Berkeley, 1990) led to a high price estimate that is unlikely to be observed. In particular, they assume a relatively high (in absolute value) excess demand elasticity of –0.5 and a very inelastic excess supply schedule from the rest of the world. That is, they assume that a small increase in the world price will lead to a large reduction in the quantity of sugar demanded but only a small increase in the quantity of sugar that producers in other countries would want to supply. Both assumptions tend to cause the world price to rise more following multilateral reform than would happen if assumptions of less elastic excess demand and more elastic excess supply were used. Schmitz and Vercammen also overstate the world price that would follow multilateral reform because they do not account for the supply responses of all exporting countries.

4. On the basis of our review of the literature, we believe that the effect of multilateral reform of sweetener markets on world sugar prices is highly uncertain. Even if world prices were to rise, this increase would likely be gradual because the reforms would likely be phased in over a substantial period of time. Therefore, we regard as speculative USDA's view that multilateral reform following the elimination of the U.S. sugar program would erase the welfare gains that we attributed to the program's elimination.

5. We disagree with USDA's assertion that our model is not well documented and includes incomplete references. However, we added language to the scope and methodology section of our report to explain further the relationship between the model we used in our analysis and the CARD model.

6. We clarified where on the linear supply schedule the supply elasticities that we use were estimated.

7. We disagree with USDA that the import supply elasticities are inconsistent with our model. We clarified our report to indicate that these elasticities are derived explicitly from the CARD model, which includes the sugar sectors of the countries listed in appendix III.

8. We disagree with USDA's assertion that our model presumes instantaneous and costless adjustments within the United States. In fact, our short-run elasticities are smaller than our longer-term elasticities because they take adjustment costs into account. However, we added clarifying language to appendix III.

9. We disagree. Our draft report defined each of the symbols describing the variables used in the LINQUAD model.

10. We disagree with USDA's assertion that the LINQUAD model is experimental and not well documented. The LINQUAD approach is the latest development of the incomplete demand system approach pioneered by Professor Jeffrey LaFrance at the University of California, Berkeley. The LINQUAD approach is fully documented in several working papers that are publicly available, and Professor LaFrance's work on incomplete demand systems has appeared in many leading economics journals. Professor LaFrance first published his results in 1990 in an article of the *Australian Journal of Agricultural Economics*. The method was first empirically implemented in an application to dairy in a 1991 article of the *American Journal of Agricultural Economics*. The model was also documented in a thesis that received the American Agricultural Economics Association's *Outstanding Thesis Award* in 1999. The incomplete demand system model was appropriate for our work in modeling sugar demand because it allowed us to compute a consistent welfare measure that included direct and indirect sugar consumption in food.

11. We disagree that our model's treatment of the sugar-processing sector was inadequate. Although no equations for sugarcane and sugar beet acreage are presented in the report, our model solves for acreage as well as prices and production levels. We clarified this point in appendix II.

12. We disagree with USDA's characterization of equation 15 (now equation 13). This equation establishes a condition that must be met for the model to solve—at the margin, the cost of producing more white cane sugar and more beet sugar must be equal to each other and to the price of white sugar. Although we do not explicitly model the decision to exit the industry, the parameter representing the refining margin takes into account changes in output.

13. Our draft report inadvertently reported slopes rather than elasticities. We revised the report to present the correct elasticities, which are much lower. The supply response reported in table 7 is consistent with these lower elasticities.

14. We agree with USDA that the revenues that producers receive are based on contracts with processors. However, we believe that the contractual arrangements, and the sugar program itself, lead to stable price expectations for producers that are captured in equations 3 and 4 (now equations 1 and 2) — producers' supply functions. In our model, prices at all stages are determined simultaneously by the satisfaction of equilibrium conditions in all markets.

15. We do not think that producers' ownership of processing plants is an important issue in our analysis. If producers' ownership were an important influence on the supply responses of producers to price changes, the expected direction of that influence would be to make supply less elastic (that is, producers might reduce supply less in response to a price decline than if they did not own the processing plants). We do not believe that incorporating this possibility into our model would have much effect because the supply elasticities we use are already low.

16. The requirement for minimum payments from processors to producers is not a concern for our model because the supply decisions in our model are calibrated using historical data that include minimum payments when relevant.

17. We added language to the report to clarify that the model's assumption of constant returns to scale in sugarcane processing implies that there are no welfare changes to sugarcane processors from price changes due to the elimination of the sugar program. Accordingly, we did not report any welfare effects.

18. We disagree with USDA that conducting the analysis at the national level implies any misspecification of our model, although we agree that more detail about regional production might be interesting. Our model does not specifically account for regional differences in cost structure or alternative crops and we agree with USDA that producers in different regions would be affected differently. Nevertheless, we remain confident that our model measures the total effects of the U.S. sugar program appropriately.

19. We revised our discussion of equation 20 (now equation 18) to say that the intercept term represents the cost to food manufacturers of inputs other than sweeteners (rather than a reflection of market power). As shown in equation 22 (now equation 20), market power results in a markup of price above marginal cost.

20. We added a definition of "conjectural variation" and explained how this parameter of market interdependence is related to industry markup.

21. We disagree with USDA's assertion that our model did not include some of the factors cited by McCorriston et al. For example, our model includes the influence of the retail price elasticity of demand on price pass-through. It also includes the influences of substitution between sugar and HFCS and the cost share of sweeteners in food products, but it does not include the role of marketing inputs.

22. We clarified that the ES_2 supply curve in figure 2 (and the ES_f supply curve in figure 3) refer to the excess supply curves that would exist in the absence of import restrictions in the United States. They were not meant to represent excess supply curves that would result from free trade in all world sugar markets.

23. USDA's conjecture that the domestic sugar industry could successfully pursue an antidumping action that would raise the price of foreign sugar for U.S. sugar users is speculative. Accordingly, we believe that it is appropriate to compare baseline prices with estimated world prices in the absence of the program, other things being equal, as we have done. See comment 2.

24. See comment 3.

25. We do not question the objective of pursuing international trade reform and free world markets through trade negotiation. To estimate the effects of the U.S. sugar program in this report, we needed to make the analytical assumption that all other factors, including other countries' sugar programs, would remain unchanged. If we had not done so, we would not have been able to separate the effects of the U.S. program from those of other countries' programs. Accordingly, when we say that domestic sugar prices are artificially high, we mean in comparison with the prices that would prevail if the U.S. sugar program were eliminated and other conditions remained unchanged. See also comment 37.

26. We disagree with USDA and stand behind our finding that eliminating the sugar program would have a limited impact on the price of HFCS. While HFCS producers benefited from the sugar program in the 1980s and early 1990s, we believe that the domestic HFCS and sugar markets have since been decoupled because of domestic price, cost, and market conditions. The president of the U.S. Corn Refiners' Association has also expressed that view. As shown in table 4 in appendix I, the weighted average wholesale price of HFCS dropped from 22 cents per pound (dry weight) in 1992 to 12.4 cents per pound (dry weight) in 1998, while the U.S. wholesale price of refined beet sugar was above 25 cents per pound throughout this period. The likelihood of substitution between sugar and HFCS is less than in prior years because technological advances have improved HFCS products and created more specialized sweetener markets.

27. We revised appendix II to clarify that the functional form we used does not imply that the cost shares of sugar and HFCS need to remain constant as the price of sugar changes.

28. We added references to the literature on the price elasticity of demand for sugar and HFCS.

29. We added language to the report to indicate that the lack of substitution between sugar and HFCS is due not just to the relative prices of the sweeteners but also to the increasingly specialized uses of sweeteners, which have limited the substitutability between sugar and HFCS.

30. In our model, the relationship between raw and refined sugar prices depends on the refining margin as well as on technical coefficients involved in the refining process. Since the refining margin will be smaller at lower levels of output, our model takes into account the lower margins for domestic cane refiners that will result from increased imports of refined cane sugar.

31. We disagree with USDA's assertion that we have not adequately analyzed the increased competition that the domestic refining industry could face as a result of the elimination of the refined sugar TRQ. If imports of refined sugar increased following the elimination of the refined sugar TRQ, the refining margin for domestic refiners would decline, according to our model. See comment 30.

32. Our report does not predict the degree to which cost reductions resulting from the elimination of the sugar program would be passed through to consumers. We present two estimates of potential benefits to consumers based on different assumptions about the pass-through of cost reductions from food manufacturers to consumers; both estimates are based on a full pass-through of cost reductions for the production of table sugar. For reasons given in the report, we believe that a full pass-through is more likely for table sugar than for sugar-containing products. In estimating potential benefits, we assumed "other things being equal" (no other changes in input costs) while the data that USDA presents on changes in wholesale and retail prices do not. Changes in the prices of marketing inputs could have offset the reduction in wholesale prices in determining retail prices.

33. It is unclear what effect accounting for marketing inputs would have had on our results.

34. See comment 32.

35. We disagree with USDA's assertion that a comparison of our estimate of the benefits that sugar beet growers receive from the program with data on growers' revenues and expenses implies that our estimate is clearly overstated. The benefits of a program that keeps price substantially higher than it otherwise would be can be very high in the short run, when supply elasticities are low. In the long run, the benefits of maintaining the sugar program are less because in the absence of the program a wider set of adjustment opportunities would be available to producers, implying larger supply elasticities.

36. We revised the report to address USDA's concern.

37. We disagree that our characterization of domestic sugar prices as artificially high is inflammatory and unprofessional. The sugar program keeps domestic sugar prices above the level at which they would be if the program were eliminated (other things being equal), which is what we mean by artificially high. Furthermore, USDA has some flexibility in its implementation of the sugar program, and our report entitled *Sugar Program: Changing the Method for Setting Import Quotas Could Reduce Cost to Users* (GAO/RCED-99-209, July 26, 1999) found that, from 1996 through 1998, domestic sugar prices were over 2 cents per pound higher than necessary to avoid sugar loan forfeitures.

38. We agree that the current conditions in sugar markets differ from those observed in 1996 and 1998. However, 1998 was the most recent year for which price and quantity data were available for our analysis when we began our study. As stated in the report, our estimates apply only to 1996 and 1998.

39. We agree that the North American Free Trade Agreement has the potential to significantly influence the operation of the sugar program and the domestic sugar market. We note in appendix I that USDA will spend substantial federal funds this fiscal year because the sugar program has resulted in significantly increased domestic sugar production—USDA recently announced that it will seek to purchase 150,000 tons of domestic sugar to reduce the cost of expected sugar program forfeitures. Because of our need to establish a base case for our economic model, we examined 1998, the most recent year for which sweetener price and quantity data were available. Accordingly, we state on page 4 of our report, "we did not analyze how the gradual reduction of U.S. tariffs for Mexican sugar through 2008 under the North American Free Trade Agreement might affect domestic sugar prices. However, our model could be used for this analysis as well as other types of analyses in the future."

40. The comments of former Under Secretary Moos on our 1993 report contrast with USDA's official written comments in 1993 (included as an appendix to the 1993 report), which state, "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." We continue to believe that our 1993 report provided a reasonable estimate of the cost of the sugar program to U.S. sugar users for the period analyzed. More important, we believe that although the precise level of the price premium is subject to debate, the program and policy problems we identified in 1993 are still relevant.

41. In preparing this report, we developed a more comprehensive model than the one we used for our 1993 report. Under our current approach, the estimated prices that would exist in the absence of the sugar program were derived by our model rather than assumed from outside the model, as was done for the 1993 report. Comparing these estimated prices with the baseline prices was appropriate for estimating the effects of the sugar program because the estimated world price reflects what domestic sugar users would have been expected to pay for sugar in those years if the sugar program had been eliminated. To estimate

the effects of the U.S. sugar program by itself, we needed to make the analytical assumption that all other factors, including other countries' sugar programs, would remain unchanged. Without this assumption, we would not have been able to isolate the effects of the U.S. program from the effects of other countries' programs. In preparing the 1993 report, if we had chosen to use a price that seemed more consistent with the elimination of the U.S. program alone, we might have selected a lower price for the "no program" scenario, which would have led to higher estimates of the cost of the program to sugar users and the benefits to producers.

42. We revised the report to address USDA's concern.

43. We revised the report to indicate that while the minimum requirement of the refined sugar TRQ is 30,900 tons, USDA has set the TRQ above this level in recent years.

44. We revised the report to address USDA's concern. The Agriculture Appropriations Act for fiscal year 2000 suspended the sugar marketing assessment for fiscal years 2000 and 2001.

45. We revised the report to address USDA's concern.

46. We revised table 1 to note that the basis point for the world raw sugar contract price is the Caribbean. According to a sugar market expert, the cost to transport raw sugar from the Caribbean to the United States is about 1.5 cents per pound. We also refined our model to more fully account for these transportation costs in our welfare analysis.

47. We revised the report to address USDA's concern.

48. We did not include a line in table 5 for the revenues that the federal government derives from sugar marketing assessments because those revenues represent only part of the sugar program's financial effects on the federal government. For example, other effects include increases in the government's costs of purchasing food and conducting food assistance programs because the prices for sugar and sugar-containing foods are higher under the sugar program. Several years ago, we estimated that the government's additional cost of purchasing food and providing the level of food assistance that it delivered in 1994 was approximately $90 million. At that time, the government collected about $30 million annually in marketing assessments.

49. We did not include a line for the benefits of the sugar program to sugarcane processors because they would see no welfare change from the elimination of the sugar program. See comment 17. The cost reported in table 5 for HFCS manufacturers and corn growers is very small; in general, the sugar program has little effect on these groups because of the decoupling of the sugar and HFCS markets. See comment 26.

50. We adjusted our model to more fully account for certain transportation costs. As a result, the 1996 estimated U.S. wholesale refined sugar price without the sugar program increased from 20.5 cents per pound in the draft report to 21.77 cents per pound in the final report. This revised price is higher than the 1996 average price of HFCS-55 of 20.6 cents per pound. To further clarify our model's results, the final report states that specialization in sweetener use was also important in estimating the effect of the sugar program on HFCS producers. See comment 29.

51. We continue to believe that transfers to foreign sugar producers that receive quota allocations are appropriately treated as a component of estimated net losses to the U.S. economy due to the sugar program. The additional revenues that they receive from higher prices as a result of the program represent a transfer outside the United States and, therefore, are a net loss to the U.S. economy. By suggesting that these transfers are more of a foreign policy issue than a sugar program issue, USDA implies that in the absence of the program the United States would provide the quota-holding countries with other forms of assistance equal to the benefits their producers currently derive from the program. We believe such a conclusion is speculative.

52. Although the estimated refining margin for 1996 is high, it is not as high relative to other years once adjustments are made for price level differences (see table 1 in app. I). Our estimate of 6.89 cents per pound for 1996 is in 1999 dollars. Expressed in 1999 dollars, the 14-year high (achieved in 1990) was 5.73 cents per pound, not 4.77 cents. Nonetheless, one limitation of our model is that the world refined and raw sugar markets are not fully linked. If our estimated price for refined sugar without the program is too high relative to the estimated no-program price for raw sugar for 1996, the implication is that we have overestimated the benefits to refiners and underestimated the benefits to other sugar users (food manufacturers and consumers) from eliminating the sugar program.

53. See comment 13.

54. We revised the report to address USDA's concern.

55. Our model does not conduct a general equilibrium analysis to determine the effects of eliminating the sugar program on the prices of other crops because of acreage being transferred from sugar to these other crops. However, we believe that any transfers out of sugar would likely have minimal effects on the total production of most other crops because of the relatively small acreage involved compared with the acreage already planted in those crops.

56. We added language to the report to show that the 20-percent markup we use is consistent with what others have used in their analyses.

Comments From the American Sugar Alliance

American Sugar Alliance Comments on
General Accounting Office Draft Report (GAO/RCED-00-126):
"Sugar Program:
Supporting Sugar Prices Has Increased Users' Costs
While Benefiting Producers"

Summary

See comment 1.

This General Accounting Office report mimics the severely flawed methodology and findings of the GAO's 1993 report on the same subject 1/. That work has been repeatedly repudiated by sweetener industry experts at the U.S. Department of Agriculture 2/ and universities 3/, and in trade journals 4/.

See comment 2.

It is based on comparisons with the meaningless world dump price and on the absurd assumption that food manufacturers and retailers would pass 100% of their savings on lower producer prices for sugar along to consumers. In addition, the report is riddled with errors of fact and of omission, misleading observations, inconsistencies, and other methodological flaws. This review attempts to summarize the shortcomings of the report.

See comment 3.

This new report, like the old one, is unequivocally biased toward the views of the Congressional critics of U.S. sugar policy who requested the work. These critics represent the desire of food manufacturers and retailers to reduce producer prices for sugar for one purpose: to increase their corporations' profit margins. Food manufacturers and retailers do *not* pass lower ingredient costs along to consumers, as this review will document, and never will. History shows that a reduction in producer prices for sugar transfers income from sugar farmers and processors to the food manufacturing and retailing corporations, and *not* to consumers, as the GAO assumes.

The Most Basic Flaws

See comment 4.

1. **Dump Market Price**. GAO bases its findings on a comparison of the U.S. producer price for sugar with the world dump market price. The world dump price is meaningless, because it bears no relationship to the actual cost of producing sugar.

   GAO offers no acknowledgment whatsoever of the dump nature of the world sugar market, though this fact has been repeatedly demonstrated to GAO by USDA and the sugar industry and in the literature. The world dump price has

averaged less than half the world average cost of producing sugar for most of the past two decades.

Much of the sugar dumped onto the world market is highly subsidized or produced in countries with substantially lower labor and environmental standards 5/, many with confirmed abuse of internationally recognized child labor laws 6/.

Dumping is a surplus-disposal mechanism for these countries, an unfair trade practice that effectively transfers the price-threatening effects of surplus production from the home market to foreign markets. U.S sugar policy plays the justifiable and critical role of insulating efficient American sugar producers from the effect of these dumped foreign surpluses, a point GAO ignores completely.

See comment 5.

2. **100% Passthrough.** GAO bases its findings on the assumption that U.S. food manufacturers and retailers would pass 100% of their savings from lower sugar costs along to consumers if they had access to world dump market sugar. In fact, there is ample evidence, unreported by GAO, that there is absolutely no passthrough (see below, pages 5-6).

   GAO acknowledges "it is unclear to what extent intermediate users of sweetener would pass through lower sugar costs to final consumers (page 18)" but produces no evidence that passthrough occurs and goes on to base its report on total passthrough.

Other Major Flaws

See comment 6.

Unilateral Disarmament. GAO assumes the unilateral elimination of U.S. sugar policy – both the import quota and the loan program. Such action – unilateral disarmament – would be sheer folly from a trade negotiation point of view, and would neither be pursued by Administration negotiators, nor approved by the U.S. Congress, because it cedes U.S. negotiating leverage without any concession from competing countries.

Unilateral disarmament would also expose American sugar and corn sweetener producers to competition from foreign producers who are not more efficient, but who are subsidized by their governments.

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Foreign government interventions in their sugar markets are numerous and varied, and are generally far more intrusive than U. S. policy. Foreign practices include: higher internal supports; higher import tariffs; less import access as a percentage of the domestic market; state trading monopolies; and other direct and indirect subsidies, such as infrastructure subsidies, low-interest loans and debt forgiveness, strategic manipulation of exchange rates, and countenance of deplorable labor or environmental practices.

See comment 7.

"Free Market" Price. GAO estimated the world price in the absence only of U.S. sugar policy, but neither attempted to estimate, nor cited existing estimates of, the world price in the absence of all government programs. Global free trade in sugar is the goal of American sugar producers and of U.S. trade negotiators.

Under free trade conditions, the world price would rise to reflect the actual cost of producing sugar. This is the benchmark GAO should have used for comparison to the U.S. price, had they intended a fair assessment of U.S. sugar policy.

LMC International estimated the weighted world average cost of producing sugar during the 11-year period of 1983/84 – 94/95 to be 18.04 cents per pound 7/. The actual level is almost certainly higher now because of inflation since that time.

Studies by Koo, of North Dakota State University 8/, Schmitz, of the University of California at Berkeley 9/, and Polopolous, of the University of Florida 10/, find world sugar market prices under liberalized trade to be at, or above, historic U.S. domestic prices around 22 cents per pound.

Clearly, GAO's finding on the supposed cost of U.S. sugar policy would be dramatically different had it been based on a fair comparison with the world free market price at, or above, U.S. levels, rather than based on the GAO's disingenuous comparison with a world market price distorted and depressed by foreign subsidies.

See comment 8.

Gross vs. Net Costs. GAO misleadingly emphasizes only the cost side of its cost/benefit analysis of U.S. sugar policy. GAO stresses its estimated $1.7 billion cost in 1996 and $2.2 billion in 1998 (page 4), but makes scant reference to the benefit side of the equation, which is considerable, and to the theoretical net cost to society, which is just a fraction of the supposed cost.

The net costs – the difference between supposed costs and benefits – were $814 million in 1996 and $1,030 million in 1998 (page 17, revised). These amounts are minimal compared with the $26-billion industry U.S. sugar policy supports, but,

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See comment 9.

even given the GAO's faulty methodology, are misleadingly high. There are several reasons GAO's "net loss to the U.S. economy" figures are exaggerated:

1. **"Transfers to foreign suppliers."** Nearly half the theoretical net loss is attributed to the benefit that 40 U.S. sugar import-quota holding countries derive from being able to sell their sugar to the U.S., at the U.S. price, rather than dump that sugar on the world market.

   There is no question this is a significant benefit to these countries, none of which can cover their costs of production by selling onto the depressed world dump market.

   But the GAO ignores two important facts:

   - The United States is required, under international trade rules (the 1995 Uruguay Round Agreement on Agriculture) to import this sugar – no less than 1.256 million short tons per year. Beginning October 1, 2000, an additional 276,000 tons per year must be imported from Mexico under North American Free Trade Agreement rules. This "loss to the U.S. economy" must be attributed to the World Trade Organization and the NAFTA, not to U.S. sugar policy.

   - The 40 quotaholders are overwhelmingly developing countries, many with weak economies highly dependent on sugar, many with fragile democracies. The United States has long achieved important foreign policy goals by providing this quota access – "trade, not aid." In the absence of U.S. sugar policy and this preferential access, the United States would either have to:

     - Provide direct foreign aid;

     - Deal with economic and political instability in these regions.

   Given these circumstances and potential consequences, it is difficult to understand how GAO can justify writing off this U.S. market access as a simple, U.S.-sugar-policy-driven "loss to the U.S. economy." This supposed U.S. sugar policy "loss" should be deleted from the study.

See comment 10.

2. **"Economic inefficiencies."** GAO attributes the remainder of its theoretical "net losses to the U.S. economy" to "economic inefficiencies." Its explanation of this concept is limited to the following: "Economic inefficiencies occurred,

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for example, when the sugar program's artificially high domestic prices encouraged farmers to grow sugar beets instead of another crop, such as wheat, that, without the sugar program, might have been relatively more profitable. Inefficiencies also occurred when high sugar prices discouraged consumers from purchasing sugar (page 6)."

Again, GAO bases these calculations on erroneous assumptions.

See comment 11.

- American sugar producers are not inefficient. In fact, they are highly efficient by world standards. Among the world's beet sugar producing countries, U.S. producers rank first, with the lowest cost of beet sugar production in the world 7/. U.S. wheat producers could not be ranked any higher relative to their foreign counterparts.

See comment 12.

GAO completely fails to make the case that sugar production is a less efficient use of use of resources than any other agricultural enterprise. If anything, sugar is probably more efficient because of its valued-added quality – according to USDA figures, the value of production from an acre of sugarbeet or sugarcane is several times that of the grains and other field crops.

See comment 13.

Furthermore, GAO egregiously ignores the effect on other crops if acreage were transferred out of sugar. GAO failed to perform the cross-commodity analysis that would have enumerated the price-depressing effect of additional production of other major crops – all of which are currently already in considerable surplus. Given the government's commitment to providing massive amounts of income assistance to the producers of these surplus commodities – roughly $70 billion since 1996 – GAO should also have estimated the cost in additional subsidies to these competing-crop producers if U.S. sugar policy were eliminated.

See comment 14.

- U.S. sugar and sweetened-product consumption would *not* rise measurably in the absence of U.S. sugar policy, for two reasons:

See comment 15.

  - Lower producer prices for sugar would *not* be passed along to consumers, either in retail sugar prices or in sweetened products. According to USDA and the Bureau of Labor Statistics, wholesale refined sugar prices fell 11% from 1990 to 1999, but retail sugar prices did not drop at all. The retail sugar price rose 1%, while retail prices for cereal, candy, ice cream, cookies, cakes, and other bakery products rose 23-33%. (See attached Chart A.)

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Since the start of the 1996 Farm Bill, wholesale refined sugar prices are down 26%, but retail refined sugar prices have not dropped at all, and sweetened products prices are up 7-9% (Chart B).

See comment 16.

- Even if some of the lower costs were passed through, the retail price difference would not be sufficient to spur additional consumption. U.S. income levels are high enough that slight changes in food prices do not affect demand. Furthermore, U.S. per capita sweetener consumption is already about the highest in the world and is regarded to be roughly at human capacity.

See comment 17.

Social/Economic Costs. The GAO ignored the cost to rural economies and the government that would accrue in areas where sugar operations close in the absence of U.S. sugar policy. Job losses would likely be high; tax revenues would plunge.

In many areas, there are no alternative crops or businesses. An example would be the island of Hawaii, formerly the most productive of Hawaii's sugar islands. Sugar had been the largest industry on Hawaii, and in some areas the only industry, for generations. Since sugar exited the Big Island several years ago, most of the land remains fallow, or in marginal agricultural uses. Unemployment, crime, and drug use have risen dramatically, as have the county and state government costs for unemployment benefits, worker retraining and relocation, and crime control. In the absence of U.S. policy, many rural communities across the nation would face similar additional costs.

In areas where there are crop alternatives, prices for all the major crops have been depressed for several years. The flight of sugarbeets and sugarcane to wheat, corn soybeans, cotton, or rice would further depress the prices for those crops, put more farmers out of business, and drive up government costs to cope with that dislocation.

These costs cannot be ignored in a responsible cost/benefit analysis.

Key Errors of Omission

See comment 18.

American Producer Efficiency. GAO made no mention of American sugar producer competitiveness. Their costs of production are well below the world average. Fully two-thirds of the world's sugar is produced at a higher cost than in the United States, despite the fact that American producers cope with the world's highest government standards, and costs, for labor and environmental protections.

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According to LMC International, the respected commodities research firm based in Oxford, England, U.S. corn refiners produce the least expensive caloric sweetener in the world. U.S. beet sugar producers are the most efficient beet sugar producers in the world. American cane sugar producers rank 28th lowest cost of 62 countries, virtually all developing countries, many with deplorable labor and environmental practices. Overall American sugar producers are 18th lowest cost of 96 producing countries or regions studied 7/.

See comment 19.

This information would have conflicted with GAO's contention that American sugarbeet and cane producers are "inefficient" users of land and other resources, and was omitted.

Low, Stable American Consumer Prices for Sugar. GAO failed to make an obvious and straightforward comparison: U.S. and foreign retail sugar prices. This certainly would have been the simplest and most direct way to assess the cost or benefit of U.S. sugar policy to American consumers. Had GAO done so, they would have found readily available data demonstrating that:

See comment 20.

- U.S. retail sugar prices are 20% lower than the average retail price of other developed countries (Chart C);

See comment 21.

- In terms of minutes worked to purchase one pound of sugar, the United States is third lowest in world. Only Switzerland and Singapore are lower; self-styled "free trade" countries such as Australia, Brazil, and Canada are higher (Chart D).

GAO might also have noted, from USDA data, that U.S. retail sugar prices are virtually unchanged since 1990, a period during which general price inflation has totaled about 30%.

See comment 22.

Revenue Raiser. GAO failed to note that U.S. sugar policy has been run at no cost to the U.S. Treasury since 1985 and became a revenue-raising program in 1991. U.S. sugar producers paid a total of $279 million in marketing assessments during 1991-99.

See comment 23.

GAO also failed to note, in its list of the many reforms to sugar policy in the 1996 Farm Bill (page 10), that this marketing assessment tax was increased by 25%.

See comment 24.

Jobs/Indirect Benefits. GAO underestimated the number of U.S. sugar producers (see below, pages 9-10), and failed to provide information on the formidable size

of the U.S. sugar and corn sweetener producing industry that relies on U.S. sugar policy.

LMC International estimates that 420,000 jobs in 40 states are involved, directly and indirectly, in this industry, generating $26.2 billion in annual revenues 11/. As noted earlier, many of these jobs are in rural areas, where there are few, if any, business alternatives.

Other Errors, Misrepresentations, Inconsistencies

Now on p. 6.

Benefits "Received." GAO says sugarbeet and sugarcane producers "received benefits of about $1.2 billion in 1996 and $1.6 billion in 1998 (page 5)." This phrasing is careless, terribly misleading, and certain to be unfairly quoted out of context by U.S. sugar policy opponents. The GAO's language implies these producers "received" some form of payments or subsidy. Just such misrepresentation occurred following the same misleading phrasing in the GAO's 1993 sugar study.

On the contrary, as GAO well knows, sugar producers have received no government payments or subsidies in decades.

See comment 25.

To be correct and unambiguous, the GAO should not refer to these calculations as "received benefits," but rather as "derived theoretical benefits valued at…"

See comment 26.

Production Impact Understated. GAO's apparent assumption that dramatically lower producer prices for sugar would have only minimal impact on production is puzzling, to say the least. For 1998, for example, GAO assumes that a 49% drop in the domestic price raw cane sugar price from the previous year (to 11.17 cents per pound) would cause only a 1.9% drop in cane acreage and that a 43% drop in the price for wholesale refined beet sugar (to 14.79 cents) would cause only a 7.1% drop in beet acreage.

While it is true that the nature of cane and beet farming makes rapid adjustment to price changes difficult, one could well expect a far greater impact on production than GAO suggests, given the magnitude of these price drops. Furthermore, GAO should note that over time, despite U.S. sugar producers' efficiency, none could survive at such low prices, dramatically below their costs of production.

See comment 27.

Contradictory Effects on HFCS. GAO argues on page 6 that loss of U.S. sugar policy would have little effect on the price of high fructose corn syrup (HFCS),

Now on p. 31.

but states the opposite on page 25: "Since the lower price for refined sugar would increase the demand for it and decrease the use of HFCS, the price of HFCS would also decrease."

See comment 28.

The latter is far more likely to be correct. The world refined sugar price averaged only 9.1 cents per pound in 1999. GAO notes that prices for HFCS-55, which is most directly substitutable for sugar, averaged 13.7 cents per pound (dry weight basis), in 1997 and 1998. Clearly, cheaper refined sugar from the world dump market would replace U.S. HFCS in the absence of U.S. sugar policy.

According to LMC International, U.S. HFCS is the least expensively produced caloric sweetener in the world 7/. Nonetheless, and contrary to GAO's initial observation, U.S. HFCS producers have benefited, and will continue to benefit, from U.S. sugar policy as a barrier to subsidized foreign dump market sugar.

Policy, Producer Price Reduced, But Policy "Costs" Rise. As noted earlier, GAO uses the highly volatile world dump market price as the benchmark by which to measure the cost of U.S. sugar policy. Another flaw with this approach is that it creates a completely misleading impression of the status of U.S. sugar policy and price from year to year.

See comment 29.

As GAO notes, U.S. sugar policy was pared back substantially in the 1996 Farm Bill. The U.S. producer price for refined sugar dropped by 11% between 1990 and 1999; as a result of Farm Bill reforms the wholesale refined sugar price has plunged by 26% since 1996 (monthly averages, September 1996 – March 2000). Yet by GAO's reckoning, the "cost" of the policy is rising – from $1.4 billion in 1989-91 1/, to $1.7 billion in 1996, and to $2.2 billion in 1998.

See comment 30.

GAO's arbitrary use of a world price benchmark that has been lower in successive periods studied is the reason for the rising "cost," not any change in U.S. sugar policy or producer price. If measured against a consistent and logical benchmark such as the world average cost of producing sugar, the "cost" of U.S. sugar policy would rightfully be falling, not rising.

Nonetheless, critics of U.S. sugar policy will surely latch on to the GAO's clumsy analysis to claim U.S. sugar policy has become more interventionist or more generous over the years, rather than less.

Now on p. 18.
See comment 31.

Underestimate of Beet Farms. On page 14, GAO describes in a footnote why a USDA/FSA estimate of the number of sugarbeet farms, 11,800, is more accurate than a 1997 census figure of only 7,097 beet farms. The higher figure is also consistent with the conservative estimate of the American Sugarbeet Growers

Association (ASGA), the national organization based in Washington, D.C. ASGA also notes that GAO fails to recognize that many of these family farms sustain more than one family unit, with many farms operated by siblings and their offspring.

Now on p. 6.
Now on p. 18.

Nonetheless, GAO uses only the lower figure in its summary (page 5) and in Table 3 (page 14). Once again, GAO provides ammunition to sugar policy critics who, again, will use the lower farm figure to divide into the GAO's supposed "benefits received" to calculate a thoroughly distorted impression of large payments to farmers.

Conclusion

See comment 32.

The methodological underpinnings of the GAO study are so fundamentally flawed, the tone is so biased, and the errors, omissions, misrepresentations, and contradictions are so numerous, that the study should be scrapped and redone.

If the study is not redone, this review, from the affected industry, must be included in the final, published version. Such action would, at least, provide some of the balance and accuracy the study lacks so glaringly.

References

1/ United States General Accounting Office, "Sugar Program Under Changing Market Conditions," GAO/RCED-93-84, Washington, D.C., April 1993

2/ USDA Rebuttals:

Letter from Eugene Moos, Under Secretary of Agriculture for Farm and Foreign Agricultural Service, to U.S. Representative Patsy Mink, October 24, 1995

Testimony of Eugene Moos, Under Secretary of Agriculture for Farm and Foreign Agricultural Service, before the Subcommittee on Risk Management and Specialty Crops, Committee on Agriculture, U.S. House of Representatives, May 24, 1995

Letter from Patrick M. Steele, Acting Administrator, Foreign Agricultural Service, to Lawrence J. Dyckman, Director, Food and Agricultural Issues,

General Accounting Office, July 8, 1999 (Published in GAO report: "Sugar Program: Changing the Method for Setting Import Quotas Could Reduce Cost to Users," GAO/RCED-99-209, Washington, D.C., July 1999, page 34)

3/ University Rebuttals:

Testimony by Professor Leo C. Polopolous, Professor of Food and Resource Economics, University of Florida, before the Subcommittee on Risk Management and Specialty Crops, Committee on Agriculture, U.S. House of Representatives, May 24, 1995

Paper presented by Professor Andrew Schmitz, Eminent Scholar, Department of Food and Resource Economics, University of Florida, to the International Sweetener Symposium, Washington, D.C., June 26, 1995

4/ Trade Journal:

Jack Roney, "Exploding the Consumer Sugar Cost Myth: Theory Versus Reality," *Sugar y Azucar*, July 1998

5/ International Sugar Organization, "An International Survey of Environmental Legislation and its Impact," London, England, October 1995

6/ U.S. Department of Labor, "By the Sweat and Toil of Children, Volume II: The Use of Child Labor in U.S. Agricultural Imports & Forced and Bonded Child Labor," Bureau of International Labor Affairs, Washington, D.C., 1995

7/ LMC International Ltd., "A World Survey of Sugar and HFCS Field, Factory, and Freight Production Costs: 1997 Report," Oxford, England, August 1997

8/ Won W. Koo, "U.S. Cane and Beet Sugar Industries Under Alternative Trade Liberalization Policy Options," Director of Northern Plains Trade Research Center and Professor of Agricultural Economics, North Dakota State University, Fargo, November 1999

9/ Andrew Schmitz and James Vercammen, "Trade Liberalization in the World Sugar Market: Playing on a Level Field?," Department of

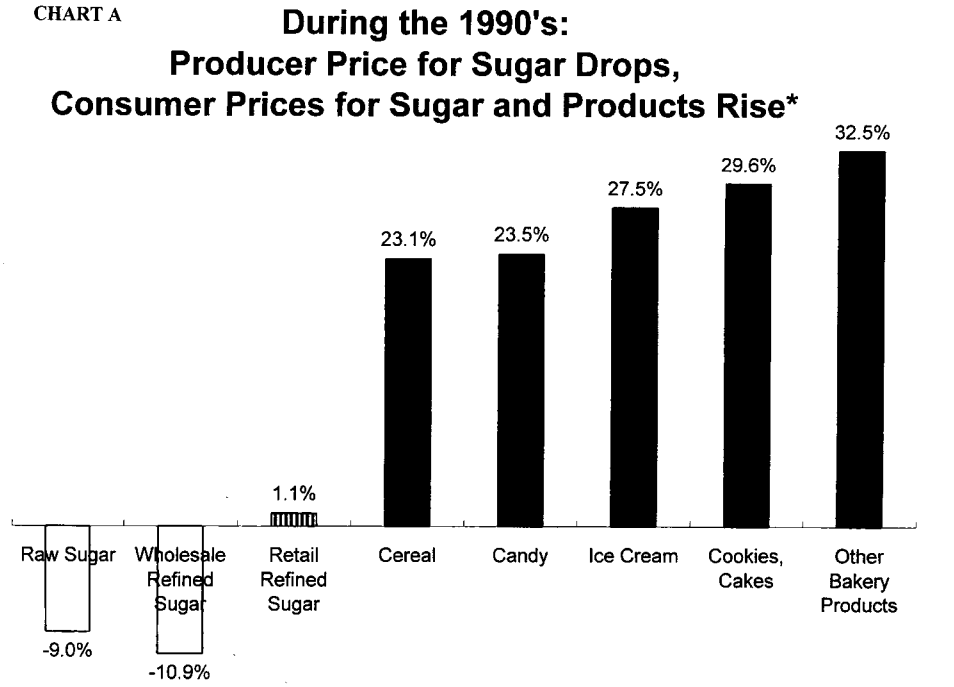
Agricultural and Resource Economics, University of California at Berkeley, November 1990

10/ Leo C. Polopolous, "Dispelling the World Price and Sugar Subsidy Myths," Food and Resource Economics Department, University of Florida, August 1993

11/ LMC International Ltd., "The Importance of the Sugar and Corn Sweetener Industry to the U.S. Economy," Oxford, England, August 1994

gao2000

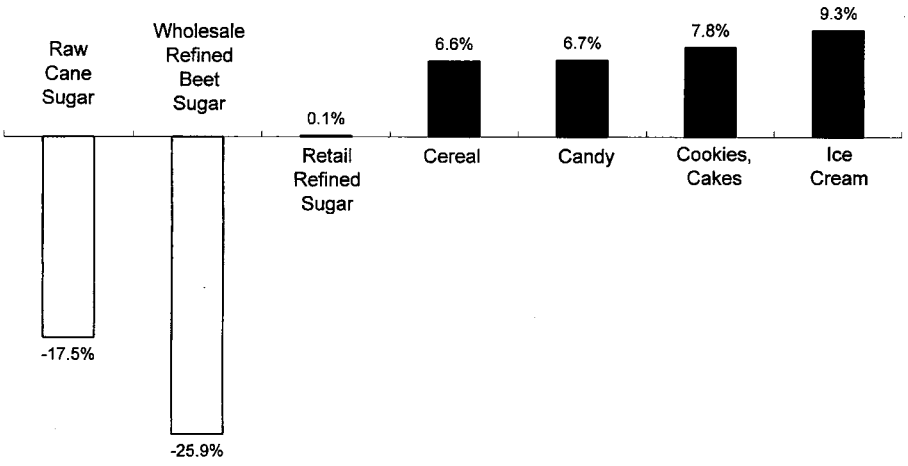
CHART A



* Change in annual average prices from 1990 to 1999. Raw cane: duty-fee paid, New York. Wholesale refined beet sugar: Midwest markets. Retail prices: Bureau of Labor Statistics consumer price indices. Data source: USDA. rawvsret5

CHART B

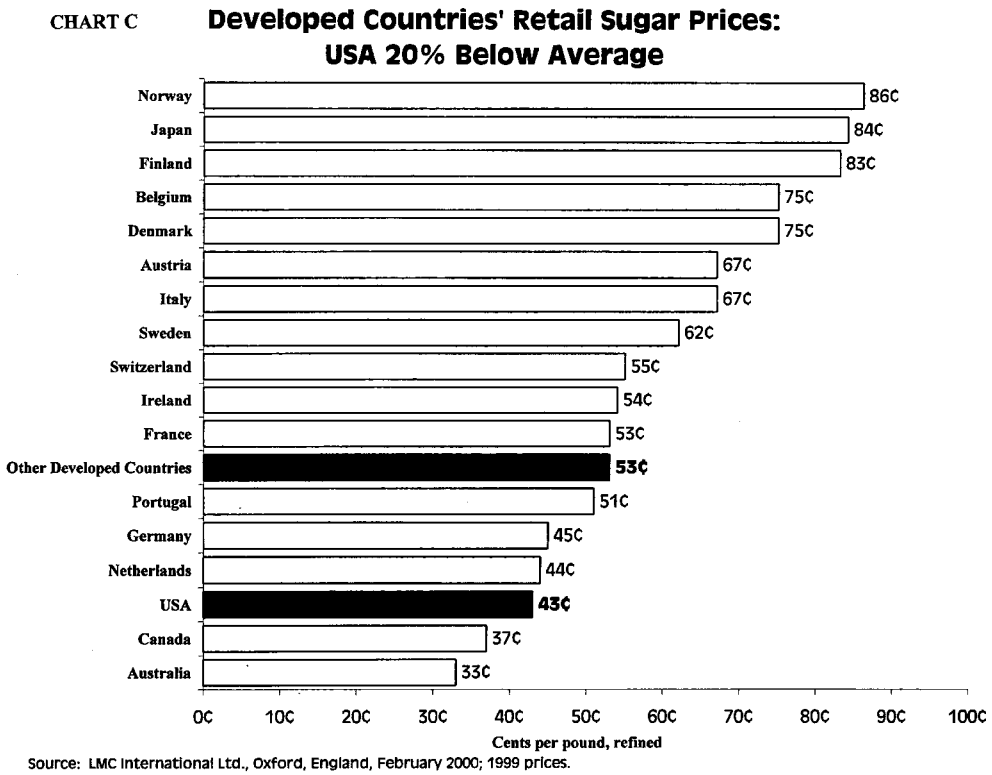
3-1/2 Years Since Start of 1996 Farm Bill: Producer Price for Sugar Falls, Consumer Prices for Sugar and Sweetened Products Rise



Monthly average price changes, September 1996 to March 2000. Wholesale refined beet: Midwest markets. Retail prices: BLS consumer price indices. Data source: USDA.

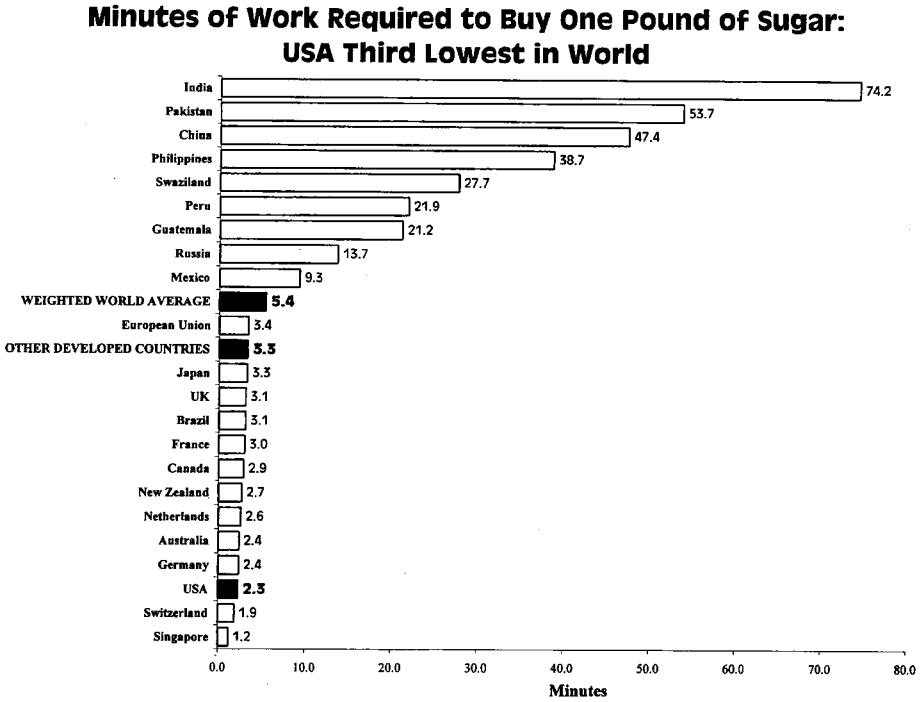
rawvsretail

CHART C



Source: LMC International Ltd., Oxford, England, February 2000; 1999 prices.
"Other Developed Countries" represents the weighted average of 20 foreign developed

CHART D



Source: LMC International Ltd., Oxford, England, February 2000. Study of 49 countries, accounting for 78% of global sugar consumption; 1999 prices.

GAO Comments

The following are GAO's comments on the American Sugar Alliance's (ASA) written response to our draft report dated May 5, 2000. Based on USDA and industry comments, we revised our model's final estimates to more fully account for certain transportation costs. As a result, cost and benefit estimates referenced in ASA's comments do not reflect those contained in the final report.

1. We disagree that the methodology used in our 1993 report on the sugar program was flawed. Nonetheless, we developed a more comprehensive economic model for our current analysis, and while we acknowledge that no economic model completely depicts reality, we are convinced that our current model is methodologically sound and that the estimates yielded by our model are reasonable. In developing the model, we took a number of actions to ensure that it was methodologically sound. First, we contracted with a well-known expert in modeling the international trade of agricultural commodities and with a prominent agricultural economist to work with us in developing the model. In December 1999, we sent our proposed model to four outside academicians specializing in agricultural economics and international trade economics and revised the model in response to their comments. We also sent our proposed model to USDA for review at that time. However, USDA did not to provide any comments. Furthermore, we asked two of the agricultural economists to review our final model and results before we sent our draft report to USDA, ASA, and the U.S. Cane Sugar Refiners' Association for comment.

2. We disagree with ASA's assertion that our findings are based on comparisons with a meaningless world price. In estimating the costs and benefits of the sugar program, our model compared baseline domestic and world sugar prices with an estimate of the domestic and world prices that would have been observed if the sugar program had been eliminated, other things being equal. Regarding the extent to which cost reductions would be passed through to consumers in the absence of the sugar program, the report presents two estimates showing how the benefits might be distributed based on two different sets of pass-through assumptions. We did not predict the extent to which cost reductions would be passed through to final consumers. See comments 4 and 5.

3. We disagree that our report is biased toward the views of the sugar program's critics. We used a standard economic welfare analysis methodology that many economists have applied to evaluate how different groups within a society are affected by specific economic policies.[1] Our report provides a quantitative analysis of the U.S. sugar program's effects, but we do not take a position on what modifications, if any, need to be made. Those decisions rest with the Congress. See comment 5 for a discussion of our assumptions about manufacturers' and retailers' behavior in passing through cost reductions.

4. As discussed in comment 2, we disagree with ASA's assertion that our findings are based on comparisons with a meaningless world price. Our model estimated domestic and world sugar prices in the absence of the program. These estimated prices were higher than the baseline world prices because our model accounted for the impact on world prices of higher U.S. sugar imports that would have occurred if the program had been eliminated. Comparing these estimated prices with the baseline prices was appropriate for estimating the effects of the sugar program because the estimated world price reflects what domestic sugar users would have been expected to pay for sugar in those years if the sugar program had been eliminated. This comparison remains appropriate regardless of whether the world price is influenced by subsidies by countries with surplus production or whether sugar is produced in countries with lower labor and environmental standards.

5. As discussed in comment 2, we disagree with ASA's assertion that our findings are based on the assumption that food manufacturers and retailers would pass all of their cost reductions through to final consumers. Our report estimated the total cost of the sugar program to sweetener users—sugarcane refiners, manufacturers of sugar-containing foods, and final consumers. We did not predict the extent to which cost reductions would be passed through to final consumers. Instead, we presented two estimates of the benefits to consumers if the sugar program were eliminated, using different assumptions about the pass-through of cost reductions. One estimate assumed that (1) cost reductions for table sugar were passed through to final consumers

[1]For example, see La France (*American Journal of Agricultural Economics*, 1991), La France and de Gorter (*American Journal of Agricultural Economics*, 1985), Thurman (*American Journal of Agricultural Economics*, 1991), Rucker and Thurman (*Journal of Law and Economics*, 1990).

(because it is a homogeneous product and likely to be more price competitive) but (2) cost reductions for sugar-containing food were not passed through. The other estimate, which shows the maximum benefit that consumers could receive, is based on the assumption that all cost reductions were passed through to consumers. We revised our discussion on page 4of the pass-through of cost reductions if the sugar program were eliminated to further clarify the effects under alternative pass-through scenarios.

6. We agree with ASA that other countries intervene in the world sugar market. However, to estimate the effects of the U.S. sugar program by itself, we needed to make the analytical assumption that all other factors, including other countries' sugar programs, would remain unchanged. Without this assumption, we could not isolate the effects of the U.S. program from the effects of other countries' programs. Our estimates represent the actual cost of the sugar program to the U.S. economy under conditions as they were in 1996 and 1998.

7. As discussed in comment 6, we did not attempt to estimate the free trade price of sugar. In addition, as discussed in comment 4, we believe that the appropriate price comparison is between baseline domestic and world sugar prices in 1996 and 1998 and an estimate of the prices that would have been observed if the sugar program had been eliminated, other things being equal.

8. As stated in the objectives, this report focuses on the U.S. sugar program's (1) costs to domestic sweetener users, (2) benefits to domestic sugar and HFCS producers, and (3) net effects on the U.S. economy. Both the resport's letter and appendix II present the results of our model, including the estimated benefits to sugarcase, sugar beet and HFCS producers. However, our model does not attempt to quantify every indirect cost and benefit associated with the program. See comments 13 and 17.

9. We disagree with ASA that our estimates of the net costs of the sugar program are "misleadingly high." See comments 10 and 11.

10. We disagree that transfers from the U.S. economy to foreign sugar producers should not be considered as a component of the estimated net losses associated with the sugar program. From the perspective of the U.S. economy, higher prices paid by domestic sugar users and received by domestic producers and processors as a result of the

program are internal transfers with no net effect. However, foreign producers selling sugar in the United States also receive higher prices because of the program. The additional revenues they receive as a result of the program represent a transfer outside the United States and, therefore, are a net loss to the U.S. economy. Whether the United States would incur similar costs if the sugar program did not exist in the form of either direct aid to countries whose producers are benefiting from the program or costs resulting from instability, as suggested by ASA, is speculative.

11. We disagree with ASA's assertion that our model assumes that U.S. sugar producers are inefficient. The types of efficiency losses we discuss occur when efficient producers produce too much of the wrong crop, or consumers consume too little of certain foods, because government programs maintain artificially high prices.

12. The report does not state that sugar production is a less efficient use of resources than any other agricultural enterprise.

13. We agree that we did not estimate the effects on other crops if acreage were transferred out of sugar, but we disagree that not doing so was egregious. Our model does not conduct a general equilibrium analysis to determine the effects on acreage and price of all other commodities. However, we believe that any transfers out of sugar into other field crops would likely have minimal effects on total production because of the relatively small acreage involved compared with the acreage already planted in those crops. For example, a transfer of 33 percent of sugar beet acreage into hard red spring wheat acreage, would have increased the hard red spring wheat acreage by only about 3 percent in 1998. See comment 17.

14. We disagree. Using generally accepted economic principles, total U.S. consumption of sugar and sweetener-containing products would rise, other things being equal, as U.S. sugar prices were reduced.

15. In the absence of the sugar program, we believe that it is unlikely that no cost reductions would be passed through to final consumers, particularly in the case of table sugar. In our analysis, we assumed "other things being equal" (no changes in other input costs), while the data that ASA presents comparing prices at different levels—especially for sugar-containing foods—do not. Changes in the prices of other food inputs between 1990 and 1999 could have been more important and

could have overwhelmed the effect of declining wholesale refined sugar prices on retail prices. Moreover, wholesale refined sugar prices did not stay down continuously over the entire decade, but increased again in 1996, 1997, and 1998. See comment 5.

16. We recognize that the demand for table sugar and many sugar-related products is relatively inelastic with respect to price (that is, price increases will lead to only relatively small declines in consumption), and we included these assumptions in our model. However, we disagree with ASA's assertion that there would be no effect on consumption at higher prices.

17. We recognize that we did not consider indirect effects associated with the elimination of the sugar program in our analysis. These effects could include losses to some groups, as suggested by ASA, but could also include gains by other groups. For example, if sugar users paid lower prices for sugar, they would be able to spend more on other items, which could lead to increased economic activity in some other sectors. Our approach estimated the program's major costs and benefits, while still maintaining tractability as well as appropriate market detail. A general equilibrium analysis would take both these gains and losses into account. We added to the report a discussion of the differences between the partial equilibrium approach we used and a general equilibrium analysis, indicating that using the latter approach would require sacrificing considerable detail.

18. We did not assess the competitiveness of U.S. sugar producers relative to producers in other countries. We assessed the costs and benefits of the sugar program in the context of the world market in 1996 and 1998. See also comment 6.

19. See comment 11.

20. We disagree that comparing U.S. and foreign retail sugar prices would have been the most direct way to assess the effect of the U.S. sugar program on consumers. Retail sugar prices in other countries do not represent the price at which U.S. sugar users could have obtained sugar in the absence of the program, which is the appropriate price to compare with current U.S. prices (see comment 4). As a result, we did not compare U.S. retail sugar prices with other countries' retail sugar prices. However, ASA's chart C shows that countries whose retail sugar prices were higher than the U.S. prices are mostly countries from the

European Union and Japan, where support for sugar producers is also high. (The Organization for Economic Cooperation and Development estimates that sugar consumer support in the European Union was even higher than in the United States in 1998.) Chart C also shows that retail sugar prices in Australia and Canada, which have relatively free trade in sugar, were lower than prices in the United States and the other countries shown.

21. The minutes worked analysis in chart D may be a misleading indicator of low sugar prices for U.S. consumers in comparison with consumers in other countries. This analysis appears to be more dependent on a country's average wage rate than on the retail price of sugar in explaining the differences in the minutes of work required to buy a pound of sugar among countries. See also comment 20.

22. We agree that U.S. sugar processors have not forfeited sugar to the government since 1994. However, USDA recently announced plans to purchase 150,000 tons of sugar to reduce the cost of expected sugar program forfeitures this fiscal year.

23. We revised the report by adding these increased assessments to the list of the 1996 Farm Act's modifications. According to a USDA official, the assessment on processors raised revenues of about $30 million in fiscal year 1998 but has been suspended for fiscal years 2000 and 2001. We note, however, that these revenues represent only part of the sugar program's financial effects on the federal government. The higher domestic cost of sugar increases the government's expenditures for the military's food purchases and for funding domestic food assistance programs. Several years ago, we estimated that the sugar program increased the government's expenditures for these purposes by about $90 million in 1994.

24. As discussed in comment 31, we disagree with ASA's statement that we underestimated the number of U.S. sugar producers. As discussed in comment 28, we also disagree with ASA's assertion that the corn sweetener industry continues to benefit from the sugar program.

25. We disagree with ASA that the benefits received by producers are derived "theoretical" benefits. Gains that result from higher prices paid by sugar users—rather than from direct government payments to producers—are nonetheless real gains in income to producers and are a direct result of the sugar program.

26. The production and acreage levels we report were the results of our simulation of the impact of eliminating the sugar program, as estimated by our model. We agree with ASA that over time, larger production responses are likely to result than in the short run.

27. We revised page 25 of the draft report (now on page xx) to clarify that our model analyzed the HFCS market to determine whether lower refined sugar prices resulting from the program's elimination would cause a substitution from HFCS to sugar in certain markets for sugar-containing products. We found that eliminating the sugar program had a limited effect on the HFCS market. See comment 28.

28. We disagree with ASA's assertion that refined sugar from the world market would replace HFCS if the sugar program were eliminated. While HFCS producers benefited from the sugar program in the 1980s and early 1990s, we believe that the domestic HFCS and sugar markets have since been decoupled because of domestic price, cost, and market conditions. The president of the U.S. Corn Refiners' Association has also expressed this view. As shown in table 4 in appendix I, the weighted average wholesale price of HFCS in the United States dropped from 22 cents per pound (dry weight) in 1992 to 12.4 cents per pound (dry weight) in 1998, while the U.S. wholesale refined beet sugar price was above 25 cents per pound throughout this period. In particular, for 1998, the higher-priced HFCS-55 (13.43 cents per pound) was below our model's estimated world refined sugar price (14.12 cents per pound) if the sugar program were eliminated. Furthermore, the likelihood of substitution between sugar and HFCS is more limited than in prior years because technological advances have improved the HFCS product and created more specialized sweetener markets. See also comments 24 and 27.

29. Although the 1996 Farm Act made some changes to the sugar program, we disagree that it substantially pared back the U.S. sugar program because the basic structure of USDA's loan program and the TRQ remained unchanged. In addition, we disagree with ASA's implication that a fall in the U.S. price for refined sugar should necessarily result in a lower estimate of the cost of the program. Because the cost of the program depends on the difference between domestic and world sugar prices, changes in the world price are also important in determining the program's cost.

30. We disagree with ASA's argument for using a world cost-of-production estimate as a benchmark. Because of a scarcity of data, estimating the international cost of production would require numerous assumptions about other countries' costs of production as well as the effects of their policies to support producers. See also comments 4 and 7.

31. We used the 1997 census of agriculture, conducted by USDA's National Agricultural Statistics Service, to identify the number of sugarcane farms and sugar beet farms for table 3 in appendix 1. USDA's census of agriculture provided a consistent and rigorous methodology for estimating the number of sugarcane and sugar beet farms. However, as ASA mentioned, table 3 also notes that the census of agriculture's estimate of 7,102 beet farms varied substantially from the USDA Farm Service Agency's estimate of 11,800 sugar beet farms in 1997. This difference reflects differences in the definition of what constitutes a farm. In any case, the draft and final reports include both estimates.

32. We disagree with ASA's conclusion. See comments 1 and 3 on our methodology and objectivity.

Comments From the U.S. Cane Sugar Refiners' Association

UNITED STATES CANE SUGAR REFINERS' ASSOCIATION
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TELEPHONE 202 331-1458 • FACSIMILE 202 785-5110

NICHOLAS KOMINUS
PRESIDENT

May 5, 2000

BY HAND

Mr. Robert E. Robertson
Associate Director, Food and
Agricultural Issues
United States General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Robertson:

Thank you for giving us the opportunity to review the draft version of your latest evaluation of the effects of the Federal Government's sugar subsidy program. Your team and subcontractor have done a very thorough job of illuminating the very significant impacts that this federal program has on different interests.

See comment 1.

We have a couple of suggestions that may help the reader better understand your analysis. First, it would be useful to clarify in the last paragraph on page 5, that the term "sugarcane producers" includes the milling function as well as the farm, since the two are for the most part vertically integrated. Similarly, in the first paragraph on page 16, you could clarify that beet processing and cane milling are covered by the welfare analysis.

See comment 2.

Secondly, we assume that you adjusted the world raw and refined sugar prices in tables 1 and 7 to a delivered US basis in doing the welfare analysis. Mentioning that in the text might avoid confusion and unwarranted criticism of the report by producers.

See comment 3.

Finally, the one point on which we think the report is in error is with respect to the number of beet farms, addressed in the footnote to table 3. Crops are rotated within each farm, not by planting a whole farm to beets one year and some other crop the next. Therefore the Farm Service Agency's assertion that rotation considerations suggest there must be 11,800 beet farms rather than the 8,070 from the census is highly questionable. USDA has always put the number of beet farms in the 8-9,000 range in recent years. See for example the sugar backgrounder for the 1995 Farm Bill, pages 2-3.

I hope these comments are helpful. Congratulations on adroitly handling a tough assignment.

Sincerely,

Nicholas Kominus

GAO Comments

The following are GAO's comments on the letter of the U.S. Cane Sugar Refiners' Association to our draft report.

1. We revised the report to address the concern of the U.S. Cane Sugar Refiners' Association.

2. We revised table 1 to note that the basis point for the world raw sugar contract price is the Caribbean. According to a sugar market expert, the cost to transport raw sugar from the Caribbean to the United States is about 1.5 cents per pound. We also refined our model to more fully account for certain transportation costs in our welfare analysis.

3. We revised the report to clarify that USDA's census of agriculture and the Farm Service Agency used different definitions of a "farm".

GAO Contacts and Staff Acknowledgments

GAO Contacts

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Acknowledgments

In addition to those named above, Jay Cherlow and Barbara J. El-Osta made key contributions to this report.

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