WESTERN AGRICULTURAL ECONOMICS ASSOCIATION

PAPERS OF THE

1989 ANNUAL MEETING

WESTERN AGRICULTURAL ECONOMICS ASSOCIATION

COEUR D'ALENE, IDAHO

JULY 9-12, 1989

SESSION 15

AN ECONOMIC ANALYSIS OF THE IMPACT OF REMOVING U.S. IMPORT QUOTAS ON SUGAR

Steven A. Neff*

The two main features of the U.S. sugar program are its support price to farmers and its import quota. The support price to farmers is ensured by a nonrecourse loan rate for raw sugarcane, which in 1987 equalled 18 cents per pound. A Market Stabilization Price (MSP) -- 21.78 cents per pound in 1987 -- is used in calculating the import duty. The import quotas were established so the government could avoid expensive stock acquisition. The 1955 GATT waiver of Article XI, which permits import quotas only in conjunction with supply reduction programs, serves as authorization to impose sugar quotas. Although the United States remains a sugar importer, support prices consistently above world prices have permitted the development and substitution of high fructose corn sweetener for sugar in beverages and many other caloric sweetener uses, which has cut sugar imports by two-thirds from its 1970-1979 average level of 5.2 million short tons.

The program has been criticized on several grounds. First, U.S. consumers pay prices far above world price levels. Second, many of the countries whose quotas have been cut are developing countries that the U.S. government wants to help -- for example, countries in the Caribbean Basin. In addition to the current problems, there is also the danger that the quota will go to zero and fail to provide trade protection. Finally, the quotas have been seen as posing severe barriers to the United States obtaining more valuable concessions from its trade partners on agricultural and other matters in GATT negotiations.

ALTERNATIVE POLICIES

This paper assesses the economic benefits and costs to producers, consumers, taxpayers, and foreign interests under alternative agricultural policies which relax existing quota restrictions. The alternative agricultural policies which will be used in this analysis are tariffs, deficiency payments, and free markets, i.e., no policy. None of these alternatives violates current GATT trading rules. The first option removes quotas on sugar, but replaces them with equivalent tariffs. A tariff is viable since it is the preferred trade instrument in the GATT.

The second option removes quotas on sugar, but makes deficiency payments to farmers. The deficiency payment option creates a two-price system, with producer support unchanged and the domestic market price equal to the world price.

The third option removes quotas and all price support programs for sugar. Although here are many subsidiary instruments of support and protection in the U.S. sugar sector including import fees on refined sugar, only the primary instruments, the producer support prices and the import quotas, are removed for the "no policy" option.

METHODOLOGY

The traditional measures of welfare, producer and consumer surplus are treated extensively elsewhere (e.g., Just, Hueth, and Schmitz 1982). Taxpayers must be taken into account since the study is specifically about government intervention. The changes in aggregate producer surplus, aggregate consumer surplus, and federal expenditure are measured and summed to obtain the net economic impact of a policy change to society. The one-time adjustment costs required to shift resources out of the sugar industry in the event of contraction of the industry are not included due to space limitations.

The effects on foreign interests are important as an indicator of how much benefit the United States might get from trading partners through the GATT negotiating process as a result of making particular types of policy change. The effects on the welfare of foreign interests are measured as the net change in foreign exchange flows.

The model traces the effects of policy changes, relative to a baseline set of commodity prices, market balances, and current policy through to their welfare outcomes for both domestic and foreign interests. The method used is comparative statics, which indicates the total change from the base case to a new equilibrium reached after all effects of a policy change have had time to occur. Although the model is based on static equilibrium, long-run elasticities are used in the behavioral equations in an effort to capture full rather than partial adjustments. While only the sugar sub-model is presented here, the full model contains corn, soybean, dairy, and beef sectors (Author 1988).

The model is a synthetic, linear, static, multi-commodity policy simulation model. It is synthetic in the sense that no new estimates of elasticities are made. The coefficients used in the commodity model are derived from elasticity estimates obtained from previous studies, with the aim of constructing reasonable behavioral equations. The model relies on linear production and consumption functions. It is static because no dynamics such as lagged response are needed and stock adjustments are included since, in long-run equilibrium, no stock adjustment occurs. The model does account for important cross-commodity effects which have not been included in as much detail in previous studies.

MODEL OF THE SUGAR SECTOR

The sugar model, having equations for broad categories of sweetener demand and for the production of high fructose corn sweetener and sugar, is presented in Table 1. Price and quantity variables are in capital letters, and constants, technical coefficients, and price parameters are in lower case.

Equation 1 represents the production of sugarbeets (SSB), and equation 2 that of sugarcane (SSC). Both are assumed to be a function of the sugar price (PS). Under current policy, the price that producers respond to is the government's sugar loan price (PSL). Cross-price supply elasticities are included for both sugarbeets and sugarcane. In equation 1, the price of corn (PC) is included because corn is a substitute crop for sugarbeets in more regions of the country than wheat and alfalfa. In equation 2, the price of nonfed beef (PLQ) is the relevant cross-price because much of the land now used to grow sugarcane would be used for cattle grazing otherwise. The total sugar production (SST -- equation 3) is the sum of production from cane and beet.

The derivation of the demand relationships is shown in equations 4 through 10. The total demand for sweeteners (DSWT -- equation 4) is a function of the price of its largest single component, sugar. Sugar's share (DSWSS) of total caloric sweetener demand (equation 5) depends on both the price of sugar and on the price of corn, the raw material for the various corn sweeteners, which is included in equation 5. Together, the total sweetener demand and the sugar share equation determine the demand for sugar, as calculated in equation 8.

The share (DSWHFS) for high fructose corn syrup (equation 6) is the remainder when the shares for sugar, glucose, and dextrose are subtracted. Glucose and dextrose (equation 7), taken as a group, have held a steady share (DSWGDS) of 14 percent throughout the 1980s. The level of HFCS consumption (DSWHF) and glucose and dextrose consumption (DSWGD) are simply the product of the the share times the total, shown in equations 9 and 10. Other caloric sweeteners, including honey and molasses, are insignificant for the purposes of this model, accounting for only one tenth of one percent of total caloric sweeteners.

Equation 11 shows that, in an unconstrained world, sugar exports (XSGRW) to the U.S. by the rest of the world depend on the price of

Table 1. Equations and Variable Definitions in the Sugar Model.

Production

$$SSB = c1 + a1*PS + a2*PC \quad (1)$$
$$SSC = c2 + a3*PS + a4*PLQ \quad (2)$$
$$SST = SSB + SSC \quad (3)$$

Consumption

$$DSWT = c3 + a5*PS \quad (4)$$
$$DSWSS = c4 + a6*PS + a7*PC \quad (5)$$
$$DSWHFS = 1 - DSWSS - DSWGDS \quad (6)$$
$$DSWGDS = k1 \quad (7)$$
$$DSWS = DSWSS*DSWT \quad (8)$$
$$DSWHF = DSWHFS*DSWT \quad (9)$$
$$DSWGD = DSWT*DSWGDS \quad (10)$$

Trade

$$XSGRW = c5 + a8*PSW \quad (11)$$
$$MSG = \min(XSGRW,MSGQ) \quad (12)$$
$$MSG = DSWS - SST \quad (13)$$
$$PSW = \min(PS,1/a8(-c5+MSGQ)) \quad (14)$$
$$MSGQ = c6 \quad (15)$$

Variable		Definition
SSB	=	Beet sugar production, thousand tons raw value
SSC	=	Cane sugar production, thousand tons raw value
PC	=	Market price of corn, dollars per bushel
PLQ	=	Market price of nonfed beef, dollars per hundredweight
SST	=	Total domestic sugar production, thousand tons raw value
[illegible]T	=	Total caloric sweetener use, thousand tons raw value
DSWSS	=	Sugar share of total caloric sweetener, percent
DSWHFS	=	HFCS share of total caloric sweetener, percent
DSWGDS	=	Glucose and dextrose share of total caloric sweetener, percent
DSWS	=	Sugar use, thousand tons raw value
DSWHF	=	HFCS use, thousand tons raw value
DSWGD	=	Glucose and dextrose use, thousand tons raw value
PS	=	Market price of sugar, cents per pound of raw sugar
PSL	=	Loan price of sugar, cents per pound of raw sugar
MSG	=	Sugar imports, thousand tons raw value
MSGQ	=	Sugar import quota, thousand tons raw value
XSGRW	=	Sugar exports to the U.S. by the rest of the world, thousand tons raw value
PSW	=	World price of sugar, cents per pound of raw sugar
t1	=	U.S. tariff, explicit or implicit, on sugar imports, cents per pound of raw sugar
min( )	=	Minimum value of two expressions in parentheses
k1	=	Constant share of caloric sweeteners provided by glucose and dextrose (14 percent)

sugar. Equation 12 says that sugar imports (MSG) equal the minimum of the exports desired from the rest of the world (equation 11) and the import quota (MSGQ). When the import quota binds, imports equal the quota, and the observed world price is PSW while the domestic price is PSL. When the import quota does not bind, imports equal the level of exports generated by equation 11, and both prices are PS. Sugar imports (equation 13) are defined in the model as the difference between domestic sugar consumption and domestic sugar production.

Equation 14 derives the relationship between the U.S. and world prices. If the import quota does not bind, the prices are the same. If the import quota is binding, the world price adjusts according to the flexibility formula in the equation, which is an algebraic manipulation of equation 11. Equation 15 identifies the sugar quota, when used, as an exogenously determined constant.

The parameter values in Table 2 are generated with the model using actual price and quantity data for 1986/87.

RESULTS OF POLICY SIMULATION ANALYSIS

The baseline values -- shown in Table 3 -- for the simulation experiments are intended to represent a long-run equilibrium in these markets. Therefore averaged data for the years 1982-1987 are used in order to make the policy simulation results more representative of changes in current policy from a long-run equilibrium rather than from the current situation.

For the tariff option, production, consumption, and trade remain unchanged from the baseline, as shown in Table 5. Tariff revenues are calculated as $370 million (Table 6), which is also the loss in foreign exchange earnings -- loss of quota rents -- by the rest of the world.

For the deficiency payments option, the U.S. consumer price is allowed to fall to the world price level, stimulating stronger domestic sugar demand, as shown in Table 4. While the domestic producer price remains at 21.1 cents per pound, the domestic consumer and world prices are at 11.35 cents per pound, which equates to a 46 percent decrease in the domestic consumer price and a 40 percent increase in the world price. Changes in the prices of competing crops cause sugar production to increase slightly from 6230 to 6280 thousand tons, an increase of less than one percent. Domestic sugar consumption rises from 7650 to 9050 thousand tons, an increase of 18 percent. Imports increase from 1420 to 2770 thousand tons, a rise of 95 percent. While there is no change in producer surplus, consumer surplus increases by $1630 million. Government deficiency payments of $1220 million leaves a net gain of $400 million in direct effects on sugar interests.

The largest indirect effect from implementing a sugar deficiency payments program is in the corn market, where the price falls nine percent from $2.15 to $2.07 per bushel. As a result of the drop in sugar prices, there is a substitution in sweetener demand from HFCS to sugar, which lowers the demand for corn to produce sweetener, yielding the results shown in Table 4. Overall, producer surplus increases by $310 million, and consumer surplus increases by $1740 million. However, federal expenditures increase by $1780 million, a combination of the new sugar deficiency payments and an increase in the already-existing deficiency payments in the corn program. On balance, instituting a deficiency payments scheme for sugar brings net domestic welfare benefits of $270 million. Impacts on foreign interests are small and positive at $90 million, as sugar exporters benefit $30 million by a higher world price and foreign buyers of U.S. corn pay $60 million less for their imports.

Table 2. Elasticities and Parameter Values in the Sugar Model.

Parameter Code		Elasticity	(Source)	Parameter Value
SSB				
a1	Own-price	2.29	Sudaryanto	338
a2	Cross-price	-0.47	Sudaryanto	-680
c1	Constant	----		-2551.8
SSC				
a3	Own-price	0.74	Sudaryanto	109
a4	Cross-price	-0.20	Sudaryanto	-16
c2	Constant	----		1436.9
DSWT				
a5	Own-price	-0.08	Langley	-61.7
c3	Constant	----		17580.2
DSWSS				
a6	Own-price	-0.31	Langley	-0.01
a7	Cross-price	0.08	Sudaryanto	0.02
c4	Constant	----		0.58
XSGRW				
a8	Own-price	2.37	Hammig	416.9
c5	Constant	----		-1952.3
MSGQ				
c6	Constant	----		1425

Table 3. Baseline Values in the Sugar Model.

Variable	Data Average (relevant units)	Baseline Value	Source
Beet Sugar Production-SSB	3118	3120	S&S
Sugar Price-PS 1/	21.1	21.1	S&S
Corn Price-PC 2/	2.15	2.15	AO
Cane Sugar Procuction-SSC	3108	3108	S&S
Nonfed Beef Price-PLQ 3/	39.3	39.3	AO
Total Domestic Sugar Production-SST	6226	6228	S&S
Total Sweetener Use-DSWT	16278	16278	S&S
Sugar Share of DSWT-DSWSS	0.47	0.47	S&S
HFCS Share of DSWT-DSWHFS	0.36	0.36	S&S
Glucose and Dextrose Share of DSWT-DSWGDS	0.16	0.17	S&S
Sugar Use-DSWS	7651	7652	S&S
HFCS Use-DSWHF	5860	5859	S&S
Glucose and Dextrose Use-DSWGD	2767	2767	S&S
Sugar World Price-PSW 4/	8.1	8.1	S&S
Sugar Imports-MSG	1425	1424	S&S
Sugar Import Quota-MSGQ	1425	1425	S&S

S&S USDA, Sugar and Sweetener Situation and Outlook Report, various issues
AO USDA, Agricultural Outlook
Calc Calculated from other variables
1/ Contract 12
2/ Chicago Cash, No. 2 Yellow
3/ Utility, Omaha
4/ Contract 11, cif NY basis

Table 4. Price Results for Sugar Program Changes.

	unit	BASE	TARIFF	DEFICIENCY PAYMENTS	NO POLICY
PRICES					
Corn					
domestic	$/bu	2.15	2.15	2.07	2.07
Soybean					
domestic	$/bu	5.12	5.12	5.10	5.10
Sugar					
world	$/cwt	8.10	8.10	11.35	13.15
loan	$/cwt	21.10	21.10	21.10	13.15

Source: Calculated

Table 5. Quantity Results for Sugar Program Changes.

	unit	BASE	TARIFF	DEFICIENCY PAYMENTS	NO POLICY
QUANTITIES					
corn exports	Mil. Bu.	1626	1626	1654	1645
corn production	Mil. Bu.	7285	7285	7286	7286
corn domestic use	Mil. Bu.	5659	5659	5632	5640
corn feed	Mil. Bu.	4462	4462	4480	4480
corn nonfeed	Mil. Bu.	1196	1196	1151	1160
soybean exports	Mil. Bu.	755	755	758	758
soybean production	Mil. Bu.	1933	1933	1938	1938
soybean domestic	Mil. Bu.	1178	1178	1180	1180
sugar imports	Th. Tons	1424	1424	2768	6054
sugar production	Th. Tons	6228	6228	6280	2726
sugar domestic use	Th. Tons	7652	7652	9048	8780
sugar share	Percent	47	47	54	52
hfcs share	Percent	36	36	29	31

Source: Calculated

Table 6. Welfare Changes from Sugar Policy Changes.

	TARIFF	DEFICIENCY PAYMENTS	NO POLICY
SUGAR	----- Million Dollars -----		
Welfare changes			
foreign exchange	-370	27	991
producer surplus	0	0	-712
consumer surplus	0	1628	1306
federal expenditure	-370	1224	0
net domestic	370	404	594
OTHER COMMODITIES			
Welfare changes			
foreign exchange	0	66	85
producer surplus	0	308	308
consumer surplus	0	109	110
federal expenditure	0	555	555
net domestic	0	-138	-138
TOTAL, ALL COMMODITIES			
Welfare changes			
foreign exchange	-370	94	1076
producer surplus	0	308	-404
consumer surplus	0	1737	1416
federal expenditure	-370	1779	555
net domestic	370	266	457

Source: Calculated

For the no policy option on sugar, the producer, consumer, and world prices of sugar are all $13.15 per hundredweight. This price is 38 percent lower for domestic producers and consumers than under the base case, but is 62 percent higher than the world price in the base case. Since this is the only option which allows a drop in producer support, it triggers cutbacks in domestic production and additional demands on international supplies. Domestic sugar production falls 56 percent from the base of 6230 thousand tons, and domestic consumption increases by 15 percent from the base of 7650 thousand tons. U.S. imports increase more than fourfold from the base level of 1420 thousand tons to 6050 thousand tons. Total sweetener consumption rises only slightly from 16.3 million tons in the base to 16.8 million tons in the no policy option. Sugar's share rises from 47 to 52.4 percent of the total, an increase of 1.2 million tons to 8.8 million tons. The HFCS share falls from 36 percent in the base case to 30.6 percent in the no policy option, which amounts to a 0.8 million ton decrease to 5.1 million tons.

The effects on sugar interests of removing all protection and producer support are consistent with expectations, as producer surplus declines $710 million, consumer surplus increases $1300 million, and federal expenditure on sugar programs is unchanged from the base. The result is an increase in net economic welfare of $590 million. The effects of removing sugar policies on other commodities is similar to the deficiency payments option. Overall, the no policy option for sugar implies a reduction in producer surplus of $400 million, an increase in consumer surplus of $1410 million, and an increase in government spending of $560 million. The result is an increase in net domestic welfare of $450 million. The foreign exchange effect is an

increase of $1080 million, $990 million of which comes directly from the changes in the sugar market and the rest from the corn market.

SUMMARY

The effects of relinquishing the quota depends, as expected, upon the program which replaces it. For example, it is possible to maintain equivalent protection by switching the quota instrument for a tariff instrument. This option allows the U.S. to relinquish the waiver with virtually no effects on the domestic economy.

The deficiency payments option achieves larger gains than a tariff, but involves large budget costs. Even so, it generates gains for both domestic and foreign interests because it removes a consumption distortion.

Removing price supports and trade interventions under the no policy option has much larger effects than the other options. However, the net gains come at the expense of politically powerful producer and processor interests. Unless a scheme could be devised to compensate (or buy out) these interests, the large gains to the economy may be extremely difficult to achieve.

In view of the impacts on the conflicting interests involved in the sugar market, the tariff policy may be the most feasible option. Given the improbability of Congress passing a total liberalization of the sugar program, the criterion for selecting a negotiating strategy should be the one which gains the greatest access for American products while causing the least disruption of U.S. industries. In this light, a bound tariff affording the same level of protection would seem to be a minimal move -- but a positive and possible one -- which removes the offensive quota instrument without suddenly leaving domestic interests vulnerable. The establishment of the tariff within GATT rules would raise the prospect of gradual reductions over time in concert with concessions from other countries.

Countries which maintain protectionist agricultural trade policies would see clearly the U.S. intent to press for more liberalization, with a more credible trade policy and demonstrated positive action. What is more, a unilateral suspension of the quotas appears domestically feasible if replaced by an equivalent bound tariff.

A phased reduction of protection and support would result in less economic dislocation and be more likely to succeed politically than immediate abandonment of the program. Especially attractive would be a phased reduction through mutual agreements with other countries and including other commodities. If the relaxation of import quotas were to assist in bringing about such liberalization, the beneficial impacts could far exceed those calculated in this study.

BIBLIOGRAPHY

Gemmill, Gordon. The World Sugar Economy: An Econometric Analysis of Production and Policies. Agricultural Economics Report No. 313, Michigan State University, October 1976.

Hammig, Michael, Roger Conway, Hosein Shapouri, and John Yanagida. "The Effects of Shifts in Supply on the World Sugar Market." Agricultural Economics Research. Vol.34, 1982, pp.12-18.

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

Neff, Steven A. "The Welfare Implications of Removing U.S. Import Quotas on Sugar and Dairy Products." Unpublished Ph.D. Dissertation, Stanford University, 1988.

Sudaryanto, Tahlim. "The Potential Impacts of Liberalized Trade Policies in the United States and the European Economic Community on International Markets for Sugar." Unpublished Ph.D. Dissertation, North Carolina State University, 1987.

U.S. Department of Agriculture, Economic Research Service. Sugar and Sweetener Situation and Outlook Report. Washington, D.C., various issues.

Zepp, Glenn A. Cane Sugar Supply Response in the United States. U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report No. 370. Washington, D.C., 1977.

The Impact of Lamb Imports on U.S. Sheep Products Markets

Glen D. Whipple, Dale J.Menkhaus and John P. Hewlett*

U.S. lamb interests have voiced concern over recent increases in lamb imports (ASPC,1988). Lamb imports were 18 million lbs. annually in the early 1980's, about 5% of domestic production. However, imports were 31 million lbs. in 1985, 28 million lbs. in 1986 and about 29 million lbs. in 1987 and 1988 (9 to 10% of production for each year) (ASPC,1988). Historically lamb has been excluded from legislation imposing import restriction on other meats. However, renewed concern about lamb imports resulted in the designation of lamb as a perishable product under the Omnibus Trade Bill of 1988. This allows for the imposition of restrictions on lamb imports if it can be shown that imports are damaging the domestic lamb market (ASPC,1988).

Carman and Maetzold estimated the effects of varying levels of lamb imports on producers and consumers for 1967 using a spatial equilibrium model. Their results show that consumers benefit from imports through increased meat supplies and lower prices while producers receive lower returns with lamb imports.

It is the purpose of this research to investigate the impacts of lamb imports on the markets for sheep products. To that end, consistent theoretical and empirical model are developed and the effects of lamb imports on impacted U.S. markets are estimated.

Economics of Wool and Lamb Markets

Wool and lamb are the joint products of sheep production and for the most part are complementary outputs. Any policy which affects prices or production levels of an output will impact its joint product. As a result, the economic effects of lamb imports are felt and thus, must be measured on farm and wholesale level wool markets as well as lamb markets.

Lamb and Wool Markets Illustrated

Domestic farm and retail level markets for wool and lamb are illustrated in Figure 1. The horizonal axis in Figure 1 represents the quantity of sheep and associated outputs of wool (sheep x wool/sheep) and lamb (sheep x lamb/sheep). Price or revenue per sheep from lamb and wool is located in the vertical axis. Thus, price in Figure 1 is defined as output per sheep times the price of the product considered. Interpretation is similar to the more traditional price/quantity graph since output per sheep is relatively unaffected by prices in the short run. Since price and quantity are adjusted for lamb and wool output per sheep, the same adjustment is implied for supply or demand schedules represented in Figure 1. This approach is necessary due to the jointness in lamb and wool production.

U.S. demands for wool at the farm or wholesale levels are labeled DWF and DWW, respectively, The wholesale level is considered the final demand in this case due to the lack of data at the retail level for wool. The farm, wholesale and retail level demands for lamb are labeled DLF, DLW and DLR, respectively, These demands are satisfied with both domestically produced and imported products. The supply of wool imports (SWm) is on a raw basis. Lamb imports supply, labeled SLm, is on a wholesale or carcass basis. The demand for domestically produced lamb, labeled EDLW in Figure 1, is defined as the excess of demand (DLW) over import supply (SLm) at various prices. Thus at a price P*, EDLW(P*) = DLW(P*) - SLm(P*). As illustrated in Figure 1, excess demand is zero at the intersection of DLW and SLm and positive at prices below that intersection, but is equal to DLW at prices below the minimum import price. The demand for domestic lamb at the farm level (EDLF) is derived from the wholesale demand (EDLW). Similarly, the farm level demand for domestically produced wool (EDW) is the excess of demand (DWF) over import supply (SWm) at