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The EU Sugar Policy Regime and Implications of Reform

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The EU Sugar Policy Regime and Implications of Reform

**Aziz Elbehri, Johannes Umstaetter, and
David Kelch**

Abstract

The European Union's sugar policy, in place since 1968, underwent its first major reform in 2005 in response to mounting and unsustainable imbalances in supply and demand. The reform, however, targeted only a few policy instruments (intervention price cut, voluntary production quota buyout, and restrictions on nonquota sugar exports), while leaving other key policies unchanged (interstate quota trading, sugar-substitute competition, and import barriers). Consequently, the extent of the reform's impact is limited, compared with more far-reaching alternatives, particularly when the oligopolistic nature of the industry and its noncompetitive pricing behavior are taken into account. A model-based analysis suggests that the reforms by themselves are unlikely to induce price adjustments sufficient to reduce overproduction unless quotas and/or high tariffs are reduced.

Keywords: European Union, EU, sugar CMO, Common Market Organization, policy reform, trade, economic model

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Summary

The European Union (EU) is one of the leading sugar producers and traders in the world. This position was built over time through the application of protectionist policies that regulated production, prices, exports, and imports. Since its creation in 1968, the existing EU sugar policy—commonly referred to as the Common Market Organization (CMO) for sugar—had changed only marginally. In 2006, however, a new sugar regime took effect, largely influenced by three factors: tariff- and quota-free access to least developed countries (LDCs) beginning in 2009, which would likely result in increased sugar imports; enforcement of World Trade Organization (WTO) commitments; and the accession of 10 new member states to the EU in 2004, which exacerbated preexisting sugar supply-and-demand imbalances.

What Is the Issue?

The EU sugar policy was reformed under multiple pressures, both internal and external. The reform package targeted a limited set of policy instruments, such as support prices and quotas, with the hope of improving the efficiency of the industry and making it more sustainable. However, the partial nature of the reform, which left several key policy interventions unchanged, raises concerns about the implications of the reform on the EU sugar industry and on international trade. Because the EU is the world's second largest producer and exporter of sugar and the third largest importer, the EU sugar reforms have important consequences for both global and U.S. sugar markets. This report examines the current EU sugar regime and uses a model-based approach to assess the potential market and trade implications of the implemented reforms.

What Did the Study Find?

Current sugar regime—The CMO for sugar is complex, encompassing a variety of policy instruments, including price support, production quotas (sugar and substitutes), export subsidies, and import barriers. The reforms targeted only a few of these instruments, principally cutting the intervention price, or the price guaranteed to EU producers. The 36-percent cut in the intervention price is designed to lower the market price and discourage sugar imports from LDCs. The reforms also included a voluntary buyout scheme for production quotas and a disallowance of exports of nonquota sugar, a step taken with the aim of reducing domestic production and bringing export subsidies within WTO limits.

The reforms did not address interstate quota trading (which could induce a significant shift in production from high- to low-cost regions), leaving in place, as before, national quota allocation. The reforms also retained production quotas on sugar substitutes (isoglucose, or high-fructose corn syrup), albeit at higher levels, preventing greater competition within the EU among different types of sweeteners.

Model-based results—According to a model-based analysis of the reform, the combined effect of cuts in prices and production quotas will lead to lower EU sugar production, lower prices for consumers, and higher consumption.

Moreover, when the prices of sugar substitutes go down, reducing the profitability of isoglucose production and, hence, its output, sugar consumption will rise. In all model scenarios, EU sugar exports decline as a result of a combination of lower production, lower export subsidies, and restrictions on exports of nonquota sugar. Consequently, EU sugar imports will have to rise to bring the market into balance.

When the model accounts for oligopolistic industry behavior, results show that EU sugar production will decline further than it would under the reform package's quota buyout scheme. Domestic market prices will not necessarily fall as much (or proportionally) as the cut in the intervention price, partly due to increased markups charged by sugar firms. Model results also show that EU sugar reform will lead to a significant exit of firms from the industry. This effect is consistent with the accelerated restructuring and consolidation of EU sugar processors that has been observed in the period following the reforms.

Market and trade implications—The analysis suggests that, given the market structure of the EU sugar industry, cutting the intervention price alone may not have the desired effect on production and market prices. The reform's impact on production and prices will likely depend more on how much sugar is actually removed from the market, which will be partly determined by the extent of the sugar industry consolidation currently under way. A more complete sugar sector reform that included lower import barriers (outside preferential agreements), interstate quota tradability, and greater market opportunities for sugar substitutes would have weakened oligopolistic behavior, thus having the potential to make the industry leaner and more competitive.

The reform's trade effects are more significant for preferential than for nonpreferential exporters to the EU. The near concurrent implementation of tariff-cutting measures in 2009 and the sugar reform in 2006 will dampen potential gains for LDCs with preferential access to the EU as they face greater competition from third-country (nonpreferential) exporters. Preferential exporters are likely to experience income loss (from preference erosion) despite possible increases in sugar exports to the EU. World sugar prices are expected to shift upward due to the EU sugar reform, but an even greater influence on prices may be rising demand for and production of sugar-based ethanol, mostly from Brazil. A tighter world sugar market and rising prices would benefit developing-country sugar exporters, partly offsetting export losses from the EU reform.

Finally, the EU sugar reform could have implications for the WTO. The reform not only reduces EU export subsidies to a level within current WTO limits, but it also might facilitate a phased removal of export subsidies by the EU as is called for in the Doha Development Round. In the area of domestic support, cuts in the intervention price and lower production would reduce the EU's aggregate measure of support. However, in the area of market access, the EU reform does not address the high import tariff barriers for sugar exporters outside preferential agreements. Reducing these import barriers could potentially have far greater impact on world sugar markets, including nonpreferential sugar trade.

How Was the Study Conducted?

This analysis of the EU sugar reform features qualitative and quantitative components. The qualitative assessment offers insights into the likely shifts in production, prices, and trade resulting from the reform, given key characteristics of the sugar industry. Due to the complexity of the EU sugar regime and the various interconnected issues to disentangle, the quantitative assessment of the reform required use of both partial and general equilibrium models. The partial equilibrium-based analysis incorporates details of the EU domestic sugar sector and policies, and the general equilibrium model directly addresses bilateral trade, distinguishing between preferential and nonpreferential trade flows and offering an account of both import and export policies. A unique contribution of this report is its explicit modeling of imperfect competition and the oligopolistic behavior of the EU sugar industry and how these attributes affect the expected responses to the policy reform.

Introduction

The European Union (EU) is one of the leading sugar producers and traders in the world. However, this position was built over time through the application of protectionist policies that regulated all aspects of the industry, ranging from production and prices to exports and imports. The existing EU sugar policy—commonly referred to as the Common Market Organization (CMO) for sugar—incorporates a set of market management tools, including an intervention price and production quotas. The CMO for sugar also includes export subsidies to dispose of excess supply, preferential trade arrangements for certain countries outside the EU, and high tariffs to insulate domestic producers from foreign competition.

Since its creation in 1968, the CMO for sugar has changed only marginally. In 1973, the United Kingdom (UK) acceded to the EU. As a result, the UK's preferential import commitments to its former colonies—the Africa-Caribbean-Pacific (ACP) countries—were incorporated within the CMO for sugar. In each of the attempts to reform the EU's Common Agricultural Policy (CAP)—including the 1992 MacSharry Reform, Agenda 2000, and the 2003 CAP reform—the sugar regime has virtually escaped reform.¹ But following the 2003 CAP reform, a combination of several internal and external factors created a greater sense of urgency to modify the sugar policy. First, the “Everything-But-Arms” (EBA) Initiative, in which the EU agreed to phase out tariffs by 2009 on imported raw sugar from 48 of the least developed countries (LDCs), opened the doors for additional preferential sugar imports. Second, a World Trade Organization (WTO) panel ruled that the EU sugar regime is in violation of the EU's WTO export commitments. This ruling requires the EU to stop out-of-quota sugar exports (which, according to the WTO, benefit from indirect subsidies through cross-subsidization) and include in the calculations of its export subsidies the amount for re-exported refined sugar made from raw imported sugar. To comply, the EU will be required to reduce its sugar exports and expenditures on export subsidies by a significant amount—from around 4 to 5 million tons per year to 1.3 million tons in volume and to 499 million euros in value. In practice, this reduction could make it no longer profitable for the EU to produce sugar outside the quota system, at least for food uses. Third, the enlargement of the EU from 15 to 25 countries (EU-15 to EU-25) in 2004 has exacerbated the EU's preexisting supply and demand imbalances of sugar.² While the 10 new member states from Central and Eastern Europe made a net contribution to EU sugar consumption, they also imported sugar from third countries (Australia, Brazil, Cuba, Mexico, and Guatemala). Thus, the enlarged EU-25 was required to compensate these third-country exporters under WTO rules with additional “current access” quotas,³ estimated at around 490,000 tons (Huan-Niemi, 2003).⁴ Together, these factors made a significant overhaul of the EU sugar regime almost inevitable.

A comparison of expected supply and demand projections over the short term reveals the severity of the market imbalance. Excess sugar supply, already chronic in the EU, is expected to worsen under the combined effect of export reductions resulting from EU compliance with the WTO ruling and implementation of the EBA Initiative. According to per year estimates from the Commission of the European Communities (2005), domestic sugar

¹The one major exception occurred in 1995, when the EU agreed to reduce its export subsidies by 21 percent in volume and 36 percent in value over the period 1995-2001 as part of the WTO Agreement on Agriculture (AoA).

²The accession of Romania and Bulgaria, effective January 2007, is not included in the present analysis.

³As part of the WTO AoA, members were required to maintain current import access opportunities for tariffed products at levels corresponding to those existing during the 1986-88 base period. Where such “current” access had been less than 5 percent of domestic consumption of the product in question in the base period, an (additional) minimum access opportunity had to be opened on a Most-Favored-Nation basis. This requirement was to ensure that in 1995, current and minimum access opportunities combined represented at least 3 percent of base-period consumption.

⁴All measurements in tons in this report refer to metric tons.

consumption (15.2 million tons) plus WTO-permissible exports (1.3 million tons) would fall far short of absorbing the supply from domestic production (19.8 million tons) plus agreement-bound preferential sugar imports (1.6 million tons), unless the EU modified its sugar regime. After accounting for high-end estimates of EU sugar imports from the EBA countries of around 3 million tons, excess supply could have reached 7-8 million tons had the EU not changed its sugar policies.

Beginning in 2005, the EU embarked on a reevaluation of its sugar policies. On July 14, 2004, the EU Commission published an initial proposal and modified it following the unfavorable WTO ruling on EU export subsidies for sugar. Member states reached a final agreement on a new sugar policy regime on November 24, 2005. The reforms were ratified by the EU Parliament on January 19, 2006, and later by the Council of Ministers on February 22, 2006. The new sugar policy entered into effect on July 1, 2006. This report examines the current EU sugar regime and uses a model-based approach to assess the potential market and trade implications of the implemented reforms.

Overview of the Common Market Organization for Sugar

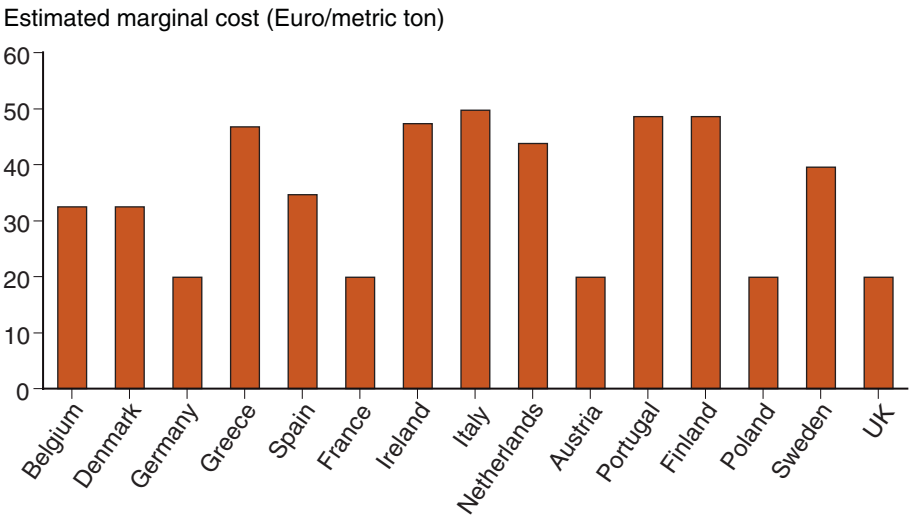
The main objective of the CMO for sugar is to ensure sugar production in all member states where sugar beet production is feasible, regardless of cost competitiveness. National production quotas given to sugar processors based on historical production levels serve to accomplish this goal. The EU also operates an intervention price—a price guaranteed to producers—as the basis for intervention purchases. Moreover, it shields sugar from competition via several mechanisms. First, the EU imposes restrictive quotas on imports of sugar substitutes, such as isoglucose; high import tariffs protect against foreign competition. Export subsidies help to dispose of excess sugar supply and maintain high domestic prices. Also, sugar-using industries receive subsidies to compensate for the high price of sugar.

The EU-25 harvested 2.3 million hectares of sugar beets in 2005, with an average yield of 61.6 tons per hectare (Bureau et al., 2007). Productivity of sugar beet production varies significantly across the EU (fig. 1). The number of sugar beet processing plants in the EU-15 shrank from 240 in 1990 to 135 in 2002/03 (table 1), while the number of sugarcane refineries fell to 6. With the EU’s 2004 enlargement, about 100 sugar processing plants from the 10 acceding countries were added to the EU sugar sector. But by 2005, the total number of plants declined to 184, and sugar production totaled about 21 million tons. The EU-25’s first and second largest sugar producers, Germany and France, account for about half of the EU-25’s production, followed by Poland, Italy, and the UK.

Production Quotas

For 2005, the total quota amount for sugar production in the EU-25 is 17.4 million tons. The sugar quota allocated may be transferred between processors within member states but not between member states.

Figure 1
Estimated marginal cost for sugar across EU member states, 2003



Source: USDA, ERS using data from Frandsen et al. (2003).

Table 1

EU sugar industry, 2002-03

Country	Factories	Companies	White sugar yield	Sugar beet yield (t/ha)	Production + carryover	A sugar	B sugar	C sugar
	Number		Tons/ha		1,000 tons			
Austria	3	1	10.3	68.4	454.0	314.0	73.0	67.0
Belgium	8	6	10.4	66.0	888.0	675.0	145.0	68.0
Denmark	3	1	9.3	57.1	501.0	325.0	96.0	80.0
Finland	2	1	5.3	38.6	166.0	133.0	13.0	20.0
France	34	17	11.6	77.5	4,105.0	2,789.0	752.0	564.0
Germany	28	7	8.8	58.9	3,798.0	2,613.0	804.0	381.0
Greece	5	1	7.2	73.1	370.0	289.0	29.0	52.0
Ireland	2	1	6.3	52.3	223.0	181.0	18.0	24.0
Italy	20	9	5.7	51.8	1,563.0	1,311.0	162.0	90.0
The Netherlands	5	2	9.6	60.0	953.0	684.0	180.0	89.0
Portugal	4	4	9.0	62.5	56.0	56.0	0.0	0.0
Spain	13	3	10.4	76.8	1,086.0	957.0	40.0	90.0
Sweden	2	1	8.0	48.5	427.0	335.0	33.0	59.0
United Kingdom	6	2	9.7	64.7	1,260.0	1,035.0	104.0	121.0
EU-15 countries	135	56	8.7	61.8	15,850.0	11,697.0	2,449.0	1,705.0
Czech Republic	12	8	6.7	44.0	474.9	441.2	13.7	20.0
Hungary	6	5	5.4	40.0	401.7	400.5	1.2	0.0
Lithuania	4	2	4.9	35.0	112.0	103.0	0.0	9.0
Latvia	2	2	4.9	34.0	66.5	66.4	0.1	0.0
Poland	54	57	6.6	40.0	1,772.5	1,580.0	91.9	100.6
Slovakia	5	4	5.0	32.0	207.5	189.8	17.7	0.0
Slovenia	1	1	5.3	45.0	53.0	48.2	4.8	0.0
EU-25 total	219	135	8.3	58.2	18,938.1	14,526.1	2,578.4	1,834.6

Source: USDA, ERS using data from EU Commission and from Comité Européen des Fabricants de Sucre (CEFS).

While the quota allocation can be revised yearly, in practice it is changed only in the case of the closure or merger of sugar beet processors. Cane refineries procure raw sugar through imports from third countries or overseas territories of the member states. Production quotas have changed little over the years, even though production began to exceed consumption in the EU around 1977. Production quotas were cut for the first time in 2000, and this cut was 3.3 percent.

A distinctive feature of the CMO for sugar, compared with CAP regulations for other agricultural products, is that the policy instruments target the sugar beet processors and sugarcane refineries, not the sugar beet growers. Processors procure sugar beets from growers on the basis of intratrade agreements defined by the CMO for sugar. These contractual agreements define standard sugar and beet qualities and set purchase terms for beets and rules for quota transfers between enterprises. Based on the quota allocated to sugar beet processors, the processors, in turn, assign “beet delivery rights” to individual growers as specified in the intratrade agreements.

Quotas comprise two quota types: “A-quota” (82 percent of total quota allocations), and supplemental “B-quota” (18 percent) to cover year-to-year production variability due to weather or unexpectedly low yields. Like the

U.S. sugar program, the CMO for sugar is designed to be self-financed (i.e., it falls outside the EU budget), so a levy is imposed on sugar quota production. A-sugar is charged 2 percent of the intervention price (12.60 euros per ton of sugar); B-sugar is charged a variable levy determined by the total cost of export refunds but has a maximum level set at 37.5 percent (237 euros per ton) of the intervention price. Sugar beet processors pay the levies, though they, in turn, pass on a portion of the cost to growers (Commission of the European Communities, 2005). If these levies prove insufficient to cover the costs of the export subsidy, an additional levy is imposed as a percentage of the amount owed by each processor under the previous two levies, with no maximum set to achieve the sum required.

Sugar produced outside the quota is called C-sugar (nonquota sugar). The price guarantee applies only to quota sugar (A and B). Hence, nonquota sugar is ineligible for any price support, nor can it be sold on the domestic market. C-sugar may be exported, but it cannot receive export subsidies. A carryover mechanism is available for C-sugar, which involves storing the sugar for a minimum period of 12 months (i.e., “carried over” to the next marketing year). Carried-over C-sugar is treated as A-sugar in the following marketing year, but the carryover amount of C-sugar cannot exceed 20 percent of the A-sugar quota (see table 1).

Sugar beet processors in member states that produce C-sugar average around 3 million tons of C-sugar per year, most of which is exported. Even though C-sugar receives no direct export subsidies, it is sold profitably at world market prices because the prices obtained for sales of A- and B-sugar (export subsidy inclusive) are high enough to cover all the fixed costs of the processing companies. This cross-subsidization (where C-sugar holders benefit indirectly because of the subsidies they receive on A- and B-sugar) was a key issue raised against the EU in the 2005 WTO ruling on export subsidies. According to the WTO Appellate Body, total subsidized sugar exports by the EU, including C-sugar, amount to almost 4 million tons per year, which far exceed the EU’s WTO commitment limit of 1.273 million tons per year. With ACP sugar re-exports added to its total, the EU spends nearly 1.3 billion euros per year on export subsidies, more than twice the official ceiling (and WTO notified amount) of 499 million euros from 2000 to 2001 and later (Agra Europe, 2004).

The CMO does not cover sugar produced for certain industrial uses, and non-CMO sugar does not qualify for any CMO support. Consequently, there is no limit on non-CMO sugar production. This provision applies to sugar processed into alcohol, including fuel ethanol, rum, and spreadable syrups, and sugar used to produce yeasts. Currently, France is the EU’s leading producer of sugar for nonfood purposes. In 2004, France reported harvesting about 40,000 hectares of sugar beets annually for nonfood purposes, of which about 10,000 hectares were used for ethanol extraction (Bruhns et al., 2004).

Sugar Substitutes

In 1977, the CMO for sugar was extended to production of isoglucose syrup to limit the product’s competitive effect on the protected sugar industry. Isoglucose, also referred to as high-fructose syrup (HFS), is extracted from maize, wheat, and starch potato and is subject to an annual production quota

of 500,000 tons for the EU-25. Unlike quotas for sugar, quotas for isoglucose are not eligible for purchase among member states; hence, they have no intervention prices. Since 1994, inulin syrup, another sweetener covered by the CMO for sugar, has been subject to a 300,000-ton per year quota (for the EU-15). Inulin syrup is treated the same as isoglucose in terms of quota restrictions but is more expensive to produce.

The cost of producing isoglucose in the EU has always been lower than the cost of producing sugar. A recent UK study shows that the production cost of isoglucose varies from 350 to 380 euros per ton, depending on the type. This cost range compares favorably with the breakeven price for sugar (below which it is no longer profitable to produce), which ranges from 300 to 350 euros per ton in some “low-cost” regions of France to 500 to 550 euros per ton in Italy (Commission of the European Communities, 2005). As early as 1995, the price of isoglucose was about 13-percent lower than the price of sugar in the EU, and the price is consistently below the intervention price of 631.90 euros per ton for white sugar. Given this price advantage, the principal factor that prevents a major substitution of isoglucose for sugar is the tight production quota on isoglucose. Nevertheless, in the EU, isoglucose prices follow sugar prices very closely and, therefore, would be affected by any reform to sugar prices or quotas. By contrast, inulin is a poor substitute for sugar, because inulin syrup is more expensive to produce (Netherlands Economic Institute, 2000).

Intervention Prices and Purchases

The EU maintains a minimum price for sugar via a two-tier strategy featuring a minimum price for sugar beets and an intervention price for white refined sugar. Intratrade agreements between sugar processors and beet growers regulate the relationship between the minimum sugar beet price (paid to growers) and processed sugar prices. Under the CMO for sugar, the basic beet price is the key support price. In 2005, the basic beet price was 4.767 euros per 100 kilograms. The basic beet price is a function of the intervention price for sugar, and its derivation takes into account the processing margin, the yield of sugar from beets, the revenue from molasses sales, and the cost of beet delivery to processors (table 2). Sugar processing returns (if sugar is sold into intervention) are split approximately 58 percent to sugar beet growers (i.e., 36.6 euros per 100 kilograms at the present intervention price) and 42 percent to processors (26.5 euros per 100 kilograms). The growers’ share of 36.6 euros per 100 kilograms of sugar corresponds to the basic beet price of 4.767 euros per 100 kilograms on the basis of 7.7 tons of standard quality sugar beets (16 percent sugar content) being needed to produce 1 ton of sugar.

From the “basic price” of sugar beets is derived the minimum price *actually* paid to beet producers. Sugar processors are required to pay the minimum price, which is the basic beet price minus 58 percent of the production levies. The 2-percent levy set for A-type sugar beets raises the unit price of sugar to 46.72 euros per 100 kilograms, and the higher levy on B-type sugar beets raises its price to 32.42 euros per 100 kilograms (table 2).

Table 2

Components of the intervention price

Item	Euros per 100 kilograms of:	
	White sugar	Sugar beets
Intervention price, white sugar	63.19	
Transport cost of sugar beets	-4.41	
Processing cost	-24.36	
Value of molasses for beet growers	2.25	
White sugar price in beets (Price paid to beet growers)	36.67	4.767
Minimum beet price for A-sugar (98 percent of basic price)		4.662
Minimum beet price for B-sugar (60.5 percent of basic beet price)		2.884

Source: USDA, ERS using data from Swedish Competition Authority (2002).

Components of the Intervention Price

The intervention price for white refined sugar is the price that the government agrees to pay to refineries on the basis that sugar beet processors will pay the growers the minimum beet price. In 2005, the intervention price was set at 63.19 euros per 100 kilograms. An equivalent intervention price is derived for raw sugar of a standard quality at 52.37 euros per 100 kilograms (83 percent of the white sugar intervention price) and is the price paid for raw cane sugar imported from the ACP countries. The sugar intervention price is increased for deficit regions (where consumption exceeds production); the premium equals the transport cost from the nearest surplus region. The sugar beet price is increased in a similar manner for deficit regions. The CMO for sugar also provides additional assistance to the sugar industry, namely “refining aid,” which is granted to the sugarcane refining industry and covers certain costs of refining raw cane sugar.

For out-of-quota sugar (C-sugar), the price paid is determined by the returns to beet processors from sales of C-sugar on the world market. Although the CMO for sugar does not stipulate how much growers should be paid for C-sugar beets, intertrade agreements show that beet growers generally receive about 58 percent of exporting sugar processors’ receipts for C-sugar. Usually, beet growers are paid for the C-sugar beets at the end of the marketing season, when all C-sugar has been exported.

Intervention purchases are the enabling mechanism backing intervention prices. However, intervention purchases are rare, as processors are able to export sugar with subsidies at prices typically above intervention prices. Only once in the last 25 years has sugar been offered to the intervention agencies: in marketing year 1986/87, the German Intervention Agency bought 15,703 tons of white sugar (Netherlands Economic Institute, 2000). In 2005, a substantial intervention store amounting to 850,000 tons resulted from countries overproducing in anticipation of the reforms. Moreover, the EU was forced to declassify to C-sugar nearly 1.9 million tons of quota sugar, which would have had to be exported with subsidies, thus exceeding the WTO limit.

Subsidies to Sugar-Using Industries

About 70 percent of total human sugar consumption in the EU comes from food and drinks, while the remainder is directly consumed. Sugar-using industries that benefit from production refunds under the CMO include the chemical and pharmaceutical industries, which receive compensation that effectively equalizes the prices that they pay to producers outside the EU. With production refunds, these industries (which represent less than 2 percent of total sugar consumption) are able to buy sugar at the equivalent of world market prices plus shipping costs. The production refund is fixed quarterly at a level equal to the average of the export refunds for a defined reference period minus 6.45 euros per 100 kilograms of white sugar equivalent. This deduction has the effect of denying the chemical industry sugar at world prices and forces the industry to use molasses or starch as its principal raw material. Food processors that use sugar also benefit from export refunds. Export refunds are fixed monthly and apply to sugar exported in processed products. This refund is fixed as a unit rate multiplied by the sugar content of the products. The sugar export refunds for processed products containing sugar operate in export transactions similar to the way that the EU's ingredient-based tariffs on processed foods and beverages containing sugar operate in import transactions.

EU Sugar and Trade Policies

The EU's external sugar trade is highly managed within the current CMO, principally through three instruments: "export refunds," contractual preferential agreements with third countries, and high import duties for nonpreferential sugar, including special safeguards. These policies regulate the two-way flow of sugar and have placed the EU in the unusual position of being both a significant importer and an exporter of sugar (fig. 2).

Export Subsidies

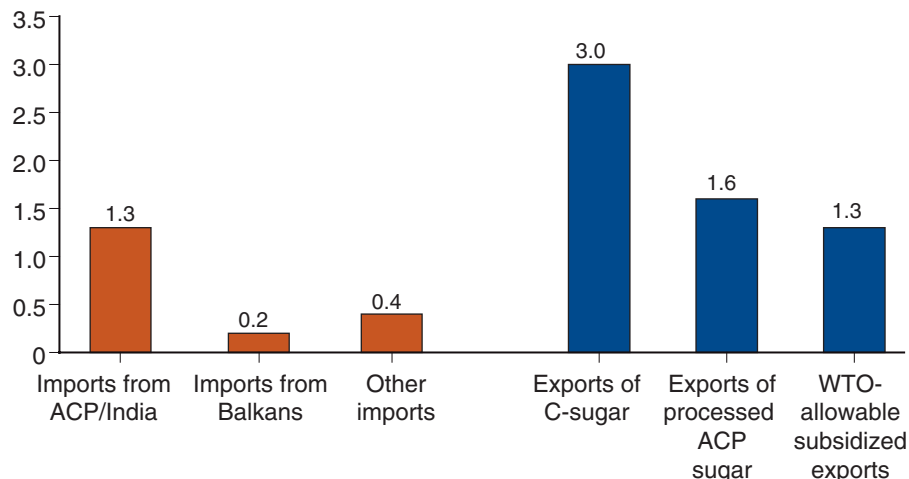
Export subsidies form the key mechanism to dispose of surplus production and maintain high internal prices. Refunds are paid from the collected levies for all exported (A+B) sugar obtained from sugar beets or cane harvested in the EU and from sugar imported under the Protocol Agreement with India and the ACP countries. Export subsidies enable sugar producers/exporters to receive a guaranteed price for exported sugar, equivalent to the price they would receive in domestic markets. Export subsidies are intended to cover the difference between the EU price and the world price for sugar, allowing the sugar to be sold on the world market. Maximum export refunds are equal to the white sugar intervention price plus the shipping cost to the port (5 euros), minus the world price. The sum of export refunds plus the world market price gives producers nearly 670 euros per ton of sugar, inclusive of transport costs. Compared with the minimum price received in the EU internal market of 670 euros per ton (intervention plus transport costs), export refunds averaged 443 euros per ton for 2001/02, 485 euros per ton for 2002/03, and 480 euros per ton for 2003/04. Export subsidies can account for up to 75 percent of the EU intervention price. As shown in table 3, export refunds for EU sugar have remained fairly steady over the past decade.

Export subsidies are particularly critical to the large EU-based confectioners competing in world markets when one of the principal components of their

Figure 2

Structure of EU sugar trade, 2004

Million metric tons



Source: USDA, ERS using data from AGRA Europe, EU Commission.

Table 3

EU export refunds, 1996-2006

Item	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	<i>Million euros</i>										
Refunds	1,230	1,360	1,370	1,593	1,497	1,008	1,168	1,021	1,285	1,081	1,117

Source: USDA, ERS.

exported product is sugar priced at roughly three times the world price. The EU has also used export subsidies to re-export 1 to 2 million tons of imported sugar under the Sugar Protocol with the ACP countries.

Export subsidies are disbursed in two ways: weekly export tenders and standing export refunds. Export tenders are awarded each season. As part of the process, traders (and some processors) bid for the minimum level of refunds they can accept for exporting sugar, based on what they would receive for domestic sales. These tenders apply to most EU sugar exports. The standing export refund for sugar is meant to apply to the export of small quantities. Set every 2 weeks, the refund equals the lowest tender minus 3 euros per ton of sugar. Sugar-containing foods, drinks, and other products also qualify for export subsidies. These refunds are fixed monthly and are based on export refunds for white sugar minus 3 euros per 100 kilograms and the sugar content of the product.

EU-25 sugar exports, whether subsidized directly or indirectly, averaged about 6 million tons a year in the late 1990s and early 2000s and accounted for about 30 percent of total world exports. An EU average of 3.5 million tons of sugar (including sugar in processed products) is exported with a direct subsidy. This amount far exceeds the 1.273 million tons allowable under WTO commitments. The EU does not report to the WTO the subsidies given to re-exported refined sugar from ACP raw sugar imports as part of the required notifications. However, the recent WTO panel ruling clearly identified both refined sugar exports from imported raw ACP sugar and C-sugar exports as benefiting from export subsidies, making the EU noncompliant with its WTO obligations concerning sugar (World Trade Organization, 2005).

Export subsidies are paid for partly from producer levies (charged on A- and B-quota sugar) and partly from the EU budget (for re-exports of white sugar from imported raw ACP sugar). Overall, sugar export subsidies accounted for 75 percent of the total CMO budget for sugar in 2004 (table 4). This includes 802 million euros for the equivalent of 1.6 million tons of re-exported ACP sugar. By comparison, sugar production refunds for the chemical industry are 194 million euros (11 percent), refining aid for cane sugar totals 41 million euros (2 percent), export refunds for value-added food products containing sugar total 183 million euros (11 percent), and aid for the disposal of raw sugar (overseas department sugar) totals 18 million euros (1 percent).

Preferential Imports

Following the UK accession in 1973, the CMO for sugar incorporated some of the UK's earlier commitments to the ACP countries. This change led to the Sugar Protocol, which opened the EU market to a cane-sugar quota from 19 ACP countries. With the addition of a separate agreement that establishes

Table 4

CMO budget for sugar and export subsidy outlays, 2004

	<i>Million euros</i>	<i>Percent</i>
Total budget for CMO for sugar	1,721	100
Total export subsidies (ES):	1,285	75
ES for ACP sugar	802	47
Refunds for chemical industry	194	11
Refining aid for cane sugar	41	2
ES for non-Annex I products	183	11
Aid for disposal for raw sugar	18	1

Source: USDA, ERS using data from CAP Monitor (2004).

an import quota of 10,000 tons of raw sugar for India, total imports under the Sugar Protocol amount to just over 1.3 million tons. These imports are exempt from duties, and the price paid to exporters is equal to the derived intervention price for raw sugar in the EU.

In addition to imports under the Sugar Protocol, the EU imports sugar under preferential terms to meet its so-called Maximum Supply Needs (MSNs), based on the capacity needs of five member states for refining raw cane sugar.⁵ Since 1995, MSNs were established for all member states, and extra sugar needs not met by production and imports under the Sugar Protocol are met by additional preferential sugar imports from India, the ACP countries, and regions within the French Overseas Department (DOM). This additional preferential sugar, totaling approximately 200,000 tons, can be imported duty free under bilateral agreements known as Special Preferential Sugar (SPS). Under the SPS agreements, exporters also receive the EU domestic price for raw cane sugar.

Since February 2001, the EU has agreed to offer progressive duty- and quota-free access to exports from 48 LDCs as part of the EBA Initiative. Access began with 74,185 tons in 2001 and will increase 15 percent annually until 2009, when free access will be allowed. The EBA Initiative ensures an increase in the flow of preferential imports into the EU, especially from low-cost countries, such as Zimbabwe, Ethiopia, Sudan, and Mozambique, as well as the possibility of implementing “SWAP” practices, which enable participating LDCs to import sugar from third countries at world prices and then export locally produced sugar to the EU. However, some in the EU question whether the EBA countries have the capacity to export significant amounts of sugar. Under the EBA Initiative, imports from eligible countries also have been counted as part of the SPS quota. EBA-eligible countries from the ACP group may choose between the EBA and Sugar Protocol agreements. Under either regime, suppliers receive the EU domestic price for raw cane sugar, but EBA countries will face no quota restrictions or duties after 2009.

In October 2007, the EU agreed to terminate the ACP Sugar Protocol by October 2009 to comply with the WTO panel ruling regarding sugar export subsidies, which includes the subsidies that went to re-export sugar from the ACP countries. The sugar arrangements between the EU and the ACP countries will depend on economic partnership agreements (EPA) that are negotiated between the EU and individual ACP countries or groups of ACP

⁵The 1.8 million tons are expressed as white sugar and are split among the UK (1.0 million tons), France (0.30 million tons), Portugal (0.30 million tons), Finland (0.060 million tons), and Slovenia (0.02 million tons).

countries. The ACP countries will be granted duty-free access on January 1, 2010, for raw sugar and sugar beets but on the same terms as non-ACP developing countries. This development means that the “SWAPS” feature of the EBA Initiative, which allows EBA countries to import sugar at world prices and then export locally produced sugar to the EU, will not be available to the ACP countries that are not party to the EBA Initiative.

The EU also has a preferential import agreement with the Balkan countries, which can export within a tariff-rate quota of 193,000 tons to the EU duty free. Also, under the Uruguay Round and as a result of the accession of Finland, Austria, and Sweden as member states, the EU agreed to a Most Favored Nation access quota covering 85,463 tons of raw cane sugar for refining, with reduced duties of 98 euros per ton for sugar from Cuba (58,969 tons) and Brazil (23,930 tons). This sugar does not qualify for a price guarantee. And, as mentioned earlier, the EU was obligated to allocate “current access” quotas of 490,000 tons to third countries to compensate for exports lost due to the accession of 10 Eastern European countries to the EU in 2004.

Import Duties

Import duties ensure that the price of imported sugar does not fall below the EU sugar price and that sugar imports from certain countries receive preferential status. It also provides for “special preferential” treatment of sugar imports from India and, starting in 2009, from the 48 LDCs as part of the EBA Initiative. Outside the preferential duties, border protection is very high and consists of two duties: one fixed and one variable resulting from the application of the special safeguard clause. The fixed duty is set at 419 euros per ton for white sugar and 339 euros per ton for raw sugar. The variable duty under the special safeguard clause is linked to the trigger price set at 531 euros per ton for white sugar and 418 euros per ton for raw sugar in the WTO Agreement on Agriculture. The EU can invoke the special safeguard clause whenever the world market price falls below the trigger price. Because the EU negotiated a high trigger price for sugar in the Uruguay Round, the safeguard clause and, hence, the additional duty have been applied consistently since 1995.

With the fixed duty and the special safeguard, the overall import tariffs on average amount to three times the world price. For example, if the world price is 250 euros per ton, the special safeguard will be 82.1 euros in addition to the fixed tariff of 419 euros, which results in a duty-inclusive import price of 751.1 euros per ton.⁶ The high degree of protection from the combined fixed tariff plus special safeguard has kept nonpreferential imports at the minimum level. This effect can be illustrated through two measures. First, the EU’s average overall duty was only 115 euros per ton in 2003 (87 euros per ton in 2002). Second, average annual imports of pure sugar at full import duty (nonpreferential) have been only 28,000 tons, compared with total imports of 1.5 million tons and the EU’s annual consumption of 12.7 million tons. Thus, nonpreferential imports equal a mere 0.22 percent of consumption and 0.19 percent of the maximum EU sugar production quota.

⁶According to Article 5.5 of the WTO Agreement on Agriculture, given the trigger price P, if the import price in CIF terms is X and $0.9P > X > 0.60P$, then the additional safeguard duty is $(0.9P - X) * 0.3$. Other formulas apply to other price ranges.

Market Implications

Sugar beet production is regulated by national quotas and a high support system, making sugar beets one of the most remunerative crops in the EU. At 4.767 euros per 100 kilograms, the basic price for sugar beets is higher than the estimated breakeven price, at which point it becomes profitable to switch to alternative crops. Breakeven prices in the EU are estimated to range from 2.5 euros per 100 kilograms (Denmark) to 4.4 euros per 100 kilograms (Finland) (Commission of the European Communities, 2005). The distribution of production via national quotas favors the partitioning of national markets and ensures that sugar beets are grown across a wide range of conditions in terms of cost efficiency, from less efficient producers, such as Finland, Italy, Spain, and Greece, to more efficient producers, such as France (with high beet yields), Belgium, Denmark, and the Netherlands (with efficient use of inputs) (see fig. 1). Even within a particular region, the production quotas limit the competitive ability of efficient producers and create barriers to their entry to the market because sugar beet producers are tied to long-term supply contracts with regional sugar processors who hold sugar quota rights.

Supply response varies with price changes and depends on marginal cost. High-cost producers, supplying only within the A-quota, will continue to produce as long as the quota rent (defined as the difference between the price received and the marginal cost of production) is positive. Producers in some regions can supply quota (A and B) and out-of quota (C) sugar to the world market at world prices. For those producers, reductions in the intervention price (and hence the producer price) will cut into the captured quota rents but will not affect production under the existing price support regime (Frandsen et al., 2003). However, this scenario may not generalize to the overall EU supply response, particularly for producers whose marginal cost is on average higher than the world sugar price, which implies that a reduction in the intervention price would affect the level of EU sugar production and not just quota rents (Gohin and Bureau, 2006).

Domestic Market Price

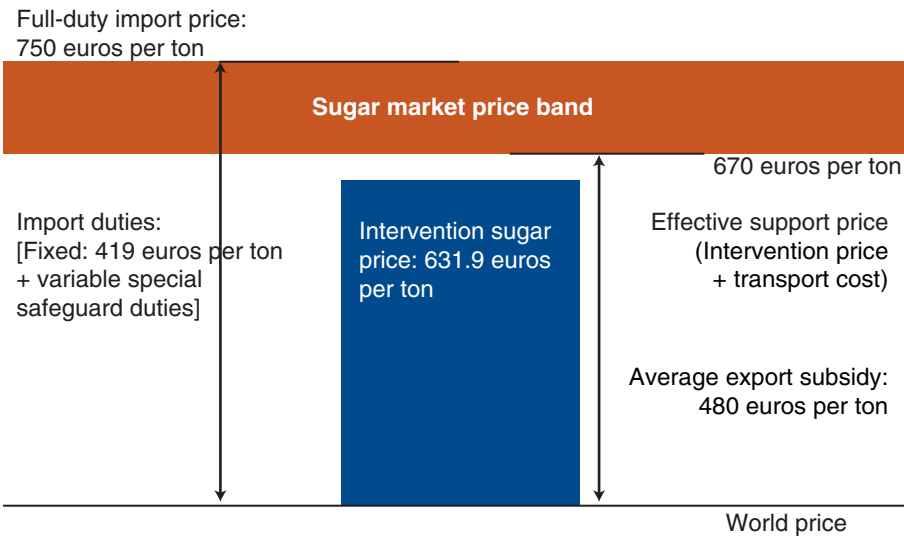
In the EU sugar regime, intervention purchases have been rare. The principal mechanisms to manage supply and demand are production quotas, import controls, and the disposal of excess supply through subsidized exports. The end result of this multilayered support mechanism has been to create a price band within which domestic market prices fluctuate (fig. 3). The availability of intervention buying at intervention prices forms the floor, while full duty-paid prices for nonpreferential third-country imports form the ceiling. Under the CMO for sugar, subsidized prices can move over an approximate range from 670 euros per ton (which represents the export price plus applicable transport costs) to 750 euros per ton (depending on the world market price). The domestic EU sugar price has typically been maintained at or around three times the prevailing world market price.

Under perfect internal competition and given excess supply, sugar prices would be driven down to or near the price-floor level (intervention price plus transportation costs). However, prices rarely deviate from the price ceiling and are consistently kept far above the intervention price. The Netherlands

Economic Institute (2000) examined price data on the sugar prices paid by industrial buyers in the EU and found that average prices in 1999 were 14 percent higher than the intervention price plus a storage levy (i.e., 743 euros per ton). Moreover, prices were high in both sugar-deficit and sugar-surplus regions, with no clear correlation between prices and supply balances. While investigating the merger between two sugar beet processors in 2001, the EU Commission found that the price level within the EU was 10- to 20-percent higher than the intervention price (i.e., ranging between 700 and 760 euros per ton). The market price for a large number of regions over several years was found to vary between 717 and 786 euros per ton, with the EU average at 746 euros per ton, according to the Swedish Competition Authority (2002) (fig. 4).

Figure 3

EU sugar price support system

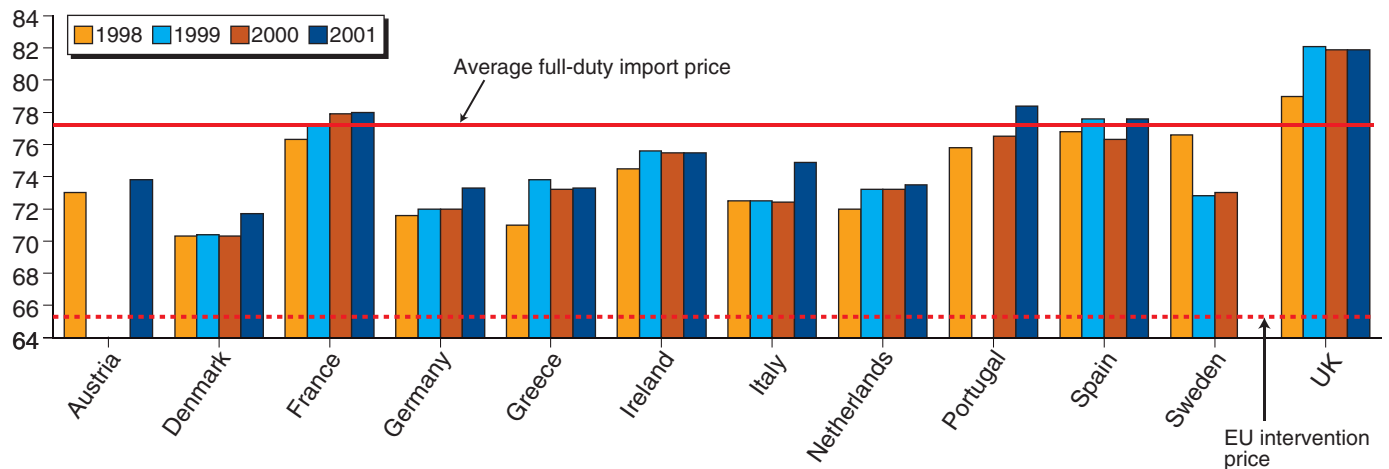


Source: USDA, ERS using data from Swinbank (2004).

Figure 4

Market prices paid by sugar users by EU member states

Market price at euro/100 kg



Source: USDA, ERS using data from AGRA Europe, EU Commission.

Sugar Industry Structure and Competition

Transport costs alone are not enough to account for the difference between observed sugar prices and expected prices under internal competition. Sweden's estimated average transportation cost is about 0.438 euros per 100 kilograms per 100 kilometers (400 kilometers is a typical distance between sugar plants in continental Europe), which is low compared with the price of approximately 70 euros per 100 kilograms (Swedish Competition Authority, 2002). An alternative explanation for the gap between market and intervention prices is the lack of competition in the sugar-processing industry and tacit collusion among firms.

Tacit collusion is a noncooperative type of collusion that does not involve any explicit communication among firms. Tacit collusion involves a restriction of output, coordination of prices, or market sharing (i.e., securing some parts of the market for certain firms) in which each firm independently or willingly engages. Each of these activities leads to an increase in price from which all firms benefit. Tacit collusion requires repeated interaction among firms, a price exceeding marginal cost that can be sustained by using the threat of retaliation in response to any attempt at competing to change the present market situation. If price is the variable that is coordinated, or if markets are shared, it is the threat of a future price war that keeps firms at the collusive equilibrium, where prices are substantially higher than marginal costs. A deviation from the collusive equilibrium is defined as a small unilateral decrease in price by one firm. A deviation lasts only as long as it goes unnoticed by other firms in the market. However, all firms are deterred from deviating by the threat of a price war during a retaliatory period, when all firms price at marginal cost and profits are low or zero for all firms. According to the Swedish Competition Authority (2002), firms in the EU sugar industry are able to charge higher prices through tacit collusion, and, thus, the exercise of collective market power without violating EU or national competition regulations.

The key factors necessary for tacit collusion to prevail are industry concentration, barriers to entry, significant transparency, and a retaliatory mechanism. In the EU-15, sugar processors are highly concentrated (see table 1). In 7 of 14 sugar-producing member states, only one firm holds the entire sugar production quota, while the remaining 7 sugar-producing member states have only a few large sugar beet processors. No clear pattern exists with respect to market structure that differs substantially across the member states. Even for countries with multiple sugar producers, such as France (15), Italy (5), and Belgium (3), prices are no lower than in countries with a single producer. The CMO for sugar has enhanced the ability of incumbent firms to sustain tacit collusion through higher market concentration. With fewer firms, it is easier for firms to determine who has deviated in order to retaliate. The CMO for sugar has maintained production in regions that otherwise would not cultivate sugar beets. By assigning quotas on a national level, the CMO for sugar has consolidated the division of national markets. Without the CMO's quota system, it would be possible to decrease concentration on the national level.

In the EU sugar market, new entry of firms is restricted because a production quota is necessary, and quotas are allocated only to incumbent firms. The tariff structure makes it difficult to import sugar from nonpreferential countries, hence preventing competition from outside the EU. Also, the CMO for

sugar has limited the possible entry of firms producing the sugar substitute isoglucose via restrictive production quotas.

Substantial transparency in the market facilitates tacit collusion. In the sugar industry, transparency refers to a firm's ability to detect whether a competing firm has deviated by offering better deals to sugar buyers (without knowing the price agreed between a supplier and a buyer). The CMO for sugar has increased transparency by separating markets geographically and fostering market sharing, thereby reducing the number of alternative suppliers.

For tacit collusion to be sustainable, threats of retaliation need to be credible (i.e., there must be some effective retaliatory mechanism that yields lower profits for all firms in the case of deviation and retaliation). In the EU sugar market, subsidized annual exports of A- and B-sugar, which average 2.9 million tons (compared with domestic sugar consumption of 12.7 million tons), provide an opportunity for retaliation by competing firms. As retaliation to an observed deviation by a firm, other firms could redirect some of their sugar normally intended for exports into the domestic market, hence starting a price war by bringing prices down to the marginal cost level (the intervention price plus transport cost). Consequently, firms are deterred from deviating by the threat of a price war during a retaliatory period, where all firms are forced to operate at marginal cost and zero profits. By assigning quotas in excess of consumption, the CMO for sugar has in effect provided an effective retaliatory mechanism.

World Sugar Markets and Prices

The EU plays a significant role in the world sugar market, accounting for 12 percent of world exports and 5 percent of world imports in 2004. On average, international sugar trade amounts to roughly 40 million tons, or 30 percent of world production. Although the leading sugar-producing countries are also the leading consumers, sugar is a widely traded commodity. Among the main features of world sugar trade are the differentiation between raw and refined sugar, the regional character of trade flows, and the existence of policies and subsidies that affect a significant portion of the sugar trade.

The differentiated nature of traded sugar derives from its two main sources: sugarcane and sugar beets. Cane sugar constitutes about 70 percent of world production (30 percent for beet sugar). Sugarcane processing has two stages. The first stage yields semiprocessed (or raw) sugar that can be transported and exported. Much of the sugar imported by the EU is in this form. Once imported, the raw sugar undergoes a second processing stage to produce a white crystal sugar (refined). Sugar beets, on the other hand, are processed domestically in a single step into crystal sugar. The EU produces mostly beet sugar, processed domestically and supplied to either domestic or international markets. The EU also re-exports excess refined sugar derived from imported raw cane sugar.

World sugar trade is also characterized by regional patterns (table 5). Australia's sugar exports to the EU-25 in 2000-02 averaged \$8 million, a small amount of the country's total sugar exports of \$799 million. The main raw/refined sugar exporters are Brazil, the EU, Central America, African producers, Thailand, and Fiji.

Most of the EU's raw sugar imports come from African, Caribbean, and Central American countries and Fiji under the Sugar Protocol (table 6a). Brazil exports raw sugar mostly to Russia, North Africa, the Middle East, and North America. For refined sugar, the top three exporters are the EU, Brazil, and Thailand (table 6b). Most of the EU's refined sugar exports go to

Table 5

Bilateral trade flow: All sugar, 2000-02

Exporter	Importer							Total
	EU-25	Japan	U.S.	Russia	N. Afr.	M. East	Other	
	<i>\$ millions</i>							
ACP	661	37	147	325	33	129	496	1,828
EU-25	0	27	18	88	327	448	788	1,696
Brazil	11	0	76	299	139	269	477	1,271
Australia	8	126	38	0	14	52	561	799
Thailand	1	121	5	42	0	36	452	657
Colombia	0	0	25	46	3	0	152	226
LDC	95	0	28	0	10	3	85	221
India	26	0	1	0	0	7	142	176
Other	382	131	476	124	65	153	1,334	2,665
Total	1,184	442	814	924	591	1,097	4,487	9,539

Note: LDC=Least developed countries. Totals reflect average over 2000-02.

Source: USDA, ERS using data from Dimaranan and MacDougall (2006) (average 2000-02).

Table 6a

Top 20 raw sugar exporters to the world and the EU-15, 2003

Exporter	Raw sugar exports			
	To world	Exporter	To EU-15	Share of world
	<i>\$ millions</i>		<i>\$ millions</i>	<i>Percent</i>
Brazil	1,350	Mauritius	298	99
Thailand	426	CARICOM	153	76
Cuba	364	Fiji	105	88
Mauritius	302	Guyana	90	72
Guatemala	212	Malawi	44	47
CARICOM	201	Cuba	33	9
South Africa	151	Belize	23	63
Guyana	125	Barbados	21	100
Fiji	120	Brazil	19	1
Colombia	107	Trinidad and Tobago	13	100
Malawi	92	Aruba	13	100
India	69	Zambia	12	39
Philippines	62	Ethiopia	10	63
El Salvador	47	Sudan	7	84
Belize	36	St. Kitts and Nevis	7	99
Zambia	31	Kenya	6	31
Costa Rica	25	Cote d'Ivoire	6	89
Barbados	21	Nepal	5	95
Kenya	20	Paraguay	3	28
Peru	19	United States	3	43
Argentina	17	Madagascar	1	99
EU-15	90	EU-15 (intra-trade)	85	94

Note: CARICOM member states include Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, Saint Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

Table 6b

Refined (white) sugar trade, 2003

Refined sugar exports			
Exporter	To world	Exporter	To EU-15
	<i>\$ millions</i>		<i>\$ millions</i>
EU-15	2836.1	EU-15	1738.7
EC-10	274.2	EC-10	152.1
Brazil	800.4	Pakistan	43.1
Thailand	549.2	United States	20.0
India	195.6	Egypt	18.4
Belarus	132.4	Cote d'Ivoire	14.8
Colombia	127.6	Canada	13.1
Canada	126.7	Brazil	10.8
Malaysia	96.7	India	9.8
Pakistan	74.3	Tanzania	8.4
United States	74.0	Sudan	6.5
South Africa	73.6	Switzerland	4.8
South Korea	71.9	Thailand	4.3
Turkey	47.4	Mexico	3.2
Kazakhstan	37.6	South Africa	3.0
Australia	34.1	Morocco	2.2
Georgia	34.0	Macedonia	2.1
Egypt	33.1	Mauritius	1.9
China	26.7	CARICOM	1.7
Singapore	24.1	Malawi	1.5

Refined sugar imports				
Importer	From world	Importer	From EU-15	Share of world
	<i>\$ millions</i>		<i>\$ millions</i>	<i>Percent</i>
EU-15	2,355.9	EU-15 (Intra-trade)	1,838.2	
EC-10	123.1	EC-10	89.8	
United States	234.3	Israel	91.2	98
Syria	150.3	Algeria	90.6	76
Indonesia	150.3	Switzerland	65.2	97
Nigeria	139.0	Norway	53.6	89
Algeria	119.1	Lebanon	40.3	97
Sri Lanka	108.6	Nigeria	39.8	29
Israel	93.0	Syria	38.7	26
Singapore	91.1	Indonesia	33.5	22
Ghana	84.3	Sri Lanka	30.7	28
Switzerland	67.2	Tunisia	30.0	65
Norway	60.6	Jordan	20.4	41
Mexico	54.0	Armenia	16.4	75
Egypt	50.7	Senegal	13.5	85
Russia	49.9	Croatia	13.1	87
Jordan	49.4	Macedonia	10.7	84
South Korea	48.4	Albania	10.1	66
Chile	46.8	Gambia	9.9	57
Tunisia	46.2	Romania	9.0	30

Source: USDA, ERS using data from COMTRADE.

other parts of Europe, the Middle East, North Africa, and, to a lesser extent, Africa and, much less, Asia. Brazil also exports heavily to the Middle East and Africa. However, neither the EU nor Brazil dominates in Asian markets, which source most of their sugar needs regionally, notably from Thailand and Australia.

Sixty percent of world sugar trade takes place under long-term contracts, preferential agreements, and subsidies, while only 40 percent trades at world market prices. Within this global sugar situation characterized by residual demand, differentiated raw/refined sugar markets, and regional trade patterns, the EU plays a significant role in influencing world prices, particularly for white sugar, mostly due to large quantities of subsidy-enabled sugar exports. Of the 21.3 million tons of white sugar exported worldwide, the EU exports over 6.4 million tons, a large share of which benefits from export subsidies, which tend to put downward pressures on prices.

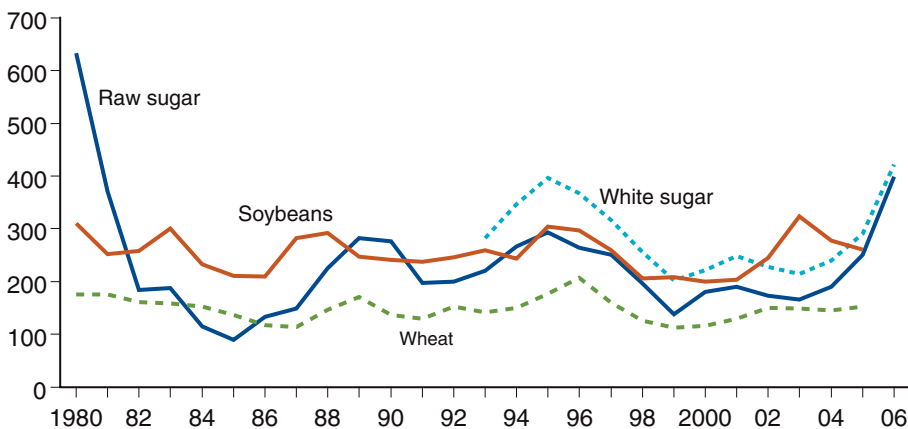
Protectionist policies and subsidies also contribute to the volatility of world sugar prices (fig. 5). For example, raw sugar prices tripled from 1985 to 1989 and more than doubled between 2003 and 2006, compared with much lower price variations for wheat. Given the high degree of intervention in the sugar market, international prices tend to be extremely volatile, following an erratic path. Factors accounting for the inherent volatility of the world price of sugar include the perennial nature of sugarcane production, the high cost of switching to alternative crops, and limited possible options for sugar beet producers due to complex capital investments, transport, and processing. Such investments require stable output even when prices are low, hence, exacerbating excess supply. Variations in exchange rates, which may mask world price signals, coupled with high levels of government support and trade protection, also contribute to world market prices that are sometimes even lower than the marginal cost of the most efficient producers (OECD, 2005).

Since 1995, world sugar prices have trended downward, mainly due to an excess of production over consumption. During the 1990s, monthly world prices for raw sugar fluctuated between 280 euros per ton (March 1990)

Figure 5

World sugar and commodity prices

Dollars per ton



Source: USDA, ERS (2006).

and 110 euros per ton (April 1999). From their low point in 1999/2000, prices improved over 2000/01, reaching an average of 240 euros per ton. By the following year, prices had declined again to 180 euros per ton. Since 2003, however, sugar prices have increased, largely driven by high oil prices and the sharp increase in ethanol-related sugar demand. The strong co-movement between rising crude oil and sugar prices also is tied to the close link between ethanol and sugar production in Brazil, the world's largest sugar producer (20 percent of the world's total) and exporter (38 percent of the world's total). Any increase in gasoline prices stimulates Brazilian domestic demand for ethanol, reduces sugar exports, and raises sugar prices. In the short run, at least, world sugar prices likely will be tied to developments in the ethanol market.

The 2005 Sugar Reform

The EU Commission issued a draft proposal for sugar reform in July 2004 that was subsequently revised following the WTO ruling on EU export subsidies. A revised reform package was proposed in June 2005, endorsed by the Council of Ministers in November 2005, and formalized by the EU Parliament (January 19, 2006) and later by the Council of Ministers (February 22, 2006). The stated aims of the reform are (1) to encourage reductions in domestic sugar output, particularly in regions with high production costs or lower sugar beet yields; (2) to bring export subsidies in line with WTO commitments; (3) to dampen incentives for EU sugar imports from the EBA countries; and (4) to reduce the price gap between sugar and competing sweeteners to forestall the substitution of sugar.

The new elements of the new sugar regime, which took effect on July 1, 2006, include lower price support, a rationalization of the production quota system through a voluntary buyout scheme, and compensation for farmers paid through the Single Farm Payment (SFP), a fixed producer payment based on historical aid entitlements, which is a key feature of the new CAP regime. The main elements of the reform, summarized in table 7, are as follows:

- The intervention price for sugar is cut 36 percent (from 631.9 euros to 404.4 euros per ton) over 4 years, beginning in 2006/07 (minimum sugar beet price is reduced 39.5 percent to 263 euros per ton).
- In exchange for cuts in support prices, farmers will receive direct compensation at an average of 64.2 percent of the price cut. The aid is included in the SFP (and, hence, partly decoupled from production) and is linked to compliance with a set of environmental and land management practices. Farmers in those countries giving up at least 50 percent of their quota receive an additional coupled payment (i.e., linked to production) of 30 percent of the income loss for a maximum of 5 years, plus possible limited national aid. In addition, sugar beets qualify for set-aside payments when grown as a nonfood crop (i.e., sugar beets for nonfood use may be grown on set-aside area) or may receive the energy crop aid of 45 euros per hectare.
- The current quota system is rearranged by merging A and B quota into a single production quota totaling 17.4 million tons for the EU-25. To maintain a certain level of production in the current C-sugar-producing countries, an additional amount of 1 million tons will be made available as new quota (plus 100,000 tons for other countries) to be purchased with a one-off payment of 730 euros per ton. Moreover, a production charge of 12 euros per ton is imposed on producers for all quota production. Production quotas exclude sugar for chemical, pharmaceutical, and ethanol production.
- To encourage the buyout of quotas, a voluntary restructuring scheme is in place for 4 years and covers EU sugar factories and isoglucose and inulin syrup producers. The scheme involves buying out quota from sugar processors and encouraging factory closures. The payment is 730 euros per ton in years 1 and 2, falling to 625 euros per ton in year 3 and 520

Table 7

Key elements of the EU's 2005 sugar reform

Item	Previous policy regime	Policy change under reform
Production quotas	National allocation of quotas; A and B quota (17.441 MT); (industrial sugar excluded)	Merging A+B; quota buyout over 4 years
Overquota sugar ("C-sugar")	Solely for exports; subject to declassification/carryover	C-sugar cannot be exported; penalty with super levy
Quotas for sugar-substitute	Isoglucose (500,000 tons), inulin (300,000 tons); no intervention	Isoglucose quota increase by 403,000 tons
Intervention price	White sugar: 631.9 euros per ton; minimum sugar beet price 46.72 euros per 100 kilograms (A); 32.42 euros (B)	Intervention becomes reference price for triggering private storage aid; 36 percent cut over 4 yrs
Intervention purchases	In place; rarely used (1987, 2005)	Phased out in 4 years
Excess supply management	Private storage subsidies	Private storage/carry forward to next year quota
Farm payments	None	64 percent of price cut; included in Single Farm Payment (new CAP)
Set-aside	None	Set-aside + energy use subsidies
Export subsidies	A+B sugar; re-export processed ACP sugar	Reducing export subsidies to WTO limits—Via lower production; no exports of C-sugar
Preferential imports	ACP/India "Sugar Protocol"; Special Preferential Sugar; EBA Initiative; Balkan TRQ; MFN quota access	No change
Duties/Special safeguards	High fixed overquota tariff/Special safeguard duty	No change

Source: USDA, ERS.

euros per ton in the final year. An additional diversification fund is set for member states where quota retirement is larger than expected. Both payments will be financed by a levy on quota holders lasting 3 years. The first-year levy is equal to 126.4 euros per ton; the second-year levy, 173.8 euros per ton; and the third-year levy, 113.0 euros per ton. The isoglucose levy is fixed at 50 percent of these rates. To discourage production outside quota (C-sugar), a prohibitive "super levy" is applied to over-quota production.

- Even though the quota release will be handled under a voluntary scheme, the production quota for 2006/07 was temporarily cut by 2 million tons, or 11 percent, to prevent overproduction.
- Supply management tools include both old and new mechanisms. A key change is the 4-year phaseout of the intervention system, which is replaced with a reference price. Intervention purchases will not be available after the transition period. Instead, supply management will rely mostly on a private storage system when the market price falls below the

reference price. Other available supply management tools include the option to carry forward quota overrun to the following marketing year, temporary quota withdrawal, or use of excess production for industrial products or for supplying the outermost regions of the EU. However, no exports of declassified sugar (C-sugar) are permitted under the new regime.

- For nonsugar sweeteners, a quota increase for isoglucose of 403,000 tons for the existing producer companies is being phased in over 3 years. This measure includes the option to purchase extra isoglucose quota in Italy (60,000 tons), Sweden (35,000 tons), and Lithuania (8,000 tons) at the restructuring aid price set in the first year at 730 euros per ton.
- The border protection regime did not change, aside from reducing exports and subsidies to WTO limits and maintaining the existing international import commitments. Nonpreferential import duties (including the special safeguards) are not affected by the new regime. Only a new WTO agreement from the current Doha Round of negotiations would affect these import policy instruments.
- In September 2007 (AgraEurope, 2007), the EU agreed to changes in the sugar-restructuring plan to encourage removal of EU sugar quota by offering higher buyback payments to beet growers while shielding refiners from receiving any less than 90 percent of the buyback payment. However, growers can apply directly to the Commission for 237.5 euros per ton payment as long as the renounced quota does not exceed 10 percent of the refiner's total quota. Also, factories that give up quota in 2008/09 will be reimbursed for the restructuring levy they paid in 2007/08. By the end of 2007, sugar producers had renounced 1.56 million metric tones of quota, more than twice that of the previous year.

What then are the likely impacts of the EU sugar reform on supply, demand, and prices in the EU? How are sugar imports from both preferential and nonpreferential sources likely to change? And, what are the likely effects on world sugar prices, if any, that would arise from the reforms?

Reform Assessment

An examination of the current market reveals some indications of the potential effects of the EU sugar reforms. While the new regime represents a significant departure from existing policies, many of the support instruments are still in place, which has the potential to limit the extent to which the goals of the reform can be achieved. Even with cuts in support prices and incentives to renounce quota, sugar crops may still be more attractive to growers than the alternatives. Moreover, high import barriers will continue to shield the domestic sugar industry. The inability of quota holders to trade quotas across member states may restrict the degree of industry adjustment toward greater cost efficiency. In addition, the new policy continues to limit substitutions between sugar and alternative sweeteners, as the new isoglucose production quotas are still highly restrictive.

The new provisions of the EU sugar regime are expected to alter the EU sugar market. According to EU Commission estimates, restricting EU sugar exports to comply with the WTO panel ruling alone will require a reduction in EU sugar production of around 2 million tons per year. High-cost regions such as Greece, Ireland, Italy, and Portugal would take the brunt of the reduction, while low-cost regions could increase production, depending on the restructuring component of the proposal. France, Germany, the Netherlands, Belgium, and the UK have been the largest producers of over-quota sugar. Nonetheless, regions within these countries are likely to see sugar production decline because of high production costs and/or inefficient processors.

Regarding trade, while the EBA countries are expected to increase sugar shipments to the EU after 2009, there is some uncertainty about the expected volume of imports from these countries. Because of the “SWAPS” provision in the EBA Initiative, EBA countries would be able to import sugar at world prices and then export locally produced sugar to the EU. Even with lower intervention prices under the reform, some in the EU sugar industry doubt that the EBA countries will be able to export raw sugar to the EU profitably at the lower intervention prices. Under the reform, ACP countries within the LDC group (i.e., Malawi, Zambia, and Zimbabwe) have the potential to offset losses in their current quota exports to the EU by increasing their export volumes under the EBA Initiative (Chaplin and Matthews, 2006).

Outside the EBA countries, the reduction of intervention prices will have adverse effects on the ACP countries, which enjoy preferential access to the EU’s high-priced sugar market. Moreover, any gains by preference-receiving countries due to higher exports under higher world prices (due to the EU reform) will depend on the proportion of their exports to non-EU countries and the extent to which their exports benefit from preferential agreements with other countries. Among non-LDC ACP countries, the adverse effects would be greater for high-cost producers that depend heavily on the EU for their sugar exports, such as Mauritius, Fiji, and Guyana. These countries, having had secure market access to the EU, lacked the incentives to improve their competitiveness, leading to high production cost structures over time (Larson and Borrell, 2001). In October 2007, the EU scrapped the ACP Sugar Protocol (AgraEurope, 2008) as a part of the economic partnership

agreements (EPA) that would inter alia reduce tariffs on raw sugar to zero by the end of 2009.

The trade implications of the EU reform are ambiguous outside preferential trade. On the import side, little change is likely given the unchanged high import barriers (outside preferential access). The EU sugar reform, therefore, may have a limited effect on competitive sugar suppliers currently excluded from the EU market. The implications of the reform may be felt more via effects on world prices. A key determinant is the extent of the sugar price rise, as the EU withdraws a significant share of refined sugar exports from the world market. Higher prices for refined sugar may adversely affect importing regions but may benefit competing sugar exporters. Such price effects are unlikely to be neutralized by raw sugar exporters, such as Brazil, as it faces greater demand for sugar by domestic ethanol producers, further contributing to higher world sugar prices.

The reform is expected to alter EU sugar production significantly. However, the key issue of whether domestic sugar prices will follow cuts in intervention prices hinges largely on whether the reforms can weaken the industry's ability to engage in tacit collusion in sugar pricing. The tendency toward the consolidation of processors is likely to reinforce market power within the industry and strengthen oligopolistic and tacitly collusive behavior. As such, market prices may not fall as much as the scheduled reduction of intervention prices might imply. A decrease in the intervention price alone would have no effect on concentration, transparency and entry into sugar processing, or import barriers.

A reduction of export subsidies in compliance with WTO constraints would also make collusion easier to sustain. Under this scenario, low-cost firms still can export at a profit (through lower quantities as profits are reduced from lower subsidies), while high-cost firms reduce their output by the amount previously exported. Because the majority of the EU's sugar-producing firms are likely to belong to the low-cost category, a reduction in export subsidies will have the effect of lowering output (from exiting high-cost firms) and may, in fact, increase the incentives for tacit collusion. With lower profits from exports, low-cost firms have a greater incentive not to deviate from tacit collusion because the profit loss under retaliation from domestic sales is now proportionally higher (Swedish Competition Authority, 2002).

The effect of a quota reduction on tacit collusion is indeterminate, particularly if the reduction is proportional to all firms. Since it is more profitable for firms to sell sugar to the domestic market than to export, the quota reduction reduces the amount of sugar available for exports. Hence, both the ability to deviate and the ability of competing firms to retaliate (by shifting export quantities to domestic sales) are weakened. If the quota reduction results in fewer quota holders within the EU, concentration will increase, and as a result, tacit collusion may be facilitated.

The effect of quota tradability on tacit collusion depends on the extent of firm concentration. If the tradability of quotas among regions (or states) leads to increased firm concentration, then the effect on tacit collusion will be indeterminate because the increase in collusive profits will counteract the lessened ability to divide markets among firms. If, however, quota tradability reduces

concentration through new firm entry, then tacit collusion will be reduced, through both the reduction of collusive profits and the lessening of the ability to divide markets among firms.

Certain policy changes not included in the new reform could have had the effect of weakening the industry's collusive behavior and, more significantly, altering the economics of EU sugar. For example, lower import tariffs would reduce both the incentives for tacit collusion and the market price, and introduction of the ability to trade quotas across member states would make tacit collusion harder to sustain. Furthermore, unrestricted production of HFCS (isoglucose) would make collusion difficult to sustain in markets where HFCS is a substitute. However, as these policy instruments are not part of the sugar reform, the net effect of the reform on the industry's competitive behavior and producer incentives is unclear.

A Multi-Model Economic Analysis

A properly specified quantitative model of the EU sugar regime must reflect the regime's key features: production quotas, price support, export subsidies, and import policies, including preferential import agreements. No single model can adequately capture all of the subtleties of the EU sugar regime. This analysis applied three economic models and focused on their distinctive features to provide a richer assessment of the EU sugar reform (see box, "Descriptions of the Models"). A partial equilibrium (PE) model called the Partial Equilibrium Model of Agricultural Trade (PEATSIM), which captures in detail many policy instruments of the EU's sugar sector and the CAP, projected likely changes in EU production, consumption, net trade, and prices. A second PE model called the U.S. Sugar and Sweetener Model, which allows for substitution between sugar and alternative sweeteners, generated detailed analysis of the U.S., Mexican, and EU sweetener industries. Finally, a special version of the global computable general equilibrium (CGE) model created by the Global Trade Analysis Project (GTAP) was used to account explicitly for bilateral trade, tariff rate quotas, export subsidies, and imperfect competition in the sugar industry. This multimodel approach enabled a broader examination of the EU sugar reform than could be obtained from any of these models individually.

Partial Equilibrium Analysis

The PEATSIM model was used to compare the EU sugar "reform scenario" with an alternative "status quo scenario" of no reform. Under the reform scenario, the intervention price is cut by 36 percent, the production quota is cut by 15 percent, and exports are cut by 53 percent to represent the removal of C-sugar exports. Under the status quo scenario, the expected impact of EBA imports induces lower domestic market prices, resulting in a downward adjustment of the producer price by 11 percent. The model baseline under both scenarios was run from 2004 to 2009. Results are shown in table 8.

Under the reform scenario, model results show that the combined effect of cuts in the intervention price and production quotas will yield a 17.3-percent contraction of EU sugar output by 2009 (compared with the status quo scenario), while consumption will rise by 7.68 percent over the 5-year period (compared with the status quo), or 1.53 percent annually. Consumer prices will fall 28.8 percent, compared with the status quo (see table 8, difference between third and fifth column). Under the reform scenario, the supply-demand balance will be reversed, with production declining and consumption increasing such that domestic consumption exceeds production. Since exports are exogenously cut relative to the base year to reflect the removal of C-sugar exports, imports will need to expand to 5.1 million tons (compared with the status quo), or 113.5 percent, to balance available supplies and demand. However, as the model computes only total country trade, these imports are not separated between EBA and non-EBA sources.

Results from the U.S. Sugar and Sweetener Model feature a larger production response (-34.3 percent by 2010) under the reform scenario, compared with that of the status quo case.⁷ This higher level of output contraction is due to the irreversible loss of production capacity once prices fall below variable

⁷Results from the U.S. Sugar and Sweetener Model are taken from Haley (2006).

Description of the Models

PEATSIM

PEATSIM is a PE, multicommodity, multiregion agricultural trade model (Stout and Abler, 2003). With a net trade specification, the model sets a region to be either a net importer or a net exporter. In this case, ERS treats the EU as a net sugar importer since researchers are most interested in import responses to the EU sugar reform and since exports are set exogenously to be reduced as part of a policy change. Sugar production in the model is handled on a raw sugar equivalent basis, and since preferential agreements are not explicitly addressed, production is adjusted to include preferential imports (from the ACP countries, India, and the Balkans). The model specifies a support price in the form of a reference price treated as an intervention price. For the import regime, import tariffs are based on two-tier tariffs using the ad valorem equivalent of specific tariffs. Under the EU policy reform, sugar farm payments equivalent to 64.2 percent of price cuts are introduced into the model starting in 2006 and treated as decoupled payments. This means that the payments are not expected to affect production decisions. Following the 2003 CAP reform, set-aside payments are ignored, given that their reallocation is linked to all arable crops (and not just grains and oilseeds, as was the case before the 2003 CAP reform). Therefore, one would expect little influence on production patterns.

For supply management, the model is initially set so that the quota is equal to beginning production. To model the impact of the reforms besides cutting the intervention price by 36 percent, the future target production quota is set to balance consumption, preferential imports, and WTO-permitted exports. For the production quota, a phased quota reduction is implemented in the reform scenario from 2006 to 2010. The desired quota level in 2010 is determined by taking into account the EU's WTO export commitment, preferential imports, and domestic consumption. Therefore, in the reform scenario, a target production quota cut is induced in line with the EU Commission's decision to cut quotas by 15 percent for 2006/07, which aims to achieve the supply-demand balance. Moreover, the model scenario "restrains" exports by preventing C-sugar from being exported, thus implicitly accounting for EU compliance with the WTO ruling on export subsidies.

U.S. Sugar and Sweetener Model

The U.S. Sugar and Sweetener Model is a PE model with greater detail on sugar and sweetener production, supply, and demand (Haley, 2006). The model is specified for the United States and Mexico and extended to the EU, with the rest of the world as a residual. The model is initialized to a 2003 base and generates yearly baseline projections to 2015. The model covers sugar, substitute sweeteners (high fructose corn syrup or high fructose syrup), and the primary sugar crops (cane sugar and sugar beets). Effects of policy changes, such as the EU sugar reform, can be compared with the model's baseline.

The EU component of the model includes the intervention/reference price and sugar and isoglucose production quotas. Because the model does not permit bilateral trade flows, preferential imports (from ACP, EBA, and Balkan regions) are treated as a composite, while over-quota sugar imports are subject to over-quota tariffs. The EU sugar and isoglucose supply response to policy changes is modeled via a logistic function that determines changes in processing capacity and, hence, production. Area planted with sugar beets has been stable because EU sugar policies limit the linkages between the world price and domestic production and given the inelastic response of price changes to planted areas and consumption. Policy-induced production change is modeled as follows. Based on estimates of sugar and isoglucose variable costs, the simulation-induced drop in producer returns (to or below the variable cost level) leads to an irreversible reduction of processing capacity by 50 percent relative to the base period. As processing capacity exits, sugar beet area devoted to that capacity exits as well.

GTAP

The applied general equilibrium model GTAP (Hertel, 1997) is a multiregion, multisector global model of production and trade that follows the standard theoretical specifications of CGE trade models. This analysis uses a special version of GTAP that deals with imperfect competition and the oligopolistic behavior of firms (Francois, 1998; Elbehri and Hertel, 2006). The model distinguishes between the sugar industry and the sugar

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beet/sugar cane crop sectors. Given the market structure of the sugar industry and its collusive practices, sugar processing is modeled under oligopolistic competitive behavior with increasing returns to scale. This allows the model to separate cases with or without firm entry or exit and, hence, enables separate assessments of production adjustments at the firm and industry levels.

In this analysis, only the sugar industry is treated as oligopolistic with scale economies, while other sectors are assumed to be perfectly competitive. Calibration of the oligopoly model and scale economies for the sugar industry was based on sugar manufacturing data using firm-level sugar production and deriving the Herfindhal index for all EU countries that produce sugar. The maximum-derived Herfindhal index (estimated for Portugal) was also applied to the remaining member states that operate a single plant (firm). To calibrate the Cournot model, Herfindhal indices and the model-conformable benchmark number of firms were combined with the perceived demand elasticity for each sector. (For a detailed description of GTAP's oligopoly specification, see Elbehri and Hertel, 2006.) The benchmark price-cost margins (markups) are derived for the imperfectly competitive sectors using GTAP trade shares and the model's elasticities of substitution. These markups are consistent with positive profits in the benchmark data set. Model implementation also requires the calibration of a cost disadvantage ratio (CDR) reflecting unexploited economies of scale. The CDRs for the EU were taken from Harrison, Rutherford, and Tarr (1994). Data for non-EU regions are reported by Roland-

Holst, Reinert, and Shiells (1994). The scaled ratios are reported in table 4 and range from 0.016 for the EU to 0.001 for non-EU regions.

Sugar production in the EU is also constrained by quota limits. The sugar production quota is modeled under a complementarity condition allowing for endogenous regime change from binding to nonbinding with associated quota rents (under binding quotas) expressed as a tax equivalent. The model does not separate between quota (A and B) and nonquota (C) sugar. Rather, the model takes into consideration the share of C-sugar in total sugar production in setting the initial degree of quota binding status. Except for Italy, all 13 EU regions start from a binding quota position.

Sugar is treated on a raw sugar equivalent basis, and the sugar import regime is modeled as a system of bilaterally allocated import quotas following the Armington specification. The model includes 28 regions, 14 of which are EU regions (Belgium, Denmark, Germany, Spain, France, Italy, the Netherlands, Austria, Poland, Sweden, the UK, Hungary, Czech Republic, other EU) and 14 non-EU regions (United States, Canada, Mexico, Brazil, China, India, Australia, Thailand, ACP, LDC, Mediterranean, Central America, other Asia, and rest of world). Preferential imports are treated via bilateral tariff-rate quotas for a specific set of partners (ACP, India). Moreover, these preferential exporters are assumed to capture the quota rents to mimic the fact that these countries receive guaranteed prices equivalent to domestic prices.

costs.⁸ The analysis assumes that EBA sugar exports to the EU will grow to 1.5 million tons by 2015, the end of the projection period. However, as the model calculates net trade balances, import flows are not separated between preferential and nonpreferential sources. Despite an 11.6-percent decrease in the price (compared with the status quo case), EU sugar consumption will increase modestly (by about 470,000 tons, or about 2.8 percent, over the period 2007-10). EU-25 sugar exports fall to insignificant levels by 2010 and remain at or below WTO commitment levels through the end of the projection period. Similar to the PEATSIM results, the U.S. Sugar and Sweetener Model results show that imports will increase 91 percent by 2010 to equalize prices across the EU-15 and the new member states.

The world sugar price will rise 8 percent by 2009 under the PEATSIM reform scenario and 15 percent by 2010 under the U.S. Sugar and Sweetener reform scenario. The larger price effect under the latter model arises from that model's much larger decline in production and, particularly, in exports.

⁸The model specifies asymmetric production responses to sugar price changes. This means that processing production capacity reductions are irreversible—closed factories do not re-open.

Table 8

Comparing EU reform to status quo: EU production, consumption, trade, and trade effects

Item	Base year*	Reform scenario	Change from base	Status quo scenario	Change from base
PEATSIM results (2009)					
	<i>Million tons</i>		<i>Percent</i>		
Production	20.6	17.0	-17.3	20.6	0.0
Consumption	18.4	20.0	8.9	18.6	1.2
Exports	4.4	2.0	-53.1	4.3	-1.5
Imports	2.4	5.1	113.5	2.4	-0.7
	<i>Dollars per kg</i>		<i>Dollars per kg</i>		
Producer price	0.6	0.4	-39.2	0.6	-10.6
Consumer price	0.6	0.4	-39.3	0.6	-10.5
Export price	0.6	0.4	-39.3	0.6	-10.5
Import price	0.6	0.4	-39.3	0.6	-10.5
World price	0.2	0.2	8.0	0.2	-1.5
U.S. Sugar and Sweetener Model results (2010)					
	<i>Million tons</i>		<i>Percent</i>		
Production	22.2	14.6	-34.3	21.6	-2.7
Consumption	16.1	16.7	3.7	16.2	0.9
Isoglucose consumption	0.6	0.7	7.8	0.5	-24.9
Exports	6.0	0.2	-97.0	8.1	36.4
Imports	2.1	4.0	91.9	2.9	37.1
	<i>Dollars per kg</i>		<i>Dollars per kg</i>		
Producer price	0.7	0.4	-37.7	0.5	-26.1
World price	0.2	0.2	15.0	0.2	-15.0

* Base period is 2004 for PEATSIM and 2003 for the U.S. Sugar and Sweetener Model.

Source: USDA, ERS.

The significant drop in exports will reduce the supplies available on the world market. These responses are broadly comparable with those reported in other studies that use PE models, as shown in table 9. For example, Andino, Taylor, and Koo (2005) found that the combination of a 33-percent cut in the intervention price and a 15-percent cut in the production quota for EU sugar boosted the world sugar price by 14.5 percent.

Still, these magnitudes of world price increases from a unilateral EU sugar reform need to be viewed as upper-bound limits for several reasons: the price-inelastic nature of sugar markets on both the supply and demand sides; the simplifying assumption, typical of PE models, that sugar is a homogeneous good and of the same quality across suppliers and countries; and the likelihood that world price hikes will be short-term adjustments because higher prices will trigger incentives to increase sugar production, which in turn will place downward pressure on the world price. Moreover, additional dynamic effects that arise from new investments in sugar processing, along with industry rationalization and consolidation, contribute to enhanced cost efficiency and hence affect cost-price relationships.

Table 9

Recent studies on EU sugar reform

Study	Model configuration	Modeling approach	Scenarios	Main findings
Conforti and Rapso-manikis (2006)	COSIMO-AGLINK (PE); 56 regions; raw/white sugar, beet/cane sugar	Evaluation of reform and the EBA initiative on world markets	(1) Baseline 2003-13; (2) reform = 39% IP cut	5% rise in world price; lower revenue for ACP countries despite export rise; EBA exports rise threefold
El-Obeid and Beghin (2005)	CARD Sugar Model (PE); 29 regions; sugar (raw equivalent); beet/cane sugar	Removal of production and trade distortions for sugar for all countries (supply and consumption are price inelastic)	(1) Free trade (FT); (2) = (1) + removal of production subsidies; (3) = (2) + consumer distortions	FT leads to 27% higher WP; FT + no domestic distortions lead to 48% WP rise by 2012; moderate rise in aggregate trade
Andino, Taylor, and Koo (2005)	World sugar model (PE); 17 regions; sugar (raw equivalent)	EU sugar reform (cut in IP and PQ) and Doha Development Agenda (DDA) effect on U.S. sugar	(1) Baseline; (2) partial EU reform (IP cut; PQ cut); (3) 4 country reform under DDA; (4) EU reform plus 20% tariff cut; (5) 20% import quota rise for China	EU reform increases world price; no U.S. effect; WP rises by 14.5%; under DDA, reform WP rises by 39%
Gohin and Bureau (2006)	Static single-region CGE model for food and agriculture for EU; 18 crops, 28 livestock commodities	In-quota and over-quota beet and sugar are distinct products; sugar is homogenous; quotas rents to exporters	(1) Baseline; (2) July 2004 EU reform + removal of export subsidies	Production falls by 10%; C-Sugar eliminated; beet prices fall (59%) more than sugar; little sugar-isoglucose substitution; removal of export subsidies means no imports of MFN-access and GSP but ACP countries not affected
Van Berkum, Roza, and Tongeren (2005)	GTAP-derived model (CGE); 12 regions; 7 commodities	Revised land allocation; labor and capital segmented between agricultural and nonagricultural sectors; production quota; bilateral TRQs; sugar processing under imperfect competition; matching drop in market price with cut in export subsidies	(1) EBA Initiative; (2) EBA + July 2004 reform (beet quota cut by 16% (from 17.4 to 14.6 tons); compensation payments (transfer to sugar output; beet value added); cut in IP by 33%	Little increase in EBA imports (384,000 tons less than 2.8 million tons by European Community); mild growth of exports by ACP; modest gains for Brazil; 37% drop in exports

Notes: PE = partial equilibrium; CGE = computable general equilibrium; WP = world price; IP = intervention price; PQ = production quota; TRQ = tariff-rate quota.

Source: USDA, ERS.

General Equilibrium Analysis

Key differences exist between PE models and CGE models. In a CGE model, there is explicit recognition of finite resources in markets for land, labor, and capital. In doing so, there is an opportunity cost associated with a farm subsidy, where subsidizing one sector comes at the expense of other sectors because of competition for fixed resources. The PE approach introduces upward-sloping supply schedules to acknowledge higher costs as output expands. Another major difference is that in a PE model there is no link

between sources and uses of income, which means there is no explicit budget constraint for the household that is tied to returns to factors. In a CGE model, it is possible to track transfers to the household for a given subsidy. Thus, the CGE approach can provide a different perspective for welfare implications of policy reform. In addition to these general differences, the GTAP Model offers specific treatment for bilateral trade between all partners. This allows for analysis of preferential and bilateral free trade reforms.

A set of scenarios was constructed to illustrate the likely impacts of different reform approaches for the EU sugar program.⁹ The first scenario (table 10) implements the EBA Initiative, whereby the EU removes tariffs and quota restrictions on all imports from LDCs. The second scenario, Reform1, implements the EU reform package of November 2005, in which domestic prices are allowed to fall below an existing administered sugar price as a result of cuts in border measures for EU sugar exports and imports. The export subsidy rate is cut by 20 percent to bring subsidized exports within WTO limits. Scenario Reform1Q implements these changes plus the 15-percent production quota cut. This scenario is closest to the reform scenarios in the PEATSIM and U.S. Sugar and Sweetener Models. Finally, scenario Reform1QE reruns Reform1Q by allowing for imperfect competition in the domestic sugar industry. EU sugar processors operate with fewer firms having market power, hence enabling a separate assessment of firm-level versus industrywide adjustments to the EU reforms. All the scenarios were modeled to generate medium-term static effects assuming exogenous total fixed supply of land, labor, and capital, but with factors mobile across sectors. Hence, any changes in sugar production came strictly from the reallocation of existing land within agriculture.

Impacts of the EBA Initiative—Implementation of the EBA Initiative (scenario EBA) will result in a rise of LDC sugar exports to the EU of about \$404 million (473 percent), compared with the base. However, as the initial level of this trade was small to begin with (\$88 million), the effects on EU sugar production will be minor (a decrease of less than 1 percent, compared with base). Under this scenario, the impact on third countries also will be small as the trade restrictions against non-EBA partners are unchanged.

⁹An updating procedure was applied to the initial GTAP database (version 6.5) to change the base year from 2001 to 2004 using actual GDP and population growth rates for all countries in the world.

Table 10

GTAP Model scenarios

GTAP Model scenarios	Policy change	Sugar market assumption	Starting database
EBA	Elimination of tariffs from LDCs		2005, EU-25 enlargement
EBA-S	Same as EBA	High product differentiation	
EBA-B	Same as EBA	Low product differentiation	
Reform1	Export subsidy rate cut by 20 percent Import tariff cut by 36 percent Intervention floor price allowed to fall	Perfectly competitive industry	2005, post-EBA
Reform1Q	Reform1, plus production quota cut by 15 percent	Perfectly competitive industry	
Reform1QE	Same as Reform1Q	Imperfect competition	

Note: Export subsidy rates in GTAP are derived based on the total value of exports and the total value of subsidy outlays as reported to the WTO for the same period; for the EU, this is adjusted to take into account subsidies for ACP sugar not reported to the WTO. Product differentiation assumption is governed by trade elasticities

Source: USDA, ERS.

Some trade will divert from non-LDC ACP countries to the benefit of the LDCs, and countries restricted from exporting to the EU, such as Brazil, will manage to channel some additional sugar exports to the EU via the LDCs (table 11).

Since this analysis does not account for the possibility of additional production by the LDCs in response to the EBA Initiative, which was a motivating factor behind the reform initiative, some uncertainty exists as to the expected new flow of sugar from the LDCs to the EU. A sensitivity analysis helped address this uncertainty, focusing on a key variable affecting the responsiveness of export demand to policy change. This sensitivity analysis varies the Armington trade elasticity of substitution, which reflects the degree of production differentiation in sugar trade. The EBA scenario was rerun using

Table 11

GTAP Model results: EU reform and changes in bilateral trade flows

Base data								
	Total initial exports	of which to:						
		EU-25	ACP	LDC	Mediterranean	U.S.	South Asia	Others
<i>Million dollars</i>								
EU-25	1,662.7	1,299.1	13.1	40.1	70.0	33.0	61.2	146.2
ACP	2,337.1	924.0	155.9	67.8	62.5	175.8	210.5	740.6
LDC	217.7	88.4	5.1	84.3	8.5	22.2	2.7	6.5
Brazil	1,723.9	29.2	13.7	95.3	313.5	74.6	109.9	1,087.8
C. America	944.2	31.9	41.9	9.3	9.7	239.7	119.2	492.5
India	241.5	43.4	0.3	28.6	8.9	2.7	37.2	120.5
Australia	852.2	0.7	3.1	0.0	32.2	51.1	535.6	229.5
Thailand	625.7	5.2	0.3	33.6	0.3	13.7	432.0	140.6
Others	1,537.6	435.2	23.6	25.9	63.9	337.6	272.6	378.9
World	10,142.6	1,557.0						
Scenario EBA: Implementation of EBA for LDCs								
	Total initial exports	of which to:						
		EU-25	ACP	LDC	Mediterranean	U.S.	South Asia	Others
<i>Million dollars</i>								
EU-25	3.7	-22.2	0.9	4.6	5.7	1.4	3.6	9.5
ACP	-96.2	-100.3	-0.2	2.3	0.1	0.5	0.4	0.9
LDC	402.7	404.0	-0.2	0.1	-0.3	-0.7	-0.1	-0.2
Brazil	-3.2	-3.8	-0.1	2.9	-0.3	0.0	-0.1	-1.9
C. America	-3.8	-3.3	-0.2	0.3	0.0	0.0	-0.1	-0.6
India	-2.0	-2.5	0.0	0.9	0.0	0.0	-0.1	-0.3
Australia	-1.0	-0.1	0.0	0.0	0.0	0.0	-0.6	-0.3
Thailand	0.0	-0.4	0.0	1.0	0.0	0.0	-0.5	-0.2
Others	-36.7	-36.8	-0.1	0.8	0.0	0.0	-0.2	-0.3
World	263.4	257.0						

—Continued

Table 11

GTAP model results: EU reform and changes in bilateral trade flows—Continued

Scenario Reform1: Support price and export subsidy cuts								
	Total initial exports	of which to:						
		EU-25	ACP	LDC	Mediterranean	U.S.	South Asia	Others
<i>Million dollars</i>								
EU-25	-129.4	-34.4	-4.6	37.3	-24.6	-16.3	-28.3	-58.4
ACP	363.5	368.2	0.9	-1.2	-0.4	-1.3	-0.1	-2.6
LDC	-45.8	-45.6	0.1	-0.5	0.0	0.1	0.0	0.0
Brazil	36.7	31.1	0.2	-1.0	0.6	0.0	0.8	5.0
C. America	22.8	18.5	0.6	-0.1	0.0	0.2	1.0	2.5
India	8.7	8.1	0.0	-0.3	0.0	0.0	0.3	0.6
Australia	5.7	0.0	0.0	0.0	0.1	0.1	4.4	1.0
Thailand	4.8	3.0	0.0	-0.4	0.0	0.0	2.0	0.2
Others	-30.7	-34.6	0.3	-0.3	0.1	0.4	2.0	1.3
World	236.3	314.5						

Scenario Reform1Q: Support price/export subsidy and quota cut								
	Total initial exports	of which to:						
		EU-25	ACP	LDC	Mediterranean	U.S.	South Asia	Others
<i>Million dollars</i>								
EU-25	58.4	283.8	-7.9	-1.6	-45.2	-23.4	-44.2	-103.2
ACP	770.4	779.1	2.0	-1.5	-0.8	-3.0	-1.4	-4.0
LDC	9.3	8.8	0.2	0.1	0.1	0.1	0.0	0.1
Brazil	59.8	38.9	0.5	-0.2	2.2	0.2	1.5	16.7
C. America	47.2	36.6	1.4	0.0	0.1	0.7	1.7	6.7
India	65.8	64.2	0.0	-0.1	0.0	0.0	0.4	1.4
Australia	11.9	0.9	0.1	0.0	0.3	0.2	8.0	2.5
Thailand	11.6	8.6	0.0	-0.3	0.0	-0.1	2.9	0.4
Others	363.5	354.2	0.8	0.0	0.5	0.9	3.7	3.4
World	1,397.8	1,575.0						

Note: ACP = Africa, Caribbean, and Pacific countries. LDC = Least developed countries.

Source: USDA, ERS model simulation results.

a range of trade elasticity values from low (greater product differentiation) to high (greater homogeneity for sugar among regions).¹⁰ The quantitative results did not change qualitatively except for the magnitude. The increase in EBA sugar exports to the EU will range from 321 percent (highly differentiated case) to 485 percent (homogenous case), compared with a 473-percent increase in the central case.¹¹ Translated into quantity terms and using 2001 prices, the value changes in EBA sugar exports to the EU will range from 0.50 to 0.75 million tons. These results suggest that while the LDCs may significantly boost their exports to the EU, the volume of new sugar exports may still fall short of the EU Commission's optimistic projections of 2.8 to 3.5 million tons of imports from the EBA countries by 2014 (Commission of the European Communities, 2005).

¹⁰This analysis uses the value of 5.4, following recent econometric work by Hertel et al. (2003) on trade elasticities.

¹¹Van Berkum, Roza, and Tongeren (2005) also applied a CGE model to examine the impact of the EBA Initiative. They found that LDC exports to the EU increase by 384,000 tons, but that quantity rises to 900,000 tons under a more homogeneous assumption.

EU Sugar Reform: Industry Impacts

Under scenario Reform1 (domestic price cut without a production quota cut), the reform's impact on total EU sugar production will be relatively small (a decrease of 3.2 percent, table 12). In the presence of binding production quotas, sugar production will decrease only in France, Italy, and the smaller producing regions. Also, the EU market price for sugar will drop 9.2 percent in response to the reform. These output and price effects are smaller than the PE modeling results due to the general equilibrium feedback arising from the simultaneous effects of lower output (lower prices), higher imports (to meet higher demand due to lower prices), and reduced exports (through cuts in subsidies).

Also in scenario Reform1, the decrease in the producer price (2.3 percent) will be smaller than the decrease in the market price (9.2 percent). This difference can be gleaned from the relationship linking producers to the market price via "tax" or "subsidy" wedges. Such wedges arise from (a) the sugar production quota, which, when binding, generates quota rents captured by the firm as a subsidy; and (b) the oligopolistic structure of the sugar industry, where price markups or excess profits are taxed away from the firm. In this scenario, the decrease in the producer price will be smaller than the decrease in the market price due to an increase in the tax equivalent of the production quota rent as quotas become more binding. When the reform is accompanied by a cut in production quotas (scenario Reform1Q), EU sugar output will contract by 14.3 percent (table 12), which is very close to the quota reduction of 15 percent. In this case, the market price of sugar will rise 22.5 percent, as supply is reduced. However, the producer price still contracts only by 2.3 percent due to the combined effect of the drop in quota rents (captured as a subsidy for the firm) and increased oligopoly markets (captured as a tax for the firm).

When the entry and exit of firms are permitted (scenario Reform1QE), the efficiency of the industry improves. In this scenario, the number of firms exiting the industry ranges from 13 to 17 percent across the 13 EU regions represented in the model—except for Italy, whose initial sugar output is below quota (table 13). For the remaining firms in the industry, sugar output will increase in eight regions and decrease in four, dampening the reduction in total output. The overall market price effect (not shown in tables) will be slightly larger (23.7 percent) than that of the no entry/exit case (scenario Reform 1Q). In addition, the producer price change will become slightly positive (2.9 percent) as markups over marginal cost will fall by less under free entry and exit.

On the demand side, the price changes resulting from the reform will lead to a small increase (1.1 percent) in EU sugar consumption under Reform1 and no change in consumption under Reform1Q, as the EU's demand for sugar is very inelastic. However, in the CGE analysis, the substitution between sugar and isoglucose is not directly modeled because the possibilities for substituting sweeteners for sugar remain limited in the EU. Unlike in the United States, where the soft drink industry relies heavily on HFCS, the EU soft drink industry uses mainly saccharose and very little isoglucose, hence, limiting potential substitutions with sugar. A separate general equilibrium study of the EU sugar reform that used a model to estimate sugar-isoglucose

Table 12

Summary of simulation results

Item	Initial base	EBA		Reform1		Reform1Q	
		% change	Value change ¹	% change	Value change	% change	Value change
	<i>Million dollars</i>		<i>Million dollars</i>		<i>Million dollars</i>		<i>Million dollars</i>
Imports into EU-25							
Total (Extra-EU)	1,363.8	5.7	273.8	19.6	361.2	62.4	1,170.3
ACP	924.0	-10.9	-100.3	45.7	368.2	92.5	779.1
LDC	88.4	473.1	404.0	-8.4	-45.6	1.6	8.8
Mediterranean	197.4	-8.7	-17.4	9.0	9.0	120.8	201.0
United States	56.4	-7.8	-4.5	-11.8	-6.8	113.6	56.4
Canada	18.7	-6.9	-1.3	-35.8	-6.4	60.8	11.0
Brazil	29.2	-12.6	-3.8	123.7	31.1	155.8	38.9
China	0.7	-8.6	-0.1	77.9	0.5	231.3	1.5
India	43.4	-5.5	-2.5	29.8	8.1	158.1	64.2
Australia	0.7	-7.9	-0.1	11.2	0.0	143.8	0.9
Thailand	5.2	-7.8	-0.4	89.7	3.0	224.8	8.6
Exports from EU-25							
Total (Extra-EU)	183.2	7.1	14.6	-25.7	-19.6	-60.1	-97.0
ACP	13.1	7.0	0.9	-34.4	-4.6	-58.2	-7.9
LDC	40.1	11.5	4.6	83.2	37.3	-6.4	-1.6
Mediterranean	70.0	8.2	5.7	-33.7	-24.6	-61.6	-45.2
United States	33.0	4.3	1.4	-48.1	-16.3	-70.1	-23.4
Canada	5.1	7.7	0.4	-37.5	-2.0	-70.2	-3.8
Brazil	3.3	5.3	0.2	-46.0	-1.6	-76.2	-2.6
China	3.6	8.3	0.3	-39.4	-1.5	-67.5	-2.6
India	4.5	4.9	0.2	-26.4	-1.3	-48.8	-2.2
Australia	5.2	8.3	0.4	-41.1	-2.2	-70.4	-3.8
Thailand	5.4	6.9	0.4	-46.8	-2.7	-71.5	-4.1
Output (raw sugar equivalent)							
EU-25	26,164.0	-1.0	-251.5	-3.2	-791.0	-14.3	-3,653.3
CP	3,981.6	-2.5	-98.8	9.6	374.0	20.4	792.6
LDC	5,322.2	7.6	403.2	-1.3	-73.0	0.3	14.4
Mediterranean	16,358.7	-0.1	-23.1	0.2	32.5	1.7	269.2
United States	32,477.9	0.0	-8.6	0.0	12.5	0.4	121.5
Canada	331.4	-0.5	-1.5	-1.9	-6.3	4.2	13.8
Brazil	5,800.6	-0.1	-4.1	0.8	45.1	1.3	74.4
China	412.7	-0.1	-0.3	0.4	1.7	1.0	4.2
India	7,171.9	0.0	-2.5	0.1	9.7	1.0	68.1
Australia	2,196.4	-0.1	-1.9	0.5	9.8	0.9	20.2
Thailand	1,527.6	0.0	-0.3	0.5	7.1	1.0	15.7
Income (millions of 2001 USD)							
EU-25	8,988,151.1		-317.2		1,302.0		1,600.7
ACP	385,024.0		-21.0		-19.1		79.9
LDC	344,329.3		362.9		-14.5		-8.3
Mediterranean	1,178,657.0		3.5		4.1		24.3
United States	11,057,000.0		-39.6		-13.7		48.4
Canada	780,615.4		4.2		-2.3		7.4
Brazil	595,336.6		1.8		2.4		27.0
China	1,384,773.0		-6.2		-2.3		-4.1
India	567,009.9		-12.6		-1.7		10.4
Australia	400,031.3		5.8		-2.4		9.8
Thailand	142,727.5		0.4		-2.4		5.5
Rest of world	1,310,200.1		7.7		-3.5		-11.4
Sugar quota rent							
—transfer by EU-25	1,151.4		135.1		-478.6		-455.7

Note: ACP = Africa, Caribbean, and Pacific countries. LDC = Least developed countries.

¹Value change is expressed in constant 2001 U.S. dollars.

Source: USDA, ERS model simulation results.

Table 13

EU reforms and market structure for EU sugar industry (GTAP Model results)

	Change in number of firms	Change in output per firm	Change in markups	Change in industry output	Change in industry output	Change in exports	Change in imports	Change in regional income
	<i>Percent</i>				<i>Million dollars</i>			
Reform1Q scenario (no firm entry or exit)								
Belgium	0	-15.00	4.51	-15.00	-227	-27	159	83
Denmark	0	-15.00	5.00	-15.00	-58	-4	106	5
Germany	0	-15.00	1.39	-15.00	-771	-32	1,534	-55
Spain	0	-15.00	4.83	-15.00	-145	-17	223	32
France	0	-15.00	-0.82	-15.00	-488	-48	863	305
Italy	0	-2.10	0.02	-2.10	-28	-31	67	53
Netherlands	0	-15.00	1.91	-15.00	-109	-21	114	37
Austria	0	-15.00	5.00	-15.00	-67	-3	135	13
Poland	0	-15.00	4.60	-15.00	-863	-7	7,398	-183
Sweden	0	-15.00	4.59	-15.00	-88	-6	139	-5
United Kingdom	0	-15.00	5.03	-15.00	-509	-13	366	885
Hungary	0	-15.00	4.77	-15.00	-45	-1	68	1
Czech Republic	0	-15.00	4.54	-15.00	-133	-1	205	-29
Other EU	0	-14.65	5.34	-14.65	-320	-18	460	459
Reform1QE scenario (with free firm entry or exit)								
Belgium	-15.42	0.50	0	-15.00	-229	-27	199	20
Denmark	-15.15	0.18	0	-15.00	-58	-4	108	-10
Germany	-13.64	-1.57	0	-15.00	-772	-32	1,550	-118
Spain	-15.05	0.06	0	-15.00	-145	-17	224	-8
France	-17.33	2.81	0	-15.00	-489	-48	869	325
Italy	-0.11	-1.86	0	-1.96	-26	-31	67	51
Netherlands	-16.13	1.35	0	-15.00	-109	-21	116	26
Austria	-15.15	0.18	0	-15.00	-67	-3	136	-7
Poland	-16.11	1.32	0	-15.00	-890	-6	10,064	-289
Sweden	-14.88	-0.14	0	-15.00	-89	-6	145	-25
United Kingdom	-14.96	-0.04	0	-15.00	-512	-11	413	727
Hungary	-15.08	0.09	0	-15.00	-45	-1	72	-10
Czech Republic	-14.71	-0.34	0	-15.00	-134	-1	216	-55
Other EU	-14.18	-0.34	0	-14.48	-317	-18	472	344

Source: USDA, ERS model simulation results.

substitution (Gohin and Bureau, 2006) found little increase in consumption from cuts in sugar prices.

These scenarios suggest that significant cuts in EU sugar output may not be realized solely through price support cuts, given the oligopolistic nature of the EU sugar industry. In 2006 and 2007, a significant restructuring of the industry took place, with both plant closures and quota reallocation between plants and countries. At least 7 factories closed in Germany; the number of plants in Italy is expected to decline from 19 to 6; all of Ireland's factories have closed; and production in Austria, Denmark, and Belgium is now concentrated in only 2 plants each (Bureau et al., 2007). However, the net decline in quota production resulting from this rationalization was just over 1 million tons, or 5.4 percent of the total production quota in 2005. Thus, a mandatory cut in production quotas may be unavoidable if the EU is to stay within its lowered sugar production targets. This is, in fact, what happened, as the EU Commission reduced production quotas in 2006 and 2007. In May

2007, the Commission decided to withdraw about 2 million tons, or 10.8 percent of total sugar quota allocations for the EU, leaving only 16.6 million tons for 2007/08.

Trade and Income Impacts

The model results indicate that cuts in the domestic price of sugar and sugar production quotas will lead to much larger adjustments in production and trade than a price cut alone. Under scenario Reform1 (price cut only), EU sugar exports will drop by 25.8 percent, the change in EU sugar production will decrease by 2.3 percent, and EU sugar imports will increase by 19.6 percent (see table 12). In contrast, under scenario Reform1Q (price and quota cut), the changes in exports, production, and imports are all far more substantial: exports will decrease by 60.1 percent, production contracts will decrease by 14.5 percent, and imports will increase by 62.3 percent. Consequently, the volume of world sugar trade increases by only 2.5 percent under scenario Reform1, compared with 14.5 percent under scenario Reform1Q.

The impact of the EU reform on world prices will be small, ranging from a slight drop (0.85 percent) under scenario Reform1 to an increase of about 1 percent under scenario Reform1Q. The small decrease in the world price under Reform1 is due to the lower price of EU sugar imports and lower export prices as the EU cuts export subsidies. When EU price changes are weighed against the modest price changes in other countries, the net result will be a small overall change in the world price index. Under scenario Reform1Q, the change in the world price will be slightly positive, as the large gains in EU sugar imports boost the benefit of exporting. The net result will be a slight rise in the world price due to the reduction of EU sugar exports.

The rise in EU sugar imports will benefit primarily the ACP countries, which will expand their exports beyond the quotas of the former Sugar Protocol. Because the reform scenario already assumes that EBA-eligible LDCs have duty- and quota-free access to the EU market, implementation of the reform will add no new benefit to these countries. On the contrary, the EBA-eligible LDCs will face greater competition from non-LDC suppliers among the ACP countries. For the non-EBA and non-ACP sugar suppliers to the world market, exports will grow only modestly as world price changes will not be large enough to affect the world demand for sugar. Brazil and Central America will benefit some, but Australia and Thailand, which export sugar mostly to Asian countries, will see minimal changes.

Welfare and income effects for the LDCs under the EBA Initiative (without the EU sugar reform) show that income gains will come largely from tariff removal on nonsugar exports because initial sugar exports to the EU are relatively small, compared with those of other commodities. The EU will see a small welfare loss under the EBA Initiative, due mostly to lost tariff revenues. Under the reform scenarios, however, the EU's welfare change is positive due to the interplay of several factors: lower sugar prices and production costs for sugar-using industries; benefits to consumers through cheaper imports; contraction of the sugar industry leading to smaller dead-weight losses; and lower export subsidies.

For preferential partners, the LDCs will show no additional benefit from the reforms (in the post-EBA environment), while the change in welfare in non-LDC ACP countries will depend on the extent of the EU sugar industry's increase in efficiency. Under modest contraction of sugar output in the EU (scenario Reform1), the welfare change for the ACP countries will be negative despite increased exports. This effect arises due to lower border-cum-domestic prices in the EU. These prices translate to quota rent losses, which dominate the welfare change. By contrast, under sufficient EU sugar production cuts, the trade creation for the ACP countries arising from larger sugar exports will outweigh the quota rent losses, resulting in a net welfare gain for the ACP countries. For nonpreferential exporters that manage to increase their exports under scenario Reform1Q, income will rise but only slightly.

Finally, given the complexity of the EU sugar regime, it is important to note some caveats inherent in the model assumptions. First, given the long-standing interventionist nature of EU sugar policies, it is not easy to calibrate the proper supply response for EU sugar. This difficulty arises in all quantitative models that deal with EU sugar (Bureau et al., 2007). Second, the model does not include dynamics such as capital accumulation that would mimic future investments in sugar processing in third countries benefiting from the EBA Initiative. Such investments are likely to push EU sugar imports beyond the levels reported in this study's comparative static analysis. Finally, the model does not explicitly address several elements of the reform, such as farm payments and payments for quota buyout. Inclusion of these elements would have rendered the analysis excessively complicated and difficult to interpret. Despite these caveats, many critical features of the previous EU sugar regime and the reform were incorporated, and the model results seem both intuitive and defensible.

Conclusions

The 2005 EU sugar reform, the first in nearly 40 years, has important implications for EU and international sugar markets. The reform is an effort to mitigate the expected increase in domestic imbalances in supply and demand arising from larger sugar imports and greater constraints on exports. Several developments are interpreted as signs of this expected imbalance: (1) the likely rise in sugar imports from least developed countries following the implementation of the EBA Initiative, (2) the issuance of new access quotas to compensate third-country exporters for the EU expansion in 2004, and (3) a WTO panel decision declaring some EU sugar export subsidies to be incompatible with the EU's WTO commitments.

The EU's CMO for sugar is a complex mix of policy instruments that includes price support, production quotas for sugar and sugar substitutes, export subsidies, and import barriers. However, the reform targeted only a few of these instruments, principally cutting the intervention price 36 percent to discourage domestic production and sugar imports from the LDCs under the EBA Initiative. In addition, the reform included a voluntary buyout scheme for production quotas and the disallowance of exports of nonquota sugar to rein in domestic production and to bring export subsidies within the WTO limits.

Other policies that would have enhanced internal competition and made the EU sugar industry more efficient were not included in the reform. For example, interstate quota trading, which could induce a significant shift in production from high- to low-cost regions, was not included, leaving in place the allocation of production quotas on a national basis. Also, restrictive production quotas on sugar substitutes remain in place, albeit at higher levels, preventing greater competition among different types of sweeteners. Despite substantial concentration in the EU sugar industry and the industry's noncompetitive pricing, the reform (which does not lower import barriers) does nothing to affect either industrial concentration or price transparency. Consequently, market prices of sugar, which tend to operate at levels above intervention prices, may fall by less than the cut in the intervention price.

The analysis suggests that, given the market structure of the EU sugar industry, cutting the intervention price alone may not have the desired effect on market prices and production. The reform's impact on production likely will depend more on the amount of sugar quota that is removed from the market. This, in turn, will depend on the extent of industry consolidation and restructuring. The first 2 years of the reform (2006 and 2007) have been marked by a wave of factory closures and reallocation of production across plants and countries. This restructuring generally did not result in individual member states abandoning a sufficiently large quota volume to reduce production to levels anticipated by the EU Commission. Rather, the member states have reallocated their quota volumes internally among their own processing plants. Thus, the net decline in quota production was smaller than expected—just over 1 million tons, or 5.4 percent of total quota production in 2005. Subsequently, the EU Commission made quota renouncement more attractive and bought out more than 1.5 million metric tons, although the Commission

expects that a permanent cut of over 1 million metric tons will be necessary in 2010 to balance EU supply with demand.

For sugar beet producers, the cuts in the intervention prices, combined with a more lucrative buyback of quota, may induce lower sugar output if these measures make other economic opportunities more attractive. Producers still can shift some sugar beets to ethanol production and collect the energy subsidy. Moreover, given the rising cereal prices induced by expanded demand, sugar beet producers could shift to cereals—mostly wheat (typically grown in rotation with sugar beets), particularly in regions with higher production costs. Nevertheless, a more complete sugar reform that includes lower import barriers (outside preferential agreements), inter-country quota tradability, and greater market opportunities for sugar substitutes would improve the efficiency of the industry by weakening oligopolistic behavior, enhancing internal competition, and providing a larger scope for output contraction.

Trade effects of the EU sugar reform suggest that the concomitant implementation of the EBA Initiative in 2009 and the EU reform (which started in 2006) will dampen the gains for LDCs as they face greater competition from other exporters to the EU. For non-LDC exporters among the African-Caribbean-Pacific (ACP) countries, the possibility of increased sugar exports to the EU may be tempered by lost income due to preference erosion and the lower quota rents associated with reduced support prices received by preferential exporters. However, for nonpreferential exporters, the direct implications of the EU reform for bilateral trade are small, owing to the dominance of the EU's preferential sugar agreements.

The EU sugar reform is expected to exert upward pressure on world sugar prices, but such price increases are likely to be overtaken by much larger price hikes due to rising demand for sugar in order to produce ethanol, mostly from Brazil. Increasing use of sugarcane for Brazilian ethanol production means tighter world sugar supplies and higher prices. This development could help many of the ACP sugar producers who face an erosion of preference benefits from the EU sugar policy reforms. Sugar exporters from the ACP countries and the LDCs would not be the only beneficiaries of rising world sugar prices. Some countries could become producers of sugarcane-based ethanol and contribute to the expanding global biofuel market.

Finally, the reform could have important implications for the WTO. While the reform reduces EU sugar export subsidies to within the current WTO limits, it also could serve as the first step in a phased removal of these subsidies under the Doha Development Round. In the area of domestic support, cuts in the intervention price and lower sugar production may reduce the EU's aggregate measure of support. However, in the area of market access, the reform does not address the high import barriers outside preferential agreements. The ad valorem level of these barriers is estimated at more than 160 percent. Significant tariff cuts for sugar of about 60-90 percent, like those tabled in the 2005 WTO meeting in Hong Kong, would not only have a greater impact on world sugar markets but would affect EU sugar trade with nonpreferential trading partners.

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