U.S. SUGAR POLICY:
A WELFARE ANALYSIS OF POLICY OPTIONS
UNDER PENDING CARIBBEAN BASIN EXPANSION ACT LEGISLATION

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ABSTRACT

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Since 1987 the U.S. Congress has considered two pieces of legislation designed to address some of the inequities in the original Caribbean Basin Economic Recovery Act (part of the Caribbean Basin Initiative or CBI). Both pieces of legislation included modifications for the sugar import quota program. In 1987 House Resolution (H.R.) 3101 proposed relaxing CBI sugar import quotas back to the 1983/84 level of 1,123,782 short tons raw value (s.t.r.v.); the Congressional session ended, however, before action was taken on this bill. In 1989 a modified version of the bill, known as the CBI-II legislation, was introduced under H.R. 1233. The modifications focused largely on the textile and sugar provisions of the original bill in response to concerns expressed by domestic textile and sugar industry organizations; instead of providing any increase in sugar import quotas for the region, the legislation proposed a "quota floor" of 409,448 s.t.r.v. for Caribbean Basin sugar imports while allowing a quota of 429,151 s.t.r.v. to remain in effect for 1989.

A welfare analysis of these two sugar import quota policy options was conducted based on the corn and sweetener model developed by the U.S. Department of Agriculture. Results indicate that relaxing U.S. sugar import quotas to Caribbean Basin sugar exporting countries back to 1983/84 levels would generate net domestic gains and net overall program gains as well as gains to the beneficiary countries potentially in excess of those provided by the entire CBI program.

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BACKGROUND AND PROBLEM STATEMENT

In 1983 the United States Congress passed a comprehensive package of legislation known as the Caribbean Basin Economic Recovery Act (CBERA); as the primary policy instrument of the Caribbean Basin Initiative (CBI), it was intended to strengthen the economies of designated beneficiary countries in the region and to contribute toward their economic and socio-political development and stability (U.S. Department of State 1986). Previously in 1982, the U.S. government had imposed import quota restrictions on all foreign sugar suppliers as part of the domestic sugar support program; despite the CBERA legislation and the critical importance of sugar exports in these economies, the U.S. government did not exempt CBERA beneficiaries from its sugar import quota program. Under the protection of this sugar support program, U.S. sugar producers increased their production by 15.5 percent between 1981 and 1989. This was in spite of the fact that, over the same period, total domestic consumption of sugar decreased by 15 percent being replaced in the diet by less expensive high fructose corn syrup sweeteners (USDA 1989). The only way to maintain its sugar support price given these trends was for the U.S. to reduce its sugar import quotas, and by 1989 U.S. sugar import quota allocations for CBI countries had fallen to less than 28 percent of their 1981 (pre-quota) levels (USDA 1989).

Since 1987 Congress has considered two pieces of legislation designed to address some of the inequities in the original CBI legislation, both of which included modifications for the sugar import quota program. In 1987 House Resolution (H.R.) 3101 proposed relaxing CBI sugar import quotas back to the 1983/84 level of 1,123,782 short tons raw value (s.t.r.v.) (U.S. Congress 1987); the Congressional session ended, however, before action was taken on this bill. In 1989 a modified version of the 1987 bill, known as the CBI-II legislation, was introduced under H.R. 1233. The modifications focused largely on the textile and sugar provisions of the original bill "to address concerns raised by the domestic textile and sugar

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industries" (U.S. Congress 1989, p. H505); instead of providing any increase in sugar import quotas for the region, the legislation proposed a "quota floor" of 409,448 s.t.r.v. for Caribbean Basin sugar imports while allowing a quota of 429,151 s.t.r.v. to remain in effect for 1989. In this paper we conduct an economic welfare analysis of the two quota policy options: maintaining the current CBI sugar import quota level of 429,151 s.t.r.v. versus expanding the quota to 1,123,782 s.t.r.v. for 1989.

THEORETICAL FRAMEWORK

The compensating and equivalent variation concepts developed by Kaldor and Hicks are widely accepted as representing the proper approach for measuring the welfare impacts of price and income changes; however, they are difficult to apply empirically (Just et al. 1982). In this paper, we use a Marshallian approach to calculate welfare estimates based on the fact that the U.S. sugar market satisfies the conditions set forth by Willig (1976) under which Marshallian consumer surplus techniques provide good approximations for the compensating and equivalent variation measures.

We also calculate our welfare estimates in a partial equilibrium framework. While general equilibrium analyses consider economy-wide effects of a policy change, partial equilibrium analyses are appropriate when the effects of a policy change are expected to impact a very narrow spectrum of the economy (Just et al. 1982). Although high fructose corn syrup (HFCS) is an important sugar substitute, its price is significantly lower than that of raw sugar (USDA 1988). Additionally, the shift in sugar import quotas being considered in this analysis is not large enough to bring about domestic sugar price adjustments of a magnitude that would make sugar anywhere near competitive with HFCS, so we would not expect the price of HFCS to be affected by the policy options under examination. It follows that there will be no impact on the corn market either[1], and these conditions provide the justification for using a partial equilibrium approach for our analysis.

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[1]HFCS production accounts for less than five percent of total domestic corn consumption (USDA 1988).

WELFARE ANALYSIS

This paper draws upon the USDA corn and sweetener model developed by Langley and Zellner (1986) to generate estimates of domestic price and production shifts that could be expected to occur as a result of the proposed sugar quota increase being considered. These price and production shifts are then used in the calculation of producer and consumer surplus estimates. The model consists of 42 behavioral and identity equations encompassing the sugar, corn and HFCS markets and describing their interrelationships; the parameter estimates were generated using nonlinear two-stage least-squares econometric estimation methods.

As discussed in the theoretical framework section, the effects on the corn market from the policy options under consideration would be negligible; this provides the basis for our separation of the sweetener portion of the model into a free-standing sub-model. At the same time, three slight modifications were made to the sugar sub-model to improve its predictive capability.[2]

Estimates obtained using the modified USDA model were generated by entering actual data for the years 1984 through 1989 and allowing the model to calculate values for 1990; Table 1 presents the results from the modified USDA model runs under the two different quota regimes; that is, it summarizes the model estimates for 1990 under current quota levels and under the increased quota levels specified in the original CBI Expansion Act legislation (H.R. 3101 from 1987). In both runs, quota levels to all other sugar suppliers are assumed to remain constant. The results from increasing quota allowances are consistent with what we would theoretically expect:

(1)   sugar imports increase;

(2)   total domestic sugar supply increases;

(3)   predicted New York sugar price decreases;

(4)   domestic sugar use increases;

(5)   domestic sugarcane and sugarbeet farm prices decrease;

(6)   domestic sugarcane and sugarbeet production decreases; and

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[2]For a description of these modifications, see Messina (1989).

Table 1. Results from Modified USDA Model under Both Import Quota Levels

Calendar Year		Existing Quota		Proposed (Higher) Quota	
		1989	1990	1989	1990
Sugar					
Cane, Harvested	Th acres	792.53	789.66	792.53	786.76
Cane, Yield	S Tons	37.24	37.07	37.24	37.07
Production, Cane	Th S Tons	29513.97	29270.96	29513.97	29163.66
Beets, Harvested	Th Acres	1144.66	1075.82	1144.66	1035.56
Beets, Yield	S Tons	22.64	22.85	22.64	22.85
Beets, Production	Th S Tons	25909.99	24577.44	25909.99	23657.65
Imports	Th S Tons	1240.00	1240.00	1935.00	1935.00
Production, raw	Th S Tons	7190.64	6967.69	7190.64	6820.77
Beginning Stocks	Th S Tons	2972.00	3605.60	2972.00	3539.10
Supply	Th S Tons	11402.64	11813.29	12097.64	12294.87
Exports	Th S Tons	220.00	220.00	220.00	220.00
Food and Beverage	Th S Tons	9301.18	9392.73	9330.47	9411.32
Ending Stocks	Th S Tons	3605.60	3631.27	3539.10	3583.48
Domestic Use	Th S Tons	7577.04	7962.02	8338.54	8491.39
Total Use	Th S Tons	11402.64	11813.29	12097.64	12294.87
Cane, Farm Price	Dol/ton	31.42	29.91	28.21	27.82
Beet, Farm Price	Dol/ton	38.41	36.66	34.69	34.24
Price, NY Price	Cents/lb	23.69	22.45	21.04	20.72
World Price, CIF, #11	Cents/lb	10.18	10.18	10.18	10.18
Cane, Loan	Cents/lb	18.00	18.00	18.00	18.00
Beets, Loan	Cents/lb	21.37	21.37	21.37	21.37
MSP to Protect Loan	Cents/lb	21.80	21.68	21.80	21.68
HFCS Price	Cents/lb	20.53	20.35	20.53	20.35
Consumer Price	67=100	368.20	381.90	368.20	381.90
Population	Mil	248.50	250.90	248.50	250.90
Disposable Income, US	Bil Dol	3675.80	3954.80	3675.80	3954.80
NY Price	Cents/lb	22.12	22.12	22.12	22.12
SGUT	Th S Tons	11800.00	11900.00	11800.00	11900.00
Sugar Duty Fee	Cents/lb	0.63	0.63	0.63	0.63
HFCS Total Use	Mil lbs	9532.92	9699.98	9532.92	9699.98
HFCS Production	Mil lbs	9860.06	9715.26	9860.06	9715.26
Corn Use for HFCS	Mil Bu	261.32	257.01	261.32	257.01
HFCS, Residual	Mil Bu	-327.14	-15.28	-327.14	-15.28
Quota	Ths Sh Ton	1240.00	1240.00	1935.00	1935.00

(7)   domestic raw sugar production decreases.

Under the current total U.S. sugar import quota restrictions (1,240,000 s.t.r.v.), the model projects a U.S. sugar price of 22.45 cents per pound, domestic raw sugar production of 6,967,690 s.t.r.v., and domestic demand of 7,962,020 s.t.r.v. for 1990. Increasing the exogenous total U.S. sugar import quota to 1,935,000 s.t.r.v. as proposed under H.R. 3101, while leaving all other exogenous factors unchanged, provides an estimated U.S. sugar price of 20.72 cents per pound, domestic raw sugar production of 6,820,770 s.t.r.v., and domestic demand of 8,491,390 s.t.r.v. for 1990. Domestic and foreign welfare gains and losses based on these figures can be found in Table 2. Total consumer surplus gains of $284,643,991 are predicted; however, from an overall domestic viewpoint these gains are largely offset by losses in producer surplus as a result of the lower domestic price (net domestic gains are estimated to be $46,103,635).

Table 2.   Summary of Gains and Losses from Increasing the Total U.S. Sugar Import Quota from 1,240,000 s.t.r.v. to 1,935,000 s.t.r.v.[a] (allocated to CBI countries)

Total Consumer Surplus (gain)	$284,643,991	
Less Producer Surplus	- 238,643,991	
NET DOMESTIC GAIN		$46,103,635
CBI Sugar Producer Gains:		
Gain from increased quota	$146,506,000	
Proportionate loss from decreased price	- 11,903,721	
Net Gain to Caribbean Basin Sugar Exporters	$134,602,279	
ROW Sugar Exporter's Proportionate Loss	- 22,500,097	
NET FOREIGN GAINS		$112,102,182
NET PROGRAM GAINS		$158,205,817

[a] s.t.r.v. = short tons raw value

While the decrease in U.S. domestic price provides gains to domestic consumers, it lowers the effective price received by countries with quota allocations to the U.S. market since the

U.S. permits the exporters to receive the domestic sugar support price for their shipments (that is the quota rents go to the exporting countries). At this point it is important to note that the potential increased sugar import volume represents only about 4.2 percent of total projected world market sugar trade for 1989 and less than six-tenths of one percent of total forecast world sugar production for 1989. Ravnholt (1988), Leu et al. (1987), Dardis and Young (1985), Vroomen (1984) and Reynolds (1989) all support the assumption that changes in sugar trade volume as small as those we are considering will have a negligible effect on world sugar prices; based on this assumption the benefits to CBI exporters are calculated by multiplying their increased quota allowance (695,000 s.t.r.v.) by the difference between the new U.S. price (20.72 cents per pound) and the world price (10.18 cents per pound) since in the immediate short run they will be redirecting production that had previously been sold on the world market to the U.S. market.

Total quota rent losses from the policy change are calculated by multiplying the initial quota level (1,240,000 s.t.r.v.) by the amount of the price decrease (22.45 cents per pound - 20.72 cents per pound); however these losses must be allocated between the CBI countries and the ROW. This is easily done by use of their respective shares of the original quota; CBI sugar allocations represent approximately 34.6 percent of the total initial U.S. sugar quota level (USDA 1989). Therefore, 34.6 percent of the losses are absorbed by the CBI countries with the balance being absorbed by the ROW sugar exporters (with no offsetting gains). Estimated gains of $146,506,000 accruing to Caribbean Basin sugar exporters from the increased quota allocation are over 12 times as large as the losses they sustain due to lower U.S. prices. In fact, these gains exceed losses to all foreign sugar exporters from the lower price, resulting in net foreign gains of $112,102,182. Net program gains are the sum of these net foreign gain estimates and the net domestic gains.

An Alternative View

Up to this point we have conducted this analysis assuming that an increase in the CBI sugar quota would increase overall U.S. sugar imports; this is not necessarily the case. Under

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the structure of both versions of the CBI Expansion Act legislation, Congress has the option of reallocating any increases in CBI sugar quotas away from other designated country quotas resulting in no change in the overall U.S. quota level. Shifting quota allocations away from the ROW to the CBI countries simply results in a change in the distribution of quota rents away from the ROW to the CBI beneficiary countries. The amount of the quota rent shift is calculated by multiplying the quota shift quantity (695,000 s.t.r.v.) by the difference between the U.S. price and the world price (22.45 cents per pound - 10.18 cents per pound). This procedure provides a quota rent shift estimate of $170,553,000 which will be transferred to CBI sugar exporters and away from ROW quota sugar exporters. This policy option obviously offers larger benefits to CBI sugar exporters since the U.S. price remains at its original level, but it exacts much more significant losses on ROW sugar exporters ($170 million versus $22.5 million) while at the same time it fails to address domestic (primarily budget related) pressures for sugar program reform.

SENSITIVITY ANALYSIS

An important analytical consideration is the degree to which the welfare estimates generated from the modified USDA model results are affected by the model's implicit elasticities; different elasticities could theoretically change our producer surplus (PS) and consumer surplus (CS) calculations to such an extent that the proposed policy change would result in net program losses rather than net program gains. A log-linear functional form was chosen and calibrated for our simulation model. The implicit supply and demand elasticities from the USDA model were estimated to be 0.192 and -0.54 respectively, which fall within the elasticity extremes selected from the reviewed literature[3]. Table 3 compares domestic and foreign gain and loss estimates generated by the different elasticity combinations in the simulation model with the USDA model results; as can be seen, the simulation model provides a range of welfare estimates within which the USDA welfare estimates fall. In all cases we find that there are potential gains to CBI sugar exporters and domestic consumers, as well as

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[3]Sources include Jesse and Zepp (1977), Vroomen (1984), and Lopez (1989).

Table 3. Sensitivity Analysis Welfare Estimates

WELFARE ESTIMATES[a]

E\N	CONSUMER SURPLUS	PRODUCER SURPLUS	NET DOMESTIC GAIN (CS - PS)
HI\LO	$173,150,577	-$143,906,609	$29,243,967
LO\HI	$250,061,093	-$209,133,983	$40,927,110
LO\LO	$1,232,825,464	-$1,028,285,092	$204,540,372
HI\HI	$37,400,547	-$31,163,250	$6,237,297

SUMMARY:

	HI\LO	LO\HI	LO\LO	HI\HI	MODIFIED USDA MODEL
CBI SUGAR PRODUCER GAINS:					
GAIN FROM INCREASED QUOTA	$155,541,000	$149,564,000	$65,608,000	$167,356,000	$146,506,000
PROPORTIONATE LOSS FROM DECREASED PRICE	-$7,431,225	-$10,389,953	-$51,949,765	-$1,582,576	-$11,903,721
NET CBI GAIN	$148,109,775	$139,174,047	$13,658,235	$165,773,424	$134,602,279
ROW SUGAR PRODUCER LOSS:					
PROPORTIONATE LOSS FROM DECREASED PRICE	-$14,046,303	-$19,638,813	-$98,194,065	-$2,991,342	-$22,500,097
NET FOREIGN GAIN	$134,063,472	$119,535,234	-$84,535,830	$162,782,082	$112,102,182
PLUS NET DOMESTIC GAIN	$29,243,967	$40,927,110	$204,540,372	$6,237,297	$46,103,635
NET PROGRAM GAINS	$163,307,439	$160,462,344	$120,004,542	$169,019,379	$158,205,817

[a]Figures are approximate due to log-linear simulation model specification.

net program gains from a policy of relaxed sugar import quotas for the exporters in the Caribbean region.

CONCLUSIONS AND POLICY IMPLICATIONS

In the way of a brief review, we have drawn upon the USDA corn and sweetener model as a basis for generating equilibrium price and quantity values for 1990 under two different sugar import quota policy options. Based on these results we calculated the changes in consumer and producer surpluses (CS and PS) within a partial equilibrium framework to estimate potential gains from a policy of relaxing sugar import quotas. The results provide an estimate for net domestic gains of $46,103,635 (CS minus PS), net gains to CBI sugar exporters of $134,602,279 and net program gains of $158,205,817. We performed a sensitivity analysis by drawing a wide variety of elasticity estimates from recent studies into a simulation model which was based on the USDA model. The elasticities implicit in the modified USDA model fall between those used in our sensitivity analysis, and the welfare estimates generated are within the range established in our sensitivity analysis.

Results in Perspective

To help put our results into perspective, consider, for example, that recent estimates of the annual cost of the U.S. sugar program to domestic consumers range from $1 billion (Hickok 1985) to $2.7 billion (Knutson et al. 1985). Based on these figures, our estimate of consumer gain (consumer surplus) of $284,643,991 represents a noticeable improvement for consumers though it falls short of lifting the entire burden of the U.S. sugar program from their shoulders.

Looking at the producer side, while the original intent of the U.S. sugar legislation was to protect consumers, even the USDA has acknowledged that "the sugar program is overly generous relative to programs for other crops" (USDA 1989, p. 83). Even with the producer surplus losses sustained under the relaxed import quota program examined here, domestic

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sugar producers will still be better off in terms of total revenue than they were in 1981 due to acreage expansion in response to high sugar support prices[4].

From a foreign policy standpoint, consider that the $134,602,279 gain to CBI sugar exporters predicted by the modified USDA model under the expanded quota policy would represent an 8.9 percent increase in total agricultural exports from the region to the U.S. or a 2.5 percent increase in total exports from the region to the U.S. based on 1988 data (USDA 1988).

U.S. Sugar Policy and the CBI

From the outset there has been some question as to how much potential for increased trade the CBI duty-free provisions really provided. Prior to passage of CBI, 87 percent of the region's exports entered the U.S. duty free under the Generalized System of Preferences (GSP); CBI only added another five percent of regional exports to the list while "excluding those products in which the region is most likely to have a competitive edge" (Samuel undated). On this basis Pelzman and Schoepfle (1988) argue that it would be unrealistic to expect more than a limited expansion of regional exports to the U.S. from the Caribbean Basin as a result of CBI. They go on to estimate that, even assuming infinite export supply elasticities (i.e. CBI countries can immediately shift their exports to the U.S. market), based on the products excluded from the legislation, CBI would have only resulted in annual export gains of approximately $88 million in 1983. Comparing this to the $134 million gain predicted by our analysis under the relaxed sugar import quota option provides further insight; even a relatively small sugar quota increase for the Caribbean Basin region can potentially provide larger annual gains than the entire CBI program.

In looking at general trends in Caribbean Basin regional exports we note that agricultural exports from CBI countries to the U.S. in 1988 were less than 63 percent of their 1981 level in real (1980) dollar terms (USDA/FATUS 1981 and 1988). This is largely the result of the U.S. sugar import quota imposition; in real (1980) dollar terms, sugar exports to the U.S. from

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[4]Since 1982 U.S. sugar support prices have remained between 2.5 and five times as high as the world sugar price.

the region in 1988 were less than 18 percent of their pre-quota (1981) level (USDA/FATUS 1981 and 1988). In other words, decreases in sugar exports from the Caribbean Basin region to the U.S. account for nearly 75 percent of the overall decrease in agricultural exports during the period. U.S. trade barriers appear to have been far more effective than our trade development programs.

Budget Considerations

That the cost of U.S. farm programs is of concern to legislators and policy makers is evidenced by the fact that the 1985 Farm Bill stipulated that the sugar support program be conducted at no cost to the government. Consider however that, without any sugar policy adjustments and given the current domestic sugar production and consumption trends, within the next ten years the U.S. will be producing more sugar than it consumes. If allowed to reach that point, budgetary monies will need to be spent to either support Commodity Credit Corporation (CCC) stock purchases or to subsidize exports.

Conclusion

In considering the CBI-II legislation, policy makers seek a balance between protecting domestic consumers, supporting domestic sugar producers, assisting our Caribbean neighbors in their economic development and protecting our foreign policy interests -- an admittedly difficult set of goals to mutually satisfy. Our analysis has sought to provide additional input into the policy making process. While we recognize that our estimates of gains and losses are approximations, the sensitivity analysis suggests they are robust, lending considerable credibility to our results.

This study finds potential net gains from even a small relaxation of sugar quotas. At the same time, from an economic development and foreign policy point of view, this study supports the conclusion of Seale et al. (1989) that relaxing sugar quotas for the Caribbean Basin region would provide more potential for enhanced economic growth and political stability than the entire CBERA program.

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