ELSEVIER

Agricultural Economics 22 (2000) 233–245

AGRICULTURAL ECONOMICS

www.elsevier.com/locate/agecon

Impacts of WTO restrictions on subsidized EU sugar exports

Daneswar Poonyth[a], Patrick Westhoff[b,*], Abner Womack[b], Gary Adams[b]

[a] *Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Pretoria, South Africa*

[b] *Food and Agricultural Policy Research Institute, University of Missouri, 101 South Fifth Street, Columbia, MO 65201, USA*

Received 26 April 1999; received in revised form 21 October 1999; accepted 23 November 1999

Abstract

The study evaluates the impact of World Trade Organization (WTO) restrictions on the European Union (EU) sugar sector and the world sugar market. A small reduction in production quotas would be sufficient to satisfy the export subsidy limitations of the Uruguay Round agreement. Complete elimination of export subsidies by 2005 would require either a 10% reduction in production quotas or the combination of an 8% reduction in quotas and an 11% reduction in intervention prices. Higher world prices resulting from reduced EU exports would result in increased production of unsubsidized C-sugar, with different impacts across EU member countries explained by differences in institutional pricing arrangements and marginal production costs.

Keywords: Sugar; European Union; World Trade Organization; Econometric model

1. Introduction

Traditionally agriculture has been treated differently than other industries within the General Agreement on Tariffs and Trade (GATT) rules. In the early rounds of GATT, agriculture received special treatment because the political reality in many industrialized countries required that support be provided to agriculture (Marks and Maskus, 1993). This support took the form of quantitative trade restrictions, subsidized exports, direct payments, and other production subsidies.

The European Union (EU) sugar sector has been regulated by the Common Agricultural Policy (CAP) since 1968. The CAP for sugar relies on a combination of institutional support prices, import levies, subsidized exports, production quotas, and production controls on high fructose starch syrup (Abbott, 1990; Devadoss and Kropf, 1996). With its sugar policies, the EU has become one of the major exporters of refined sugar in the world, accounting for 20% of the total world sugar exports and 14% of the total world sugar production (Hannah and Spencer, 1996). There is general agreement that EU sugar polices depress the world sugar market (Roningen and Dixit, 1989).

With the recent WTO agreements, trade barriers and other domestic support policies are being reduced gradually. In the case of the sugar sector, the WTO agreement requires only minor changes in the EU sugar import regime, but does establish limits on subsidized exports, both in terms of volume and budgetary expenditure. The WTO agreement gave its member countries discretion in determining how to alter their policies so as to meet their WTO obligations. The European Union has agreed to reduce production quotas to meet its subsidized exports obligations.

Previous studies (Zietz and Valdes, 1986; Sudaryanto, 1987; Roningen and Dixit, 1989; Wong et al., 1989; Leuck and Neff, 1991; Roberts and

* Corresponding author. Tel.: +1-573-882-3576; fax: +1-573-884-4688.
E-mail address: westhoffp@missouri.edu (P. Westhoff)

0169-5150/00/$ – see front matter
PII: S0169-5150(99)00055-9

Wish-Wilson, 1991; Devadoss and Kropf, 1996) evaluated the implications of trade liberalization on the world sugar market. These studies in one way or another found that trade liberalization would increase the world price of sugar. However, the implications of the current WTO agreement on the EU sugar sector have not been well addressed empirically.

This study examines the effect of WTO restrictions on subsidized exports on the EU sugar sector and the world sugar market. This study also considers two alternative approaches that the EU could pursue in meeting its WTO obligations, production quota reduction, and intervention price reduction. Furthermore, this study evaluates the implication for the EU sugar sector and the world sugar market of a complete elimination of EU subsidized exports phased in over the period 2001/2002 to 2005/2006, using production quota reduction alone and using a combination of intervention price and production quota reduction. The analysis uses a simulation model of supply for each EU member country and of aggregate EU demand which is linked to a world sugar model. Disaggregating EU supply allows for a more rigorous analysis to be performed since institutional pricing differs among member nations.

The following sections describe the EU sugar program and the EU sugar model. The model is then used to evaluate the implications of the WTO restrictions on EU subsidized sugar exports and of a hypothetical step toward sugar trade liberalization.

2. EU sugar program

In 1968, the EU set up the CAP for sugar, establishing a system of production quotas, internal price supports, variable import levies, and export subsidies (Abbott, 1990). To regulate the sugar industry, the EU uses a production quota system. A-quota sugar receives the highest price, the intervention price net of a 2% production levy. B-quota sugar receives the intervention price net of a maximum production levy of 39.5% (Abbott, 1990). Both A- and B-sugar are produced primarily for domestic consumption. Production within these quotas that is not used domestically is exported with subsidy, and production levy revenues are used to subsidize exports. Sugar production in excess of the A- and B-quota is known as C-sugar and is exported on the world sugar market without subsidies. The EU also imports a certain quantity of sugar from the African-Caribbean-Pacific (ACP) group of countries under the Lomé Convention and its Special Preferential Sugar (SPS) program. This imported sugar is for domestic consumption or re-export with subsidies which are paid from the EU budget. The variable import levy is such that it has historically eliminated the possibility of imports from countries other than the ACP group.

The WTO agreement brought small changes in the EU sugar regime. Sugar production quota and price systems remain unchanged, but EU subsidized exports are subject to volume and budgetary limits (Table 1). Domestic support provisions of the WTO agreement do not require any change in support prices, as the limitation applies to an aggregate measure of support rather than support for any one sector. Minimum access provisions of the agreement do not require any increase in imports because the EU imports about 10% of its domestic consumption from the ACP countries, as compared to the 5% required in the WTO agreement. The agreement does require that imports from countries not in the ACP group be subject to a fixed tariff instead of a variable import levy. The import tariff is to be reduced by 3.33% each year until 2001. In practice, the final bound import tariff of 339 euros per metric ton may be high enough under normal market conditions to exclude non-ACP sugar even after the full implementation of the WTO agreement [1]. Compared to the 1986–1988 average, the WTO agreement requires the EU to reduce its subsidized export volume by 21% and its expenditures on export subsidies by 36% by 2000/2001 (Table 1). The EU has indicated it would reduce production quotas if necessary to meet its WTO obligations to reduce subsidized exports.

In their production decisions, EU sugar beet producers consider both market and policy factors. For most producers, the price received for A- and B-sugar is sufficient to cover marginal production costs, so producers generally will produce enough sugar to fill their quota. For producers with marginal production costs between the prices received for B-sugar and C-sugar, the desired production levels should equal

[1] An anonymous reviewer correctly points out that the final bound tariff may not be sufficient to defend the intervention price if world prices are as low as they were in early 1999.

Table 1
Permitted EU sugar export refunds and subsidized export quantities under the WTO agreement[a]

	Average						
	1986–1988	1995/1996	1996/1997	1997/1998	1998/1999	1999/2000	2000/2001
Export refund (1,000,000 ecus)	779	733	686	639	592	545	499
Quantity (1000 metric tons)	1617	1555	1500	1442	1386	1330	1274

[a] Source: Price and Taylor, 1996.

the sum of A-sugar and B-sugar quotas. On the other hand, producers whose marginal costs are equal to the C-sugar price (world price) will first fulfill the A- and B-sugar production quotas and then will produce above quota C-sugar.

However, member-state-level institutional pricing arrangements pose considerable difficulties in modeling producers' production decisions. Let PAS=$(1-L_a)\times$IP be the price of A-sugar, PBS=$(1-L_a-L_b)\times$IP be the price of B-sugar, PCS=WPS be the price of C-sugar where IP is the intervention price, L_a is the production levy on A-quota sugar of 2%, L_b is the production levy on B-quota sugar which varies between 2 and 39.5% and WPS is the world price of sugar. The producers' marginal prices differ across countries depending on their institutional pricing arrangements and may differ across producers within the same country. In some countries (e.g., UK, Italy, and Ireland) producers received a weighted average price, regardless of individual production level relative to quota (Bureau et al., 1997). The producer marginal incentive price in these countries is a weighted average of the prices for A-and B-quota sugar and C-sugar, where the weights are the shares of A-, B-, and C-sugar in the total sugar production for the country. In this study, the expected weighted average price is computed as follows

$$\mathrm{WAPS}_t = \frac{\mathrm{ASP}_{t-1}}{\mathrm{TSP}_{t-1}}\mathrm{PAS}_t + \frac{\mathrm{BPS}_{t-1}}{\mathrm{TSP}_{t-1}}\mathrm{PBS}_{t-1} + \frac{\mathrm{CSP}_{t-1}}{\mathrm{TSP}_{t-1}}WPS_{t-1}$$

where WAPS is the weighted average expected price of sugar in period t, ASP_{t-1} the A-sugar production in time $t-1$, BSP_{t-1} the B-sugar production in time $t-1$, CSP_{t-1} the C-sugar production in time $t-1$, and TSP_{t-1} the total sugar production in time $t-1$.

In contrast, other EU countries have a different pricing arrangement. Producers receive the beet equivalent of A-and B-sugar quota prices for their in-quota production, but receive the C-sugar price (world price) for any additional production. For producers that consistently produce C-sugar, this implies that the world price is the producer incentive price, since producers receive the world price for a marginal unit of production. In our model, the C-sugar price is used as the supply-inducing price for France, Germany, and several other countries.

However, even in countries with substantial C-sugar production, some high-cost producers may produce only A-sugar and B-sugar. Producers with such high marginal costs would produce no C-sugar or only a limited amount of C-sugar in order to assure that the A- and B-allocated sugar quotas are fulfilled. These producers may respond to some combination of A-, B-, and C-sugar prices rather than to the C-sugar price alone in making production decisions. Given the heterogeneity of producers in any given country, the area equation for most countries (e.g. France, Germany, The Netherlands, Belgium, and Denmark) includes both the C-sugar price and the A- and B-sugar allocated production quotas. This specification is consistent with the assumption that some producers have marginal costs equal to the C-sugar price (and thus they will adjust production in response to movements in the C-sugar price), while most other producers in those countries have marginal production costs somewhere between the B-and C-sugar prices (and thus will produce only enough to ensure fulfillment of their A- and B-sugar quotas)[2].

[2] Some producers may have marginal production costs that exceed the price paid for B sugar. This would explain the underfill of B quota reported by an anonymous reviewer. The model specification assumes that costs are below the price paid for B-sugar for most producers. Even if this assumption is appropriate under current policies, it may limit applicability of the model when examining large changes in B-sugar prices. For example, if there were a large reduction in B-sugar prices, the result would likely be a significant underfill of B-quota that would not be captured by the model.

3. Modeling approach

The overall structure of the model is based on the dissertation research of Poonyth (1998). The model is a non-spatial partial equilibrium model: non-spatial because it does not identify trade flows between specific regions and partial equilibrium because only one commodity is modeled. The structural econometric model focuses primarily on the policy variables that influence sugar production, consumption, and trade in the European Union. The model consists of 104 equations. There are 12 behavioral equations for beet area harvested and 12 beet production identities (Belgium and Luxemburg are treated as a single entity and Portugal and Greece are exogenous. Estimated supply equations for Greece and Portugal yielded results that did not conform with expectations, hence the production block for these two small producers is declared exogenous.) The model has nine extraction rate equations, 12 sugar production identities, and three identities for each country to account for A-sugar, B-sugar, and C-sugar production. Identities determine total EU area harvested, beet production, and production of A-, B-, and C-sugar. While supply equations are estimated for each country, a single equation estimates total EU domestic sugar consumption and another single equation estimates total EU ending stocks.

3.1. Supply equations

The typical beet area harvested equation is a function of the previous period's area harvested, the expected incentive price of sugar, allocated quota, a competing crop price, and input prices. As stated earlier, the incentive price of sugar is either the average or the world price, depending upon the particular nation's policy mechanism. Sugar production is a product of beet area harvested, beet yield, and the sugar extraction rate. Furthermore, production quota sugar is computed for each country as follows. A-quota sugar (ASP) is the minimum of sugar production and the allocated A-sugar quota (SQAL), $ASP_t=MIN[SPW_t,SQAL_t]$. B-sugar quota (BSP), then takes up where allocation to higher-priced A-sugar left off, $BSP_t=MAX[0, MIN(SPW_t-ASP_t, SQBL_t)]$, where SQBL is allocated B-sugar quota. The following identity is used to compute lowest priced C- sugar production (CSP), $CSP_t=MAX[0, SPW_t-BSP_t-ASP_t]$. The total EU sugar supply is the sum of sugar production for each country, EU total beginning stocks, imports from French Overseas Territories, and other EU imports including imports from ACP countries.

3.2. Demand equations

The demand component consists of total EU consumption and ending stocks equations. Per capita consumption for the EU is a function of the real retail price of sugar, a time trend, and per capita gross domestic product (as a proxy for income). Due to its sugar policies, the European Union limits isoglucose production, thus restraining the role of isoglucose as a substitute for traditional sugar. As a result, no prices of substitutes are included in the domestic demand equation. The ending stocks are aggregated across the EU and expressed as a function of beginning stocks, the world price of sugar, C-sugar production, and minimum required stocks. The exports component is treated as a residual to close the model (exports equal production plus beginning stocks and imports, minus domestic consumption and exports).

3.3. Price determination

With 20% of world exports, the European Union is not a 'small country,' and so the world price cannot be treated as an exogenous variable. Endognizing the world price allows the model to capture the effect of EU exports on the residual world market for sugar. Instead of developing a new world sugar model, a reduced form equation to determine the world sugar price is derived from the existing world sugar model maintained by the Food and Agricultural Policy Research Institute (FAPRI). This world price equation can be thought of as an inverted total EU export demand equation.

The retail price of sugar is expressed as a function of the intervention price and income. Income is included as a proxy for demand factors that may cause the margin between intervention and retail prices to grow over time.

Table 2
Estimated parameters for area harvested equations[a]

	Constant	AH_{t-1}	Incentive price	Quota quantity	CP price	Trend	R_2	DH
Belgium	14.814	0.415	0.035	0.453	–	–	0.94	0.238
		(4.88)	(2.64)	(6.63)				
Denmark	14.148	0.633	0.045	0.153	–	–	0.96	1.422
		(764)	(1.96)	(4.39)				
France	50.895	0.320	2.987	0.664	−3.325	–	0.95	0.621
		(2.27)	(6.53)	2.140	(−1.32)			
Germany	71.696	0.492	3.042	0.321	−7.098	–	0.99	0.893
		(8.36)	(6.46)	(5.97)	(−3.51)			
The Netherlands	48.048	0.440	0.483	0.162	–	–	0.65	0.864
		(2.56)	(1.84)	(1.98)				
Spain	23.003	0.649	0.048	–	–	–	0.71	1.562
		(2.05)	(1.83)					
UK	21.797	0.663	3.677	0.200	−7.238	–	0.94	1.243
		(4.36)	(1.89)	(1.96)	(−1.94)			
Italy	33.376	0.369	0.016	–	–	–	0.70	0.200
		(1.80)	(2.21)					
Ireland	13.219	0.576	0.136	–	–	–	0.91	1.388
		(5.26)	(1.56)					
Austria	17.169	0.603	0.079	–	–	–	0.77	1.366
		(4.12)	(2.86)					
Finland	2.753	0.723	0.040	–	–	2.117	0.81	1.346
		(3.34)	(1.78)			(2.05)		
Sweden	10.034	0.447	0.043	–	–	5.600	0.92	1.036
		(3.88)	(1.68)			(2.05)		

[a] Constant=intercept; AH_{t-1}=area harvested in previous year; Incentive Price=price of sugar (weighted average of A-, B-, and C-sugar prices in Ireland, UK, and Italy; C-sugar price in all other countries); Quota Quantity=allocated A-+B-sugar production quota; CP Price=competing crop (wheat) price; DH-Durbin H statistic. In parentheses are *t*-statistics.

4. Data sources

Data for area harvested, beet production, sugar production, and sugar content were provided by two institutions, the Confederation Internationale des Bettraviers Europeen and the Comite Europeen des Fabricant de Sucres. Consumption, stocks, imports, exports, production, quota, and policy prices, as well as consumption prices and world sugar prices (the Paris spot market price), are from Eurostat's Agricultural Statistical Yearbook[3]. Eurostat also provided the price statistics for competing crops and green rates[4]. Market exchange rates, income and price measures, wage rate indices, and population statistics are from *International Financial Statistics*, an International Monetary Fund publication. The data are adjusted to reflect the crop year by weighting calendar year data. Policy prices are converted to local currency using green rates. World sugar prices were converted to local currency using market exchange rates. Sugar data are expressed in terms of refined equivalent. Germany from 1990 onward includes the former East Germany.

5. Estimated parameters and elasticities

The equations in the model are estimated using the 2SLS estimation technique for the period 1976/1977–1996/1997. Table 2 reports the estimated parameters and the relevant statistics for area harvested equations. All equations are expressed as linear functions. The estimated equations in the model were subjected to a range of statistical tests. Based on the results of these statistical tests, it can be concluded

[3] Eurostat. Agricultural Statistical Yearbook. Office for Official Publication of the European Communities, Luxemburg (various years).

[4] Eurostat. Agricultural Prices. Office for Official Publication of the European Communities, Luxemburg (various years).

that the estimated econometric model provides reliable estimates of EU sugar supply and utilization. For example, most of the root mean square (RMS) percent errors for both static and dynamic simulations are less than 3%, whereas for the new entrants (Spain, Austria, Finland and Sweden) the RMS percent errors are between 2 and 8%. The Thiel U statistics are in the range of 0.006 to 0.038. The fit of most of the area harvested equations as measured by R^2 is above 0.80, the exception being The Netherlands and Italy where estimated R^2 are 0.65 and 0.70, respectively.

The estimated coefficients associated with allocated sugar quota (transformed to hectarage) are smaller than one (between 0.16 and 0.67), implying that a 1 ha change in the area-equivalent of sugar quota affects harvested area by less than 1 ha. This is consistent with the hypothesis that some producers are responding to the quota at the margin, while others are responding to the C-sugar price, even within a given country. In the cases of France, Germany, and the UK, wheat was found to be the competing crop. C-sugar forms the major share of the ending stocks of sugar in the European Union. Since C-sugar receives the world price, ending stocks are influenced by the world price of sugar as well as C-sugar production.

A reduced form equation can be used to determine the world sugar price as a function of EU sugar net exports,

$$\mathrm{LOG(WPS)} = -1.0 \times \mathrm{LOG(EUEXPT - EUIMP)} + 0.46 \times \mathrm{LOG(EUEXPT - EUIMP)}_{t-1}$$

where WPS is the world price of sugar, EUEXPT represents total EU sugar exports, and EUIMP represents total EU sugar imports. The parameters are derived from FAPRI's world sugar model. The short-run flexibility is negative one and the long-run flexibility is approximately half that of the short-run, reflecting EU sugar export demand elasticities that are approximately twice as large in the long run as in the short run.

Both short-run and long-run EU supply elasticities are less than one (Table 3). In countries where the world price is the incentive price, short-run supply elasticities with respect to the world price are between 0.01 and 0.16, whereas long-run elasticities range between 0.03 and 0.34. In countries responding to average sugar prices, the short-run and long-run supply elasticities with respect to the average of A-, B-, and C-sugar prices are between 0.02 and 0.83. The estimated short-run supply elasticities with respect to the production quotas for Belgium, Denmark, France, Germany, The Netherlands, and UK are between 0.14 and 0.54, whereas the long run elasticities are between 0.25 and 0.79. As stated earlier, wheat was found to be a competing crop in France, Germany, and the UK. The short-run cross-price supply elas-

Table 3
Estimated supply elasticities[a]

	World price		Average price		Quota quantity		CP price	
	SR	LR	SR	LR	SR	LR	SR	LR
Belgium	0.040	0.069	–	–	0.416	0.703	–	–
Denmark	0.018	0.050	–	–	0.140	0.388	–	–
France	0.155	0.228	–	–	0.541	0.794	−0.130	−0.200
Germany	0.050	0.098	–	–	0.336	0.663	−0.075	−0.148
The Netherlands	0.029	0.052	–	–	0.141	0.252	–	–
Spain	0.115	0.336	–	–	–	–	–	–
Austria	0.087	0.220	–	–	–	–	–	–
Finland	0.028	0.100	–	–	–	–	–	–
Sweden	0.021	0.038	–	–	–	–	–	–
UK	–	–	0.088	0.263	0.185	0.548	−0.057	−0.148
Italy	–	–	0.592	0.832	–	–	–	–
Ireland	–	–	0.020	0.047	–	–	–	–

[a] Average Price=weighted average of A-, B-, and C-sugar prices; Quota Quantity=allocated A-+B-sugar production quota; CP Price=competing crop (wheat) price; SR=short run; LR=long run.

Table 4
Demand and price transmission elasticities

	Retail price	Income	World price	Intervention price
Domestic consumption	−0.304	0.710	–	–
Ending stocks	–	–	−0.361	–
Retail price	–	–	–	0.812

ticities range from−0.06 to−0.13, whereas long-run elasticities fall between −0.15 and −0.20. Previous studies such as those of Graham (1983), Wong et al. (1989), Leuck and Neff (1991), Devadoss and Kropf (1996) estimated long run supply elasticities in the range of 0.1–2, whereas Ball et al. (1993) estimated short run elasticities in the range of 0.1–1.6.

The computed income elasticity of demand for sugar in the European Union is 0.71 and the own-price elasticity of demand is −0.30 (Table 4). Wong et al. (1989) estimated a demand price elasticity of −0.32 and an income elasticity of 0.26, while Devadoss and Kropf (1996) estimated an income elasticity of 0.30 but did not report an own-price elasticity.

6. Implication of WTO limits

To estimate the effects of WTO restrictions on EU subsidized exports, the estimated model is used to generate a baseline for the period 1998/1999 to 2005/2006. The main assumptions underlying the baseline are that policy variables such as production quotas, intervention prices, and production levies are kept at the same level as prevailed prior to adoption of the WTO agreement. Forecasted values of exogenous macroeconomic variables for the baseline period are from the WEFA Group.

To meet its WTO obligations to reduce subsidized exports, the European Union has opted to reduce quota production. We use the model to estimate the magnitude of the quota reductions required to bring subsidized EU sugar exports within the limits set by the Uruguay Round agreement. By 2000/2001, the estimated reduction is 1.9%. The resulting reduction in EU sugar exports results in a 1.9% increase in world sugar prices. This increase in world sugar prices, in turn, increases C-sugar prices and production, offsetting much of the decline in A- and B-sugar production. While subsidized exports decline by the required 263,000 metric tons relative to the baseline, unsubsidized C-sugar exports increase by 142,000 metric tons (Table 5).

Alternatively, the European Union could have chosen to reduce intervention prices to meet its WTO obligations for subsidized export. Model results indicate that a 9.9% reduction in intervention prices would have been required by 2000/2001 to reduce subsidized exports by the required amount. Reducing intervention prices would reduce subsidized exports in two ways. First, lower intervention prices would result in lower retail prices, and lower retail prices would increase domestic EU consumption of sugar. The increase in domestic consumption would reduce the amount of surplus A-and B-sugar available for export (Table 7).

Second, lower intervention prices would reduce sugar production in some countries. In UK and Italy, producers receive the same average price for all of their production so a reduction in intervention prices would reduce the supply-inducing price. Reduced sugar production in these countries, however, would be offset by increased production in other EU countries. In countries such as Germany and France, producers receive the C-sugar price for any production in excess of their A- and B-quotas. Reduced EU exports increase world prices by more than 4% in 2000/2001 under the reduced intervention price scenario. The price on a marginal unit of sugar increases, and therefore, production increases. This occurs even though the reduction in intervention prices means that the average price received by most producers declines.

What will happen after the Uruguay Round agreement expires is uncertain. Some sugar producing countries are likely to seek the eventual elimination of subsidized exports by the EU in a future WTO agreement. We used the model to estimate the consequences of a hypothesized future WTO agreement requiring the EuropeanUnion to phase out subsidized exports by 2005/2006. Two alternative approaches

Table 5
EU sugar supply and utilization outlook using production quota reduction alone[a]

	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
Area harvested (1000 ha)								
Baseline	2081	2074	2063	2047	2036	2026	2014	1998
Scenario 1	2070	2061	2050	2025	2007	1989	1968	1944
Absolute difference	−11	−13	−13	−22	−29	−37	−46	−54
Percentage difference	−0.5	−0.6	−0.6	−1.1	−1.4	−1.8	−2.3	−2.7
Sugar production (1000 metric tons)								
Baseline	16,052	16,103	16,267	16,292	16,392	16,529	16,698	16,735
Scenario 1	15,958	15,998	16,148	16,102	16,130	16,180	16,257	16,205
Absolute difference	−94	−105	−119	−190	−262	−349	−441	−530
Percentage difference	−0.6	−0.7	−0.7	−1.2	−1.6	−2.1	−2.6	−3.2
A-+B-sugar production								
Baseline	13,972	13,972	13,972	13,972	13,972	13,972	13,972	13,972
Scenario 1	13,758	13,733	13,709	13,492	13,278	13,062	12,887	12,636
Absolute difference	−214	−239	−263	−480	−694	−910	−1,085	−1,336
Percentage difference	−1.5	−1.7	−1.9	−3.4	−5.0	−6.5	−7.8	−9.6
C-sugar production								
Baseline	2080	2131	2295	2320	2420	2557	2726	2763
Scenario 1	2200	2265	2439	2610	2852	3118	3370	3569
Absolute difference	120	134	144	290	432	561	644	806
Percentage difference	5.8	6.3	6.3	12.5	17.9	21.9	23.6	29.2
Domestic use								
Baseline	12,368	12,399	12,432	12,471	12,511	12,553	12,594	12,635
Scenario 1	12,368	12,399	12,432	12,471	12,511	12,553	12,594	12,635
Absolute difference	0	0	0	0	0	0	0	0
Percentage difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subsidized exports								
Baseline	1604	1574	1540	1502	1461	1420	1378	1337
Scenario 1	1390	1334	1277	1022	767	510	255	0
Absolute difference	−214	−240	−263	−480	−694	−910	−1123	−1337
Percentage difference	−13.3	−15.2	−17.1	−32.0	−47.5	−64.1	−81.5	−100.0
Total exports								
Baseline	5626	5659	5762	5780	5825	5909	6028	6055
Scenario 1	5532	5551	5641	5571	5536	5535	5562	5502
Absolute difference	−94	−108	−121	−209	−289	−374	−466	−553
Percentage difference	−1.7	−1.9	−2.1	−3.6	−5.0	−6.3	−7.7	−9.1
World price (dollars per metric ton)								
Baseline	268	268	262	264	261	257	253	254
Scenario 1	272	272	267	274	275	274	272	277
Absolute difference	4	4	5	10	14	17	19	23
Percentage difference	1.5	1.5	1.9	3.8	5.4	6.6	7.5	9.1
(percent)								
Quota Reduction	1.5	1.7	1.9	3.4	5.0	6.5	7.8	9.6

[a] Note: Baseline freezes intervention price and production quotas at pre-Uruguay Round levels. Scenario 1 assumes production quotas are reduced to comply with Uruguay Round commitments through 2000/2001 to reduce export subsidies and with a hypothetical requirement to eliminate export subsidies by 2005/2006.

to achieving this objective are analyzed. The first would rely solely on production quota reductions, the second would combine both intervention price and production quota reductions.

To eliminate export subsidies by 2005/2006, we estimate that production quotas need to be reduced by 9.6% if intervention prices are not adjusted. Under such a scenario, A- and B-quota production would decline by a total of 1.3 million metric tons in 2005/2006, while C-sugar production would increase by 0.8 million metric tons in response to a 9.1% increase in the world price (Table 5).

Reducing quotas reduces sugar production in all major EU countries, but has a proportionally smaller effect in countries such as Italy, where average-pricing practices prevail. Even though many producers operate at C-sugar prices at the margin in countries such as France and Germany, other higher-cost producers in those countries produce only enough to fill their A- and B-quotas, and so reduce their sugar production when quotas are reduced (Table 6).

Reducing intervention prices by 11.1% to meet WTO restrictions on subsidized exports and then reducing production quotas to eventually eliminate subsidized exports results in smaller reductions in EU sugar production. Instead of the 9.6% reduction in quotas under the previous scenario, here the required quota reduction is 7.9%. This occurs because the lower intervention price results in an increase in domestic EU sugar consumption that absorbs a portion of surplus production (Tables 7 and 8). The combination of intervention and quota reductions results in lower sugar production than under the baseline in all major countries.

Table 6
EU Sugar production outlook using production quota reduction alone[a]

	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
France (1000 metric tons)								
Baseline	4114	4086	4146	4103	4088	4,100	4,177	4,138
Scenario 1	4074	4041	4096	4019	3967	3,938	3,968	3,888
Absolute difference	−40	−45	−50	−84	−121	−162	−209	−250
Percentage difference	−1.0	−1.1	−1.2	−2.0	−3.0	−4.0	−5.0	−6.0
Germany								
Baseline	3905	3885	3901	3898	3932	3978	3980	3989
Scenario 1	3875	3851	3863	3838	3845	3859	3829	3805
Absolute difference	−30	−34	−38	−60	−87	−119	−151	−184
Percentage difference	−0.8	−0.9	−1.0	−1.5	−2.2	−3.0	−3.8	−4.6
Italy								
Baseline	1693	1745	1770	1800	1822	1867	1900	1924
Scenario 1	1687	1738	1762	1791	1819	1865	1894	1914
Absolute difference	−6	−7	−8	−9	−3	−2	−6	−10
Percentage difference	−0.4	−0.4	−0.5	−0.5	−0.2	−0.1	−0.3	−0.5
UK								
Baseline	1376	1382	1395	1407	1417	1422	1427	1434
Scenario 1	1369	1373	1385	1392	1397	1396	1395	1396
Absolute difference	−7	−9	−10	−15	−20	−26	−32	−38
Percentage difference	−0.5	−0.7	−0.7	−1.1	−1.4	−1.8	−2.2	−2.6
Other EU Countries								
Baseline	4964	5005	5055	5084	5133	5162	5214	5250
Scenario 1	4953	4995	5042	5062	5102	5122	5171	5202
Absolute difference	−11	−10	−13	−22	−31	−40	−43	−48
Percentage difference	−0.2	−0.2	−0.3	−0.4	−0.6	−0.8	−0.8	−0.9

[a] Note: Baseline freezes intervention price and production quotas at pre-Uruguay Round levels. Scenario 1 assumes production quotas are reduced to comply with Uruguay Round commitments through 2000/2001 to reduce export subsidies and with a hypothetical requirement to eliminate export subsidies by 2005/2006.

Table 7
EU sugar supply and utilization outlook using a combination of intervention price reductions and production quota reductions[a]

	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
Area harvested (1000 ha)								
Baseline	2081	2074	2063	2047	2036	2026	2014	1998
Scenario 2	2075	2064	2053	2050	2034	1991	1970	1945
Absolute difference	−6	−10	−10	3	−2	−35	−44	−53
Percentage difference	−0.3	−0.5	−0.5	0.1	−0.1	−1.7	−2.2	−2.7
Sugar production (1000 metric tons)								
Baseline	16,052	16,103	16,267	16,292	16,392	16,529	16,698	16,735
Scenario 2	16,023	16,059	16,219	16,182	16,173	16,239	16,313	16,255
Absolute difference	−29	−44	−48	−110	−219	−290	−385	−480
Percentage difference	−0.2	−0.3	−0.3	−0.7	−1.3	−1.8	−2.3	−2.9
A-+B-sugar production								
Baseline	13,972	13,972	13,972	13,972	13,972	13,972	13,972	13,972
Scenario 2	13,972	13,972	13,972	13,751	13,530	13,310	13,090	12,870
Absolute difference	0	0	0	−221	−442	−662	−882	−1,102
Percentage difference	0.0	0.0	0.0	−1.6	−3.2	−4.7	−6.3	−7.9
C-sugar production								
Baseline	2080	2131	2295	2320	2420	2557	2726	2763
Scenario 2	2051	2087	2247	2431	2643	2929	3223	3385
Absolute difference	−29	−44	−48	111	223	372	497	622
Percentage difference	−1.4	−2.1	−2.1	4.8	9.2	14.5	18.2	22.5
Domestic use								
Baseline	12,368	12,399	12,432	12,471	12,511	12,553	12,594	12,635
Scenario 2	12,582	12,639	12,695	12,729	12,764	12,799	12,835	12,870
Absolute difference	214	240	263	258	253	246	241	235
Percentage difference	1.7	1.9	2.1	2.1	2.0	2.0	1.9	1.9
Subsidized exports								
Baseline	1604	1574	1540	1502	1461	1420	1378	1337
Scenario 2	1390	1334	1277	1022	767	510	255	0
Absolute difference	−214	−240	−263	−480	−694	−910	−1123	−1337
Percentage difference	−13.3	−15.2	−17.1	−32.0	−47.5	−64.1	−81.5	−100.0
Total exports								
Baseline	5626	5659	5762	5780	5825	5909	6028	6055
Scenario 2	5384	5380	5451	5439	5345	5344	5376	5317
Absolute difference	−242	−279	−311	−341	−480	−565	−652	−738
Percentage difference	−4.3	−4.9	−5.4	−5.9	−8.2	−9.6	−10.8	−12.2
World price (dollars per metric ton)								
Baseline	268	268	262	264	261	257	253	254
Scenario 2	278	280	274	284	285	281	279	285
Absolute difference	10	12	12	20	24	24	26	31
Percentage difference	3.7	4.5	4.6	7.6	9.2	9.3	10.3	12.2
Quota reduction	0.0	0.0	0.0	1.6	3.2	4.7	6.3	7.9
Intervention price reduction (percent)	8.5	9.2	9.9	11.1	11.1	11.1	11.1	11.1

[a] Note: Baseline freezes intervention price and production quotas at pre-Uruguay Round levels. Scenario 2 assumes intervention prices are reduced to comply with Uruguay Round commitments through 2000/2001 to reduce export subsidies and that a combination of intervention price reductions and production quota reductions are used to comply with a hypothetical requirement to eliminate export subsidies by 2005/2006.

Table 8
EU sugar production outlook using a combination of intervention price reductions and production quota reductions[a]

	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
France (1000 metric ton)								
Baseline	4114	4086	4146	4103	4088	4100	4177	4138
Scenario 2	4137	4110	4174	4060	4037	4016	4046	3963
Absolute difference	23	24	28	−43	−51	−84	−131	−175
Percentage difference	0.6	0.6	0.7	−1.0	−1.2	−2.0	−3.1	−4.2
Germany								
Baseline	3905	3885	3901	3898	3932	3978	3980	3989
Scenario 2	3911	3891	3908	3863	3883	3903	3873	3849
Absolute difference	6	6	7	−35	−49	−75	−107	−140
Percentage difference	0.2	0.2	0.2	−0.9	−1.2	−1.9	−2.7	−3.5
Italy								
Baseline	1693	1745	1770	1800	1822	1867	1900	1924
Scenario 2	1641	1679	1695	1791	1743	1791	1824	1848
Absolute difference	−52	−66	−75	−9	−79	−76	−76	−76
Percentage difference	−3.1	−3.8	−4.2	−0.5	−4.3	−4.1	−4.0	−4.0
UK								
Baseline	1376	1382	1395	1407	1417	1422	1427	1434
Scenario 2	1360	1360	1368	1397	1391	1382	1376	1373
Absolute difference	−16	−22	−27	−10	−26	−40	−51	−61
Percentage difference	−1.2	−1.6	−1.9	−0.7	−1.8	−2.8	−3.6	−4.3
Other EU countries								
Baseline	4964	5005	5055	5084	5133	5162	5214	5250
Scenario 2	4974	5019	5074	5071	5119	5147	5194	5222
Absolute difference	10	14	19	−13	−14	−15	−20	−28
Percentage difference	0.2	0.3	0.4	−0.3	−0.3	−0.3	−0.4	−0.5

[a] Note: Baseline freezes intervention price and production quotas at pre-Uruguay Round levels. Scenario 2 assumes intervention prices are reduced to comply with Uruguay Round commitments through 2000/2001 to reduce export subsidies and that a combination of intervention price reductions and production quota reductions are used to comply with a hypothetical requirement to eliminate export subsidies by 2005/2006.

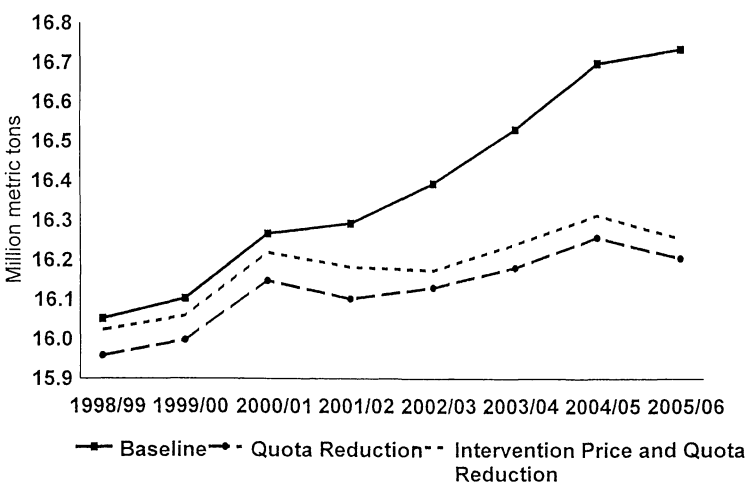

Fig. 1. EU sugar production outlook.

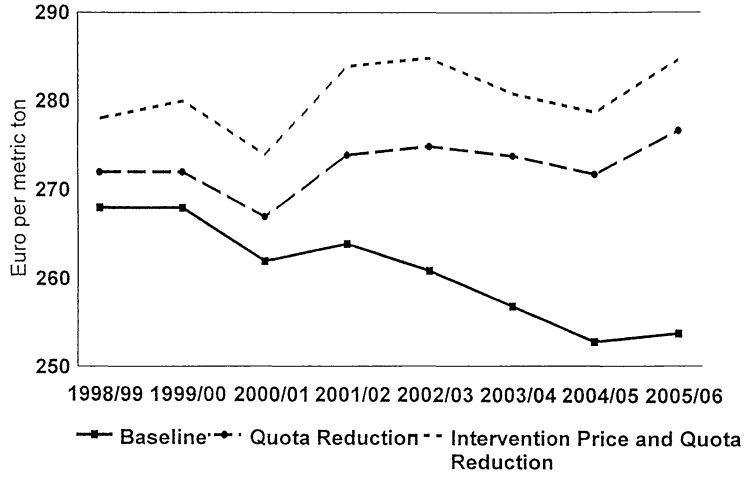

Fig. 2. World price of sugar.

Figs. 1–3 summarize the aggregate results. In the baseline, EU sugar production and exports would increase over time, while world prices fall. The scenarios that phase out export subsidies result in more stable levels of EU production and exports, and of world prices. Because lowering intervention prices results in increased domestic sugar consumption, EU sugar production is greater but exports are less when intervention prices are reduced compared to the scenario relying strictly on quota reductions.

7. Summary and conclusions

One important empirical finding of the study is that the world price of sugar has a major influence on EU sugar production, even though EU sugar policy prices are well above the world price. In some countries, the world price is the marginal incentive price for a significant proportion of sugar production so world price movements may have a greater impact on production than would marginal changes in EU policy prices. In

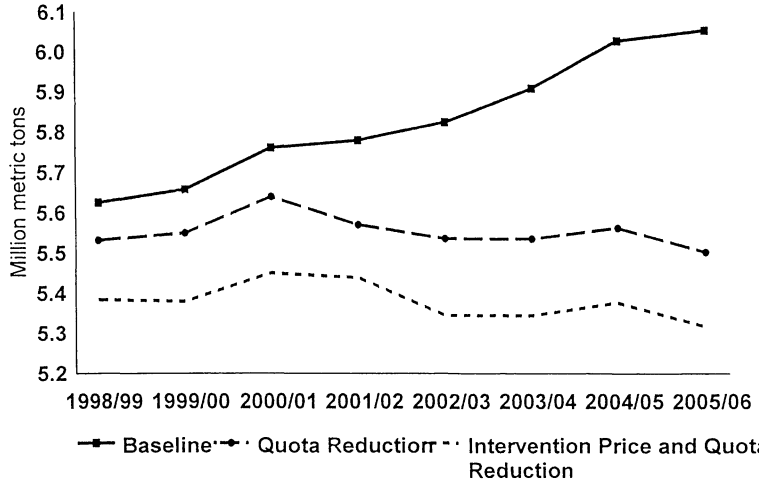

Fig. 3. EU total sugar exports.

other countries, producers receive an average price for all sugar produced so policy prices have a larger impact on production than do world prices.

A second major finding of this study is that the world market impacts of reductions in subsidized EU sugar exports depend on the manner in which those reductions are achieved. Relying on quota reductions alone results in smaller reductions in total EU exports than if intervention prices are reduced. Lower intervention prices result in adjustments in both EU production and consumption, while quota changes only affect production.

The implications for a future WTO agreement are important. If such an agreement requires further reductions in subsidized exports but does not require reduced tariffs, EU may choose to rely on quota reductions to meet its obligations, thus minimizing the benefits of lower EU exports and higher world prices for competing sugar exporters. In contrast, if the agreement also requires substantial tariff reductions, the EU could be forced to reduce intervention prices to avoid large increases in sugar imports. Even if the result is no increase in EU sugar imports, the resulting further reduction in EU sugar exports could benefit other exporters, as well as EU sugar consumers.

Acknowledgements

The authors are grateful to Kevin Hanrahan and two anonymous referees for their useful comments on an earlier draft.

References

Abbott G.C., 1990. Sugar. Routlege, London.

Bureau, J.C., Guyomard, H., Requillart, V., 1997. Quota mobility in the European sugar regime. Eur. Rev. Agric. Econ. 24, 1–30.

Devadoss, S., Kropf, J., 1996. Impacts of trade liberalizations under the Uruguay round on the world sugar market. Agric. Econ. 15, 83–96.

Graham, H.E., 1983. Sugar beet supply response in three EEC countries, Report 1. Institute of Agricultural Economics, University of Oxford.

Leuck, D., Neff, S., 1991. Potential effects of policy reforms on the European Community Sugar Market. Staff Reports AGES 9129. Agricultural and Trade Analysis Division, ERS, UDSA, Washington, DC.

Marks V.S., Maskus E.K., (Eds), 1993. The Economics and Politics of World Sugar Policies. The University of Michigan Press, Ann Arbor, MI, USA.

Poonyth, D., 1998. A structural econometric model of European Union sugar industry and the potential implications of the GATT WTO. Unpublished Ph.D. Dissertation, University of Missouri, Columbia, MO.

Price, J., Taylor, R., 1996. European Union Sugar: The EU Sugar Policy, The Agrimonetary System, GATT and The WTO. E D & F Man Sugar Ltd, London.

Roberts, I.M., Wish-Wilson, P., 1991. Domestic And world markets of EC sugar policies. Discussion Paper 91-1. Australian Bureau of Agricultural and Resource Economics, Canberra, Australia.

Roningen, V.O., Dixit, M.P., 1989. How level is the playing field? An Economic Analysis of Agricultural Policy Reforms in Industrial Market Economies. FAER-239. USDA., ERS, Washington, DC.

Sudaryanto, T., 1987. The potential impacts of liberalized trade policies in the United States and the European Economic Community on international market for sugar. Unpublished Ph.D. Dissertation, North Carolina State University, Raleigh, NC.

Wong G., Sturgis, R., Borrell, B., 1989. The Economic Consequences of International Trade Sugar Reform. Discussion Paper 89-7. Australian Bureau of Agricultural and Resource Economics, Canberra, Australia.

Zietz, J., Valdes, A., 1986. The costs of protectionism to developing countries: An analysis for selected agricultural products. World Bank Staff Working Paper No 769. The World Bank, Washington, DC.