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SUGAR POLICY REFORM IN THE REPUBLIC OF TURKEY

Recently, the Republic of Turkey passed a significant milestone on its road to becoming a full member of the European Union (EU). On January 1, 1996, the customs union agreement contained in Decision No. 1/95 and issued by the EC-Turkey Association Council became effective. The agreement eliminates barriers to trade between Turkey and the EU in industrial goods and processed agricultural products. In addition, Turkey has agreed to adopt the EU's Common External Tariff for trade with third countries and to align its domestic policies with the EU's common commercial policy (Customs Union, 1998). Turkey stands to gain between 1.0 and 1.5 percent annual growth in its GDP as a result of the customs union in manufactured goods. The benefits from Turkey's customs union with the EU would increase if the agricultural sector were included (Harrison, Rutherford, and Tarr, 1996). However, until Turkey adopts domestic programs that are compatible with the Common Agricultural Policy (CAP), trade in agricultural commodities will continue to be restricted (EC-Turkey Association Council, 1998).

The process of harmonizing Turkey's domestic agricultural policy with the CAP has already begun in the sugar sector. In 1997 the Turkish Sugar Corporation (TSC) drafted a proposal to change Turkey's current sugar policies to coincide with the existing CAP. With the aid of a partial-equilibrium simulation model of Turkey's sugar industry, this paper examines the impact of the proposed sugar regulation on Turkey's sugar production and trade. As a policy alternative, we also analyze changes in Turkey's sugar sector resulting from a reduction of tariffs on sugar imports under the current domestic policy.

The remainder of the paper is divided into four sections. The first section describes Turkey's sugar sector and the development of sugar policy. We also look briefly at the proposed changes in Turkey's sugar policy and its consistency with the CAP. This discussion is followed by an outline of the econometric model and estimation results that form the basis for the simulation model. The third section presents the simulation results of the current proposal

for policy change, and the last section considers the impact of tariff reductions under the current policy.

Historical Background of Turkey's Sugar Market

Sugar beet production has been an important agricultural activity in Turkey since 1923 when the first sugar factory was established in Usak. In 1926 only 6,664 Turkish farmers produced sugar beets; however, by the early 1990s the number of sugar beet farmers was approaching 500,000 (OECD, 1994). Sugar beets are grown throughout Turkey, but the major production regions are Marmara, east-central, and south-central Turkey. Almost all beets are grown under contract with processing plants operated by the state-owned TSC or state-regulated Central Union of Sugar Beet Producer Cooperatives (PANKOBIRLIK). As part of the contract, the processor prescribes the optimal crop rotation for the region, sowing sugar beets on a field once every three or four years. Crop rotations commonly include wheat and other cereals, pulses, fodder crops, and sunflowers. Sugar beet planting begins as early as February and continues through May. The sugar beet harvest begins in late July and continues through November.

The TSC and PANKOBIRLIK guarantee to buy all beets produced on the area specified in the contract. This policy guarantees farmers a market for their product. Consequently, farmers often prefer to produce beets even when the expected return may not be as high from other crops. In addition to eliminating marketing uncertainty, the TSC provides seeds and fertilizers to farmers as part of the production contract. Farmers must use the seeds provided by the processor, but they are free to purchase their own fertilizers from other sources. However, farmers generally prefer to purchase fertilizers from the processor because payment can be deducted from their proceeds after harvest. The disadvantage of delaying payment for inputs purchased from the processor is the high opportunity cost of the farmer's capital exacted by rapid inflation, particularly since farmers generally do not receive their final payment until March or later. If needed, the TSC also provides harvesting equipment or custom harvest services. Farmers are responsible for providing the land, labor, and irrigation, and for transporting the beets from the farm to the designated collection point (Sarigedik, 1998).

When the Turkish Sugar Corporation was established in 1935, all processing of sugar beets was placed under the control of the state monopoly. Private sugar refiners have been established as part of the structural adjustment program initiated in 1980. Presently there are 29 sugar refineries in Turkey, 24 of which are solely owned by the TSC. The remaining factories are jointly owned by the TSC in partnership with other entities. The majority shares of three jointly-owned refineries are held by PANKOBIRLIK, which operates these plants independently of the TSC. Each sugar refinery is assigned a geographical region in which it is free to contract with farmers for sugar beets.

Since 1956 the Ministry of Commerce and Industry has prepared sugar beet procurement and ex-factory sugar price suggestions for the government. Based on these suggested prices, the Turkish government announces a sugar beet procurement price each fall after the harvest has begun. The producer price has been disclosed only twice before the harvest, in 1990 and again in 1996. The ex-factory price is set to account for expected production costs and is revised periodically throughout the year to adjust for inflation. Retail prices for sugar are allowed to fluctuate according to market conditions.

Turkey's current sugar policy is designed to insulate the domestic market from international price shocks and to ensure a stable sugar supply. Under this policy, Turkey is self-sufficient in sugar production. However, domestic prices are well above world prices, and imports are limited by a prohibitive tariff rate. Moreover, excess sugar production is exported with the aid of subsidies. Based on producer and consumer subsidy equivalents, the Organization for Economic Cooperation and Development (OECD, 1994) has concluded that Turkey's sugar regime provides a transfer from consumers to producers. This transfer is more than 40 percent of the purchase price in some years. Likewise, Ören (1998) found that the effective protection coefficient for Turkish sugar beets is as high as 56.4 percent. The level of effective protection, like the producer and consumer subsidy equivalents, fluctuates from year to year as a consequence of Turkey's rapid inflation rate. The variation in effective protection can be quite large, ranging from -21.7 percent in 1989 to 56.4 percent in 1992.

In the draft legislation proposed by the TSC, sugar beet producers would contract with sugar processors for a fixed quantity of sugar beets rather than for a production area. In other words, farmers will have production quotas. Farmers will be able to sell their contracted

quantity of sugar beets to the TSC at the support price announced by the government of Turkey. Purchase price adjustments will be made for farmers whose production falls short or exceeds the contracted amount. Processing plants operated by PANKOBIRLIK will be required to follow the same pricing and contracting rules as state-owned refineries. Quota levels for individual farmers will be established as an average of their contracted production for the last three years. National production levels will be determined by the Sugar Committee, which will be composed of government officials representing industry, agriculture, finance, and trade, as well as representatives from PANKOBIRLIK and the Farmers Union (Sarigedik, 1998).

While the specific provisions of Turkey's new policy may differ from the CAP sugar regime, the basic principles are essentially the same. The EU sugar regime is based on a sophisticated system of production quotas designed to ensure a stable supply of sugar and a "fair" return to sugar beet and cane producers. Production designated for domestic consumption is established by the A and B Quota levels. These quotas were originally set to meet existing sugar demand in member countries and expected future growth. Consequently, the regime was prone to overproduction from its inception, and excess sugar under the B Quota is exported with subsidies. The price for A Quota sugar is supported by the white sugar intervention price. Producers supplying beets for A Quota sugar are paid a price that is derived from the sugar intervention price, taking into consideration the processing margin, yield of sugar from the beets, receipts from molasses, and the cost of transporting the beets to the refinery. The price for B Quota sugar is reduced by the levies that are collected to finance the cost of export subsidies needed to sell excess B Quota sugar on world markets. In this manner, the sugar regime is intended to be self-financing. C Quota sugar is excess sugar produced to ensure that the A and B quotas are met in the event of a shortfall. C sugar does not receive support under the CAP, and it is exported without subsidy (Harris and Tangermann, 1993).

Turkey's proposed policy is consistent with the EU sugar regime in its establishment of production quotas and in the use of sugar and sugar beet support prices. At this point, it is unclear whether Turkey will follow the EU's multitiered quota system and what approach it will take toward the disposal of excess sugar. In the simulation analysis that follows, it was necessary to make assumptions regarding these and other uncertainties that have a significant

impact on the scenario outcomes. These assumptions are clearly delineated in the discussion of the simulation results.

An Econometric Model of Turkey's Sugar Sector

The CARD simulation model contains four components: sugar demand, supply, trade, and price relationships. In most cases these relationships are represented by equations estimated from historical data. Table 1 displays the estimated parameters and relevant validation statistics for the model equations.

Consumer demand for refined sugar is specified as a function of per capita income and the average of the retail crystal and cube sugar prices. The homogeneity condition is imposed by dividing the price and income by the consumer price index (Alston et al., 1998). Prices of complementary and substitute goods were omitted from the demand equation to maintain a parsimonious specification. It is difficult to discern clear substitutes and complementary goods for sugar; nevertheless, given the food consumption and dietary habits in Turkey, one may consider tea, flour, and vegetable oil the principal goods complementary with sugar consumption. However, the cost of modeling these additional goods was greater than the expected benefit gained from accounting for cross-price effects on sugar demand. Consequently, the influence of complementary goods on sugar consumption is approximated using a dummy variable to indicate when prices of complementary goods rise more rapidly than the sugar price. Historically, an inverse relationship has existed between Turkish sugar consumption and the change in the food price index relative to the sugar price. Sugar consumption declines when the food price index rises more rapidly than the sugar price, as it did during 1985 to 1988; thus, the dummy variable for this time period captures the negative impact of rising prices for complementary goods.

Devadoss and Kropf (1996) provide a list of price and income elasticities for sugar demand in different countries. Their study did not include Turkey; nevertheless, the elasticities displayed in Table 2 can be compared with Devadoss and Kropf's Table 1 to assess the plausibility of our estimates. The own-price and income elasticities estimated in this study are 0.14 and 0.49. Both values look reasonable when compared with elasticities for other developing countries. For example, sugar own-price and income elasticities for Asia reported

by Devadoss and Kropf are 0.12 and 0.41. Reported income elasticities for the European Union, United States, Indonesia, and Mexico are 0.30, 0.25, 1.25, and 0.25.

On the supply side, sugar beet production is calculated as the product of area harvested and yield. Using this conversion factor, refined sugar production is derived from sugar beet production. The area response for sugar beets is specified as a function of sugar beet area three years earlier [t 3], lagged producer procurement price [t 1], the wheat producer price lagged three years [t 3], and a policy dummy. As mentioned earlier, farmers can produce sugar beets under the contract with TSC and PANKOBIRLIK. Every sugar beet production region is divided into three subregions, and farmers within a subregion can produce sugar beets on a three-year rotation. Wheat is the principal substitute crop for sugar beets because wheat is produced in every region of the country, while other substitute crops are produced only in some regions. Hence, the wheat price measures the impact of crop substitution in the sugar beet supply equation. Due to the lack of appropriate data, this sugar beet supply model specification does not include input prices as right-hand-side variables. The policy dummy variable captures the influence of the economic stabilization program introduced in April 1994 that continued until the end of 1995. The economic stabilization program affected both input and output prices, reduced subsidies, and adjusted terms of payment.

Sugar beet yield is specified as a function of the lagged producer price [t 1], a time trend, and dummy variables indicating climatic conditions. The time trend was included to account for the impact of technological improvements on yield, such as high-yield variety seeds, irrigation, and advances in sowing and harvesting practices. Since the government procurement price is announced after sugar beet harvest, naive price expectations were considered appropriate for the yield model specification.

Sugar beet supply response to changes in the producer procurement price is calculated as the sum of area and yield elasticities. In the short run our estimated supply response is 0.9. This value is comparable to sugar beet supply elasticities reported by Devadoss and Kropf (1996) for India (0.99) and Western Europe (0.71). As expected, the cross-price elasticity of sugar beet area with respect to the wheat price reported in Table 2 is smaller than the own-price response in both the short and long run.

Turkish sugar trade fluctuates in response to political concerns and the presence of excess sugar supplies in the domestic market rather than in response to international price movements. Consequently, net sugar exports are estimated as a positive function of lagged sugar stocks. A minimum stock level of 10 percent of the previous period's consumption is imposed in the simulation period. The ending stock of sugar is calculated as the maximum of the difference between domestic consumption and total domestic supply and the minimum stock level. When the minimum stock constraint is binding, then net trade is derived residually from the domestic market balance.

Data

The data used in this study were obtained from two sources. Area, yield, production, prices, population, price indices, GDP, and GDP deflator were taken from publications issued by the State Institute of Statistics Prime Ministry, Republic of Turkey (SIS). The source of consumption, export, import, and stock data is the Ministry of Agriculture and Rural Affairs (MARA). Sugar consumption is disappearance consumption. Data obtained from the MARA are the same data series used by the OECD to calculate producer and consumer subsidy equivalents. The 1979-1993 series of consumption, export, import, and sugar production data are reported in the OECD country report for Turkey (1994).

Baseline Results

In order to analyze the impact of the proposed changes in Turkey's domestic sugar policy, it was necessary to construct a baseline under the existing policy regime. The estimated equations described earlier were used to project future values for the endogenous variables. Projections of macroeconomic variables were either assumed or taken from the projections published by the OECD or FAPRI. Table 3 provides a summary of the baseline assumptions for exogenous variables.

The Turkish wheat price used in the sugar beet area equation was derived from FAPRI projections of the U.S. Gulf price using a price transmission equation with an elasticity of 1.0. The domestic price for crystal sugar was derived from the average London spot price for refined sugar via a lagged-adjustment equation with a short-run price elasticity equation of 0.78 and a long-run elasticity of 1.0. Projections of the London spot price were calculated as a

linear function of FAPRI projections for the Caribbean raw sugar price.[1] Turkish retail prices for cube sugar and producer prices for sugar beets were generally assumed to increase proportionally to the crystal sugar price. Finally, the import tariff for refined sugar was reduced in equal increments from 1999 to 2004 and then held at the bound rate for the rest of the simulation period. The model was calibrated to 1997 sugar beet production, area, yield, and price data from SIS. Data from the most recent year were not available for other variables; consequently, equations calculating these variables were calibrated to 1995 or 1996 data. The baseline projections are presented in Table 4.

In 1995 Turkey's sugar beet harvested area dropped nearly 25 percent below the previous year. In response the government increased the real price of sugar beets 43 percent; however, since the price was announced at harvest, the impact on area was delayed until planting season the following year. Uncharacteristically, the procurement price for sugar beets was announced at planting time in 1996, and though the nominal price nearly doubled, the real price for sugar beets actually declined slightly. Nevertheless, sugar beet area increased more than 35 percent. Real sugar beet procurement prices rose significantly again in 1997, but area increased a mere 5 percent to reach 445 thousand hectares. The baseline projection for 1998 has sugar beet area down slightly from 1997 due to the impact of reduced planting in 1995 on crop rotations. Sugar beet area will remain fairly stable until the impacts of falling real wheat prices begin to surface as increased sugar beet plantings after 2000. After the turn of the century, Turkey's sugar beet area increases at an average annual rate of 2.5 percent. Though yields fluctuate in response to real sugar beet price movements, the sugar beet yield averages 0.8 percent annual growth after 2000. Assuming a conversion rate of approximately 8.2 kg of sugar beets per kg of refined sugar, rising sugar beet area and yield implies a 26.5 percent increase in refined sugar production by 2007. Sugar consumption increases 3.4 percent annually; however, growth in sugar supply is able to keep pace with consumer demand. Ending sugar stocks remain above 700 tmt for most of the projection period, and net exports average 238 tmt. With real sugar and sugar beet prices fairly stable throughout the projection period, changes in consumer and producer surplus mirror changes in quantities.[2] The cost of export subsidies to remove excess sugar from the domestic market increases in the short run.

The budgetary burden of the policy remains high after 2000, averaging 4.51 trillion Turkish Lira valued at 1996 prices ($55.5 million).

Adoption of Turkey's New Sugar Policy

Two major adjustments must be made in the simulation model to accommodate the changes in Turkey's sugar policy embodied in the new legislation. First, we assume that Turkish procurement and ex-factory prices will adjust to the Turkish Lira equivalents of the EU intervention prices. Sugar intervention prices and sugar beet prices for 1998 are 631.9 ECU/mt and 47.67 ECU/mt. Based on observed historical relationships between the world sugar price movements and changes in EU policy prices, we assume that the sugar intervention price will decline to 618.8 ECU/mt in 1999 and remain at that level through 2001. From 2002 to 2005, the sugar intervention price is assumed to fall farther to 611.1 ECU/mt before rising to 613.9 ECU/mt for the last two years of the simulation. The sugar beet intervention price is assumed to move with the sugar intervention price, reaching 46.68, 46.10, and 46.31 ECU/mt over the respective periods.

Second, we establish production quota levels and a mechanism through which the quota influences producer decisions. The proposed sugar legislation stipulates that production contracts with farmers will be based on an average of their output over the last three years. The policy is designed, in part, to maintain domestic market equilibrium. Consequently, we establish the national production quota equal to average sugar production less net sugar trade over the last three years. Unlike the European Union, sugar consumption in Turkey is expected to continue to increase. Therefore, the production quota is allowed to grow 2.5 percent annually from 2001 onward.

We anticipate that sugar beet producers will seek to grow enough beets to ensure they meet their quota each year, even when returns from growing other crops may be higher. The guarantee to purchase the farmer's full quota of sugar and the production and marketing assistance provided by the TSC are assumed to provide the incentives necessary to induce farmers to meet their quotas. Since yields are uncertain, they will plant additional hectares to cover the event that yields fall below expected levels. Thus, we specify sugar beet area under the quota system as equal to the maximum of the area generated by the equation in Table 1 and

the amount of land necessary to satisfy the sugar quota given yields 5.5 percent below the five-year moving average yield.[3] Since the sugar beet price under the new policy is lower than in the baseline, the sugar quota determines production area throughout the simulation period.

Table 5 displays the simulation results under the new policy. In most years, harvested area under the new policy exceeds the baseline levels. This is largely due to the fact that the sugar beet yield falls below baseline level as a consequence of lower returns under the EU sugar beet intervention price. Thus, producers require more area to meet their sugar production quota. The national production quota lies between 2 and 13 percent below baseline production levels, so it is not surprising that production under the new policy is generally below the baseline. The EU sugar intervention price projection is slightly below the baseline price for crystal sugar. Accordingly, sugar consumption in the new regime is 0.1 to 0.8 percent above the baseline. Higher consumption with lower production leads to declining stock levels and falling sugar exports. Turkey becomes a net importer in 2004 and continues to import small quantities of sugar for the remainder of the projection period.

Welfare and government cost measures for the production quota and tariff reduction scenarios are presented in Table 6 along with the percentage change from the baseline levels. The direct government cost of the proposed sugar policy is lower than the current policy because fewer funds are required to subsidize exports of excess sugar production. Since Turkey is a net importer of sugar after 2003, Table 6 shows positive government revenues from tariff collections on imported sugar. However, if Turkey imports sugar from the European Union, no tariff revenue will be collected under the customs union. All other things equal, lower producer and consumer prices imply that producers are worse off and consumers better off under the proposed policy. In 2007 consumer surplus is 1.7 percent above the baseline, but producer surplus is more than 40 percent below the baseline level.

The simulation results indicate that if Turkey harmonizes its sugar policy with the EU's sugar regime, EU intervention prices may not provide sufficient revenue for Turkish farmers to maintain growth in sugar beet yields. As a consequence, significantly more area is planted to sugar beets to meet the quota for sugar production. This result depends, in part, on our assumption that farmers would sow enough land to sugar beets to fulfill their quota. When we relax this assumption, both sugar beet area and yield decline, leaving sugar production up to

13.5 percent below the quota level. Thus, production subsidies, input subsidies, or other production incentives will likely be necessary to avoid declines in sugar beet yield, area, or production under the new policy. Without additional compensation, Turkish sugar beet producers will be worse off under the proposed policy change. Turkish consumers, however, will benefit from lower retail sugar prices. Assuming quotas are filled, Turkey is apt to become a small importer of sugar, most likely from the European Union, within the next 10 years.

Tariff Reduction Scenario

As an alternative to Turkey's integration into the Common Agricultural Policy's sugar regime, we analyze the impacts of accelerated tariff reduction under the current policy. Beginning in 2000, Turkey's tariff on imports of refined sugar is reduced 10 percent each year from 142.5 percent to 61.3 percent. Through the price linkage equation described in the discussion of the baseline results, Turkey's domestic sugar and sugar beet prices decline as the border price drops. The impact of changes in Turkish trade patterns on international sugar prices is simulated using the FAPRI sugar model. The tariff reduction simulation results are presented in Table 7.

As the sugar import tariff declines, domestic sugar and sugar beet prices fall farther below the baseline level. In 2000 sugar prices are 4.2 percent lower in the scenario than in the baseline, and the gap grows to 22 percent by 2007. Lower returns to sugar beet cultivation cause sugar beet area harvested to stagnate around 470 thousand hectares. Producers devote fewer resources to their sugar beet plantings, inducing yields to decline more than 10 percent below baseline levels. The combined effects of area and yield reductions leave sugar production nearly 25 percent lower than in the baseline by the end of the projection period. Consumers respond to lower sugar prices by increasing consumption an additional 62 tmt in 2007. Consumer surplus grows 4.6 percent relative to the baseline by 2007 as a consequence of greater sugar consumption at lower prices.

With domestic production declining and border prices falling, Turkish net sugar exports decline rapidly. In 2004 Turkey switches from a net exporter to a net importer of 253 tmt, and imports continue to grow at a rate of 36.1 percent annually until the end of the projection

period. Despite tariff reductions, revenues generated by import taxes exceed 5 trillion Turkish Lira by 2006. Adding 892 tmt of import demand to international sugar markets drives the London spot price for refined sugar up $39.55/mt in 2007. The increase in international sugar prices helps counteract some of the negative impacts of liberalization on sugar producers in Turkey. Nevertheless, producer surplus declines more than 50 percent relative to the baseline by 2007.

Our results indicate a much larger trade impact from Turkey's reduction of sugar tariffs than the study undertaken by the Southeastern Anatolia Project Administration (SAP, 1992). The SAP study utilized a world trade model to evaluate the impacts of full implementation of the Uruguay Round Agreement (URA) on agriculture. In the SAP baseline, Turkey was a net importer of 40 tmt of sugar in 2010. With full implementation of the URA, Turkey increased its imports marginally to 60 tmt. The present study indicates a much larger change in Turkey's net sugar trade because the assumed reduction in tariffs is significantly greater than in the SAP study, which only reduced sugar tariffs to 90.7 percent. The two studies use different methods for transmitting border price changes into the domestic market which may account for much of the disagreement about the impact of liberalization between the two.

Conclusions

The sugar market in Turkey has been heavily protected for decades, and the baseline projections in this paper indicate that the cost of protection is not likely to decline without policy reform. A recent trade agreement with the European Union and participation in the World Trade Organization are prompting the Turkish government to slowly begin the process of liberalization in this sector. At present it appears that the Turkish government has chosen to harmonize its sugar policy with the EU's sugar regime as part of its customs union agreement. Our analysis indicates that this shift in policy is apt to reduce returns to sugar beet producers, degrading their incentives to devote adequate resources to maintain yields. Depending on how producers respond to production quotas, the Turkish government may have to provide additional support to sugar beet farmers to maintain adequate domestic production to meet consumption needs. Consumers and the government may benefit from this policy change,

however, since consumer prices and budgetary outlays for subsided exports of excess production will both decline.

We also examine how simply reducing import tariffs under the current policy regime affects sugar production, consumption, and trade in Turkey. Not surprisingly, we find that Turkish producers are not competitive when exposed to greater pressure from the international market. Over a seven-year period, production drops off by nearly one-quarter relative to the baseline, and imports increase more than threefold. If tariffs are completely removed, domestic sugar production in Turkey can be expected to stabilize at a little over 1.1 mmt, about one-half the 1997 level, and imports will continue to rise with growth in domestic consumption.

Our analysis, as in any simulation study, is conditioned on the underlying macroeconomic projections and other assumptions made in the process of constructing the model. Moreover, there are dynamic impacts of liberalization that cannot be captured in a partial equilibrium model like the one used in this study. It is possible that increased competition from producers outside Turkey will induce Turkish sugar producers to adopt more efficient production and management techniques, enabling them to remain viable in a liberalized market setting. However, without efficiency gains, our analysis suggests that Turkey will become increasingly dependent upon imported sugar as it continues to dismantle its system of protection.

Table 1. Estimated demand, area, yield, and net trade equations

Independent Variables	Dependent Variables			
	Per Capita Sugar Demand	Sugar Beet Area	Sugar Beet Yield	Net Sugar Trade
Intercept	17.77	5.91	7.52	-223.42
	(6.10)	(7.0)	(104.7)	(-1.92)
Real retail sugar price	-1.41			
	(-2.21)			
Real GDP per capita (at 1987 prices)	0.0095			
	(5.73)			
Beginning sugar stock				0.56
				(4.65)
Lagged sugar beet area [t-3]		0.53		
		(8.7)		
Real sugar beet producer price [t-1]		2.46	2.8484	
		(3.6)	(7.22)	
Real wheat producer price [t-3]		-0.43		
		(-3.1)		
Time trend			0.0048	
			(3.29)	
Dummy (D1=1 for 1980, 1989 and 1994)			-0.164	
			(-6.56)	
Dummy (D= 1 for 1985 and 1988)	-2.04			
	(-2.21)			
Dummy (D1=1 for 1988)			0.149	
			(3.46)	
Dummy (D=1 for 1990 and 1995)				-379.5
				(-3.55)
Dummy (D=1 for 1995)		-0.26		
		(-3.6)		
R2	0.76	0.89	0.88	0.89
Durbin-Watson	1.81		1.87	
Durbin-h		0.24		0.68
Rho1				0.65
				(3.18)

Note: t value in parentheses.

Table 2. Estimated demand and supply elasticities

	Per Capita Demand	Sugar Beet Area	Sugar Beet Yield
Retail Sugar Price	-0.14		
Per Capita Income	0.49		
Sugar Beet Price			
Short-Run		0.42	0.48
Long-Run		0.88	
Wheat Producer Price			
Short-Run		-0.29	
Long-Run		-0.62	

Table 3: Baseline macroeconomic and exogenous variable assumptions

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Macroeconomic Variables					Percentage Change						
Real GDP	7.5	4.7	4.9	5.2	5.1	5.2	4.9	4.4	4.4	4.4	4.4
GDP Deflator	87.3	76.1	61.5	45.3	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Population	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.3	1.3
Consumer Price Index	85.7	79.8	60.8	43.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Wholesale Price Index	81.8	82.7	60.6	42.1	31.0	31.0	31.0	31.0	31.0	31.0	31.0
Dollar Exchange Rate	85.8	81.7	55.9	39.9	29.1	29.1	29.1	29.1	29.1	29.1	29.1
Exogenous Variables					U.S. Dollars per Metric Ton						
U.S. Wheat (FOB Gulf)	184	155	150	151	157	159	160	162	164	166	171
World Sugar Price (London)	315	305	304	306	307	308	310	313	316	318	319
					Percentage Change						
Sugar Beet Producer Price	150.0	64.5	49.8	46.0	33.3	30.9	30.4	30.5	31.3	30.9	30.9
Retail Sugar Price (Crystal)	69.4	71.2	62.2	46.0	33.3	30.9	30.4	30.5	31.3	30.9	30.9
Retail Sugar Price (Cube)	75.8	84.6	62.2	46.0	33.3	30.9	30.4	30.5	31.3	30.9	30.9
					Percent Ad Velorem						
Sugar Import Tariff	144.0	144.0	142.5	141.0	139.5	138.0	136.5	135.0	135.0	135.0	135.0

Table 4: Baseline projections

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
						Thousand Hectares					
Area Harvested	445	443	452	455	473	520	513	518	543	539	542
						Metric Tons per Hectare					
Sugar Beet Yield	41.4	43.8	41.9	40.1	41.0	41.7	41.9	42.0	42.0	42.3	42.5
						Thousand Metric Tons					
Sugar Supply and Utilization											
Beginning Stocks	379	698	937	907	732	733	929	904	850	879	805
Production	2,222	2,382	2,315	2,221	2,372	2,651	2,622	2,659	2,791	2,789	2,812
Consumption	1,946	2,008	2,074	2,143	2,216	2,298	2,381	2,460	2,541	2,624	2,711
Net Exports	-43	137	270	254	155	156	266	252	222	238	197
Ending Stocks	698	937	907	732	733	929	904	850	879	805	709
Prices						Thousand Turkish Lira per Kilogram					
Sugar Beet Producer	11.0	18.1	27.1	39.6	52.7	69.0	90.1	117.5	154.3	202.0	264.5
Sugar Retail (Crystal)	115.2	197.3	320.0	467.4	622.9	815.2	1,063.5	1,387.5	1,822.3	2,386.0	3,123.0
Sugar Retail (Cube)	144.1	266.0	431.5	630.1	839.8	1,099.2	1,433.9	1,870.8	2,456.9	3,217.1	4,210.7

Table 5: Production quota scenario simulation results and percentage change from baseline

	2000	2001	2002	2003	2004	2005	2006	2007
Area Harvested				Thousand Hectares				
Scenario	498	490	498	504	524	552	576	598
Percentage Change	9.4	3.6	-4.2	-1.7	1.1	1.5	6.9	10.3
Sugar Beet Yield				Metric Tons per Hectare				
Scenario	40.1	37.8	37.9	37.6	37.6	37.5	37.5	37.6
Percentage Change	0.0	-7.7	-9.1	-10.3	-10.5	-10.8	-11.4	-11.7
Sugar Supply and Utilization								
Production								
Scenario	2,429	2,267	2,308	2,312	2,405	2,529	2,640	2,741
Percentage Change	9.4	-4.4	-12.9	-11.8	-9.5	-9.4	-5.4	-2.5
Consumption								
Scenario	2,145	2,223	2,311	2,395	2,476	2,560	2,645	2,734
Percentage Change	0.1	0.3	0.6	0.6	0.7	0.8	0.8	0.8
Net Exports								
Scenario	254	271	143	61	-20	-49	-39	-20
Percentage Change	0.0	74.6	-8.1	-77.0	-107.9	-122.1	-116.3	-110.2
Ending Stocks								
Scenario	938	710	564	420	368	386	419	447
Percentage Change	28.2	-3.1	-39.3	-53.6	-56.7	-56.1	-47.9	-37.0
Prices				Thousand Turkish Lira per Kilogram				
Sugar Beet Producer								
Scenario	35.0	45.7	58.5	75.9	98.5	127.8	166.6	216.2
Percentage Change	-11.5	-13.4	-15.2	-15.7	-16.2	-17.2	-17.5	-18.3
Sugar Retail (Crystal)								
Scenario	464.2	605.4	775.7	1,006.5	1,305.9	1,694.4	2,208.5	2,865.5
Percentage Change	-0.7	-2.8	-4.8	-5.4	-5.9	-7.0	-7.4	-8.2

Table 6. Welfare and government cost measures and percentage change from the baseline

	2000	2001	2002	2003	2004	2005	2006	2007
EU Scenario								
Consumer Surplus				Trillion 1996 Turkish Lira				
Scenario	354.5	375.8	400.5	424.2	447.1	471.3	496.6	523.9
Percentage Change	0.2	0.7	1.2	1.2	1.3	1.5	1.6	1.7
Producer Surplus								
Scenario	22.0	21.5	21.7	21.8	21.3	21.2	21.3	21.2
Percentage Change	-23.2	-30.9	-36.9	-35.4	-37.3	-41.1	-40.7	-41.2
Tariff Revenue/Subsidy Cost								
Scenario	-5.3	-5.6	-2.9	-1.2	0.3	0.8	0.7	0.3
Baseline	-5.4	-3.4	-3.4	-5.7	-5.4	-4.7	-5.0	-4.1
Percentage Change	-1.1	66.6	-15.3	-79.0	-106.4	-117.7	-112.9	-108.0
Tariff Reduction Scenario								
Consumer Surplus								
Scenario	357.6	381.3	407.1	432.6	454.4	483.0	506.2	538.7
Percentage Change	1.0	2.2	2.8	3.3	3.0	4.1	3.5	4.6
Producer Surplus								
Scenario	25.9	24.5	24.2	21.9	22.1	19.7	20.4	17.0
Percentage Change	-9.4	-21.4	-29.6	-35.0	-35.0	-45.2	-43.2	-53.0
Tariff Revenue/Subsidy Cost								
Scenario	-5.0	-2.8	-1.2	-0.7	3.0	3.3	5.7	5.4
Baseline	-5.4	-3.4	-3.4	-5.7	-5.4	-4.7	-5.0	-4.1
Percentage Change	-6.9	-17.8	-64.9	-87.1	-156.6	-170.8	-213.9	-229.2

Table 7: Tariff reduction scenario simulation results and percentage change from the baseline

	2000	2001	2002	2003	2004	2005	2006	2007
Area Harvested				Thousand Hectares				
Scenario	455	461	493	477	469	487	464	464
Percentage Change	0.0	-2.5	-5.3	-7.0	-9.5	-10.4	-14.0	-14.3
Sugar Beet Yield				Metric Tons per Hectare				
Scenario	40.1	39.8	39.2	38.5	38.0	38.3	37.1	37.8
Percentage Change	0.0	-2.9	-6.1	-8.0	-9.5	-9.0	-12.3	-11.1
Sugar Supply and Utilization								
Production								
Scenario	2,221	2,246	2,358	2,243	2,178	2,277	2,104	2,145
Percentage Change	0.0	-5.3	-11.0	-14.5	-18.1	-18.4	-24.6	-23.7
Consumption								
Scenario	2,154	2,240	2,330	2,419	2,496	2,592	2,670	2,773
Percentage Change	0.5	1.1	1.4	1.6	1.5	2.0	1.8	2.3
Net Exports								
Scenario	254	149	69	46	-253	-324	-575	-638
Percentage Change	0.0	-4.0	-55.9	-82.8	-200.3	-245.9	-341.5	-424.7
Ending Stocks								
Scenario	721	578	537	315	250	259	267	277
Percentage Change	-1.5	-21.2	-42.2	-65.2	-70.6	-70.5	-66.8	-60.9
Prices				Thousand Turkish Lira per Kilogram				
Sugar Beet Producer								
Scenario	37.9	48.1	60.9	77.4	101.9	125.8	168.6	206.3
Percentage Change	-4.2	-8.8	-11.8	-14.1	-13.3	-18.5	-16.6	-22.0
Sugar Retail (Crystal)								
Scenario	447.7	568.0	719.1	913.8	1,203.1	1,485.5	1,990.7	2,436.6
Percentage Change	-4.2	-8.8	-11.8	-14.1	-13.3	-18.5	-16.6	-22.0

ENDNOTES

1. Price linkage equations were estimated from historical price data. Regression result may be obtained from the authors upon request.

2. Since the sugar refining sector is not explicitly modeled, producer surplus does not include surplus accruing to the sugar processing sector. The producer surplus measure in Table 6 is calculated as total revenue less the area under the sugar beet supply curve.

3. Historic yields fall within 5.5 percent on either side of the 5-year average yield with 95 percent confidence.

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