INTERNATIONAL FOOD
POLICY RESEARCH INSTITUTE
sustainable solutions for ending hunger and poverty

Supported by the CGIAR

IFPRI Discussion Paper 00829

December 2008

The Future of Global Sugar Markets

Policies, Reforms, and Impact

Proceedings of a Public Conference

David Orden
Convener and Editor

Authors
by chapter

Jean-Christophe Bureau, Alexandre Gohin, Loïc Guindé, and Guy Millet
Antônio Salazar P. Brandão
Stephen Haley, Owen Wagner, and David Orden
Ron Sandrey and Nick Vink

Markets, Trade, and Institutions Division

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI) was established in 1975. IFPRI is one of 15 agricultural research centers that receive principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR).

FINANCIAL CONTRIBUTORS AND PARTNERS

IFPRI's research, capacity strengthening, and communications work is made possible by its financial contributors and partners. IFPRI receives its principal funding from governments, private foundations, and international and regional organizations, most of which are members of the Consultative Group on International Agricultural Research (CGIAR). IFPRI gratefully acknowledges the generous unrestricted funding from Australia, Canada, China, Finland, France, Germany, India, Ireland, Italy, Japan, Netherlands, Norway, South Africa, Sweden, Switzerland, United Kingdom, United States, and World Bank.

Notices

[1] Effective January 2007, the Discussion Paper series within each division and the Director General's Office of IFPRI were merged into one IFPRI–wide Discussion Paper series. The new series begins with number 00689, reflecting the prior publication of 688 discussion papers within the dispersed series. The earlier series are available on IFPRI's website at www.ifpri.org/pubs/otherpubs.htm#dp.

[2] IFPRI Discussion Papers contain preliminary material and research results. They have not been subject to formal external reviews managed by IFPRI's Publications Review Committee but have been reviewed by at least one internal and/or external reviewer. They are circulated in order to stimulate discussion and critical comment.

AUTHORS

Antônio Salazar P. Brandão, State University of Rio de Janeiro
Professor of Economics abrandao@firjan.org.br

Jean-Christophe Bureau, AgroParisTech, Paris Institute of Technology and Institut National de la Recherche Agronomique (INRA)
Professor of Economics and Researcher at INRA, Grignon, France bureau@grignon.inra.fr

Alexandre Gohin, Institut National de la Recherche Agronomique
Researcher, Rennes, France

Loïc Guindé, Institut National de la Recherche Agronomique
Ingénieur, Grignon, France

Stephen Haley, Economic Research Service (ERS), U.S. Department of Agriculture (USDA)
Agricultural Economist SHALEY@ers.usda.gov

Guy Millet, Institut National de la Recherche Agronomique
Researcher, Grignon, France

David Orden, International Food Policy Research Institute and Virginia Polytechnic Institute and State University
Senior Research Fellow and Director of Global Issues Initiative, Institute for Society, Culture and Environment d.orden@cgiar.org

Ron Sandrey, Trade Law Centre for Southern Africa (tralac) and University of Stellenbosch
Senior Research Fellow and Professor Extraordinaire in the Department of Agricultural Economics
sandrey@xtra.co.nz

Nick Vink, University of Stellenbosch and Trade Law Centre for Southern Africa
Professor and Chair of the Department of Agricultural Economics and an Associate at tralac
nv@sun.ac.za

Owen Wagner, LMC International
Research Economist owagner@lmc-dc.com

Contents

List of Tables

List of Figures

List of Boxes

ACKNOWLEDGMENTS

This discussion paper presents the proceedings of a one-day public conference titled Global Sugar Markets: Policies and Reform Options, held at IFPRI in Washington, D.C., on June 1, 2007. Financial support for this conference from the William and Flora Hewlett Foundation is gratefully acknowledged. The conference was an activity of IFPRI's Markets, Trade and Institutions Division under a 2006 grant provided by the Hewlett Global Development Program for the project Assessment of the Doha Outcome: A Development Perspective on the Global Agricultural Trade Regime. Antoine Bouet and David Orden are the IFPRI project leaders and Ann Tutwiler is project liaison for the Hewlett Foundation.

Participation by the authors, discussion openers, and audience at the conference is also gratefully acknowledged. The support of the division director, Maximo Torero, is appreciated. Shirley Raymundo provided administrative and technical support for the conference and preparation of the proceedings.

CONFERENCE PROGRAM

Global Sugar Markets: Policies and Reform Options
Friday, June 1, 2007

MORNING:

9:00–9:15 Welcome by **Maximo Torero**, Markets, Trade, and Institutions Division Director, IFPRI
Introduction/Overview by **David Orden**, Senior Research Fellow, IFPRI

Morning Sessions Moderator: **David Orden**

9:15–10:30 Presentation/Discussion

EU Sugar Reforms and Their Impacts

Jean-Christophe Bureau, AgroParisTech and INRA
Alexandre Gohin, Institut National de la Recherche Agronomique (INRA)
Loïc Guindé, Institut National de la Recherche Agronomique (INRA)
Guy Millet, Institut National de la Recherche Agronomique (INRA)

Discussion Opener: **Thomas Earley**, Promar International

11:00–12:15 Presentation/Discussion

The Sugar/Ethanol Complex in Brazil: Development and Future

Antônio Salazar P. Brandão, State University of Rio de Janeiro

Discussion Opener: **Siwa Msangi**, IFPRI

AFTERNOON:

Afternoon Sessions Moderator: **Antoine Bouet**, Senior Research Fellow, IFPRI

1:00–2:15 Presentation/Discussion

The U.S. Sugar Program: Reform Pressures and Options

Stephen Haley, Economic Research Service, U.S. Department of Agriculture
Owen Wagner, Virginia Tech
David Orden, IFPRI

Discussion Opener: **Donald Mitchell**, World Bank

2:15–3:30 Presentation/Discussion

Future Prospects for African Sugar: Sweet or Sour?

Ron Sandrey, Trade Law Centre for Southern Africa
Nick Vink, University of Stellenbosch

Discussion Opener: **Chris Delgado**, World Bank

3: 30–4:00 Concluding Discussion – Panel of Presenters and Audience Remarks
Moderator: **David Orden**

ABSTRACT

Sugar is one of the most highly protected agricultural commodities worldwide. This protection depresses trade opportunities and the prices received by exporters without preferential market access. For this reason, dialogues about sugar policy are often polarized and short sound bites caustic. Yet today's sugar markets are being driven by a complex array of dynamic and emerging supply, demand, and policy forces that need to be understood.

A number of these forces have the potential to reshape the global market scene. Recent sugar policy reforms in the European Union (EU) have received little attention in North America but may turn the EU into a net importer, with substantial compensation paid to its farmers and displaced processing facilities. High oil prices and the related ethanol boom place Brazil at the fulcrum of new market developments. In the United States, corn sweetener and sugar markets are being integrated with Mexican markets under the North American Free Trade Agreement (NAFTA), raising the question of whether the EU reforms provide a template for new policies. And among developing countries in Africa and elsewhere there are low-cost producers that would benefit from more open trade but others who would be disadvantaged by the loss of preferential markets.

This discussion paper presents the proceedings of a one-day conference that served as a forum for the discussion of these and other critical issues affecting global sugar markets, policies, and reform options. The conference was attended by 60 representatives of governments, research institutions, producers and processors from the sugar sector, and other groups interested in sugar markets and policies. The four papers were presented by internationally recognized experts from the EU, Brazil, the United States, and South Africa. Discussion openers and general discussion at the conference added further policy insights, and the papers were edited and revised after the conference to reflect the dialogue that had occurred.

Keywords: sugar, ethanol, EU, US, NAFTA, Brazil, Africa, WTO

1. EU SUGAR REFORMS AND THEIR IMPACTS

Jean-Christophe Bureau, Alexandre Gohin, Loïc Guindé, and Guy Millet

Introduction

The European Union's Common Agricultural Policy (CAP) has experienced considerable reforms since the early 1990s. A growing number of Common Market Organizations (CMOs) have been affected by a cohort of reforms in 1992, 1999, 2003, and 2004–2006. These reforms have led to growing exposure to market signals and to increasing decoupling of subsidies from actual production.

For a long time, the sugar sector stood out as seemingly reform-proof. There were several reasons for this. Sugar was highly supported and ranked among the most profitable crops in the EU. Considerable rents were associated with the supply control policy, some of them capitalized in the value of quotas and the value of land eligible for quotas, making reforms difficult. The sugar sector had powerful lobbies that defended vested interests whose influence far exceeded the economic importance of the sector. Because the policy was self-funded – or, more precisely, funded by the final consumer – there was no budgetary pressure to reform the system as there was in many other sectors. In addition, the national allocation of production quotas resulted in the distribution of production between all EU members, regardless of their comparative advantage (see Box 1.1 for description of the sector). Because of the particular decision-making process within the EU Council, where even a small minority of countries could prevent the adoption of a regulation, reforms of this sector looked impossible.

However, changes eventually took place, and a reform of the CMO was adopted in February 2006.[1] The reform resulted in a large cut in the sugar price, the merging of the two types of existing quotas, and incentives to reduce production in the less efficient areas (see discussion below for details). The consequences have been considerable for the EU sugar sector. Consolidation, factory closures, and a major reallocation of production between plants and countries have been taking place since 2006. Because the EU was the second largest exporter (due to its export subsidy policy) and the third largest importer (due mainly to its development assistance policy), consequences are being felt on the world market as well. Some market analysts estimate that EU production will eventually drop by 6 million tons to 15 million tons (white sugar equivalent) and that EU sugar exports will virtually disappear.[2] In 2002 the EU was a net exporter of 3.4 million tons. It may soon become a major net importer alongside Russia and China. The Food and Agricultural Policy Research Institute (FAPRI) now predicts that EU net imports will reach 3 million tons by 2016/17.

It is likely that further adjustments are still ahead. In spite of the reform, the pressures created by growing preferential imports and the need to cut subsidized exports have recently required emergency measures. After adopting exceptional measures to limit production in March 2007, the EU Commission issued a new proposal to deepen the 2006 reform in May 2007. Given the prospect of duty-free and quota-free access for all African, Caribbean, and Pacific (ACP) countries (a proposal was presented by the EU Commission in May 2007), a possible agreement under the Doha Round of the World Trade Organization (WTO) that would dramatically cut sugar tariffs, and a possible EU-Mercosur free trade agreement, additional reforms might need to take place within the next decade.

The purpose of this paper is to shed light on the recent developments in EU production and to assess what might be the consequences of the present reforms by 2015. Because it is becoming irrelevant to consider the sugar policy independently from the biofuels policy, we also address the impact of the EU target for the incorporation of biofuels in transport fuel.

[1] Note that the reform is often referred to the "November 2005 reform," based on the date of agreement by the Council, even though the European Parliament added some minor changes before final adoption.

[2] Tons refers to metric tons throughout this chapter.

The Reform of the EU Sugar Sector

Pressures and Challenges for Reform

The EU sugar policy before the reform was particularly complex (it still is). Before the reform, there were two types of production quotas ("A" and "B") eligible for different supported prices, corresponding to two levels of levies that were used to fund exports of in-quota sugar on the world market. The system also included an intervention price that acted as a minimum price (supported by public purchase when necessary), high specific tariffs, preferential access under import quotas, and a safeguard clause. Producers could produce out-of-quota sugar for the world market (see Van der Linde et al, 2000, for a complete description of the sector, or Frandsen et al, 2003, for a briefer one). The system had been in place for 40 years, with only minor adjustments. Until recently, the sugar CMO was still seen as the last bastion that would resist all changes. So, what are the factors that drove such an ambitious reform?

Domestic pressures. The need for reform was no secret within the EU, and the Commission had already pressed unsuccessfully for changes to the sugar CMO in the past. The national allocation of quotas prevented reallocation toward more efficient areas. This eventually led to a high cost of production for EU sugar, creating doubts regarding the sector's long-term competitiveness. The EU enlargement raised the difficult issue of allocating new quotas and made the problem worse. The food industry criticized the high price of sugar. The gap with the world price required the implementation of a complex system of additional duties for imports of processed products containing sugar. It also required a system of refunds for exports of processed products, since exporters needed to be compensated for the higher cost of their raw material. The rents provided to EU producers of sugar beets were capitalized in the right to produce and inflated the price of land eligible for beet quotas. As a result, sugar support partly leaked to landowners, rather than fully benefiting farmers. Nongovernmental organizations pointed out that out of the 20 million tons produced within the EU each year, only 16 million tons were consumed within the EU and that the surplus was "dumped" on the world market, to the disadvantage of the some of the world's poorest countries. Environmentalist groups also pointed out that the high prices were pushing farmers to adopt techniques favoring high yields, relying on intensive use of pesticides and techniques that increased soil erosion.

However, most of these criticisms of the EU regime had been made for decades and had never led to major changes in the regime. External pressure played a significant role in triggering the reform, even though some of this pressure was somewhat endogenous: the reform was made necessary by import measures that were themselves proposed and implemented by the Commission.

External pressure. Major pressure came from the initiative aimed at the least developed countries (LDCs) under the "Everything But Arms" (EBA) initiative, as part of the EU Generalized System of Preferences (GSP). By granting duty-free and quota-free access to the EU market, it was expected that these countries would considerably expand their exports to the EU. The Commission estimated that this might result in some 3 million tons of sugar being imported into the EU. Sugar was subject to a transition period until 2009, with progressive market access granted through increasingly large import quotas. But eventually, the EU production would have to adjust to these extra imports, given that the 1994 Uruguay Round agreement capped the export subsidies, and henceforth the possibility of disposing the EU production that would be displaced by imports.

In 2003, the Dispute Settlement Body (DSB) established a panel to examine three separate complaints by Australia, Brazil, and Thailand regarding export subsidies for sugar and sugar-containing products accorded by the EU. The three countries claimed that re-exports of preferential imports of sugar from developing countries (ACP countries and India) for development assistance purposes should be counted in the maximum quantities benefiting from export subsidies under the Uruguay Round (the EU had, apparently in good faith, indicated these extra quantities in a footnote in its schedules). Second, the complaining parties argued that the exports of out-of-quota (or "C") sugar that EU producers could

produce for the world market and be paid at the world price benefited from subsidies, given that their in-quota production benefited from a higher, supported price. The panel supported the views of the complainants, and the appellate body of the WTO upheld most of the panel's conclusions in 2005 (WTO, 2005b). As a result, it became necessary for the EU to not only considerably reduce its exports of in-quota sugar (by a level corresponding to the imports of ACP and Indian sugar), but also to stop exporting "C" sugar. This imposed a significant constraint on the EU sector, as it required the EU to remove 4–5 million tons of its sugar from the export market by May 2006.

The EU Commission stressed that the WTO ruling had no connection with the EU reform. However, the prospect of "losing" the case added extra pressure for reform, and some of the features of the reformed regime (such as not allowing exports of out-of-quota sugar when the world price reached extraordinarily high levels in 2006) can hardly be explained without taking into account the panel's decision.

Challenges ahead. Additional pressure for reform came from ongoing trade negotiations within both the regional framework and the multilateral framework. Negotiations with Mercosur, which started in 1995, have run into Brazil's insistence that the EU liberalize access to sugar. Even though the EU formally argued that intra-Mercosur sugar trade had not been liberalized and therefore sugar could not be part of a free trade agreement between the EU and Mercosur, Brazil made it clear that sugar was an important component of a potential deal. Brazil has recently toughened its position in this area, knowing that a regional agreement is likely to become more important for the EU if the Doha Round fails.

Under the agreement with the ACP countries, the EU imported 1.4 million tons of sugar at a high (domestic) price. Some of the imports came from countries with high production costs, such as Caribbean islands, Fiji, and even Mauritius, and some of these countries are unlikely to continue exporting at the lower prices paid by the EU after the reform. However, the reform of the ACP agreement might lead to imports from other origins. Indeed, for WTO compatibility, the ACP agreement (currently the Cotonou Agreement) must move from a nonreciprocal regime to a series of regional reciprocal free trade agreements. Because many ACP countries had free access under the EBA, and the EU wanted to promote regional integration, the EU had little choice but to offer all ACP countries the duty-free access granted to LDCs. This proposal was presented in May 2007. Prospects of larger sugar imports from ACP countries add to the pressure for further adjustment.[3]

The reform was also intended to prepare the sector for a potential agreement under the Doha Round. The EU sugar tariff corresponds to an ad valorem tariff equivalent to roughly 160 percent, even though there is still no agreement on the methodology that should be used to calculate an ad valorem equivalent of the specific tariff for sugar within the WTO. The sugar tariff should therefore be in the band that is subject to the greatest cuts under the Doha framework agreement – that is, between 60 percent and 90 percent, based on the various proposals presented in Hong Kong in 2005. In addition, even though the commitment is subject to a global agreement, in 2005 the EU agreed to end its export subsidies by 2013. A Doha agreement would therefore impose significant pressure on the EU sugar sector.

The EU Situation after the 2006 Reform

The pro-competitiveness orientation of the reform. The positions of the various EU member states following the Commission's proposal in 2004 and 2005 show the interests at stake. Sweden, Denmark, and Estonia were the only countries in favor of more radical reform. France, Germany, the United Kingdom (UK), Belgium, the Netherlands, Hungary, and the Czech Republic were in favor of the reform proposed in 2005 because they felt that the cuts in production would hit other, less competitive countries. Predictably, the countries whose production was most likely to be hit by the drop in prices, such as

[3] Note that preferential imports were a way to promote a "trade as aid" policy. The decrease in sugar price has had dramatic consequences for some ACP countries, which have closed their factories and laid off large numbers of workers. The EU committed to providing support for adjustment but seems to be in little hurry to allocate the funds.

Ireland, Italy, Spain, Portugal, Greece, Latvia, and Lithuania, opposed the reform. Poland went as far as to threaten to boycott discussions, a rare event in EU life.

When the highest-cost producers realized that there was little possibility of resisting ambitious reform, they pushed for a more ambitious compensation scheme. Most countries also pushed for larger direct payments than those originally proposed by the Commission as a compensation for the price cuts. The final proposal was adopted by the Council in November 2005 and finally approved in February 2006.

Box 1.1. Some key figures relating to the EU sugar sector

In the EU-25, sugar beets were grown on 2.3 million hectares in 2005. The average yield was 61.6 tons of sugar beet per hectare, or 8.75 tons of white sugar equivalent. The 21 sugar-producing members, with a total of 184 sugar-processing plants, produced roughly 21 million tons of sugar in 2005, making the EU the second largest producer in the world. Consumption is roughly 16 million tons. France and Germany are the largest producers (22 and 21 percent of EU sugar production in 2005, respectively), but among the new members Poland is also a major producer. These three countries accounted for half the EU-25 sugar beet acreage in 2005.

Source: Confédération générale de la betterave, 2005.

The new regime is in place until 2015. The reformed CMO still relies on a system of quotas, which should persist until 2014/15. However, the "A" and "B" quotas were merged, without any decrease in the global level of quotas. The quota for isoglucose was increased by 300,000 tons. An additional quota (1.1 million tons) was granted to 11 countries that produce "C" sugar. Ten other countries were also granted a small, 10,000-ton quota.[4] Within the limit of these national quotas, any private producer of sugar or isoglucose willing to acquire extra quota could do so by paying 730 euros per ton to the EU agricultural budget before September 2007. Sugar used to produce alcohol or ethanol is not counted in the quota. As we will see below, this may have significant consequences.

[4] France, Germany, Poland, the UK, the Netherlands, and Belgium were granted quotas ranging from 352,000 tons to 62,000 tons; an extra quota of isoglucose was also granted to three countries: Italy, Sweden, and Lithuania.

The intervention price of sugar is maintained for four years (until 2009) but will then be replaced by a simple reference price. The Commission intends to use available market instruments to ensure that the market price will be close to the reference price, but the possibility of managing the market is clearly limited under the new system (the intervention price is set at 80 percent of the previous year's reference price and limited to 600,000 tons).

The reference price of sugar will decrease over four years from 632 euros per ton to 404 euros per ton in 2009 (i.e., a 36 percent cut), with a levy of 12 euros per ton. A minimum price is maintained for sugar beet; 26.29 euros per ton should be paid to producers (i.e., a cut of 42 percent) in 2009.[5]

The production of "C" sugar is not formally forbidden, but sugar produced out of quota must be used for chemical or pharmaceutical products in the EU (which represents a limited outlet of roughly 0.6 million tons), or for the export of ethanol (the EU is a net importer, and so far no ethanol exports by the EU have taken place). Exports of out-of-quota sugar can be authorized, but only up to the export subsidies commitment of the Uruguay Round agreement, which proved to be too limited to provide an outlet for the surplus in-quota sugar in 2006 and 2007.

In order to adjust supply and demand and manage a market price that is close to the reference price, the Commission will stipulate, if necessary, a temporary reduction in the overall quota before October 31 each year. The quantities withdrawn will be stored by processors (with no compensation for storage costs) and will be considered as produced the following year, unless they are exported under the EU commitments of the Uruguay Round agreement.

An important feature that acts as a potential threat to EU producers is that if the market is unbalanced in 2010, and in particular if there is little reduction in production, quotas will be readjusted downward, if necessary, through a linear decrease in all member states' quotas.

Compensation and incentives for adjustment. At the farm level, the decrease in the price of beet is partially compensated by a direct payment (for 64 percent of the cut). This direct payment is included in the general Single Farm Payment, that is, a decoupled payment that no longer affects planting decisions since the 2003 reform of the CAP. In addition, the member states that reduce their production by more than half can provide an extra payment to their producers for a five-year period. Finally, sugar beets grown for ethanol (energy) production become eligible for a special payment for energy crops, provided that they are not grown on set-aside land. The overall area eligible for payments is limited to 2 million hectares for all energy crops; energy crops are allowed on set-aside areas but without this specific payment.[6]

A special fund has been implemented and financed by a levy in order to provide incentives for the least-competitive processors to cease production on a voluntary basis. Payments are available over a four-year period (until the 2009/10 campaign) for diversification of activities and for cessation of activity. When closing a plant (even partially) and providing a social plan to employees, the processor receives payments for cessation. The processor must consult with beet growers and national authorities, and a minimum 10 percent of the aid must be allocated to beet growers. The absence of a clear upper bound in the 2006 regulation raised controversy and legal challenges in some cases. The aid amounts to 730 euros per ton (to be decreased after 2008). Extra aid for diversification can be provided at the regional level.[7] For diversification of production, the payment (173 euros per ton in 2007/08) will be available only until 2008/09 (113 euros per ton). The fund for the restructuring aid amounts to 5.7 billion euros and has thus far been largely underspent. Indeed, the Commission foresaw the possibility of funding a decrease in production of 6.2 million tons, but production cuts over the first two years have fallen short of expectations.

[5] Note that there has always been a gray area regarding whether or not this price is actually paid to farmers in the EU, with some behind-the-door pressure from the processing companies, at least in the cooperative sector. In 2006, some UK companies already offered beet growers a price lower than the one set in the regulation.

[6] The maximum area was 1.5 million hectares, which was increased to 2 million in January 2007.

[7] The aid for diversification of the regions affected by the closure of a plant is 15 percent of the restructuring aid, that is, 109.5 euros per ton in 2007/08, to decrease to 78 euros per ton in 2009/10, the last year of the scheme.

EU trade policy. Sugar imports still face very high tariffs in the EU. Nevertheless, many developing countries enjoy preferential access. EU protection for sugar is more porous than it seems.

The reform has not introduced changes in the preferential quotas for ACP countries and India, but these countries have seen considerable erosion of their quota rent due to the decrease in the domestic price of sugar. Some will no longer produce for export to the EU. In ongoing negotiations on Economic Partnership Agreements (EPAs), the EU has offered to grant ACP countries duty-free and quota-free access to the EU market, even though a transition period will be imposed to phase in duty-free and quota-free access for ACP sugar exports until 2015 (then ACP sugar will be duty- and quota-free, and there will be an adjustment to the standard EPA safeguard to take account of the sensitivity of sugar).

Under the EBA initiative, duties on sugar were reduced by 20 percent on July 1, 2006, and by 50 percent on July 1, 2007; they will be reduced by 80 percent on July 1, 2008, and eliminated by July 1, 2009, at the latest. Meanwhile, the sugar quota for LDCs, initiated in 2001/02 at 74,717 tons, has been increasing by 15 percent per year. What will happen after 2009, as far as the quantities exported to the EU are concerned, is still subject to considerable controversy. Given the price changes under the reform, the Commission expects that some 2 million tons could be imported by the EU instead of the initial forecasts of some 3 million tons. However, such estimates are fragile. The agreement includes a safeguard clause, in the event that imports from a country increase by more than 25 percent within a year. It is noteworthy that the agreement includes the possibility for the LDCs to "swap," that is, to export their production and import for their domestic consumption. While some experts believe that this could lead to a considerable volume of exports from the LDCs, others question the actual impact, given the safeguard mechanisms and rules of origin, as well as the transportation costs that would result from importing and exporting into and from a (often landlocked) LCD. In brief, it is particularly difficult to predict the future exports of LDCs to the EU, with estimates in the literature varying by a factor of 15 (see DEFRA, 2006; Van Berkum et al, 2005; Bruntrup, 2006).

Few other agreements include provisions to import sugar products or substitutes. The EU-Mexico agreement includes molasses, and several Mediterranean agreements have liberalized trade in processed sugar products.

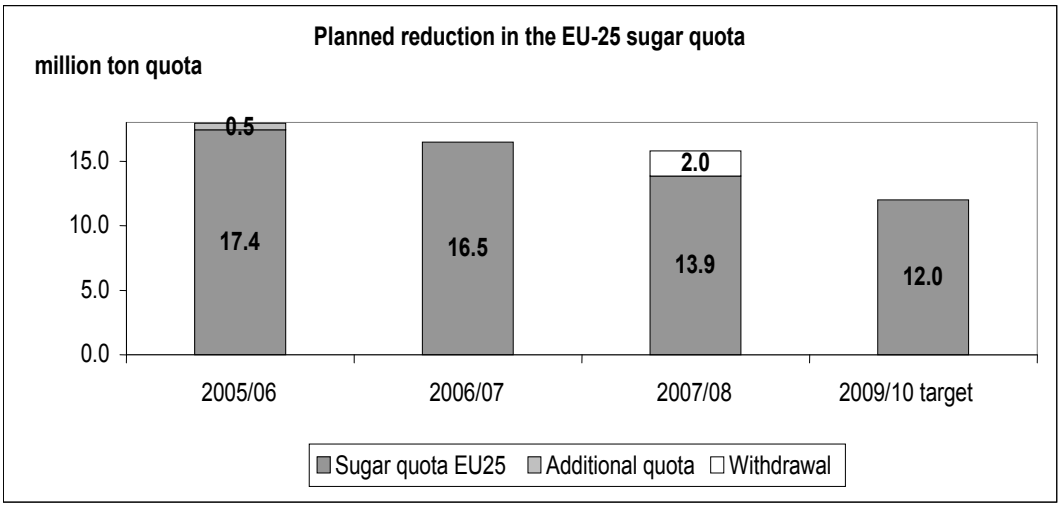
Trade in bioethanol is a growing issue and has been interfering with the sugar market. Ethanol faces a high level of protection in the EU. This is particularly the case for undenatured ethanol, which is used in transport fuel. As noted by the European Commission, "there is currently no specific customs classification for bioethanol for biofuel production" and "it is not possible to establish from trade data whether or not imported alcohol is used in the fuel ethanol sector in the EU" (Commission of the European Communities, 2006). Despite this uncertainty, one can reasonably assume that the recent increase in EU imports of alcohol is largely due to demand for bioethanol for fuel rather than for liquor or industrial use. Thanks to the various preferential agreements in force in the EU – in particular the EU GSP for LDCs (the EBA initiative); the GSP+ granted to 14 countries, including all Latin American countries except Argentina, Brazil, Chile, Paraguay, and Uruguay; and the Cotonou Agreement with 77 ACP states – large quantities of alcohol can enter into the EU at a zero or reduced tariff. EU imports of alcohol at a reduced or zero duty increased from 1.2 million hectoliters in 2002 to 2.0 million hectoliters in 2004. With the growing number of developing countries interested in accessing the EU market under the GSP+, these favored imports are expected to continue to grow.

A Year after the Reform: More Adjustment Needed

In addition to a price cut of 36 percent and the payment of decoupled aid to farmers, a key element of the EU sugar reform was the establishment of a restructuring fund financed by sugar producers to assist in the restructuring process needed to render the industry more competitive. The fund was supposed to help balance the market after the four-year implementation of the reform, which might require reducing production by some 6 million tons (see Figure 1.1). If the quotas that are freed by some member states prove insufficient to restore market equilibrium, the Commission has warned that there will be a linear cut in the quotas of all member states after 2010. This is feared by the most competitive producers, who feel

that if world prices are high enough, due to the potential demand for ethanol, they might be limited in their ability to take advantage of export possibilities.

Figure 1.1. Reduction in the EU sugar quotas (prospects)



Source: Authors, using information from EC Commission

More reallocation than reduction in the overall EU sugar quota. The first year of the reform saw impressive restructuring and consolidation of the sugar industry. The closure of 7 factories was announced in Germany. Only 6 factories out of 19 will remain in production in Italy in the near future. In Austria, Denmark, and Belgium, production will be concentrated in only 2 plants, and all factories have been closed in Ireland. Box 1.2 describes the 2007 situation in France.

Box 1.2. Practical consequences of the reform for French producers

In France, the area in which beets were grown decreased from some 600,000 hectares in the early 1980s to less than 400,000 hectares in 2007. For farmers in our sample, the reduction in the sugar price has resulted in the producer price for beets decreasing from 42 to 32 euros per ton. At this level, most of the current French producers can still make a profit. During these first two years of the reform, we have not observed any significant change in planting. Prior to the reforms, the gross margin per hectare of sugar beet was three times the gross margin for wheat and four time the gross margin for barley. That is, sugar was a very profitable crop and not all the rents have been exhausted by the price decrease that has taken place during the first two years of the reform. We believe that with the price of 26 euros per ton in 2010 that is planned under the new Common Market Organization, most producers will remain in business. At this price, if there were no production control, French production might expand by a factor of 2.5 (estimates the Institut National de la Recherche Agronomique (INRA), Grignon, based on extrapolations of current cost functions using farm business management data).

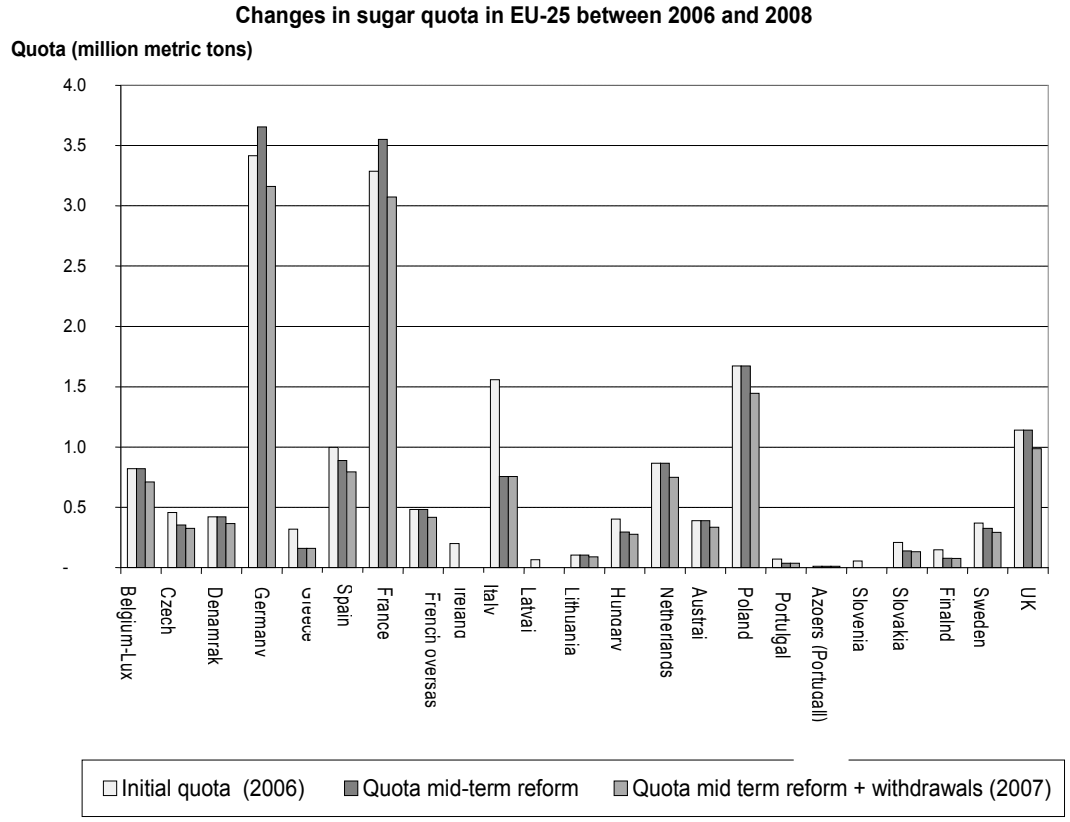
However, with prices at 26 euros and with the move toward decoupled payments that no longer require production, some farmers are likely to abandon sugar production in the near future. Pressure comes from the processors, who would see those producers located too far from the processing plant continue producing. In 2007, the Commission proposed the introduction of an extra payment for immediate cessation of production, and this could provide impetus to giving up production.

Regarding farm incomes, the first two years of the reform have led to a decrease in income of some 260 euros per hectare of sugar beet. No farm specializes in sugar beet, but for the typical French producer of beets (130 hectares, including 13 hectares in beet), this amounts to an 8 percent decrease in income, once the partial compensation through the Single Farm Payment has been taken into account.

However, in many countries, the restructuring did not result in abandoning plants but in reallocation between processing plants. Even though this reallocation had a significant impact, including on the agricultural sector, it was not enough to solve the market imbalance in the EU caused by growing imports and the need to cut exports following the WTO panel's decision. The 2007 production plans show that quotas have fallen by only 2.2 million tons over the first two years, well below the target of 5 to 6 million tons. In addition, more producers than expected purchased extra quota (available at 730 euros per ton), with nearly 900,000 tons of extra quota having been bought.

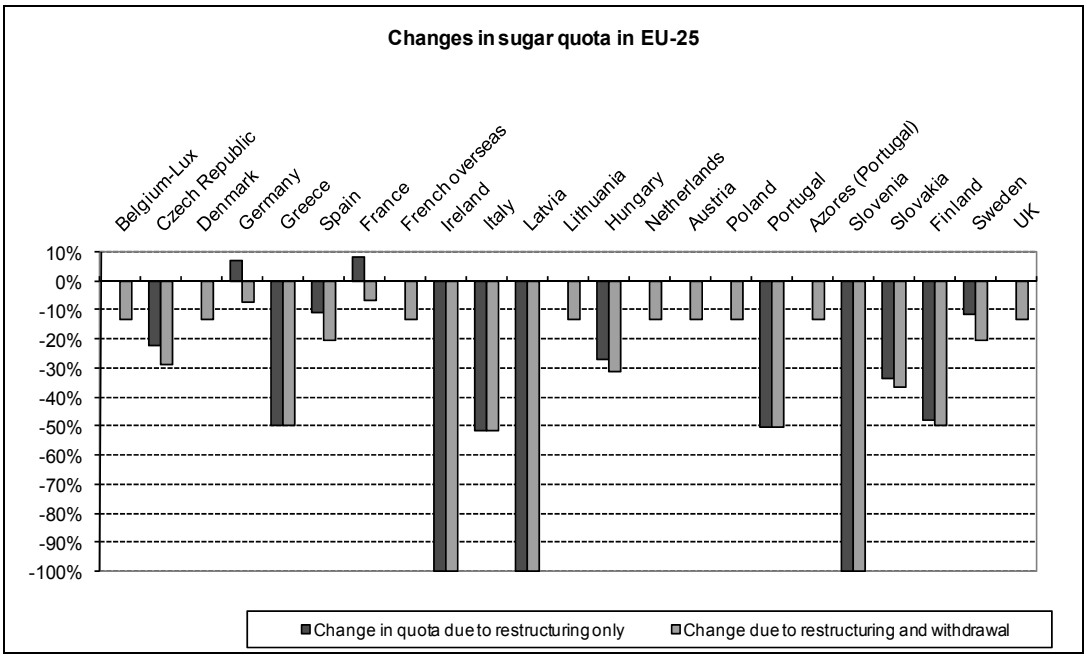
Adding up the increase in quota and the actual abandonment of quota, sugar quotas have fallen by only a net total of just over 1 million tons. Only three countries have ceased production altogether: Ireland, Latvia, and Slovenia. Overall, this is unlikely to lead to a balanced market, given the expected growth in imports. These limited effects were obtained while, in the case of full dismantling of production facilities, each ton of quota renounced was compensated with 730 euros from the restructuring fund. After 2008, the restructuring aid will fall to 625 euros per ton and then to 520 euros per ton in 2009/10, the fourth and final year, so the abandonment of quotas is expected to be lower. Clearly, the consolidation has not led to the results that were expected in terms of reducing quotas during the two years when most action was supposed to take place (Figures 1.2 and 1.3).

Figure 1.2. National changes in sugar quotas



Source: Authors, using information from EC Commission

Figure 1.3. Details on the reduction of quotas (withdrawals and restructuring schemes)



Source: Authors, using information from EC Commission and Confédération générale de la betterave (CGB)

New measures needed. Forecasting an oversupply of about 4 million tons, the Commission decided in March 2007 to withdraw about 2 million tons of quotas. EU quota sugar production in 2007/08 will thus amount to just 16.6 million tons. The Commission also agreed to lesser cuts for those member states that have already permanently renounced quota under the restructuring scheme, so as to send the signal that efforts will be taken into account and not generate counterproductive expectations. In order to accommodate these adjustments while still achieving a 12 percent–plus overall cut, the Commission has imposed a reduction of 13.5 percent on the majority of member states – and lesser cuts for those that have decommissioned sugar plants in the previous year. This measure was taken on the basis of special powers given to the Commission "for emergencies."[8]

In May 2007, the Commission proposed changes to the sugar restructuring scheme aimed at making it more effective. The analysis of the Commission is that, under the current regime, processors' decisions are those of risk-averse agents in an unpredictable environment because, under the current system, member states can fix the percentage of aid to be given to farmers above the 10 percent minimum. Processors must therefore decide whether an application to the restructuring fund is

[8] Note that it is the third consecutive year in which exceptional measures have been taken. During the 2005/06 campaign, the Commission already used the so-called declassification mechanism for 1.8 million tons. This mechanism allows the Commission to decide, before October 1, an adjustment of the level of quotas so as to respect the WTO ceilings for export subsidies following the 1994 Marrakesh agreement. The sugar "declassified" was treated as "C" sugar. On the basis of special measures designed to facilitate the transition between the old and the new CMO, the Commission (March 2006) then decided on a one-off preventive withdrawal for the 2006/07 marketing year. This withdrawal was based on a threshold resulting from a coefficient applicable to the allocated quota, which allowed enterprises to limit production under quota at the threshold level, and a differentiation of threshold per member state to take into account both the states' responses to the restructuring regime and the former "A" and "B" quotas. This measure resulted partly in a reduction of sugar production and partly in sugar being either carried forward or available for industrial uses (1.1 million tons).

appropriate for them without knowing exactly how much aid they will get.[9] The Commission proposes to set this limit at 10 percent so as to clarify the rules for those processors that might be tempted to give up quota. Beet growers who renounce quota will receive an additional payment. Beet growers will be able to apply directly for aid from the restructuring fund, up to a certain limit. As an additional incentive for companies to participate, those that renounce a certain amount of their quota in 2008/09 will be exempted from paying the restructuring levy on the part of their quota that was subject to preventive withdrawal in the 2007/08 marketing year. The Commission also proposed additional measures, as described in Box 1.3. The Commission believes that the changes proposed should allow the renunciation of about 3.8 million tons of sugar quota in addition to the 2.2 million tons given up thus far. If insufficient quota has been renounced by 2010, the Commission also proposes that the level of compulsory quota cuts would vary depending on how much quota each member state had renounced under the restructuring scheme, rather than requiring a linear cut.

Box 1.3. The Commission's May 2007 proposal

Withdrawal. Introduce a system of thresholds, moving away from a system that reduces the level of sugar effectively produced under quota. In addition, during the transition period, until the 2009/10 marketing year:

• a first decision should be allowed before sowing takes place, possibly completed by a further withdrawal in October based on updated data;

• the threshold in those member states that have participated in the restructuring regime should be adapted in proportion to the quota renounced, with modulation between undertakings according to their individual restructuring efforts; and

• traditional supply needs, which are total quantities for which full-time refiners have priority access to preferential imports, should not be reduced in relation to the withdrawal.

Restructuring scheme. The percentage of aid to be given to growers and contractors should be fixed at 10 percent, with a top-up to growers; the improved conditions should be made retroactive to avoid penalizing growers and enterprises that took part in 2006/07 and 2007/08; growers should be given the possibility of taking the initiative to renounce quota, within certain limits, to avoid endangering the survival of the factory concerned. If in 2008/09 an enterprise renounces at least a certain amount of quota, it will not be subject to the payment of the restructuring amount in 2007/08 for the part of the quota that is affected by the withdrawal decision. If there are reliable indications that the quantitative objective of the temporary scheme for the restructuring of the sugar industry in the EU will nearly be reached in 2008/09, the Commission can extend the application deadline. In addition, in the event of an obligatory quota cut in 2010, the cut per member state should reflect each state's success in reducing national quotas under the restructuring regime.

According to the EU Commission, the adaptation of the restructuring scheme is intended to reach the objective of a further 3.8 million tons of quota renunciation in 2008/09 and 2009/10. The additional amounts for the restructuring aid should be financed within the restructuring fund, whose principle of self-financing remains valid.

Source: EU Commission

Assessing the Future Developments of EU Production

There are uncertainties regarding EU sugar production and its net trade situation. Studies that have assessed potential EU production in the event of major reforms or trade liberalization have led to very

[9] The uncertainty regarding the share of the restructuring fund that goes to farmers is seen as a deterrent to closing plants down. The closure of the last Greencore plant in Ireland led to a legal challenge, with the Irish government allowing Greencore to keep only 62 percent of the payments rather than the 90 percent it claimed.

different and somewhat puzzling conclusions. Clearly, the scenarios envisioned by different authors vary, but the variations in the findings can hardly be explained by differences in the policy changes that are modeled. For example, El Obeid and Beghin (2005) predict a considerable decrease in the production of sugar in the EU, that is, a drop of 61 percent under multilateral liberalization. As a result, the EU would become a net importer of some 8 million tons of sugar. Based on a similar increase in the world price, Wohlgenant (1999) finds that EU production would increase by 2 percent and that the EU would remain a net exporter of 2.5 million tons. Poonyth et al (2000) find that EU production would be barely affected by the reduction in the intervention price required to export without subsidies, and that, overall, EU exports would remain relatively stable. The Organization for Economic Cooperation and Development (OECD, 2005) finds that EU production would decrease by some 60 percent under its trade liberalization scenario. Witzke and Kuhn (2003) find a significant decrease in the production of "C" sugar based on a 30 percent decrease in the price of sugar. Under a reform that liberalizes the sugar market, Frandsen et al (2003) show mainly an erosion of rents. They find that production would be only marginally affected by a major reduction in the intervention price in France, Germany, Austria, and the UK. Bouët et al (2005) find that the reduction in EU supply would be significant if tariffs were cut by 60 percent and export subsidies removed, but the resulting increase in the world market price would be minimal. Van der Mensbrugghe, Beghin, and Mitchell (2003) find that the EU would become a very large importer of sugar under a multilateral liberalization of the world market. Overall, it seems that the researchers' conclusions are particularly sensitive to the structure of the supply response in the model.

There are several reasons why an assessment of what will happen in the EU sugar sector is particularly difficult. First, it is hard to draw lessons from the past. Production quotas have been in place for more than 30 years, and the administrative price has shown little variability. This makes it difficult to infer the effect of changes that would induce large variations away from the present equilibrium. Because of the two-tier production quotas of the past, it is unclear how the quantity produced will now respond to price changes. The problem is made worse by the interaction between the agricultural and processing sectors. Indeed, there is evidence that part of the support for the beet sector is retained by the processing sector, which will also be affected by reforms. Because of high fixed costs and the need to find suppliers of beet within limited distances, the strategies of processing firms are likely to interact with those of the farm sector and affect the overall EU supply response.

Second, the agricultural and sugar production potential of the 12 new member states is largely unknown. So far, economists involved in modeling the EU agricultural sector have run into considerable difficulties and data problems (e.g., social accounting matrices) in introducing these countries into a detailed model. The way the 12 new member states are taken into account in models is simply not satisfactory (and our model is no exception).

Third, the world market situation is a considerable source of uncertainty as far as EU production is concerned. It is likely that one of the reasons why many processors have not given up production capacity as was expected by the Commission has something to do with the high prices of sugar observed in 2006, largely driven by energy demand. The interaction between agricultural and energy policies is particularly difficult to assess in the EU, given that very little happened for a long time, and there has been a surge in the development of biofuel in the last two years. Extrapolating such a recent trend is risky, since it is likely that the ambitious targets for the development of renewable fuels will soon meet financial constraints when production increases (Jacquet et al, 2007).

Given the difficulties of characterizing EU supply response, the microeconomic analysis of the EU supply is an important step toward a better assessment of future developments in the EU sugar supply.

What Drives Producers' Behavior in the EU?

Costs of production vary a great deal across EU regions. Because of the national allocation of quotas and the high prices, some particularly inefficient regions previously produced sugar. Major changes are now taking place, and the 2006 reform should definitely result in more efficient and lower-cost production (Bureau et al, 1997). However, the extent to which EU costs could go down enough so that the EU could

compete in a freer trade environment is largely unknown (Buysse et al, 2007; Bogetoft et al, 2007; Revoredo, Renwick, and Reader, 2005). Most observers believe that production costs for EU beet will never match the low production costs of Brazilian sugar. Most estimates of costs of production, including those used in the WTO dispute, rely on budget generators and engineering data. They suggest that costs of production are particularly high (over 40 euros per ton of beet). Based on the data used by the panel, production should have decreased much more than what was observed in 2006 and 2007. Econometric or linear programming–based estimates of marginal costs or "opportunity costs" seem lower than the estimates obtained by budget generators. In some efficient regions, opportunity cost estimates suggest that beet would be produced at a price below 18 euros per ton of beet (see Rozakis and Sourie, 2005). The EU has some significant advantages in terms of transportation costs, compared to countries such as Brazil and many African countries. The processing sector is particularly efficient in several member states. Now that processors can source from the most efficient areas and are less constrained by the geographical allocation of quotas, the capacity of the EU sugar industry to resist trade liberalization will depend on the level of world prices.

The producer's supply response behavior. The EU production of "C" sugar (i.e., out-of-quota sugar) has been significant over the last decade, representing 4 to 13 percent of the 18 to 20 million tons of sugar now produced in the EU-25, depending on the year. It is therefore tempting to believe that, at least in the most efficient regions, producers respond to the world price, since it is the one that seems to drive their marginal supply. However, both the WTO panel and the appellate body concluded that the out-of quota "C" sugar was cross-subsidized by the in-quota sugar prices. Under this assumption, the in-quota sugar was in fact driving the production of "C" sugar. This would mean that without the rent on the in-quota sugar, the "C" sugar would not have been produced. More generally, Gohin and Bureau (2006) summed up three possible effects that should be taken into account in assessing the supply response behavior of EU producers:

- The high supported price for production under the "A" and "B" quotas could be covering fixed costs. This would have allowed production of "C" sugar at low prices, given the need to recover only variable costs (Van der Linde et al, 2000). If this is the case, it is not only marginal (variable) costs that drive EU sugar production.
- Some producers grew "C" sugar beets as an insurance strategy against in-quota sugar revenues forgone when there are poor harvests. Again, if this is the case, one cannot model EU supply as a function of marginal cost only.
- Another possibility is that "C" sugar was produced so as to build references when producers expected that the ongoing reforms would result in a particular allocation of future production rights, premium rights, or compensation. Again, under this assumption, the price of "C" sugar cannot be seen as driving production before the reform.

These factors may result in interactions between in-quota sugar and "C" sugar, and could play a role in the response of EU sugar production to price changes. Because the model that we use to infer the consequences of the reform in 2015, as well as the consequences of counterfactual scenarios, must be calibrated using past behavior, the above effects must be included in modeling the supply response of EU producers.

The cross-subsidization of production through fixed costs, as considered by the WTO panel and explained by Chau and de Gorter (2005), is not compelling. Indeed, the short-run profit-maximizing problem of the beet producer in the presence of quasi-fixed factors can be written as (1), where z denotes an aggregate of quasi-fixed primary factors (capital, self-employed labor, and land owned or subject to long-term leases) whose (exogenous) price is pz. The variable w denotes the price of variable inputs; $p1$ denotes the price of in-quota sugar beets, $p2$ the price of out-of-quota beets, $y1$ the quantity produced in the quota, and $y2$ the quantity produced out of the quota (quantities of beets are expressed in sugar equivalent, so as to adjust for the sugar content). C^{SR} denotes the variable cost function subject to the fixed level of endowments, z.

$$\underset{y_1,y_2}{Max}\,\pi^{SR} = p_1 y_1 + p_2 y_2 - C^{SR}\left(y_1 + y_2; w; z\right) - p_z.z \tag{1}$$
$$\text{subject to } y_1 \le Quota$$

Given the specification (1), one can show that, for certain levels of the marginal cost function of the quota and of the price of "C" beets, the existence of quasi-fixed inputs may have resulted in a cross-subsidy between in-quota and "C" beets. This might have happened when *p2* and *y1* were such that the production of "C" sugar induced a lower average cost due to a larger production scale. In such a situation, profit maximization may result in a larger output than if the quantity *y1* were not subsidized, that is, if there were only one sugar price, *p2*. This situation is well described by Kopp and de Gorter (2005) and Chau and de Gorter (2005). Their demonstration shows that the coverage of fixed costs by the rent provided by in-quota production is a possible determinant of the supply of out-of-quota sugar.

However, Gohin and Bureau (2006) believe that such a cross-subsidization cannot hold in the long run. If quasi-fixed factors can adjust to their optimal level for production, *y1*, then there is no point in producing "C" sugar at a loss. The simple expression of the long-run producer's profit maximization problem (2) and Hotelling's lemma shows that such a cross-subsidy is not optimal.

$$\begin{aligned}\underset{y_1,y_2}{Max}\,\pi^{LR} &= p_1 y_1 + p_2 y_2 - C^{LR}\left(y_1 + y_2; w; p_z\right) \\ &= p_1 y_1 + p_2 y_2 - C^{SR}\left(y_1 + y_2; w; z^*\right) - p_z.z^*\end{aligned} \tag{2}$$

with
$$z^* \equiv z^*(y_1 + y_2) = Arg\frac{\partial \pi^{LR}}{\partial p_z} \tag{3}$$

Because *z* can freely adjust in the long run, there will be no production of *y2*. The reason is that there is no cost saving due to increasing returns to scale (caused by a nonoptimal level of fixed cost at *y1* in the short run) that can offset a loss in the out-of-quota market. As pointed out by Witzke and Kuhn (2003), the quota regime had been in place for many decades almost without modification, and it is difficult to believe that the situation that has been taking place during the last years is merely a short-run equilibrium. Major nonconvexities (indivisible inputs) could prevent firms from adjusting their production structure to the optimal input level corresponding to the quota, as in (3). However, in the beet sector, there are many opportunities to share machinery, to buy second-hand machinery, and to purchase contract work. Contract harvesting or contract planting costs decrease only slightly with the size of operation. The fixed components in the cost of contract work were not large enough to provide a significant incentive for producing "C" beets so as to spread this fixed cost across a larger output. Overall, the argument that the fixed costs of "C" sugar were covered by the quota, and that this explained the production of "C" sugar in the EU, is not compelling.

However, a recurrent problem in production economics is to define how long the "long run" is. In Europe, there is evidence that some farm equipment has a long service life (Ball et al, 1993). In addition, in the processing sector, some equipment might be less divisible, or less easily adjustable, than in agriculture, and fixed costs in refineries could have led sugar processors to encourage farmers to produce "C" sugar. For this reason, in the model that we use to assess future production, we keep open the possibility that the production of "C" sugar benefited from the high price of in-quota sugar, that is, that there was some form of cross-subsidy.

Quota overshooting as insurance. Because of the high price received for in-quota sugar beets, producers may have overshot so as to be sure to capture the rent in case of poor harvests. A rational producer of beet would accept losses on out-of-quota sugar to maximize expected profit. Gohin and Bureau (2006) showed that prior to the 2006 reform, producers had some incentive to overshoot and produce out-of-quota sugar, since the determination of the optimal supply behavior responded to the

condition that marginal costs equals the price, *p2*, plus a positive term. They showed that this term depends positively on the probability of a bad harvest and on the difference (*p1–p2*).

This relation does not prove that "C" sugar is formally cross-subsidized in the EU. The incentive to overshoot was mitigated by the possibility of "carrying over" sugar quota rights from one year to another, a feature of the EU CMO. Some sugar processors also have private arrangements giving flexibility to beet suppliers to smooth the supply over several years, so as to prevent overshooting. In addition, empirical evidence suggests that the insurance behavior was unlikely to explain all the "C" sugar production in the EU-15 (Adenäuer et al, 2004; Adenäuer and Heckelei, 2005). However, the "overshooting" factor certainly explained a share of the "C" sugar production, and we believe that the resulting implicit cross-subsidy must be included in the modeling of EU supply response behavior.

Expectations. In the past, expectations of major reforms may have played a significant role in explaining producers' behavior. It is possible that farmers have produced beyond the (static) optimum level, expecting that historical references will be used in the future. Indeed, in past reforms of the CAP, many quota allocations, premium rights, and compensation levels have been based on historical references. A precautionary behavior so as to "build up" potential references would be rational under particular expectations by producers and/or processors regarding future reforms. Gohin and Bureau (2006) introduced this possibility in their modeling of EU supply response, showing that in such a case the optimal production of "C" sugar verifies the condition that the marginal cost was equal to the out-of-quota price, *p2*, plus a positive term. This term depends on future rents, that is, on future in-quota prices. This may be one of the explanations for the relatively high levels of "C" sugar produced during the early 2000s in the EU, in spite of low world prices.

Modeling the EU Sugar Sector

Estimation of national supply response. Gohin and Bureau (2006) built on the demonstration that the three effects described above resulted in the introduction of a gap between marginal revenue and marginal costs for the producer. That is, a common feature of the three effects described above (fixed costs, uncertainty regarding future yields and the asymmetry of gains/losses, expectations regarding future references) is that the producer's behavior leads to conditions between the marginal cost, *Cm*, and the out-of-quota price, *p2*, of the type $Cm = p2 + \theta$, where θ is a positive function of *p1*, a negative function of *p2*, and a positive function of the quota. Having little information on the value of θ, the researchers estimated econometrically the linkage between the decision to plant *L* hectares in sugar beet on one hand, and sugar prices and quotas on the other hand. They assumed that *Cm* was a linear (increasing) function of *L* and, including a trend *t* to account for technical change, they specified the marginal cost as $Cm = W(a + brL + ct)$, where *W* is a price index of inputs. The variable θ is also assumed to depend in a linear way on in-quota and out-of quota sugar prices, that is, $\theta = d + eQ + f(p1–p2)$, with *Q* being the level of quota. Combining the expressions of *Cm* and θ, and the coefficients *a*, *b*, *c*, *d*, *e*, *f* (or a linear combination when enough), they estimated econometrically using data on *L*, *W*, *p1*, *p2*, and *Q* for the all member states producing "C" sugar in the early 2000s, as in (4). A generalized maximum entropy (GME) estimation technique was used, which allowed the introduction of inequality constraints that are consistent with the theory (such as $b > 0$; $\theta \geq 0$; see Gohin and Bureau, 2006).

$$L = \frac{1}{Wr}\left(\frac{d}{b} - \frac{a}{b}W - cWt + \frac{1}{b}p_2 + \frac{f}{b}(p_1 - p_2) + \frac{e}{b}Q\right) \tag{4}$$

Sugar in a CGE framework for EU agriculture. The econometric estimation of the coefficients of (4) was used to estimate the supply response of the EU producers. The supply response behavior for the EU sugar sector was then introduced in a detailed model of EU agriculture, which relies on a computable general equilibrium (CGE) framework in order to assess the effect of trade liberalization and policy reforms on the EU economy (see Box 1.4 for description of the model). At first glance, this may seem an "overkill" strategy, since the sugar sector is unlikely to be large enough to have significant

macroeconomic effects. However, there is no serious obstacle to including a more detailed sector within a broader framework (Gohin and Moschini, 2006). The GE framework is appropriate for modeling multi-output production, consistent with the fact that sugar is always produced in combination with other crops. In addition, proper modeling of the EU sugar response to policy changes requires that one take into account the interaction of the farm sector with both the processing sector (refineries) and the food sector, which uses sugar, an issue better dealt with in a GE framework. Given the uncertainty of EU production costs, it is also noteworthy that GE approaches impose internal coherence because of accounting equalities. This, for example, makes production costs more consistent with prices and rents than in many partial equilibrium approaches (Hertel, 2002). Because production costs play a significant role in the characterization of sugar supply, a proper endogenization of returns to primary factors accounting for intersectoral linkages is an asset.

Box 1.4. The general equilibrium model

The model used in this paper is static, with perfect competition in most sectors and a neoclassical closure. Investment is savings driven, and balance-of-payments equilibrium is ensured by financial flows. The model focuses on the agricultural and food processing sectors of the EU. Other countries and sectors are treated in a much less detailed way. The sectoral coverage distinguishes 75 products, including 18 products in the arable crops sector and 29 products in the animal sector. There are three primary factors (capital, labor, and land) whose quantities remain constant but which are mobile across sectors. The EU is a large region whose trade affects other regions' exports prices through a series of export supply and demand functions. The model has four main original features: (1) the use of flexible forms that globally satisfy regularity conditions for production technology, household preferences, and factor mobility; (2) a detailed disaggregation of the agricultural sector; (3) a detailed representation of all instruments of the CAP; and (4) the use of mixed complementarity programming (MCP) methods in order to represent changes in regimes such as production shifts under a quota. The specification used to represent preferences, technologies, and factor mobility makes use of latent separability. The model is described in Gohin (2007b).

In order to assess the potential impact of reform on the EU agricultural sector, particularly on the EU sugar sector, the model details the agricultural sector and departs from the standard Armington assumption for a variety of commodities that we believe are not differentiated enough to justify this assumptions with drawbacks and unwanted consequences (such as the lumpiness in prices brought about by the implicit market power). We consider that sugar, ethanol, barley, maize, and other products such as butter are homogenous commodities. For other, more differentiated commodities, such as beef or cheese, the Armington assumption is used.

The sugar sector in the model includes sugar beet activity, which supplies in-quota beets and out-of-quota beets, and the sugar processing sector, which offers in-quota sugar, out-of-quota sugar, pulp, and molasses. The in-quota and out-of-quota beets (with respect to sugar) are distinct products but perfect substitutes. They differ in terms of prices, levies, and constraints. Sugar beets are assumed to be nontradable. Sugar is modeled as a homogenous product, and a net trade specification is used so that the difference between EU sugar exports minus preferential imports meets a net export demand function from non-EU countries. EU imports are limited by tariff quotas, which generate rents, assumed to be retained by the exporting countries. The processing sector is represented in the model. Raw sugar is the only type of sugar imported, while only white sugar is exported. The difference in price between raw and refined sugar is kept constant, so that the products behave like perfect substitutes. The modeling of the beet and processing sectors allows for a cross-subsidy between in-quota and out-of-quota production at both stages. Beets and sugar are linked through a Leontief technology, and assumptions must be made regarding the share of the rent passed to the farm sector and retained by the processing sector. The convention adopted here is the one used by Frandsen et al (2003), with a constant proportion of price decrease between the two sectors as long as some positive rents remain at the two stages.

We assume that the decoupled direct payments still provide an incentive to produce beets. Indeed, several authors have stressed that because of the flow of income these payments provide, they reduce risk and have a positive effect on production. There is considerable controversy regarding the actual elasticity of output to decoupled payments. Several studies have found that they have a very small impact on the quantities produced (Abler and Blandford, 2005). However, others estimate that the effect is significant (see Sumner, 2003, as an example). Here, we consider that the provision of Single Farm Payments to the sugar producers subsequent to the 2006 reform provides an incentive that corresponds roughly to a premium on the sugar beet price of 7.5 percent, which is in the middle of the range of estimates in the literature as far as the degree of "coupling" of direct payments is concerned.

The GE model is first used to simulate the 2015 baseline, using average figures obtained from our econometric estimations.[10] National supply curves are then used to calculate country-level supply and production costs under the baseline and the reform scenarios. The drop in domestic production caused by the reform is then introduced into the GE model, which is used for simulating the overall impact of the corresponding scenario. This iterative technique makes it possible to include information on supply in the various EU countries while taking advantage of the GE model.

The model focuses on the EU-15. The 10 new members are modeled as a specific group of countries. In our simulations, these 10 countries joining the EU add roughly 3 million tons of sugar production to the EU.[11] However, this has little impact on external trade because the new members are roughly self-sufficient. In addition, adding the new members increases the uncertainty of EU results, as little is known regarding their production costs. Here we choose to present the variations for the EU-15. One must keep in mind that the EU is a larger producer than the figures in Table 1.1 suggest.

There are large variations in production costs among countries exporting sugar to the EU. That is, exports of third countries to the EU, including those under preferential agreements, might be affected by the change in EU prices. Information on production costs provided by Garside et al (2004), LMC (2004), and House of Lords (2006) shows that some countries that export to the EU, such as Guyana, St. Kitts and Nevis, Barbados, and Trinidad and Tobago, are unlikely to produce for the EU market after a large cut in the EU intervention price. Their present production is driven by the high internal EU price. However, since we do not consider the possible outcome of a revision of the Cotonou regime, we assume that import quotas for ACP countries and LDCs will remain at a fixed level (see Box 1.5.).

Results

The simulations are constructed as a counterfactual scenario relative to the 2015 reference so as to account for possible developments in the EU trade policy, and also to distinguish the effects of the biofuel policy.

[10] In order to calibrate the sugar sector in our GE model, we first determine the gross margin of both types of beet production (in- and out-of-quota beets). We use input/output coefficients for a vector of intermediate inputs, and returns to land from various sources, including Eurostat SPEL and the Farm Accountancy Data Network. We assume that the sum of the margin of in-quota and out-of-quota beets is exhausted in returns to the labor and capital bundle and quota rents. The econometric estimates of (4) are used to calibrate the cross-subsidies between in-quota beets and out-of-quota beets, assuming that the unitary implicit subsidy on out-of-quota beets adjusts to satisfy budget neutrality (i.e., the total implicit tax on in-quota beets equals the total implicit subsidy on out-of-quota beets). This makes it possible to measure the value of the rent and the value of the returns to the capital and labor aggregate. For the refining sector, a similar calibration procedure is performed, imposing the condition that only in-quota sugar beets are used to produce in-quota sugar. Both in-quota and out-of-quota sugar processing produces molasses and pulp. Unit labor costs cannot adjust in the processing sector. Profit is exhausted in returns to capital and in quota rents.

[11] Romania and Bulgaria are not yet included in the model.

The EU in 2015 Ceteris Paribus

We first present the results of the reference scenario, constructed as a pre-experiment simulation with the model described above. The pre-experiment simulation is constructed assuming exogenous changes in what is taking place in non-EU countries (mainly based on FAPRI projections; see FAPRI, 2007). The baseline is described in Box 1.5. While we focus on the sugar sector, we also present some other results so as to illustrate the linkages between the various markets.

Box 1.5. Assumptions for the pre-experiment simulation of the EU in 2015

The pre-experiment scenario is used to define the 2015 reference situation by running the model under a set of assumptions, some of them involving data from external sources (including the supply and demand of third countries on the world market). More precisely, the following assumptions were made. Technical progress in the EU results in 1.25% annual growth in total factor productivity in the grain sector, 1% in other crop sectors, 0.75% in animal sectors, and 1.2% in nonagricultural sectors. Given some other exogenous assumptions regarding the annual growth of the supply of labor (0.25%), capital (1.2%), and land (decrease by 0.25% a year), the gross domestic product (GDP) increases roughly by 2% on average until 2015. Continuation of recent trends toward lower relative consumption of animal fats and beef compared to other meats and vegetable oil is assumed. The Food and Agricultural Policy Research Institute (FAPRI) projections regarding the net trade of third countries are used so as to determine the endogenous world price, through equilibrium of the world market given EU import demand and excess supply (exports) functions. The exchange rate is assumed to be 1.2 dollars for a euro.

The 2003 reform of the CAP (decoupling of direct payments) and the 2006 reform of the sugar Common Market Organization (CMO) are included in the baseline. Mandatory set-aside is 10%. In the baseline, the EU can no longer export out-of-quota sugar but can export, under the de facto ceilings defined by the appellate body, some in-quota sugar (in value terms) and can export extra quantities of sugar in processed food refunds. In the baseline, we assume that there is no demand for biofuels in the EU, since this issue will be tackled by a particular scenario.

It is noteworthy that in the pre-experiment, the imports from the African, Caribbean, and Pacific (ACP) countries and least-developed countries (LDCs) are set exogenously at a rather conservative level. Indeed, we assumed that, despite the lower domestic price subsequent to the 2006 sugar reform, all ACP countries will still export the same quantities to the EU. In contrast, we assume that LDCs will export but to a lower level than expected, given the safeguard clauses in the "Everything But Arms" (EBA) agreement. However, recent South African investments in Mozambique indicate that some LDCs could increase their exports to the EU under the EBA. Clearly, more attention should be paid to the export supply behavior of the LDCs and ACP countries. Finally, it is unclear how the EU will manage to prevent the fraudulent re-exportation of sugar, which is particularly difficult to detect (there are presently some 21 cases of fraud involving sugar under investigation in the EU). Each of these issues is a research project in itself. In this paper, imports from ACP countries and LDCs amount to 2.5 million tons in the reference scenario.

We assume that a country benefiting from a duty-free tariff quota will export sugar (possibly purchased on the world market) to the EU market as long as the EU domestic price for raw sugar is higher than the world price. We also used a simplified assumption regarding in-quota imports with a positive tariff (e.g., Special Preferential Sugar [SPS] provisions), which have been reformed and now adjust annually.[12] Here, we assume that exports continue as long as the gap between the EU domestic price for raw sugar and the world price exceeds the tariff.

[12] The SPS provisions have now become the Complementary Quantities.

In the pre-experiment scenario (the "Reference" column in Table 1.1), the reform of the sugar sector leads to a significant reduction in the EU supply of sugar (note that the 2006 provisions are included in the reference scenario but not the recent May 2007 proposal, which has not been adopted by the Council). However, when preferential imports are taken into account, this supply remains higher than domestic consumption. It is noteworthy that the reform leads to a significant reduction in the domestic price, as expected, with a price of 404 euros per ton within the EU, compared to a price of 288 euros on the world market. Under the assumption that there is no change in border protection, the gap between the two prices is lower than the present tariff in ad valorem equivalent.

In the pre-experiment scenario, the level of exports seems higher than the EU commitments under the Uruguay Round agreement, once the constraints resulting from the WTO panel decision are taken into account. The explanation is that we believe the EU will be able to export sugar, thanks to untapped possibilities for processed products, facilitated by the market situation in the dairy sector. This assumption is debatable, but in our case it appears to provide a degree of flexibility that seems important to ensure market equilibrium in the sugar sector.

The second column in Table 1.1, "WTO threshold on export refunds," corresponds to a situation in which the EU decides to decrease production so as to respect WTO obligations without using export refunds on non–Annex 1 products. Compared to the reference scenario, production must decrease by a further 12 percent, leading to a 10.7 percent decrease in total sugar beet income (assuming that all rents accrue to farmers). Note that in this situation, we assume that quota reductions reduce the production of less-competitive farmers, so that aggregate production costs adjust downward. In that case, sugar production costs amount to 310 euros per ton (not shown in the table), a level very comparable to the world price. If the Commission chooses not to use the possibilities of export refunds for processed products, as allowed under the WTO agreement, the results suggest that the 2006 sugar reform will not be sufficient to ensure market equilibrium.

Table 1.1. The EU-15 sugar markets under different scenarios (change in % with respect to the reference in parentheses)

	Reference	WTO threshold on export refunds	WTO agreement (EU proposal)	Biofuel target
Sugar production (MT)	13,862	12,199	10,927	15,682
		(-12.0%)	(-21.2%)	(13.1%)
Sugar consumption (MT)	13,076	13,075	13,075	14,929
		(0.0%)	(0.0%)	(14.2%)
Imports (MT)	2,499	2,499	2,499	2,499
		(0.0%)	(0.0%)	(0.0%)
Exports (MT)	2,933	1,271	0	2,900
		(-56.7%)	(-100%)	(-1.1%)
Domestic price (€/T)	404	404	404	404
		(0.0%)	(0.0%)	(0.0%)
World price (€/T)	288	308	325	288
		(7.0%)	(13.0%)	(0.1%)
Export subsidies (M€)	342	123	0	337
		(-64.1%)	(-100%)	(-1.5%)
Sugar beet production costs (€/T)	19.2	17.0	15.1	22.4
		(-11.4%)	(-21.6%)	(16.3%)
Sugar beet quota rents (M€)	1093	1156	1182	771
		(5.7%)	(8.1%)	(-29.5%)
Sugar beet value added (M€)	758	498	321	1,166
		(-34.3%)	(-57.7%)	(53.8%)
Sugar beet total income (M€)	1,851	1,654	1,503	1,937
		(-10.7%)	(-18.8%)	(4.6%)

Notes: *€/T = euros per ton; M€ = million euros; MT = million tons; WTO = World Trade Organization*

Counterfactual Scenario: Impact of a Trade Liberalization Scenario

The bound tariff for sugar is very high in the EU. Should a WTO agreement take place, sugar would be in the highest "band," subject to the largest tariff cuts. The question arises regarding the possible classification of sugar as a sensitive product. Indeed, sugar producers have already pointed out the considerable reduction in EU production that resulted from the combination of the EU reform, the ending of the "C" sugar category , the lowering of the export ceiling for in-quota sugar (due to the WTO panel decision), and imports from LDCs. These producers have made it clear that a trade agreement with Mercosur that would liberalize the sugar trade, or a large cut in tariffs under the Doha Round agreement, would be beyond what they could absorb, given that they expect production to decrease by some 35 percent compared to the 2004/05 level. However, it is unclear whether the Commission would classify sugar as a sensitive product. Indeed, the 2006 cut in the intervention price provides some degrees of freedom for lowering tariffs (the formal removal of the intervention price might also affect the calculation of the aggregate measure of support [AMS]). Our calculations suggest that the present tariffs for sugar could be decreased by more than 60 percent without leading to the considerable surge in imports feared by producers. This is, however, dependent on the level of the world price (even though the EU tariffs are specific tariffs) and on the exchange rates between the euro and the dollar and the dollar and the real.

In this counterfactual scenario, we consider possible trade liberalization under a WTO agreement in the Doha Round following the EU proposal presented in December 2005 at the Hong Kong ministerial meeting.[13] We assume that by 2015 the EU no longer subsidizes exports, including exports of processed products, and that the distorting domestic support provisions result in a 70 percent cut in the AMS (which should have limited consequences for the EU since we already included the decoupling that took place between 2005 and 2007 in our reference scenario, and we consider that the decoupled direct payments will remain excluded in the computation of the AMS). And we assume a reduction in tariffs in four bands (ranging from 35 percent to 60 percent), in addition to a cap of tariffs at a 100 percent ad valorem equivalent. We also select 8 percent of the tariff lines at the eight-digit level that the EU would classify as "sensitive." These sensitive products, in our scenario, include most tariff lines for beef, sheep meat, butter, and maize. For these products we assume that the corresponding tariff is reduced by only half of the percentage corresponding to the relevant band. Our scenario is clearly a conservative one, as it is unlikely that the 2005 EU proposal will be accepted by other WTO members and that more than 5 percent of tariff lines would be eligible for "sensitive" status in the event of an agreement. In addition, when a product is classified as sensitive, plans normally call for some import quotas to be expanded, according to the August 2004 Framework agreement, even though there is no agreement on the practical modalities or on what should be done for products not subject to a tariff rate quota. Here, we ignored this increase in quota, making our scenario even more conservative.

The results for the sugar sector are provided in the "WTO Agreement" column of Table 1.1, as a percentage of the reference scenario. In this scenario we assume that the sugar sector adjusts by reducing production quotas rather than by decreasing the domestic price. Compared to the reference scenario, there is therefore a 21 percent reduction in production. EU exports fall to zero, and, as a result, the world price increases slightly. It is noteworthy that the production costs are such that beets are produced at a loss, and the level of production clearly depends on our assumption that some of the Single Farm Payments still provide some incentive to produce.

The Impact of the Planned EU Biofuels Policy

It is becoming somewhat irrelevant to assess the situation of the EU sugar market without addressing the ethanol issue. Schmidhuber (2007) shows how, in practice, the price of sugar now follows the price

[13] We do not consider trade liberalization under ongoing negotiations such as those between the EU and Mercosur, or those between the EU and Central American countries. Nor do we assume that the ongoing process of progressive trade liberalization within the bilateral agreements with Mexico and South Africa will include more sugar products.

fluctuations of the oil market much more closely than in the past. He also shows that the energy market sets a de facto threshold price (and possibly a floor price) on the fluctuations of commodities such as sugar, even though these prices depend themselves on the price of oil, so that the overall impact on price volatility is unclear.

The EU biofuel policy. Jacquet et al (2007) have provided a recent analysis of the EU biofuel policy. In brief, the EU has set ambitious targets for the incorporation of renewable fuels in transportation fuel. The main motivation is the willingness to meet targets for greenhouse gas emissions, but some member states clearly pushed for an ambitious biofuel policy as a way to provide extra outlets to farmers, whom they see as threatened by the likely reform of the CAP after 2013, by the prospects of trade liberalization, and, perhaps more importantly, by the erosion of the consensus for an ambitious CAP among member states. The biofuel targets are met through support for the production of biofuels both at the farm level (through a direct payment per hectare for energy crops as well as the right to grow energy crops on set-aside land) and at the end-use level (tax exemptions). At the farm level, the energy crop payments are part of the CAP and therefore subject to EU-wide regulations, while the other measures are left to the member states. This explains why they differ so greatly, with some countries having implemented very ambitious policies and others having done little. The tax exemptions for using biofuels in gasoline and diesel are currently the main driving force for the increased consumption of ethanol and biodiesel in France, Germany, and the UK, for example. However, given the growing costs for public finances, there is a trend, particularly in the UK and Germany, to impose mandatory incorporation rates and therefore pass the cost of using biofuels on to consumers.

Some member states, such as Sweden, are keen to rely more on imported biofuels, whose energy balance (at least for the ethanol produced from cane) is seen as more appealing than EU-grown ethanol. However, so far, imports of ethanol still face a high tariff, as described above.

In the EU, most of the biofuel produced (and consumed) is biodiesel. One explanation is the high share of diesel (55 percent vs. 45 percent for gasoline) in transport fuel, but the incorporation of ethanol in gasoline is only 0.4 percent while the incorporation of biodiesel in diesel reaches 1.6 percent. This unbalanced utilization of bioethanol and biodiesel reflects the supply structure, as roughly 80 percent of the biofuel domestically produced is biodiesel. Production of bioethanol reached 720,000 tons in 2005, compared to 200,000 tons of imports (see Table 1.2 and Figure 1.4). Spain was the main producer, producing ethanol from both cereals and wine alcohol, but was overtaken by Germany in 2006, which opened a large-scale plant for producing ethanol from cereals. The 2006 figures should also show a significant increase in French and Spanish production. Ethanol is produced primarily from wheat in the EU and interacts only in a very indirect way with the sugar market. In 2006, the production capacity was limited (Tereos in France, producing less than 100 million liters; Cristanol in France, 200 million liters; Saint Louis Sucre in France, less than 100 million liters). Several plants intending to produce ethanol from sugar, sugar beets, or molasses are under construction.[14] For example, French production capacity should increase by 300 to 400 million liters, and German capacity by 300 million liters in the near future.

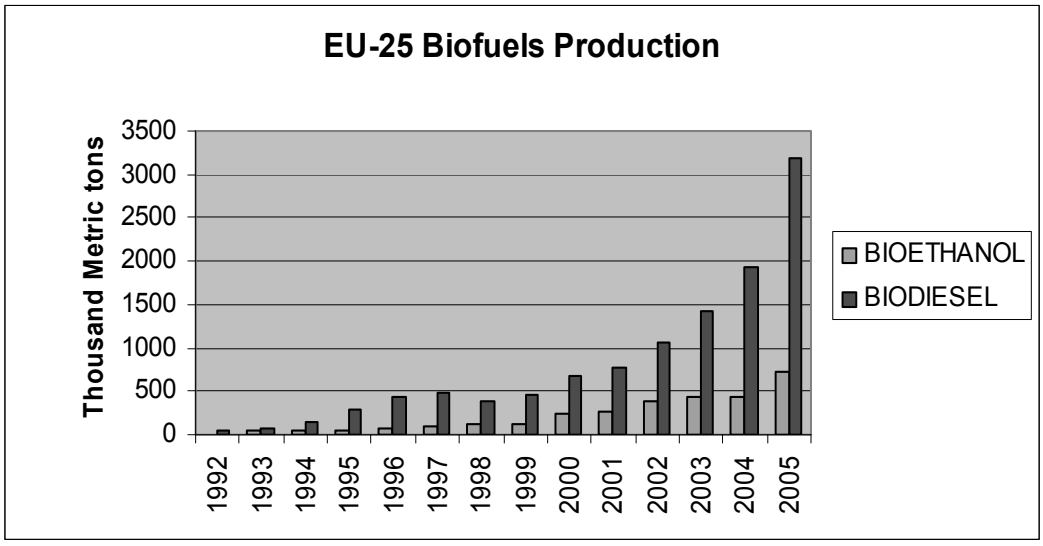
[14] AgroetanoTTD Dobrovice in the Czech Republic, Cristanol Bezancourt and Saint Louis Sucre-Dunkerque in France; Nordzucker Klein-Wanzleben, CropEnergie-Seitz, and Danisco-Aklam in Germany; and BritishSugar-Downham in the UK. Some are designed to produce ethanol from various materials, including beets (BioWanze SA in Belgium, PLP-Trmice in the Czech Republic, Helenic Subar EBZ in Greece).

Table 1.2. Bioethanol production in the EU-25 (million liters), all sources (cereals, wine, sugar)

	2003*	2004	2005	2006
Spain	160	254	303	402
Sweden	52	71	153	140
Germany	60	25	165	431
France	82	101	144	250
Poland	60	48	64	120
Finland		3	13	0
Hungary			35	34
Netherlands		14	8	15
Lithuania			8	18
Total EU-25	**424**	**528**	**913**	**1,565**

Source: EurObserv'ER (Biofuel Barometer) and European Bioethanol Association (2004–2006)
Note*: * Thousand tons for 2003.*

Figure 1.4. Growth in ethanol vs. biodiesel production



Simulation results. The EU directive regarding the incorporation of biofuels in transport fuel sets targets but no mandatory constraints. A higher target was set for 2020, and some member states have set their own targets, some of which are higher than the EU-wide targets. However, it is unlikely that the 5.75 percent target will be met by 2010 as planned. In this realistic though somewhat conservative scenario, we consider that the EU biofuel policy is such that the 5.75 percent target will be met in 2015 without changes in the EU trade policy. Here, we assume that energy crops are grown primarily on set-aside land. Given that duties on ethanol remain in place, that soybean oil still faces some technical obstacles to use (at least pure) in biodiesel, and that the EU policy is unlikely to encourage large imports of palm oil because of the dreadful environmental impact of its production, most of the EU demand is met by local production, primarily by higher production of rapeseed.[15] However, ethanol is produced from sugar beet under this scenario when imports of cane ethanol face high tariffs (see Gohin, 2007a).

[15] The European Parliament has tried to ban imports of palm oil because of its devastating effects on rain forests and biodiversity. Several member states, including the UK and Sweden, have announced that they will attempt to discourage the use

The results corresponding to this scenario are presented in Table 1.1, with the "Biofuel target" column reflecting the EU 5.75 percent incorporation target alone. These results are clearly subject to caution, since the coefficients that lead to predictions of the expansion of the use of sugar for biofuels can hardly be estimated based on past data. However, they suggest that the mandatory target will lead to significant changes in the market for arable crops, including sugar, compared to the reference scenario, where there was no incentive and no demand for biofuels. The EU supply of arable crops, including wheat, adjusts, but the adjustment takes place through the lowering of exports of wheat and oilseed oil. It is noteworthy that the impact on sugar production is also significant. Indeed, some of the demand for biofuel is met by ethanol production from beets, which takes place outside the quota. This additional production leads to an increase in production costs and, accordingly, a decline in quota rents. Overall, the total income of sugar beet farms increases slightly (4.6 percent) compared to the reference scenario, partially compensating for the effects of further sugar policy reform. However, these figures suggest that this EU biofuel outlet will be insufficient to compensate for the negative effects of a new WTO agreement on the sugar sector. Only strong demand for sugar in other countries, for their biofuel consumption, may reverse these negative figures.

Conclusion

The 2006 sugar reform has introduced major change to EU production. These changes affect the world market, given that the EU, the second largest exporter a few years ago, is likely to become a major net importer of sugar in the next few years. The shock has been considerable for the EU sugar industry. For the last 18 months, a major consolidation of the industry has been taking place. However, given that prices are still higher than the world price, on average, and that some significant protection persists against imports from the most competitive producers such as Brazil, Australia, and Thailand, EU production is still profitable in many areas. This explains why even though some countries such as Italy and Ireland have given up production, less quota than expected by the Commission has been freed. Because some producers have purchased extra quota, the reform falls short of reducing EU production by 5 to 6 million tons. This is the quantity that is seen as balancing the market, given the EU commitments to import more sugar under preferential agreements and to considerably reduce its exports due to the 2006 ruling of the WTO DSB. The Commission is proposing a deepening of the reform, so as to cope with market imbalance.

A likely agreement with the ACP countries might add even more pressure to reduce EU prices and production. So would a potential agreement within the Doha Round, or a successful negotiation with the Mercosur countries. The EU would become an even larger importer, and a significant reduction in the EU domestic price might be needed.

The EU biofuel policy should provide a significant outlet for rapeseed as an energy crop, but also (to a minor extent) for sugar beet producers. However, the costs of producing ethanol from sugar are such that domestic production would fill the demand generated by mandatory targets for biofuels in transport fuels only if some significant protection for ethanol was maintained. Otherwise, imports will meet most of the new demand, and there is little hope that the EU sugar sector will find sufficient outlets in this area.

of palm oil for biodiesel, even though it is unclear how they will actually do so (Sweden has expressed a commitment to eliminating tax exemptions and incentives for biofuels made from palm oil).

REFERENCES

Abler, D., and D. Blandford. 2005. *A review of empirical studies on the production impacts of PFC and MLA payments under the U.S. FAIR Act*. Consultants' report. Paris: Organization for Economic Cooperation and Development (OECD).

Adenäuer, M., and T. Heckelei. 2005. Economic incentives to supply sugar beets in Europe. Paper presented at the 89th European Association of Agricultural Economists seminar, Modeling Agricultural Policies, Parma, Italy, February 3–5.

Adenäuer, M., K. Louhichi, B. Henry de Frahan, and H.P. Witzke. 2004. Impact of the "Everything but Arms" initiative on the EU sugar sub-sector. Paper presented at the International Conference on Policy Modelling (EcoMod2004), Paris, June 30–July 2.

Ball, V.E., J.C. Bureau, J.P. Butault, and H.P. Witzke. 1993. The stock of capital in European Community agriculture. *European Review of Agricultural Economics* 20(14): 12–23.

Bogetoft, P., K. Boye, H. Neergaard-Petersen, and K. Nielsen. 2007. Reallocating sugar beet contracts: Can sugar production survive in Denmark? *European Review of Agricultural Economics* 34(1): 1–20.

Bouët, A., J.C. Bureau, D. Decreux, and S. Jean. 2005. Multilateral agricultural trade liberalization: The contrasting fortunes of developing countries in the Doha Round. *The World Economy* 28(9): 1329–1354.

Brüntrup M. 2006. Everything But Arms (EBA) sugar market reform: Development gift or Trojan horse? German Development Institute, Discussion Paper 10/2006, Bonn.

Bureau, J.C., H. Guyomard, L. Morin, and V. Réquillart. 1997. Quota mobility in the European sugar regime. *European Review of Agricultural Economics* 24:1–30.

Buysse, J., B. Fernagut, O. Harmignie, B. Henry de Frahan, L. Lauwers, P. Polomé, G. Van Huylenbroeck, and J. Van Meensel. 2007. Farm-based modeling of the EU sugar reform: Impact on Belgian sugar beet suppliers. *European Review of Agricultural Economics* 34(1): 21–52.

Chau, N., and H. de Gorter. 2005. Disentangling the consequences of direct payments schemes in agriculture on fixed costs, exit decisions and output. *American Journal of Agricultural Economics* 87(5): 1174–1181.

Commission of the European Communities. 2006. Impact assessment of the Communication on an EU strategy for biofuels. Annex. Draft working document, SEC2006/142, COM2006-34, Brussels.

DEFRA (Department for Environment, Food and Rural Affairs). 2006. Full and final regulatory impact assessment of options for reform of the EU sugar regime with particular reference to the Agriculture Council Agreement of 24 November 2005. United Kingdom, London, May 2006

El-Obeid, A., and J. Beghin. 2005. Multilateral trade and agricultural policy reforms in sugar markets. Working Paper 04-WP 356, Center for Agricultural and Rural Development, Iowa State University, Ames.

FAPRI (Food and Agricultural Policy Research Institute). 2007. *FAPRI US baseline briefing book*. FAPRI-UMC Report #02-07. Ames Iowa: Iowa State University.

Frandsen, S., H. Jensen, W. Yu, and A. Walter-Jorgensen. 2003. Reform of the EU sugar policy: Price cuts versus quota reductions. *European Review of Agricultural Economics* 30(1): 1–26.

Garside, B., T. Hills, J.C. Marques, C. Seeger, and C. Thiel. 2004. *Who gains from sugar quotas?* Report, London School of Economics and Overseas Development Institute DESTIN DV406 Research Project. London: London School of Economics.

Gohin, A. 2007a. Impacts of the biofuel policy on the EU farm sector: A general equilibrium analysis. TRADEAG working paper presented at the Farm Foundation workshop Biofuel, Feed and Food Tradeoff, http://www.farmfoundation.org.

Gohin, A. 2007b. The GOAL CGE model: An updated technical description. TRADEAG Deliverable 11. http://www.tradeag.eu/.

Gohin, A., and J.C. Bureau. 2006. Modeling the EU sugar supply to assess sectoral policy reforms. *European Review of Agricultural Economics* 33:223–247.

Gohin, A., and G. Moschini. 2006. Evaluating the market and welfare impacts of agricultural policy in developed countries: Comparison of partial and general equilibrium measures. *Review of Agricultural Economics* 28(2): 195–211.

Hertel, T.W. 2002. Applied general equilibrium analysis of agricultural and resource policies. In *Handbook of agricultural economics*, vol. 2A, ed. B.L. Gardner and G.C. Rausser. North Holland.

House of Lords. 2006. *Too much or too little? Changes to the EU sugar regime.* 18th Report of Session 2005/06, European Union Committee. Vol. I (report) and Vol. II (evidence). London: House of Lords.

Jacquet, F., L. Bamière, J.C. Bureau, L. Guindé, H. Guyomard, and D. Treguer. 2007. Recent developments and prospects for the production of biofuels in the EU: Can they really be "part of the solution"? Working paper presented at the Farm Foundation workshop Biofuel, Feed and Food Tradeoff, http:// www.farmfoundation.org.

Kopp, J., and H. de Gorter. 2005. The economics of cross-subsidization: Implications of the WTO panels on EU sugar and Canadian dairy. Paper presented at the International Agricultural Trade Research Consortium symposium Pressures for Agricultural Policy Reform, Seville, Spain, June 21–25.

LMC International. 2004. *Addressing the impact of preference erosion in sugar on developing countries.* Study prepared for Department for International Development, Landell Mills Corporation International, and Oxford Policy Management London. London: LMC.

OECD (Organization for Economic Cooperation and Development). 2005. *An analysis of sugar policy reform and trade liberalisation*. Paris: OECD.

Poonyth, D., P. Westhoff, A. Womack, and G. Adams. 2000. Impacts of WTO restrictions on subsidized EU sugar exports. *Agricultural Economics* 22:233–245.

Revoredo, C., A. Renwick, and M. Reader. 2005. UK sugar beet farm productivity under different reform scenarios: A farm level analysis. Paper presented at the EAAE (European Association of Agricultural Economists) Congress, Copenhagen.

Rozakis, S., and J.C. Sourie. 2005. Micro-economic modeling of biofuel system in France to determine tax exemption policy under uncertainty. *Energy Policy* 33(2): 171–182.

Sumner, D.A. 2003. Implications of the U.S. Farm Bill of 2002 for agricultural trade and trade negotiations. *Australian Journal of Agricultural and Resource Economics* 47(2): 99–122.

Schmidhuber, J. 2007. Impact of an increased biomass use on agricultural markets, prices and food security: A longer-term perspective. Discussion paper, Notre Europe, Paris; and Food and Agriculture Organization of the United Nations (FAO), Rome.

Van der Linde, M., V. Minne, A. Wooning, and F. van der Zee. 2000. *Evaluation of the common organisation of the markets in the sugar sector*. Evaluation Report for European Commission, Directorate-General for Agriculture and Rural Development. http://www.europa.eu.int/comm.

Van der Mensbrugghe, D., J. Beghin, and D. Mitchell. 2003. Modeling tariff rate quotas in a global context: The case of sugar markets in OECD countries. Working Paper 03-WP 343, Center for Agricultural and Rural Development, Iowa State University, Ames.

Witzke, H.P., and A. Kuhn. 2003. Assessing reform options for the sugar common market organisation: Quantitative analyses with interlinked models. Paper presented at Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaues, Stuttgart-Hohenheim, Germany, October.

Wohlgenant, M.K. 1999. Effects of trade liberalization on the world sugar market. Report prepared for the Food and Agriculture Organization of the United Nations (FAO), Rome

WTO. 2005b. *European Communities: Export subsidies on sugar*. AB-2005-2. Report of the appellate body. WT/DS265/AB/R. Geneva: WTO.

2. THE SUGAR/ETHANOL COMPLEX IN BRAZIL: DEVELOPMENT AND FUTURE

ANTONIO SALAZAR P. BRANDÃO[16]

Introduction

The creation of the Organization of Petroleum Exporting Countries (OPEC) and the rise in petroleum prices in 1973 motivated the Brazilian government to support the production of ethanol to be used as a substitute for gasoline. Since then, several policies have been implemented to support the sugar/ethanol production complex, and new technologies have been developed and implemented in the automobile industry. At present, Brazil is a large world producer of ethanol. Most domestic cars run on a mix of ethanol and gasoline that contains 23 percent of the former, and a significant number of new vehicles, called "flex fuel" vehicles, can run with any mixture of ethanol and gasoline.

The interest in renewable sources of energy presents opportunities to Brazil, which is at present competitive in the production of sugarcane for ethanol and soybeans for biodiesel. At the same time, the country has large amounts of land available to support increases in production and to maintain and expand other agricultural activities without negative environmental consequences, particularly deforestation.

This paper analyzes the development of the sugar/ethanol complex from the early 1970s to the present, emphasizing policies and policy reform as well as selected aspects of industrial organization. It is organized as follows: section 2 highlights the performance of the sector; section 3 deals with policy issues; section 4 describes the market and industry organization; section 5 highlights constraints for the development of the sugar/ethanol complex, stressing labor legislation and environmental issues; and section 6 summarizes the analysis.

Sector Performance

Table 2.1 and Figure 2.1 show production, area, and yields of sugarcane since 1970. From 1970 until the mid-1980s, production grew rapidly.[17] This growth was followed by a period of stagnation that lasted until 1994, after which growth resumed. In the period as a whole, the performance was remarkable, with an average annual growth rate of 5 percent.

Table 2.1. Area, production, and yield of sugarcane, 1970–2006

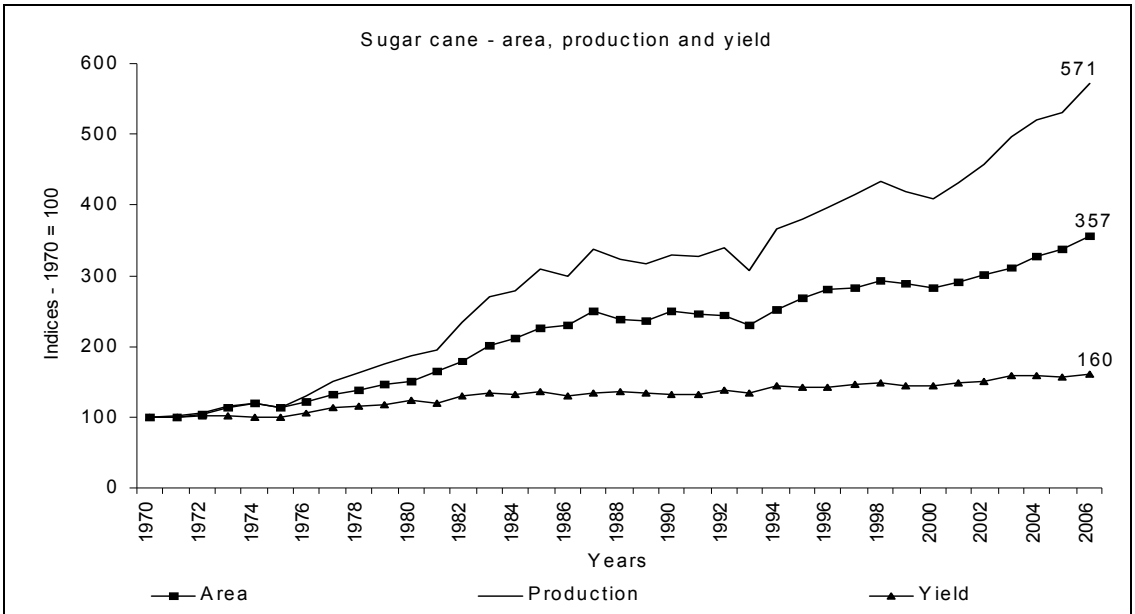
Year	Area	Production	Yield
	1,000 hectares	1,000 metric tons	metric ton/hectare
1970–1974	1,854	86,571	47
1975–1979	2,311	121,912	52
1980–1984	3,391	205,625	60
1985–1989	4,153	256,051	62
1990–1994	4,283	274,539	64
1995–1999	4,923	330,788	67
2000–2006	5,535	399,692	72

Source: Instituto Brasileiro de Geografia e Estatística (IBGE), Pesquisa Agrícola Municipal. Data for 2006 are from IBGE, Levantamento Sistemático da Produção Agrícola, April 2007.

[16] The author would like to acknowledge the contributions of several people: "I had a long and illuminating conversation with Guilherme Leite da Silva Dias about the sugar/ethanol industry when I started writing the paper. Siwa Misangi, Márcia Azanha Moraes, G. Edward Schuh, David Orden, and Ignez Vargas made many useful comments on earlier versions of the paper. Thanks are also extended to the participants of the conference where this paper was presented. Olivia Bertoche Gryzagoridis was an efficient research assistant who helped with data and other information for the paper. I am solely responsible for any remaining errors and omissions

[17] Throughout this chapter, tons refers to metric tons.

Figure 2.1. Sugarcane – area, production, and yield



Source: IBGE, Pesquisa Agrícola Municipal. Data for 2006 are from IBGE, Levantamento Sistemático da Produção Agrícola, April 2007.

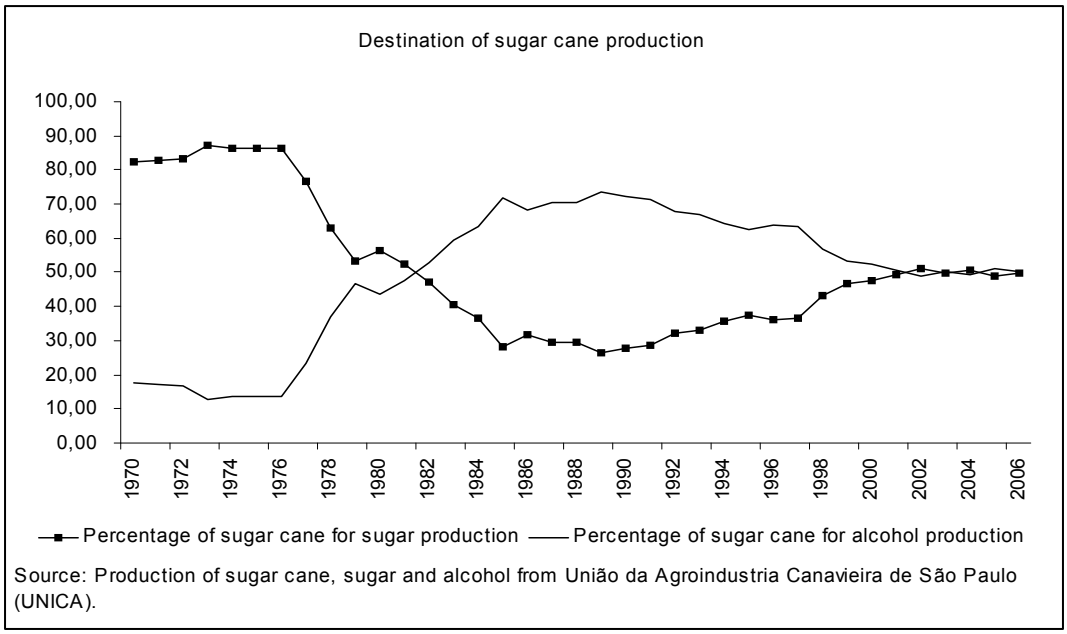
This trajectory is similar to that of many other crops in Brazil during this period. The relative stagnation in the mid-1980s was influenced by the extinction of generous credit subsidies that were the cornerstone of Brazilian agricultural policy from the 1970s until then. As argued below, however, factors specific to the sugar/ethanol complex are fundamental to explaining the development of this industry and contributed significantly to the impressive expansion observed after the period of stagnation in the production of sugarcane.

At the same time, it is somewhat surprising that during the period 1970–2006, yields increased only about 1 percent per year. Planted area, which expanded at an average annual rate of 4 percent, explains the largest share of production growth. The increase in acreage is larger than the increase for most other crops, while sugarcane yields have increased less than yields of other dynamic crops such as soybeans and corn.

Figure 2.2 displays the percentages of sugarcane used for sugar and ethanol production.[18] As can be seen, ethanol's share of sugarcane production increased sharply from the beginning of the gasohol program (Proálcool) in 1975 until 1985, when 70 percent of sugarcane was made into ethanol. A period of stagnation that lasted until 1991 followed this initial euphoria, and afterward production diminished. At present, sugar represents 49 percent of sugarcane production, and ethanol accounts for 51 percent.

[18]Conversion to equivalent units (ATR) is based on the following technical coefficients: 1 kg ATR = 0.953 kg sugar; 1 kg ATR = 0.550 liters anhydrous alcohol; and 1 kg ATR = 0.574 liters hydrous alcohol. Data for this figure is from Centro de Estudos Avançados em Economia Aplicada, Escola Superior Luiz de Queiroz, Universidade de São Paulo (CEPEA).

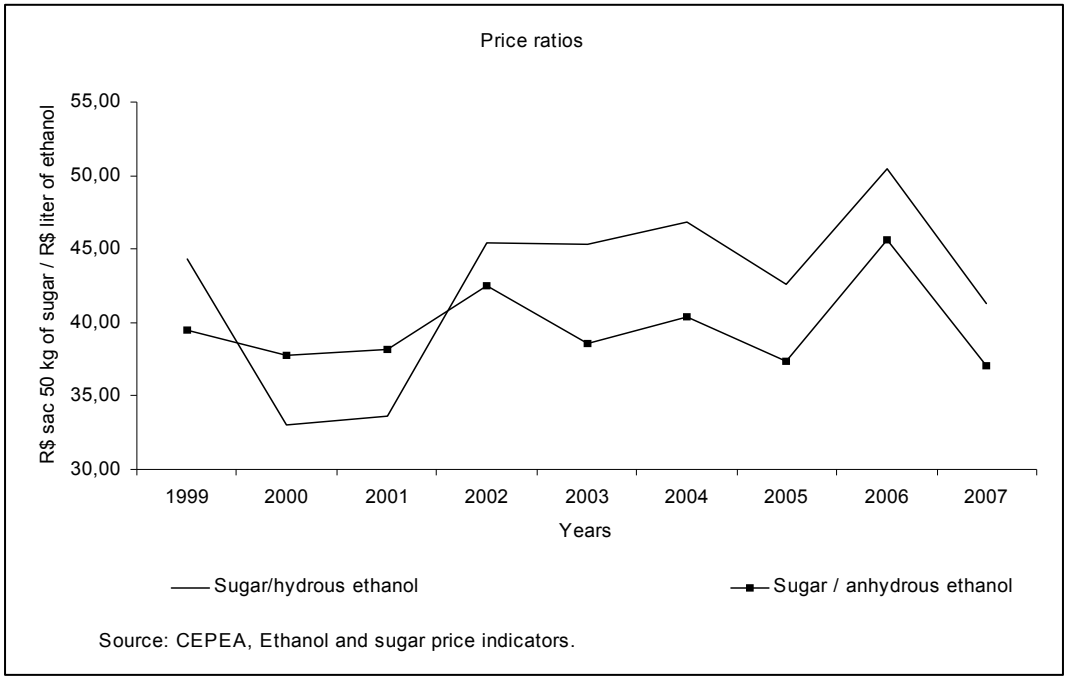
Figure 2.2. Destination of sugarcane production



Source: Production of sugar cane, sugar and alcohol from União da Agroindustria Canavieira de São Paulo (UNICA).

Figure 2.3 displays the monthly price ratios of sugar / hydrous ethanol and sugar / anhydrous ethanol from February 1999 to June 2007. In January 2002, both ratios jumped upward and remained high until around October 2006. Nonetheless, as shown in Figure 2.3, use of cane for sugar remained relatively constant. The two price ratios decreased in 2007. Despite this significant drop in the relative price of sugar, the data do not yet show any significant reduction in the percentage of sugarcane used for sugar production.

Figure 2.3. Price ratios

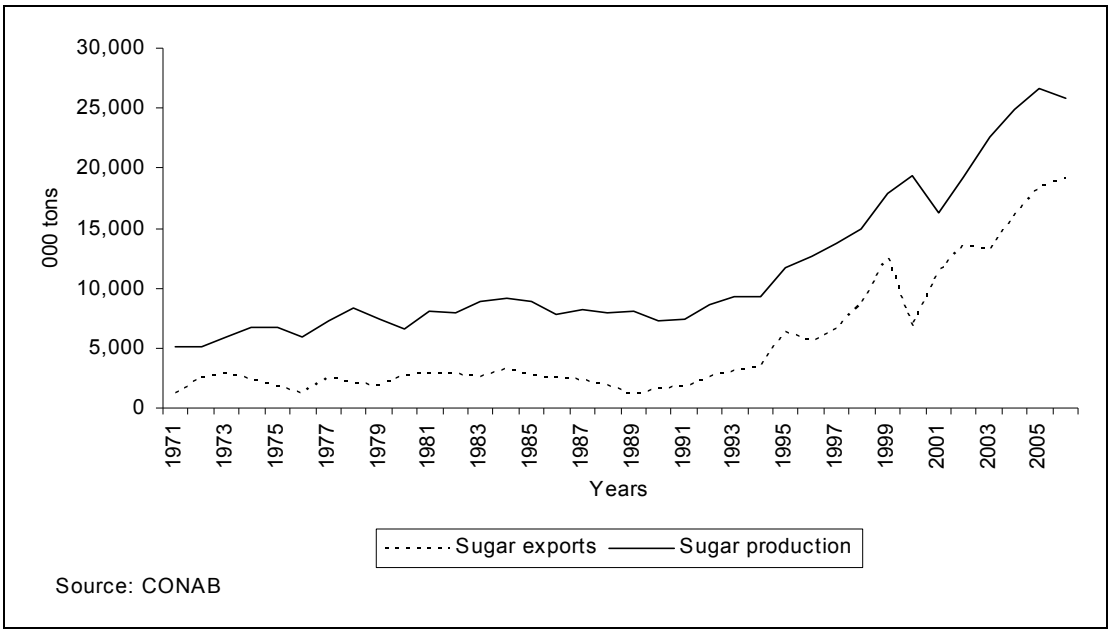


Source: CEPEA, Ethanol and sugar price indicators.

The years 1989 and 1990 were turning points for the Brazilian ethanol program. As seen in Figure 2.2, after 1990 the proportion of sugarcane used for ethanol production stopped its sharp increase and slightly diminished until stabilizing after 2002. An important factor underlying this process was a shortage of ethanol production in 1989 and again in 1990, when most mills took advantage of relatively favorable international sugar prices. The main consequence was skepticism by ethanol consumers, which led to a sharp reduction in sales of ethanol-fueled cars, as discussed further below).

Figure 2.4 shows the volume of sugar production and exports. Production and exports were relatively stagnant until around 1989.[19] Both increased remarkably afterward, and exports represented an increasing share of production, from 20–30 percent before 1992 to about 70 percent after 1999. Another feature that deserves attention is the fact that apparent consumption – estimated using the difference between production and exports – increased little during the period.

Figure 2.4. Sugar: Production and exports



In the face of a stagnant domestic market for sugar, the stimulus for the increase in sugarcane production from 1970 until the mid-1980s came from incentives provided by government programs established in the early 1970s, as will be discussed below. But by 1980 production of ethanol was already accounting for more than 40 percent of sugarcane production, and this added strength to the expansion of production in the first half of that decade. The skepticism about ethanol at the end of the decade reduced demand growth for this product, and exports of sugar took the lead in providing the stimulus for the expansion of sugarcane production. This took place despite the fact that world sugar prices were declining.

Two concentrations of ethanol are produced in Brazil: hydrous and anhydrous. The former is used as a substitute for gasoline, and the latter is mixed with gasoline. Production of both, as well as total production, is shown in Figure 2.5.[20] The period of rapid increases in production extends from the beginning of the implementation of the gasohol program in 1975 until 1985, when total production reached 12 million cubic meters. This, as noted above, was an anchor for the expansion of sugarcane

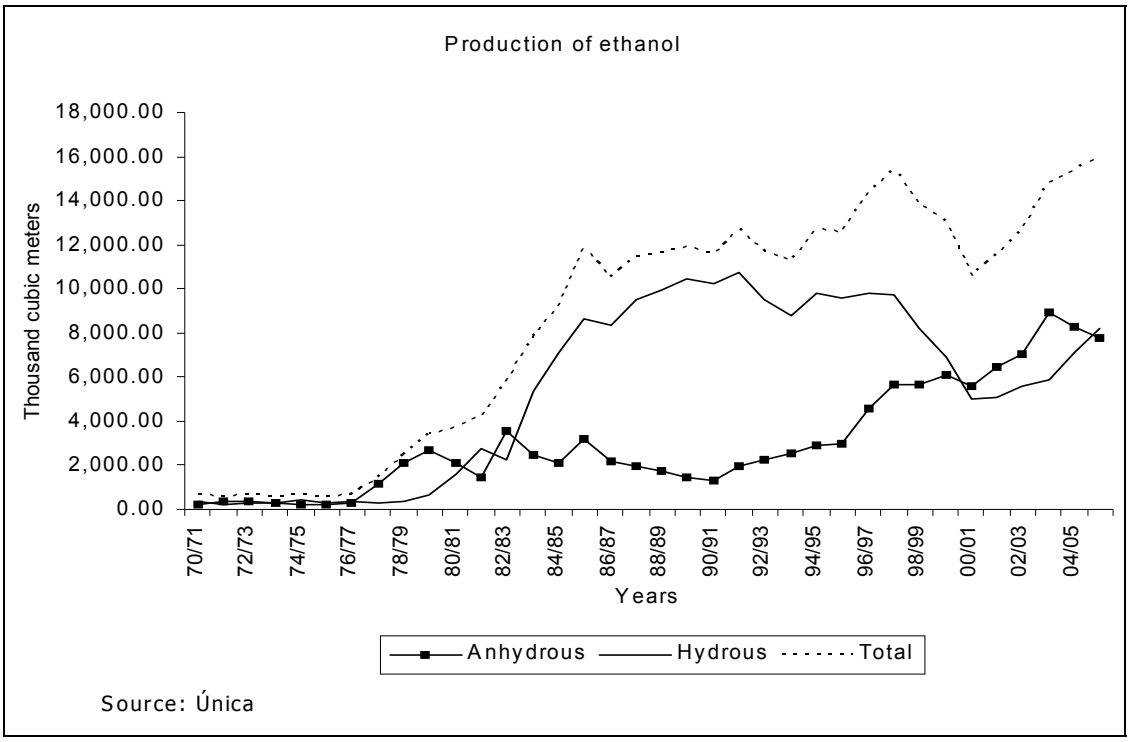
[19] Source of this figure is CONAB, the Companhia Nacional de Abastecimento.
[20] Source of this figure is União da Agroindústria Canavieira do Estado de São Paulo (UNICA).

production during that period. However, for the next 17 years ethanol production remained relatively stable. After 2002 production again increased, reaching 16 million cubic meters in the crop year 2005/06 and 17 million cubic meters in the crop year 2006/07. Ethanol production grew at an annual average rate of 8 percent during the period 2002/03 to 2006/07.

Production of ethanol has been almost entirely for the domestic market. Exports occurred occasionally, in small volumes, and in years of abundant production. However, that situation seems to have changed recently, and exports of fuel ethanol of 2.4, 2.6, and 3.4 million cubic meters occurred in 2004, 2005, and 2006, respectively.[21] The United States, Japan, and the European Union were the largest importers.

The production shares of hydrous and anhydrous ethanol depend essentially on two variables: the stock of ethanol-fueled vehicles and government regulation that determines the volume of ethanol to be mixed with gasoline. Thus, in the early 1970s production of anhydrous ethanol was larger than that of hydrous ethanol, as Figure 2.5 shows. From 1983 to 1994, the situation was reversed, largely because of the increase in the stock of ethanol-fueled cars. Afterward, production of hydrous ethanol began to diminish, induced by lower sales of cars and by an increase in the ethanol mix from 13 to 22 percent in 1992. In 2003, with the introduction of flex fuel cars, production of hydrous ethanol was again on the rise.

Figure 2.5. Production of ethanol



To complement the previous analysis, Figure 2.6 shows the production of ethanol-fueled cars since the inception of the program in 1975. A peak occurred in 1986, when almost 700,000 units were produced, and afterward a dramatic drop occurred. Production of flex fuel cars began in 2003, and sales of ethanol-fueled cars resumed. In 2006, 1.4 million such cars were produced and sold, comprising 64 percent of total sales of automobiles and light vehicles in the domestic market.[22]

[21] Ethanol exports before this period were directed to nonfuel uses, such as beverages and fragrances.
[22] Anfavea (National Association of Producers of Automotive Vehicles) at http://www.anfavea.com.br.

Figure 2.6. Production of ethanol and flex fuel cars

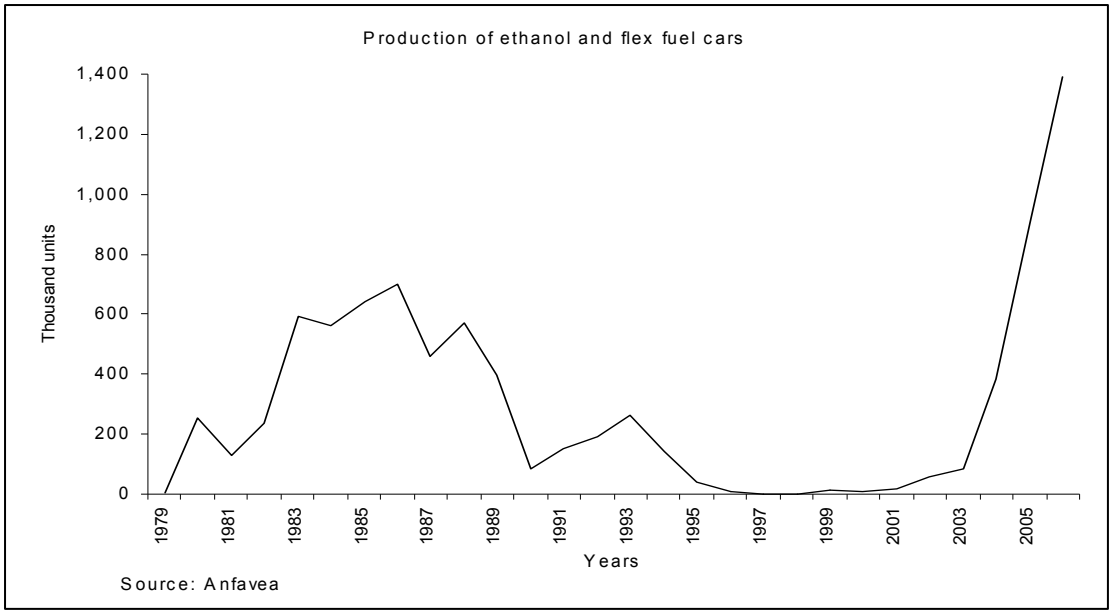
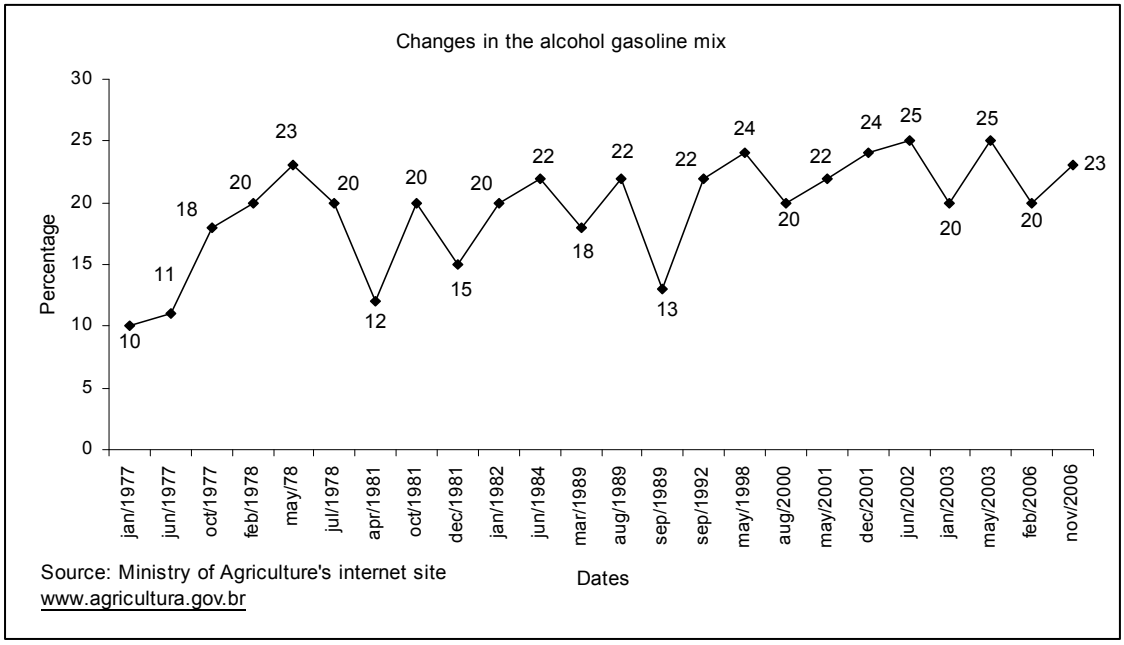


Figure 2.7 shows the evolution of the government-determined percentages of ethanol added to gasoline. There are two things to be noted here: the increase between 2000 and 2002 and the fact that recently the government has often reduced that percentage at the beginning of the year, a period of short supply of ethanol that coincides with the end of the sugarcane harvest.

Figure 2.7. Changes in the alcohol-gasoline mix



Policy Reform: From Domestic Support to Freer Markets

The history of government interventions in the sector dates back to the early 1930s, when the Sugar and Alcohol Institute (IAA) was created. Moraes (2000)[23] divides this period into four subperiods for purposes of analysis: from 1930 to the end of the 1960s, from 1970 to 1980, from 1980 to 1990, and after 1990.

From the 1930s to the 1960s, production quotas were established for each mill, prices were fixed, and marketing rules were established to reduce conflicts between sugarcane producers and processors.

In the 1970s, quotas and price controls remained in place, and programs to stimulate productivity and modernization in agriculture were implemented. An important program – known by the acronym Planalsucar – provided support for research and development and established experimental stations in the states of São Paulo, Rio de Janeiro, Alagoas, and Pernambuco. Other incentives were provided through Programa Nacional de Melhoramento da Indústria Canavieira, which also addressed the modernization of industrial units. A third initiative was the creation of incentives[24] for mergers and acquisitions of industrial units.

The creation, in 1975, of the gasohol program (Proálcool) in response to the first oil shock was a landmark for this industry. From the end of 1975 to 1978 several new distilleries, most of them annexed to sugar mills, began to produce anhydrous ethanol. Initially the proportion of ethanol added to gasoline was 10 percent, but the volume increased, and in 1978 the proportion was already 23 percent. Production of hydrous ethanol and of ethanol-fueled cars began in 1979.

One important step in the implementation of Proálcool was the decision by Petrobras, the state petroleum company, to purchase the entire production of ethanol at a price fixed by the government.[25] At the same time, the creation of Proálcool qualified annex distilleries to receive subsidized credit from government finance agencies. Resources for these initiatives came from the government budget and from the net result of sales of ethanol by Petrobras.[26]

Credit conditions were generous for both distilleries and agricultural producers. For example, during the period 1975–1979 the interest rate for agricultural credit was between 13 and 15 percent per year,[27] credit could be used to finance 100 percent of investment, and the repayment period was 12 years. For industrial projects, credit was available for up to 80 percent of investment, at an interest rate of 17 percent per year, and the repayment period was between 3 and 12 years. One important aspect is that despite the fact that financing conditions were similar to those for other activities, the government effectively made resources available for the sugar/ethanol complex (see Marjotta-Maistro, 2002, p. 28).

Domestic support for less-competitive producers of sugar in the northeast began in 1971 and was designed to equalize costs with the center/southern region. Another subsidy was granted to producers in remote regions in order to equalize ethanol prices in the country.

In the 1980s a new phase of intervention began. The Brazilian economy was facing balance-of-payments problems, macroeconomic instability, increasing inflation, and increasing federal budget deficits. This situation limited the government resources available for investment. Nevertheless, several initiatives were taken to stimulate demand for ethanol-fueled cars: the price of ethanol was fixed below the price of gasoline[28]; the property tax for ethanol-fueled cars was set below that for non-ethanol cars;

[23] This section draws heavily on the excellent surveys contained in the works of Moraes (2000) and Marjotta-Maistro (2002).

[24] Most incentives consist of availability of credit by government agencies, such as Banco do Brasil, the National Development Bank (BNDES), at subsidized rates.

[25] At the beginning, the price of one liter of ethanol was (60/44) times the price of a 60 kg bag of sugar, where the fraction corresponds to the technical coefficient of conversion of sugar into ethanol. The coefficient was later increased to (60/38), and it kept changing over time.

[26] A short time after implementation, this account had negative balances and Petrobras had to participate in funding Proálcool.

[27] Annual inflation rates in this period rose from 30 percent in 1975 to 54 percent in 1979.

[28] Initially the price of ethanol was fixed at 65 percent of the price of gasoline. Until 1999, this involved production subsidies, as described in the section below.

the tax on industrial products (IPI) for gasoline-fueled cars was set above that for ethanol-fueled cars; and loans for the acquisition of ethanol-fueled cars had longer repayment periods.

The sugar and ethanol industry was not excluded from the economic liberalization wave of the 1990s. The first and most fundamental step was the abolition of the IAA. By 1999, sugarcane and ethanol prices were free from government intervention.[29] In 1996, the price of gasoline at the pump was also freed, and in 2002 the gasoline producer sales price was no longer determined by government decree.[30]

For a long period after the implementation of the gasohol program, the government stood ready to purchase all ethanol produced. Initially this was entirely done by Petrobras, but the system moved toward direct negotiations and contracts between producers and distributors. Subsidies to ethanol producers were discontinued with the liberalization of prices.

A question that naturally arises here is what the future policies for the sector will be. The answer is, of course, difficult to identify, but a few tentative observations are worth making. First, a return to the past, where prices were controlled and production was limited by quota, is unlikely. Second, it appears that the practice of granting credit at concessionary rates for machinery and equipment will be maintained and may even increase for this sector. Third, since the stability of fuel prices is a permanent concern, the government is likely to take steps to build up stocks of ethanol either in the hands of the private sector or even as government stocks.

Adjusting to a Freer Market: Industry Organization and Price Formation

Sugarcane. Production of sugarcane in Brazil is concentrated in two regions, the center/south and the northeast. The former accounts for approximately 85 percent of total production, with the state of São Paulo representing the largest share, about 60 percent of total production.

Approximately 70 percent of the total consumption of sugarcane by mills and distilleries comes from their own production.[31] In the state of São Paulo, mills and distilleries purchase about 21 percent of their raw material from 11,500 farmers. Approximately 77 percent of them produce less than 4,000 metric tons per crop year (Moraes, 2000, p. 172),[32] which suggests that transaction costs are high in this segment of the market. This situation is by no means specific to the state of São Paulo, but data are not available for the country as a whole.

There are approximately 400 mills and distilleries in Brazil, and, in the crop year 1998/99, the number of independent sugarcane producers – farmers who are not shareholders in mills and distilleries – was 39,000 (Moraes, 2000, p. 172, Table 9). In view of the fact that sugarcane has a high transportation cost, the acceptable distance between the production location and the processing plant is limited to a radius of approximately 50 kilometers. In consequence, local markets are created and price formation varies somewhat among them. In some markets, several industries compete for sugarcane, and independent producers may be able to exercise limited market power in the determination of the price. In situations such as this, sugarcane producers' associations participate in price negotiations with industry, and their action is often effective.

Other markets exist in which one industry purchases from several farmers and exercises market power in determining prices. Producers' associations often play an important role in the mitigation of industry's market power.

The price of sugarcane is, at present, entirely determined as described in the previous paragraphs. However, the transition from the period of government intervention, in which prices were fixed by the IAA, to the market-based system is not concluded in some states. The state of São Paulo is where most

[29] This was not a smooth process. Several delays occurred and many institutional changes also took place along the way.

[30] An aside relevant to this analysis is that since the creation of the National Petroleum Agency (ANP) in 1997, Petrobras has no longer held exclusive rights to the production and importation of petroleum. Nevertheless, Petrobras still has a de facto monopoly since it continues to be the sole producer of petroleum in the country.

[31] See Moraes (2000), pp. 171–172. Data refer to the crop year 1998/99.

[32] Data for the crop year 1998/99.

advances have occurred. In that state, sugarcane prices are established by a formula that takes into account sugar content, the domestic prices of sugar and ethanol, and their variation during the crop season.[33] The other main producer states, such as Paraná, Minas Gerais, Alagoas, and Pernambuco, already use a similar parametric formula to price the sugarcane. Disputes, when they arise, can be settled in a private arbitrage court established at the Futures and Commodities Exchange (BMF).

The extinction of the IAA and the subsequent liberalization of the sector gave rise to several modifications in the structure and organization of the industry as well. A landmark was the creation of the Union of the Sugarcane Industry of the State of São Paulo (UNICA) in 1997 to "strengthen producers' representation and unify actions in face of the new reality" (Moraes, 2000, p. 97). This union comprises more than 100 industrial units in the state of São Paulo, which produces approximately 58 percent of Brazilian sugarcane, 58 percent of sugar, and 60 percent of ethanol.[34]

Other attempts at organization by the private sector included the creation of a company called Brasil Álcool S.A. (BA), to export ethanol, and the Brazilian Ethanol Exchange (Bolsa Brasileira de Álcool, BBA), whose purpose was to stabilize domestic producer prices. Both were closed a few years after their creation. BA's problems arose because the original agreement was not enforced, leading to frequent sales by individual producers, and also because the company was not effective in influencing prices for its shareholders (Marjotta-Maistro, 2002, p. 34). The government competition authority ruled that BBA was a cartel.

Sugar. There are no interventions[35] in the sugar market, and domestic prices depend on international prices and on the exchange rate (Silveira, 2004). The product is spot traded in the São Paulo Commodities Exchange, and future contracts are negotiated in the Futures and Commodities Exchange. Sugar producers sell directly to their domestic clients and to exporters, and some even export directly.

Ethanol. The fuel market is regulated by ANP. Before price liberalization, distributors were required to inform ANP of the volumes of transactions involving ethanol. The purpose was to monitor producers' subsidies. ANP regulates and monitors the activities of the petroleum and ethanol industries but no longer keeps track of ethanol transactions.

That the price of ethanol depends on the price of gasoline is almost a truism. Petrobras is a key player in this market since it has a de facto monopoly on petroleum derivatives and has a large market share in the distribution and sales of gasoline, diesel, and ethanol.

Until 2002 the price of gasoline to the producer was set by the government, and until 2001 a percentage of the producer sales price was in effect a tax that is known in Brazil by the acronym PPE (Parcela de Preço Específica). The revenue was used to subsidize hydrous ethanol (to make it cheaper than gasoline) and the transportation cost of ethanol (to make prices identical in the whole country). When the ethanol market was liberalized in 1999, subsidies were eliminated and Petrobras used PPE revenue to postpone or sometimes prevent changes in the domestic price of gasoline and other petroleum derivatives in periods of instability in the international petroleum market.

In December 2001 PPE was replaced by a tax on imports and the marketing of fuels, CIDE. Revenue collected from this tax was earmarked to subsidize the prices and transportation costs of ethanol, natural gas, and petroleum products; to finance environmental projects related to petroleum and gas; and to finance transportation infrastructure. Thus far, however, the revenue collected from this tax has been for the most part retained by the federal government as a strategy to finance the budget deficit.
At present, the consumer price of gasoline is determined as follows:

- the producer sales price of gasoline is set by Petrobras, taking into account the international price of oil, the exchange rate, domestic transportation costs, and domestic taxes;

[33] Consecana, a technical group representing sugarcane producers and the industry, establishes rules and procedures for determining the price of sugarcane.

[34] This is for the 1998/99 crop year. More recent information is not available, but there is no reason to believe that Unica lost representation in this period; the contrary is more likely.

[35] Legislation establishes an export tax that varies from 0 to 40 percent. At present the tax rate is zero.

- the cost of gasoline at the distributor plant is equal to the sales price of gasoline plus transportation costs;
- the price of anhydrous ethanol at the distillery is determined on the open market by interactions between distributors of gasoline and ethanol producers, and the cost at the distributor's plant is equal to the anhydrous ethanol price plus transportation costs;
- the cost of gasoline to the distributor is equal to the weighted average of the costs of gasoline and anhydrous ethanol, with weights determined by government regulation[36]; and
- to establish the price of gasoline at the pump, distributors add taxes and their margins to the cost of gasoline.

The price of hydrous ethanol is also determined on the open market by producers and distributors.

There are more than 150 distributors, but the largest five – Petrobras, Ipiranga, Shell, Esso, a subsidiary of Exxon, and Texaco – have a combined market share of 73 and 53 percent of the anhydrous and hydrous markets, respectively.

The analysis of this section shows that producers and processors of sugarcane are moving toward the establishment of stable institutional arrangements to negotiate prices. São Paulo, the largest producer, is more advanced in this process, but other states and regions are following the same path. The price of sugar is negotiated in a free and transparent market where international prices influence and are influenced by domestic prices (Silveira, 2004). The price of ethanol is also determined in an open market, but the role of Petrobras and of large fuel distributors must be acknowledged. The government can influence prices through changes in the mix of ethanol and gasoline and also through the auctions for acquisition of ethanol conducted by Petrobras.

The changes in consumer prices for gasoline and hydrous ethanol in the city of Rio de Janeiro are shown in Figure 2.8.[37] The straight line parallel to the horizontal axis (labeled "Série4" in the legend) represents the upper bound of the ratio required to make consumers have no preference between hydrous ethanol and gasoline, accounting for the differences in performance of the two types of automobiles (Marjotta-Maistro and Asai, 2006). The ethanol production shortages in 1989 and 1990 dramatically reduced the credibility of Proálcool and led car makers to decrease production of ethanol-fueled vehicles. The loss of interest in Proálcool and captive demand by owners of existing ethanol-fueled cars led to an increase in the relative price of ethanol above the threshold level of 0.7. The relative price fell to a level close to 0.6 in 1999, a few years before the production of flex fuel cars began in 2003.

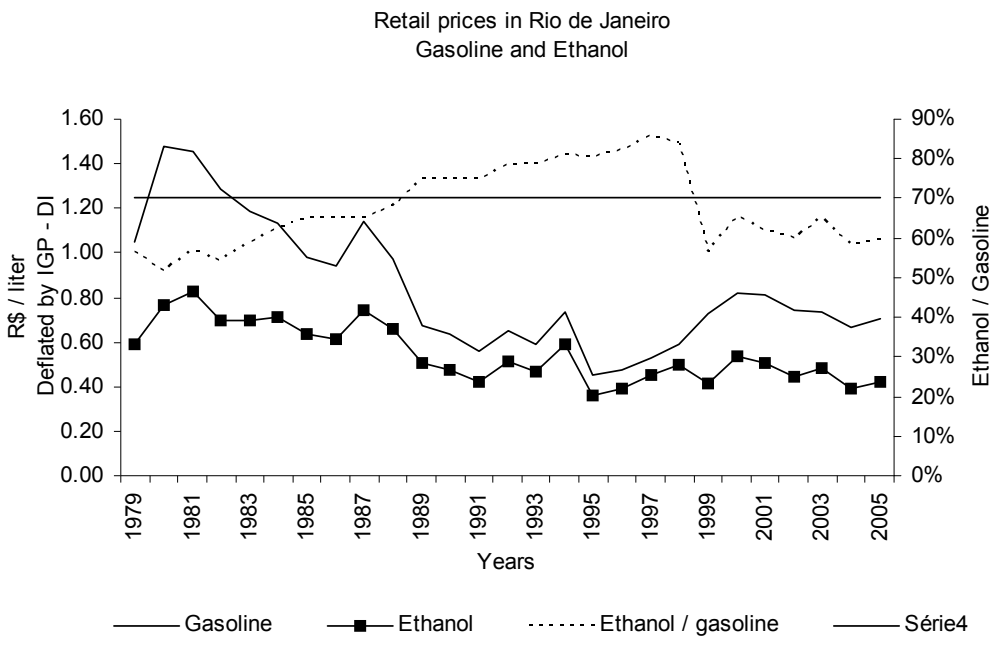
Finally, it is important to note that the majority of existing industrial units are able to produce both sugar and ethanol. This was a source of concern for consumers because increases in the relative price of sugar could lead to supply shortages. The production of flex fuel cars, however, was a breakthrough because it assured consumers of the sustainability of the supply of fuel for their cars and the ability to purchase the cheapest type of fuel.

Nevertheless, since flex fuel cars are not yet sold abroad, importers of ethanol are reluctant to contract purchases with annex distilleries, and, similarly, investors are cautious with these industrial units. Decisions to build dedicated plants, however, are riskier for producers, who would have to concentrate rather than diversify their portfolios.

[36] In June 2007, the percentage of ethanol in the gasoline-ethanol mix**?** was 23 percent.

[37] Prices have been deflated by the General Price Index – Domestic Availability, (IGP – DI) of Fundação Getulio Vargas.

Figure 2.8. Retail prices in Rio de Janeiro



Source: Ministério das Minas e Energia, Balanço Energético Nacional, 2006.

Challenges: Agricultural Protection, Labor Legislation, and Environmental Issues

The sugar/ethanol complex has come a long way since the beginning of the gasohol program in 1975. Two pillars of the sector's expansion were exports of sugar and the domestic consumption of ethanol. The domestic sugar market has shown little growth during the period.

The future expansion of the sector thus hinges on the development of the ethanol market and on the potential to increase sugar exports.

The first important challenge lies in the prospect for reduced protection of sugar in the Organization for Economic Cooperation and Development (OECD), particularly the European Union and in the United States. These are by now well-known issues and will not be further analyzed here.

A second challenge is to increase exports of ethanol. As indicated above, exports have reached a significant plateau in the last few years. Data for 2005, published by the Ministry of Mines and Energy, shows that ethanol comprises 34 percent of the domestic consumption of liquid fuels and 25 percent if natural gas is included.[38] Additional substitution will be induced by the renewal of the automobile stock and by a high relative price of gasoline. Even though both domestic ethanol and gasoline are likely to maintain demand growth for some time, it is the perspective of substitution abroad, particularly in the United States, in the European Union, and in Japan, that can provide stimulus for large investments in the ethanol sector. Thus, protectionism in the ethanol market poses a new external challenge that requires the attention of the government and of the private sector.

But there are domestic challenges as well. One of them is the inadequacy of the country's labor legislation.

[38] Ministério das Minas e Energia, Balanço Energético Nacional, 2006, at http://www.mme.gov.br. The inclusion of natural gas distorts the result, as only a minor portion is used as fuel in automobiles.

The harvesting of sugarcane is at present a primarily manual endeavor, and to perform this tiresome activity – probably one of the more demanding tasks in agriculture – seasonal labor is needed. In the most important producing regions, such as São Paulo, hiring takes place elsewhere, frequently in the northern and northeastern regions, a fact that creates uncertainty and increases costs (Rezende and Kretter, 2007). An additional difficulty arises from the fact that Brazilian legislation does not include provisions that apply to seasonal labor in agriculture. Thus, a farmer who hires temporary workers must bear all the hiring and firing costs of taking on permanent employees. Sugarcane harvesting in the center/south of Brazil usually starts in May and finishes in December. Most farmers harvest their plots in shorter periods, and this significantly increases the burden of the fixed cost of hiring and firing.

A solution to this problem encountered by the market is represented by the figure of the labor contractor. This agent contracts labor for the season to work on the plots of different farmers and is able to dilute fixed costs over a longer contract with its employees. In other words, the value of the services of the labor contractor rests on the fact that they avoid a sequence of costly hiring and firing operations by individual farmers. However, this agent performs other economic functions as well, such as recruitment and the provision of transportation, lodging, and supervision of workers (Rezende and Kretter, 2007). This arrangement can reduce labor costs for sugarcane producers, but it can also benefit workers who have a contract for the entire harvesting season and may reap gains due to the reduction in fixed costs.[39]

However, the services of the labor contractor are not recognized by legislation. Labor courts, when ruling in favor of the worker,[40] place the burden of the cost on the sugarcane producer or on the industry rather than on the contractor. Thus, producers and industrial units are burdened with large liabilities, a fact that restricts future growth and will induce a change in the capital-to-labor ratio in this activity. Mechanization will be the way out of this problem, but the speed at which it will take place will be determined by the capital constraints faced by the industry.

As an aside, it is useful to point out that the high cost of hiring and firing workers gave rise in some regions of Brazil to coordination among employers (Rezende and Kretter, 2007). This is through an association of farmers that hires labor to work in different farms sequentially during the year. The arrangement has been successful in regions where agricultural activities are sufficiently diversified so that the demand for labor services is spread throughout the year. The arrangement has not been used in sugarcane, but it may eventually be adopted, as the industry is trying to find ways to lengthen the harvesting season.

The inadequacy of the country's labor legislation, coupled with the fact that cutting sugarcane is a demanding activity, raised concerns in Brazil and abroad about the existence of slave labor in the sugarcane sector. This is by no means a generalized practice in the sector. But it is frequent, in Brazil and abroad, to associate any type of violation of labor legislation with slave labor. Notwithstanding misstatements frequently made, close attention by policymakers is needed to prevent slave labor from becoming an issue in trade negotiations. A revision of the labor legislation that takes into account the nature of the activity is, however, the best solution, as it will benefit all parties: jobs will be preserved, costs will be reduced, and the number of undue judicial disputes will diminish.

Another challenge facing the sector comes from environmental concerns. There are positive aspects to note in this regard as well. Ethanol is a renewable source of energy that reduces the use of fossil fuels and, as such, helps mitigate global warming. A study by Macedo (2005),[41] using assumptions that are consistent with the Brazilian situation, estimates that the substitution of gasoline with ethanol from an increase in sugarcane production of 100 million metric tons could reduce emissions by the equivalent of 9.1 million metric tons of carbon dioxide (CO_2). Considering that most mills and distilleries

[39] There are no studies, to my knowledge, that estimate how these gains are divided between sugarcane producers, contractors, and workers.

[40] Labor courts more often than expected rule in favor of workers.

[41] This document was prepared for UNICA. Cited in Macedo (2005), chapter 4, p. 99.

are self-sufficient or have excess energy supplies, emissions could be further reduced by 2 million metric tons.

The effects on urban pollution are difficult to measure because improvements in automobile emissions control were taking place at the same time that the use of ethanol was being disseminated in Brazil. However, a study by Cetesb[42] (Companhia de Tecnologia de Saneamento Ambiental, Ciência e Tecnologia a Serviço do Meio Ambiente, Secretaria do Meio Ambiente, Estado de São Paulo), comparing emissions of selected pollutants, shows that emissions of CO_2 were on the order of 54 grams per kilometer before 1980. With the introduction of cars fueled by a mixture of ethanol and gasoline, emission levels were reduced to 13.3 grams per kilometer in 1990 and to 6 grams per kilometer in 1994. Other pollutants were reduced as well.

On the negative side, two issues must be considered: burning before harvesting and the expansion of cropped area into the tropical forest. The use of fire reduces workers' risks of being injured by the sugarcane shrubbery and increases their productivity. The pollution effects, however, are significant and highly visible, subjecting producers daily, during harvest time, to questions and protests by the communities directly affected. Additionally, burning increases the emission of gases that contribute to global warming[43] and reduces the positive emissions balance indicated by Macedo (2005). The state of São Paulo has passed legislation to completely phase out the use of harvest fires in sugarcane areas. The speed of the elimination process depends on the availability and cost of capital and, of course, on the topography. Adjustment costs are likely to be higher for small producers, who normally face tighter capital constraints and whose scale does not justify the acquisition of harvesters.

The effects of mechanization on the use of labor have been analyzed by Guilhoto et al (2002) using a regional input-output model for the year 1997. Three scenarios were considered. In all three scenarios, 50 percent of the harvest in the northeast and 80 percent in the rest of Brazil is mechanized. In scenario one, no change in harvest productivity takes place. In scenario two, harvest productivity increases by 20 percent in all five regions. In scenario three, harvest productivity increases by 20 percent in all regions except the northeast, where the increase in productivity is 140 percent for manual harvesting and 20 percent for mechanized harvesting.

The study found that labor use is reduced by 243,211 people in scenario one, 273,276 in scenario two, and 316,288 in scenario three. The total number of workers employed in sugarcane production in 1997 was 559,711, of which 236,000 were temporary workers. Thus, the reduction due to mechanization would have quite significant effects on employment and should virtually eliminate the use of temporary labor in the sector.

A second negative issue is the concern regarding expansion in the Amazon region. This, however, does not find support in the data. Brazil still has vast amounts of land available for agricultural expansion, and the 7 million hectares currently planted with sugarcane are a relatively small percentage of the total crop area, which is 61 million hectares. For comparison purposes, areas planted with soybeans and corn cover 22 and 13 million hectares, respectively. There is, therefore, room for substitution of less profitable products. Needless to say, there are technical constraints for sugarcane production in the humid tropics.

But the bulk of the area available for expansion will come from pastureland. According to the latest agricultural census (IBGE, 1998),[44] there are approximately 178 million hectares of pastureland in the country. Around 78 million hectares, or 44 percent of the total land in pasture, are natural pastures. These natural pastures are areas with a very low carrying capacity, where no investment was made and which are often suited for agriculture.

[42] Cited in Macedo (2005), chapter 3, Table 1, p. 79.

[43] Macedo (2005)assumes that harvesting is mechanized and does not require the use of fire.

[44] It is worth noting that the Instituto Brasileiro de Geografia e Estatística (IBGE) is conducting a new agricultural census this year. The results, when available, may show a different picture.

The recent expansion of the sugar/ethanol complex is primarily taking place in pastureland.[45] Livestock is at the moment an extensive activity, and the additional demand for land is making production a less extensive activity, so that sugarcane will be able to expand with little impact on the level of that activity. Even considering that additional land may be needed to increase oilseed production[46] for biodiesel, this does not necessarily need to be a threat to the Amazon region. If one makes the assumption that sugarcane and soybean area will double over the next 10 years, this will require around 30 million additional hectares, and there are about 78 million hectares of natural pastures that can be used to support that expansion.

Conversion of pastureland has an additional advantage over forest areas, in that infrastructure is already developed.

A detailed land analysis is needed to provide a sound basis for the urgent establishment of a more effective land policy in the Amazon region. This is particularly important because the landowner, which is the government, cannot enforce its property rights, and this is an incentive for deforestation and the occupation of land by individuals who want to reap capital gains from that operation.[47] At the same time, the government cannot control illegal logging activities in the region.

To conclude this section, two points are seen as the most significant domestic challenges for the sector: legislation that unduly increases labor costs, and the use of fire before the harvest of sugarcane. The two are, in a sense, linked because environmental concerns indicate that fires will eventually be banned. But this is a long away ahead, and in the meantime changes in the labor legislation are essential to prevent the loss of jobs. On the external front, a reduction of protectionism in the sugar and ethanol markets is essential to guarantee that the industry will maintain and improve its past performance.

Summary

The sugar/ethanol complex has had an impressive development since the early 1970s. The engines of this expansion were exports of sugar and the domestic market for fuel ethanol, which emerged after the first oil shock in 1973.

Government intervention was a hallmark of this industry for many years. Intervention was based on production quotas, price controls, and subsidized credit for agriculture as well as for industry. The gasohol program led to government intervention in other sectors as well, as it granted special tax treatment for ethanol-fueled cars, determined the volume of anhydrous ethanol to be added to gasoline, and provided purchase guarantees for the ethanol production.

Intervention was phased out after 1990 when the IAA was abolished. Later, ethanol prices were freed from government control, as were gasoline prices. In addition to its usual regulatory role, the government was left with two instruments of intervention: the ethanol-gasoline mix and auctions in which Petrobras purchases ethanol.

The transition to the new policy regime is taking longer than initially envisaged by some, but it has been successful thus far and has been able to create anchor institutions capable of handling conflicts and defending interests in the political arena. The experience of the more advanced regions is being transferred to the rest of the country, and this process is likely to be completed in the short to medium term.

The future growth of the sector will continue to depend on sugar exports and domestic sales of ethanol, but ethanol exports are now a strategic variable for this industry. The importance of these exports can be better understood considering that by now Brazil has already substituted a great deal of gasoline with ethanol. Production of ethanol, if based on the domestic market alone, will accompany economic

[45] This statement is based on casual observation and on informal reports of analysts.

[46] A substantial share of the vegetable oil used for biodiesel production is likely to come from current exports of soybean oil and not from additional production of soybeans.

[47] Brandão, Rezende, and Marques (2005) consider the issue in their analysis of soybean expansion during the period 1999–2004.

growth and the increase in automobile demand. However, Japan, the United States, and the European Union still have a long way to go to in the substitution of gasoline. This may be the source of a big push, one that could double or triple current levels of ethanol production.

The challenges, however, are to fight against protectionism in sugar markets and a new wave of protectionism in the ethanol market, to modify labor legislation, and to avoid environmental damage. Brazil has land available to support such expansion without causing further damage to its Amazon forest.

REFERENCES

Brandão, Antônio Salazar P., Gervásio Castro de Rezende, and Roberta Wanderley da Costa Marques. 2005. Agricultural growth in the period 1999–2004: Outburst in soybeans area and environmental impacts in Brazil. Texto para Discussão 1062, Instituto de Pesquisa Econômica Aplicada (IPEA), Rio de Janeiro.

Guilhoto, J.J., A.L.M. Barros, M.C. Marjotta-Maistro, and M. Istake. Mechanization process of the sugar cane harvest and its direct and indirect impact over the employment in Brazil and in its 5 macro regions. Texto de Seminários, N. 09/2002, 09/05/2002, Instituto de Pesquisas Econômicas, Universidade de São Paulo (IPEUSP), São Paulo .

IBGE (Instituto Brasileiro de Geografia e Estatística). 1998. *Censo agropecuário 1995–96*. Rio de Janeiro: IBGE.

Macedo, Isaias de Carvalho, ed. 2005. *A energia da cana-de-açúcar: doze estudos sobre a agroindústria da cana-de-açúcar no Brasil e sua sustentabilidade*. União da Agroindústria Canavieira do Estado de São Paulo (UNICA), São Paulo.

Marjotta-Maistro, Marta Cristina. 2002. Ajustes nos mercados de álcool e gasolina no processo de desregulamentação. Ph.D. dissertation, University of São Paulo at Piracicaba.

Marjotta-Maistro, Marta Cristina, and Guilherme Augusto Asai. 2006. Álcool combustível: do carro a álcool ao carro flex. Mimeo. Centro de Estudos Avançados em Economia Aplicada, Escola Superior Luiz de Queiroz, Universidade de São Paulo (CEPEA), Piracicaba.

Moraes, Márcia Azanha F.D. 2000. *A desregulamentação do setor sucroalcooleiro do Brasil*. Coleção Centro de Estudos Avançados em Economia Aplicada, Escola Superior Luiz de Queiroz,Universidade de São Paulo (CEPEA), Americana, Brazil: Caminho Editorial.

Rezende, Gervásio Castro, and Ana Cecília Kretter. 2007. Legislação trabalhista agrícola e pobreza no Brasil: uma abordagem de custos de transação. Mimeo, Instituto de Pesquisa Econômica Aplicada (IPEA), Rio de Janeiro.

Silveira, André Mascia. 2004. A relação entre os preços de açúcar nos mercados doméstico e internacional. M.S. thesis, University of São Paulo at Piracicaba.

3. THE U.S. SUGAR PROGRAM: REFORM PRESSURES AND OPTIONS[48]

Stephen Haley, Owen Wagner, and David Orden

Introduction

Because the Farm Security and Rural Investment Act of 2002 (2002 Farm Act) was set to expire in 2007, much attention has been focused on the U.S. sugar program. There are several areas of concern. First, there is a high likelihood of increased sugar imports that could make program management more costly or difficult to sustain. Sugar imports are certain to increase from Mexico with the full phase-in of the sugar and sweetener provisions of the North American Free Trade Agreement (NAFTA) in 2008. Additionally, imports may increase as a result of expansion of free trade agreements (FTAs) and/or a Doha Round agreement under the World Trade Organization (WTO). A second problem is that sugar users are turning away from purchases of sugar, either by switching to off-shore production of sugar-containing products (SCPs) or by using new high-intensity sweeteners (HISs) in place of sugar. Producers face the prospect of a shrinking market that implies sector contraction.

Both these problems present challenges to sugar program design. The current program emphasizes price support, with import restraints and restrictions on domestic processors' marketing to prevent oversupply. Under the 2002 Farm Act, however, marketing restrictions are suspended if sugar imports for consumption exceed a trigger level of 1.532 million short tons, raw value (STRV), which is about 15 percent of consumption. In this instance, price support becomes the responsibility of the U.S. Department of Agriculture (USDA), which must accept sugar pledged as collateral as full payment for loans made to processors. The USDA (2007a) proposed that a new Farm Bill eliminate the import trigger for the suspension of marketing allotments. This approach still strove to keep domestic sugar prices far above of world levels, providing no incentive for sugar users to expand demand.

Sugar users have suggested that direct government subsidies be made to sugar producers, which would allow prices to drop to more competitive levels and not penalize those who buy sugar. The sugar program would come to resemble other commodity programs that the USDA uses to support producers of various feed and food crops. There are others who question the desirability or wisdom of supporting domestic sugar production. Lower prices could be had by simply eliminating the program. A benefit these individuals point to is that the elimination of the program would enhance the likelihood of negotiating new international agreements that expand trade opportunities. The national benefit could be great enough to compensate sugar producers and processors for the termination of government support through a buyout of their interest in the program.

Using the Economic Research Service (ERS) long-term sugar projection model, this paper analyzes four sugar policy alternatives under a set of five possible scenarios affecting imports.[49] The first policy alternative is retention of the current nonrecourse loan program, marketing allotments, and other policy features of the 2002 Farm Act over projection years 2008 to 2020. In the second alternative, the sugar program is assumed to be recast with income-support provisions similar to those used for other U.S. crops such as wheat, corn, and peanuts. The sugar user pays a market-determined price, and sugar processors and producers receive government payments. These payments are not necessarily tied to production levels. The USDA does not hold or own sugar withdrawn from the market to support the price of sugar. In the third policy alternative, the criteria for suspending domestic marketing restrictions under

[48] This paper is based on Owen Wagner's master's thesis at Virginia Tech (*Impetus, Options and Consequences for Sugar Policy Reform in the United States*, 2007). The thesis utilized the ERS long-term sugar projection model, and Stephen Haley and David Orden served as co-chairs of the thesis advisory committee. The views expressed in this paper are those of the authors and may not be attributed to the ERS, the USDA or LMC International.

[49] The analysis was completed prior to enactment of the Food, Conservation and Energy Act of 2008.We briefly describe the sugar provisions of this new legislation and discuss the continued relevance of the evaluations of alternative trade scenarios and policy options presented herein in our conclusions section.

the current program are removed. In this case, the USDA allocates marketing allotments subject to domestic consumption needs and the availability of imported sugar to sustain the existing price-support levels. The fourth policy alternative incorporates a buyout under which relatively high-cost processors are paid to end their sugar production. The producer, market, and taxpayer outcomes of these alternative policies are analyzed under the alternative exogenous scenarios of pressure on the U.S. program from increased sugar imports. Subsequent to the completion of our analysis, revised sugar policies were adopted in the Food, Conservation, and Energy Act of 2008 (2008 Farm Act). In our conclusions we discuss briefly how the new policies reflect some of the implications of our study.

The plan of this paper is to first provide a brief overview of the U.S. sugar producing sector, the structure of U.S. sugar policy, and trends in sugar demand. The analytical framework is introduced, and then a summary of the results from the analysis of the sugar policy alternatives is presented. The paper ends with the discussion in the conclusions section.

The U.S. Sugar Producing Sector

The United States is among the world's largest sugar producers, ranking high in the second tier of sugar producing countries, with less production than China but more than Thailand or Mexico. Unlike most other producing countries (China and Pakistan being notable exceptions), the United States has large and well-developed industries for producing sugar from both sugarcane and sugar beet. The United States also has the world's largest corn-based sweetener industry.

Although the United States is an important sugar producer, sugar crop production accounts for a relatively small part of total U.S. agricultural output. The value of the combined 2004 sugar beet and sugarcane crop was $1.93 billion. This amount constituted about 2.4 percent of the U.S. field and miscellaneous crop value in 2004. Its value was higher than some crops such as tobacco, rice, and peanuts, but much less than other crops such as corn, soybeans, wheat, and cotton.

The value of the sugar beet crop since 1978 has constituted about 55.7 percent of the combined sugar crop value. Sugar beets are currently grown in 11 states grouped into six regions: Great Lakes (Michigan), Upper Midwest (Minnesota, North Dakota), Northern and Central Great Plains (Colorado, Montana, Nebraska, Wyoming), Northwest (Idaho, Oregon, Washington), and Southwest (California). Production has been halted in several states, including Ohio, New Mexico, Texas, and Arizona.

Sugar beet production has grown from about 21.0 million short tons in the first half of the 1980s to between 29.0 and 30.0 million tons since 1995.[50] Production growth has been largest in the Upper Midwest – its share of national production has grown from about 30 percent in the early 1980s to about 48 percent in the 2000s. The Northwest has also seen its share of national production grow, from about 17 percent to 20 percent over the same time period. Production has held steady in the Great Lakes region (10–11 percent). Production declines have taken place in the Great Plains (from 20 percent in the early 1990s to 13 percent in the 2000s) and especially in the Southwest (from 24 percent in the early 1980s to just above 7 percent in the 2000s).

Sugarcane is grown in four states: Florida, Louisiana, Texas, and Hawaii. Sugarcane production has grown from an average of 27.7 million tons in the first half of the 1980s to about 32.0 million tons in the 2000s. The largest growth has been in Louisiana, where production has more than doubled since the early 1980s. Growth in Florida and Texas has been strong as well. Area and yield growth have both been instrumental in accounting for increased sugarcane production. In Hawaii, in contrast, high costs and competing uses for land have meant a reduction in sugarcane production, from 8.8 million tons in the early 1980s to 2.0 million tons in the 2000s. Sugarcane is now grown on only two of the islands – Kauai and Maui.

The costs of producing sugar in the United States vary from region to region and are higher than those of the world's lowest-cost sugar producers. Cost ranges based on estimates made by LMC

[50] Tons may refer to short tons or metric tons in this chapter (short tons when not specified).

International are shown in Table 3.1 for U.S. mainland cane producers and for U.S. eastern and western beet sugar producing areas.[51] The eastern beet regions are the Great Lakes and Upper Midwest, and the western regions include the Great Plains, Northwest, and Southwest regions. Mainland cane producing regions exclude higher-cost Hawaii.

Table 3.1. Ranges of costs of producing raw cane sugar, refined beet sugar, and high-fructose corn syrup, United States and Mexico, and other categories of world producers, 1999/00–2004/05

Category	Dollars/metric ton[1]			Cents/pound		
Raw cane sugar						
U.S. mainland producing regions[2]	276.60	-	442.60	12.55	-	20.08
Mexico – Eastern producing regions[3]	293.80	-	361.50	13.33	-	16.40
Mexico – Western producing regions[4]	304.40	-	540.70	13.81	-	24.53
Low-cost producers[5]	119.50	-	254.30	5.42	-	11.53
Weighted world average	237.20	-	270.20	10.76	-	12.26
Cane sugar, white value equivalent						
U.S. mainland producing regions[2]	365.66	-	546.11	16.59	-	24.77
Mexico – Eastern producing regions[3]	384.36	-	457.95	17.43	-	20.77
Mexico – Western producing regions[4]	395.88	-	652.74	17.96	-	29.61
Low-cost producers[5]	194.90	-	341.42	8.84	-	15.49
Weighted world average	322.84	-	358.71	14.64	-	16.27
Beet sugar, refined value						
Eastern U.S. producing regions[6]	369.70	-	555.35	16.77	-	25.19
Western U.S. producing regions[7]	411.10	-	718.00	18.65	-	32.57
Weighted World Average	573.10	-	622.20	26.00	-	28.22
High-fructose corn syrup[8]						
United States and Mexico	221.20	-	473.20	10.03	-	21.46

Source: LMC International
[1] Ex-mill, factory basis; [2] U.S. mainland producing regions comprise Florida, Louisiana, and Texas; [3] Mexican eastern regions include Central, Gulf, Northeast, and South; [4] Mexican western regions include Northwest and Pacific; [5] Seven producing regions (Brazil - North/East, Brazil - Center/South, Malawi, South Africa, Sudan, Swaziland, and Zimbabwe); [6] Eastern U.S. producing regions comprise the Great Lakes and the Red River Valley; [7] Western U.S. producing regions comprise the Northern Great Plains, Central Great Plains, Northwest, and Southwest; [8] HFCS-55, dry weight.

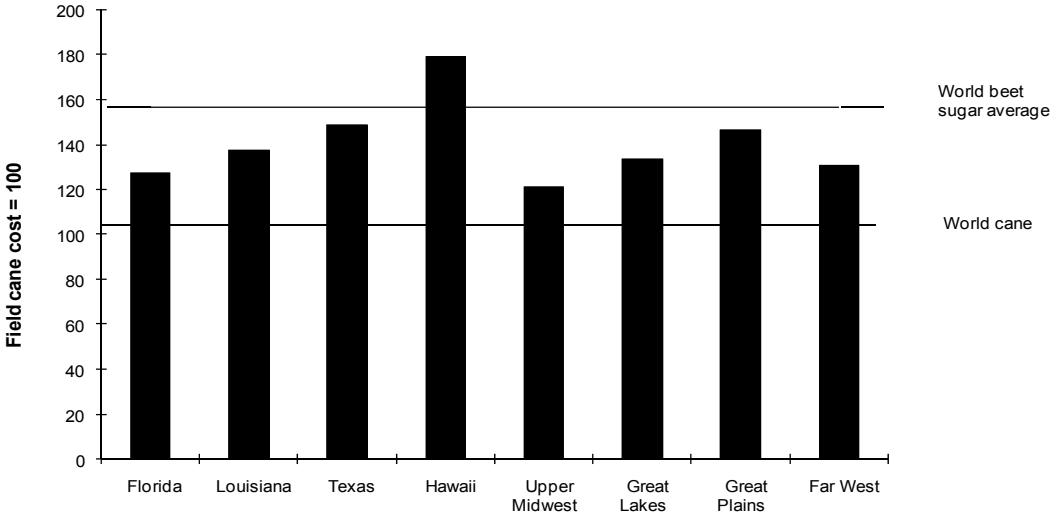
U.S. cane production costs are at least twice as high as those of the world's lowest-cost producers and are typically higher than the production-weighted world average of all cane producing countries. The range of U.S. raw cane sugar costs, adjusted to white value equivalence, and U.S. beet sugar costs are overlapping. U.S. beet production costs are below the production-weighted world average of all beet producing countries. The world's average cost of production for beet sugar, however, is about 75 percent above the average cost of production for cane sugar, white value equivalence. U.S. costs of producing high-fructose corn syrup (HFCS) have been much lower than U.S. sugar production costs.

Figures 3.1 and 3.2 show added field and factory cost details for individual U.S. cane and beet sugar producing areas. All U.S. regions have field costs that are higher than the world's production-weighted field cost average for cane sugar. Sugar crop growers in the Upper Midwest have the lowest relative field costs of production, according to the LMC International estimates. Florida cane growers are ranked as second in field costs within the United States. All other areas except extremely high-cost Hawaii have field costs below the world's production-weighted average for beet sugar. The U.S. factory

[51] LMC International Ltd. is an independent economic and business consultancy providing economic research and consultancy services for a broad range of industries related to agricultural commodities, foods, industrial materials, biofuels, and their end markets.

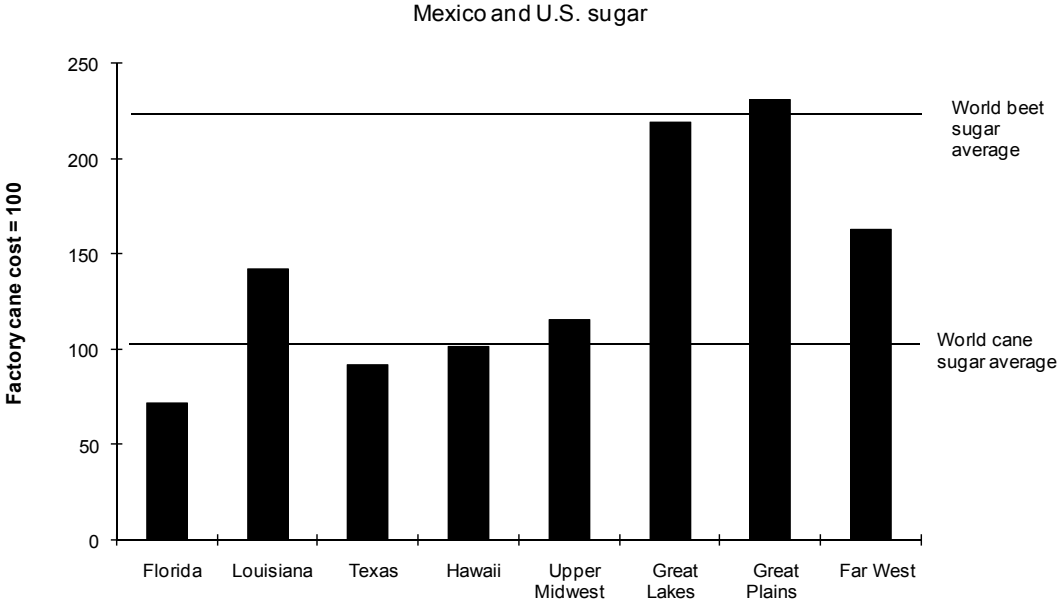
costs of producing sugar are more competitive relative to world averages than are the field costs.[52] Exceptions are the Great Lakes and Great Plains regions, where factory costs are higher than in the other U.S. regions.

Figure 3.1. U.S. field costs of sugar production, relative to world average for cane and beet sugar, 1999/00–2004/05



Source: LMC International.

Figure 3.2. U.S. processing and refining factory costs of sugar production, relative to world average for cane and beet sugar, 1999/00–2004/05



Source: LMC International.

[52] Factory costs tend to be only about 40 percent of field costs. This is partly reflective of LMC International's attribution of byproduct credits to factory costs. These credits include molasses and beet pulp sales revenue.

The U.S. Sugar Program

The Domestic Support Program

The goal of the legislated U.S. sugar program has been to provide for adequate supplies of sugar at prices judged to be reasonable for both producers and consumers while avoiding significant federal budget expenditure. To accomplish this objective, the U.S. sugar program has since 1982 combined a domestic price-support program with control over sugar imports. There are no direct government subsidies paid to producers or processors. Support for the sugar sector is embedded in the price that sugar users pay for their sugar.

The 2002 Farm Act provides for the USDA to make loans available to processors of domestically grown sugarcane at a rate of 18 cents per pound of raw cane sugar and to processors of domestically grown sugar beets at the rate of 22.9 cents per pound for refined beet sugar. Loans are taken for a maximum term of nine months and must be liquidated along with interest charges by the end of the fiscal year in which the loans were made. The loans are nonrecourse. This means that when the loan matures, the USDA must accept sugar pledged as collateral as payment in full in lieu of cash repayment of the loan, at the discretion of the processor. By forfeiting the sugar, the processor effectively withdraws sugar from the market, thereby helping to support the market price of sugar.

The 2002 Farm Act requires the USDA, to the maximum extent possible, to operate the U.S. sugar loan program at no cost to the federal government. Specifically, this provision means that the USDA must operate the program in order to avoid the forfeiture of sugar. In order to discourage forfeiture of nonrecourse loans, the sugar price at the time of loan repayment must be high enough to cover the loan principal plus interest expenses and other costs. This price is referred to as the minimum price to avoid forfeiture, and is about 20.76 cents per pound for raw cane sugar at the 18-cent loan rate.

To ensure that the sugar loan program operates at no cost to the federal government, the USDA is required to establish flexible marketing allotments for sugar. The overall allotment quantity (OAQ) is determined by subtracting the sum of 1.532 million STRV and carry-in stocks of sugar from the USDA's estimate of sugar deliveries for domestic food and beverage use and reasonable carryover stocks at the end of the crop year. The OAQ is divided between refined beet sugar, at 54.35 percent of the overall quantity, and raw cane sugar, at 45.65 percent of the overall quantity. For cane sugar, Hawaii and Puerto Rico are jointly allotted 325,000 STRV. (The USDA has since eliminated Puerto Rico from receiving an OAQ allotment because Puerto Rico has ceased producing sugarcane.) The allocations to the mainland cane sugar producing states (Florida, Louisiana, and Texas) are assigned based on past marketing of sugar, the ability to market sugar in the current year, and past processing levels. Beet sugar processors are assigned allotments based on their sugar production for the 1998–2000 crop years.

The USDA's authority to operate sugar marketing allotments is suspended if the USDA projects that import levels of sugar for human consumption will exceed 1.532 million STRV, such that the overall allotment quantity would have to be reduced. The marketing allotments would remain suspended until such time that projected imports have been restricted, eliminated, or otherwise reduced to or below the 1.532 million STRV level.

Tariff-Rate Quotas

A tariff-rate quota (TRQ) is a two-tiered tariff for which the tariff rate charged depends on the volume of imports. A lower (in-quota) tariff is charged on imports within the quota volume. A higher (over-quota) tariff is charged on imports in excess of the quota volume.

The United States establishes separate TRQs for imports of raw cane sugar and for imports of certain other sugars, syrups, and molasses. Prior to the start of the fiscal year (October 1–September 30), the Secretary of Agriculture announces the quantity of sugar that may be imported at a low tariff rate during the upcoming fiscal year. Any additional annual quantity may be imported at a higher tariff rate. Under the Uruguay Round Agreement on Agriculture (URAA), the United States agreed to import a

minimum quantity of raw and refined sugar each marketing year. This amount is equal to 1.139 million metric tons, raw value (MTRV), or 1.256 million STRV. Included in this amount is a commitment to import at least 22,000 MTRV, or 24,251 STRV, of refined sugar.

The raw cane sugar TRQ is allocated by the U.S. Trade Representative (USTR) to 40 countries based on a representative period (1975–1981) when trade was relatively unrestricted. Additional allocations are made available to certain other countries to satisfy U.S. obligations under various FTAs, including NAFTA and the Central America–Dominican Republic–United States Free Trade Agreement (CAFTA-DR). The refined sugar TRQ contains several components, including specific allocations to Canada and Mexico, and a quantity of refined sugar that is available to all countries on a first-come, first-served basis. The first-come, first-served section of the refined sugar TRQ also includes a category for specialty sugars such as organic sugars.

Sugar and HFCS in a Fully Implemented NAFTA

There is a concern about sugar imports from Mexico beginning in 2008 when high-tier NAFTA sugar tariffs fall to zero. Although the high-tier tariffs have been falling steadily during the NAFTA phase-in period, import pressures have been mitigated by strong domestic Mexican demand for sugar. Strong domestic demand has been the result of a consumption tax on beverages that use any sweetener besides cane sugar, mainly HFCS. This tax significantly weakened the demand for HFCS in Mexico and ensured a large domestic market for Mexican cane sugar, which otherwise would have contributed to an exportable sugar surplus. After the WTO found the tax to violate international trade rules, the U.S. and Mexican governments reached an agreement in July 2006 that promised the repeal of the tax (accomplished in January 2007) and ensured that no new restrictions would be placed on U.S. shipments of HFCS to Mexico. Also under this agreement, the NAFTA partners affirmed that effective January 1, 2008, there would be no duties or quantitative restraints on sweetener trade between the two countries. In May 2007, the Mexican government lowered its over-quota tariff on U.S. sugar to 3.531 cents per kilogram in advance of the January 1 date for tariff elimination.

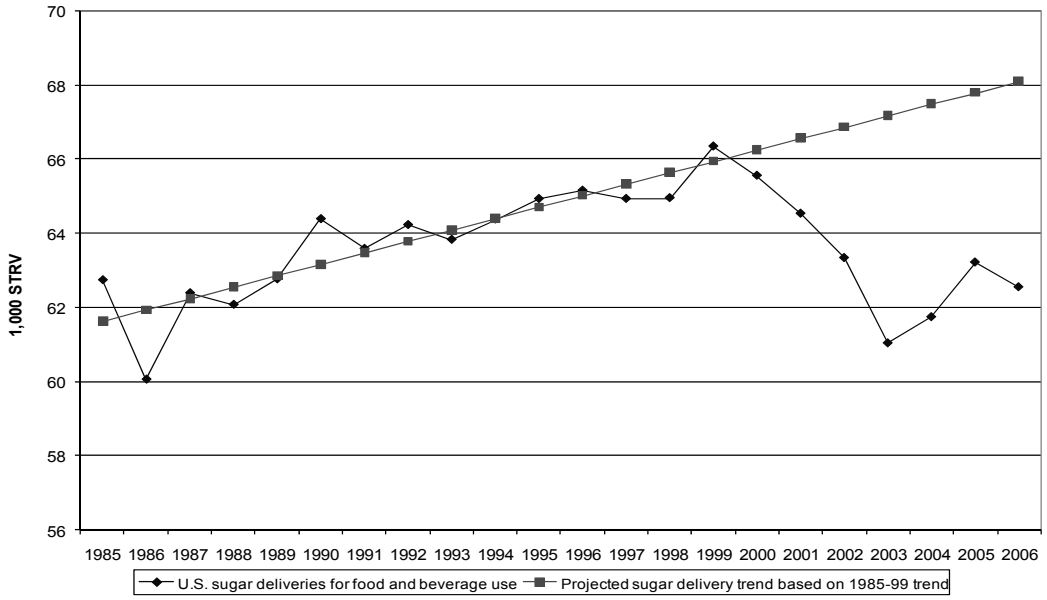
Although it is not known with certainty how much HFCS will ultimately be consumed in Mexico, given that beverage sweetener demand in Mexico is estimated at about 1.8 million metric tons, a significant loss of sugar's share of the market could lead to a large sugar surplus for export to the United States.

Sugar Demand in the United States

With the current program design, the sugar user pays for the support of sugar processors and producers. These users maintain that the program encourages imports of products that contain sugar as an ingredient as long as there are low import restrictions on those products. Under NAFTA, there are many SCPs whose importation no longer involves tariffs or quantitative restrictions (ERS, 2006a). U.S. sugar prices, which are higher than world levels, are also thought to encourage the development and use of lower-priced HISs. Both SCPs and HISs reduce domestic sugar demand, although the quantitative effects have not been exhaustively researched.

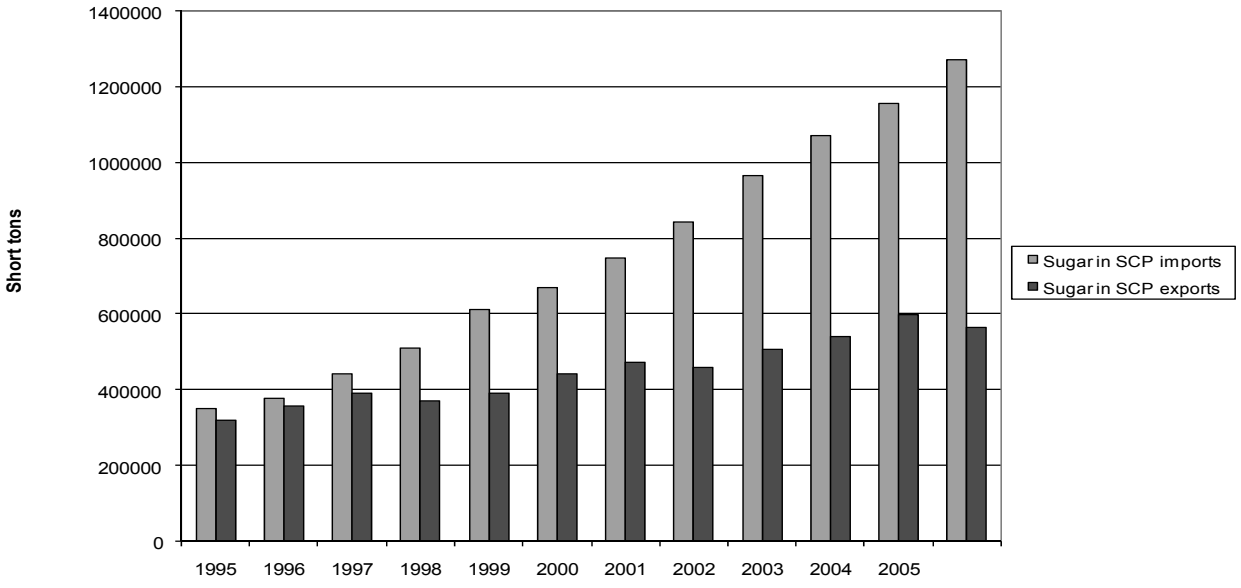
Figure 3.3 shows per capita sweetener deliveries for food and beverage use since 1985. These deliveries peaked in 1999 at 66.3 pounds and fell to 61.0 pounds by 2003. For the next two years, deliveries recovered somewhat but fell once again in 2006. The 2006 estimate is 62.5 pounds. If the trend for sugar delivery growth for the period 1985–1999 had been maintained, projected per capita deliveries would have been 68.1 pounds. Figure 3.4 shows estimated imports and exports of sugar in products since 1995. Sugar in imported products has grown from 349,000 STRV in 1995 to 1.269 million STRV in 2006. Sugar in net imports has added an additional 5.4 pounds to per capita sugar available to the U.S. consumer, compared with 0.9 pounds in 1995.

Figure 3.3. U.S. sugar deliveries for food and beverage use, per capita basis, actual and projected, 1985–2006



Source: Sweetener Market Data, FSA, USDA.

Figure 3.4. Estimated sugar contained in U.S. imports and exports of certain sugar-containing products, 1995–2006



Source: Sugar and Sweetener Team, MTED, ERS.

Although it is far from certain that U.S. sugar prices that are higher than corresponding world levels are responsible for the delivery downturn, sugar users have used the downturn as an argument for lower prices. Although sugar users have typically called for expanded sugar imports, there is now more focus on changing the form of support for domestic sugar production rather than diluting the support.

These users argue for a sugar program with more market orientation, in which producers receive income support from the USDA instead of price-level support through limitations on supply to the market. The resulting program would more closely resemble other USDA commodity programs, with support delivered through a combination of direct producer payments, countercyclical payments, and loan deficiency payments. (See Box 3.1 for a description of income support for certain other crops, including peanuts.)

Box 3.1. Income support for certain other program crops

The sugar program contrasts with income-based support provided by the 2002 Farm Act to producers of other crops, including wheat, feed grains, upland cotton, rice, oilseeds, and peanuts since 2002. Income support is based on three programs: direct payments, countercyclical payments, and marketing loans. A producer is defined as an owner, operator, landlord, tenant, or sharecropper that shares in the risk of producing a crop and is entitled to share in the crop available for marketing, or would have shared had the crop been produced. As a means of targeting benefits and reducing commodity program costs, payment limitations in each of the programs place ceilings on payments to farm operations. Program provisions are described here.

A *direct payment* is equal to the product of the national payment rate of the applicable crop, the producer's payment acres (85 percent of base acres) for the crop, and the producer's payment yield for the crop. The payment rate is fixed for each crop and is not affected by current production or by current prices. Payments to individual producers are based on their historical acreage planted to the crop and on historical yields.

Countercyclical payments provide a price-dependent benefit whenever the effective price for a covered commodity is below its target price as set out in the 2002 Farm Act. Payments are made when the higher of the crop's loan rate or season average price is less than the crop's target price less the direct payment rate. The payment amount is equal to the product of the countercyclical payment rate for the crop, the producer's payment acres (85 percent of base acres), and the producer's payment yield for the crop. As with direct payments, payments are based on historical area and yields, not current production.

Marketing loans provide loan deficiency payments and marketing loan gains to producers when prices are low. Producers of covered commodities can receive a loan from the government at the crop's loan rate by pledging production as loan collateral. The loan is settled in one of three ways: (1) repaying the loan at the loan rate plus interest; (2) forfeiting the crop at loan maturity; or (3) repaying the loan at a lower repayment rate, if available for the crop. When the producer repays the loan at a lower repayment rate, the difference between the loan rate and the repayment rate represents the marketing loan gain to the producer. Another benefit to this third method is that accrued interest is waived when paying off the loan. An alternative to the marketing loan gain is a loan deficiency payment (LDP). Except for extra-long-staple cotton, the producer can choose to receive marketing loan benefits (LDPs) when prices are below the loan rate. The gain is the same as the marketing loan gain but there is no crop loan.

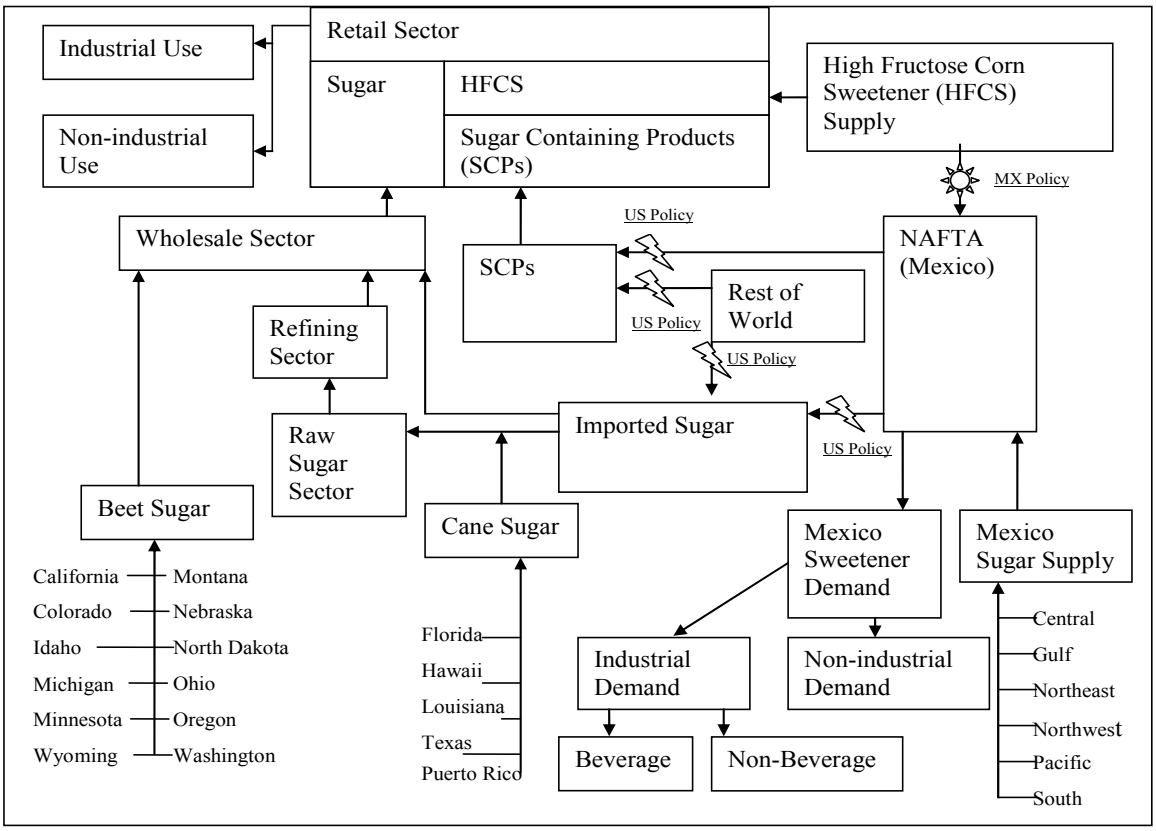
The payment limitation on direct payment is $40,000 per person per crop year. The payment limitation on countercyclical payments is $65,000 per person per crop year. The payment limitation on marketing loan gains and loan deficiency payments is $75,000 per year. There is a three-entity rule, which allows individuals to effectively double payment limits per individual up to a $360,000 maximum per person. Producers with adjusted gross incomes over $2.5 million are not eligible for payments unless more than 75 percent of adjusted gross income is from agriculture.

Under the 2002 Farm Act, producers have great flexibility in deciding which crops to produce, although there are some limitations on using base acreage for planting fruits, vegetables, and wild rice. Base acreage must be kept in agricultural or conserving use, and certain conservation and wetland provisions must be observed. Under these conditions, producers can receive direct payments and countercyclical payments corresponding to a crop, whether or not the crop is actually being produced in the year in which the payments are received.

The Analytical Framework

The ERS long-term sugar projection model is used to generate sugar supply and utilization projections for incorporation into the USDA's official long-term projections that are published each year prior to the USDA's Agricultural Outlook Forum in February. The model's advantage is that it incorporates substantial policy, production, processing, and consumption detail from the U.S. and Mexican sugar and HFCS sectors. A schematic overview of the model is shown in Figure 3.5. The model is continuously updated to be consistent with estimates and projections published in the USDA's *World Agricultural Demand and Supply Estimates* (WASDE) report.

Figure 3.5. Overview of ERS long-term projection model



Source: ERS long-term projection model

The U.S. component models adjustments to the following five policy instruments: (1) the nonrecourse sugar loan program; (2) TRQ, including minimum import access commitments (WTO, NAFTA, and CAFTA-DR access) and the high-tier sugar tariff; (3) other NAFTA provisions relating to trade in sugar and HFCS; (4) the U.S. marketing allotment program; and (5) payment-in-kind (PIK) authority for the Commodity Credit Corporation (CCC) to compensate producers for voluntarily reducing their sugar crop area as an option to dispose of publicly owned sugar stocks. The Mexican component models sugar import controls, NAFTA provisions for trade in sugar and HFCS, and government-set processor payments to sugarcane growers. With the elimination of trade restrictions anticipated in 2008, U.S. and Mexican refined sugar prices are equilibrated through trade between the two countries.

The U.S. production sector includes sugarcane producing areas of Florida, Louisiana, Texas, and Hawaii. The sugar beet producing areas are divided (see ERS, 2006b) into the Great Lakes region, the Upper Midwest, Northern Great Plains (Montana, northwestern Wyoming, and western North Dakota), the Central Great Plains (Colorado, Nebraska, and southeastern Wyoming), the Northwest, and the Far

West. The Mexican production sectors include the six major sugarcane producing regions (Central, Gulf, Northeast, Northwest, Pacific, and South).

Table 3.2 describes how the U.S. sugar component of the model is organized. The model structure is based on the primary supply and utilization categories of beginning stocks, production, imports, exports, deliveries, and ending stocks. Market prices for raw and refined sugar are related to the ending stocks-to-use ratio through estimated regression equations. Area planting decisions are modeled as functions of grower prices relative to alternative crop prices. Sugar crop yield projections are based on observed trends. Regional projections of sugar yield per acre are based on econometric analysis of the relationship between sugar yields and crop yield developments and yearly trend improvements that capture technical improvements in each region.

Table 3.2. Factors affecting sugar supply and utilization in the long-term projection model

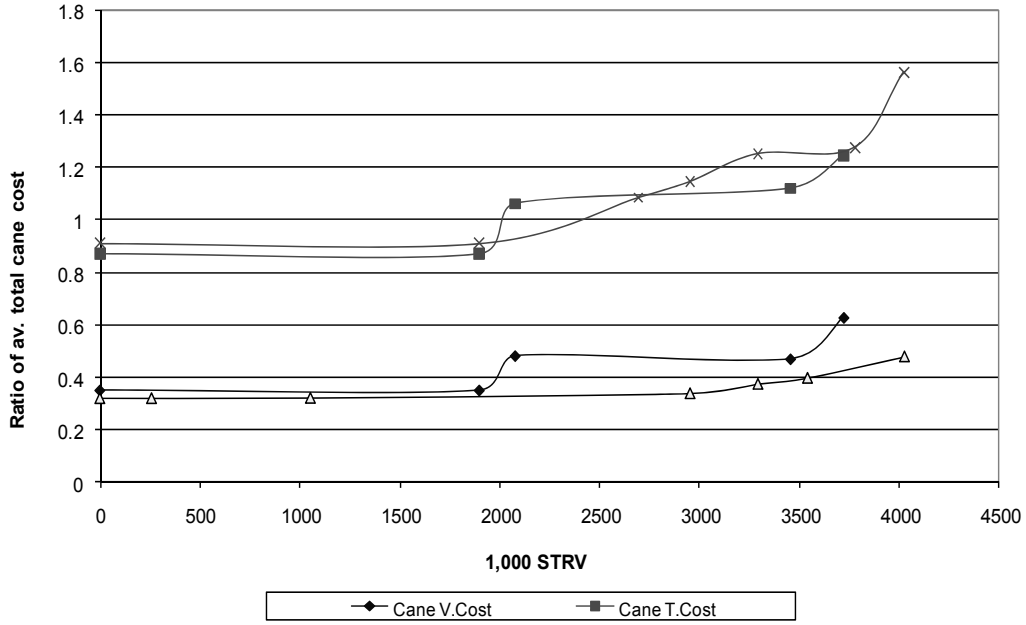
Beginning Stocks	**+ Production**	**+ Net Imports**	**= Deliveries**	**+ Exports**	**+ Ending Stocks**
Processor/refiner owned CCC sugar used in PIK program to reduce planted or harvested sugar crop area and FTA imports	Beets/cane a function of lagged state-level or regional sugar beet/cane prices Production dependent on available processing capacity Processing capacity dependent on product returns covering minimum average variable costs in short run and average total costs in longer term	TRQ - minimum WTO access - additional TRQ from OAQ reassignments - high-tier tariff imports if price = world price + tariff + marketing costs NAFTA imports - depend on Mexico exportable sugar surplus derived from domestic production and consumption decisions - HFCS use is exogenous - Mexico-U.S. price equalization FTA imports - CAFTA-DR	Deliveries for human food and beverage consumption - constant per capita sweetener consumption - sugar deliveries influenced by assumptions regarding imports of SCPs - possible substitution for HFCS if sugar price approaches the HFCS production cost (refined price below 20 cents/lb) Exogenous deliveries for SCP exports, polyhydric alcohol programs, and livestock feed	Exogenous refined sugar re-export program	Processor/refiner owned - influenced by OAQ allocation Accumulated by CCC if price = minimum level to avoid forfeitures

Source: ERS (Economic Research Service of the U.S. Department of Agriculture) long-term sugar projection model
Notes: *CAFTA-DR = Central America–Dominican Republic–United States Free Trade Agreement; CCC = Commodity Credit Corporation; FTA = free trade agreement; HFCS = high-fructose corn syrup; NAFTA = North American Free Trade Agreement; OAQ = overall allotment quantity; PIK = payment-in-kind; SCP = sugar-containing product; TRQ = tariff-rate quota; WTO = World Trade Organization*

Sugar crops differ from other field crops in that they require extensive processing to be put in a form that is marketable. Unless processing facilities are close to cropping acreage, it is uneconomical to grow sugar crops. In the projection model, adjustments to processing capacity are a function of the margins between predicted sugar prices and the average sugar price necessary to cover variable costs in the short term and total average costs over the medium term. Within a producing region, it is assumed that there is a normal distribution of costs around point estimates by LMC International. If either margin drops to zero, the modeling specification posits the exit of half of the processing capacity from that region. It is further assumed that capacity reductions are irreversible; that is, there is a very high cost of reopening closed facilities.

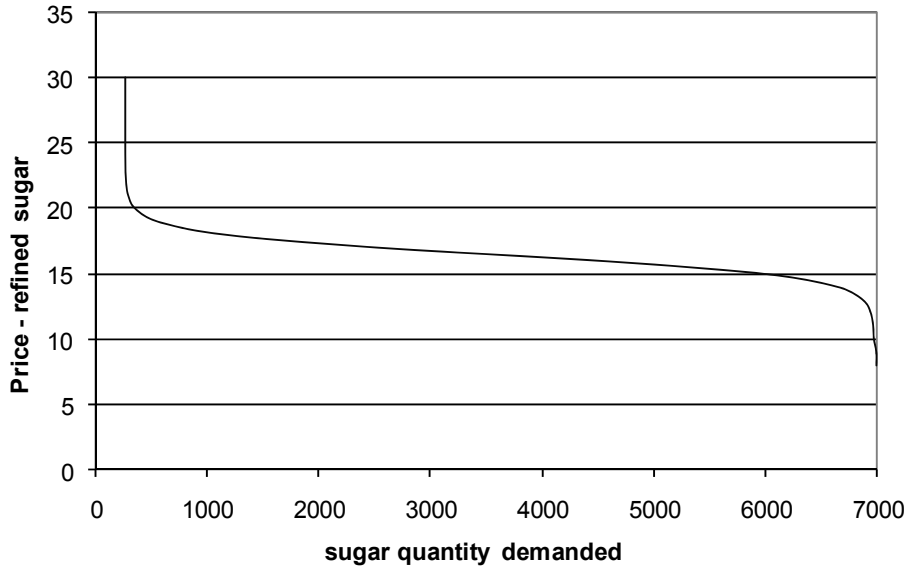
Figure 3.6 is a cumulative representation of how much U.S. sugar is produced at what average costs (variable and total, raw basis), arranged sequentially from low- to high-cost areas for cane and beet sugar producers/processors. Variable costs are a small fraction of total costs. The highest total costs are those for certain beet sugar producers. The implication is that they would be the first to exit the market through retirement of capacity if sugar prices were sufficiently reduced. For further price reductions, the figure indicates the degree of beet and cane sugar capacity retirements.

Figure 3.6. Cumulative U.S. cane and beet sugar cost of production, 2000/01–2005/06



U.S. sweetener demand is composed of end-use demand by the beverage and food-processing industries, nonfood users, and households or nonindustrial users. U.S. per capita sweetener demand (including in purchased processed products) is assumed to be constant – it does not grow with income and is insensitive to price changes. It is assumed that trends in sugar imported in products and HFCS continue, meaning that sugar in product imports increases while HFCS consumption is flat. The residual demand for sugar shows slightly declining per capita deliveries over the projection period. An exception is when sugar prices decrease sufficiently to approach the cost of producing HFCS plus a 20-percent profit/marketing margin. At that point, sugar is substituted for HFCS as a sweetener input in the production of beverages. As seen in Figure 3.7, sugar demand by the beverage industry is almost perfectly inelastic above 20 cents per pound, refined basis. For progressively lower prices below 20 cents, demand becomes increasingly elastic.

Figure 3.7. Demand for sugar by beverage industry as function of own price



Source: ERS long term projections model.

Like U.S. demand, Mexican sweetener demand is composed of end-use demand by the beverage and food-processing industries, nonfood users, and households or nonindustrial users. Per capita sweetener demand is an increasing function of real income growth, with an income elasticity of 0.37. Real income is assumed to grow as specified in the USDA long-term projections released in February 2007 (USDA, 2007b). Sugar in imported products is not modeled. For this paper, HFCS consumption is assumed to be an exogenous determinant of several of the alternative "external event" trade situation scenarios.

Price projections for sugar in the United States in the model are limited at the bottom under the current loan rate program (the lower limit is the minimum price to avoid forfeiture) and are limited at the top by high-tier tariff imports (the upper limit is the world price plus high-tier duties – tariffs and safeguards – and marketing costs). Between these boundary points, U.S. sugar prices are calculated as an estimated function of ending fiscal year stocks to use, as mentioned above. A similar specification is made for Mexico, and sugar trade between Mexico and the United States equilibrates refined sugar prices in both countries.

Analysis of Reform Pressures and Policy Options

The remainder of the paper analyzes the four different U.S. sugar policy options: (1) continuation of the current price-support program; (2) switching to an income-support structure; (3) the extension of marketing allotments with no suspension criteria; and (4) the introduction of producer/processor buyouts. Analysis is presented with respect to several future possible developments affecting the U.S. sugar market under NAFTA, other FTAs, or a possible Doha Round agreement of the WTO. The policy options and external events defining the model simulation scenarios are shown in Table 3.3. The analysis time horizon is from fiscal year (FY) 2008 through 2020. The world sugar price is assumed exogenously to be 12 cents per pound in all years and all scenarios, a reasonable assumption for modest changes in U.S. import levels or policies but a simplification that would merit further analysis for major changes in the U.S. situation.

Table 3.3. Sugar policy options and external circumstances affecting import levels

Alternative policies 1. **Price support** – BASE case is current policy (raw sugar loan rate is 18 cents per pound); this is reduced to 17 cents per pound (LR17.0) and to 16 cents per pound (LR16.0) if necessary to avoid federal expenditures. 2. **Income support** – Loan rates with loan deficiency payments (LDPs) and target prices with countercyclical payments (CCPs). Raw sugar loan rate is initially 18 cents per pound (LR18.0); this is reduced to 17 cents per pound (IS17.0) and to 16 cents per pound (IS16.0) if necessary to avoid federal expenditures. Target price is same as minimum level needed to avoid forfeitures with price support. 3. **Administration proposal** (ADM) – Eliminates provision to suspend marketing allotments if imports exceed 1.532 million short tons, raw value (STRV) and retains raw sugar price support at 18 cents per pound. 4. **Buyout** – Net present value of federal expenditure under BASE case price support is what government is willing to spend for buyout of capacity. States/regions with lowest present value of net returns (revenue less total costs) to processing capacity surrender capacity until available funds are exhausted.
Exogenous events affecting imports 1. **HFCS50%** – High-fructose corn syrup (HFCS) adoption of 50 percent in Mexican beverage sector 2. **HFCS75%** – HFCS adoption of 75 percent in Mexican beverage sector 3. **ACCESS** – Tariff-rate quota (TRQ) increased to 20 percent of domestic consumption 4. **COMBO** – ACCESS and HFCS75% 5. **GLOBAL** – ACCESS with reduction of over-quota tariff to 25 percent and setting of loan rate equivalent to world price over five-year period

Source: Author definitions

More specifically in terms of the policy alternatives, in the first, denoted "BASE" or "LR," the current sugar loan rate structure is retained to provide a floor to market prices. Marketing allotments are kept but are subject to suspension if sugar imports for domestic human consumption exceed 1.532 million STRV (plus only reassignments from OAQ that cannot be filled out of domestic beet sugar or cane sugar production). The raw sugar loan rate is 18 cents per pound in the initial (BASE) price-support case. If scenario results indicate federal expenditure stemming from the external event, one or more model experiments are run that decrease the loan rate by increments of 1 cent per pound until there is no longer any budget expenditure.[53]

The second policy specification, denoted "Income Support" (IS), replaces price support with income-support payments similar to those used for other crops, as described in Box 3.1. The loan rate is initially kept at 18 cents per pound. The target price is assumed to equal the minimum price to avoid forfeiture, as described above. The direct payment rate is assumed to be zero. For market price outcomes between the loan rate and the target price, the processor would receive the difference between the target price and the market price as a countercyclical payment rate multiplied by program acreage and yields established from the 1998–2001 period. For prices below the loan rate, the processor would receive a marketing loan deficiency payment. The rate is the loan rate minus the price. The countercyclical payment rate becomes the difference between the target price and the loan rate. As in the case of price support, if scenario results indicate federal expenditure stemming from the external event, one or more model experiments are run that decrease the loan rate by increments of 1 cent per pound until there is no longer any budget expenditure.

The third policy specification is termed the "Administration's Sugar Policy" (ADM) proposal. It is a continuation of the current price-support program with an 18-cent loan rate but with no criteria for

[53] Although not mentioned in the text discussions, the refined sugar loan rates are set at differing levels that correspond to the assumed raw sugar levels.

suspending marketing allotments. In the formula for determining OAQ, the expected level of imports for domestic human consumption replaces the 1.532 million STRV level. Expected imports are presumed to equal minimum amounts guaranteed under sugar access agreements in the WTO and FTAs, plus NAFTA imports equal to those from the previous year. Allotments are allocated to beet and cane sugar processors as under the 2002 Farm Act.

The fourth policy specification is a buyout option (BUYOUT). It is implemented for three cases in which a continuation of current policy (price support with an 18-cent loan rate) combined with the modeled external condition indicates significant federal budget expense, in excess of a total of $1 billion, net present value (NPV), over the 13-year projection period. It is assumed that the federal government has no preference between providing this level of expenditure through price-support payments or through a direct buyout that retires capacity at the beginning of the projection period. For each of the scenarios, the model calculates the present value of the net return (revenue less total costs) for processors at the state or regional level over the 13-year projection horizon. Processors are ranked on an ascending scale of the calculated unit value of their capacity. It is assumed that processors would be amenable to a buyout if the unit amount that the government is willing to pay for capacity retirement exceeds their own unit evaluation. The per-unit buyout price is the calculated unit value of the last capacity partly or wholly bought out; thus, higher-cost processors/producers receive buyout payments exceeding their expected returns from continued production. Capacity is retired up to the dollar amount available for the buyout. The model is then run absent the retired capacity for an analysis of the effect of the buyout.

There are five specific external conditions under which the performance of the alternative sugar policy instruments are analyzed (Table 3.3). The first (labeled HFCS50%) assumes that Mexico's beverage industry uses corn syrup for 50 percent of its sweetener needs. This scenario under the existing price-support program (BASE) is similar to the assumptions utilized for the 2007 USDA long-term outlook projections. Annual sugar imports from Mexico average between 820,000 and 923,000 STRV.[54] The second external condition (HFCS75%) assumes that the proportion of HFCS use increases to 75 percent. Annual sugar imports range between 1.2 and 1.5 million STRV. The third scenario (ACCESS) assumes other countries gain additional annual sugar import access of about 700,000 STRV, either through a Doha Round agreement in the WTO or through negotiated FTAs. The fourth (COMBO) combines the second and third assumptions: the Mexican beverage industry uses HFCS for 75 percent of its sweetener needs and the United States provides additional annual third-country access of 700,000 STRV. The fifth scenario (GLOBAL) assumes a strong Doha Round agreement with sugar provisions resembling proposals recently advanced by the Global Alliance for Sugar Trade Reform and Liberalization. These provisions, modeled with a five-year phase-in period, would require the United States to increase minimum duty-free sugar import access to 20 percent of human consumption; reduce over-quota sugar tariffs to a maximum of 25 percent of the world price; and eliminate all domestic producer support.

The buyout policy option for the GLOBAL scenario differs from the others because there is no internally calculated dollar amount of federal expenditure from the case of an 18-cent-per-pound loan rate. This is because the scenario itself involves lowering the loan rate significantly below the initial 18-cent-per-pound level. For the buyout, it is assumed that the federal government would be willing to pay processors for their processing capacity if the no-buyout GLOBAL scenario leaves a beet region or cane state with less than 50 percent of its original capacity remaining. The dollar amount of federal expenditure becomes a modeling output.

[54] By way of comparison, a study for the American Farm Bureau Federation using the Iowa State University Center for Agricultural and Rural Development (CARD) model to evaluate effects on U.S. sugar assumed a low-imports scenario with imports from Mexico of only 218,000 STRV. See Wagner (2007) for a discussion of this and other differences and similarities between the two studies.

Summary of Results

Results for the various scenarios are summarized in Table 3.4, in average values over the projection period for quantities and prices, NPV of total federal expenditures for the 13-year period, and capacity losses at the end of the period in 2020. Given the model structure, total deliveries for food and beverage consumption are nearly constant for all policy options and external circumstances, except for the GLOBAL scenario. Lying behind the other summary results are the shifts and dynamics involved in the model's projections.

Table 3.4. Modeling results for selected variables

Exogenous event	Policy regime[2]	Average production	Deliveries for food & beverage	Average total imports	Average imports from Mexico	Average raw sugar price	Ending stocks-to-use ratio	Ratio of blocked/CCC stocks to total stocks	Federal budget expenditure Net present value	Production/pr reduc	
		FY 2008–20	FY 2008–20	FY 2008–20	FY 2008–20					Beet	C
		(1,000 STRV)	(1,000 STRV)	(1,000 STRV)	(1,000 STRV)	(cents/lb)	(percent)	(percent)	(1,000 dollars)	(percent)	(pe
HFCS50%	BASE	8,408	10,631	2,561	820	20.90	16.48%	1.65%	132,195	-2.33%	-
HFCS50%	LR17.0	8,377	10,642	2,592	851	21.07	15.84%	0.00%	0	-3.70%	-
HFCS50%	IS18.0	8,420	10,649	2,561	820	20.89	16.28%	0.00%	105,989	-3.75%	-
HFCS50%	IS17.0	8,377	10,642	2,592	851	21.07	15.84%	0.00%	0	-3.70%	-
HFCS50%	ADM	8,277	10,616	2,664	923	22.03	15.01%	9.35%	0	-1.05%	-
HFCS75%	BASE	7,965	10,675	3,063	1,322	20.78	18.40%	10.10%	747,136	-5.38%	-
HFCS75%	LR17.0	8,118	10,756	2,991	1,250	20.11	18.49%	0.00%	0	-8.03%	-
HFCS75%	IS18.0	8,245	10,796	2,913	1,172	19.88	19.19%	0.00%	848,619	-8.02%	-
HFCS75%	IS17.0	8,118	10,756	2,991	1,250	20.11	18.49%	0.00%	0	-8.03%	-
HFCS75%	ADM	7,732	10,637	3,235	1,494	22.00	16.74%	17.10%	0	-4.56%	-
ACCESS	BASE	7,921	10,686	3,119	681	20.73	18.62%	10.54%	787,567	-5.60%	-
ACCESS	LR17.0	8,073	10,774	3,052	614	20.05	18.68%	0.00%	0	-9.46%	-
ACCESS	IS18.0	8,243	10,824	2,946	509	19.78	19.52%	0.00%	1,074,819	-7.79%	-
ACCESS	IS17.0	8,073	10,774	3,052	614	20.05	18.68%	0.00%	0	-9.46%	-
ACCESS	ADM	7,631	10,632	3,330	892	22.17	16.40%	18.20%	0	-4.08%	-
ACCESS	BUYOUT	7,696	10,631	3,268	831	20.93	16.63%	0.00%	787,567	-13.76%	-
COMBO	BASE	7,325	10,708	3,747	1,254	20.77	20.65%	19.83%	1,620,858	-6.34%	-
COMBO	LR17.0	7,766	10,880	3,489	1,051	19.67	20.70%	3.95%	329,830	-11.80%	-
COMBO	LR16.0	7,831	10,937	3,477	1,039	19.58	20.23%	0.00%	0	-14.70%	-
COMBO	IS18.0	8,223	10,968	3,248	810	19.27	21.32%	0.00%	2,414,373	-7.11%	-
COMBO	IS17.0	7,916	10,633	3,427	990	19.49	20.52%	0.00%	321,705	-13.17%	-
COMBO	IS16.0	7,831	10,937	3,477	1,039	19.58	20.23%	0.00%	0	-14.70%	-
COMBO	ADM	6,939	10,937	4,010	1,573	23.20	16.63%	27.05%	0	-12.69%	-2
COMBO	BUYOUT	6,457	10,595	4,462	1,561	21.58	14.57%	0.00%	1,620,858	-22.73%	-3

Table 3.4. Continued

Exogenous event	Policy regime[2]	Average production	Deliveries for food & beverage	Average total imports	Average imports from Mexico	Average raw sugar price	Ending stocks-to-use ratio	Ratio of blocked/CCC stocks to total stocks	Federal budget expenditure Net present value	Production/pr reduc	
		FY 2008–20	FY 2008–20	FY 2008–20	FY 2008–20					Beet	C
		(1,000 STRV)	(1,000 STRV)	(1,000 STRV)	(1,000 STRV)	(cents/lb)	(percent)	(percent)	(1,000 dollars)	(percent)	(pe
GLOBAL	WTO liberalization	6,557	13,675	7,718	600	17.57	31.04%	0.65%	117,294	-49.81%	-3
GLOBAL	BUYOUT	4,400	13,925	9,779	600	17.96	30.04%	0.00%	5,055,183	-55.02%	-5

Source: ERS (Economic Research Service of the U.S. Department of Agriculture) long-term sugar projection model

CCC = Commodity Credit Corporation; FY = fiscal year; HFCS = high-fructose corn syrup: STRV = short tons, raw value; WTO = World Trade Organization

[1] HFCS50% = HFCS constitutes 50% of Mexican beverage industry sweetener consumption
HFCS75% = HFCS constitutes 75% of Mexican beverage industry sweetener consumption
ACCESS = Minimum WTO raw sugar import access increased by 696,795STRV and HFCS50%
COMBO = Minimum WTO raw sugar import access increased by 696,795 STRV and HFCS75%
GLOBAL = WTO liberalization, see Tables 3.3 and 3.5

[2] BASE = Sugar title provisions of 2002 Farm Act
LR17.0 = Same as BASE with loan rate at 17.0 cents/lb
LR16.0 = Same as BASE with loan rate at 16.0 cents/lb
IS18.0 = Income support replaces price support with support at same level as BASE
IS17.0 = Income support replaces price support with support at same level as LR17.0
IS16.0 = Income support replaces price support with support at same level as LR16.0
ADM = USDA sugar program change suggested for 2007 Farm Bill (no suspension criteria for marketing allotment suspension)
WTO liberalization = See text and Table 3.3 and 3.5
Buyout = See text and Table 3.3

[3] Relative to FY 2008, first year of projection period

HFCS50% Results

Scenario outcomes for the price- and income-support policy specifications are close for HFCS50% (Table 3.4). Annual production averages about 8.4 million STRV, and annual imports average about 2.6 million STRV. Because total imports average more than 2.5 million tons, marketing allotments are suspended in most or all years. The ending stocks-to-use ratio is between 15.28 and 16.48 percent. With a raw sugar loan rate of 18 cents per pound, the NPV of federal budget expenditure is $132.2 million for price support in the BASE case and $106.0 million for income support. A one-cent reduction in the loan rate eliminates all federal budget expenditure. Average raw sugar prices range between 20.89 and 21.07 cents per pound. Over the projection period, processing capacity is reduced by 3.4 percent or less. Slightly more sugar beet processing capacity is lost than sugarcane processing capacity.

Under the ADM simulation, average annual production is 8.277 million STRV, between 100,000 and 143,000 STRV less than the results under price and income support. The model implementation of this policy results in a conservative approach – domestic production is restricted sufficiently to keep ending stocks to use at their lowest value and the domestic market price higher than under the other price- or income-support policies. Blocked stocks that processors have to keep off the market rise to 9.35 percent of total stocks. The higher average raw sugar price of 22.03 cents per pound attracts more imports from Mexico, an annual average of 923,000 STRV, which is between 72,000 and 103,000 STRV more than under the other policies. Processing capacity is reduced by only 2.2 percent, with slightly more sugarcane capacity being lost (3.5 percent), compared with sugar beet processing capacity (1.1 percent).

HFCS75% and ACCESS Results

These two scenarios are grouped together for discussion because of many similarities in the results. In HFCS75% and ACCESS, U.S. production under price support and income support declines by an average of 301,000 STRV compared with HFCS50%, and ending stocks to use are higher. Domestic production is highest, and domestic raw sugar prices lowest, in the HFCS75% and ACCESS scenarios when there is income support with a loan rate of 18 cents. Under the price-support and income-support policies, total imports increase relative to HFCS50% by an average of 413,000 (HFCS75%) to 466,000 STRV (ACCESS) a year. In ACCESS, although third-country imports increase by an average of 700,000 STRV, imports from Mexico decrease by an average of 230,000 STRV compared with the HFCS50% cases, leaving total imports about 53,000 STRV under the HFCS75% scenario. Lower prices due to the third-country imports reduce the attractiveness of the United States as a destination for Mexican sugar shipments.

With a raw sugar loan rate of 18 cents per pound, both the price- and income-support policies imply federal budget expenditures between $0.75 billion and $1.07 billion. With price support, the average raw sugar price is close to the minimum to avoid forfeiture: about 20.70 to 20.80 cents per pound, with 10.1 to 10.5 percent of total ending year sugar stocks held off the market through loan forfeitures to the CCC. With income support at the 18-cent loan rate, the average market price is between 19.78 and 19.88 cents per pound. For both price and income support, reducing the loan rate by 1 cent per pound implies a total elimination of federal expenditure supporting the sector. Sugar beet processing capacity is reduced between 8.0 and 9.5 percent, and sugarcane processing capacity is reduced about 5.3 percent.

Under the administration's suggested sugar policy (ADM), tight marketing allotments accommodate the increases in sugar imports. Domestic production falls to between 7.6 and 7.7 million STRV, and raw sugar prices are again higher than under the other policies. As a consequence, there is not much of a reduction in Mexican imports in the ACCESS scenario compared to HFCS50% – only 31,000 STRV. Price outcomes are significantly higher, between 22.00 and 22.17 cents per pound, as a greater proportion of stocks are held off the market, 17.1 to 18.2 percent, compared with 10.1 to 10.5 percent under the BASE price-support scenario with an 18-cent loan rate. Capacity reductions are larger than in the other price- and income-support cases. With the sugar allotments driven by a formula divided between beet sugar (54.35 percent) and cane sugar (45.65 percent), capacity adjustments again show that more sugarcane processing capacity is reduced compared to beet capacity than in the other cases.

An ACCESS buyout scenario is modeled, with a sugar buyout costing an equivalent of what would be charged to the federal budget under the BASE 18-cent loan rate price-support policy ($788 million). Total sugar crop processing is decreased by 10.8 percent, with proportionally more sugar beet processing reduction (13.8 percent) than sugarcane processing reduction (7.6 percent). Sugar production ceases in the Central and Northern Great Plains (beet) and Hawaii (cane), and 90 percent of capacity in the Great Lakes region (beet) is eliminated. The raw sugar price averages 20.93 cents per pound, higher than under the price- and income-support policies but lower than under ADM, and there are no forfeitures to the CCC. Average annual imports from Mexico are 831,000 STRV, about 226,000 STRV more than under the price- and income-support policy cases but 61,000 STRV less than under the administration's sugar program proposal.

The buyout is based on the present value of net returns for the 2008–2020 period, discounted at 5 percent annually. The amount to fund the buyout is capped by the present value of federal expenditures in the BASE 18 case for the same time frame. There is no price discrimination in the amount offered to the buyout participants, meaning that all who accept the buyout receive the same price. The result is differing levels of compensation for buyout participants. Those with the highest marginal value of production capacity, namely producers in the Great Lakes region, are reimbursed less than those with the lowest marginal value of production capacity, in the Central Great Plains. The Great Lakes region, the most efficient producing region participating in the buyout, sets the payment offered by the government, and, as a result, producers in that region are only compensated for the 13-year projection period of the model. Areas with progressively lower marginal values of processing capacity receive greater compensation. Producers in the Northern Great Plains would receive 15 years of compensation, while those in Hawaii would receive over 47 years of compensation. Producers in the Central Great Plains would be compensated at a rate higher than their net returns in perpetuity.

COMBO Results

The COMBO scenario assumes that annual duty-free import access is increased by 700,000 STRV and that the Mexican beverage sector uses HFCS for 75 percent of its sweetener needs. Domestic production falls to 7.3 million STRV under price support, and to 8.2 million tons with income support, assuming an 18-cent loan rate. For price support at 18 cents per pound, the average raw sugar price is equal to 20.77 cents per pound, just at the forfeiture level. The ending year stocks-to-use ratio is 20.7 percent, with 19.8 percent of all stocks being owned by the CCC as a result of forfeitures. Sugar processing capacity is reduced 4.4 percent, again with more sugar beet processing loss (6.3 percent) than sugarcane processing loss (2.1 percent). Total federal budget expenditure is $1.621 billion. Lowering the loan rate to 17 cents per pound reduces the expenditure to $329.8 million, and lowering the loan rate to 16 cents per pound reduces the expenditure to zero. The 16-cent loan rate reduces capacity by 11.2 percent, with beet processing 14.7 percent lower and cane processing 7.3 percent lower.

Ending stocks-to-use ratios, assuming income support, average above 20 percent, and at an 18-cent loan rate, federal expenditure is $2.414 billion, NPV, 49 percent higher than in the corresponding price-support scenario. Expenditure is reduced to $321.71 million by lowering the loan rate to 17 cents per pound and zero at 16 cents per pound. Capacity reductions are about the same as under price support. Lower average prices under income support (19.27 to 19.58 cents per pound) imply an average of 168,000 STRV fewer imports from Mexico annually (444,000 STRV less with income support and an 18-cent loan rate than under price support with the same rate).

Under the ADM proposal, 27.1 percent of all ending stocks are held off the market by processors, and more capacity than in either of the support policy alternatives is retired: 17.0 percent. As seen above, more cane processing is retired (22.0 percent) than beet processing (12.7 percent) under this policy. Annual raw sugar prices average 23.2 cents per pound, which attracts more imports (1.573 million STRV) from Mexico than under the other policies (which average 1.115 million STRV for price support and 946,000 STRV for income support).

A sugar buyout is modeled, with a cost equivalent to what would be charged to the federal budget under an 18-cent loan rate price-support policy under the COMBO scenario. Total sugar crop processing is decreased by 27.7 percent, with somewhat more similar reductions in sugarcane processing (33.1 percent) and sugar beet processing (22.7 percent). Sugar production ceases in the Central and Northern Great Plains and the Great Lakes (beet), Texas (cane), and Hawaii (cane), and 56 percent of capacity in Louisiana (cane) is eliminated. Beet production remains in the Upper Midwest, Northwest, and Southwest, and cane production remains in Florida and parts of Louisiana.

With the buyout, raw sugar prices average 21.58 cents per pound, and there are no forfeitures to the CCC. Average annual imports from Mexico are 1.561 million STRV, about 446,000 STRV more than under price support, 614,000 STRV more than under income support, and the same as under ADM. Average annual U.S. production is 6.457 million STRV, about 16 percent less than the average under the other policies. Annual total imports are 4.462 million STRV, about 28 percent more than the average of the price- and income-support policies and 450,000 tons more than under ADM, as the U.S. TRQ is expanded to ease upward price pressure on raw sugar given the reduced U.S. production capacity with the buyout.

GLOBAL Results

The GLOBAL scenario represents a WTO liberalization with a five-year phase-in period. Modeling of the GLOBAL scenario for the policy simulations is described in Table 3.5. The liberalization consists of three components. In the first, low-duty minimum access increases by 700,000 STRV (same as under ACCESS) to 1.928 million STRV, or 20 percent of average deliveries for food and beverage use for the base period 2004–2006. The increase occurs in the first year of the liberalization (FY 2008) and remains constant over the projection period. The second component calls for the over-quota tariff to decrease to 25 percent. Assuming data from 2004–2006, this implies a raw sugar over-quota tariff reduction from 15.36 cents per pound to 3.19 cents per pound over five years, with no remaining special price- or quantity-based safeguards. The third component calls for an elimination of domestic sugar support. Average support is calculated for the 2004–2006 period as production multiplied by the difference between the raw sugar loan rate and the spot world raw price plus a marketing margin. The average annual support afforded the U.S. sugar sector is $867 million. Elimination of this support over five years, with 50 percent of the reduction occurring in the first two years, implies the following sequence of new loan rates: FY 2008: 16.64 cents per pound, FY 2009: 15.28 cents per pound, FY 2010: 14.38 cents per pound, FY 2011: 13.47 cents per pound, and FY 2012–2020: 12.56 cents per pound.

The GLOBAL scenario is run both with and without a buyout. In the no-buyout case, processing capacity is reduced by 41.5 percent (a 49.8 percent reduction in beet processing capacity and a 32.1 percent reduction in cane processing capacity). Processing capacity in all areas except Florida and the Upper Midwest is reduced by more than 50 percent. Average annual production is 6.557 million STRV, and imports rise to 7.718 million STRV. With an average raw sugar price of 17.57 cents per pound, sugar partially replaces HFCS in the U.S. beverage industry. Domestic sugar deliveries for food and beverage use increase by more than 25 percent over HFCS50% levels, to 13.675 million STRV.

A buyout of production/processing capacity in all areas except Florida and the Midwest is calculated to cost $5.055 billion. This amount retires 54.7 percent of all capacity (55.0 percent of beet capacity and 54.2 percent of cane capacity). Average annual production is reduced to 4.4 million STRV and total imports average 9.779 million STRV.

Table 3.5. Modeling of WTO trade reform per Global Alliance for Sugar Trade Reform and Liberalization

I. Developed countries increase market access to 20 percent of domestic consumption

	1,000 MTRV	1,000 STRV
3-year base average (FY 2004–06)	9,032	9,956
20 percent	1,806	1,991
Refined TRQ	57	63
New raw sugar TRQ	1,749	1,928
Current minimum access	1,117	1,231
Increase	632	697

II. Eliminate special safeguard duties and cap over-quota tariffs at 25 percent of import price

Raw sugar import prices:			Cents per pound
	World price	Marketing	U.S. import price
FY 2004	7.58	1.50	9.08
FY 2005	10.46	1.50	11.96
FY 2006	15.78	1.50	17.28

U.S. import price, 3-year average:	12.77
25 percent (A):	3.19
Current over-quota raw sugar tariff (B):	15.36
Reduction (B – A):	12.17

Liberalized raw sugar over-quota tariffs:	
Year 1	12.32
Year 2 (50 percent of tariff reduction)	9.28
Year 3	7.25
Year 4	5.22
Year 5 (100 percent of tariff reduction)	3.19

III. Eliminate all forms of trade-distorting domestic support, with 50 percent of the reduction over the first two years of the agreement, with the balance achieved over the following three years

	Production	Valued at support price	Valued at import price	Support	Loan rate
	1,000 STRV	1,000 dollars			Cents/lb
3-year (FY 2004–06) averages:	7,975	2,870,835	2,003,857	866,978	
Calculations:	(W)	(X)	(Y)	(X – Y)	(X/W)*100/2000
Year 1		2,654,090	2,003,857	650,233	16.64
Year 2 (reduce to 50 percent)		2,437,346	2,003,857	433,489	15.28
Year 3		2,292,849	2,003,857	288,993	14.38
Year 4		2,148,353	2,003,857	144,496	13.47
Year 5 (100 percent)		2,003,857	2,003,857	0	12.56

Source: ERS (Economic Research Service of the U.S. Department of Agriculture) long-term sugar projection model
Reform based on proposals released March 15, 2007, by the Global Alliance for Sugar Trade Reform and Liberalization.
Note: *FY = fiscal year; MTRV = metric tons, raw value; STRV = short tons, raw value; TRQ = tariff-rate quota; WTO = World Trade Organization*

Concluding Remarks and Implications of the Current Environment

This paper has focused on U.S. sugar policy options reflecting various levels of reform: continuation of the current price-support program; a switch to income support similar to the programs used for other crops; continuation of price support but with marketing allotments having no suspension criteria; and the introduction of producer/processor buyouts. Analysis is presented with respect to future possible developments that could put increased pressure on imports into the U.S. sugar market: increased sugar imports from Mexico, other FTAs, or a possible Doha Round agreement under the WTO. The analysis time horizon is from FY 2008 through 2020.

Under the first external event scenario (HFCS50%), NAFTA imports average about 850,000 STRV a year, there are no new FTAs that include provisions for more sugar access to the U.S. market, and there is no Doha Round agreement. Continuation of the current U.S. sugar program with existing price-support levels involves a low total federal expenditure of only $132.2 million, NPV, over the 13 years. One conclusion is that these external market conditions do not present insurmountable problems to policy design. An alternative income-support scheme with about the same level of sector support yields similar results. The administration's proposed extension of marketing allotments with no suspension criteria (ADM) produces higher prices in our analysis, but processors must bear the cost of withholding sugar from the market.

The most direct challenge to the U.S. sugar sector comes from the likelihood of increased imports. Likely additions to imports stem separately from increased use of HFCS in Mexico, making more sugar available for export, or from an increase in minimum import access from expanded FTAs or a Doha Round agreement. In the analysis, it is assumed either that NAFTA imports increase to 1.300 million STRV (HFCS75%) or that minimum import access increases to about 20 percent of domestic consumption, that is, 1.928 million STRV (ACCESS). Results for all these possibilities yield similar conclusions. With price- or income-support policies, federal expenditure over the 13 years is between $787.6 million and $1.075 billion. Processing capacity is reduced no more than 5 percent. Reducing support by lowering the sugar loan rate to 17 cents per pound eliminates federal budget expense, with slightly more capacity loss, up to 7.5 percent. The ADM alternative of marketing allotments implies capacity reductions of 6.6 percent, with more cane processing lost, about 9.4 percent, than under the other price- or income-support cases. A direct sugar buyout costing $787.6 million reduces sugar processing capacity by about 11 percent. Sugar prices average 20.93 cents per pound, and average sugar imports increase to 3.268 million STRV per year.

The next level of analysis (COMBO) assumes that NAFTA imports increase due to expanded HFCS use in the Mexican beverage industry and that minimum import access increases to 1.928 million STRV. With an 18-cent loan rate, the NPV of federal expenditure over 13 years is about $1.6 billion with price support or about $2.4 billion with income-support policies. Lowering the loan rate to 17 cents per pound reduces federal expenditure to between $322 million and $330 million, and lowering the loan rate to 16 cents per pound eliminates federal expenditure. A 16-cent loan rate implies about 11 percent less processing capacity. The marketing allotment approach involves no federal expenditure, but more capacity is lost, about 17 percent. A sugar buyout equaling $1.621 billion reduces capacity by about 28 percent and results in higher prices than under other price- or income-support policies for those still producing. Sugar imports rise to an annual average of 4.462 million STRV.

The final analysis assumes a comprehensive Doha Round agreement: minimum duty-free sugar import access is increased to 20 percent of human consumption, over-quota sugar tariffs are reduced to a maximum of 25 percent of the world price, and all domestic producer support is eliminated. The average annual price of sugar is 17.57 cents per pound, domestic sugar consumption increases by over 25 percent to an average of 13.675 million STRV, imports rise to 7.718 million STRV, and processing capacity is reduced by 41 percent. A buyout of processing in areas where over 50 percent of capacity is projected to be lost is estimated to cost $5.055 billion. The only U.S. areas still producing sugar for consumption are Florida and the Upper Midwest area of Minnesota and North Dakota.

Overall, these results have several basic implications, some already well understood but others less so. First, under the most limited assumption about the use of corn sweeteners by the Mexican beverage industry (HFCS50%) and no other external changes to trade policy, the existing sugar price-support program may not be put under much pressure for change. Second, the most substantial trade liberalization and support policy reform (GLOBAL) would likely result in lower domestic prices and reduced U.S. production concentrated in the lowest-cost producing areas. A buyout could ease losses to sugar producers and processors in this case. Third, even quite a substantial increase of sugar imports (COMBO) could allow the continuation of U.S. policies that keep domestic prices well above world levels, although with less U.S. production. As modeled in our analysis, a buyout of high-cost processing capacity is quite favorable to the industry in this case, as some receive the buyout payments and the remaining processors/producers receive higher prices than under the price- or income-support policies. Fourth, under our model structure and assumptions, the use of domestic marketing allotments together with the continuation of existing levels of price support (ADM) leads to less production and higher prices than under other price- or income-support policies.

Subsequent to our analysis, the Food, Conservation, and Energy Act of 2008 was enacted in June 2008 and will govern the bulk of federal agriculture and related programs for the next five years (ERS, 2008). The new act reflects the potential for pressure from increased sugar imports that we have emphasized. The response is that the 2008 Farm Act strengthens existing sugar price-support mechanisms and introduces new instruments to guarantee that the sugar program will avoid the forfeiture by sugar processors of sugar pledged by them as loan collateral to the CCC. The raw cane sugar loan rate increases by 4.2 percent over the course of the period addressed by the new act, and the refined beet sugar loan rate increases by 5.2 percent, in contrast to the decreases we consider as policy options. Flexible marketing allotments are retained, with the requirement that allocations to domestic sugar crop producers be set at no less than 85 percent of estimated sugar deliveries for human consumption. Thus, neither our switch to income support nor buyout are adopted. The 2008 Farm Act eliminates marketing allotment suspension criteria, meaning that marketing allotments are permanently in effect. This was one of our policy options, but we assumed that the allotment levels would be adjusted to sustain specified prices rather than be given as a fixed percentage of domestic human consumption. To make the new program operational, the act directs the Secretary of Agriculture to set sugar TRQs at minimal levels consistent with U.S. WTO obligations and existing FTAs (specialty sugars are exempt). Sugar TRQs cannot be increased during the first half of the fiscal year unless there is a national emergency due to drastic weather or war. The 2008 act creates the Feedstock Flexibility Program, whose aim is to avoid sugar loan forfeitures by requiring the diversion of sugar from food use to ethanol production when it appears likely that forfeitures will take place at the end of the marketing year.

The 2008 Farm Act significantly reduces the chances of sugar loan forfeitures to the CCC because CCC purchases of sugar remove excess sugar from the market before most of the loans are due at the end of September each year. However, if there were to be forfeitures, the 2008 Farm Act retains from the 2002 Farm Act the option to offer a PIK program that reduces production in the next marketing year. Additionally, the 2008 act explicitly provides for the sale of forfeited sugar for ethanol production and for the exchange of CCC sugar for certificates of quota entry, thereby reducing TRQ imports. The ethanol component represents the potential for significant costs to the taxpayer if the US market becomes oversupplied. While the government must ultimately purchase raw sugar at 18.75 cents per pound once the loan rate increase is complete, it is likely that sugar as a feedstock for ethanol may only have a value between seven and ten cents per pound.

Higher sugar prices from increased loan rates increase the chances of retaining processing capacity in high-cost producing areas. These regions include Hawaii and parts of Louisiana for cane sugar, and the Great Plains and Michigan for beet sugar. Despite the improved market environment offered by the 2008 Farm Bill, as of the beginning of the 2008/09 crop year, the US sugar industry appears to have entered another period of consolidation. In the sugarbeet producing areas high prices for alternative crops have lead to questions of growers' commitments to co-ops. In 2008, growers in every beet producing region could have received far higher returns from soybeans, corn or wheat than from

sugarbeets, which are a high cost crop. Because of this, beet acreage was down nearly 15% from last year and down 21% from 2006. The beet sugar factory in California's Sacramento Valley announced closure following this crop year because of lack of available beets. There were also questions about the future of the Sidney, MT factory for the same reason. Moreover, several lawsuits have been filed between co-ops and the grower owners for failing to produce as agreed. Despite the somber environment during much of 2008, the recent outlook for beet sugar has improved on the back of high refined prices, falling alternative crop prices and the release of Roundup ready beets, which have proven to be a useful tool for beet growers.

On the cane sugar front the situation has been more murky but no more optimistic. One of the two remaining sugarcane producer in Hawaii announced in September that it would cease production of cane sugar and convert solely to an ethanol and electricity company. The bigger story occurred in June when U.S. Sugar Corporation (USSC), which represents 11 percent of domestic sugar production announced it would be selling all of its assets to the state of Florida as part of a project for Everglades restoration and cease sugar production in six years. The credit crisis has since forced the state to revisit the deal, now only offering to purchase the cane land but leaving the company with all of its other assets. How this would impact the profitability of the deal to USSC's shareholders is questionable and it remains unclear as to when and how this deal will be approved and what the ultimate impact will be on the sugar sector.

The ultimate impact these latest industry developments remains to be seen. Everything indicates that decline in beet acreage should be short lived, as competing crop prices fall back and domestic sugar prices remain high. However beet production will not be an option for growers in the Sacramento Valley as that loss of processing capacity is likely to be permanent. The end result of the USSC deal also remains to be seen. It is certain, however, that every time a geographic entity loses sugar production or a sugar producing company goes under, the sugar program, increasingly provides benefit to fewer people, meaning the sector could ultimately lose strength and political influence.

While the supply side of the U.S. sugar sector remains unclear, one thing that is clear is that as a result of slightly higher loan rates, sugar prices in the U.S. will also be higher. Higher U.S. prices could attract more sugar imports from Mexico, which has recently passed a national sugar program with the goal of expanding and modernizing its industry. Increased costs for sugar users may revive the growth of imports of SCPs, or lead to the expanded use of HISs, or less substitution of sugar for HFCS. Although the costs associated with sugar forfeitures are expected to be minimal, the cost of subsidizing the sale of sugar to ethanol producers will likely make the federal budget expense higher than what would have been the case had the provisions of the 2002 Farm Act been retained.

These outcomes will remain controversial, so exploring the consequences under alternative decision rules about the allotment levels and other provisions of the 2008 Farm Act merits further analysis. Our assessments in this paper point out some likely outcomes under alternative policies and external trade circumstances. They also highlight some important areas for further policy assessments given the possible circumstances in which the U.S. sugar sector may find itself in the coming decade.

REFERENCES

ERS (Economic Research Service), USDA (U.S. Department of Agriculture). 2006a. Measuring the effects of imports of sugar-containing products on U.S. sugar deliveries. SSS-237-01, September, 13–19.

ERS, USDA. 2006b. Mexico overview. In *Sugar and Sweetener Outlook*. SSS-246, May, 28–41.

ERS, USDA. 2008. 2008 Farm Bill side-by-side comparison. http://www.ers.usda.gov/FarmBill/2008/.

USDA. 2007a. *America's Farm Bill: 2007 Farm Bill proposals*. Washington, D.C.: USDA.

USDA. 2007b. *USDA agricultural projections to 2016*. Long-term projections report OCE-2001-1. Washington, D.C.: USDA.

Wagner, Owen. 2007. Impetus, options and consequences for sugar policy reform in the United States. Master's thesis, Department of Agricultural and Applied Economics, Virginia Polytechnic Institute and State University, Blacksburg.

4. FUTURE PROSPECTS FOR AFRICAN SUGAR: SWEET OR SOUR?

Ron Sandrey and Nick Vink

Introduction

Africa's share of global sugar production is around 5.7 percent, with a similar figure for global exports but a higher one for imports. Thus, the continent is a net importer. Most of Africa's production (excluding Egypt) is concentrated in southern and southeastern countries. South Africa is the dominant regional producer and exporter and is classified as one of the global low-cost producers. Currently some of Africa's[55] main sugar producers, although not global giants, are internationally competitive based upon their raw sugar production costs.[56] While hard to assess in a distorted sector, these competitive or potentially competitive countries, in addition to South Africa, seem to include the Democratic Republic of the Congo (DRC), Malawi, Swaziland, Tanzania, Zambia, and Zimbabwe, although big questions must be asked of Zimbabwe in the wake of its current economic meltdown. Mauritius, previously a major sugar exporter and beneficiary of economic rents from sugar exported into the European Union (EU) under preferences, is recognizing that this position is becoming less tenable, and higher production costs (and opportunity costs for its limited land) are leading to an adjustment away from sugar production. Madagascar appears to be uncompetitive, while Angola and Mozambique are refocusing on sugar following their emergence from protracted and costly civil wars, with their competitive position unknown but potentially viable.

The global sugar trading regime is complex: high protection rates in the major Organization for Economic Cooperation and Development (OECD) countries are only partially balanced by concessions to some developing countries that have preferential access deals for relatively minor quantities. Production costs have become almost irrelevant for these two groups. In the middle are the major sugar exporters trading at a global price that is artificially reduced by a combination of denied access and subsidized exports, from the EU in particular.

In this context, the key to local success in African sugar has been access to the highly protected international markets of the EU in particular, but also the United States and Japan. This was epitomized during the World Trade Organization (WTO) dispute over EU sugar export subsidies, where even within the Southern African Customs Union (SACU), Swaziland was on the side of the EU, trying to preserve its access conditions, while those on the opposing side included South Africa, a country that had no preferential access to the EU as a part of the Trade, Development and Cooperation Agreement (TDCA). Thus, vested interests relating to EU access were governing the arguments made by the various countries. To paraphrase Hemingway, it has been to date "to have or have not." These relationships are changing, particularly for sugar exports into the EU.

The objective of this paper is to place African sugar production in perspective and to consider the future trading opportunities for the continent in a global setting dominated by reforms in the EU. Reforms in the EU sugar regime now operate on a definite time frame. On the supply side, following an adverse WTO decision, EU cross-subsidies between the "A" and "C" sugar markets are to be slashed, production quotas reduced, and the internal domestic prices reduced by around one-third – yet these will still be

[55] The title of this paper should more correctly refer to eastern and southern Africa. Other African countries that produce sugar but are net importers include Burkino Faso, Burundi, Chad, Mali, Rwanda, Senegal, and Togo, while Central African Republic, Ethiopia, and Sudan export minor quantities (LMC International, 2004). Egypt is a significant producer but also a net importer. Sudan, which has a highly distorted sugar policy regime that stifles competition and taxes domestic production, has a large area of land available for production of sugar that could be exported to the EU should the country be able to rationalize its sugar sector and capitalize upon its potential.

[56] See the discussion below for an international comparison of production costs. We caution that these costs refer to production costs only and that costs of getting sugar to global markets from many of the landlocked African nations with poor infrastructure can be very high and thus negate at least part of any production cost advantage.

somewhere near 50 percent above the global reference price. On the market access front, the sugar import regime is to be gradually relaxed, with quota- and duty-free access from the world's poorest countries under the "Everything but Arms" (EBA) concession beginning in 2009.

This creates both winners and losers among African producers. The losers are those that currently have preferential access (the haves) and will see their economic rents dissipated, while the winners are those that operate almost exclusively on the global market (the have nots) and will see their world export price rise. In Africa the first group consists mainly of Mauritius (a high-cost producer) and Swaziland (a lowish-cost producer). These production costs are likely to now dictate how a country fares in the sugar market. Among the losers it is likely that Mauritius, at the extreme, will exit the sugar sector completely.

The second group (winners) is exclusively South Africa (a low-cost producer), and here there is potential to see an expansion of the sector in response to enhanced global market prices. It is not, however, a foregone conclusion that this expansion will eventuate within the country in the face of more competitive production from Brazil and Australia, in particular.

There is a third group of least-developed countries (LDCs) that will have quota- and duty-free access to the EU under EBA. In Africa, these countries with reasonable supply potential are Malawi, Zambia, and possibly Zimbabwe and Sudan. Their future is basically in their own hands and depends upon their ability to increase production and exports under the new EBA regime (although Zimbabwe currently does not have EBA access, it is becoming an LDC given its current economic performance).

The wild card is the recent offer by the EU to the African, Caribbean, and Pacific (ACP) countries to negotiate a package of Economic Partnership Agreements (EPAs) for quota- and tariff-free access to the EU. The offer covers all products, including agricultural goods except rice and sugar, and will apply immediately following the signing. It appears that rice and sugar will be fully liberalized in 2015, but this is a guarded offer with the threat of safeguards. The only country exception will be South Africa.

Finally, there appears to be limited hope in the short or medium term for multilateral sugar policy reforms. The United States has consistently blocked reform attempts through free trade agreements (FTAs), with Australia a case in point, and the stalling of the Doha Round emphasizes yet again the problem of special interest groups, even though the current position points toward the ability of developed countries to use their policy space in sensitive products to block sugar reforms. Perhaps the dogleg of high oil prices, leading to ethanol production from sugar directly and corn indirectly through artificial sweeteners, may offer hope for sustained higher global sugar prices, as that is the best the African continent can hope for. This, however, has the downside of exaggerating a sugar price drop should oil prices decline and delaying more substantive developed-country reforms in the meantime.

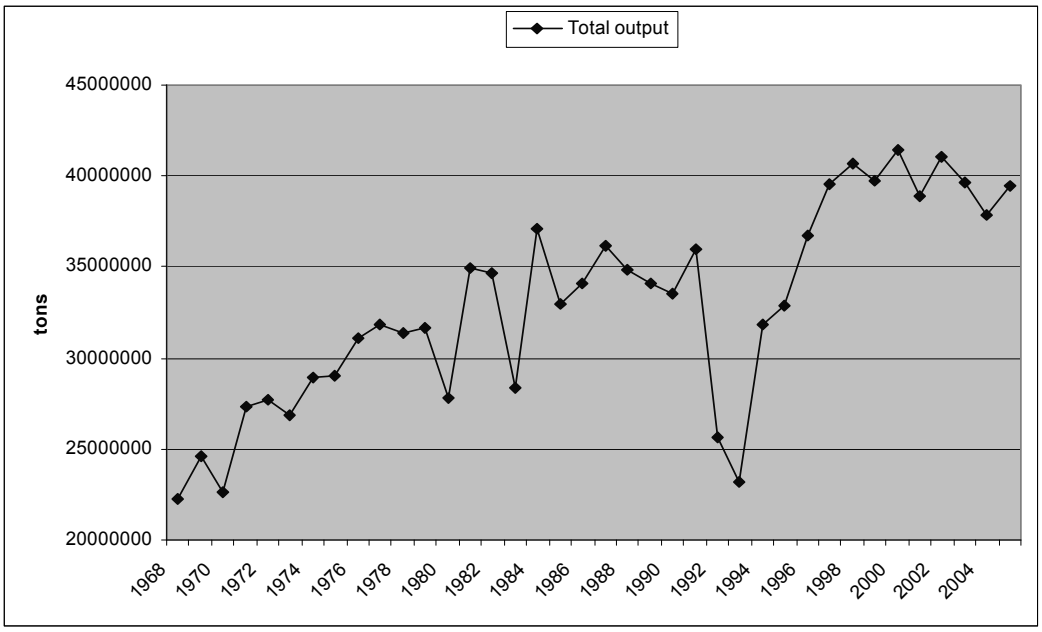
Sugarcane Production in Africa

Data on the production of sugarcane in eastern and southern Africa[57] were obtained from the statistical website of the Food and Agriculture Organization of the United Nations (FAOSTAT, http://faostat.fao.org). Sugarcane production in the Southern African Development Community (SADC) region increased from less than 25 million metric tons in 1968 to around 40 million tons in 2000–2005, interspersed with two to three periods in which production actually declined during droughts.[58] Figure 4.1 shows the three main drought periods over the past four decades: the decline in 1980 was almost entirely due to the collapse in production in South Africa, while in 1983 and 1992/93 virtually all producers experienced a decline in production. Nevertheless, the general trend is positive.

[57] Countries include Angola, DRC, Madagascar, Malawi, Mauritius, Mozambique, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. Note that the data refer to sugarcane production and not sugar per se.

[58] Throughout this chapter, tons refers to metric tons.

Figure 4.1. Output of sugarcane in eastern and southern Africa, 1968–2005



Source: FAOSTAT, 2006.

Table 4.1 disaggregates the data and shows sugarcane production by country. These data show the effect of war on sugarcane production in Angola (decreasing from more than 600,000 tons in the 1970s to less than 300,000 tons in the 1980s, then recovering to an average of 360,000 tons in the 2000s, according to the FAO) and Mozambique (where the increase started a decade later, but where total output is still only a sixth of the level reached in the 1970s). Mauritius has also experienced a decline in output, while production has more than doubled in DRC, Malawi, Swaziland, and Zambia. Production increases in Madagascar, South Africa, Tanzania, and Zimbabwe have been smaller.

However, South Africa has been responsible for some 4.5 million tons of the additional 10 million tons (i.e., 45 percent) that have been added to regional production since the 1970s, and the country is similarly responsible for almost half of the total output.

Table 4.1. Sugarcane production in eastern and southern Africa (tons)

	1970s	1980s	1990s	2000–2005
Angola	638,155	286,000	294,500	360,000
Democratic Republic of the Congo	734,250	1,091,668	1,709,055	1,580,810
Madagascar	1,291,536	1,715,489	2,073,600	2,256,698
Malawi	661,559	1,648,400	1,790,000	2,000,000
Mauritius	5,821,079	5,550,429	5,303,612	5,206,585
Mozambique	2,568,000	803,105	290,070	397,276
South Africa	17,043,561	18,518,672	18,201,730	21,470 ,657
Swaziland	1,834,834	3,548,664	3,828,993	3,980,767
Tanzania	1,260,824	1,330,500	1,319,180	1,642,500
Zambia	600,908	1,116,910	1,351,758	1,950,000
Zimbabwe	2,231,700	3,438,605	3,112,992	4,104,417
Total	**34,686,406**	**39,048,440**	**39,275,491**	**44,949,710**
South Africa as a % of total	**49**	**47**	**46**	**48**

Source: FAOSTAT, 2006

Average yields have either been fairly constant or declining in all these countries, with the exception of Tanzania, where yields have increased by more than twofold over the period (Table 4.2). The economic impact of a decrease in yields depends, of course, on the rate of extraction of sugar from the cane. Such data are unfortunately not available on a comparative basis for the SADC countries.

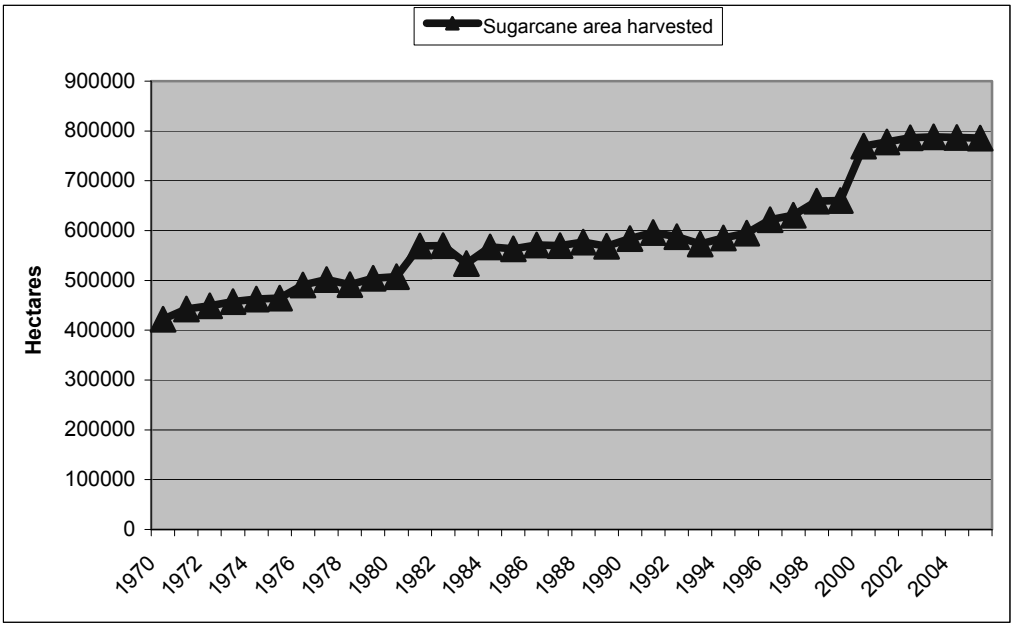
Table 4.2. Sugarcane yields in eastern and southern Africa (tons/hectare)

	1970s	1980s	1990s	2000s
Angola	46	32	36	38
Democratic Republic of the Congo	60	42	49	40
Madagascar	43	32	34	33
Malawi	109	114	102	106
Mauritius	72	71	72	73
Mozambique	47	23	13	14
South Africa	88	71	63	50
Swaziland	108	105	98	99
Tanzania	40	95	89	110
Zambia	108	109	103	105
Zimbabwe	100	108	97	95

Source: FAOSTAT, 2006

Given these declining yields, it is evident from Figure 4.2 that the increase in sugarcane production over the period is largely due to increased area harvested. This is supported by the data in Table 4.3, which again shows the effects of war in Angola and Mozambique and the recovery over the past decade, as well as the declining area harvested in Mauritius. Area expansion was the greatest in DRC, Malawi, South Africa, Swaziland, Zambia, and Zimbabwe. Nevertheless, South Africa, as the largest producer, was responsible for some 75 percent of the additional area harvested over these four decades as the sugar industry expanded out of the traditional growing areas of KwaZulu-Natal into Mpumalanga province.

Figure 4.2. Area of sugarcane harvested in the SADC region, 1961–2005



Source: FAOSTAT, 2006
Note: SADC = Southern African Development Community

Table 4.3. Area of sugarcane harvested in eastern and southern Africa, 1970–2005

	1970s	1980s	1990s	2000s
Angola	13,600	8,800	8,250	9,500
Democratic Republic of the Congo	12,300	25,636	34,661	40,083
Madagascar	30,844	54,496	64,513	68,307
Malawi	6,057	14,519	17,415	18,667
Mauritius	80,318	78,067	73,749	71,261
Mozambique	55,000	29,000	22,500	27,000
South Africa	193,240	259,286	285,199	428,500
Swaziland	17,010	33,739	39,059	44,820
Tanzania	32,500	14,179	14,819	16,417
Zambia	5,579	10,296	13,096	15,000
Zimbabwe	22,209	31,782	36,049	42,833
Total	**468,656**	**559,801**	**609,309**	**782,388**

Source: FAOSTAT, 2006

Sugar Policy Setting in Africa

South Africa and SACU/SADC

Currently there are no tariffs on the importation of sugar into South Africa. All product from the SACU partners of Botswana, Lesotho, Namibia, and Swaziland (BLNS) enter duty-free, as do almost all products from the other SADC countries (with the exceptions being secondhand clothing and motor vehicles and their parts), while in 2007 the most favored nation (MFN) tariff was set at zero given the relatively high price of world sugar. Domestic marketing arrangements are complex. A price pooling system is in operation, and producers are allocated quotas to be sold on the domestic markets, while the South African Sugar Association is the only exporter. In a policy environment where agriculture is lightly supported (the OECD Producer Support Estimate (PSE) for 2003 is 8 percent), sugar's 32 percent PSE is double that applying to milk, the second highest at 16 percent. This result is derived from a situation in which the 2003 domestic price of South African sugar was nearly 50 percent above the global reference price. Given that South Africa is competing globally, this gave a producer nominal protection coefficient of 1.46 in 2003 (OECD, 2006).

Sugar trade within SACU and SADC is protected by the SADC 2001 Protocol on Trade, Annex VII, Concerning Trade in Sugar.[59] Sugar is designated as a product requiring special dispensation within the framework of the Protocol on Trade so that no sugar industry within SADC will suffer harm, but with the long-term objective of establishing full liberalization of trade in the sugar sector in the SADC region after the year 2012 (but only if the world sugar market has "normalized" sufficiently to make such liberalization acceptable). Within SACU, a portion of the SACU sugar market, based on the annual growth in that market, will be allocated to each SADC net surplus producer according to that producer's relative net surplus production. Duty-free access to the SACU sugar market of 20,000 tons of sugar per annum will be available to the non-SACU SADC surplus sugar producing countries and will be allocated according to each producer's relative net surplus production.

Madagascar

The sugar industry accounted for 60 percent of the value of food processing output in Madagascar in 1986, but farmers continue to be implicitly taxed, as their producer prices are very low relative to the

[59] This protocol was negotiated in 2000 and revised in 2006.

world price. Since 1991, Madagascar has become a net importer, even though exports rebounded in 1999. It has an export quota, which it has generally filled, to the United States of 7,258 tons and to the European Community of 10,760 metric tons, as of 2001. Despite the fact that sugar imports are subject to import tax (35 percent) and value-added tax (VAT, 20 percent), inefficiencies associated with low capacity utilization, low yields, and high input costs lead to high production costs for domestic sugar and therefore make imported sugar cheaper. Local communities have grown dependent on policy-dependent sugar industries, which makes the political cost of reform high.

Mozambique

In Mozambique, sugar is subject to a variable tariff surcharge that depends on the international price of sugar on top of the normal duty (7.5 percent). In 2004, this surcharge was close to 60 percent (as an exception, in 2006, due to higher international prices, the surcharge was at 0 percent, and only the standard duty applied). Sugar imports are also VAT exempt. The sugar sector, after the privatization of the sugar plantations and mills, has been granted high protection for the domestic market and benefits from sugar quotas in preferential export markets (e.g., the EU, United States, and SADC). Sugar is grown on large plantations that control production and milling, and only recently have outgrowing schemes been introduced.

Sugar has been a very important focus of government support in terms of agroindustrial policy. During the 1980s Mozambique shifted from being a net exporter to a net importer, but during the 1990s, when protection was granted to the domestic market, production increased; however, it was oriented toward the national market as import substitution (relatively profitable), and exports were limited to the more profitable preferential markets such as the EU or the United States. Protection is high, as sugar has a large positive net rate of assistance (NRA) based on a very high import surcharge.

Tanzania

The levels of protection for sugar in Tanzania are hard to interpret, due to data limitations, but seem to show that the sector is highly protected, as sugar typically is. Primary producers are effectively subsidized and the implied tax rates on consumers are very high, but at the same time farm-gate and wholesale prices for the primary product appear to have remained very low, far below the reference import price, which is in turn below the retail price. There is limited competition in processing, with few buyers, while import quotas for processed sugar persist. It seems likely that the processors benefit from protection, and thus the estimated subsidy actually relates to processors, as consumers pay a high price.

The Global Picture

Details of the global production and trade data for sugar are shown in Table 4.4, with the data expressed in 1,000 metric tons (raw value) on the left side and their relative percentage shares on the right side. The data are expressed as an average of the last five years, with the EU the exception, as the average of the last three years is shown in that case. The share data are adjusted to account for the potential double-counting of Africa (and note that Africa does not include Egypt, a significant producer and importer but not an exporter).

The table highlights the following:

- Africa (excluding Egypt) accounts for 5.7 percent of world production, 14.9 percent of imports, and 7.7 percent of exports.
- South Africa is the only significant African player (1.8 percent of production), and the data from the table can be used to place Africa in perspective.
- The largest producers globally are Brazil (18.6 percent), the EU (13.7 percent), India, and China.
- The largest exporters are Brazil (34.9 percent) and the EU (11.2 percent), followed by Africa, Australia, and Thailand.

- The largest importers shown are Africa, Russia, and the EU (and the balancing entry of "unrecorded").
- The EU has a dual nature as a large importer and exporter (intra-EU trade is *not* included here).
- Note that the data shown represent some 88.3 percent of the production and 86.4 percent of the exports but a lesser 58.9 percent of imports even when the balancing "unrecorded" category is included.

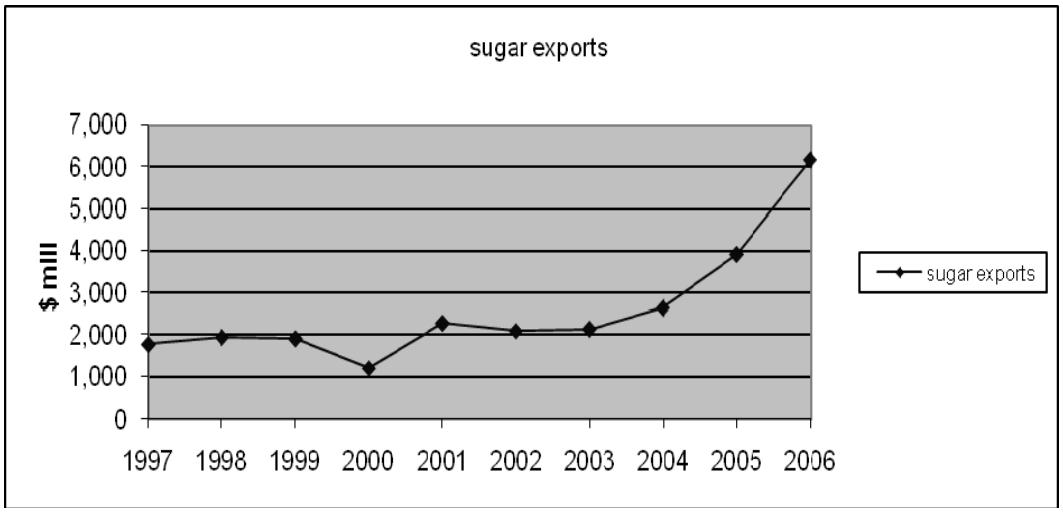
Table 4.4. The global sugar production and trade picture, volumes and % shares

	1,000 metric tons, raw value			% global share		
	Production	**Import**	**Export**	**Production**	**Import**	**Export**
World	146,296	43,117	48,099			
Brazil	27,217	-	16,780	18.6%		34.9%
EU-25	20,110	2,560	5,398	13.7%	5.9%	11.2%
India	19,526	549	970	13.3%	1.3%	2.0%
China	10,507	1,167	207	7.2%	2.7%	0.4%
Total Africa	8,378	6,443	3,684	5.7%	14.9%	7.7%
USA	7,415	2,038	198	5.1%	4.7%	0.4%
Thailand	6,114	-	4,071	4.2%		8.5%
Other Africa	5,789	6,219	2,520	4.0%	14.4%	5.2%
Mexico	5,592	205	244	3.8%	0.5%	0.5%
Australia	5,255	9	4,149	3.6%		8.6%
Pakistan	3,488	585	64	2.4%	1.4%	0.1%
South Africa	2,589	224	1,163	1.8%	0.5%	2.4%
Caribbean	2,588	605	1,709	1.8%	1.4%	3.6%
Colombia	2,555	44	1,097	1.7%	0.1%	2.3%
Philippines	2,206	10	221	1.5%		0.5%
Russia	2,182	3,654	140	1.5%	8.5%	0.3%
Guatemala	1,985	2	1,366	1.4%		2.8%
Cuba	1,760	189	1,249	1.2%	0.4%	2.6%
Egypt	1,435	1,010	-	1.0%	2.3%	
Japan	895	1,375	12	0.6%	3.2%	
Unrecorded	-	4,982	-		11.6%	
Subtotals				**88.3%**	**58.9%**	**86.4%**

Source: U.S. Department of Agriculture (USDA) data http://www.ers.usda.gov/Briefing/Sugar/data.htm. These data represent the averages over the years 2002/03 through 2006/07, except for the EU data, which are the averages over the years 2004/05 through 2006/07.

However, Table 4.4 does not reveal the most dramatic feature of world exports, namely the marked increase in Brazil's exports over the last decade. These exports are shown below in Figure 4.3 for 1997 through to 2006 and clearly demonstrate the large increases over the last three years. If it has not already become so, Brazil is primed to become the benchmark against which exporters will set themselves in future sugar export competition. We therefore include the Brazilian data to set a benchmark against which Africa must compete.

Figure 4.3. Brazilian sugar exports, US$ million[60]



Source: *World Trade Atlas* data

Table 4.5 provides more information, as it displays the destinations of Brazilian sugar (Harmonization System [HS] code 1701, for unrefined cane sugar) over the last 10 years. These data are expressed in US$ million for the total amounts and then the percentage shares for the respective main destinations as ranked for 2006 exports. It is interesting to compare the destinations for sugar exports from the main global exporter and South Africa: first, the destinations are very different, and second, the South African data show much more year-on-year variation in export destinations. Indeed, Figure 4.3 and Table 4.5 show that the big increase in Brazilian exports over the last three years remains within a similar export destination profile. Brandão (2007) provides an excellent discussion of the Brazilian sugar sector, and in particular the linkages between traditional sugar products and ethanol production in Brazil. Given the currently high international oil prices, the latter will provide support to global sugar prices, but it leaves open the question as to what may happen to sugar prices should international oil prices retreat.

Table 4.5. The main export destinations for Brazilian sugar, percentage share

Country	1997	1999	2000	2001	2002	2003	2004	2005	2006	Total
World $ mill	1,774	1,911	1,199	2,279	2,094	2,140	2,640	3,919	6,167	100%
Russia	21%	33%	26%	31%	24%	32%	19%	20%	21%	24%
Nigeria	9%	6%	9%	9%	9%	8%	8%	7%	6%	8%
Arab Emir.	7%	3%	9%	7%	7%	7%	9%	6%	7%	7%
Egypt	8%	8%	5%	7%	7%	5%	6%	4%	5%	6%
Morocco	6%	2%	4%	4%	5%	4%	4%	4%	3%	4%
EU-27	4%	4%	6%	6%	3%	5%	3%	2%	2%	4%
Canada	2%	3%	3%	3%	4%	6%	4%	4%	4%	3%
Iran	3%	4%	5%	4%	4%	1%	0%	2%	6%	3%
Saudi Arabia	0%	2%	4%	2%	3%	2%	3%	4%	4%	3%

[60] Refers to HS 1701, sugar, cane/beet, solid form. The World Customs Organization's (WCO) developed the Harmonised Commodity Description and Coding System (HS) to categorise goods for customs purposes. It is used by more than 190 countries as a basis for their Customs tariffs and for the collection of international trade statistics. It follows a hierarchical structure, comprising 21 sections, 98 chapters (2 digit), 1,228 headings (4 digit), and 5,059 sub–headings (6 digit).

Table 4.5. Continued

Country	1997	1999	2000	2001	2002	2003	2004	2005	2006	Total
USA	6%	2%	6%	2%	2%	3%	2%	3%	1%	3%
Yemen	6%	3%	4%	3%	3%	2%	2%	3%	4%	3%
Algeria	1%	2%	2%	1%	2%	4%	5%	3%	4%	3%
Malaysia	0%	3%	1%	2%	2%	1%	1%	2%	5%	2%
Bangladesh	1%	1%	1%	0%	0%	1%	4%	3%	4%	2%
Ghana	2%	1%	1%	1%	1%	3%	3%	3%	2%	2%
Syria	0%	1%	0%	1%	3%	1%	3%	3%	2%	2%

Source: *World Trade Atlas* data

Global Sugar Policies[61]

The sugar market is generally recognized (along with rice and dairy products) as being the most heavily protected agricultural market worldwide. This protection has the effect of distorting the data in several ways. The first is in the production data, where large subsidies to producers in the EU, United States, and Japan in particular increase production beyond what it would be in the absence of those supports. An estimate of this protection level is provided by the OECD, which suggests that producers in the EU, United States, and Japan are paid some 2.23, 1.76, and 2.42 times the world reference price, respectively. This is then accentuated by (a) these same countries having to maintain high rates of protection against imports and (b) in the case of the EU, unlawful exports to third countries further depressing world prices. The first issue, high rates of protection, is especially acute in the case of the EU, United States, and Japan, although in the EU and to a lesser extent the United States, preferential access is available to many developing and least-developed countries. This creates the winners and losers among third-country producers (hence the "haves" and "have nots").

The EU sugar policy is particularly distorted, with the root cause being attempts to isolate and protect the more expensive temperate-climate sugar beet production from the cheaper tropical cane sugar production.[62] These sugar policies are in the process of being reformed in the face of WTO pressure from a panel case that the EU lost, thus forcing it to reduce the – mostly illegal – exports of sugar (see, for example, Oxfam, 2002); internal reforms of the Common Agricultural Policy (CAP); and preferential access being offered to the world's poorest countries through the EBA agreement. These reforms are, as expected, complex, and involve a voluntary quota retirement scheme, a reduction of 36 percent in the sugar price over a four-year period starting in 2006/07, and a raft of other (cosmetic?) changes. Compensation will be paid to farmers at an average of 64.2 percent of the price cut, and, of course, the EU being the EU, the retirement schemes are made financially attractive (Mitchell, 2005). See in particular Bureau et al (2007) for a more detailed discussion of these reforms.

While this is all well and good, there is a twist in that although the producers are adequately compensated, producer prices are expected to decline to around 80 percent of their current levels or lower over the next few years. This means that (a) the economic rents enjoyed by the "haves" with preferential access will fall even more dramatically, as their rents are very much a function of the difference between the world reference price and the EU domestic price, and (b) the WTO-sanctioned tariff-rate quotas (TRQs) in place will still act to prevent the "have nots" from exporting sugar at the world reference price. Despite the loss of preferences, the "haves" must still regard the EU market as the most lucrative, and a likely increase in their exports will put further pressure on the EU to implement meaningful reforms in the

[61] This discussion is based on Oxfam (2004) and Mitchell (2005). For the EU and United States, the earlier papers provide much more thorough and updated discussions of sugar policy. Nonetheless, we include brief synopses for consistency of coverage in our paper.

[62] Globally, around 75 percent of sugar is from cane rather than beet (Mitchell, 2005).

sugar sector (already there is talk of "voluntary restraints" from the "haves" as a way of allowing the EU to avoid these meaningful reforms). The reform also offers assistance to the ACP countries that currently enjoy preferential access to the EU sugar market, but although negotiations are under way for better market access for the ACP countries into the EU, these negotiations are almost certain to exclude sugar. There are six SADC countries that have access to the EU under the EU-ACP Sugar Protocol – namely Malawi, Mauritius, Swaziland, Tanzania, Zambia, and Zimbabwe – and are thus part of the "have" group.

From 2002 through 2004, the EU was a net importer of sugar within its highly complex and severely distorted trade regime, but during 2005 it again became a modest net exporter (Mitchell, 2005). This pattern will alter as the illegal cross-subsidy regime between the so-called "A," "B," and "C" sugar prices is modified and the internal EU sugar price declines to nearer (but still above) the world reference price. Table 4.6 shows the main sources of sugar imports into the EU during 1995 and 2005. These imports are all under preferences, as the high MFN tariffs effectively prohibit other imports. These preferences are as follows:

- The Cotonou Agreement (an extension of the old Lomé Convention) with the EU, whereby all countries in the southern African region except South Africa have nonreciprocal trade preferences for exports into the EU, but subject to a safeguard clause and rules of origin. This access includes special access for bananas, beef and veal, and sugar. The agreement is for the period to December 31, 2007, and in theory will be replaced by the EPAs.
- The Sugar Protocol, associated with the Cotonou Agreement, a bilateral agreement between 20 ACP countries and the EU that allows for a fixed import of 1.3 million tons of sugar, duty-free and at a guaranteed price that is linked to the EU institutional price. It will be reviewed in the context of the EPA negotiations.
- Complementary Sugar, a virtual add-on to the Sugar Protocol that allows for an extra 300,000 tons annually from the Sugar Protocol countries and India to be imported duty-free.
- GATT (WTO) MFN Quota – a tariff quota of 85,000 tons annually for mainly Brazil and Cuba since 1996, with a duty of 98 euros per ton.
- EBA, which from 2009 finally allows for quota- and duty-free sugar imports from the LDCs, several of which are in Africa.
- Western Balkans, another quota access commitment from the EU of around 400,000 tons.

Table 4.6. The major sources of EU sugar imports, 1995 and 2005, million euros

	EU imports				Average annual growth (%)
	Million euros		% of total		
	1995	2005	1995	2005	
Extra-EU	985	1,175	100	100	1.8
Mauritius	279	301	28	26	0.8
Croatia	0	111	0	9	
Fiji	93	90	9	8	-0.3
Guyana	90	85	9	7	-0.5
Swaziland	87	80	9	7	-0.8
Jamaica	74	63	8	5	-1.5
Serbia and Montenegro	0	56	0	5	
Brazil	37	45	4	4	1.8
Zimbabwe	30	34	3	3	1.1
Malawi	13	30	1	3	0.9
Rest	282	280	29	24	-0.1

Source: Eurostat COMEXT, September 20, 2006 (S.R. 4).

In all these agreements, the sources exporting are under some form of preferences. Except for sugar imports from the arrival of the Western Balkans, there is the stability that one would associate with controlled import regimes. The African countries of Mauritius and Swaziland are significant traders, while both Malawi and Zimbabwe have a presence at the bottom of the table. Returning to African sugar access to the EU, we see that the major regional producers (South Africa, Mauritius, Swaziland and Zimbabwe)[63] are *not* entitled to EBA access, while the EBA-eligible countries (Madagascar, Malawi, Mozambique, Tanzania, and Zambia) have not been major producers during an era when potential economic rents from preferential access to the EU may have been available to them. The data are updated in the appendix to this paper, and those data extend to an extrapolation of the potential losses that will be incurred by these exporters after 2009/10.

The United States

U.S. sugar policies are less complex but still very protectionist. The domestic price of around double the world price is maintained through domestic marketing allocations to control supply at these prices and import TRQs with high associated over-quota tariffs to restrict imports (see Wagner, 2007). In almost all cases, sugar is restricted or ineligible under the so-called FTAs between the United States and parties that produce sugar. These restrictions or bans extend to the Generalized System of Preferences (GSP) scheme for poorer countries and the African Growth and Opportunity Act (AGOA) for selected African nations.[64] An exception to this general principle is the Mexican component of the North American Free Trade Agreement (NAFTA), whereby over-quota tariffs are supposed to decline to zero by 2008, creating considerable uncertainty in the United States despite Mexican production costs appearing to be higher than those in the United States.

Annual imports under the raw and refined sugar TRQs have averaged 1.22 million short tons since 2000. Most U.S. sugar imports are raw cane sugar. The raw cane sugar TRQ is allocated to 40 countries based on patterns established during the relatively unrestricted free trade period of 1975–1981, with the Dominican Republic, Brazil, and the Philippines holding the largest shares, approximately 17, 14, and 13 percent, respectively. The United States also administers two re-export programs to help U.S. sugar refiners and manufacturers of sugar-containing products compete in world markets. These are the Refined Sugar Re-Export Program and the Polyhydric Alcohol Program, which provides world-priced sugar to U.S. manufacturers of polyhydric alcohols.

Two possible wild cards must be introduced into U.S. sugar policies. One is the possible triangular effect of the production of methanol from maize (corn), which may impact sugar substitutes and direct more of the sweetener demand back to sugar rather than substitutes. The second is the inevitable regime change in Cuba following Fidel Castro, as opening the U.S. market to Cuban sugar would be a major win-win situation for both Cuba and the United States in normalizing their relations.

Japan

Japanese sugar policies are in some ways just as complex and even more inscrutable than those of the EU and the U.S. While notional tariffs are very high for sugar imports into Japan (up to 171 percent), there seem to be several channels through which duty-free imports can be brought into the country. These are tightly controlled and act as TRQs, and are currently benefiting South African sugar exporters.

---

[63] We note that there is debate regarding conferring LDC status to Zimbabwe, as its crippling economic situation has deteriorated to a level that leaves it well within the LDC definitions. If this happens, there is a secondary issue as to whether the EU would follow the U.S. lead (under the African Growth and Opportunity Act [AGOA]) and refuse preferential access, and even a third issue as to whether the oppressive Zimbabwean regime would submit to the indignity of being classified as an LDC by Western powers. This complex political issue has major implications for the sugar sector in Zimbabwe.

[64] Zimbabwe is not eligible for any preferences for exports to the United States under AGOA, and there are no AGOA preferences for sugar to any countries. Similarly, there are restrictions for most non-African countries under the much more modest GSP that the United States offers to developing countries for sugar imports.

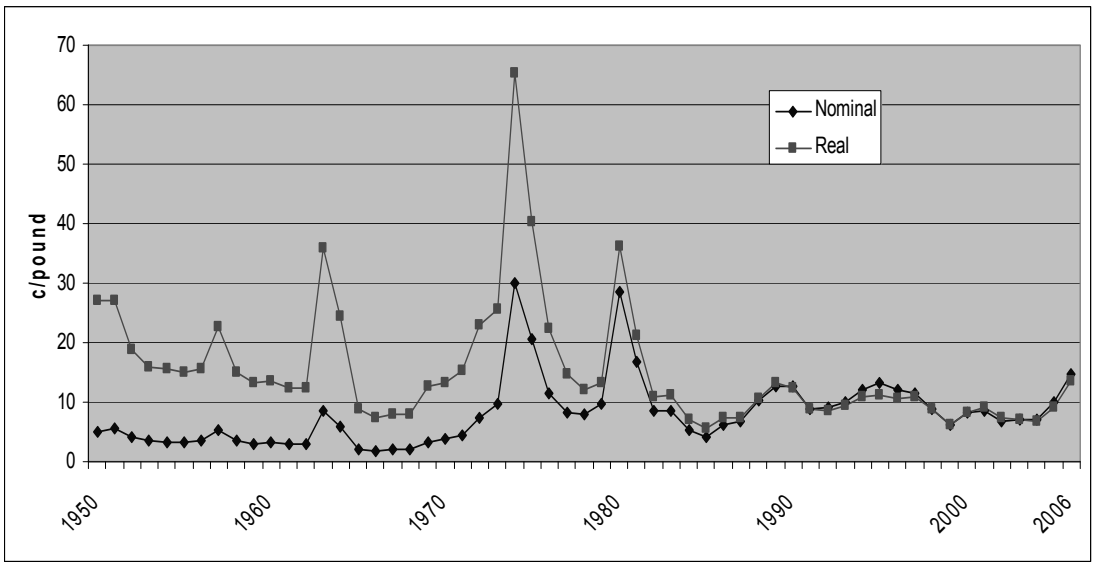
Other Countries

The major sugar exporting nations of Brazil, Australia, and Thailand, which operate at or near world prices, have relatively unsupported sugar sectors.

Global Prices and Prospects

Real and nominal global sugar prices (1990 = 100) since 1950 are shown in Figure 4.4, both in U.S. cents per pound. The price spikes during the commodities booms of 1963, 1974/75, and 1980 are clearly visible, as are the lows of the mid-1980s. Prices in both real and nominal terms have been relatively stable over the last 20 years, with an upturn visible over 2005 and 2006.[65] On a side note, this upturn has implications for the SACU tariff schedule, as the sugar tariff, set as a function of the world price, is currently[66] zero.

Figure 4.4. Global sugar prices, cents per pound, real and nominal



Source: World Bank data series, personal communication

What are the prospects for the world sugar price from 2006 onward? Much of the answer will lie with the real impacts of EU sugar reforms, with these impacts coming through different channels. There is also the possibility of agricultural policy reform being mandated through an agreed outcome to the Doha Development Agenda (DDA) of the WTO. This is, however, looking increasingly unlikely in the short to medium term as (a) the agreement itself is looking increasing difficult to finalize and (b) more importantly, despite the second D in "DDA" standing for "development," the major OECD countries are almost certain to continue sugar protection under the Sensitive Products escape clause as the situation currently stands. This clause nullifies much of the potential gains from a DDA outcome for the key products of interest to developing countries. Thus, unilateral reforms in the EU in particular hold the key for future prospects, although, as discussed, these reforms and the associated lowering of EU internal prices will affect the "haves" and "have-nots" in diametrically opposite ways.

[65] Although prices have fallen since December 2006 (FAO, 2006).
[66] As of June 25, 2007.

What then are the likely impacts of the EU sugar reforms? There is little doubt that the global price will increase as the EU internal price declines. Estimates of these likely global increases are provided by the following organizations:

- OECD (2004) reports that studies undertaken in the late 1990s and the early years of this millennium calculate increases in sugar prices from global trade liberalization ranging from a low of only 2–8 percent by the International Monetary Fund (IMF) to 5–41 percent (depending upon assumptions) by the Australian Bureau of Agricultural and Resource Economics (ABARE), and from the U.S. Department of Agriculture's (USDA's) 16 percent with full reforms to the FAO's 43 percent. The OECD's own estimates are around 10 percent for EU liberalization only, increasing to around 15 percent with liberalization in North America and the rest of the OECD countries included, and to 23 percent for complete global liberalization. Its model also suggests that South African production would increase by some 38 percent and global exports would double under extreme global liberalization. For the other main "free" producers, production from the 2004 baseline would increase in Brazil (19 percent), Australia (7 percent), and Thailand (3 percent), while decreasing in the EU, the United States, Japan, the ACP countries, China, and India.
- The Economic Research Service of the USDA has estimated a global price increase due to EU liberalization under different assumptions as ranging from 24 to 44 percent. In this case, production in the EU declines by around one-third as exports are effectively blocked off, although the tariff rates still maintain protection that in turn restricts imports and maintains producer prices at levels still well above global prices.
- Iowa State University's Center for Agricultural and Rural Development (CARD) simulated the possible outcome of complete global liberalization in sugar (Elobeid and Beghin, 2004). Under this scenario, prices increase by 47 percent by the end of the projection period and aggregate trade expands moderately, but the location of production and trade patterns are substantially affected. OECD high-cost countries experience an import expansion or export reduction and significant contraction in production (particularly the EU and Japan), while the big gainers are Brazil, Cuba, and Australia.

There is almost symmetry between the EU internal price reductions of 36 percent – a known factor – and the range of world price reductions offered above, although the 36 percent is probably at or beyond the extreme range for the global price increases. Nonetheless, the world price may increase more or less in tandem with the EU price decreases.

A note must be made about what these modeling estimates actually say – they are estimates of how much above the baseline global sugar prices would be at the final implementation of the policy change. Looking at Figure 4.4, it can be seen that the 2006 price is part of an upward trend, and indeed is higher than the price has been for more than 20 years. It could be that much of the projected price increase is already being factored in with respect to EU reforms, and thus the final outcome may well be something far short of the projected increases when expressed against 2006 global prices. Support for this more pessimistic scenario is given by the recent (June 2007) decline in global sugar prices to the level of less than 10 cents per pound that has prevailed through most of the present millennium, and it has been suggested that the recent price spike may have been driven more by speculative pressures than real economic factors.

Indeed, ABARE, in its 2007 projections through 2011/12, projected that current prices would fall by 27 percent in 2007 due to increased global production that resulted in increased stocks. Furthermore, prices are projected to decline in real terms over the majority of the forecast period despite EU reforms and rising ethanol demand (and in real terms decline from 16.3 U.S. cents per pound in 2005 to between 7.0 and 8.9 U.S. cents per pound during the last three years of the forecast period). Production is expected to stabilize over the period as increases in Brazil and other low-cost cane producers balance the EU reductions, and in the absence of these reductions the global price would be driven even lower. These

forecasts are consistent with the OECD's over the period to 2014, but the OECD sees a large one-off increase in 2015 before prices decline again the next year.

This takes us to the next stage – among the African countries, who will lose and who will gain? However, before examining this question it is appropriate to look at relative production costs to see where the dice may fall for the potential winners and losers. Unfortunately, preferential access to the EU has distorted the production costs in many countries, as the economic rents are dissipated through inefficient production and processing.

Conforti et al (2007) analytically examine the sugar prospects for LDCs following trade reforms in the EU. They find that these reforms do not make much difference in terms of export volumes from these countries collectively, but exporters' revenues are reduced significantly as the EU preferences are reduced and quotas are abolished. The export increase seems to be restricted to about 500,000 tons, with general supply constraints the limiting factor. However, as this reference price remains above the world price, these preferences are still valuable. They confirm that losers are (a) the high-cost producers of (mainly) the Caribbean and (b) lower-cost producers who are not in the LDC group and therefore are not eligible for EBA access. The latter group includes Swaziland and Mauritius.

This analysis is supported by Van Berkum, Roza, and van Tongerman (2005), who also develop a sugar-specific computable general equilibrium (CGE) model based upon the Global Trade Analysis Project (GTAP) and using the GTAP database. They look at two scenarios: the first really just the EBA and its impacts, and the second broadening this to simulate the more complex issues associated with the overall EU sugar reform package. For the latter, the key question is the degree of substitutability between EBA-sourced sugar and EU-produced sugar, as the two are not perfect substitutes for each other, and this makes a big difference to EBA imports. In the EBA simulation, imports into the EU increased by 384,000 tons to 444,000 tons annually. However, four features of this EBA increase are crucial:

- The low direct production in EBA countries (only 142,000 tons)
- The so-called triangular trade from third parties who channel extra exports into EBA countries to enable the EBA countries to export to the EU (118,000 tons)
- Diversion of EBA sugar away from third destinations (41,000 tons)
- A decline in sugar consumption in EBA countries of 83,000 tons in response to higher world prices

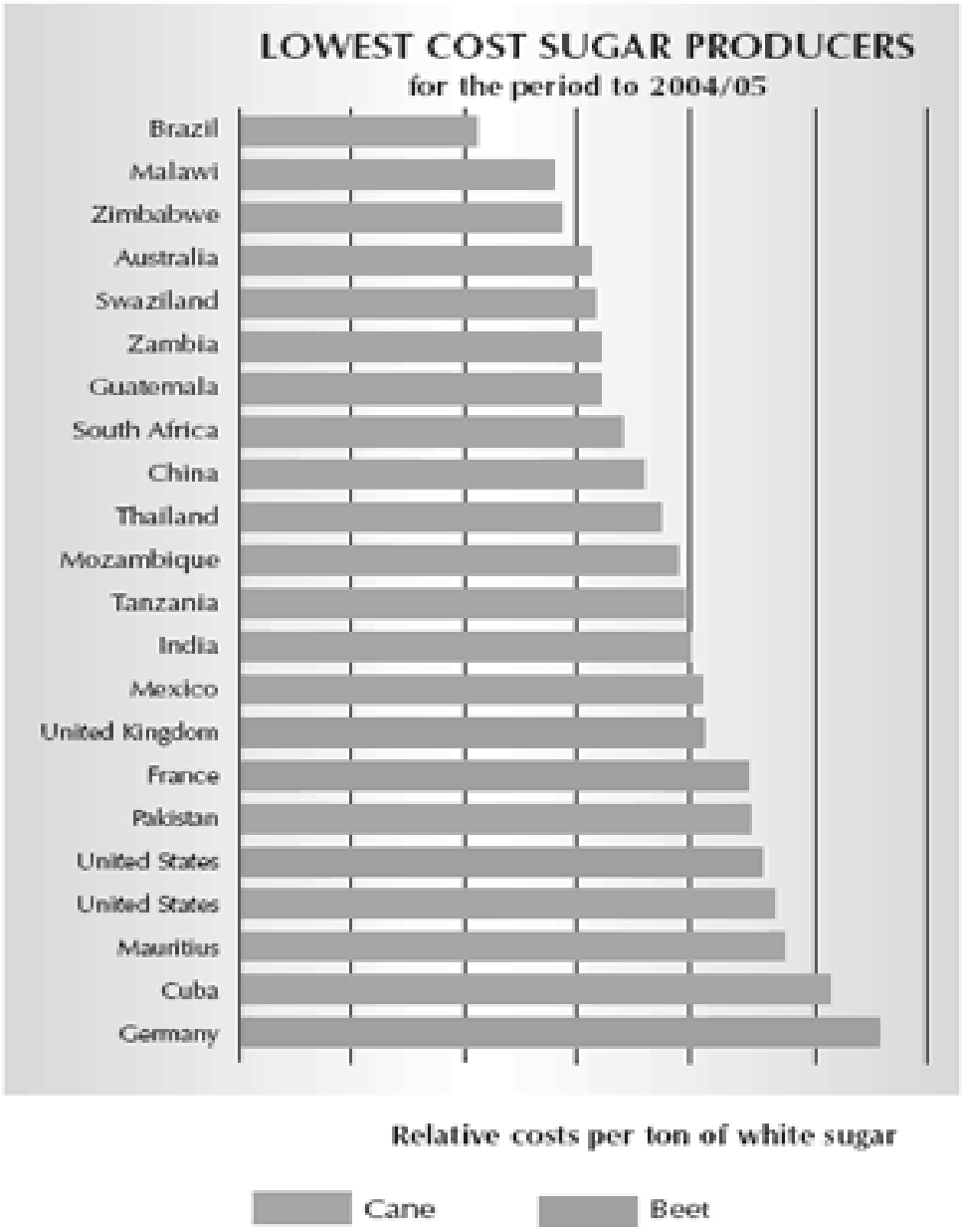
Under the EBA scenario, the EBA countries gain some $443 million in welfare, while under the broader EU reform scenario, in which all the complex factors are considered, this drops marginally to $382 million. And, of course, despite the EU maintaining that all this reform exercise is to help EBA countries, under comprehensive (but still incomplete) reform the EU gains $4.647 billion itself through enhanced efficiency, lower consumer prices, and lower export subsidies. The authors continue from this analysis to assess the developing-country winners and losers under these reforms, and agree with other researchers that the big African losers are Mauritius and Swaziland, which currently gain some 4.0 and 4.3 percent of their gross domestic product (GDP) through the pure economic rents from preferential access to the EU. Potential African gainers are DRC, Côte d'Ivoire, Zambia, and Zimbabwe, although only the latter two have significant sugar exports. In addition, we note that these authors also list Malawi as an important sugar producer and exporter that is both a low-cost producer and an EBA country.

Global Production Costs – Where Does the Region Sit?

An indication of global sugar production costs is provided in Figure 4.5, which highlights the following:

- The absolute advantage of Brazil
- The good position of many African countries
- The poor position of some other African countries (Mauritius in particular)
- The high costs of production in both the EU and the United States

Figure 4.5. Global production costs



Source: Illovo website: http://www.illovosugar.com/worldofsugar/internationalSugarStats.htm.

Further support to these costs is given by Mitchell (2005) who presents a graphical representation of the data collated by LMC International over the 2000–2005 period. These data show production costs relative to the efficient free market exporters of Australia, Brazil, Colombia, Guatemala, South Africa, and Thailand.[67] His graphindicates that Zimbabwe and Malawi are marginally below the indicative line, while Zambia and Swaziland are perhaps 10 to 15 percent above it. The next African grouping of Mauritius, DRC, and Tanzania is perhaps 50 to 60 percent above the line (thus signaling real problems),

[67] These countries account for around 60 percent of global exports.

while Madagascar is well out of the picture, with production costs at least three times the benchmark. While we have not accessed the LMC original research, this work is the accepted benchmark, and other studies such as Van Berkum, Roza, and van Tongerman (2005) also use the same data source. Again, these costs are the direct production costs, and officials in Mauritius[68] point out that transport costs of sugar from that country to the major markets can be less than $40 per ton given the efficient bulk terminals and easy sea access, while transport costs from the landlocked African nations can be at least four times that figure.

The Region – Implications for the Future

This section will sequentially examine prospects for the region. A useful starting point is the analysis provided by Chaplin and Matthews (2006), who calculate the expected revenue loss from the EU reforms confronting ACP sugar exporters to the EU. These total 307 million euros, with one-third (100.2 million euros) of the loss being faced by Mauritius and a further 33.8 million euro loss faced by Swaziland. Thus, these two countries must contend with some 45 percent of the total adjustment costs. Other African countries facing reductions of between 5 and 10 million euros are Côte d'Ivoire, Malawi, Zambia, and Zimbabwe, while DRC, Kenya, and Madagascar face relatively minor losses and can be discounted from future analysis.

In interpreting these arguments, it is important to consider that a relatively large proportion of the total output of refined cane sugar in the countries under discussion is produced by a single firm, namely Illovo. This firm produced 35 percent of Swaziland's national output, 25 percent of Mozambique's, all of Malawi's, and 50 percent of Tanzania's over the past few years, plus it is also a large producer in South Africa. Future investments by the firm, and its ultimate owners, are likely to be based on their estimate of the extent of trade concessions that these countries are able to retain, especially for exports to the EU.

Losers

The losers will be concentrated among the exporters currently operating under preferences that face a declining EU price. Within this group are several subgroups. One of these is the two major exporters Mauritius and Swaziland, neither of which has the fallback position of quota- and duty-free access under EBA. Another is the less significant group of EBA countries that will continue to have quota- and duty-free access to the EU but at a lower price and therefore lower economic rents. These are placed into the "uncertain" group below rather than the "losers."

The Kingdom of Swaziland has all the characteristics of a dual economy and is a small landlocked country with high levels of poverty and income inequality. South Africa is the source of nearly 90 percent of its total imports and the destination of around 55 percent of its exports. Sugar (mostly to the EU) and sugar-related products are the major export, and these are heavily dependent upon preferential access to the EU. Around 60 percent of agricultural production is focused on the sugar sector, and it contributes some 11 percent of the country's GDP. While the potential losses of EU rents are important, Swaziland does have the potential, through a combination of increased production and higher global prices, to take advantage of its relatively low cost structure and compensate for this by increasing global exports. Action is being taken to maintain competitiveness in the sugar sector so that the country and, in particular, the sugar industry itself can adequately prepare for the income losses still to come. Restructuring of the sector is under way, with a third of the workforce having recently been retrenched (down from 10,000 to 6,500, a major impact given the plague of unemployment that blights Swaziland) and others affected by outsourcing, which reduces their rights of access to health care, education, and housing. Social service facilities such as hospitals and clinics are also being substantially downsized in sugar growing areas, as the industry seeks to off-load these facilities onto a government that itself is facing revenue losses as a result of EU sugar sector reforms, thus accentuating the initial problems.

[68] Laurent Law, Mauritius Chamber of Agriculture, personal communication.

Mauritius is a very small country of some 1.2 million people that has become relatively wealthy by African standards, with much of this wealth derived from crucial sugar exports to the EU.[69] While a successful transformation program to lessen sugar dependence has been under way for the last few years, Mauritius continues to lead the argument for slower reforms and compensation assistance from the EU. Despite a program to improve production efficiency, Mauritius remains a relatively high-cost producer, with costs about double those of other African low-cost producers, due, in part, to climatic and land constraints and complacency during the economic rent period. This has led to a situation in which some 99 percent of production is exported (mainly to the EU) to reap economic rents from preferential access while domestic consumption is met with lower-cost imports from South Africa.[70] Such a regime will not be tenable under sharply reduced rents, and given the cost structure in Mauritius it is even possible that the country will be forced out of sugar production entirely, unless some dramatic restructuring takes place. This restructuring does not look feasible, and the Mauritius sugar industry may well go the way of wheelwrights a hundred years ago with the advent of the combustion engine.

Uncertain

The "uncertain" group is another relatively small but generally low-cost producing group, consisting of Zimbabwe, Zambia, and possibly Malawi, that will (or may in the case of Zimbabwe) have access to the EU under the EBA initiative. These countries will lose from lower economic rents on current exports to the EU but will still be eligible for unrestricted access to the EU at above world prices. Supply constraints are the main issue here, not access, assuming Zimbabwe does obtain EBA access.

Winners

We see only one clear candidate here, and that is South Africa, a relatively low-cost producer[71] that does not currently benefit from preferential access to any markets. Below we will investigate the sector and its prospects in greater detail.

The Issue of Compensation / Adjustment Assistance

There are two sides to this debate. The first is the view taken, as always, by the losers and supported by civil society: there is both a need and an obligation for this assistance. The sugar producing LDCs are taking the view that the adjustment process should be changed to allow for continued trade volumes at higher prices. This is, of course, diametrically opposed to the concept of trade reform and will serve to continue maintaining inefficient sectors in many cases.

The second view is that the "haves" have been benefiting from severe distortions to the sugar regime over an extended period of time and that if they cannot compete in the "real world," that is what the concept of efficiency is all about. This view is complicated by the moral issue of adjustment assistance, which in itself raises several questions, one of which is the fundamental question of why they should be "compensated" for having privileges removed, and the second is that if such compensation is to be given, through what channels should it be delivered? Continuing to prop up an inefficient industry may not be an appropriate channel. We will not comment upon this issue except to say that it will not go away (although we would note that EU producers have been handsomely compensated).

---

[69] During 2004 the FAO reports that sugar occupied some 70 percent of the total arable land of only 106,000 hectares.

[70] This trade is shown in Table 4.7 below, where Mauritius was South Africa's seventh main export market for sugar during 2006. It highlights the absurdity of international markets in which this concept of "swaps" operates to enable those with preferences to take full advantage of these rents and import product to meet domestic requirements from those without preferences.

[71] While generally a low-cost producer, the South African sugar sector is still heavily protected, with a PSE of 32 percent during 2003, according to the OECD. This is double that of the next highest sector (milk) and far above the almost free-market level for overall agriculture at 5 percent. This is supported by Kirsten et al (2007), although we would note that currently (June 2007) there is no tariff levied on sugar imports into South Africa/SACU.

The Prospects for Southern African Exporters

Table 4.4 showed that South Africa has had an average global export share of 2.4 percent over the last five years. The export data for South Africa are expanded in Table 4.7, where the data are provided at the HS 4 level and expressed in million South African rand. Several features can be pointed out from the export profile. The first is that the main OECD markets of the United States and particularly the EU provide limited opportunities to South Africa. The second is that the Japanese (and Korean) markets are both important and consistent. And the third is that, in contrast to this consistency, most of the other major markets show a great deal of variation. Not shown are (a) exports to fellow SACU members and (b) important almost one-off exports to Egypt, the Philippines (2001), Malaysia, India, and Israel during the period.

Table 4.7. South African sugar exports, million rand

Country/Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
World	1,208	1,142	1,694	1,444	1,802	2,623	2,242	1,693	1,438	1,770	2,573
Iran	21	99	208	170	320	278	29	0	63	93	673
Mozambique	36	54	49	112	196	308	423	390	253	30	315
Japan	205	132	246	191	188	318	253	196	207	305	290
Korea	147	117	259	170	217	357	330	166	154	208	255
Angola	13	12	22	19	13	19	27	25	36	47	108
Bangladesh	0	0	0	0	0	0	6	1	0	25	90
Mauritius	33	51	65	54	69	36	101	62	62	42	90
Kenya	32	80	113	96	131	152	132	87	115	114	87
USA	185	114	161	36	124	87	106	80	64	133	85
China	13	0	0	0	0	0	3	0	0	30	66
Saudi Arabia	0	114	54	128	217	59	89	0	84	23	64
Pakistan	0	2	0	0	40	172	0	0	0	0	56
Madagascar	10	30	70	39	22	90	76	96	85	52	53
Uganda	7	13	10	10	5	0	2	3	3	18	43
Russia	34	0	179	144	0	42	0	88	0	0	40
Ghana	5	4	8	13	22	20	63	25	27	28	29
Tanzania	46	53	39	53	63	45	41	23	58	55	26
Indonesia	0	0	3	0	0	30	70	1	0	287	22
Nigeria	2	0	0	0	36	1	29	37	17	24	19
Sudan	0	0	0	0	0	1	**75**	15	0	2	5
EU-27	2	82	12	6	6	50	31	22	13	8	1

Source: *World Trade Atlas* data

Tralac has been producing a series of research papers examining the implications of alternative trade policy options for South Africa/SACU using the GTAP model. These have included a "most likely" outcome for the WTO DDA and a suite of FTAs. Brazil is widely expected to be a big winner in an agricultural DDA outcome, but the data hardly support this. There is almost no change in Brazilian sugar exports (up $15 million only, with this split between $6 million to Africa and $8 million to the rest of the world), indicating that all the protected sugar markets are using their Sensitive Products rights for sugar to avoid having to make access changes to their markets. This is confirmed by looking at the results for South Africa, where both exports and imports decline by around 2 to 3 percent and production similarly declines by around 1 percent. There is, however, a marginal increase of 0.2 percent in South African sugar prices as a result of the DDA outcome, but the production declines as other agricultural sectors become relatively more profitable in the absence of any meaningful reforms in the sugar sector.

Turning to FTAs, Sandrey and Jensen (2007) indicate that if South Africa, Brazil, and India open up their sugar markets to each other, South African production will decrease (0.8 percent), exports will decrease (3.9 percent), and imports will also decrease (0.6 percent), but output prices will increase (0.8 percent). This indicates that South Africa is competitive against the global benchmark producer Brazil.

Looking at the implications of extending the South African and EU TDCA to complete duty- and quota-free access for SACU products indicates that in the case of sugar exports to the EU-27, the aggregated countries of Lesotho, Namibia, and Swaziland gain a great deal from free access to the EU. Currently, in-quota exports from Swaziland are imported duty-free, but should the country wish to export more, it faces an import tariff of 81 percent in the EU, which is reduced to zero in our FTA (note that Swaziland is not included in the EBA agreement, although it is in the EU Sugar Protocol). The results suggest a doubling of sugar production and exports from the rest of SACU (Swaziland) and an increase of 50 percent in the price, with exports increasing by $916 million in 2015. In theory, these gains to Swaziland should mostly transfer across to open access under the EBA or a similar agreement such as a liberal EPA outcome. South African sugar exports actually decline overall following an FTA with the EU, as the increase of $22 million to the EU is not enough to compensate for an overall decline in exports to other markets as resources are marginally diverted away from sugar despite the abolition of the 61.8 percent EU tariff.

In response to an FTA with the United States, in contrast, sugar imports from Swaziland increase by around 15 percent and those from South Africa by some $34 million. These results for South Africa are less than would have been intuitively expected. In the case of an FTA with Japan, there are no sugar access gains for South Africa, as sugar exports are currently entering Japan duty-free. Given the comparative advantage that South Africa has in the sugar sector, it is surprising that there is a somewhat muted response in the highly protected markets of the EU and United States in particular. In reality, this may be an artifact of the GTAP model, as usually in a situation in which there is little or no trade prior to liberalization the model does not have a "platform" to increase from. Technically, the so-called Armington elasticity assumptions that differentiate between products from different sources should help reduce but not completely alleviate this problem.

Would South Africa sacrifice its sugar sector in an FTA with the United States in the same manner in which Australia did? This is a hypothetical question, as South Africa is not able to unilaterally negotiate any new trade agreements under the terms of the new SACU agreement without the involvement of its fellow SACU members, and, given the importance of sugar to Swaziland, it is unlikely that Swaziland would acquiesce on sugar even if it were possible for South Africa to negotiate with the United States. Similarly, for any extensions to the TDCA for South Africa, the country is in a situation in which the complexities of the TDCA and the EPA negotiations (discussed below) will be the overarching factor. But the answer to the hypothetical question is most likely to be yes to both the United States and the EU, as South Africa is not in a good negotiating position with either.

The University of Pretoria's Bureau for Food and Agricultural Policy (BFAP) publishes projections each year for South African agriculture. Its 2007 estimates for sugar production, price, and exports are shown in Table 4.8. Note that the world price (in nominal U.S. cents per pound) as supplied to BFAP by the Food and Agricultural Policy Research Institute (FAPRI) is forecast to decline modestly over the period and that South African exports actually decline. An indication of the degree of market control exercised in South Africa can be found in this BFAP publication (2008). During 2006 and 2007, sugarcane prices increased marginally, while the world price showed a large increase over the same period. The report also shows the so-called recoverable value of sugar, where the price is a composite of the domestic price, the export price, and domestic production, thus confirming the disjoint between domestic and export prices and therefore market power. And, of course, the SADC Sugar Protocol operates to assist in the protection of this regime.

Table 4.8. South African sugar projections, 2005–2015

Variable/Year	2005	2007	2009	2011	2013	2015	% Change (avg)
		1,000 hectares					
Area in sugarcane	428	425	423	421	419	419	-0.23%
Area harvested	331	321	321	318	317	317	-0.43%
		1,000 tons					
Sugarcane production	21,052	20,898	20,912	20,823	20,809	20,830	-0.11%
Sugar production	2,507	2,457	2,459	2,448	2,447	2,449	-0.23%
Domestic use	1,262	1,275	1,271	1,271	1,273	1,280	0.01%
Exports	1,239	1,178	1,183	1,173	1,169	1,165	-0.61%
		U.S. cents/lb					
Global price (nominal)		11.9	11.3	12.0	12.4	12.8	-2.82%

Source: University of Pretoria, using the Food and Agricultural Policy Research Institute's (FAPRI's) projections on world sugar price.

The future global sugar price is crucial, as it sets a benchmark for the economic rents in the EU (although this is not relevant to South Africa). Some media reports and hype are suggesting highs of even 20 cents per pound in the future, and if this were to be sustained through reduced EU production and exports and global ethanol production, then world sugar prices might approach the same level as post-reform EU sugar prices. This would lessen the demand for further EU sugar market reforms and allow ACP countries to gain some value from the remaining preferences. Even if the price spike is a bubble indirectly linked to oil prices, it is likely to allow a softer landing for the preference countries and give South Africa gains from greater export values. The problem is that sugar production response is rather a ponderous beast in that while it takes time to mobilize it also takes time to switch off, thus exaggerating the price swings.

The Provincial Decision-Making Enabling (PROVIDE) Project (2004) gives further insight into the likely impact on South Africa following liberalization of the global sugar industry. The analysis examines the twin effects of increasing the world prices of sugar by 50 percent and then improving South African processing efficiency by 10 percent. The researchers conclude that the outcomes of sugar liberalization for South Africa are not definitely positive, but the expectations are that changes will be positive and visible in the sugarcane producing areas, with increases in GDP of 0.03 percent and 0.078 percent after liberalization of trade with technical changes and without technical changes, respectively. Thus, increasing global sugar prices must be accompanied by increased efficiency in the processing sector for South Africa to benefit. In terms of the factor income welfare effect, gains are clearly distributed more heavily toward low-income groups.

As a final thought on South Africa, we must consider the sugar-related trade in processed fruit products such as canned fruit and jams that contain large amounts of sugar. Currently there are no concessions for these products under the TDCA with the EU, and a major concession on these products under the current review of the TDCA could make a considerable difference to South African fruit and fruit-related exports, a field in which the country has a significant comparative advantage and global trade.

The Wild Card – the EPA Negotiations with ACP Countries

The unknown factor for Africa is how the negotiations on replacing the Cotonou Agreement with the proposed EPAs will proceed. While this will not affect the EBA countries, it has major implications for the non-EPA countries, and, indeed, as a special case, for South Africa. The EPAs will replace the Cotonou Agreement between the EU and the ACP countries, as the waiver exempting these chapters from WTO law expired at the end of 2007, requiring both parties to have implemented a WTO-compatible alternative. Under 2007 arrangements, the 40 ACP LDCs had duty- and quota-free access to the EU while

the 37 non-LDCs had special tariff preferences. South Africa had the TDCA, an agreement that excludes sugar and many other agricultural products.

On April 4, 2007, the EU proposed removing all remaining quota and tariff limitations on access to the EU market for all ACP countries as part of the EPA negotiations. The offer covers all products, including agricultural goods such as beef, dairy, cereals, and all fruit and vegetables. It will apply immediately following the signing of an agreement, but (and here is the kicker) with a phase-in period for rice and sugar. The only exception will be South Africa, where a number of globally competitive products will continue to pay import duties (read sugar). For ACP exports to the EU, the offer will do the following:

- Eliminate all tariffs and import quotas for all ACP countries.
- Give all ACP countries the same full access to EU markets that all LDCs have under the EBA duty- and quota-free market access system.

Apply in full from day one – planned to be January 1, 2008 – with the exception of a transition period for rice and sugar. The transition periods for rice and sugar will ensure compatibility with EU market reforms and ensure stability to protect the interests of both the EU and ACP producers who supply those markets. From 2015 onward, ACP sugar will be duty- and quota-free, and there will be an adjustment to the standard EPA safeguard to take account of the sensitivity of sugar.

South Africa is marginalized, as the offer makes it clear that a number of competitive products originating in South Africa will nevertheless continue to attract import duties, but otherwise all African sugar exporters can, in theory, expect quota- and duty-free access to the EU by 2015. We note, however, the reference to "an adjustment to the standard EPA safeguard to take account of the sensitivity of sugar," and suggest that this may prove to be a serious stumbling block in the medium to longer term. How all this will play out remains to be seen, but it does offer hope for Swaziland and potentially Mauritius (although we have noted that Mauritius is unlikely to continue in sugar production). Elsewhere in the ACP, the Caribbean countries are generally higher-cost producers, while in the Pacific the same comment applies to Fiji; thus, potentially the African non-EBA countries have the most to gain.

A mid-2008 update on the EPAs shows the expiration at the end of 2007 of the WTO waiver relating to the Lomé/Cotonou-based nonreciprocal trade preferences for ACP countries exporting goods to the EU market. The EPAs that were supposed to replace the preferential regime, with one exception, did not materialize as comprehensive or full agreements. The exception is the Caribbean group, CARIFORUM. Seventeen African states initialed interim EPAs, that is, partial agreements on reciprocal goods trade that would meet the requirements of GATT, Article XXIV. The 18 African states that initialed interim EPAs include Swaziland but not South Africa. Consequently, South Africa trades with the EU under the TDCA concluded in 2000 while the remainder of the African countries that did not initial agreements export to the EU under the EU GSP, or as LDCs under the more favorable EBA dispensation. Meanwhile, the SADC EPA group now faces two immediate challenges: (a) each participating member state must complete the liberalization schedule for one services sector and (b) the parties must negotiate an investment chapter, taking into account the relevant provisions of the SADC Protocol on Finance and Investment.

Still-unanswered questions relate to (a) how generous the transition arrangements will be for non-EBA countries such as Swaziland and Mauritius and (b) the medium- to longer-term prospects for South Africa. The complicating issue of the TDCA seems to have been subsumed into the SADC EPA, and the whole process is still rather messy. Sugar is, however, one of if not the most important market access question facing South Africa, and of all the African countries South Africa faces the greatest potential gain from unfettered access to the EU.

REFERENCES

ABARE (Australian Bureau of Agricultural and Resource Economics). 2007. *Commodity projections to 2011–12*. Canberra, Australia: ABARE.

BFAP (Bureau for Food and Agricultural Policy). 2008. South African agricultural baseline. University of Pretoria (accessible on www.bfap.co.za).

Brandão, Antônio Salazar P. 2007. The sugar/ethanol complex in Brazil: Development and future. Paper presented at the IFPRI conference Global Sugar Markets, Policies and Reform Options, Washington, D.C., June 1.

http://www.ifpri.org/events/conferences/2007/20070601Sugar.asp.

Bureau, Jean-Christophe, Alex Gohin, Loic Guindé, and Guy Millet. 2007. EU reforms and their impacts. Paper presented at the IFPRI conference Global Sugar Markets, Policies and Reform Options, Washington, D.C., June 1. http://www.ifpri.org/events/conferences/2007/20070601Sugar.asp.

Chaplin, H., and A. Matthews. 2006. Coping with the fallout for preference-receiving countries from EU sugar reform. *Estey Centre Journal of International Law and Trade Policy* 7(1): 15–31.

Conforti, P., J.R. Deep Ford, D. Hallam, G. Rapsomanikis, and L. Salvatici. 2007. The European Union preferential trade with developing countries: Total trade restrictiveness and the case of sugar. In *WTO rules for agriculture compatible with development*, ed. James Morrison and Alexander Sarris. Rome: Food and Agricultural Organization of the United Nations (FAO).

Elobeid, A., and J.C. Beghin. 2004. Policy reforms in world sugar markets: What would happen? *Iowa Ag Review* 10(2). Summary at http://www.card.iastate.edu/iowa_ag_review/spring_04/article2.aspx.

FAO (Food and Agricultural Organization of the United Nations). 2006. *Food outlook* 2. Rome: FAO.

Kirsten, Johann, Lawrence Edwards and Nick Vink, 2007. Distortions to Agricultural Incentives in South Africa. World Bank Agricultural Distortions Working Paper 38, December. Washington DC, World Bank.

LMC International. 2004. LDC sugar industries: An overview. *Sweetener Analysis*, October. http://www.lmc.co.uk.

Mitchell, D. 2005. *Sugar in the Caribbean: Adjusting to eroding preferences*. World Bank Policy Research Working Paper 3802. Washington, D.C.: World Bank.

OECD (Organization for Economic Cooperation and Development). 2006. *Review of agricultural policies: South Africa*. Paris: OECD.

OECD. 2004. *An analysis of sugar policy reform and trade liberalisation*. Paris: OECD.

Oxfam. 2002. *The great EU sugar scam: How Europe's sugar regime is devastating livelihoods in the developing world*. Oxfam Briefing Paper 27. Oxford, UK: Oxfam International.

Oxfam. 2004. *Dumping on the world: How EU sugar policies hurt poor countries*. Oxfam Briefing Paper 61. Oxford, UK: Oxfam International.

Sandrey, Ron, and Hans Jensen. 2007. *Examining the India, Brazil and South African (IBSA) triangular trading relationship*. WP 1/2007. Stellenbosch, South Africa: Trade Law Centre for Southern Africa (tralac).

PROVIDE. 2004. *Trade liberalization, efficiency and South Africa's sugar industry*. PROVIDE Working paper 2004:1. Elsenburg, South Africa: Department of Agriculture: Western Cape.

Van Berkum, S., P. Roza, and F. van Tongerman. 2005. *Impacts of the EU sugar policy reforms on developing countries*. Agricultural Economics Research Institute (LEI) Report 6.05.09. The Hague, the Netherlands: LEI. http://www.lei.dlo.nl/publicaties/PDF/2005/6_xxx/6_05_09.pdf .

Wagner, Owen. 2007. The U.S. sugar program: Reform pressures and options. Paper presented at the IFPRI conference Global Sugar Markets, Policies and Reform Options, Washington, D.C., June 1. http://www.ifpri.org/events/conferences/2007/20070601Sugar.asp.

APPENDIX

Table A.1. Estimated losses to countries exporting sugar to the EU

	Protocol quota	Current earnings (€)	Earnings 2006–2008 (€)	Earnings 2008/09 (€)	Earnings 2009/10 and after (€)
Barbados	54,687.4	28,639,787	27,168,696	23,739,797	18,320,276
Belize	43,857.4	22,968,116	21,788,352	19,038,494	14,692,226
Congo	11,071.8	5,798,327	5,500,494	4,806,289	3,709,069
Côte d'Ivoire	11,071.8	5,798,327	5,500,494	4,806,289	3,709,069
Fiji	179,726.4	94,122,723	89,288,082	78,019,236	60,208,348
Guyana	173,271.8	90,742,467	86,081,454	75,217,309	58,046,069
Jamaica	129,017.4	67,566,408	64,095,840	56,006,450	43,220,826
Kenya	0	0	0	0	0
Madagascar	11,695.7	6,125,013	5,810,400	5,077,083	3,918,043
Malawi	22,635.2	11,854,063	11,245,176	9,825,948	7,582,798
Mauritius	533,728.3	279,513,490	265,156,200	231,691,438	178,798,967
St. Kitts & Nevis	16,946.6	8,874,950	8,419,086	7,356,532	5,677,121
Swaziland	128,091.8	67,081,701	63,636,030	55,604,671	42,910,769
Tanzania	11,071.8	5,798,327	5,500,494	4,806,289	3,709,069
Trinidad & Tobago	47,555.4	24,904,781	23,625,540	20,643,814	15,931,071
Zambia	0	0	0	0	0
Zimbabwe	32,853.0	17,205,139	16,321,392	14,261,506	11,005,770
Total	**1,407,283.1**	**736,993,618**	**699,137,730**	**610,901,145**	**471,439,492**

Source: Sugar ExecBrief 2006–07

Note*: * Losses by African, Caribbean, and Pacific (ACP) Sugar Protocol beneficiary countries only.*

RECENT IFPRI DISCUSSION PAPERS

For earlier discussion papers, please go to www.ifpri.org/pubs/pubs.htm#dp.
All discussion papers can be downloaded free of charge.

828. *The impact of climate change and adaptation on food production in low-income countries: Evidence from the Nile Basin, Ethiopia*. Mahmud Yesuf, Salvatore Di Falco, Claudia Ringler, and Gunnar Kohlin, 2008.

827. *The Philippines: Shadow WTO agricultural domestic support notifications*. Caesar Cororaton, 2008.

826. *What determines adult cognitive skills?: Impacts of preschooling, schooling, and post-schooling experiences in Guatemala.* Jere R. Behrman, John Hoddinott, John A. Maluccio, Erica Soler-Hampejsek, Emily L. Behrman, Reynaldo Martorell, Manuel Ramírez-Zea, andAryeh D. Stein, 2008.

825. *Accelerating Africa's food production in response to rising food prices: Impacts and requisite actions*. Xinshen Diao, Shenggen Fan, Derek Headey, Michael Johnson, Alejandro Nin Pratt, Bingxin Yu, 2008.

824. *The effects of alternative free trade agreements on Peru: Evidence from a global computable general equilibrium model.* Antoine Bouët, Simon Mevel, and Marcelle Thomas, 2008.

823. *It's a small world after all. Defining smallholder agriculture in Ghana*. Jordan Chamberlin, 2008

822. *Japan: Shadow WTO agricultural domestic support notifications*. Yoshihisa Godo and Daisuke Takahashi, 2008.

821. *United States: Shadow WTO agricultural domestic support notifications*. David Blandford and David Orden, 2008.

820. *Information flow and acquisition of knowledge in water governance in the Upper East Region of Ghana***.** Eva Schiffer, Nancy McCarthy, Regina Birner, Douglas Waale, and Felix Asante, 2008.

819. *Supply of pigeonpea genetic resources in local markets of Eastern Kenya*. , Patrick Audi, and Richard Jones, 2008.

818. *Persistent poverty and welfare programs in the United States.* John M. Ulimwengu, 2008.

817**.** *Social learning, selection, and HIV infection: Evidence from Malawi.* Futoshi Yamauchi and Mika Ueyama, 2008.

816. *Evaluating the impact of social networks in rural innovation systems: An overview*. Ira Matuschke, 2008.

815. *Migration and technical efficiency in cereal production: Evidence from Burkina Faso*. Fleur S. Wouterse, 2008.

814. *Improving farm-to-market linkages through contract farming: A case study of smallholder dairying in India*. Pratap S. Birthal, Awadhesh K. Jha, Marites M. Tiongco, and Clare Narrod, 2008.

813. *Policy options and their potential effects on Moroccan small farmers and the poor facing increased world food prices: A general equilibrium model analysis*. 2008. Xinshen Diao, Rachid Doukkali, Bingxin Yu, 2008.

812. *Norway: Shadow WTO agricultural domestic support notifications*. Ivar Gaasland, Robert Garcia, and Erling Vårdal, 2008.

811. *Reaching middle-income status in Ghana by 2015: Public expenditures and agricultural growth.* Samuel Benin, Tewodaj Mogues, Godsway Cudjoe, and Josee Randriamamonjy, 2008.

810. *Integrating survey and ethnographic methods to evaluate conditional cash transfer programs*. Michelle Adato, 2008.

809. *European Union: Shadow WTO agricultural domestic support notifications.* Tim Josling and Alan Swinbank, 2008.

808. *Bt Cotton and farmer suicides in India: Reviewing the evidence.* Guillaume P. Gruère, Purvi Mehta-Bhatt, and Debdatta Sengupta, 2008.

807. *Gender, caste, and public goods provision in Indian village governments.* Kiran Gajwani and Xiaobo Zhang, 2008.

806. *Measuring Ethiopian farmers' vulnerability to climate change across regional states*. Temesgen Deressa, Rashid M. Hassan, and Claudia Ringler, 2008.

805. *Determinants of agricultural protection from an international perspective: The role of political institutions*. Christian H.C.A. Henning, 2008

804. *Vulnerability and the impact of climate change in South Africa's Limpopo River Basin*. Sharon Shewmake, 2008.

803. *Biofuels, poverty, and growth: A computable general equilibrium analysis of Mozambique*. Channing Arndt, Rui Benfica, Finn Tarp, James Thurlow, and Rafael Uaiene, 2008.

802. *Agricultural exit problems: Causes and consequences*. Derek Headey, Dirk Bezemer, and Peter B. Hazell, 2008.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

www.ifpri.org

IFPRI HEADQUARTERS

2033 K Street, NW
Washington, DC 20006-1002 USA
Tel.: +1-202-862-5600
Fax: +1-202-467-4439
Email: ifpri@cgiar.org

IFPRI ADDIS ABABA

P. O. Box 5689
Addis Ababa, Ethiopia
Tel.: +251 11 6463215
Fax: +251 11 6462927
Email: ifpri-addisababa@cgiar.org

IFPRI NEW DELHI

CG Block, NASC Complex, PUSA
New Delhi 110-012 India
Tel.: 91 11 2584-6565
Fax: 91 11 2584-8008 / 2584-6572
Email: ifpri-newdelhi@cgiar.org