Impetus, Options and Consequences for Sugar Policy Reform in the United States

Owen C. Wagner

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of:

Master of Science
Agricultural and Applied Economics

Co-Chairs:

Dr. David Orden
Professor, Virginia Polytechnic Institute and State University
Senior Research Fellow, International Food Policy Research Institute

Dr. Stephen Haley
Economist, United States Department of Agriculture, Economic Research Service

Committee Members:

Dr. Everett Peterson
Associate Professor, Virginia Polytechnic Institute and State University

May 9th, 2007
Blacksburg, Virginia USA

Keywords: (Sugar, Agricultural Policy, Policy Reform, Agricultural Trade)

Impetus, Options and Consequences for Sugar Policy Reform in the United States

Owen C. Wagner

ABSTRACT

Sugar has a long history of being a contentious commodity important in international trade. Initially, the global framework for sugar trade was based on sugarcane, a grass grown in the tropics with trade being dictated largely by the British. In the Napoleonic wars, commercialization of the beet sugar industry arose on the continent in response to and a direct challenge to British control over the industry. The advent of the temperate sugar beet as an alternative to tropical cane in sugar production opened up a north-south trading dynamic that exists to this day.

The United States, although a late entry into sugar production, is now at the forefront of the debate on trade liberalization for sugar, which can be produced more economically and out of greater necessity in a battery of nations, many with developing economies. Between 2003 and 2007, the United States ranked 5th in production, averaging 5% of the world total, and 2nd in total imports averaging 4%. Sugar as a percentage of the total value of the crop in the US is relatively minor at roughly 2.5% of the total putting it well below crops like corn and cotton, on par with tobacco and rice and greater than peanuts.

Currently, the US sugar program operates on a price support system which regulates imports from other countries and provides a price floor for sugar. However, the US Sugar sector is under pressure for reform both by other nations with a comparative advantage in sugar production and from within due to an impending NAFTA commitment that allows for free trade with Mexico in sugar beginning in 2008. With large amounts of Mexican sugar entering the United States, the market price will likely fall below the price floor established by the USDA and there will be large amounts of forfeitures to the Commodity Credit Corporation. This would be in direct violation of the government mandate to keep the US sugar program operating at no government cost.

In this thesis, we lay out a matrix of possible alternative policy scenarios and potential exogenous shocks which could impact the US sugar sector. Using the USDA

ERS Sugar and Sweeteners model, we illustrate the outcome of this matrix of policies and exogenous shocks to the biggest players in the North American sugar sector. Policies used in the model draw inspiration from the recent reforms to the sugar sector in the European Union and recent commodity program reforms in the US for peanuts and tobacco. Finally, the implications of various policy reform options are discussed in light of their ambition and likelihood.

Those with food have many problems; those with no food have only one
-Byzantine Proverb

Acknowledgments

This research was made possible through the Economic Research Service of the United States Department of Agriculture and the William and Flora Hewlett Foundation which provided financial support through the following research grants.

1) The USDA/ERS under the project "A New Generation of Farm Policy Tools: Developing a Conceptual Framework" (2004-2006)

2) The Global Development Program of the William and Flora Hewlett Foundation under the project "Assessment of the Doha Outcome: A Development Perspective on the Global Agricultural Trade Regime" (2006-2007)

I would like to thank my thesis advisors Dr. David Orden and Dr. Stephen Haley for their expertise and experience in the specific topic of sugar markets and more broadly in the pursuit of academic research. Dr. Everett Peterson was also helpful as a committee member and as an audience and sounding board for the ideas generated by Dr Orden, Dr. Haley and myself.

I would also like to thank my colleagues at Virginia Tech who set the bar high but always put cooperation ahead of competition. Most importantly, I would like to thank my friends and loved ones who make the professional efforts worthwhile.

Table of Contents

List of Tables

List of Figures

List of Boxes

List of Acronyms

1. USDA – United States Department of Agriculture
2. EU- European Union
3. NAFTA- North American Free Trade Agreement
4. WTO- World Trade Organization
5. AMS- Aggregate Measure of Support
6. HFCS- High Fructose Corn Syrup
7. ERS- Economic Research Service
8. CCC- Commodity Credit Corporation
9. FAIR- Food and Agricultural Reform Act
10. TRQ- Tariff Rate Quota
11. FSRI –Food Security and Rural Investment Act
12. PIK- Payment in Kind
13. GAO- Government Accountability Office
14. ASA- American Sugar Alliance
15. CSR- Coalition for Sugar Reform
16. NASS- National Agricultural Statistics Service
17. OECD- Organization of Economic Cooperation and Development
18. PSE- Producer Support Estimates
19. ACP- African Caribbean and Pacific Countries
20. EBA- Everything but Arms
21. CBI- Caribbean Basin Initiative
22. GATT- General Agreement on Tariffs and Trade
23. CMO- Common Market Organization
24. AFBF- American Farm Bureau Federation
25. FTA- Free Trade Agreement
26. AUSFTA- Australia Free Trade Agreement
27. DRCAFTA- Dominican Republic and Central American Free Trade Agreement
28. MTBE- Methyl tertiary-butyl ether
29. DOE- Department of Energy
30. FADN- Farm and Agriculture Data Reporting Network
31. URAA- Uruguay Round Agreement on Agriculture
32. CRS- Congressional Research Service
33. CARD- Center for Agriculture and Rural Development
34. USCSRA- US Cane Sugar Refiners Association
35. CCP- Counter Cyclical Payment
36. DP- Direct Payment
37. LDP- Loan Deficiency Payment
38. ROW- Rest of World
39. NYBOT- New York Board of Trade
40. MTRV- Metric Ton Raw Value
41. STRV- Short Ton Raw Value
42. WASDE- World Agricultural Supply and Demand Estimates

Chapter 1: Introduction

Sugar has long been an important agricultural commodity highly valued for its ability to impart sweetness in food and as a source of calories in the diet. When colonization of the new world and the south Pacific fomented a north-south trading pattern for natural commodities and refined goods, sugar consumption from tropically-produced sugarcane came became within the reach of most Europeans. With Great Britain largely controlling the north-south trade routes, one response of the continental European powers was the development of a purely temperate climate sweetener industry based on the sugar beet.

The north south dimension still persists in world sugar production, consumption and trade. Globalization and world trade has cast a spotlight on sugar policies. Broadly, developed countries seek market access for their industrial products while developing countries seek markets for their agricultural commodities. Sugar trade is highly politicized in that it is still competitively produced in tropical countries, with typically underdeveloped economies, using sugarcane as a feedstock. Likewise most developed economies, have the capacity to produce sugar through sugar beets and in some instances cane, at costs that seem reasonable to local consumers. Support for agriculture, the power of the agricultural lobby, and compelling arguments made by trade groups have allowed the current price support program to persist in the United States, though that of the European Union (EU) was recently scaled back significantly.

This thesis addresses the current pressures and climate for change in world sugar markets. The focus of the thesis is primarily on the price support system of sugar in the United States and its relationship to various trade agreements the United States has or might enter into. Because current trade commitments may make the current price support system untenable beginning in 2008 alternatives to the current system are proposed and modeled using the United States Department of Agriculture (USDA) baseline-projections sugar model. Alternatives to the current system are derived from past US commodity program buyouts, the approach of the European Union to its recent sugar reform, and various budget and trade goals. Theses policy results are evaluated and interpreted in light of their ambition and impacts.

1.1 Problem Statement: A Climate of Change in the World Sugar Sector

As mentioned above, the world sugar trade has become highly politicized and in many ways is representative of the impasses confronted in trade liberalization negotiations at the regional and global scale. As major economic powers, access to American and European agricultural markets remains a prize for developing economies. Being developed economies in temperate climates the US and the EU have little comparative advantage in sugar production. Both are competitive in beet production but sugar production from beets is an inherently more expensive endeavor than from sugarcane.

Historically, the developed world has sought to protect its agricultural base while promoting exports of industrial goods as the developing economies seek to promote exports of agricultural commodities and protection of fledgling industries. Typically, this polarization has been resolved, in part, through the give and take of trade negotiations. For the United States sugar sector, the most relevant of the negotiations occurred under the North American Free Trade Agreement (NAFTA). This agreement, initiated in 1993, calls for unlimited market access for Mexican produced sugar beginning in 2008. Because the US sugar price support program functions by limiting imports, losing this ability with respect to Mexico may result in an unsustainable domestic support program in which the government accrues sugar stocks at a cost to the taxpayer. Although the US sugar program is in line with WTO (World Trade Organization) commitments, it counts toward the Aggregate Measure of Support (AMS) that the agricultural sector has been allotted. Reductions in the current U.S. AMS commitment of $19.1 billion negotiated in the WTO Doha Round negotiations (2001- present) may put pressure on the sugar program. Additional pressure may come from additional trade commitments. While sugar was excluded from the U.S-Australia agreement (2005) and only very limited additional sugar access was provided in the U.S. agreement with Central American countries (2005) agreements with other sugar exporters such as Cuba, Thailand, South Africa or Brazil could lead to higher sugar imports.

Furthermore, the US sugar program has grown relatively more isolated with buyouts of other US commodity programs including tobacco and peanuts. Additionally,

drastic cuts in the level of support provided to the EU sugar sector make lack of reform in the US even more anomalous. Given the relative isolation of the US sugar program and the impending changes in 2008, reform options need to be closely examined and modeled.

1.2 Thesis Objectives and Methodology

The objectives of this thesis are manifold but are ultimately related in providing realistic reform options for the current sugar price support system in the US and delineating their impacts. To set the stage for this exercise, recent world sugar trade is put in historical perspective. The modern sugar and sweetener industry is discussed to make the reader cognizant of the technical issues important to sugar production and the role of High Fructose Corn Syrup (HFCS) as a sweetener. To understand the arguments made in the sugar debate, world production and trade are discussed in the context of countries' competitiveness. Because the crux of this research is on the US industry, specific detail is given on US production and consumption statistics. Production for both beets and cane is disaggregated to the state level. On account that the price support system is so integral to the US sugar market, the reader is given a thorough examination of its development and how it operates to maintain US prices and limit foreign imports. So that upcoming trends in the sugar market can be better understood, recent anomalies and new developments, including hurricane Katrina and growth of the ethanol industry, are presented.

The thesis also presents a synoptic review of some of the more recent papers written on the topic of US sugar reform. These papers provide for an understanding of where the sugar debate has been and its current direction. Additionally, a comprehensive look at the 2006 EU sugar reforms is provided along with analysis of recent commodity program reforms in the US. These reforms serve as a source of ideas for reforms to the US sugar program.

Before policy scenarios are presented and modeled the theoretical basis of the model is outlined. Organization of the model description is based largely on the organization of the model itself, with the model being broken up into price determination,

supply and use variables and policy levers. The US-Mexico duality of the model makes it particularly useful for analyzing the impending effects of NAFTA.

After providing a solid foundation of understanding in both the global and American sugar sectors and delineating the USDA baseline model, baseline projections and reform options are presented, justified and run. To accurately model these policy reforms some adjustments are made on the model. Finally, policy results are discussed in light of their likelihood, level of ambition and domestic and global impact.

1.3 Thesis Organization

Chapter one being an introductory chapter, the remainder of this study is structured as follows. Chapter two provides the historical framework for the sugar industry. Additionally it discusses the domestic and global sugar sector including pertinent information on trends in production, consumption, trade, and prices. It also introduces the role of alternate sweeteners as well as recent shocks and emerging trends in the market. Chapter three provides a review of the recent reforms to the EU sugar sector and buyouts of US commodity programs in light of lessons to be imparted on US sugar reform. Chapter four is a review of recent literature on the subject. Chapter five presents the theoretical basis of the model and the baseline and free trade scenarios. Chapter six introduces the policy reform scenarios and explains their results and implications. Finally, chapter 7 culminates the study with a summary and conclusions.

Chapter 2: Sugar Production, Trade and Policy: History and Overview of a Contentious Commodity

Sugar has long been the primary caloric sweetener in the human diet. First introduced to the western world around 300 BC, sugar, at first an expensive luxury, quickly became a widely consumed staple affordable to all strata of society. As a tropical traded commodity, sugar became a contentious part in the battle for influence of European superpowers in the mid-16th century. British domination of the world cane sugar trade eventually led to a backlash in continental Europe, with the development of a beet sugar industry in the early 19th century. The contention in world sugar markets persists today as a commodity that can be produced both by northern, largely developed economies, and by the tropical developing economies seeking market access. An agricultural commodity with this peculiar dynamic makes sugar a bellwether for success in the promotion of open trade and free markets.

This chapter will familiarize the reader with the history and essential background to today's current sugar debate. It provides an in-depth discourse into the global sugar trade using relevant statistics to reveal trade balances and other important themes on the subject. Because, this study is ultimately interested in reform options for the US sugar program, particular attention will be given to the US production and consumption. An understanding of the US market requires an understanding of the US price support system, which is presented in the context of the US in the world market, using the large-country assumption. The cost disparities, changing trade patterns and subsidies that make the sugar industry a controversial topic are also discussed in the framework of trade commitments. Particular attention is given to the US and the EU as large developed countries with well developed sugar sectors. The EU, as a trading bloc in the midst of sugar program reform, also provides an example of world pressure on the sugar sector and how developed countries can alter their policies to align with their trade commitments.

Finally, emerging issues in the sugar industry are discussed with particular attention given to the emergence of a competitive ethanol sector. Here the global ethanol industry is discussed with focus given to Brazil, as a pioneer in its development, and the US. The

findings of a 2006 study by USDA, ERS (Economic Research Service) on the feasibility of a sugar based ethanol sector in the US are given special consideration.

2.1 Sugarcane and the Sugar Beet: A Brief History

In general use, sugar is taken to denote sucrose or saccharose, also called table sugar, a white crystalline solid disaccharide used as a sweetener. Sugars are naturally occurring carbohydrate compounds and are produced during photosynthesis and are the resulting source of food for the plant. During photosynthesis, carbon dioxide and water are combined to generate oxygen and glucose, which is the simplest form of sugar, a monosaccharide.

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$

carbon dioxide + water → glucose + oxygen

This reaction is driven by the energy of sunlight with glucose being energy that can be recovered during respiration. Table sugar or sucrose is a result of plants linking together of glucose molecules to store glucose and provide the physical compounds for growth. Sugar cane and the sugar beet represent the plants of primary importance for commercial sugar production. Additional plant sources of sugar of minor importance include the date palm, sorghum, and the sugar maple. Historically, sugar has been the most widely used sweetener and remains so to date. Recently, however, alternative sweeteners have become more economically attractive and readily available and have been adopted for greater use. Chief among these alternatives are high fructose corn syrup, isoglucose derived from small grains, artificial sweeteners, stevia, an herb many times sweeter than sugar, and inulin syrup, most typically derived from chicory.

Sugarcane (saccharum), is a genus of 6 to 37 species (depending on taxonomic interpretation) of tall grasses native to warm temperate to tropical regions of the old world (Blackburn 1984). All species of the saccharum genus interbreed and the most commonly planted commercial cultivars are complex hybrids. The development of the modern sugarcane industry has been well developed by Glyn James' overview of the crop in his book Sugarcane (James, 2004) and is cited frequently here.

Sugarcane has historically been the primary source of sucrose and is an important source today. It is hypothesized that the common ancestor of all sugarcane originated in southern Asia and spread southeastwards across an ancient land mass that extended from southern Asia to Australia during the early cretaceous period, some 60 million years ago (James 2004). Barnes has maintained that cane originated in Indian subcontinent, however this assertion was based on its mention in ancient Hindu mythology with no other evidence given (Barnes 1974). Other authors claim New Guinea and India as two separate origins of sugarcane. The most likely explanation, however, is the development of wild sugarcane ancestors in the separate Asiatic and Melanesian population centers starting in the cretaceous period.

From the wild ancestors, two broad groups of cultivated cane have been identified, the northern Indian canes of S. barberi and S. sinense lineage and the canes of S. officianarum lineage. The former is characterized by thin hardy stalks while the latter are differentiated by thick and softer stalks.

Sugar was a very precious commodity when the first shipments of cane sugar from the orient arrived at European markets. Sugar was produced centuries before this in Asia and throughout the Polynesia. The Persians discovered a method of refining and crystallizing sugar sometime around the seventh century which eased transport and increase sugar trade. Alexander the Great returned to Europe from India with sugarcane in 325 BC, though it was the Islamic conquests that gave impetus to the westward movement with cultivation spreading from India to Iran and then to Syria (Blackburn 1984). Gradually, cane spread to the environs of Europe with a climate suitable for cane growing, namely, Spain, Madeira, the Canaries and eventually Sao Tome off the coast of West Africa. During this same period, a refining industry was developed in Venice. There is no categorical evidence of an aforethought scheme to spread cane to these areas. However, Columbus' taking cane to the new world on his second voyage from Spain in 1492 was undoubtedly intended to establish an industry in the West Indies. Initial attempts to grow the crop on Hispaniola failed, however success was achieved in 1506 on the western part of the island in the French colony of Saint Domingue, what is now Haiti. Sugarcane was taken to Puerto Rico from Haiti in 1515 and introduced to Mexico in 1520, marking the origin of Mexico's sugar industry (James 2004).

The first recorded sugar shipment from the Caribbean reached Spain in 1516. By 1530 twelve ships were recorded as bringing sugar to Spain with total cargo equaling roughly 1,500 tons. The Dutch brought commercial cane production to the East Indies founding a cane industry in Java in 1596 operated by workers brought from China. The British founded a cane industry in Barbados which displaced much of the sugar elsewhere in the Americas. By 1665, Barbados was exporting close to 7,000 tons of sugar annually to Britain (Mitchell 2004).

The high demand for sugar and the high price associated with its overseas cultivation and high transport costs to Europe for refinement and consumption prompted the establishment of a purely European industry based on the sugar beet *Beta vulgaris*. Draycott's book Sugarbeet (2006) is among the most comprehensive sources on the subject and provides the basis for the following summary. The sugar beet was first grown at least 2,000 years ago as a garden vegetable. The vegetable probably represented a cross of several Beta (beet) species selected from their growing regions on the shores of the Mediterranean with these species likely being derived from Beta vulgaris, native to the coasts of the present United Kingdom. The sugar beet grown commercially today is very different from its origins as a garden plant but still is grown in temperate regions.

In the middle ages the beet was widely used albeit not as a sweetener, the leaves were eaten as a spinach-like vegetable. During this time, bee honey was prized as a sweetener with only limited amounts of cane being available and at prices only accessible to the rich. Those who could not afford cane used honey or fruit and vegetable juices as sweeteners. Consequently any plant whose juice was sweet was highly valued (Draycott, 2006). In 1600 the French Agronomist Olivier de Serres reported in his "Theatre d'Agriculture et Mesnage de Champs" of the beet "The root is counted among choice foods, and the juice which it yields on cooking is like a sugar syrup and very beautiful to look at for it vermillion color" (Draycott 2006). When the beet was first cultivated on a large scale as a field crop however, it was done so as animal fodder, with the tops used as feed directly, rather than as a crop destined specifically for sugar production (Draycott 2006).

The foundation for a sweetener industry based on the sugar beet was laid in 1747 when Andreas Margraaf, a well known scientist in the Berlin Academy of Science, demonstrated that the sweet crystals derived from beet juice were identical to those of refined cane sugar and reported his findings to the Prussian Academy of Science. In these early experiments however the amounts of crystallized sugar obtained from the beet were small, only around 1.6% of fresh weight (Margraaf 1749). The low sugar content persuaded Margraaf to abandon his work and his findings were largely ignored by the public.

In 1776 Margraaf's student, Franz Achard, now credited as being the father of the sugar beet industry, was inducted into the Berlin Academy of Science. Extending on the findings of his mentor, Achard cultivated beets as well as other plant species to evaluate their potential as sweeteners. After testing many types of Beta, he found that those with white skin and a smooth conical form were highest in sugar by weight. This form that he selected, was given the name "White Silesian beet" referring to the town of Silesia, in modern-day Poland, where it was propagated for a time. Still, problems remained in processing due largely to the great variation in beet morphology and sugar content. Early funding for Achard's work was provided by Frederick the Great of Prussia (Draycott, 2006).

In 1801 subsequent funding was provided by Frederick the Great's son Frederick William III and allowed Achard to purchase a large estate and construct a sugar beet factory where he continued his research. With a larger scale of production, Achard's campaign proved successful with crystallized sugar content equaling 4% of bulk weight. At the time, the Dutch and British, the world's eminent naval powers, controlled most of the world sugar trade coming from their colonies in the East and West Indies respectively. It can be surmised that neither country was enthusiastic about the advent of a competing sugar industry in continental Europe, a portentous event played out today in the struggle between the cane and beet industries. Tellingly, Achard claimed that after publishing his findings, representatives of cane refineries offered him an appreciable amount of money to rescind his discourse, something he refused to do (Draycott, 2006).

With Achard's main work published in 1809 he was able to show that agronomic factors could play a role in beet morphology and sugar content and discussed research

that should be pursued in the future for a more efficient industry. Additionally, he described in detail differing methods for beet processing including production of useful by-products such as obtaining alcohol from molasses. In 1807 Achard's factory burned down. However, in 1810, in part to overcome economic difficulties, Achard established a school for sugar beet production at his estate and the techniques developed by Margraaf and improved upon by Achard became widely know (Draycott, 2006).

2.2 Development of the Global Sugar Industry and a Protectionist Mentality

For over a century, between the beginning of the fifteenth century and the middle of the seventeenth, international trade in sugarcane was largely dominated by Portugal. The spread of cane accompanied the Portuguese westward colonial expansion, initially to Madeira and Sao Tome, then to Bioko island (now part of Equatorial Guinea) and Angola on Africa's southwestern coast, and finally across the Atlantic to Brazil. Though Portugal enjoyed a comfortable early lead in its colonial expansion, France, Spain, Britain and the Netherlands refused to acquiesce and vied for influence in the West Indies and in the Guineas on the Caribbean basin of South America. In 1654 the Dutch settlers of Brazil, many of whom grew cane, were expelled by the Portuguese and helped establish competing sugar industries around the Caribbean shortly thereafter, bringing their plant stock and technical aptitude with them (Blackburn, 1984).

The European demand for sugar fomented a rapid and fruitful expansion of the sugarcane plantations of the Caribbean basin in the latter part of the seventeenth century through the eighteenth century. Burgeoning industries were established by the British in Barbados, Jamaica and throughout the Leeward and Windward islands; the Dutch in Suriname and what is now the Netherlands Antilles; the Spanish in Cuba, the eastern 2/3 of Hispaniola, now the Dominican Republic, and Puerto Rico; the French in Haiti, Guadeloupe and Martinique; and the Danish in St. Croix. During these years of growth for the fledgling industry these countries warred over possession of these colonies, with possession of some colonies changing hands many times (Blackburn, 1984).

Without exception, the expansion of these industries throughout Brazil and the Caribbean relied on the labor of slaves brought from Africa. The triangular slave trade relied on raw products from the New World being obtained for the manufacture of

finished European goods which in turn were traded for more raw goods or used to purchase or trade for slaves. The segment of the slave trade which brought slaves from Africa was known as the middle passage. The likelihood of a slave revolt was always a real consideration of the minority white plantation owners. The first real uprising took place in St. Domingue in 1791 under the leadership of James Oge, a free man of color with that sugar colony becoming the independent nation of Haiti in 1804 under the leadership of Toussaint L'Ouverture and Jean-Jacques Dessalines. Concurrent uprisings were taking place in other sugar colonies of the Caribbean. For example, when the British captured Jamaica from the Spanish, the Spaniard masters emigrated to Cuba and their former slaves refused to serve under the new British rulers. The rebelling slaves, known as Maroons, moved to the mountainous interior of Jamaica. Their independence attracted a large share of newly imported slaves, destabilizing the status quo of slavery and sugarcane production in Jamaica (Blackburn, 1984).

Beginning in 1799, the Napoleonic wars were underway in Europe. This struggle for French domination of continental Europe ultimately had a strong and lasting impact on the global sugar industry by promoting the growth of the sugar beet sector in Europe. In 1806, with the intention of weakening the British system of seafaring commerce, Napoleon banned all imports of British goods into continental Europe. Coupled with the British response of cutting France off from its colonies, the price of sugar in Europe quickly rose. Also during this time, the institution of slavery, on which the sugarcane industry was critically dependent was under increased criticism. In 1807, the slave trade was made illegal in the United Kingdom with Denmark, the Netherlands, Sweden, and the US following suite over the next seven years. Slavery itself was abolished in the United Kingdom in 1833 with abolishment of slavery taking place in Argentina, Peru, Uruguay, and the colonial powers of France, the Netherlands, Portugal and finally by the United States in 1865 (Blackburn 1984). Emancipation of slaves by the colonial powers had an almost immediate impact on sugarcane production in the West Indies and was further incentive for an alternate and less volatile domestic industry in Europe.

West Indian cane sugar disappeared from European shelves almost entirely in 1806, and there was great economic incentive to find a replacement. In 1811 Napoleon, still sovereign over much of Europe, issued a decree calling for 32,000 ha of sugar beet to

be sown. Following this decree, over 40 sugar beet factories were built, mostly in northern France. A second edict was issued in 1812 declaring that 100,00 hectares of beet be sown within the French empire. Much of the credit for further developing the sugar beet industry in France has been given to the manufacturer Crespel-Delisse who improved extraction techniques through the use of new machinery (Draycott, 2006). Parallel advances continued to be made in the agronomic side of production. Publications of these advances helped accelerate growth of the sugar beet industry elsewhere in Europe. Thus, although the initial discoveries of sugar production from the beet were made in Germany, the building of a modern and efficient industry ultimately took place in France (Draycott, 2006).

By the middle of the 19th century, France, Germany, Austria and Russia were the four countries producing beets in considerable quantities with all four nations taxing cane sugar imports to support domestic sugar production. Having the desired effect of increased domestic production, much of the taxed cane sugar imports were ultimately displaced and the revenue stream from tariffs dwindled. Acting on this the governments of France, Germany and Prussia all imposed a form of tax on their domestic beet industries. This tax had the unintended side effect of prompting increased yields from sugar beets, increased efficiency in refinement and ultimately increased domestic production. By the second half of the nineteenth century, production began to outstrip consumption. This development meant the economic battle between the cane industry of the south and the beet industry of the north was well underway (Draycott, 2006).

During the second half of the 19th century, Belgium, the Netherlands, Sweden, Italy, Spain and Denmark all began to produce beet sugar on a large scale (Deerr 1949,1950). Britain perpetuated the role of sugarcane in the global economy and successive attempts to establish a beet industry there failed until the early nineteenth century. The British writer de Man called for a domestic beet industry in Britain because of the rural jobs it would create which would "take away the dangerous inducement of flocking to large towns for employment, where they often contract immoral habits" (de Man, 1870). This argument for support of the rural economy by agriculture is one that is still used extensively today.

By the beginning of the twentieth century, more of the world's sugar was being produced from beet than from cane (Draycott, 2006). The Brussels convention of 1898 ended in general agreement that no national bounties would be paid for sugar beet production and that import taxes on cane sugar would end effective from 1903. This allowed cane to regain its competitiveness with the sugar beet. By 1914 cane sugar accounted for half or global sugar consumption.

During World War I, Britain, the main proponent of the world sugar cane industry and trade developed a domestic beet industry to obviate the need for overseas trade routes required in cane sugar production. The beet industry in Britain was developed further with the help of government support in the form of a reprieve of the excise duty and a ten year period of subsidy from 1925-1935. When the beet subsidy was up for renewal in 1935 there were massive protests from beet growers. The majority group of the inquiry committee called for an end to all subsidies while the "Lloyd minority report" emphasized the advantages of a domestic beet industry. The arguments at that time for reducing the dependence on imports, beets having an important role as a cash crop used in rotation, beet production as a source of employment in the rural economy, and improving whole farm stability (because beets were grown on contract) are all arguments that reverberate today. In the end, the government opted for the minority report and continued support of a British beet industry (Draycott, 2006).

In terms of world sugar production, the end of slavery in the British West Indies and subsequent declines in production on those islands meant that much cane production shifted to Brazil, Cuba, and Puerto Rico where slave labor was still legal. Coupled with the advancements in European sugar beet production the dominance of the BWI in world sugar markets was lost forever, though its continued impacts on world cane markets cannot be overlooked. By the end of the 19th century the United States was exerting greater influence on world sugar markets having made special commercial arrangements with Cuba and Puerto Rico, which were still Spanish colonies, Hawaii, and Brazil in addition to developing a small domestic cane industry in Louisiana. The abolition of slavery in the Spanish colonies had little effect on their cane industries. By 1894, the Cuban sugar industry was the largest in the world, producing over 1 million tons per year (Blackburn 1984). After the end of the Spanish-American war, Cuba and the Philippines

became a protectorate and colony, respectively, of the United States which gave them preferential trade conditions further promoting their industries. Hawaii became an integral part of the U.S. in 1898 and sugar production increased from 150,000 tons in 1894 to 250,000 tons in 1899 (Blackburn, 1984).

The first successful beet sugar operation in the United States was opened in 1880 in Alvarado California with another factory opening a few miles away in Watsonville in 1888. Other factories opened in the coming years, however, there were only six factories in the United States by 1896. The following year, the government enacted policy changes aimed at promoting a domestic beet industry. By 1900, 79,000 tons of beet sugar was being produced in 34 factories around the United States (McGinnis 1982). By the 1950s, sugar beet was cultivated over 360,000 hectares in 22 states. The centers of beet production then, as now, were located in California, the Great Plains from Montana to Texas, the Red River Valley of Minnesota and the Dakotas, and the Great Lakes area representing Michigan and (formerly) Ohio.

2.3 The Modern Sugar Industry

The sugar industry today is far different from that of a century ago. However, sugar is still produced by the two markedly different crops, the sugar beet and sugar cane. Sugar beets are an annual root crop grown in temperate climates while sugar cane is a perennial grass grown in tropical and subtropical climates.

2.3a Sweetener Processing

Upon harvest, the naturally occurring sugars in beet and cane begin a rapid conversion to carbohydrates through respiration. Respiration is the oxidative process in which cellular organic compounds are converted to carbon dioxide and water to generate metabolic substrates and energy. Consequently the requisite factories for extracting the juice of the crop must be located nearby. Because neither beet nor cane is valuable in and of itself, sugar growers and sugar processors are economically interdependent and share in the total value of the sugar produced and the byproducts of value, such as molasses and beet tops, in accordance with contractual agreements (Mitchell, 2004). Both the farmers and the processors can influence the value of the end product because the practices of

both parties are important. Farmers can influence sugar yields occurring in beet or cane through careful agronomic practices while processors influence the recovery rate of sugar through investment in equipment. Numerous ownership arrangements exist in the sugar industry. In the developing countries, state ownership of the factories and producing lands is still fairly common (Mitchell 2004). In developed countries, a common arrangement is one of privately owned production facilities buying beet or cane from independent growers and there are many growers participating in cooperatives with the production facility representing a joint investment. In both developed and developing countries, some of the most productive sugar enterprises are run by a single company which owns both the production facilities and the lands.

The process for obtaining the final sugar product from beets and cane is somewhat different with beet sugar being the result of a one-step process and cane sugar being a two-step process taking place at separate facilities. The juice of both the sugar beet and sugar cane contain molasses, however, unlike cane molasses beet molasses has a bitter unpleasant taste and is therefore refined directly into white sugar. Additionally, because of higher levels of naturally occurring sucrose by volume in the sugar beet it is more economic to refine it directly to white sugar. Sugar is crystallized from molasses until it is no longer economical to do so. The remaining molasses can be sold for human consumption. A third boiling of molasses results in blackstrap molasses which can be sold as a supplement for animal feed or used in bio-processing for fermentation.

The refinement of cane molasses is done in a factory separate from the facility used in extraction and is not bound geographically to be close to the cane farms. Therefore, raw sugar is typically refined near to the area where it will be sold even when the raw product was milled halfway around the world. The reason for this is two-fold. First, sugar is hydrophilic and trying to keep it dry during overseas transport would require great expense and care in packaging. Secondly, sugar can be refined to different grades depending on the final use. These orders can be filled more easily if the sugar is refined locally. Because of the high costs associated with refinement of cane molasses, much of the world consumes cane sugar in the form of syrups or other intermediaries short of the pure white sugar.

The sweetener industry today extends beyond the sucrose derived from beets and cane. High fructose corn syrup derived from corn starch is hugely important in the United States, where it is valuable as a liquid sweetener, such as in the beverage industry. Overall, corn sweeteners, including HFCS, Glucose syrup and Dextrose account for a larger share of the caloric sweetener consumption in the United States than sugar. The United States is the world low cost producer of corn sweeteners because of access to world market price, domestically produced, corn and large factories able to take advantage of economies of scale. Because HFCS is a liquid, it is heavy and expensive to transport, therefore trade of HFCS is limited primarily to land-based cross border shipments (Mitchell, 2004). Caloric sweeteners produced from commodities other than corn include isoglucose in the European Union (EU) which is derived from wheat and a sweetener derived from potato starch in Japan. Since the advent of saccharin in 1879, artificial sweeteners have displaced a limited amount of sugar in the world market for sweeteners.

2.3b World Sugar Production and Trade

According to the Food and Agriculture Organization of the United Nations, there are currently about 55 countries that grow sugar beets and 105 countries that grow sugar cane (UN FAO). World sugar production by country is typically thought of in three tiers. The top tier of total production consists of Brazil, India, and the EU-25 accounting for 18.7%, 12.98%, and 9.25% of world production respectively over the period of 2002/03-2006/07, as shown in Table 1. During this same period, the United States ranked high in the second tier with about 5% of world production, placing it below China, and above Thailand, Mexico, and Australia. American production was severely impacted by Hurricane Katrina in September of 2005, particularly production in Louisiana. As a result, US cane production dropped from 3.59 million MT in 2003/04 to 2.75 million MT in 2005/06.

Leading exporters of sugar are Brazil, Australia, and Thailand accounting for 35%, 8.76%, and 8.43% of exports between 2002/03-2006/07. Not coincidentally, these three countries were plaintiffs in a case brought to the World Trade Organization (WTO) in 2003 for what they viewed as the European Union's (EU) violation of its General

Agreement on Tariffs and Trade (GATT) commitments. Prior to a WTO tribunal siding with these plaintiff countries, the EU operated a program of subsidies for sugar destined for the foreign market. This had the effect of increasing exports, reflected in the EU's position as number two world exporter averaging 4.1 million MT of exports, 10.4% of the world total, between 1997/98-2001/02 as shown in Table 2. Since the EU has begun implementing the reforms to comply with the WTO it has dropped to the number four world exporter, averaging 2.9 million tons, 6.11% of world exports, between 2002/03-2006/07. This is projected to decrease as the EU reforms become fully implemented. A more comprehensive review of the EU reforms is given in chapter three.

Import trade in sugar between 2002/03 and 2006/07 has been dominated by the Russian Federation with 9.1% of total imports (Table 1). Traditionally, Indonesia and Japan have imported more sugar than the United States however during the most recent time frame, the United States has been the world number two importer, with 3.95% or world imports. Again, this change in the source of American sugar is a partial anomaly caused by the devastation of Katrina. A more accurate depiction of the US role of sugar importer can be found in the observed time frame 1997/98-2001/02 when the US was the number four world importer at 1.4 million MT of imports during this period, accounting for 3.8% of the world total (Table 2).

Table 1: Top 10 Producers, Importers, and Exporters, Fiscal Years 2002/03-2006/07

5yr average (2002/03-2006/07)

Production	1000 MT	% of world total	Net Importers	1000 MT	% of world total	Net Exporters	1000 MT	% of world total
Brazil	27161	18.72%	Russian Federation	3954	9.10%	Brazil	16675	35.03%
India	18829	12.98%	United States	1714.4	3.95%	Australia	4171.8	8.76%
EU-25	13423.2	9.25%	Indonesia	1630	3.75%	Thailand	4011	8.43%
China, Peoples Republic of	10529	7.26%	Japan	1363.4	3.14%	EU-25	2909.4	6.11%
United States	7368.8	5.08%	Korea, Republic of	1323.4	3.05%	Guatemala	1450.6	3.05%
Thailand	6098.6	4.20%	Canada	1316.2	3.03%	Cuba	1054	2.21%
Mexico	5596.2	3.86%	Malaysia	1103.4	2.54%	Colombia	1053.6	2.21%
Australia	5301.8	3.66%	Algeria	1091.8	2.51%	South Africa, Republic of	935.4	1.97%
Pakistan	3332.6	2.30%	Nigeria	1080	2.49%	Mauritius	548.8	1.15%
South Africa, Republic of	2597.2	1.79%	Egypt	1009.6	2.32%	Argentina	392	0.82%
World	145055		World	43444		World	47598	

Source: USDA, FAS

Table 2: Top 10 Producers, Importers, and Exporters, Fiscal Years 1997/98-2001/02

5yr average (1997/98-2001/02)

Production	1000 MT	% of world total	Net Importers	1000 MT	% of world total	Net Exporters	1000 MT	% of world total
India	18640.4	14.17%	Russian Federation	4822	12.79%	Brazil	9310	23.53%
Brazil	18320	13.92%	Indonesia	1545.8	4.10%	EU-25	4123.8	10.42%
EU-25	13865.8	10.54%	Japan	1527.2	4.05%	Australia	3876.4	9.80%
China, Peoples Republic of	8055.8	6.12%	United States	1440.4	3.82%	Thailand	3577.8	9.04%
United States	7639.8	5.81%	Korea, Republic of	1170.2	3.10%	Cuba	2974.4	7.52%
Thailand	5371.2	4.08%	Canada	1152.8	3.06%	Guatemala	1215	3.07%
Mexico	5167.2	3.93%	Iran	1005	2.66%	South Africa, Republic of	1190.8	3.01%
Australia	4967.2	3.77%	Malaysia	981.4	2.60%	Colombia	975.8	2.47%
Cuba	3644	2.77%	Algeria	951	2.52%	Mauritius	534.6	1.35%
Pakistan	3258.4	2.48%	Bangladesh	780	2.07%	Turkey	493.6	1.25%
World	131586		World	37,714		World	39,568	

Source: USDA, FAS

Production and trade decisions on the world market are closely tied to production costs of sugar in a given country. Table 3, displays cost of production data for 1997/98-2001/02 from information obtained by LMC International, a British firm specializing in economic, marketing and planning services in the field of agricultural products. More complete data was obtained by the firm but is available only to subscribers. Nevertheless, the table offers insight into the major discrepancies in world production costs. The competitive advantage of the low cost producers and major exporters is apparent and it is reasonable to expect that given increased market access, these countries could export more of their sugar. Among the low cost countries for production of raw cane sugar are Australia, Brazil, Guatemala and Malawi, Zambia, and Zimbabwe of southeastern Africa whose average cost of production is equal to ¢7.55/lb. Australia, Brazil, and Guatemala are also counted among the major exporters, coupled with Colombia, Cuba, South Africa, and Thailand. These countries have slightly higher costs of production averaging ¢9.36/lb during the same time period. Costs of production for refined cane sugar are also given in this table with the difference between cost of production for raw sugar and costs for refined sugar representing the refining costs. The low cost sugar beet producers are represented by the United States and Canada from North America, France, Belgium and the United Kingdom from Western Europe, Chile, and Turkey. Refined beet sugar production costs are approximately double those of refined cane sugar, for both the low cost and major exporter categories.

Table 3: Costs of Production Among Selected Countries

Category	*1997/98*	*1998/99*	*1999/00*	*2000/01*	*2001/02*	5-year average
			Cents/pound /1			
Raw cane sugar						
Low-cost producers 2/	8.25	8.11	6.84	7.95	6.59	7.55
Major exporters 3/	10.55	9.66	8.7	9.51	8.38	9.36
Cane sugar, white value equivalent						
Low-cost producers 2/	11.92	11.77	10.39	11.6	10.11	11.16
Major exporters 3/	14.41	13.45	12.41	13.28	12.06	13.12
Beet sugar, refined value						
Low-cost producers 4/	22.44	24.07	23.12	23.56	24.23	23.48
Major exporters 5/	25.44	27.02	25.51	24.2	26.19	25.67
High fructose corn syrup 6/						
Major producers 7/	12.62	11.41	11.62	12.87	12.62	12.23

1/ Measured in current U.S. cents per pound, ex-mill, factory basis.
2/ Average of six producing regions (Australia, Brazil - Center/South, Guatemala, Malawi, Zambia, and Zimbabwe).
3/ Average of seven countries (Australia, Brazil, Colombia, Cuba, Guatemala, South Africa, and Thailand).
4/ Average of seven countries (Belgium, Canada, Chile, France, Turkey, United Kingdom, and United States)
5/ Average of four countries (Belgium, France, Germany, and Turkey).
6/ Cents per pound, HFCS-55, dry weight.
7/ Average of 22 countries (Argentina, Belgium, Bulgaria, Canada, Egypt, Finland, France, Germany, Greece, Hungary, Italy, Japan, Mexico, Netherlands, Poland, Slovakia, South Korea, Spain, Taiwan, Turkey, United Kingdom, and United States).
Source: LMC International.

2.3c The US Sugar and Sweetener Industry

As the focus of this study and as an influential component of the world sugar market the US sugar sector is given special consideration below. Essential to understanding the U.S. market is the price support program maintained by the USDA. The program is introduced and presented verbally and graphically in section 2.3c-1. In section, 2.3c-2 US sugar production is disaggregated by the geographic distribution of the industry, including common trends and the clear differences among the sugar producing states. Section 2.3c-3 describes the American sugar and sweeteners market in terms of consumption and price trends.

2.3ci The US Sugar Price Support Program and Coalition Advocates

Because costs of production on most American farms growing beets or cane are higher than the world market prices for sugar, substantial protection is needed by the industry to remain profitable and viable. Sugar figured early in the history of the United States, with one of the first acts of the newly created congress in 1789 to impose a tariff on imported sugar as a source of revenue. Protection of the domestic industry began in 1842 when the existing tariff schedule was modified to provide protection to the domestic sugar refining industry and to promote the domestic production of sugar (Abler et al

2005). The Jones-Costigan Act of 1934 used a series of quotas on domestic production and imports to maintain the price paid to producers. The principles of the Jones-Costigan act were perpetuated with minor changes until 1975 when record high world sugar prices prompted the removal of limitations on domestic production. The exuberance of the market did not persist and in 1977 a price support program was re-enacted.

The framework for the current sugar program was laid out in the Food and Agriculture Act of 1977. Producer price support was enabled by the non-recourse loan program which allowed sugar processors to obtain government loans using sugar as collateral provided that the processor promised to pay their producers a fixed minimum price. If sugar prices were sufficiently high, the processors could repay the loan with interest. If sugar prices were low the sugar could be surrendered to the Commodity Credit Corporation (CCC) at an agreed upon loan rate. This loan rate effectively established a guaranteed baseline price for the domestic sugar producers. So that the program operated at minimal cost to the government, by minimizing stocks accumulated by the CCC, a "market price objective" was established. Import duties were established to control imports and support this targeted price. In 1981 the duty program was switched outright to quotas, which were assigned by country, to provide even greater control over sugar imports.

Since 1977, except for the brief and infrequent periods of high sugar prices, the combination of import controls and a loan rate system has provided price support to American sugar producers. The Food Security Act of 1985 amended the program by introducing the requirement that the sugar price support program be operated at no net cost to the federal government. This meant that the USDA was to operate the program so that the CCC did not accumulate sugar stocks. Consistent with the 1994 Uruguay Round trade agreements under the auspice of the WTO, in the 1996 Food and Agricultural Reform Act (FAIR) the method of import controls for sugar was specified as a tariff rate quota (TRQ)[1] system instead of the absolute quotas established in 1981. Under the FAIR Act, loans were non-recourse if the TRQ was set at 1.5 million tons or greater and were recourse if the TRQ was set below 1.5 million tons. This allowed the CCC to demand a

[1] A TRQ is a two-level tariff. TRQ's were adopted during the Uruguay Round as a method for providing greater access to markets with high tariffs. A limited volume of imports is allowed at the lower tariff, and all subsequent imports are charged the higher tariff.

cash repayment of the loan at maturity despite the price of sugar. FAIR temporarily eliminated the no-cost provision. Penalties were introduced on sugar forfeited to the CCC at one cent per pound for cane sugar and 1.07 cents per pound for beet sugar. There were also marketing assessments[2] and increases in interest rates charged on loans.

The sugar price support program was modified slightly in 2002 under the Farm Security and Rural Investment Act (FSRI)[3]. Under FSRI all loans to processors are non-recourse and must be repaid within 9 months. The loan rates to processors are set at 18 cents per pound for cane sugar and 22.9 cents a pound for beet sugar, the same levels as under FAIR. There are no marketing assessments, interest rate premiums or forfeiture penalties. The no-cost provision of the sugar program has been reinstated and to this end, marketing allotments were reinstated, but can only be applied if imports for domestic consumption are less than 1.532 million tons [4]. The 1.532 million ton figure is essentially the sum of the minimum access WTO TRQ and the maximum of NAFTA duty-free imports in any one year through 2007. If imports were projected at higher than this level, the producers feared that they would have to hold sugar off the market and lose sales if there were marketing allotments. Therefore, for producers and processors to be able to sell if there is a surge in imports for consumption above the 1.532 million ton level, the

[2] Beginning with fiscal 1997, sellers of domestic raw cane sugar were required to pay to the Treasury an assessment of 0.2475 cents per pound, raw value, of sugar sold. Sellers of domestic refined beet sugar were required to pay an assessment of 0.2654 cents per pound. Sugar marketing assessments were paid on all processed, domestically grown sugar for fiscal 1997 through 1999, but were suspended for FY 2000 and 2001 by the 2000 Agriculture Appropriations Act.

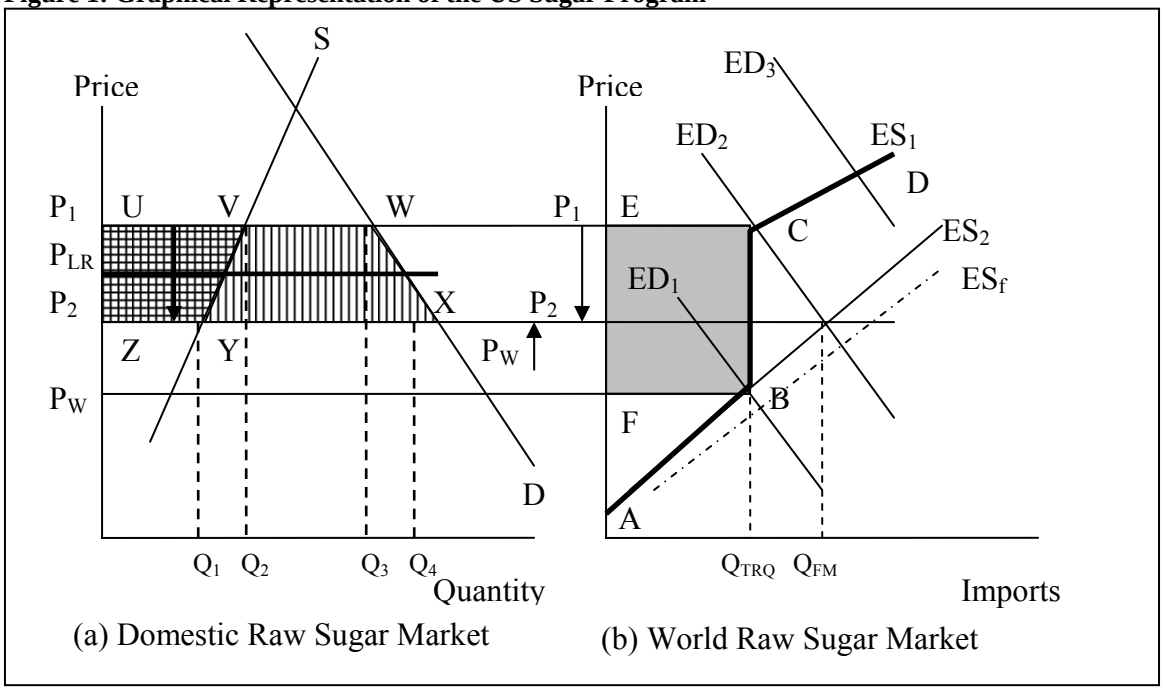
[3] The FSRI of 2002 is more commonly referred to as the 2002 Farm Bill

[4] Marketing allotments provide each processor or producer of a specified commodity a specific limit on sales for the year, above which penalties would apply. Marketing allotments are determined by the Overall Allotment Quantity (OAQ). The overall quantity of sugar to be allotted for a crop year is determined by subtracting the sum of 1.532 million short tons, raw value (STRV) and carry-in stocks of sugar (including CCC inventory) from the USDA's estimate of sugar consumption and reasonable carryover stocks at the end of the crop year. USDA is required to adjust allotment quantities to avoid the forfeiture of sugar to CCC. The overall allotment quantity 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 mainland cane sugar producing states (Florida, Louisiana, and Texas) allocations are assigned based on past marketings 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 2002 Farm Act provides for a number of contingencies that could require reassignment of allotments during the crop year.

marketing allotments must be suspended. The allotment suspension requirement means that the likelihood of processors forfeiting sugar to the USDA is high at low prices and if that were to happen, the USDA would incur budget expense. So USDA is meant to manage imports below the 1.532 million ton level, or it could end up costing money from increased budget expense, which would violate the no-cost provision unless there were significant demand increases. Additionally, the legislation offers a payment-in-kind option (PIK), which allows producers to producers to forego planting or harvesting of their product in exchange for CCC sugar. This provision is also designed to make the program operate at no government cost.

The GAO (Government Accountability Office) developed a simple model to demonstrate the effects of the price support program for sugar. Here we expand on that exercise in figure 1. Panel (b) represents the excess supply and demand functions for the world market. ES_f represents the excess supply curve resulting if the United States did not have any import restrictions while ES_2 is the excess supply curve under the in-quota tariff. Because of free trade agreements or other preferential agreements, very few quota-holding countries exporting sugar to the United States under the TRQ actually pay any tariff. Therefore, it is assumed that ES_2 is actually the free trade excess supply curve facing the United States in the absence of import restrictions. Additionally, marketing costs are assumed to be zero.

Figure 1: Graphical Representation of the US Sugar Program



Source: GAO, 2000

The TRQ introduces a kinked excess supply curve denoted in bold as ES_1. As shown in panel (b) the kinked excess supply curve can result in three price/import outcomes depending on the excess demand curve of the United States. If the excess demand curve of the United States intersects ES_1 in the lower portion, A-B, as denoted by ED_1 there will be both a world supply and price response to shifts in the excess demand schedule. This area of the curve represents the below TRQ supply. ED_1 is not the actual excess demand schedule of the US. If it were, domestic prices would equal world prices because there is no premium (import quota) charged on imported sugar to the United States at this level. ED_3 is another hypothetical scenario and represents an import demand schedule that intersects ES_2 at a level above the TRQ. This equilibrium could occur with very strong demand, inducing imports even with the over quota tariff.

ED_2 represents the excess demand schedule if the TRQ is binding and corresponds to the actual US sugar import situation (GAO, 2000). Price and quantity reach equilibrium at the intersection of the excess demand curve ED_2 and the vertical segment of ES_1, B-C. The TRQ serves to generate rents for foreign import quota holders denoted by the shaded area C-B-F-E. If the TRQ were to be removed the excess supply

curve would shift to ES_2. If the excess demand schedule ED_2 remained unchanged, world prices would rise and domestic prices would fall to equilibrium P_2. If this were to happen, imports of foreign sugar would rise to level Q_{FM} on the world market and would increase from Q_2-Q_3 to Q_1-Q_4 on the domestic market (Panel a). The loan rate (P_{LR}) acts as a price floor to producers. If it were kept in place, the CCC would begin to acquire sugar stocks at a considerable cost, shifting rents paid from consumers to taxpayers. Cost of the program to US consumers is represented by the area U-W-X-Z. Gains by the US sugar industry are denoted by U-V-Y-Z. Net US societal (deadweight losses) are the difference between the two, area V-W-X-Y. Of this, part is captured by foreign producers.

Numerous studies have quantified the economic impact of the US sugar program in terms of rents imparted to US sugar producers, foreign quota holders, costs borne by consumers, and deadweight losses. Many of the early studies estimate the deadweight losses of the sugar program to exceed $1 billion dollars annually. Table 4 displays the results of a well know 1987 study by Leu, Schmitz, and Knutson. The results are based on differing quota price premiums, representing the disparity between prices received by US producers and the world raw sugar price. The range in premiums modeled goes from 7.5¢ at the low end to 16¢ at the high end. Between 1990 and 2005 this premium has been between ten and fifteen cents. An infinite excess supply elasticity and an elasticity value of 2.37 are used to reflect the small and large country assumptions respectively. Because the US has traditionally been a large importer of sugar, it is reasonable to use the large country assumption. Finally, substitution with HFCS was either allowed or disallowed by scenario. The range of results is wide. Lower price premiums, an infinite excess supply elasticity and substitution with HFCS make the program less costly to consumers and less lucrative for producers. Inversely, high price premiums, the small country assumption, and no substitutability exaggerate the economic impacts of the program.

Table 4: Costs of US Sugar Program

Quota Price Premium	Elasticity of Excess Supply Curve	Consumer Cost		Producer Gain	Net Societal Cost	
		Substitution			Substitution	
		Without	With		Without	With
(¢/lb.)		----------($ million of 1983 dollars)----------				
7.49	2.37	423	372	169	253	203
	∞	1,856	1,636	598	1,258	1038
10.70	2.37	926	815	345	580	470
	∞	2,661	2,347	742	1,919	1,605
16.05	2.37	1,769	1,559	578	1,191	981
	∞	4,017	3,546	833	3,184	2,713

Source: Leu, Schmitz, Knutson, 1987

Later studies suggest that these impacts have in the middle range of the Leu, Schmitz, and Knutson estimates. For example, the 2000 study of the sugar program by the U.S. General Accounting Office suggests a cost to consumers of $1.9 billion and a deadweight loss of U.S. $532 million for 1998 when factoring in the benefits received by the US through preferential agreements with sugar exporters to the United States (table 5). A more comprehensive analysis of sugar program costs and gains is presented in chapter 4.

Table 5: Estimated Economic Gains and Losses Resulting from the Sugar Program

1999 dollars in millions

Category	**1996**	**1998**
Welfare gains accruing to producers	788	1,045
Sugarcane Producers	241	307
Sugarbeet Producers	490	650
Sugarbeet Processors	58	89
HFCS Manufacturers and Corn Growers	-1	-1
Welfare losses accruing to sweetener users	-1,471	-1,938
Loss to US economy	-683	-893
Loss from economic inefficiencies	-273	- 532
Transfers to foreign suppliers	- 410	-361

Source: GAO, 2000
Numbers in parentheses are economic losses

All studies suggest that the economic gains and losses from the sugar program are significant. The benefits of this program provide tremendous incentive to the sugar producers to maintain the current program. Likewise the costs of the program to consumers and industry have prompted the formation of coalition structures to change the price support system for sugar. Representing the two sides of the debate are the American Sugar Alliance (ASA) and the Coalition for Sugar Reform (CSR).

The ASA is a strong coalition made up of sugarcane and sugar beet growers, as well as corn producers and HFCS manufacturers. The ASA acts as the rent seeking organization of U.S. sugar producers lobbying for protection from the lower costs of foreign producers garnered through competitive advantage as well as production and trade subsidies. The ASA has worked well symbiotically with other agricultural groups to generate the needed political clout for the industry (Schmitz and Moss, 2002). The highly integrated nature and wide geographic dispersion of the US sugar industry has made political support relatively easy to obtain. The ASA and its supporters have invested funds in political campaigns to garner support for the sweetener industry. The ability to maintain the current sugar program in the face of well funded opposition from the CSR is testament to the effectiveness of the ASA.

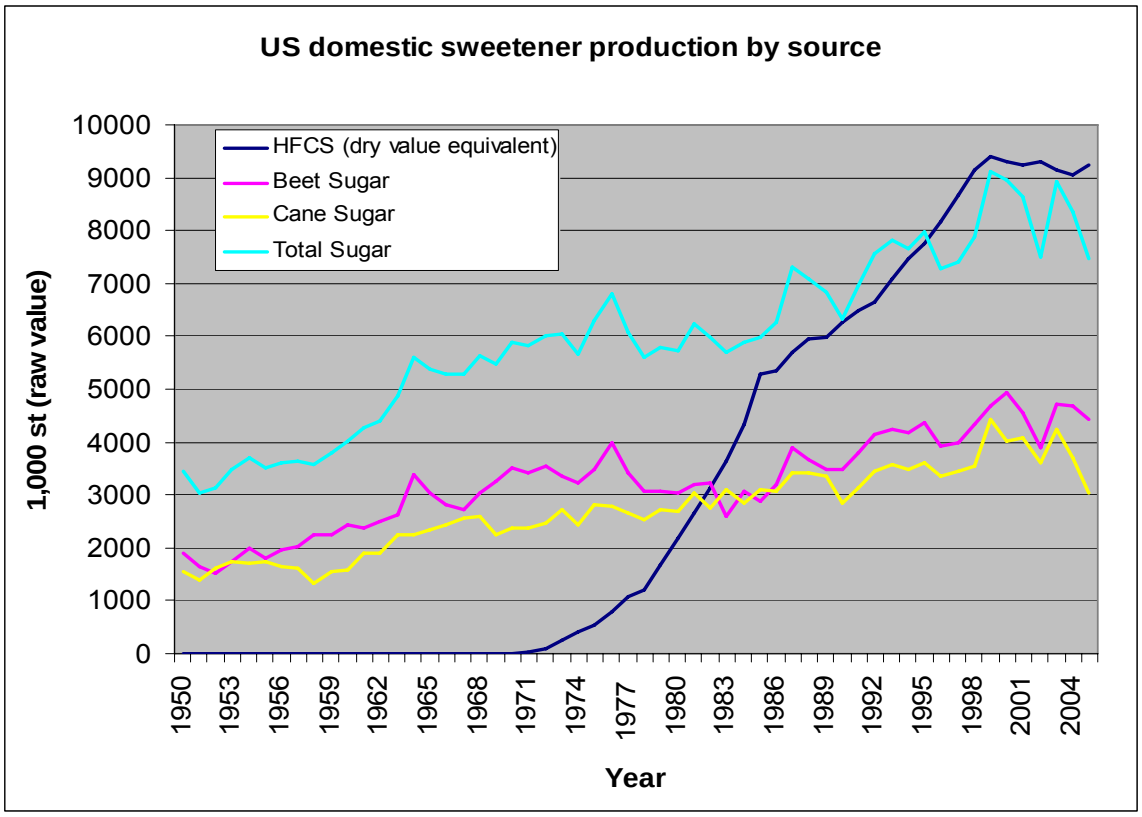
Unlike the ASA, the CSR is a proponent of change in the US sugar program. The CSR was formed in 1997 partly out or response to a lack of sugar program reforms in the 1996 FAIR act (Schmitz and Moss, 2002). The CSR is composed of a variety of interest groups representing food, soft drink, and confectionary industries as well as environmental groups and the US cane refiners association. The CSR contends that the US sugar program costs consumers $1.4 billion dollars annually in higher food costs. The response of the ASA has been that the lower sugar prices from policy reform would not be passed along to consumers and that industrial users would capture these reduced costs in the form of higher profits (Roney, 2002).

2.3cii US Sugar and Sweetener Production

As noted in the world production statistics, the United States is among the world's larger sugar producers, consistently ranking high in the second tier of global production. In 2004, there was an estimated 2.4 million acres of sugar beets and sugarcane planted in the US, representing an area the size of Rhode Island, Delaware, and Washington DC combined. Making the United States sweetener sector unique, is a well developed sugarcane and sugar beet sector, as well as being the world's leading producer of HFCS. If the production of HFCS were added to total US sugar production, total production of all sweeteners would be over 16.7 million tons of raw sugar equivalent basis in 2005 (figure 2).

Despite being a large sugar producer, the production of sugar in the United States represents a smaller share of total agricultural production than that of the world on average. Sugar production, as a whole, represents a greater share of agricultural receipts in other countries. In 2004, for example, the value of the combined sugarcane and sugar beet crop was $1.93 billion, representing less than 2.4% of all U.S. crop values (Haley 2006). This puts the value of US sugar production less than important crops like tobacco, rice, and peanuts and far less than the major field crops, corn soybeans and cotton.

Figure 2: US Domestic Sweetener Production

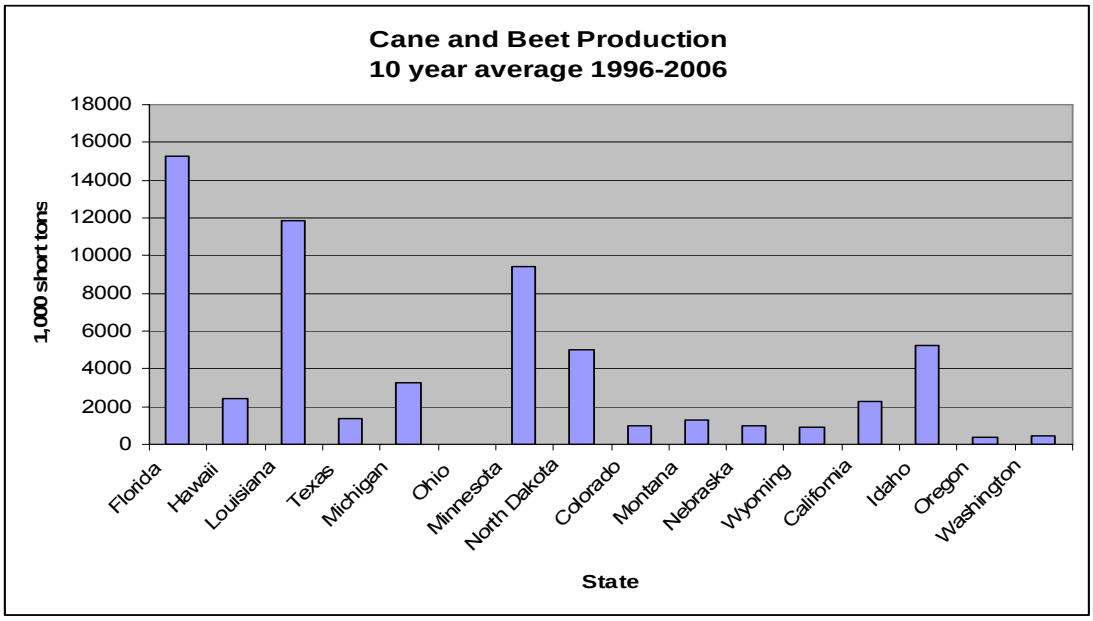


Source: USDA, ERS

In the United States, sugarcane is grown in only four states, Florida, Louisiana, Texas, and Hawaii. Beets are currently grown in 11 states which are grouped into 5 regions, the Great Lakes (Michigan and Ohio), the Upper Midwest (Minnesota and North Dakota), the Great Plains (Colorado, Montana, Nebraska, and Wyoming), the Northwest (Idaho, Oregon and Washington), and California. The Northwest region and California are sometimes grouped together to form the Far West region. The majority of the milling

facilities in the U.S. are farmer or employee owned, approximately 94% for beet processing factories and 64% of cane mills (ASA 2006). Figure 3 displays average production in the cane and beet producing states over the last ten years. As with other field crops, there has been a general trend towards larger sugar crop acreages on fewer farms.

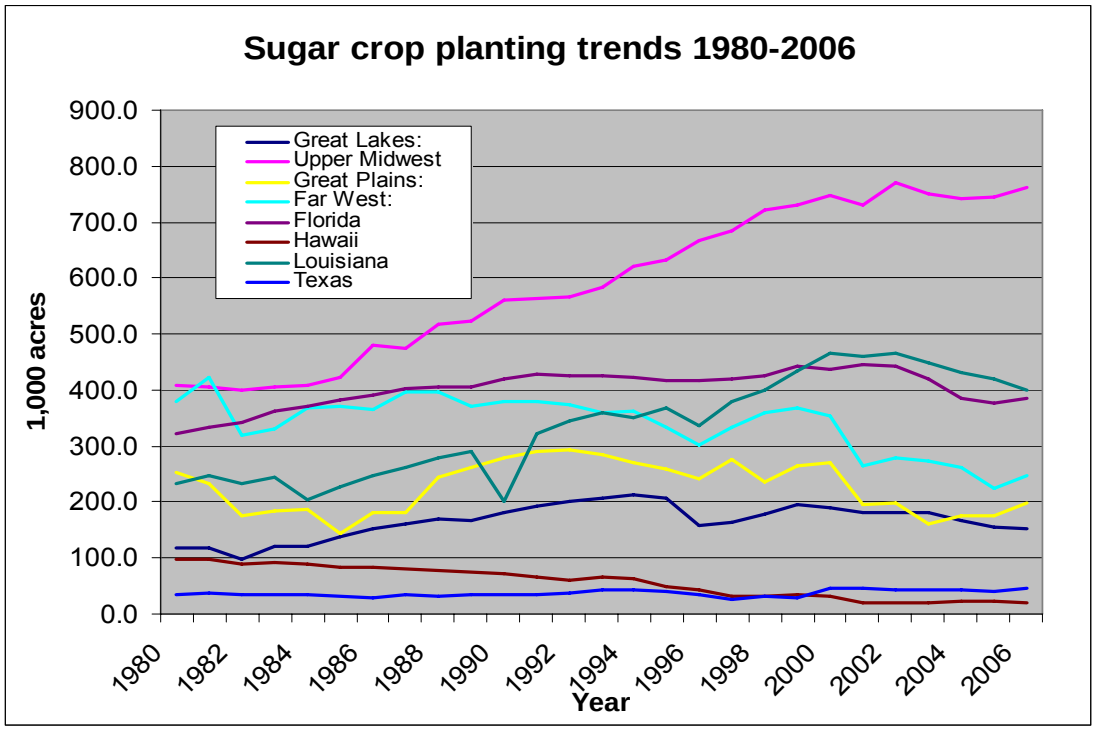
Figure 3: Cane and Beet Production by State, 10 yr average (1996-2006)



Source: USDA, ERS

Acreage in higher cost regions has held flat or is decreasing while marked expansion has occurred most notably in Louisiana and the Upper Midwest (figure 4). Production costs of sugar crops vary between cane and beets and vary depending on the region within the US. All costs are higher than the world's lowest cost producers of cane sugar. Beet producers in all parts of the country are more efficient than the world's beet growers on average. Cane production costs for Florida, the US low cost producer, are on par with those of Mexico; however, processing costs for Florida are significantly less than those for Mexico. According to the American Sugar Alliance (ASA), American beet farmers have the third lowest cost of beet sugar production in the world, and of the 64 countries that produce cane sugar, nearly two-thirds have higher production costs than U.S. cane growers.

Figure 4: Sugar Crop Planting Trends by Region (Beet) and State (Cane)



Source: USDA, ERS

Figure 5 Mexico and US Field Costs of Production Relative to World Average

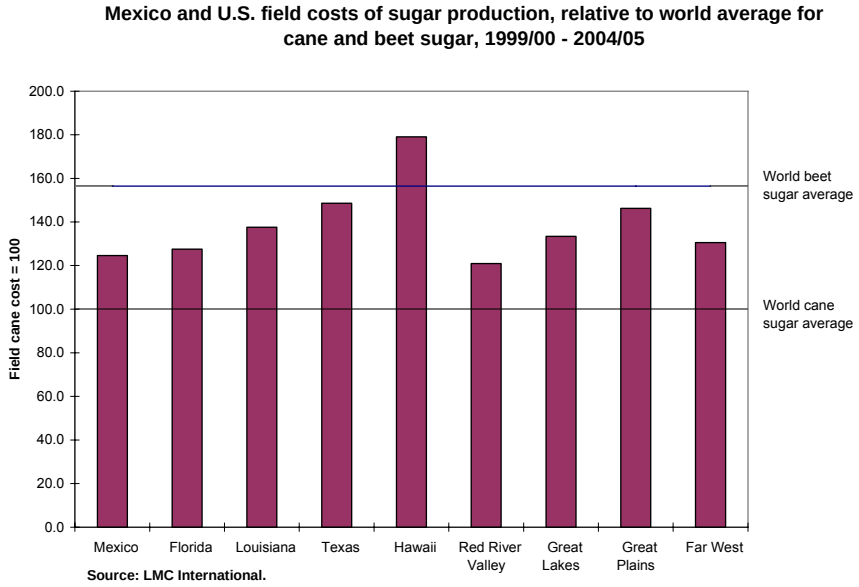
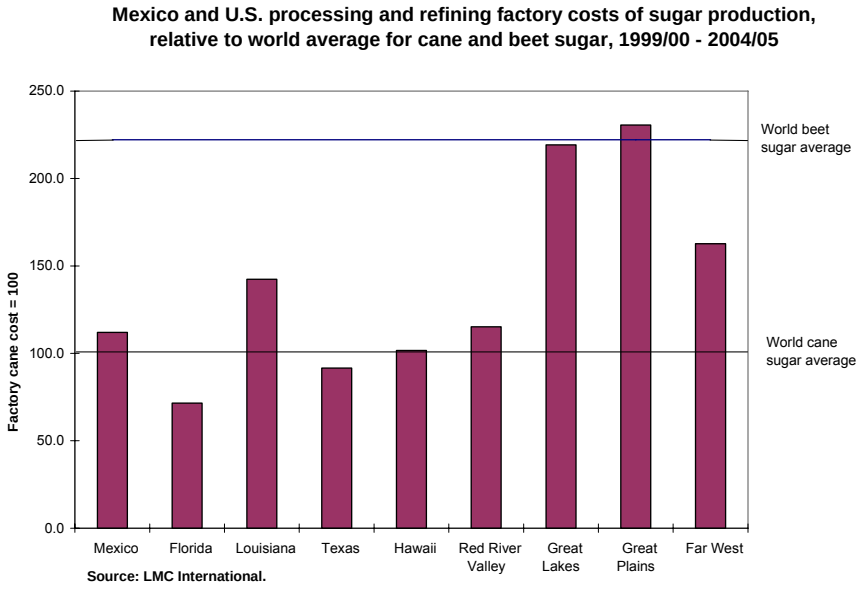


Figure 6 Mexico and US Processing and Refining Costs of Sugar Production Relative to World Average



Based on the two most recent agricultural censuses, in 2002 there were 5,027 farms producing sugar beets, almost exclusively in rotation with other crops. This represented close to a 29% decline in sugar beet producing farms since 1997 compared to a 12% decline in farms of all crops in these states. On an aggregate basis however, harvested beet acreage fell only 6% from 1997 to 2002 compared to a decline in 5% for all crop production in these states (USDA, NASS).

Alternatively, sugarcane production in the United States has grown in the recent past from an average of 27.7 million tons in the early 1980s to about 32 million tons in the 2000s brought about with increased acreage and yield. Most of this growth has taken place in Louisiana with production more than doubling. Production in Hawaii and Puerto Rico has been dramatically reduced, with Puerto Rican production falling from 15,759 tons in 1998 to zero today and Hawaiian production falling from 8.8 million tons in the first half on the 1980s to 2 million tons today (Haley, 2006). In 2002 there were 953 farms growing sugarcane in the United States, representing a 12% decline in the number of farms in 1997. This trend has been similar to the overall reduction in farms in these states except, with acreage in Texas being the exception. Texas has seen a 60% increase in sugarcane farms since 1997 while seeing a 10% reduction in its number of farms. Cane acreage overall has expanded during this period by about 10%. This increase

coincides with an increase in individual farm size of about 24%, averaging 825 acres in 1997 to 1027 acres in 2002. A map of displaying the relative harvests of sugarbeets and sugarcane at the county level for 2004 is given in figure 7 and figure 8.

Figure 7: Geographic Distribution of the US Sugarbeet Harvest

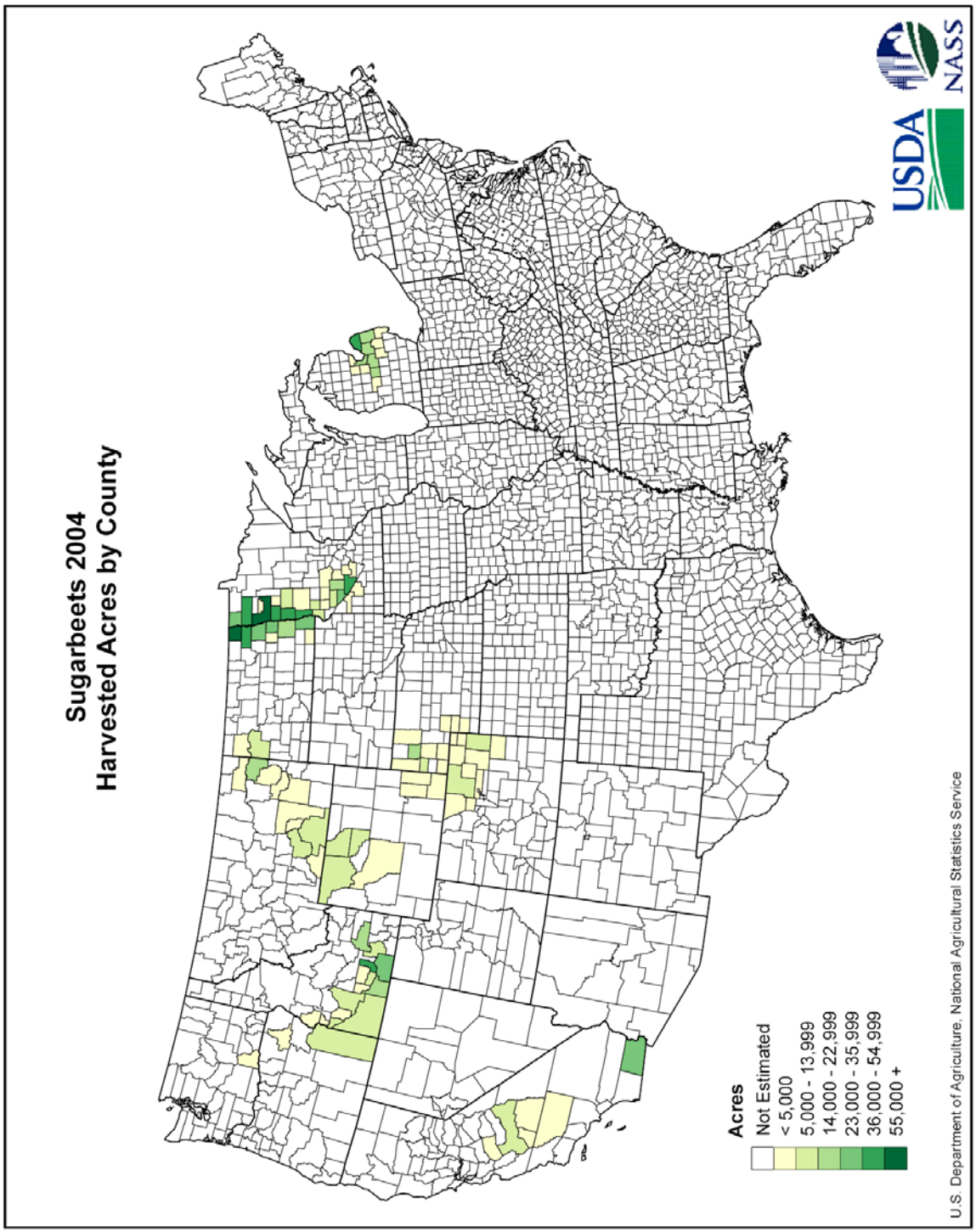
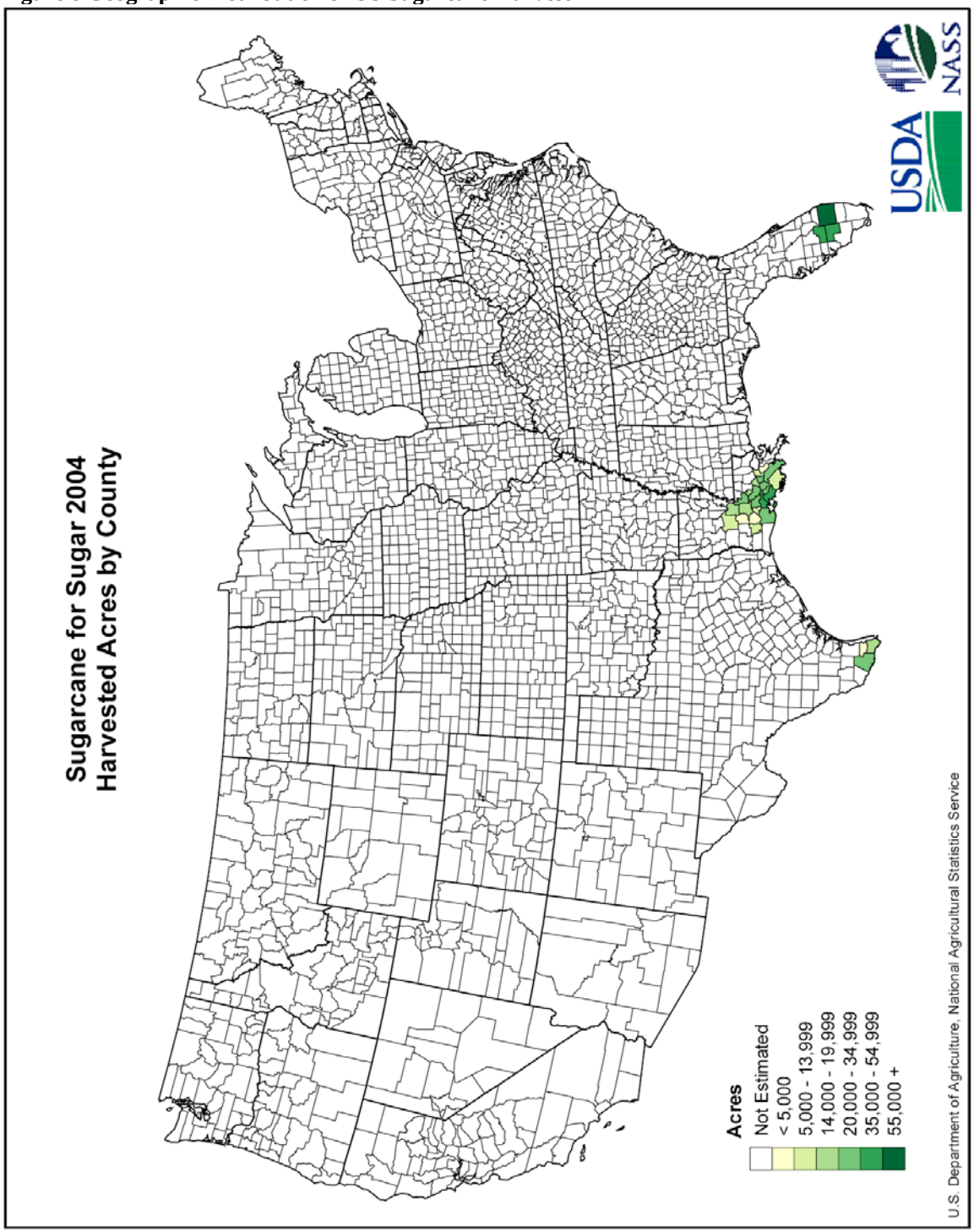


Figure 8 Geographic Distribution of US Sugarcane Harvest

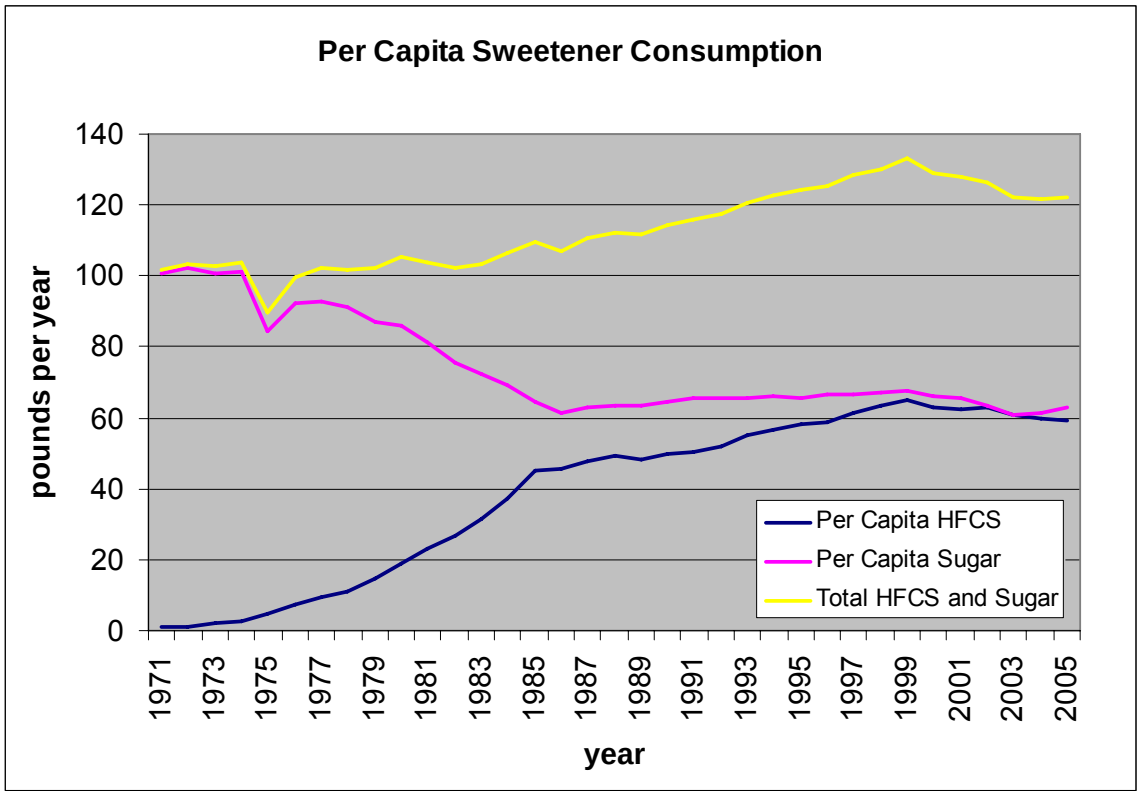


2.3ciii Trends in US Sugar and Sweetener Consumption

Per capita sweetener consumption in the US had been rising slowly but steadily since 1971, reaching its peak in 1999 at 133 pounds per year dry weight equivalent as

shown in figure 9. During this time HFCS has come to represent a larger share of sweetener consumption. Currently sweetener consumption in the US is roughly evenly divided between HFCS and sugar. The increased use of HFCS stemmed from reformulation of most soft drinks for HFCS use beginning in the mid-1970s.

Figure 9: Per Capita Sweetener Consumption in the US

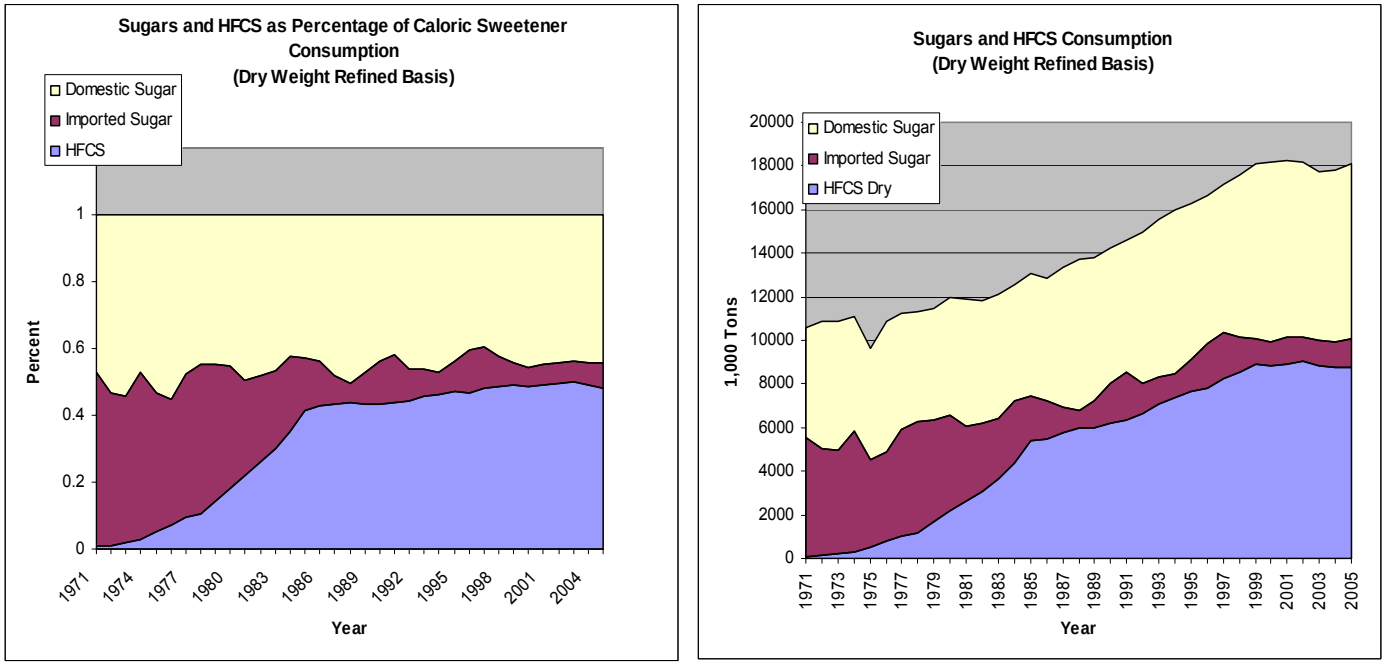


Source: USDA, ERS

Similar trends in caloric sweetener consumption can be seen on an aggregate national scale. Figure 10 shows a breakdown of sugar consumption by source, with sweetener consumption rising with population and higher incomes. This chart offers the additional insight of providing a breakdown by source of sugar, in terms of domestically and foreign produced sugar. Domestic sugar accounted for five million tons of consumption in 1971, this number has increased to approximately eight million tons in 2005. During this same time frame, foreign sugar has dropped from 5.4 million tons of consumption to 1.3 million tons. On a percentile basis these trends in sugar sourcing are even more pronounced. In 1971, for example, imported sugar accounted for 52% of

sweeteners consumed and domestically produced sugar accounted for 47%. In 2001, imported sugars grabbed only a 7% share of US sweetener consumption, while domestically grown sugar accounted for 44%. Essentially, the growth in the HFCS share of the market was pushed on to the foreign producer by U.S. policy.

Figure 10: Composition of US Sweetener Consumption

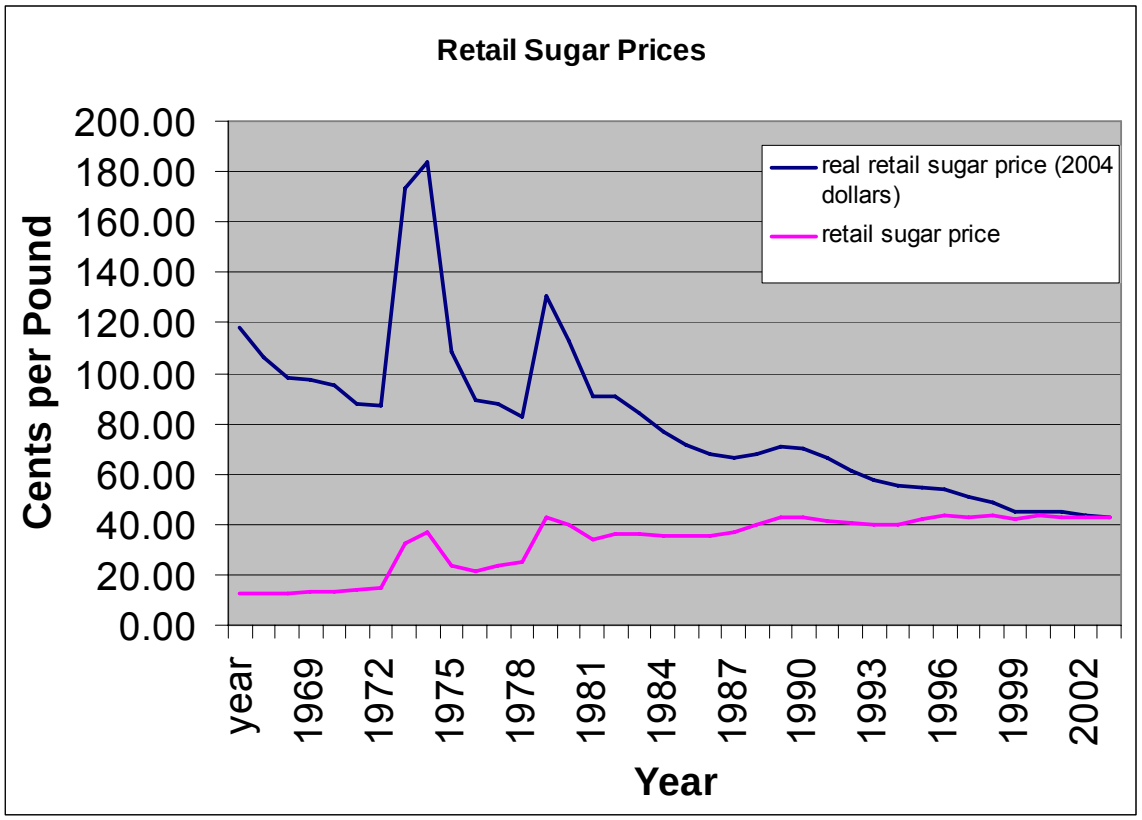


Source: USDA, ERS

Prices paid by consumes for sugar have risen only slightly in the last thirty five years while incomes have risen close to ten-fold. The result is that real retail prices for sugar are approximately one-third the prices paid in 1971 (figure 11). Empirical evidence suggests that sugar and sweeteners are normal goods with consumption increasing with incomes. As caloric foods, sugar and HFCS, are know to have adverse health affects when eaten in abundance and with little physical activity. Excessive consumption of sugar and HFCS has been linked to increased incidence of obesity and diabetes. As incomes rise, consumers become more aware of these negative health impacts and tend to adjust their diets accordingly. Thus beyond a certain income, sugar consumption is likely to remain relatively flat or even decrease in response to these negative health impacts (Haley correspondence). In the United States, sweeteners, and HFCS in particular are increasingly used in processed foods. These foods tend to be low cost and appeal to

consumers with lower incomes. As a relatively inexpensive product with limited substitutability demand for sugar is largely independent from price. Even during the price run-up of the early 1970s, where retail sugar prices more than doubled, sugar consumption only declined by about 10%.

Figure 11: US Retail Sugar Prices

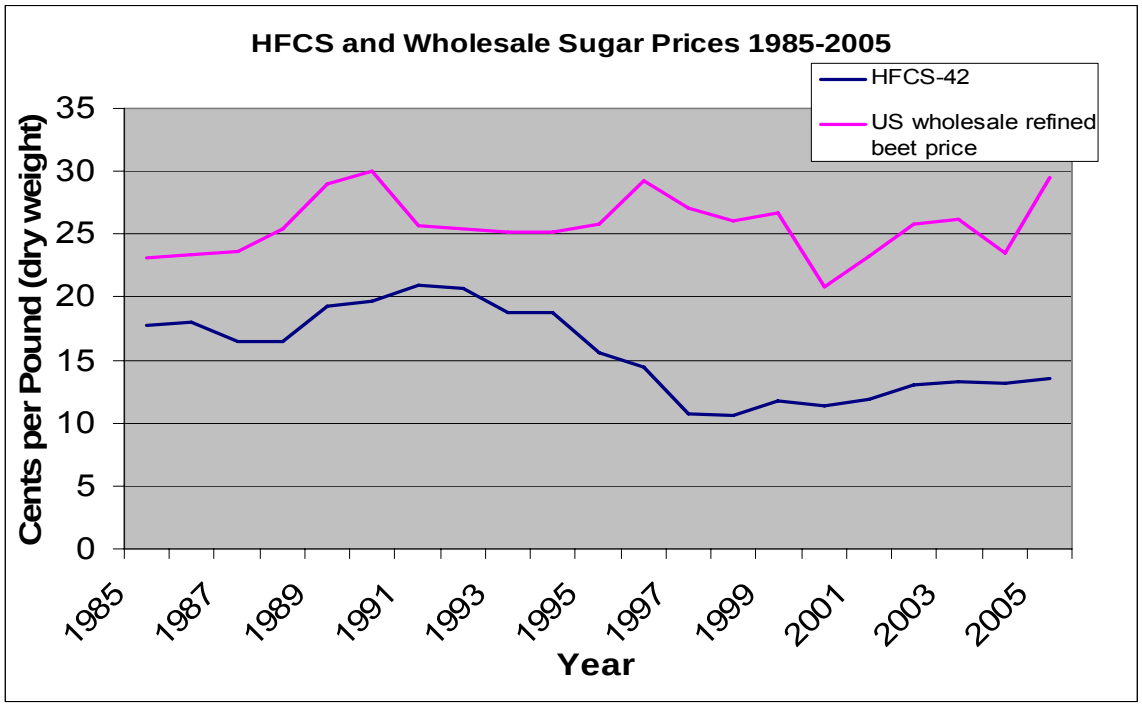


Source: USDA, ERS

HFCS competes with sugar for leadership in the US sweetener market. Currently, HFCS accounts for more than half of US sweetener output with approximately 75% of the entire HFCS supply going to the beverage industry (GAO, 2005). The price of HFCS-42, the corn sweetener used to impart mild sweetness, such as in canned fruits and condiments, peaked in 1992 at 20.9 cents per pound on a dry weight basis. By 1997, this price had dropped to 10.7 cents per pound. Partly because of this price advantage, HFCS production grew by more than 40% between 1992 to 1999, rising from 6.8 million tons dry weight to 9.5 million tons.

Industry analysts suggest that the prices of HFCS and sugar were closely related throughout the 1970s (Ruffalo, 2006). Then, HFCS producers used sugar price as an umbrella for their product. In the early 1980s the price gap between sugar and HFCS became high enough to encourage reformulation of soft drinks to HFCS. Almost all soft drink manufacturers made this switch by 1984 (Ruffalo, 2006). Largely because of this reformulation, US sugar consumption fell by about 35% between 1975 and 1985. During the 1980s, however, US consumption of HFCS was rising quickly and demand was close to production capacity. The 1994 signing of NAFTA (addressed more fully in section 2.4) made millers of HFCS optimistic about exports and production capacity was increased. Mexican barriers and taxes on soft drinks made with HFCS then made this impossible and the US market was left with a glut in supply. This glut meant that product was being pushed to market, capacity utilization dropped to a range between the mid-70th and low-80th percentile. HFCS prices dropped, and since then, have been largely independent of sugar prices (Ruffalo, 2006) (figure 12).

Figure 12: HFCS and Wholesale Sugar Prices



Source: USDA, ERS and GAO, 2000

2.4 Disparities and Discord in the World Sugar Market

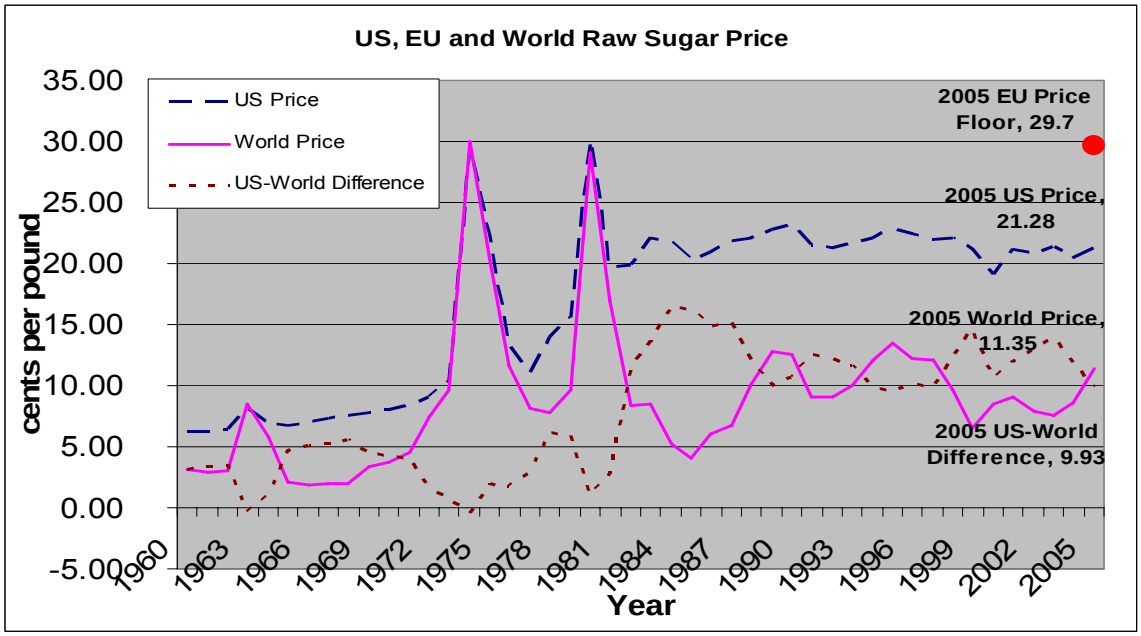
As discussed in sections 1.1 and 2.2, sugar has historically been among the few agricultural commodities that could be produced in both temperate and tropical climates, with developed and undeveloped economies potentially in direct competition with one another (Marks and Maskus, 1993). The substantial differences in costs of production among countries has made sugar one of the most heavily protected and controversial farm commodities. Thus, although it is no longer of strategic importance, sugar remains a highly politicized, internationally traded commodity. Additionally, because of some unique characteristics of the sugar industry, it brings several important general issues of the political economy of agriculture into sharp relief, and serves as a bellwether in agricultural negotiations. Sugar as a microcosm of agriculture is reflected in its high cost variations by nation and region, world market price volatility, high adjustment costs, and dynamic technical change in the industry (Marks and Maskus, 1993).

The world sugar market and the domestic markets of many OECD (Organization for economic Cooperation and Development) countries are among the most policy distorted markets of all commodities. The European Union, Japan, and the United States have traditionally been among the worst offenders. In 2003, for example, OECD producer support estimates (PSEs) for sugar were 63% for the EU(15), 41% for Japan, 61% for the US, and 56% for OECD as a whole (OECD, PSE/CSE database, 2004). Producers in the EU and the US receive between two and three times the world market price through TRQs on imports and production and baseline support prices established by the governments. The protections afforded to producers in OECD countries have meant foreign net imports into these countries have remained relatively stagnant over time and have actually declined as a percentage of total world imports.

The difference in the world raw sugar price and that of the US is shown in figure 13 for 1960-2005. Between 1990 and 2005, this difference has average just above 11.5 cents. EU prices for raw sugar offer a basis of comparison for prices in the US. Researchers instead typically use the intervention (base price) of the EU to gauge its price disparity with world markets. The intervention price, although set to decline under the 2005 reforms, is currently €497 per metric ton. On a cents per pound equivalent this would be roughly equal to 28.6 cents per pound using an exchange rate of $1.27 to €1.00.

This would put the minimum EU raw sugar price at 7.4 cents above the US price and 17.3 cents above the world price of raw sugar (figure 13).

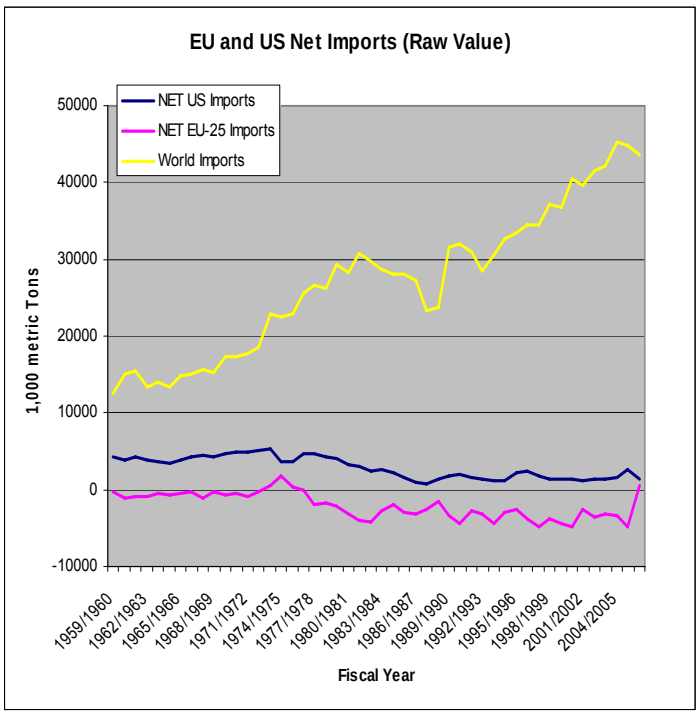
Figure 13: US, EU, and World Raw Sugar Price

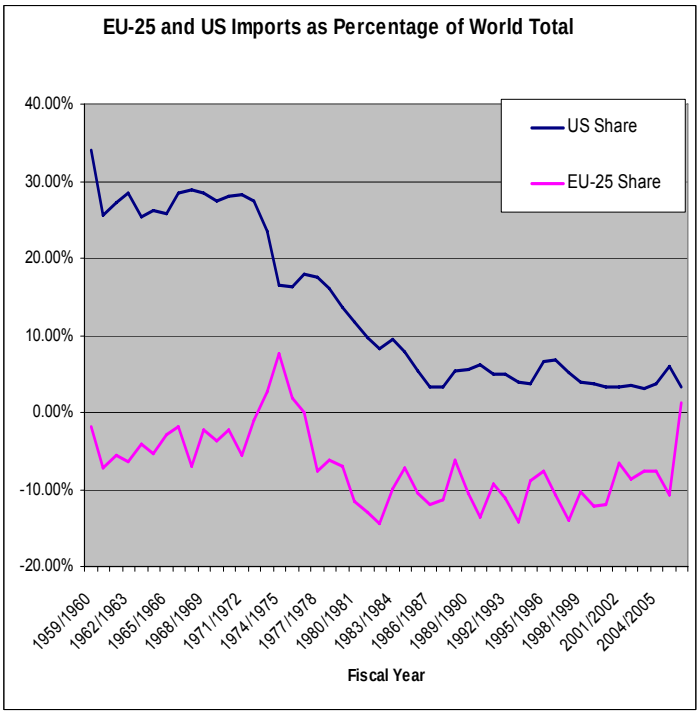


Source: USDA, ERS

Differing production costs in sugar have lead to price discrepancies in sugar markets that are enforced in part by government policies. Recognizing opportunity in these discrepancies, developing countries and low cost producers have pushed for more access in sugar markets of developed countries, with little avail. In the case of the EU and the US, preferential market access for sugar from developing countries has been granted on a limited basis. The EU grants preferential market access to African, Caribbean, Pacific countries (ACP), which are composed primarily of former colonies and under its Everything But Arms (EBA) initiative which grants unlimited market access to the world poorest countries. Similarly, the US grants market access through numerous bilateral preferential trade agreements and the Caribbean Basin Initiative (CBI). The US currently imports around 15% of its sugar consumption while it is estimated that the EU will be a net-importer of just over 20% after its reforms. Figure 14 shows graphically the declining share of the US and the EU in world imports.

Figure 14: US and EU Imports (Absolute Values and as Percentages of the World Total)





Source: USDA, ERS

Providing enhanced market access for agricultural commodities is one of the roles of the World Trade Organization. The WTO was formed in 1995 after the culmination of the Uruguay Round negotiations of the GATT (General Agreement on Tariffs and Trade), effectively replaced and expanded on the GATT. The WTO now acts as the primary vehicle to promote freer trade and resolve trade disputes under the guidelines of the GATT.

In July of 2003, Australia, Thailand and Brazil filed separate requests for the establishment of a panel in the WTO's dispute settlement body with respect to the EU's Common Market Organization (CMO) for sugar. The WTO panel ruled in favor of the plaintiff countries, upholding their assertion that the EU was subsidizing exports and depressing world prices, violating GATT commitments. In February 2006, the EU reformed its CMO for sugar to bring it in line with the rest of its Common Agricultural Policy (CAP). The reforms are significant, expected to result in a 39% reduction in institutional price after fully implemented in 2013 and speculated to reduce exports from 3.1 million mt to .4 million mt and expand imports from 2.3 million mt to 3.9 million mt

during this same timeframe (EU Commission, 2005). A more detailed examination of the EU reforms is given in chapter three.

The significant reforms of the EU regime, coupled with the role of sugar in the WTO negotiations leave the current price support scheme of the United States increasingly isolated and vulnerable to international pressure. In addition to the international pressure faced to reduce trade barriers and the associated economic distortions, there are additional pressures that are more unique to the United States. The most portending of these pressures is the North American Free Trade Agreement. NAFTA, which went into effect on January 1, 1994 established a free trade area between Canada, Mexico and the United States. In NAFTA, the provisions relating to trade in sugar with Mexico have significant implications for the US market.

In NAFTA sugar was insulated from some of the immediate impacts of free trade through a 15-year transition period for exports of Mexican sugar to the United States. During the 15-year transition period, Mexican exports of sugar to the US could not exceed its surplus production which would equal domestic sugar production less sugar consumption. Imports from Mexico would be duty free for a minimum of 7,258 metric tons. Additional quantities could be exported duty free to the US if Mexico had a production surplus over a two-year period. The original provisions specified that during the first six years of NAFTA however, duty-free access was capped at 25,000 metric tons. In year seven, however, the cap would be lifted to 150,000 metric tons and would increase 10% each consecutive year.

To secure congressional support for NAFTA, side letters were exchanged by the US and Mexican governments which modified some of the key sugar provisions in NAFTA (Haley, correspondence). The agreement postulated that Mexican sugar production would have to exceed Mexico's consumption of both sugar and HFCS for Mexico to be considered a net sugar producer, and thus be granted the additional American market access. Additionally, the side letter allowed for Mexican sugar imports of up to 250,000 metric tons during fiscal years 2001-2007 if its surplus producer status was defined in this manner. There was also a provision which allowed for the net surplus calculation to be adjusted for amounts by which projected surplus differed by actual surplus at the end of the marketing year. Subsequent to its signing, the Mexican

government has protested the validity of these side agreements, however, the US has implemented these provisions as being valid.

On January 1, 2002, Mexico protested the side letter by imposing a beverage tax of twenty percent on all beverages and syrups diluted to make beverages using any sweetener other than cane syrup. There was an additional tax of twenty percent on services used in the transport of these beverages and syrups. In Mexico, cane sugar is almost exclusively a domestic product, whereas before the tax, HFCS accounted for 99% of Mexico's sweetener imports, with almost all HFCS coming from the United States. Thus, by taxing soft drinks and syrups made with HFCS, but not those made with cane sugar, Mexico was discriminating against American imports.

The beverage tax had an immediate effect on HFCS. Prior to the imposition of the tax, soft drink bottlers were the primary consumers of HFCS in Mexico and were increasingly substituting HFCS as a cost-effective alternative to cane sugar. The beverage tax reversed this trend as its application made the use of HFCS in soft drinks and syrups cost prohibitive.

At the request of the US, the WTO established a panel to review the Mexican HFCS tax. The panel ruled with the US in finding that the HFCS tax was inconsistent with Mexico's WTO obligations. Mexico has since agreed to repeal the tax and by doing so will once again use American HFCS in its beverage industry.

For the future, the most important provision of NAFTA is a declining high tier tariff schedule for both raw and refined sugars which will drop to zero in 2008. At that time, Mexico will no longer be subject to the condition of surplus production. When this happens, the current no-cost to the federal government sugar program may become unsustainable as the US will no longer have absolute control over its imports. If domestic consumption of sugar in Mexico is displaced by cheaper HFCS from the US, sugar exports to the US will increase. This could cause stocks to accumulate at tax-payer cost with the current loan rate and program structure or require a change in the US price support program. Recent studies have been undertaken to estimate these costs. Critical to the interpretation of these studies is the level of displacement of Mexican sugar by HFCS and the related sugar coming to US markets which the ERS model places at 50% and 75%, although some estimates are much higher.

A paper titled "Sugar Policy Options and Consequences" for the American Farm Bureau Federation looks at program costs based on a low import and high import scenario of 218,000 and 1.355 million short on per year raw basis respectively. Using these scenarios, and a loan rate of 18 cents their model projects annual sugar expenditures of eight million dollars for the low import scenario and $175 million for the high import scenario. It is important to note the differences in these two studies. The AFBF study for example uses the FAPRI model for its US component and reports costs on an average annual basis for 2008-2015. The USDA, ERS simulation uses the USDA model and reports costs as a lump sum discounted over twelve years.

The Budget concerns of an unsustainable program coupled with the relative isolation of the sugar program after reforms to the US peanut and tobacco programs (discusses extensively in chapter three) and the role of sugar in trade negotiations leaves the current sugar price support program a potential target for reform. Additional free trade agreements (FTAs) with, Thailand and South Africa, granting them greater market access for sugar, could also jeopardize the sustainability of the current program. However, FTAs with Australia (AUSFTA 2005) and the Central American Countries (DR-CAFTA 2005) granted no increased access to Australia and only limited increases to DR-CAFTA member countries.

The US sugar program is currently compliant with GATT commitments, though it will likely face increased pressure in the future. US sugar policy is gauged in WTO negotiations by its share of the Aggregate Measure of Support (AMS) and its assigned TRQ. The AMS for sugar is calculated from the difference between the US support price and a world reference price (about 10 cents per pound) multiplied by US production. This puts sugar's share of the AMS at $1.1 billion annually (Roney, correspondence). Under WTO rules, domestic supports by all subsidies other than export contingent ones, are divided into three categories or "boxes". Subsidies that fall into the "amber box" are restricted by upper limits on the total amount conferred on all commodities with no product-specific caps. The amounts of permissible "green box" and "blue box" subsidies are not limited by the Agriculture Agreement (Sumner 2005).

Table 6 AMS Calculations for the US

AMS Calculations ($ millions)							
	2000	2001	2002	2003	2004	2005	2006
AMS calculations based on US notifications to the WTO	16,082	14,413	14,007	9,497	7,018	13,385	13,291
AMS calculations adjusted for the WTO cotton ruling	29,148	25,341	14,007	9,497	7,018	13,385	26,341

Source: Sumner, 2005

Amber box policies, are those considered to affect production and distort trade such as price supports, input subsidies, and subsidies linked to prices or production. The amber box AMS for the US is capped at $19.1 billion. The sugar price support policies of the US are said to fall under the amber box. Based on notifications to the WTO, the US has been well under its $19.1 billion cap on amber box AMS. However, a 2005 study by Sumner suggests that under a reasonable interpretation of AMS rules, put forward under the WTO cotton ruling, the US may have been well in excess of its cap in 2000, 2001, and 2006 (Table 6) [5].

Although stalled, the Doha Round WTO negotiations have expressed the intention of reducing the amber box AMS. A 2005 proposal for example called for a 60% cut in the total amber box limit and product specific AMS caps based on 1999-2001 levels. A 60% cut in the AMS cap would push that of the US down to $7.6 billion. This action coupled with product-specific caps would require significant cuts in domestic supports to which the US sugar program may be vulnerable. Additionally, the minimum TRQ for sugar could be negotiated higher, increasing imports. Discussions for these reforms will likely take place in the context of the 2007 farm bill.

[5] In September 2004 a dispute settlement panel in Geneva found US subsidy programs of upland cotton violated US WTO commitments. In March of 2005, the WTO's appellate body upheld the panels finding. Brazil, the plaintiff party in the dispute, has insisted on $1 billion in trade retaliation unless the US fully adopts the decisions of the appellate body. Specifically, the appellate body found that certain programs the US asserted were "green box" permitted, namely, production flexibility contract payments and direct payments, were in fact more than minimally trade distorting and thus granted support to cotton. By prohibiting production of fruits and vegetables on land eligible for payments, the appellate body affirmed that the program likely stimulated cotton production. If these payments were moved into the amber box, the US would have been in excess of its WTO commitments in 2000, 2001, and 2006.

2.5 Recent Price Shocks and Emerging Issues in Sugar and Sweetener Markets

Several recent developments are likely to influence any debate on sugar policy. Chief among these developments are ethanol and hurricane Katrina. Particularly relevant in this debate is what role the US sugar industry will play in ethanol production, if any. The agricultural lobby has long been a strong supporter of ethanol, deriving great benefit from its use. Katrina, the disastrous hurricane that made landfall in late summer of 2005 laid waste to much sugar acreage. Compensation and support for the industry in light of this disaster will likely be a politically attractive during the 2007 farm bill debate.

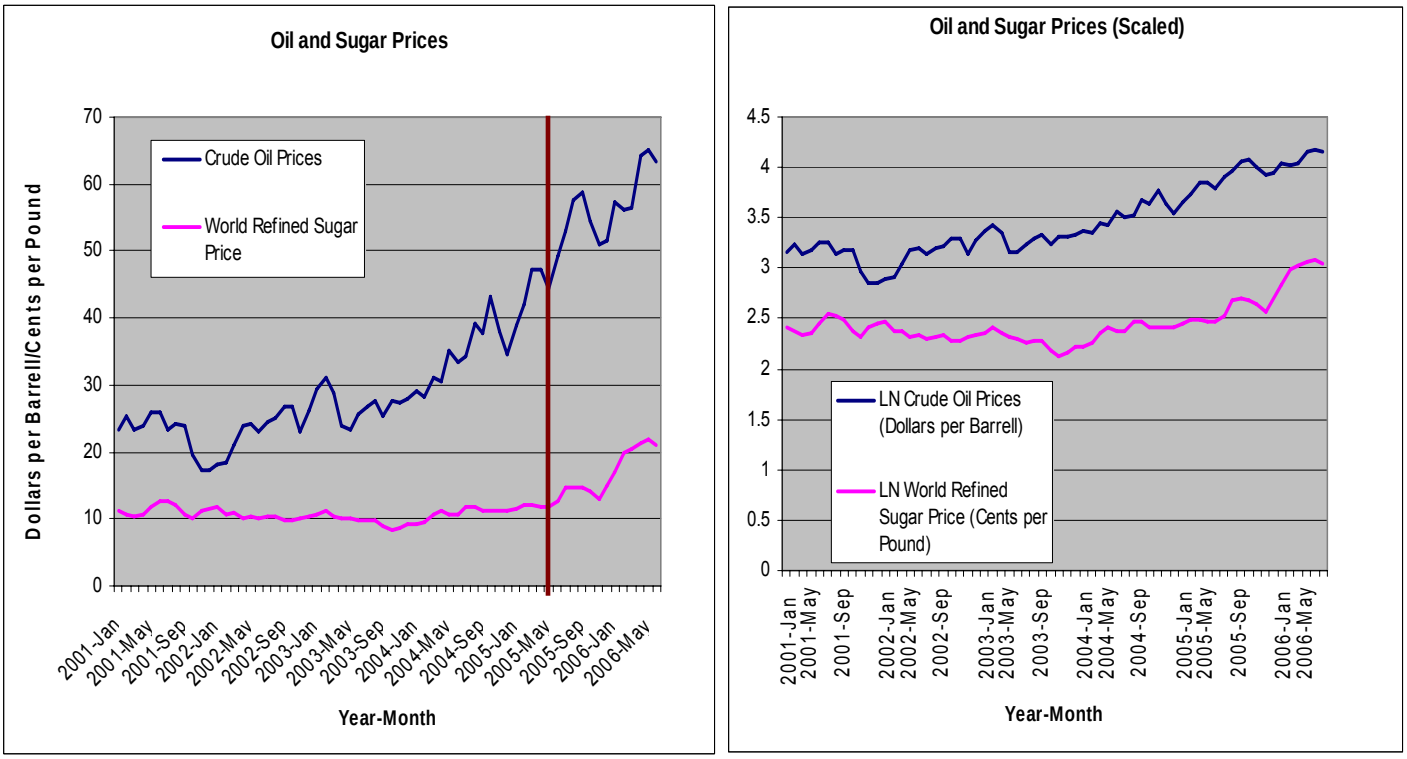
High oil prices have lead to a renewed interest in alternative fuels. Chief among these alternatives is ethanol, C_2H_5O, a clear, colorless, combustible, hydrocarbon which can be used as a high octane fuel, or as a gasoline additive and extender. Ethanol's popularity is due in part to being a home grown commodity, unlike fossil fuels of which over 50% of supply currently comes from non-domestic sources. High oil prices and technological advancements in processing have made ethanol use increasingly cost-competitive with oil. Ethanol is currently produced at the industrial level from plant starches. In the US the primary feedstock is corn while in the Brazil, sugar is used. The emergence of a sizable ethanol industry has meant that the value of these commodities is now closely tied to the price of oil. This discussion will focus on the role of sugar in ethanol production.

After the Asian financial crisis ended in late 1999, world oil prices began a rise that has continued through today. The growth of the economies of China and in Southeast Asia has pushed prices from approximately $20/barrel in January of 2001 to $70/barrel in August of 2005. These price increases have been aggravated by few discoveries of new large oil fields, geopolitical conflict in Iraq and elsewhere, and natural disaster. In September of 2005, hurricane Katrina hit the gulf coast of the United States. Aside from the devastating affects on the city of New Orleans, Katrina destroyed much of the energy infrastructure of the gulf, crippled shipments from Gulf Ports, and leveled significant agricultural acreage, particularly sugar. This had a two pronged affect on world sugar prices; it lay waste to significant sugar acreage in Louisiana and diverted sugar to production of ethanol because of the resulting higher oil prices. The reduced supply and increased demand, ultimately caused prices to increase. The exact sugarcane

acreage destroyed in Louisiana is difficult to determine because Louisiana had several years of sub-optimal growing conditions and was hit by Rita after Katrina. Louisiana production peaked at 1.68 million short tons in 1999/2000 and was down to 1.2 million short tons after Katrina. The USDA had predicted a crop of 1.4 million short tons before the hurricanes (Roney, correspondence).

Although commodities historically have tended to go through bullish and bearish cycles together, the close relationship between world oil prices and world sugar prices is a new phenomenon. The link is found in ethanol with corn and sugar being the primary feedstocks for its production. This relationship can be observed in figure 15.

Figure 15: Price Trends in Oil and Sugar



Source: USDA, ERS and USDOE, EIA

Currently in the US, the dominant role of ethanol has been that of a fuel oxygenate, which is used to replace lead from gasoline. Methyl Tertiary Butyl Ether (MTBE) has been used for this purpose since 1979, though it has also been found to be a groundwater pollutant (Shapouri and Salassi 2006). As prices for petroleum have surged in recent years, there has been more interest in ethanol as a substitute for oil. With the

emerging economies and affluence of India and China driving higher fuel prices, the demand for ethanol in the United States is expected to increase dramatically over the next ten to twenty years (DOE, 2007).

Current technological and financial constraints have limited ethanol production on a commercial scale to using carbohydrates such as sugar and starch as a feedstock. This feedstock is then converted to ethanol by fermentation using yeast or some other organism. Starch and sugars do however have economic value for other uses such as food or animal feed. As an alternative, cellulosic ethanol production, which uses the carbohydrates found in plant cell walls, is being developed though is not yet at a commercial scale. In 2005 the world production of ethanol was estimated at about 12 billion gallons (Renewable Fuels Association, 2006). The United States and Brazil are the major producers of ethanol in the world, each producing about 35% of global production.

In 1970, approximately 80% of the Brazilian sugarcane crop was processed into food. However, beginning in 1975, Brazil began a large ethanol production program to insulate itself from the high oil prices at the time. The program received much criticism when oil prices fell and was scaled back in the early 1990s. Currently, most Brazilian plants have the capacity to make refined sugar for food or ethanol, giving the producers flexibility to respond to the markets. For 2006/07 it is projected that Brazil will use 53% of its sugarcane production to produce ethanol (F.O. Licht 2006).

American ethanol production has been increasing in recent years, producing 3.9 billion gallons of ethanol in 2005, up from 3.4 billion gallons in 2004. Corn is the primary feedstock in US ethanol production, accounting for 97% of the total. In 1990, congress passed the Clean Air Act Amendments which mandated that certain regions must use oxygenated, reformulated gasoline during high smog months, and that a certain percentage of these oxygenates must be derived from renewable sources such as corn. This legislation provided tax incentives of about $0.54 per gallon for ethanol blended with gasoline at a 10% rate (Mitchell 2004). Additional regulations such as the Energy Policy Act of 1992 and the Energy Conservation Reauthorization Act of 1998, significantly increased the demand for ethanol in the 1990's. More recently, the phasing out of MTBE, the Farm Security and Rural Investment Act of 2002, and the Energy

Policy Act of 2005 along with the escalating price of oil have sharply expanded the demand for ethanol. USDA points out that it took twenty years for the ethanol industry to reach 1.6 billion gallons in 2000, but took only five more years for the industry to reach 3.9 billion gallons of production (Shapouri and Salassi, 2006).

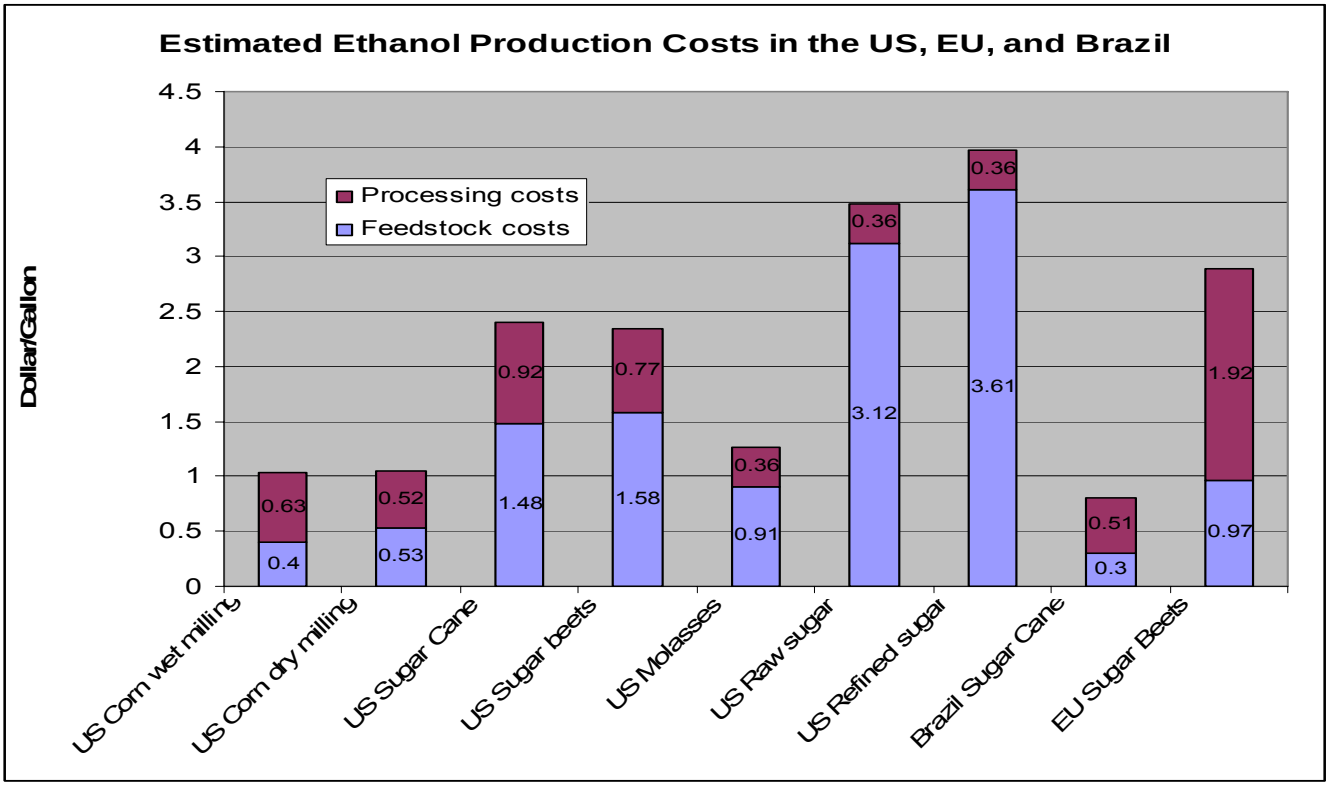
The 2005 Energy Policy Act requires renewable fuels to be utilized at a minimum of 4 billion gallons by 2006 and 7.5 billion by 2012. Ethanol production has been project at 5 billion gallons in 2006 and well above 7.5 billion by 2012 (Shapouri and Salassi, 2006).

A July 2006 report "The Economic Feasibility of Ethanol Production from Sugar in the United States" was released by the USDA with the intent of evaluating the potential of the sugar beet and sugarcane in ethanol production in the US. The study found that the higher processing costs and feedstock costs for cane and beets made ethanol production from sugar less competitive in general than ethanol production from corn in the United States. However, the study found that ethanol production from molasses, a byproduct of sugar refining, is cost competitive with corn based ethanol. Given the high ethanol prices in mid 2006, ethanol production from cane and beets is profitable. However, ethanol prices are expected to moderate, which could reduce the profitability of ethanol derived from sugar. Additionally, feedstock costs reported in this study have a skewed reflection of their true production costs. For example, in the US corn production is subsidized while sugar prices are artificially inflated, rendering feedstock costs for corn and sugar, higher and lower respectively, in relation to their true costs.

Ethanol production costs in Brazil and the US at prevailing feedstock prices are presented in figure 16. Brazil's competitiveness in ethanol production is interesting to note. Compared with US ethanol using sugarcane as a feedstock, Brazilian ethanol production is one-third the cost. The substantially lower cost of cane in Brazil is only part of this disparity. With a well developed, sugar based, ethanol production infrastructure, similar to corn based ethanol production in the US, Brazil is able to take advantage of economies of scale in ethanol production. This is manifested in its low processing costs. If the US was to pursue sugar based ethanol production, it is likely the processing costs would fall. However, it is unlikely the US could ever match Brazil's

cost competitiveness in production of sugarcane as a feedstock and cane based ethanol production as a whole particularly if sugar prices were kept high through government policy. Protecting US ethanol producers, and increasing consumer costs, is a tariff on foreign ethanol of 54 cents per gallon. Without such a tariff it is possible that low cost producers such as Brazil would reach a significant share of US markets.

Figure 16: Composition of Production Costs for Ethanol



-Excludes capital costs.
- Feedstock costs for U.S. corn wet and dry milling are net feedstock costs; feedstock costs for U.S. sugarcane and sugar beets are gross feedstock costs.
- Excludes transportation costs.
-Average of published estimates.
Source: USDA, ERS

Chapter 3: Insights from Recent Commodity Program Reforms

With the push for freer and more open agricultural markets many commodity programs have been reformed in the recent years. It is likely that these reforms will render the US sugar program increasingly anachronistic and further isolated. Chapter 3 will look at these reforms as sources of insight into what variety of change will confront the US sugar program and how these challenges can be met. For the US this will be presented in the context of policy reform for all of agriculture in light of recent and upcoming farm bills. Particular attention will be given to the changes to the peanut and tobacco programs in the US.

First, the recent reforms of the EU sugar sector, introduced in brief in chapter 2, will be discussed more thoroughly in this chapter. These reforms are substantial and offer an interesting example into how economic incentives and industry financing can make a buyout of such magnitude feasible.

3.1 The 2006 Reforms of the European Sugar Regime

The Common Agricultural Policy for the European sugar regime was established in 1968. Traditionally, the CAP for sugar relied on a combination of institutional support prices, import levies, subsidized exports, production quotas, and production controls on corn syrup. Under the former regime, "A" quota sugar received the highest price, the intervention price net of a 2% production levy while "B" quota sugar received the intervention price net of a levy up to 39.5%. Both "A" and "B" quota sugar were produced primarily for domestic consumption. Production within these quotas that was not consumed domestically was exported with subsidy onto the world market. Sugar produced above quota levels was known as "C" sugar and was exported onto the world market without direct subsidies. The EU has also imported quantities of sugar from the African-Caribbean-Pacific group under its Special Preferential Sugar program. This sugar was historically imported for domestic consumption or for re-export with subsidy. With these sugar policies, the EU became one of the largest exporters of sugar in the world. Prior to the 2006 reforms to the EU sugar regime, the EU accounted for 20% of the world sugar exports and 14% of total world sugar production. Before these reforms,

there was a general consensus that the policies of the EU depressed the world sugar market (Poonyth et al., 2000).

Sugar beet growing in the EU covers 1.8 million hectares in the EC-15[6], which is 1.2% of utilized agricultural area and amounts to 1.6-1.8% of its agricultural production. Sugar beet is grown on approximately 230,000 farms, alongside other crops. In general, sugar beet holdings are larger than average farms, averaging 70 hectares. Data from the Farm Accounting Data Network (FADN) of the EU indicates that the income per annual agricultural work unit is 1.7 times higher on sugar beet holdings than the EU average.

3.1a The Case against the EU Sugar Regime

In July of 2003 the permanent missions of Australia, Thailand, and Brazil filed separate requests for the establishment of a panel to the dispute settlement body of the WTO with respect to the European Union's common market organization for sugar. All three requests were the result of unsuccessful dispute resolutions between these complainant countries and the EU taking place in November of 2002 concerning the international commitments of the EU under the GATT. Although the three complainant countries drafted their panel requests using slightly different terms, each of the complaining parties' panel requests had identified essentially the same measures. The plaintiff countries argued that the EU was violating its WTO agreements, specifically the Agreement on Agriculture and the Agreement on Subsidies and Countervailing Measures. Under the former regime, Australia estimated that the EU was providing about €1.3 billion annually on sugar export subsidies and in doing so artificially depresses world prices (WTO, 2005).

3.1b The WTO Panel Ruling

An initial ruling was made, which was upheld by the Appellate Body of the WTO in October of 2004 which ruled in favor of the complainant countries. The panel held that the EU-25[7] re-exporting of sugar from the ACP countries of 1.6 million metric tons

[6] The EC15 is composed of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom

[7] The EU-25 countries include those from the EU-15 as well as Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia

must be counted against the EU's export subsidy commitments made as part of the Uruguay Round Agreement on Agriculture (URAA). The EU had initially argued that a footnote in their schedule granted an exemption for subsidies on exports of EU sugar that had originally been from the India/ACP group, however, the ruling of the panel means this carve-out was never valid. Upon the release of the Appellate Body's decision in April 2005, the EU issued a statement that "the Appellate Body's reading implies that the EU agreed to reduce its subsidized exports of sugar by 72% rather than 21%...."(McGivern, 2005). In accordance with these findings, the EU had exported 2,823,500 tons in excess of its agreed 1,273,500 metric tons per annum and had exceeded its budgetary outlay for exports of €499 million in the marketing year 2000/2001.

Additionally, the panel ruled that the EU's export of C-sugar (above-quota sugar for export onto the world market) is cross subsidized by the high guaranteed prices for A and B quota sugar and therefore should fall under the URAA commitments. The panel said that there was "no doubt that, without the highly remunerative prices guaranteed by the EU sugar regime for A and B beet, sales of C beet could not take place profitably at a price below the total cost of production" (WTO, 2005). Under the regime, A & B quota sugar was effectively used to pay farmer's fixed costs while sugar produced for the world market need only cover variable costs (Poonyth et al., 2000).

By subsidizing exports in excess of its schedule commitments, the EU violated Article 3.3 of the Agreement on Agriculture. Additionally, re-export of ACP/India sugar fell, in opinion of the panel, under the definition of export subsidy laid out in Article 9.1 in the Agreement.

3.1c Changes to the EU Sugar Regime

On February 20, 2006 three EU council regulations were approved to bring the EU CMO for sugar in line with its international commitments, and in line with the rest of the Common Agricultural Policy of the EU. The three expressed issues of focus for regime change are (Commission of the European Communities, 2005):

- A sustainable long-term policy perspective for the EU sugar sector
- Environmental and socially acceptable competitiveness for the EU sugar sector
- Keeping the EU in line with its international commitments

These three goals are addressed by three legal instruments, EU Council Regulations (EC) 318/2006, (EC) 319/2006, and (EC) 320/2006. Additionally, the EU has suggested future regulations to provide compensation to the ACP countries adversely affected by these changes, though none has been finalized. In the past, CMOs have been reevaluated every five years, however, this new plan will remain in place through 2014/2015 marketing year with no requirement for an interim review. This is meant to impart some long term stability to the regime.

3.1ci On the Common Organization of Markets in the Sugar Sector (EC) 318/2006

Under (EC) 318 the council addresses issues related to duration of the new sugar regime, pricing issues and quotas, market balance tools, measures related to non-food uses of sugar and international commitments. Changes to the CMO are designed to induce inefficient producers to exit the market while allowing efficient producers to increase market share, with the intended outcome being a net reduction in domestic sugar production and exports.

pricing

To move the sugar regime away from the public intervention mechanism the past intervention price has been abolished and replaced with a new reference price. This sugar price is reduced by 36% over a four year period starting in 2006/07 (table 7). This new price also serves as the trigger level for private storage.

Table 7: Declining Reference Price Schedule Under the EU Reforms

Euros per metric ton	2006/2007	2007/2008	2008/2009	2009/2010
White Sugar	631.9	631.9	541.5	404.4
Raw Sugar	496.8	496.8	448.8	335.2

In addition, the minimum beet price has been reduced by 39.5% and has been calculated in line with the reference price cuts, net of a restructuring amount (table 8). The reduction in prices, coupled with the graduated reduction in restructuring incentives is intended to encourage less competitive producers to leave the industry.

Table 8: Declining Beet Price Schedule Under the EU Reforms

Euros per ton	2006/2007	2007/2008	2008/2009	2009/2010
Price	32.86	29.78	27.83	26.29

quota reform

Coupled with changes to the pricing structure, quota reform is also an important tenet in the reform of the sugar CMO. Quota reform involves simplifying the formula by merging "A" and "B" quotas into a single quota. Under the regulation, this new quota is set equal to the allocated "A" and "B" of 2005/06. Additional quotas have also been allocated to member states and can be requested until September 2007 by any sugar processor operating in that state. This additional quota allocation will be levied through a one-off amount of €730/ton. Totaling 1.1 million metric tons for the entire EU, this additional amount is designed to maintain a certain production in the current C-sugar producing countries which are most efficient. The allotted quotas by member state including additional quota for which producers are allowed to purchase are displayed in table 9.

Table 9: New Quota Allotments Under the EU Reforms

Metric Tons	*Belgium*	*Czech Republic*	*Denmark*	*Germany*	*Greece*	*Spain*
Sugar	819,812	454,862	420,746	3,416,896	317,502	996,961
Isoglucose	71,592	-	-	35,389	12,893	82,579
Inulin Syrup	215,247	-	-	-	-	-
Additional	62,489	20,070	31,720	238,560	10,000	10,000

Metric Tons	*France (metropolitan)*	*French Overseas Departments*	*Ireland*	*Italy*	*Latvia*	*Lithuania*
Sugar	3,288,747	480,245	199,260	1,557,443	66,505	103,010
Isoglucose	19,846	-	-	20,302	-	-
Inulin Syrup	24,521	-	-	-	-	-
Additional	351,695	-	10,000	10,000	10,000	8,985

Metric Tons	*Hungary*	*Netherlands*	*Austria*	*Poland*	*Portugal (mainland)*	*Azores*
Sugar	401,684	864,560	387,326	1,671,926	69,718	9,953
Isoglucose	137,627	9,099	-	26,781	9,917	-
Inulin Syrup	-	80,950	-	-	-	-
Additional	10,000	66,875	18,486	100,551	10,000	-

Metric Tons	*Slovakia*	*Slovenia*	*Finland*	*Sweden*	*United Kingdom*
Sugar	207,432	52,973	146,087	368,262	1,138,627
Isoglucose	42,547	-	11,872	-	27,237
Inulin Syrup	-	-	-	-	-
Additional	10,000	10,000	10,000	17,722	82,847

Because of the close economic relationship between sugar and high fructose corn syrup (HFCS), known as isoglucose in Europe, price reductions in sugar will also have an impact on the EU HFCS sector. To this end, the commission has implemented an increase of HFCS quotas by 300,000 metric tons, 100,000 tons per year for three years, starting in 2006/07. Italy, Lithuania, and Sweden have the option of purchasing additional HFCS quota.

During the restructuring period, no compulsory quota reductions will be applied. Nevertheless, there will be a decrease of subsidized exports and production is expected to decrease, with market balance being reached by the restructuring scheme and the available market balance tools. If, at the end of the restructuring scheme, the EU has not achieved the necessary reductions in subsidized production, mandatory quota cuts will be applied. These quota cuts would be applied on the basis of a flat-rate percentage cut in the total quota of each member state. To date, the reforms appear to be having the desired effect of reducing production.

market balance tools and surplus production

To avoid surplus production a levy will be imposed, at sufficiently high levels, to discourage above-quota production. For purposes of market balance, the commission has allowed for carry-forward and withdrawal mechanisms as well as private storage. These mechanisms allows for sugar processors to carry over-quota production to the following market year to avoid the prohibitive super duty charged on this production and to preserve the structural balance of the market at a price level which is close to the reference price. Beginning in 2007/08, a production charge of €12/ton will be levied on quota sugar and €6/ton on HFCS. Processors may require beet and cane growers to bear up to 50% of this cost. Additionally, the refining aid of €29.2 metric ton under the old regime has been eliminated.

In line with the rest of the price cuts, the minimum prices paid for ACP and EBA imports into the EU will be cut over a four year period. The pricing schedule for these imports appears in table 10.

Table 10: Schedule of Declining Prices Paid to ACP and EBA Countries Under the EU Reforms

€ per metric ton	ACP	EBA
Current regime	523.7	
2006/07	496.8	496.8
2007/08	496.8	496.8
2008/09	434.1	434.1
2009/10	335	335

In accordance with Everything But Arms (EBA) initiative, starting in 2006/07, the high-tier tariff on sugar from the EBA countries will be reduced, declining to zero by 2009/10. When the tariff is completely eliminated, EBA market access will be unlimited. It is important to note that the tariff of €339/ton may still be applied to non-preferential sugar imports. Imports made at a level below the WTO "trigger price" are also subject to an additional import duty.

industrial uses

Sugar destined for non-food use such as in the chemical and pharmaceutical industries are largely exempt from the changes to the EU sugar regime. First, industrial use sugar is exempt from quota restrictions and these sugars may receive a production refund if sugar is not available at the world price. Furthermore, sugar beets cultivated as a non-food crop may be eligible for the energy crop aid of €45/hectare.

3.1cii Measures for the Restructuring of the EU Sugar Sector (EC) 320/2006

Under the reforms, the commission established regulations for a new voluntary and temporary restructuring scheme for the EU sugar sector to take place between 2006/07-2009/10. Under the restructuring scheme, incentives are provided, in the form of diminishing payouts to sugar processors coupled with decreased prices, for less competitive processors to leave the industry. Additionally, funds are provided to ease social and environmental transitions involved in the restructuring. Lastly, the restructuring scheme acknowledges the potentially severe impacts to the sugar sector in high cost regions by providing them with additional funding. Processors who choose to keep their quota will be forced to pay into the restructuring fund during the restructuring period.

aid to outgoing processors

Under the restructuring scheme, aid is made available to any sugar processor between the marketing years 2006/07 and 2009/10 if it renounces its assigned quotas. At

least 10% of this aid must be reserved for growers of beet, cane and chicory who delivered their product to the closing factory. The amount of restructuring aid made available depends on when the processors exits the sector (table 11) and on the following three scenarios:

1. The factory is completely dismantled
2. The factory is partially dismantled and completely unused for sugar refinement
3. Or, the factory is simply unused

Table 11: Restructuring Aid Available to Processors Under the EU Reforms

Marketing Year	Scenario 1	Scenario 2	Scenario 3
2006/2007	730	547.5	255.5
2007/2008	730	547.5	255.5
2008/2009	625	468.75	218.75
2009/2010	520	390	182

regional diversification aid

Diversification aid for nations adversely affected by the decrease in sugar production is also provided for under the new regime. This aid is granted in relation to sugar quota renounced by processors in that country.

Table 12: Maximum Diversification Aid Available Under the EU Reforms

Euros per ton	2006/2007	2007/2008	2008/2009	2009/2010
Diversification Aid	109.5	109.5	93.8	78

The amount of available aid to a member state is scheduled to increase by 50% once 50% of allocated quota has been renounced. An additional 25% of diversification aid will be available at a 75% quota reduction with aid a doubling of original aid once the quota has been completely surrendered. Transitional aid has also been granted to full time refiners in the U.K., Portugal, France and Slovenia to help them adapt to industry restructuring.

aid financing

Those processors who choose to keep their quota will be forced to pay into the restructuring scheme to help in offsetting the costs of payments to outgoing producers.

The payments of quota holders for HFCS will be half those of sugar quota holders (table 13).

Euros per ton	*2006/07*	*2007/08*	*2008/09*
Sugar/Inulin Payment	126.40	173.80	113.30
HFCS Payment	63.2	86.9	56.65

Table 13: Payments Required for Retention of Quota Under the EU Reforms

3.1ciii Measures for the Direct Income Support for Sugar Beet Producers (EC) 319/2006

decoupled payments

Because the institutional support price for EU sugar is reduced significantly, measures have been taken under the reforms, to accommodate farmers by providing them with direct income support to compensate for their financial loss. Under the reforms, the payments to beet farmers have been brought in line with the direct support schemes under the CAP. During the restructuring period, income support for beet farmers is increased in parallel with the reduction in market supports. To steer production towards the needs of the markets and the demands of the consumers, the link between production and subsidy has been severed, yielding a decoupled "single farm payment". These new payments will be linked to environmental, food safety and animal welfare standards as highlighted in (EC) 1782/2003, the common rules for direct support schemes under CAP.

farmer compensation

Under the new regime, income support for farmers averages 64.2% of the price cut with monies being distributed through national envelopes based on historical production. Income support is linked to the farmer and not to the land on which the product was grown. Thus, payments are non-transferable except in the case of inheritance. In countries where at least 50% of quota is renounced, an additional coupled payment of 30% of the income loss, for a maximum of five years, may be made. These member states may also be eligible for additional national aid. Under the reform, income support for beet growers may be made in perpetuity, with no termination date set.

3.1d Budgetary Impact of the Sugar Reform

It is estimated that the costs of the new measures proposed for the sugar sector, for which the direct decoupled payment to farmers represents the major element, will be mainly offset by the savings resulting from a substantial reduction in export refund expenditures and the abolition of the refining aid. When the proposed measures for the sector have been fully implemented, the envelopes for direct income support will involve an annual cost of approximately €1.542 billion (Commission of the European Communities, 2005).

With regard to the restructuring scheme, the restructuring amount charged to producers keeping their quota will be assigned to a restructuring fund. An amount of approximately €4.225 billion will be charge over the marketing years 2006/07-2008/089 and will be made available as aid for the four marketing years between 2006/07-2009/10.

3.1e Impact Assessment of Change to the EU Sugar Regime

The impact of the changes to the EU sugar regime will be widespread and affect many economic actors namely, consumers, agri-food industries, the HFCS industry and inulin syrup producers, the ACP countries, Least Developed Countries, and EU sugar beet growers (Commission of the European Communities, 2005). The EU commission developed a model to assess the impact of the changes to the EU sugar sector (Table 14). This model is based the initial prospect of price reduction to €385.5/mt for refined sugar, a reduction of 39%, as opposed to the actual 36%. Nevertheless, the results offer interesting insights. In the model sugar production in the EU was found to decrease from about 19.7 million tons to 12.2 million tons by 2013, with C-sugar, currently produced at 3 million tons annually, being reduced to zero. In this time frame, the sugar beet industry will be consolidated to the most competitive regions and the EU will go from being a net exporter to a net importer. Because of reduced support prices, most ACP countries will decrease production however their lost production will likely be picked up by low cost producer such as Malawi, Swaziland, Zimbabwe, Zambia and Mozambique (Commission of the European Communities, 2005).

Table 14: EU Estimations on Impacts of Reform on Imports, Consumption and Production

Prices	Euro/mt	Base Year	2012/13 Reform
Institutional Price		631.9	404.4
Cumulative Reduction in Institutional Price			36%
Results below based on initial planned price cut to €385.5/mt			
Quantities		**Million mt**	
Consumption		15.9	16
Cumulative Increase in Isoglucose Production		NA	0.3
Estimated EU Production Under Quota		16.7	12.2
C Sugar Production		3	NA
Total EU-25 Production		19.7	12.2
Total Imports		2.3	3.9
Total Exports		3.1	0.4

Source: Commission of the European Communities

Within the EU, the break-even price for sugar production varies widely. Consequently, the changes to the EU sugar regime will have varied effects throughout the member states. The north of France and western Germany have the most efficient production with current break-even prices ranging between 300 and 350 €/mt. Italy, on the other hand, has break-even prices between 500 and 550 €/mt in the north and break-even prices above €550 in the south of Italy. Assessing the specific impact of the proposed price cut, the EU member states fall into three groups depending on their break-even price compared with the new sugar price. The table below bases these estimates on a price of €385.5/mt, an initial goal in price reduction early in talks of restructuring of 39%. Keep in mind that the final reduction in price was 36% to €404.4/mt.

Table 15: EU Estimation on Impacts on Production by Member State

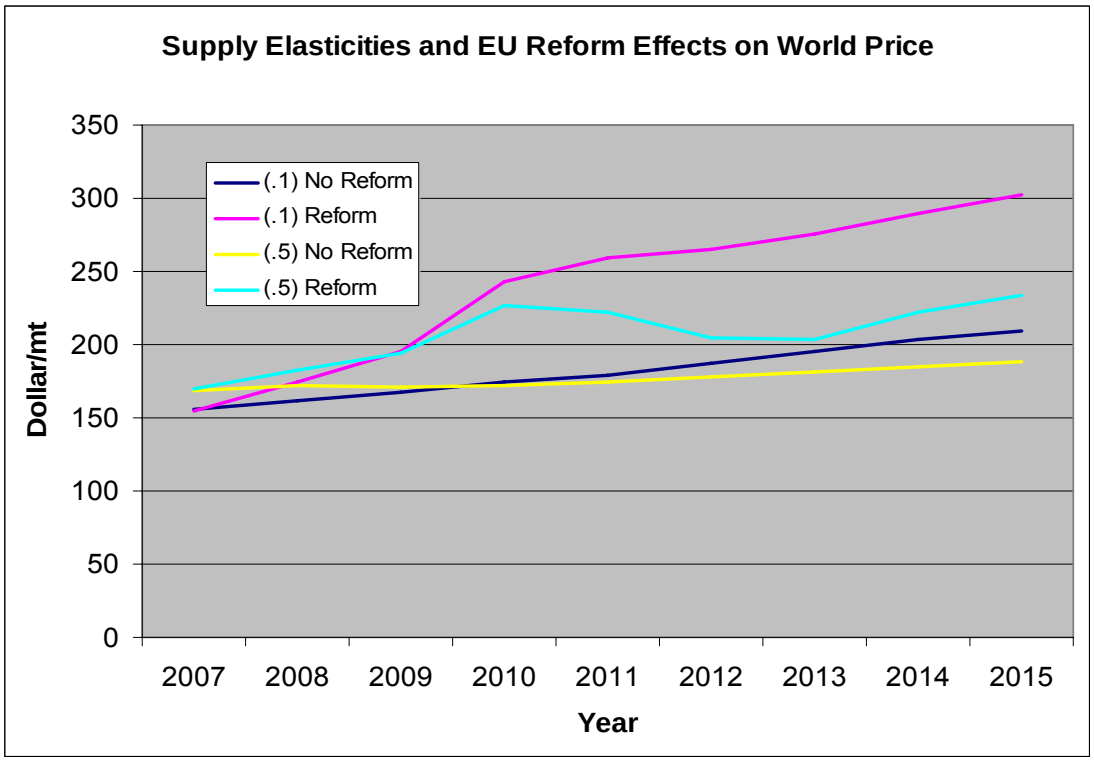
	The reduction in sugar is likely to be…					
	Drastic		**Significant**		**Limited**	
	Member States	**Current Production 1000mt**	**Member States**	**Current Production 1000mt**	**Member States**	**Current Production 1000mt**
	Greece	311	**Czech Republic**	455	**Austria**	382
	Ireland	197	**Denmark**	413	**Belgium**	808
	Italy	954	**Finland**	145	**France**	3.497
	Portugal	70	**Hungary**	402	**Germany**	3.341
			Spain	991	**Netherlands**	851
			Latvia, Lithuania, Slovakia, Slovenia (collectively)	430	**Poland**	1.672
					Sweden	365
					UK	1.129
Sub-Total		1.532		2.836		12.044
% of current production		9%		17%		73%

Source: Commission of the European Communities

Greece, Ireland, Italy, and Portugal will observe drastic reductions in sugar production, with the complete phase-out of production a possibility. In the Czech Republic, Denmark, Latvia, Lithuania, Hungary, Slovakia, Slovenia, and Finland production is likely to be maintained, but at a significantly lower level. Impacts of the decrease in sugar price are likely to be limited in Austria, Belgium, France, Germany, and the Netherlands. The impact coincides closely with the relative efficiency of beet growers and processors in the member states.

In an alternate impact assessment, performed by the USDA world prices are estimated to rise under the reforms to between $233.6/mt and $302.3/mt by 2015, depending on the estimated supply elasticity. Moreover, production is projected to increase up to 138,224,000 metric tons by 2015 from a baseline of 116,267,000 for 2007 (Table 16). The price effects of EU reform are shown graphically in figure 17.

Figure 17: USDA Assessment of EU Reforms on World Price



Source: USDA, ERS

Table 16: USDA Assessment of EU Reforms on World Price

Year	*Production*		*Consumption*		*World Price*	
	No reform	**Reform**	**No reform**	**Reform**	**No reform**	**Reform**
Case A low (0.1) world supply elasticity						
2007	118,146	118,146	121,729	121,777	155	155
2008	119,554	119,545	123,366	122,209	161	175
2009	121,049	121,271	124,936	122,636	168	195
2010	122,607	123,288	126,536	121,107	175	244
2011	124,182	125,728	128,405	122,117	179	259
2012	125,710	128,051	129,901	123,821	187	266
2013	127,273	129,739	131,435	125,300	195	275
2014	128,908	131,361	132,939	126,504	204	290
2015	130,551	133,078	134,727	127,824	210	302

Year	Production		Consumption		World Price	
	No reform	Reform	No reform	Reform	No reform	Reform
Case A high (0.5) world supply elasticity						
2007	116,267	116,267	120,549	120,527	169	169
2008	119,189	119,203	122,453	121,561	172	182
2009	121,573	122,161	124,666	122,674	171	195
2010	123,450	125,920	126,791	122,295	172	227
2011	125,016	130,653	128,782	124,808	174	222
2012	126,840	135,744	130,658	128,444	178	204
2013	128,969	135,942	132,660	130,697	181	204
2014	131,240	135,586	134,638	131,404	185	223
2015	133,412	138,224	136,636	132,767	188	234

Source: USDA, ERS

3.2 The 2002 Farm Bill and Reforms in Peanuts and Tobacco

When considering potential reforms to the US sugar price support regime, it is important to consider the most recent reforms of similar commodity programs in the United States, those for peanuts and tobacco. Both peanuts and tobacco have a long history, dating back to the 1930s, of federal price support achieved through a combination of marketing quotas and non-recourse loans (Womack, 2003). Peanut quotas were terminated by the 2002 Farm Bill which provided a buyout payment to the quota owners, but continued support for producers. Likewise, The Fair and Equitable Tobacco Reform Act of 2004 terminated the 66-year-old federal tobacco program. It provided compensation to quota holders and also provided additional compensation to all tobacco farmers. Both programs offer interesting examples as to how a commodity program becomes politically unfavorable, how these programs become terminated, and how those who are adversely affected by the termination of such a program are compensated.

In a study on the feasibility of farm program buyouts, Orden (2006) attests to the importance of commodity reform in reducing the long run cost of subsidies and in facilitating the liberalization of agricultural trade. Recognizing that reforms to decouple farm support programs, which are supposed to reduce production and trade distorting effects, can be unfavorable in the eyes of program beneficiaries, Orden suggests compensation in the form of a buyout for sugar would make it more convincing, as was the case with peanuts and tobacco. Although there were similarities in the US sugar, peanut and tobacco price support programs prior to the reform of the latter two, Orden

advances the idea that the narrowly defined benefits of the peanut and tobacco programs, namely production quotas, are easier to buyout than broader support policies of sugar. For sugar, marketing allotments, which are similar to production quotas with the important difference of being only intermittently binding, have not been bought out.

The onset of reforms for a price support program can also coincide closely with shrinking benefits derived from the program. This was seen particularly for tobacco, whose producers were faced with increased pressure and from reduced quotas and revenue (Orden, 2006) as well as public pressure relating to the deleterious effects of tobacco and its broader costs to society. For reform of the sugar program to occur, Orden suggests that support for reform must be generated at the level of the producer. And emergence of the necessary support is decidedly related to a curtailing of benefits. The opinion of producers does not need to be unanimously in favor of reform for it to take place. In both the case of tobacco and peanuts, small vocal minorities, opposed program reform, with these groups typically being among the highest cost producers (Orden, 2006).

Interestingly, while buyouts of price support programs may be conducive to trade liberalization particularly in the case of sugar, the reforms of both the tobacco and peanut price support benefited domestic rather than foreign producers at the national level. Prior to reform the US was a net exporter of peanuts. However, the high domestic prices under the price support program attracted imports. The lower prices following reform will reduce the import market and make US peanut exports more viable overseas (Orden, 2006). Similarly for tobacco, decreased prices are expected to make US tobacco more competitive and increase acreage.

3.2a Peanut Reform

In 2002, peanut policy was transformed by the elimination of a decades-old marketing quota program. The peanut marketing program originated in the Great Depression as an effort to stabilize grower incomes. The marketing quota system was a price support program that placed a limit on the amount of peanuts that could be produced and sold in the domestic market for all food uses. These peanuts were referred to as quota peanuts and the right to sell them was allocated among close to 70,000 quota

owners who farmed or leased the quota on close to 9,000 peanut farms (Dohlman, 2005). Under the former system, peanuts grown in excess of a farmer's allotment of quota could only be exported or sold in the lower value "crush market" and were commonly referred to as "additionals". Quotas were determined annually by the USDA and distributed unevenly among quota holders. The distribution was based upon original acreage allotments which were established in 1949, which limited the amount farmers could plant. These acreage allotments were converted to poundage quotas in 1981 to prevent excess production stemming from technological advancement and yield increase (Dohlman 2005). In-quota production was guaranteed the government loan rate of $610 per ton during 1996-2001. Those without quota or producers who grew in excess of their allotment were eligible only for the "additionals" loan rate of $132 per ton during this same period. Additionals were typically grown on contract for export to the world market with prices averaging $389 per ton between 1996-2001.

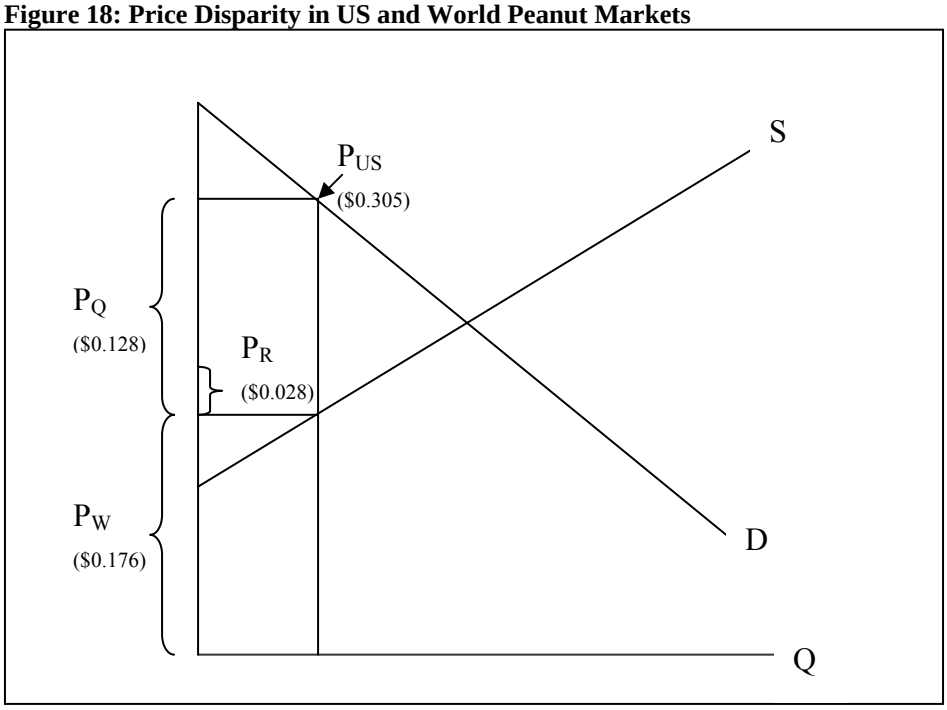
The 2002 farm bill, the Farm Security and Rural Investment Act (FSRIA) which applied to the crop year between 2002 and 2007 replaced the old framework of peanut price support with a program similar to those adopted for soybeans, wheat, corn, cotton, and rice. These program crops are supported by a schedule of direct payments, depending on the crop, and counter-cyclical deficiency payments that make up the difference between a crops' average market price plus the fixed decoupled payment, and its target price for an historical base of production. The decoupled payments are also made based on historical acreages and production. Replacing the quota system for peanuts with a traditional commodity program takes place in the form of a quota buyout. The financing for such a buyout was allotted under FSRIA when in fiscal year 2002 there was a budget surplus. A fiscal year 2002 budget resolution allowed $73.5 billion dollars in additional farm program spending. Re-estimates project these costs to be closer to $82.8 billion dollars. In the wake of 9/11 and an economic slowdown it was widely and correctly projected that there would be a large budget deficit, so the Farm Bill was created using the surplus budget numbers (Chilton, 2006). The high costs of the 2002 FSRIA made it the most expensive Farm Bill in history and offered favorable circumstances in terms of buyout financing.

With the changes of the FSRIA and the peanut buyout, peanuts came to be treated in terms of a traditional commodity program. Producers with past peanut production became eligible for annual fixed direct payments on $.018 per pound on 85% of their base acreage. Additionally, producers with base acreage became eligible for counter-cyclical payments when the marketing year average farm price is below $.2475 per pound. The counter cyclical payment rate also applies to only 85% of past production and was estimated to be $.092 per pound for the years 2002-2006 for an average cost of $175 million per year (Dohlman, 2005).

Under the new program, peanut cultivation is unrestricted, and anyone producing peanuts are eligible for marketing assistance loans or loan deficiency payments on all production. The established loan rate for peanuts is $.1775 per pound. The USDA estimates an average deficiency payment of $.033 per pound of peanuts, which equates to an annual total cost of almost 136 million (Womach, 2003). The combined average cost of direct payments, counter-cyclical payments, and marketing loan benefits is about $0.091 per pound of projected peanut production, or $376 million per year (Womach, 2003).

Understanding the revised commodity program for peanuts is important if one is to look seriously at reforming the sugar program. However, before reforms to the sugar sector can be modeled with the peanut reforms as inspiration, it is first necessary to understand what the old program was worth to the peanut quota holders, how they were compensated, and the costs of the buyout. The figure below is representative of the six years prior to the buyout, the years 1996-2002. During these years the price paid to peanut quota holders was $0.305 per pound of in-quota production. During this same time frame, the world price varied between $1055 and $700 a metric ton, with an average price equal to approximately, $0.176 ($P_W$) per pound. Using these prices, we find that the economic value of the quota was $0.128 ($P_Q$).

Figure 18: Price Disparity in US and World Peanut Markets



Under the old peanut system, peanut quota could be rented though not sold. Ultimately, peanut quota holders were reimbursed with a lump sum payment of $0.55 per pound of quota. This is equivalent to $0.028 ($P_R$) discounted in perpetuity at 5%. If the quota holders were reimbursed with a lump sum payment discounted annually at 5% for the economic value of their quota, $0.128, the payment would have amounted to $2.57. USDA estimates that quota buyout payments of $0.55 per pound at 2001 quota levels would cost a total of $1.47 billion dollars.

Despite the conceptual argument about the level of quota rents, national estimates of rents paid reveal much lower values prior to the buyout. The rental value was determined on a national scale, which overlooked some significant differences in the rents received on a regional basis. Data was collected by the USDA ERS during the period leading up to the buyout which included information on the opportunity cost of quota. Table 17 reveals this information interpreted as the quota rental rate for the region. The table demonstrates the higher quota rental rates of Georgia, quota rental rates in Texas slightly below the national averages, and the lowest rates in Virginia and North Carolina. Because the buyout payment provided was uniform nationally, the quota holders of NC and VA were compensated more generously than those with quota having a higher rental value, such as the growers from Texas and especially Georgia. At the

national average pre-buyout rental rate of $0.0374 per pound, the buyout payment of $0.55 per pound is equivalent to 27.2 years of rental income at a 5% discount rate, for Texas it is equal to 36.1 years, for Georgia and Alabama it is equal to 23.6 years and for Virginia and North Carolina it is equal to 62 years.

Table 17 : Peanut Quota Valuation by Region

		1995	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*(7 year average)*
USA									
	Opportunity cost of quota	89.56	88.53	89.80	86.40	87.66	80.42	83.47	86.55
	Yield	2140.00	2443.00	2324.00	2469.00	2359.00	1997.00	2580.00	2330.29
	Quota Rental Rate per pound	0.04	0.04	0.04	0.03	0.04	0.04	0.03	**0.0374**
Prairie Gateway (Texas)									
	Opportunity cost of quota	65.90	63.01	69.36	58.51	62.06	44.51	51.96	59.33
	Yield	1645.00	1928.00	2084.00	1939.00	2071.00	1255.00	1690.00	1801.71
	Quota Rental Rate per pound	0.04	0.03	0.03	0.03	0.03	0.04	0.03	**0.0332**
Southern Seaboard (Georgia and Alabama)									
	Opportunity cost of quota	98.95	98.86	98.71	98.63	98.64	98.28	98.39	98.64
	Yield	2264.00	2520.00	2311.00	2569.00	2427.00	2231.00	2995.00	2473.86
	Quota Rental Rate per pound	0.04	0.04	0.04	0.04	0.04	0.04	0.03	**0.0402**
Southern Seaboard (Virginia and North Carolina)									
	Opportunity cost of quota	80.53	80.63	80.56	80.63	80.66	80.57	80.62	80.60
	Yield	2402.00	2972.00	2711.00	3080.00	2555.00	2908.00	3082.00	2815.71
	Quota Rental Rate per pound	0.03	0.03	0.03	0.03	0.03	0.03	0.03	**0.0289**

7-year average quota rent		**Quota buyout annual rent equivalent**	**Buyout as a share of average rent**
USA	0.0374	0.0275	73.61%
Texas	0.0332		82.84%
Georgia and Alabama	0.0402		68.36%
Virginia and North Carolina	0.0289		95.30%

Source: Womack, 2003 and USDA, ERS

3.2b Tobacco Reform

"The Fair and Equitable Tobacco Reform Act of 2004" was the culmination of a controversial effort to end the tobacco program with compensation for quota owners and growers that began in 1997. At that time, U.S. cigarette manufacturers reached an agreement with attorneys general of states who were suing the industry for the recovery of health care costs stemming from smoking (Brown and Thurman, forthcoming). The

agreement recast the debate on the manufacturing and the sale of cigarettes and fomented a litigious trend of individual lawsuits against tobacco companies.

The tobacco program, along with supply restriction programs for many other commodities, including peanuts and sugar, was established under the Agricultural Adjustment Act of 1938 as a means to raise and stabilize tobacco prices and income. Under the original program, tobacco growers agreed to limit their production in exchange for a minimum price guarantee. If tobacco companies did not meet this minimum price in auction, grower cooperatives would purchase the tobacco using CCC funds.

Marketing quotas for U.S. tobacco were initially divided among tobacco growers based on production history. Each quota owner's quantity was set in proportion to a national aggregate quota based upon projected domestic purchases, exports, and CCC loan stock levels. Originally, the allotment was based on acreage however, this was changed to a poundage quota early on. The price support functioned by shifting supply through the marketing quota, with a decrease in demand accommodated through a reduction in the aggregate quota set by USDA (Brown and Thurman, forthcoming).

Like the peanut quota, tobacco quota ownership gradually shifted to the heirs of tobacco farmers, non-producers who purchased farms with tobacco quota, and active tobacco farmers who inherited or purchased quota. Tobacco quota could be rented and sold while peanut quota could only be rented.

From the 1930s to the 1980s the tobacco program underwent few changes. However, beginning in the early 1980s increasing international competition from other tobacco producing countries, and decreased domestic tobacco consumption because of technical advancements in processing and lower cigarette use in the US began to threaten the tobacco program's existence. In 1982 the price support program was mandated to operate at a no net cost to the federal government. Costs arose when tobacco was purchased by co-ops at the loan rate using CCC funds and later sold at prices below the loan rate. The no-net cost to the federal government mandate meant that these costs would be paid by an assessment on growers and buyers at the wholesale level (Brown and Thurman, forthcoming).

The tobacco quota buyout campaign gained momentum when a coalition of farmers, public health advocates, and Philip Morris began seeking new authority for the

Food and Drug Administration to regulate tobacco products (Womack, 2005). Additionally, a compensation package for tobacco producers and quota holders had some powerful proponents in congress, such as Senator Jesse Helms from North Carolina on the Senate Agricultural Committee (Chilton, 2006). In the end the tobacco buyout did not happen in the tobacco master settlement or the 2002 farm bill, but took place shortly thereafter.

The tobacco buyout is funded at $10.1 billion with $9.6 billion to be paid to growers and quota owners for the ten year period beginning on October 22, 2004. The remaining $500 million of the fund is being used for compensation to the grower cooperatives and the CCC owning surplus tobacco. Beginning in the 2004 crop year, there is no federal provision regulating tobacco production. Quota owners are compensated at $7.00 for each pound of quota based on the 2002 base level. The payment will be over 10 years at $0.70 per pound per year. In 2002, the national basic tobacco quota totaled approximately 959 million pounds. Using this number, payments to quota holders should amount to $6.7 billion. Producers of quota tobacco are also entitled to receive $3 dollars per pound on quota tobacco grown in the 2002 marketing year. A farmer who produced quota tobacco during the 2002-2004 marketing years would receive the full $3 dollar payment. This payment would be paid over 10 years at annual installments of $0.30 per pound. For each of the three base years the farmer did not produce tobacco, the payment is reduced by one-third. In 2002, effective quota totaled approximately 970 million pounds which would yield payments of $2.9 billion dollars (Womack, 2005).

An interesting component of the tobacco buyout is industry financing. The cost of the buyout will be met by assessments on tobacco product manufacturers and importers. The assessment will be collected by the CCC on a quarterly basis over the life of the buyout, fiscal year 2005 through 2014. The amount collected will be equal to the expenditures of the program, about $1 billion dollars per year. The assessments are apportioned according to domestic market share of each class of tobacco product and are reevaluated annually based on shifts in market trends. In 2005, these share were: cigarettes, 96.31%, cigars, 2.783%, snuff 0.539%, roll your own tobacco, 0.171%, chewing tobacco, 0.111%, and pipe tobacco, 066% (Womack, 2005). After the 1998

Master Settlement Agreement between the major cigarette manufacturers and the State Attorneys General, the manufactures agreed to pay $5.15 billion dollars to tobacco producing states in a Phase II agreement. These payments were to be made over a 12 year period between 1999 and 2010. An estimated $2 billion dollars in remaining "Phase II" payments will be offset by the buyout.

A side-by-side comparison of the tobacco and peanut buyouts was done in a the 2003 CRS report for congress. Specifically, the report compares the buyout as a share of average rent among peanuts, flue-cured tobacco, and burley tobacco allowing for objective comparisons of compensation. National rental values for peanuts and tobacco were obtained from this report (table 18) (Womack, 2003).

Table 18: Value of Buyout for Peanut and Tobacco Quota as a Percentage of Average Rent

	Peanuts	*Flue-cured*	*Burley*
1995	$0.042	$0.41	$0.59
1996	$0.036	$0.40	$0.38
1997	$0.039	$0.37	$0.26
1998	$0.035	$0.44	$0.28
1999	$0.037	$0.52	$0.35
2000	$0.040	$0.57	$0.50
2001	$0.032	$0.59	$0.52
7-Year Simple Average Rent	$0.037	$0.47	$0.41
Quota Buyout Annual Rent Equivalent (discounted in perpetuity)	$0.028	$0.35	$0.35
Buyout as Share of Average Rent	74%	74%	85%
Actual annual payout (dollars per pound)	$0.11 for 5 years		$0.70 for 10 years
Estimated Total Cost of Buyout (Billion dollars)	1.47		9.6

Source: Womack, 2003 and USDA, ERS

In their recent study, Brown and Thurman ask if compensation for the tobacco quota buyout was too much or too little, and their approach is emulated below. In answering this question, a number of important factors must be examined, namely the discount rate of future economic rents had congress not ended the program and the discounted value of the 10 years of compensation. Additionally, the buyout could consider the value of quota in terms of rental value, sale value (for tobacco, not peanuts), or as the difference between quota price and market price.

Discounting the 10 year payment stream of $0.70 annually from the tobacco buyout with a 5% discount rate yields a present value of $5.40 per pound. Using the CRS estimate of annual quota rent for flue-cured tobacco of $0.47 this value would have to be discounted in perpetuity at 8.5% to yield an equivalent present value to the buyout. Perhaps a more practical approach would be to ask how long the tobacco quota program would have had to remain in place to render a value equal to the present value of compensation. If a discount rate of 5% is used and the quota value was assumed to remain constant at $0.47, the program would have to remain in place for 17.5 years for the present value of quota rents per pound to equal the present value of compensation. Farm groups argued that since the tobacco was "permanent legislation" and did not have to be renewed as do farm bill programs quota owners should receive compensation reflective of the quota income being guaranteed in perpetuity. Consistent with this perspective, the then Chair of the Senate Committee on Agriculture, Senator Richard Lugar, proposed compensation for tobacco quota at $8 per pound, which equals $0.40 per pound discounted in perpetuity at 5% (Brown and Thurman, forthcoming). In the end, the $7.00 value of the buyout was in sync with the views of the farm groups. If the value of the rents, $0.47 per pound for flue-cured, were discounted 5% in perpetuity, then the payout to the farmers would have had to be $9.40 per pound. By this measure, the quota holders were under-compensated.

A second approach to evaluating compensation for a quota buyout is presented by Brown and Thurman and involves a comparison of the market price for tobacco quota sales to the discounted value of the buyout payments. Basic economics suggest that the market price for tobacco quota integrates expectations for future levels of price support and the likelihood of program continuation. Therefore, the market price should be a measure of the discounted benefits expected from future from program continuation and should reflect an appropriate level of compensation. Prior to the buyout however, sale prices for quota were bid up substantially in anticipation of government compensation. Therefore, they do not provide a good reflection of the true economic value of the quota. The authors suggest using quota rates from 1997, prior to serious discussions of a buyout, when sale prices ranged between $3 and $4 dollars per pound (Brown and Thurman, forthcoming). Discounting the 10 $0.70 payments made to quota holders at 5% for ten

years yields a value of $5.40, more than the $3 to $4 dollar range in the market. By this measure it could be argued that the quota holders were overcompensated. As was done with peanuts, the value of quota could be measured in terms of the economic rents captured by quota holders, the difference between world price and US price. However, as a highly heterogeneous good that has no futures market establishing a meaningful world price for tobacco is futile. Therefore that exercise has been confined to the more homogenous commodity, peanuts.

A third perspective suggests that market prices for quota should reflect the inherent risk of a quota program, namely that government officials could abolish the program without any compensation whatsoever. In this train of thought, the logical purchaser of tobacco quota should have bid on it as if the program could have ended at any time and this should have been reflected in prices. In this context, the payments made to quota owners are not far from a cash bonanza.

Finally Thurman and Brown suggest a fourth consumer oriented perspective. Throughout the years of the tobacco quota program consumers paid higher prices than the free market would have sustained and quota holders profited. Accordingly, former quota holders should recompense those who consumed their product at artfully high prices with some sort of payment.

That these four scenarios are so disparate in terms of outcome should shed some light on the controversies surrounding a buyout. Whether the tobacco buyout was excessive, deficient or appropriate depends largely on perspective and on notions of the future value and sustainability of the program.

3.3 Implications of Recent Reforms for US Sugar

The reforms of the EU sugar sector and recent reforms of the peanut and tobacco offer interesting insight into how growers and industry are compensated in the wake of termination of a commodity support program. For the purposes of this thesis, the EU case presents the obvious connection as a reform of a sugar program. The tobacco and peanut buyouts in the US are important because they operated within a similar political economy as sugar. This section will discuss what can be drawn from the buyouts and

what important differences must be acknowledged if these buyouts are to be considered if and when the US sugar price support program is reformed.

It is important to begin any discussion of the EU reforms by recognizing that prior to these reforms, the EU sugar program had policy instruments, levels of support, and bearing on WTO agreements that were substantially different than those of the US sugar program. Policy instruments of the EU subsidized sugar exports at levels well beyond those agreed in WTO negotiations. The US sugar program does not subsidize exports in any considerable quantity and its program is well within the rules of the WTO. As mentioned in chapter two, the US program imparts an estimated level of support at $1.1 billion annually. This falls under the amber box limits for the US of $19.1 billion. In being in violation of WTO agreements the EU was in effect forced to implement change or relinquish credibility in the WTO.

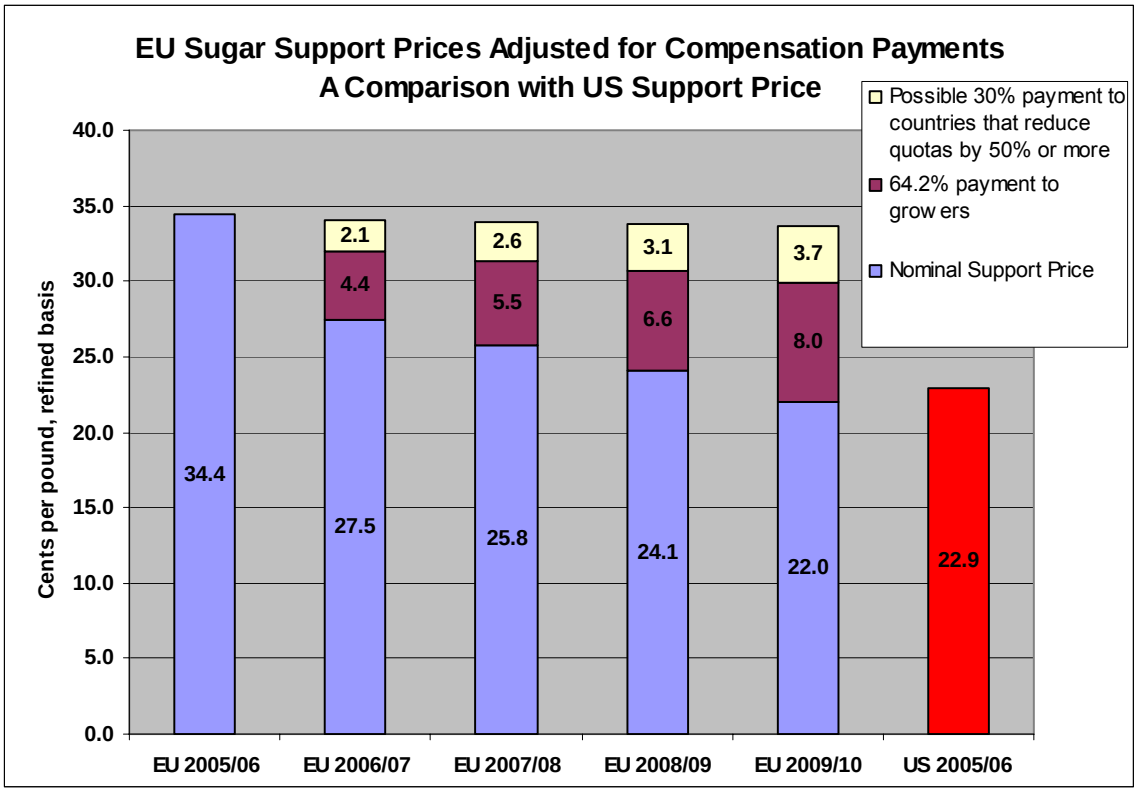
The binding agreement for the US sugar program may be NAFTA. In theory the US could honor its commitment to Mexico and leave the US sugar program unchanged. However, the no-cost provision would have to be scrapped as the CCC would begin to accumulate stocks. If the US reneged on its sugar commitments with Mexico it would likewise lose credibility under the regional trade agreement.

Ownership of production quota in the EU made the program more amenable to a buyout. As was the case in the US peanut and tobacco buyouts, quota, as an asset, had to be compensated for. To summarize some of the EU reforms discussed earlier, EU processors owned the quota rather than farmers. If the processor surrendered its quota it would be remunerated based on a declining schedule. 10% of this compensation was reserved for farmers that delivered their crop to the closing factory. Processors that wanted to keep their quota were forced to pay for it during the restructuring period. Efficient producer who hope to increase production are able to buy additional quota at €730/mt. That the US sugar program does not use production quotas means that any buyout of production would have to be done differently, perhaps by targeting production capacity or domestic production allotments. The handling of a buyout of US production in this study is discussed in chapter 6.

Proponents of the sugar sector such as ASA correctly point out that the EU was able to make significant reductions in its intervention price because this price, initially

was so much higher than US support price. Furthermore, even with these reforms, EU sugar beet farmers still receive a higher level of support for their crop than those in the US. The European Union plans to reduce nominal sugar support prices by 36% over the next four years. At current exchange rates of €1.00=$1.20, this would mean that the EU support level in 2009/10, after full implementation would fall to $0.22 per pound, roughly equivalent to the level of price support available to US producers over the past 20 years. However, the compensation payments equal to an average of 64.2% of the price cut must also be considered. With compensation payments, the effective EU income support level for sugar producers will drop by 13%, not 36%. Additionally, countries that cut their production by half would be able to pay their farmers an additional 30% of their income loss for five years. If these payments are accounted for, then the cut in effective support price to farmers drops to a mere 2% (figure 19). It is estimated that the compensation payments to farmers will cost close to $1.8 billion annually. Individual countries also have the option of extending additional "national aid" to farmers. The US sugar sector, farmers and processors, in contrast, receive no payments from the US government. However, any reform to the US sugar program could also offer payments as compensation.

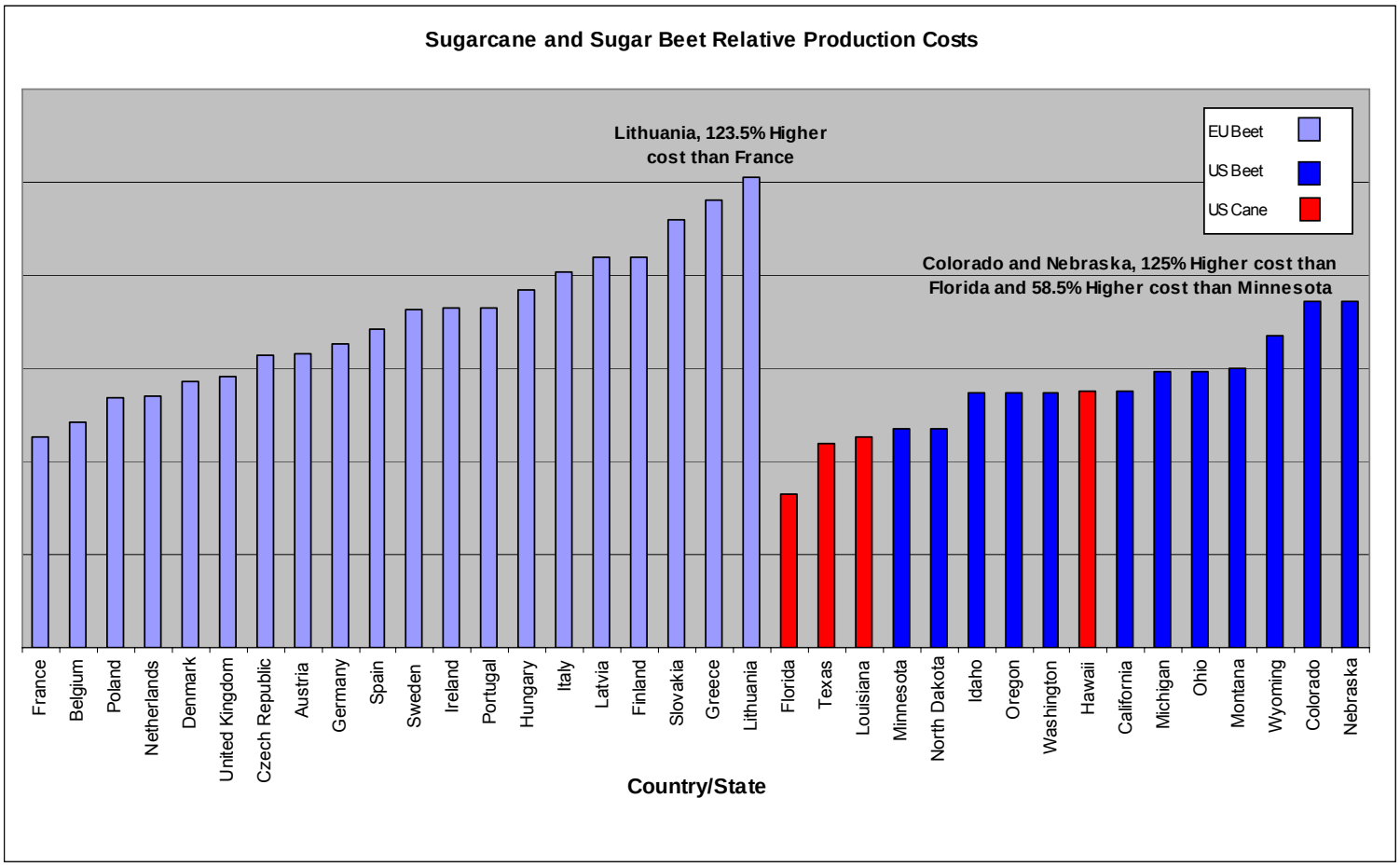
Figure 19: EU Sugar Support Prices Adjusted for Compensation Payments



Source: American Sugar Alliance

Despite the differences in the EU and US sugar regimes, the EU reforms offer some interesting and novel ideas in terms of buyouts of production. Foremost of these ideas are a large amount of industry financing and permitting efficient producers to stay in production while inefficient producers are encouraged to exit the industry. The EU reforms make no initial mandatory cuts in production. Rather, by decreasing quota prices and reducing compensation for surrendered quota over a four year period they encourage inefficient producers to leave. Producers who believe they can remain viable after reductions in quota prices are given the opportunity to actually expand production.

Figure 20: Comparison of Disparities in Production Costs in the EU and US



Source: LMC

The high disparities in production cots across the EU present an obvious similarity. For the EU the range in high and low cost producer is 123%. In the US this range is 125%. The US has the added dynamic of being both a cane and beet producing country and disparities are seen with crops as well as between them. The high cost beet producers, Colorado and Nebraska, while 125% higher than Florida, are 58.5% higher than the low cost beet producers Minnesota and North Dakota. For cane, production costs in Hawaii are 67% higher than those in Florida (figure 20). Estimates of production costs in the EU contain the disparities found in the US. France, for example has production costs on par with Minnesota and North Dakota, while production costs in Ireland and Portugal are on par with those in Colorado and Nebraska. For the EU, not surprisingly, the countries with high production costs are the ones estimated to make the largest production cuts and take fullest advantage of the buyout.

Finally, tobacco and peanuts offer some insight into how compensation for ending a commodity program is carried out in the US. How compensation should be gauged is variable depending on perspective. In the end, economic compensation implies some sort of justice or fair reimbursement. Thurman and Brown bring up the important question of justice for whom? These considerations are valid and interesting however in the end, Farm Bills and agricultural programs more generally must assume their role as relatively minor concerns (in comparison with national security, services, etc.) under shared federal budget constraints.

Chapter 4: Review of Recent Literature on the US Sugar Debate

Because sugar is such a contentious topic in trade liberalization, there is no shortage of literature on the topic. Previous chapters in this thesis attest to and cite much of this literature. However, to inform the reader of the most current trends in the debate and the most relevant issues to this thesis this sub-chapter serves to function as a more formal literature review of just a handful of current papers. These papers are summarized and grouped by theme with the hope of better framing our discussion of the topic. This list is by no means comprehensive and the omission of a given paper from this formal literature review is by no means an implication of its value in the debate. For the purposes of this thesis we have chosen current papers relating thematically to 1) quantifying the current program, 2) policy options for reform, 3) quantifying these policy options, 4) an overview of world sugar markets, and 5) the EU sugar reforms.

Most papers addressing the sugar debate provide background on the industry and, in light of sugar price dependence on the USDA administered program, an extensive review of the program's functionality. Presenting this information in depth in chapter two obviates the need for summary of this information in our reviewed literature.

4.1 Evaluating the Costs of the Current US Sugar Program

4.1a The 2000 GAO Study

A rigorous estimate of costs of the current sugar program was done by a June 2000 study by the GAO, "Sugar Program: Supporting Sugar Prices Has Increased Users' Costs While Benefiting Producers". GAO reports such as this one are written by the request of congress for legislative purposes. This 2000 study was the scion of a 1993 report, also by GAO, which estimated costs of the sugar program to domestic consumers at $1.4 billion (in 1991 dollars) annually from 1989 through 1991 and found that the program primarily benefited US sugar producers and manufacturers of HFCS. The 1993 report went on to recommend that the Congress gradually lower the loan rate for sugar and direct USDA to adjust import quotas accordingly to obtain a lower market price in the U.S (GAO, 1993). The 1996 Farm Act did not revise the sugar program along the recommendations made by this 1993 study.

The 2000 report is meant to address the changing conditions in the U.S. and world sugar markets and specifically estimates the US sugar program's costs to domestic sweetener users, benefits to domestic sugar and HFCS producers, and impact on the U.S. economy. The study models these impacts by incorporating an economic model of the US sweetener market with the international trade model for agricultural commodities from the Center for Agricultural and Rural Development (CARD) at Iowa State University. World and US sugar and sweetener prices were estimated in the absence of the US sugar program. The GAO study does not analyze how the gradual tariff reductions for Mexican sugar under NAFTA may affect sugar prices.

The CARD International Sugar Model is non-spatial, partial equilibrium model consisting of 29 countries/regions, with a rest of the world aggregation to close the model. Countries were included in the model based on their being a major sugar importer, exporter or producer. Only raw sugar trade is modeled however an equation linking refined sugar to raw sugar is applied to endogenize the world price of refined sugar. The general structure modeling each countries sugar market is based on functions for area harvested, yield, and sugar crop production on the supply side and per capita consumption and ending stocks on the demand side. The domestic price for each country is linked to world price using a combination of exchange rates and other policy wedges.

As reported in chapter two the GAO study estimates welfare losses accruing to sweetener users at $1,471 million and $1,938 million for 1996 and 1998 respectively. 1998 costs are higher because in that year there was a greater disparity in world and domestic prices. Likewise, welfare gains to producers in 1998 were estimated to be higher, $1,045 million as opposed to $788 million in 1996. In both years gains to cane growers account for close to 30% of the total while gains to beet producers and beet processors account for approximately 62% and 8% respectively. The difference in welfare loss to users and gain to producers yields a net societal loss of $683 million in 1996 and $893 million in 1998.

The model results report limited welfare gains for HFCS producers from the sugar program. This is in contrast to the 1993 report that concluded that HFCS producers benefited from high sugar prices and that removing the program would have caused HFCS producers to lower their prices. Since 1993 however, two substantive changes

have emerged. First, HFCS prices have been much lower than the wholesale price of sugar in the US since 1995 and technological advances in HFCS have improved the product and created specialized sweetener markets limiting substitution. The study cites the Corn Refiners Association, which represents HFCS manufacturers, assertion that HFCS and sugar prices have become decoupled and that the soft drink industry relies on competition among HFCS manufacturers to minimize its sweetener costs. This being the case, HFCS manufacturers would not need to lower their prices to remain competitive if the sugar program were eliminated.

The GAO study attempts to estimate gains to final consumers if the sugar program were eliminated. However, because, as the report acknowledges, these estimates are based on certain assumptions these estimates are both widely variable and contentious. The primary point of dispute is to what degree food manufacturers would pass along savings to end consumers. The partial pass-through assumption represents sugar refiners passing savings to consumers through lower priced table sugar while manufacturers of sugar-containing products retain their cost savings in the form of greater revenues. Using this assumption end consumers would have gained $587 million in 1996 and $769 million in 1998. The full pass-through assumption is also presented in table 19.

The partial pass-through assumption reflects the homogeneity of table sugar and the differentiation of sugar containing products as justification. As a homogenous product various brands of table sugar are almost perfectly substitutable for each other and it is more difficult for a manufacturers to cushion their product from competition. For differentiated manufactured products such as candy, price becomes a less important consideration, and there is less motivation for these manufacturers to pass their savings along to consumers. Moreover, raw sugar represents a greater percentage of the cost of table sugar compared with its share of other food products meaning a change in the price of raw sugar will have greater bearing on the price of table sugar than other sugar-containing products (Promar 2005).

Table 19: Distribution of Benefits Among User Groups from Termination of the US Sugar Program

Estimated Distribution Among User Groups of Benefits of Eliminating the Sugar Program Under Different Pass-Through Assumptions, 1996 and 1998

	1999 dollars in millions			
	1996		1998	
Distribution of benefits	Partial Pass-through	Full Pass-through	Partial Pass-through	Full Pass-through
Final Consumers	587	1,434	769	1,960
Food Manufacturers	715	-60	999	-85
Sugarcane Refiners	95	97	61	63
Total	**1,397**	**1,471**	**1,829**	**1,938**

Source: GAO, 2000

Additionally, the GAO study estimates the impact of removing the current sugar program on both prices and production. Removal of the program decreases US prices while increasing world price. In 1996 the actual sugar price was 22.40 cents per pound and the world price was 12.24 cents per pound. If the U.S. sugar program was removed, U.S. raw sugar price would fall to 14.91 cents per pound and the world price would rise to 13.41 cents per pound. It also estimates acreage reductions for both sugar beets and sugarcane although for both crops these reductions are relatively small. To account for lost production, imports rise in the case of no sugar program (Table 20).

Table 20: Estimated Effects of Eliminating the US Sugar Program on Prices and Production

Estimated Effect of Eliminating the Sugar Program on Prices and Production

	1996		1998	
	Actual	Without the Sugar Program	Actual	Without the Sugar Program
U.S. raw sugar price	22.40	14.91	22.06	12.46
World raw sugar price	12.24	13.41	9.68	10.96
U.S. wholesale refined sugar price	29.20	21.77	26.12	16.12
World wholesale refined sugar price	16.64	19.77	11.59	14.12
Sugarcane				
-Acres Harvested	953,700	941,300	931,500	916,200
-Production	29.1	28.7	30.0	29.5
Sugar beet				
-Acres Harvested	1,420,100	1,350,300	1,428,300	1,338,600
-Production	28.1	26.7	29.9	28.0
Raw sugar imports	2.2	3.3	1.7	3.3

Source: GAO, 2000

Finally, the GAO study provides a breakdown of net losses to the U.S. economy accruing to foreign sugar exporters, all of whom are TRQ holders. A breakdown of these economic losses by country is given in table 21.

Table 21: Estimated Economic Loss to US TRQ Holders from Termination of US Sugar Program

Allocation and imports in short tons (raw value)

Country	TRQ Allocation	Actual Imports	Estimated Economic Loss
Argentina	72,300	72,200	$14,600,000
Australia	139,500	140,100	28,400,000
Barbados	8,600	0	0
Belize	18,500	18,500	3,800,000
Bolivia	13,400	12,600	2,600,000
Brazil	243,700	242,900	49,300,000
Colombia	40,300	37,200	7,500,000
Congo	8,000	8,000	1,600,000
Costa Rica	25,200	25,200	5,100,000
Cote d'Ivoire	8,000	30	6,000
Dominican Republic	295,800	294,500	59,700,000
Ecuador	18,500	18,500	3,800,000
El Salvador	43,700	44,000	8,900,000
Fiji	15,100	11,900	2,400,000
Gabon	8,000	0	0
Guatemala	80,700	80,400	16,300,000
Guyana	20,200	20,200	4,100,000
Haiti	8,000	0	0
Honduras	16,800	16,900	3,400,000
India	13,400	13,800	2,800,000
Jamaica	18,500	18,300	3,700,000
Madagascar	8,000	8,100	1,600,000
Malawi	16,800	13,200	2,700,000
Mauritius	20,200	20,400	4,100,000
Mexico	27,600	27,600	5,600,000
Mozambique	21,800	22,100	4,500,000
Nicaragua	35,300	35,400	7,200,000
Panama	48,700	48,700	9,900,000
Papua New Guinea	8,000	100	20,000
Paraguay	8,000	5,500	1,100,000
Peru	68,900	69,000	14,000,000
Philippines	226,900	222,800	45,200,000
St. Christopher/Nevis	8,000	8,000	1,600,000
South Africa	38,700	38,800	7,900,000
Swaziland	26,900	27,000	5,500,000
Taiwan	20,200	20,200	4,100,000
Thailand	23,500	23,500	4,800,000
Trinidad-Tobago	11,800	12,100	2,400,000
Uruguay	8,000	8,200	1,700,000
Zimbabwe	20,200	20,100	4,100,000
Total	**1,763,700**	**1,706,030**	**$346,026,000**

Source: GAO, 2000

4.1b Critics Response to the GAO Study

When the GAO study was written in draft format, it was circulated for review among several groups, most notably USDA, the American Sugar Alliance, and the United States Cane Sugar Refiners' Association (USCSRA). As the study estimated substantial costs borne by society and industry because of the current program it could be argued that it cast a negative light on those who seek to perpetuate it. The USCSRA, which would benefit from cheaper sugar costs, largely agreed with and supported the study. On the other hand, the USDA and the ASA were largely critical of the first draft and offered numerous suggestions for change. The ASA went so far as to suggest the study be scrapped all together. Because of the scope of the criticisms from the two parties it is not practical to review them all. Instead, we will focus on the deepest points of contention where the GAO refused to make the changes insisted by the complainant parties. Instances where the ASA and USDA, in the opinion of the GAO, correctly pointed out errors of fact, of omission, and lack of clarity were accounted for in the final report of the GAO, reviewed above, and are not mentioned below.

USDA took issue with the both the analytical approach of the report and its conclusions. Markedly, USDA stated that the results of the GAO study were suspect and should not be quoted authoritatively because it was neither adequately documented nor justified. GAO disagreed with USDA on this issue asserting that its model was methodologically sound having recruited experts in the field for its design and execution.

USDA also suggested that the results of the model were inconsistent with GAO's description of the model and its data sources. Specifically, they suggest that the impact to the HFCS sector by the program are understated, the potential gains to the domestic cane refining industry are overstated, the pass-through assumption of savings to consumers is false or overstated, and the benefits to sugarcane and beet farmers are unrealistically exaggerated.

The USDA also implies that the modeling attempt was irresponsible because it overlooked some important elements to the US and world sugar markets. For example the USDA suggests that the validity of the model is dependent on world prices being free of market distortions. GAO counters that this report was not meant to estimate a free world trade scenario. Recognizing lower labor and environmental standards of other

sugar producing countries GAO asserts that this study was meant to isolate the effects of the US program and estimates its costs in the current environment of sugar trade.

USDA also criticizes the model as inadequately treating unique structural considerations of the sugar industry such as high barriers to entry and the interdependence of farmers and refiners. Citing a study by Schmitz and Vercammen (1990) USDA argues that if the U.S. were to achieve multilateral sugar reform wherein many countries abort their price support systems, the world market price could conceivable rise to levels close to current domestic levels. However, if the US surrenders its current price support program unilaterally U.S. producers will be driven out and will stay out even if prices were to rebound because of high barriers to entry. If USDA's predication were proven true, GAO's calculated welfare gains would largely vanish and the net affect would be the replacement of domestically produced sugar with foreign sourced sugar. GAO responded that the Schmitz and Vercammen study used a high price elasticity that is unlikely to be observed. According to GAO, this and other miscalculated assumptions would erroneously lead to a rapid price adjustment following any multilateral reform and would overestimate world prices.

USDA extends another weighty retort to the GAO study suggesting that aggregation of the US as one region of sugar production would lead to misspecifications of the model. Because of differences in production costs across region and differences in prices for alternative crops, removing the sugar program would have differing effects across regions implying that supply adjustments due to lower prices are not likely to be a continuous process, averaged out across cane and beet producing areas, as presumed by the GAO. In its defense, GAO acknowledges no regional breakdown of production adjustments but maintains its profession that the model results are nonetheless valid.

The grievances of the American Sugar Alliance in regards to this study stem from what ASA suggests as a GAO bias toward critics of the sugar program. Specifically, the ASA takes issues with the recurring theme, as seen in the USDA comments, of distorted trade in the world market and the issue of pass-through gains to consumers. GAO's response to these criticism offered by ASA is largely the same as to the USDA criticisms; GAO did not attempt to model free world trade and the likelihood of pass through of

gains to consumers from eliminating the sugar program was not being measured. Instead, the GAO sought to measure the financial impact if such gains were to occur.

As the primary lobby for sugar producers ASA extends the criticism of the GAO study to many of ASA's key talking points in the debate over sugar. These key talking points will be addressed in the results and discussion chapter of this thesis in an effort to offer a more balanced perspective to the reader.

4.2 Catalysts for Sugar Policy Reform, the Cash-Out Option and the Obstacles

In his contribution to the 2002 compilation "Sugar and Related Sweetener Markets" (Schmitz et al. 2002) Orden characterizes the major pressures for sugar reform and establishes a case for the "cash out" option. He goes on to examine the likelihood of success with such an option in the face of opposition.

Orden begins his chapter, "Alternative Sugar Policies for the United States" by explaining the relative isolation of the sugar program. Compared with other U.S. farm programs, the price supports and import restrictions characterizing the sugar program are anachronistic. There are, as Orden explains, many crop and livestock products which receive little direct subsidization. Among agricultural products that have retained support, support has shifted away from the market distorting policies of high price levels and supply control to direct payments to farmers, which are less distorting. If American agriculture is envisioned as a competitive and positive contributor to the American economy than this shift to direct payments only represents partial reform. However, it contributes transparency to the value of the program, allows farmers more control over their enterprises, and expands export market opportunities. Of all methods to move commodity programs out of the rut of economic distortion, this cash-out, as defined by Orden, Paarlberg and Roe (1999), has proven to be the most effective. In his chapter, Orden argues that the time has come to apply the cash-out to U.S. sugar policy.

Previous attempts at sugar reform have proven to be difficult despite well-founded consumer, equity, and environmental arguments and substantial financial backing from the refining and sugar-using industries. A well-organized lobby of sugarcane and sugar beet growers and processors has stayed one step ahead of proponents of reform. Being less punitive to beneficiaries of the current sugar program, by offering

financial compensation in the form of cash payments, a cash-out of the sugar program would be a novel approach with increased likelihood for success. Furthermore, a cash-out of the sugar program would align it more closely with other commodity programs and enable sugar markets to operate with less border intervention. Although, as Orden asserts, the offer of a cash-out does not insure reform, it may shift alignments among the industry enough to break the deadlock of program opponents consistently being defeated by its resolute and well-organized supporters.

In Policy Reform in American Agriculture (1999) Orden, Paarlberg and Roe define policy reform strategies they call a cutout, a buyout, a squeeze out, and a cash out, as they describe the speed of implementation of the reform and whether compensation is offered. In it, they argue that the cash out, payments made over an extended period of time or accounting for an extending period of time, as the only strategy that has proven itself to be politically viable in American farm policy. Orden, Paarlberg and Roe aver that a cash out has never occurred for a domestic crop that competes with imports, such as sugar, because they have never been subjected to the requisite political and economic pressure. As an example they cite the adjustment in the U.S. sugar market for HFCS being almost entirely accommodated by reduced imports rather than pressure on domestic production. However, as has been laid out in the beginning of this thesis, the market imperative for sugar reform may be increasing.

Orden describes the familiar catalysts for change to the current sugar program. Namely, high costs to consumers, impending commitments from NAFTA, the FAIR Act, and multilateral trade agreements. He also extends the idea of open trade with Cuba, which was at one time, the major sugar exporter to the U.S., after its transition from the Castro government.

Orden forwards three varieties of cash out options, direct payments on all output, direct payments on a fixed volume of output, and fully decoupled payments, all of which represent successful options used in past program cash outs and move sugar policy in the direction of the widely accepted accord of how farm policy should operate. The first two options would entail setting a specified loan rate and providing direct payments to producers for the difference between this loan rate and the market price. Price induced distortions to resource use would be largely unchanged if the support price was near the

current loan rate. However, distortion on the consumer side would be reduced as the market would clear at a lower cost and consumption would likely increase. A moderate approach such as this would insulate domestic producers from what the sugar industry refers to as the "world dump market price" that encapsulates the price distortions from subsidized production abroad. Fixing production which is eligible for this cash out and future support at a given level would be more ambitious by discouraging any future increase in production.

Orden's third proposal, that of direct decoupled payments to farmers, is his most ambitious. By severing the link between production and financial compensation land and resources would flow into their optimal use. The domestic market price would be the incentive price determining supply. If pursued, liberalizing border restrictions would allow the incentive price on domestic production to approach the world market price and approach a free trade scenario, all while maintaining producer income.

The chapter closes while addressing the potential obstacles to a cash out and addressing its ultimate feasibility. Orden identifies four primary barriers to reform expressly transparency, budget constraints, retention of gains, and producer opposition. Transparency in government policy is generally considered to be desirable. However, in the event of a cash-out producer benefits would be shifted from consumers to taxpayers, where their gains would be more explicit and accountable. Opponents of the program often use the substantial rents the program generates for producers as a basis for criticism. However, as price supports these rents are less overt. If the program was shifted to federal support, its costs would be obvious. Furthermore, a transition to federal support would illuminate some inequities in the program. For example, the larger sugarcane farms are on average 20 times the size of beet farms. Program benefits would inordinately go to cane farmers (as individuals, not in aggregate) and give credence to those who attack the program on the basis of inequity. The sugar industry recognizes this, making them less likely to accept such a change.

Constraints on the federal budget are an obvious limitation to reform of the sugar sector. The reforms to peanuts and tobacco were in some respects a special case of the government surplus at the time and industry financing in the case of tobacco. In light of

current events commanding a good deal of government resources and record deficits, money for the sugar sector reform is likely scarce.

As was brought up in the GAO study, the probability of consumer gain from sugar reforms is highly contentious. The sugar lobby argues that monetary gains from sugar reform would be retained by cane refiners and food manufacturers. This plays on an anti-corporate sentiment which has a constituency and turns the argument away from industry gains at the expense of tax-payers. Sugar users have in turn suggested that they are in a competitive industry which must adjust costs to remain competitive. However, even when an industry is competitive it may still benefit from reduced input costs, changing the apportionment of impacts of sugar policy reform to the more familiar consumer and producer surplus argument.

The sugar program is popular in the industry for the degree of protection and profit it affords the industry as well as its ability to keep the cost to consumers abstract. To the extent that it is popular the sugar industry assembles arguments against reform. As a well organized and successful representative of sugar producers the sugar lobby has continually out maneuvered program opponents and remains a formidable obstacle for program reform.

4.3 Quantifying Policy Options to Sugar Reform

4.3a The 2005 AFBF Study

A 2005 study for the American Farm Bureau Federation (AFBF) titled "Sugar Policy Options and Consequences" adds to the discussion of U.S. sugar reform by quantifying the costs of the current program if left unchanged, and estimating economic effects of reform (Abler et al, 2005). Recognizing the pressures for reform from the WTO, and more importantly from NAFTA, the report acknowledges the likelihood of the sugar program breaking down in 2008, with unlimited Mexican imports, and incurring substantial costs for the federal government.

Specifically, the report examines three scenarios. First, it evaluates the existing U.S. sugar program under the 2002 FSRIA, which is termed the baseline scenario. Second, it seeks to model the effects of the replacement of the current sugar policy with a program equivalent to those used for other major. In this second scenario, this shift

would occur without changing any trade policies beyond those already agreed. This is referred to as the standard program scenario. Finally, the report builds on a shift toward the standard program scenario with the addition of further liberalized international trade, namely an increase in the TRQ and a reduction in over-quota tariffs. This is termed the trade liberalization scenario.

The analyses in this report are based on a linkage of two economic models. For the domestic component the FAPRI model from University of Missouri is used. For the international component, the CARD model from Iowa State University is used. The authors explain that the U.S. component captures the interaction between the corn sweetener and sugar sub-sectors. The international component reflects trade and policy wedges used in major importers and exporters of sugar and allows for observation of how these wedges effect trade volumes and prices in addition to feedback effects on the U.S. market. The modeling is done for fiscal years 2005-2015.

In their baseline scenario Abler et al maintain the loan rates for cane sugar and beet sugar at 18 and 22.9 cents per pound, respectively. They project consumption to develop in line with recent trends. They project beet and cane yields to increase slightly over the observed time frame and similarly small increases in sugar recovery rates. In developing their baseline scenario the authors endorse the importance of future HFCS use in Mexico. They correctly assume resolution of the US-Mexico trade dispute in HFCS (see chapter 2) and suggest that U.S. exports of HFCS to Mexico will displace Mexican sugar to the US To accommodate for variation in the degree to which HFCS displaces Mexican sugar, the authors apply two variants to their baseline scenario. First, they use what they term a limited displacement of sugar by HFCS in Mexico, resulting in modest increases, averaging 218 thousand short tons raw value, in shipments of sugar to the United States between 2008-2015. Next they offer an alternate, substantial displacement of sugar by HFCS, resulting in an average increase in Mexican sugar exports to the US of 1.355 million tons over the same period.

The two variants impart substantial differences to the baseline scenario. With the assumption of only a modest increase in imports, the New York spot price for sugar averages over 20 cents per pound, domestic production is constrained by marketing allotments and stock accumulation by the CCC is modest. Under the high import

assumption, US sugar production declines by 3.5% as the raw sugar price moves below 19 cents per pound. The price decline is limited by the assumption that USDA would limit oversupply using the PIK option. Additionally, CCC stocks would increase to an average of 1 million tons accruing an estimated average cost of $175 million to the federal government, a stark contrast to the estimated $8 million cost under the modest import scenario. The report also suggests a modest displacement of HFCS with lower sugar prices which decrease corn prices and yield a higher counter cyclical payment for corn.

The results of the baseline scenario, particularly the high import variant, suggest that the ability of the US program to operate at no expense to the government will be jeopardized beginning in 2008, when Mexican imports become unlimited. Given the high costs likely to be accrued by the existing program and disproportionately high impact on beet farmers relative to their cane growing counterparts, the report suggests, as has this thesis, that the program will become untenable over the long term.

A proposed solution for this problem would be to replace the current program with a standard commodity program. The paper models the effects of such a change, and again uses the variants of low and high imports, the results are shown in table 22. In this scenario, the loan rates for cane and beet sugar are reduced to 12 and 16.48 cents per pound, respectively. In addition, producers would be paid a fixed direct payment of 3 cents per pound, raw sugar equivalent on fixed areas and yields. Furthermore, a target price of 20 cents per pound would be set for both cane and beet sugar which would be used to determine counter-cyclical payments if prices for sugar fell beneath this target. Under this scenario, trade policies for the sugar program would remain unchanged.

Using these parameters, the New York spot price drops to 18½ cents per pound under the low import scenario, and just under 17 cents per pound under the high import scenario. The drop in price is associated with an increase in sugar consumption by roughly 350-400 thousand tons from the baseline equivalent and decrease in HFCS use by 230-250 thousand tons. Under both the low and high import scenarios, U.S. production increases. Under this new program, its is forecasted that the government will not accumulate any stocks because prices remain above the new loan rates. Total cost of the program does rise, however, primarily through expenditures on direct payments,

which average $463 million per year. Under the high import scenario, additional costs are generated from counter cyclical payments and loan deficiency payments from lower prices immediately following 2008's suspected surge in imports. They estimate, that in the long term however, prices under the high import assumption will equilibrate to a level above the loan rate, obviating the need for the loan payments.

Table 22: AFBF Simulation Results for Baseline (no reform) Scenario and Conversion of the US Sugar Program to a Standard Commodity Program

	Low Import Baseline Scenario	High Import Baseline Scenario	Low Import Standard Program Scenario	High Import Standard Program Scenario
	Thousands short tons, raw basis, fiscal year 2008-15 avg.			
Domestic Production	8,591	8,287	9,088	8,630
Sugar Imports	1,847	2,984	1,767	2,919
(of which, duty free NAFTA)	218	1,355	138	1,290
CCC stock accumulation	87	1,066	0	0
	Cents per pound, fiscal year 2008-15 avg.			
New York spot price (RSE)	20.60	18.73	18.42	16.86
	Million dollars, fiscal year 2008-15 avg.			
Total sugar costs to government	8	175	462	520

Source: Abler et al., 2005

By bringing up direct payments to farmers, the AFBF study introduces the possibility of payment limitations. Under the 2002 Farm Act, payment limits per individual are set to $40,000 for direct payments, $65,000 for counter-cyclical payments and $75,000 for loan deficiency payments. However an operation can be reorganized so that an individual can effectively double these amounts. In its scenarios the study assumes no payment limitations. However, it asserts that if payment limitations were introduced, expenditures on direct payments made to farmers would be reduced by half, down to approximately $224 million per year. This is because the size of many sugar crop farms, particularly cane, is large and would exceed the payment limitation if payments were made to all acreage. In its response to the AFBF study, ASA suggests that this would introduce a significant new financial constraint to the sugar sector. Using a direct payment rate of $164 per acre for sugar beets and $218 per acre for sugar cane, and assuming a reorganization to double payment eligibility, Abler et al estimate that payment limits would be exceeded at 488 acres for beets and 366 acres in cane. These

thresholds would be lower for farmers growing other program crops because payments on these crops would also count toward the limit. Beet farms of the upper mid-west tend to grow significant amounts of wheat and feed grains. There are some sugarcane farmers in Louisiana who also grow rice.

14% of all sugar beet farms are larger than 500 acres and they account for 41% of domestic production. In contrast, 67% of cane farmers have farms larger than 500 acres and they account for 96% of production. The extent to which payment limitations would affect these farmers is not addressed in this study. The ASA asserts that such limitations would decrease farm size and efficiency.

In their last scenario, the authors examine the implications for sugar under a new WTO agreement. Because the WTO concessions were never agreed on, the authors use the proposals forwarded by Stuart Harbinson, the chairman of the WTO committee on agriculture when the Doha Round Negotiations were launched in 2001. These proposals include an increase in TRQ volume to 8% of domestic consumption (based on a 1999-2000 average) for developed countries and a minimum of 5% of consumption for developing countries. Bound tariffs are reduced according to a detailed schedule according for both developed and developing countries occurring in five equal installments (table 23). They also assume that sugar will not be declared a sensitive product by any developing country and therefore will not be subject to lower tariff reductions than agreed to for this group of countries as a whole. They also apply a schedule to reductions in export subsidies. These reduction have the greatest impact on the world market, but come almost exclusively from the EU.

Developed-country WTO members		***Developing-country WTO members***	
Existing tariff rate	**Line Reduction**	**Existing tariff rate**	**Line Reduction**
Above 90%	45%	Above 120%	30%
15-90%	35%	60-120%	25%
Below 15%	25%	20-60%	20%
		Below 20%	17%

Table 23 Schedule of Bound Tariff Decreases Under Harbinson Proposal

Under the parameters of the trade liberalization scenario, the U.S. market is not affected. This is because the US TRQ already exceeds the Harbinson requirement that the TRQ equal at least 8% of domestic consumption. Given the world prices projected under scenario three, the out of quota tariff for the U.S. would remain prohibitive. This being the case, it would seem that WTO negotiations are unlikely to have a direct impact

on the U.S. sugar market. However, implementation of the reforms proposed by Abler et al would open up credit under the amber box of support as introduced in chapter 2.

4.3b ASA Response to the AFBF Study

In 2006, the American Sugar Alliance commissioned a study to provide an alternative estimate of projected costs to changing the sugar program, "The Future of U.S. Sugar Policy" (McKeaney-Flavell, 2006). In the report, they assert that the AFBF study underestimated the costs if sugar were changed over to a standard payment program. Wherein the AFBF study estimates a high-end cost for a traditional commodity program for sugar at $520 million, the ASA study estimates a cost at over $1.3 billion per year. They also assert that, in contrast to conclusions drawn in the AFBF study, that the AMS for sugar would be higher for sugar under a standard program, rather than lower. They maintain that the $1.3 billion would fall under the Amber Box supports, higher than the current AMS for sugar of $1.1 billion.

The disparity is in part the result of the McKeaney-Flavell study assuming additional import volumes from Mexico between 500,000 and 1,000,000 tons and also from DR-CAFTA countries, which from their estimate could exceed 126,000 tons by 2012. Using these parameters, the market price would fall to 10 cents per pound. To reach the target price, a 5 cent per pound countercyclical payment would be needed and a 2 cent per pound loan deficiency payment. The CCP is calculated as the target price minus the loan rate minus the higher of the market price or loan rate and the LDP is calculated as the loan rate minus market price. This is in contrast to the AFBF estimate of a CCP of 0.1 cents per pound and no required LDP making McKeaney-Flavell's estimated program costs much higher.

4.4 Multilateral Reforms in World Sugar Markets

A common argument made by supporters of the current sugar program is that unilateral reform by the U.S. unfairly exposes U.S. producers to a distorted world market. "Multilateral Trade and Agricultural Policy Reforms in Sugar Markets" (Elobeid and Beghin, 2006) uses the CARD international sugar model to estimate the effects of multilateral liberalization of the world sugar market. In it, the authors examine three

scenarios for reform contrasting them with a baseline scenario. The sequence of scenarios starts with the removal of the largest distortions in world sugar markets, namely the trade and border distortions of tariffs, export subsidies, and TRQs. In this scenario, producers receive the domestic market price for sugar but also receive a production subsidy, leaving the domestic support to production unchanged. Beghin and Elobeid recognize that such a change is unlikely because it would incur huge costs to the government, which would render them unsustainable in the long run. However, it serves to separate the effects of trade and domestic policy wedges. The second scenario builds on the first by removing domestic production policies in addition to the removal of the trade policies of the first scenario. Finally, in the third scenario, they consider the removal of consumption distortions in addition to the reforms under the first two scenarios.

The report assumes policy changes are fully implemented by 2002/03, with their impact being measured through 2011/12. Here, we will discuss the average of the annual changes over this period as reported by the authors. In scenario one, removal of trade distortions increases the world sugar price by 32% on average. Aggregate trade increases by 2.4% on average during this period, while increases in production and consumption are just under 1%. In scenario two, trade liberalization and domestic policy reforms, the increase in world price is more dramatic, at 66% on average. Aggregate trade increases to just under 12% with production and consumption dropping close to 3%. Under the full market liberalization, scenario three, we see changes that are comparable to the reforms under scenario two. Elobeid and Beghin also report the results for the final year of the observed time frame, 2011/12 to represent the long term impact of reforms (table 24).

Table 24 World Sugar Production, Consumption, Total Exports and World Price

World Sugar Production, Consumption, Total Exports and World Price

	Million Metric Tons						Dollars per Metric Ton	
	Production		Consumption		Total Exports		FOB Caribbean Price	
Scenario 1	**11/12**	**Average**	**11/12**	**Average**	**11/12**	**Average**	**11/12**	**Average**
Baseline	155.81	144.82	156.13	145.25	35.51	32.02	238.83	214.61
Reform	156.94	146.02	156.97	146.08	37.01	32.83	302.47	282.31
Change	1.13	1.20	0.85	0.82	1.50	0.81	63.64	67.69
% chg from baseline	0.72	0.83	0.54	0.56	4.22	2.40	26.65	31.95
Scenario 2								
Reform	153.06	140.76	153.12	141.21	38.42	35.76	353.32	353.93
Change	-2.75	-4.06	-3.01	-4.04	2.91	3.75	114.49	139.32

% chg from baseline	-1.76	-2.86	-1.93	-2.82	8.19	11.73	47.94	66.18
Scenario 3								
Reform	152.76	140.48	152.82	140.91	38.47	35.76	351.54	352.04
Change	-3.05	-4.34	-3.11	-4.33	2.96	3.75	112.71	137.42
% chg from baseline	-1.96	-3.05	-2.00	-3.02	8.33	11.72	47.19	65.27

Source: Elobeid and Beghin, 2006

The long term impact on U.S. production to such multilateral reforms is relatively small, less than 5% under all scenarios. In the short term, model estimates show a bigger hit to U.S. production which declines as the market equilibrates. Long term increases in imports range between 6% and 10% though imports would be much higher initially. Consumption would remain relatively flat in the long term (Table 25). Estimations on impacts to US prices are not given in this study.

Table 25 U.S. Sugar Production, Consumption and Net Imports

U.S. Sugar Production, Consumption and Net Imports

	Thousand Metric Tons					
	Production		Consumption		Net Imports	
Scenario 1	**11/12**	**Average**	**11/12**	**Average**	**11/12**	**Average**
Baseline	7,983.34	7,965.40	10,975.62	10,258.58	3,132.43	2,423.20
Reform	7,921.85	7,688.57	11,049.92	10,294.51	3,339.86	3,043.90
Change	-61.49	-276.83	74.30	135.93	207.43	620.61
% chg from baseline	-0.77	-3.46	0.68	1.35	6.62	29.62
Scenario 2						
Reform	7,614.48	7,482.78	10,992.55	10,306.18	3,430.32	2,941.35
Change	-368.86	-482.62	16.93	47.60	297.89	518.16
% chg from baseline	-4.62	-6.06	0.15	.47	9.51	22.58
Scenario 3						
Reform	7,594.61	7,461.36	10,994.56	10,308.51	3,453.22	2,966.04
Change	-388.73	-504.03	18.94	49.93	320.79	542.84
% chg from baseline	-4.87	-6.33	0.17	0.50	10.24	23.67

Source: Elobeid and Beghin, 2006

4.6 The EU Reforms as a Source of Disparity in Modeling Multilateral Reforms

Many other estimates of the effects of multilateral trade liberalization in sugar markets have been undertaken. The large discrepancies among these studies lead to some ambiguous results for quantifying trade liberalization. Gohin and Bureau discuss the variability of these results and the reasons behind it in "Modeling the EU Sugar Supply to Asses Sectoral Policy Reforms" (Gohin and Bureau, 2006).

Some estimates of multilateral reforms, such as the 2005 study by El Obeid and Beghin, suggest that even a partial liberalization of world sugar markets will yield a very large increase in world sugar markets. As suggested by Gohin and Bureau, a large component of such an increase would be the liberalization of the EU market, which

would cause a 61% drop in domestic production and net imports of 8 million tons for the EU by their estimates. Similarly, an OECD study (2005) reported that EU production would decrease under their trade liberalization scenario.

Other partial equilibrium models, similar in structure to that used in the El Obeid and Beghin paper, suggest very different results. For example, Wohlgenant (1999) and Poonyth et al. (2000) found that EU production would be largely unaffected by a the reduction in intervention price required to export without subsidies and rendering world prices on par with those estimated by El Obeid and Beghin.

General equilibrium approaches also lead to dissimilar results. Frandsen et al. (2003) showed an erosion of rents with production in low cost countries, such as Germany, France and Great Britain largely unchanged by deep cuts in the intervention price. For Bouet et al. (2005) the reduction in EU supply is significant at deep tariff cuts, but the resulting increase in world price is small.

Gohin and Bureau suggest that there are several explanations for the wide variability across studies, with model specification being an obvious source of the differentiation. They also submit that the supply response of LDCs and Brazil has a large impact on the world price as does assumptions made about the ethanol market. However, because of the importance of the EU in the world market, being both a major importer and exporter, different assumptions made about the EU response to a given policy shock have significant impacts on the world market equilibrium.

Because of the complex structure of the existing CMO for sugar, different levels of support across the different quotas, deducing the effects of the 2006 reforms is a cumbrous task where many differences arise. That production quotas have been in place for more than 30 years makes assessing the impact of program change even more difficult. Finally, a characteristic that is not unique to the EU, the interaction between the processing and agricultural sectors makes it difficult to model reforms. The processing sector also gains rents from the program, and consequently will also be adversely affected by any reforms.

Aside from these differences, two elements seem to be particularly critical to successfully modeling the EU reforms and ultimately being successful in modeling

multilateral reforms, expressly the level of costs and rents under production quotas, and the modeling of supply of C (non-quota) sugar.

Cost estimates performed in the EU have proven to be widely varied. That EU production of C sugar has been significant over the last decade suggests that at least in the most efficient regions, producers respond to the world price. However, as Bureau and Gohin assert, this would suggest that the resulting EU supply curve is one that any decline in intervention price would erode rents rather than affect production. While this is consistent with the production of C sugar, it may lead to underestimation of impacts of reform on EU production if EU production were set to respond to the marginal costs of Europe's most efficient producers.

An understanding of C sugar production is equally critical to correctly model the effects of reform. In terms of what drives C sugar production, the study offers three possibilities: a cross subsidization of C sugar by A and B sugar, C sugar production as an insurance strategy against poor harvests and foregone revenues, and the possibility that C sugar production would be considered in terms of grower compensation if and when a buyout occurred.

As discussed in the review of the EU reforms, the WTO panel, as well as other program critics, believed that the high prices paid for A and B sugar covered fixed costs and in doing so cross subsidized C sugar by allowing growers to sell it at a price to recover only variable costs. If this were true, any change in the in-quota price would affect the possibility of recovering fixed costs. During recent period of low sugar prices, the world price paid for C sugar rarely covered even the variable costs of C sugar production. The authors forward a possible explanation that C sugar production at these low costs acts as insurance against poor harvests, and an inability to meet even A and B quota production. If this were the case, EU supply could not be modeled as a function of marginal cost only. Rather it would be imperative to more finely explain the interaction between C sugar production and the rents gained from in-quota sugar production. Finally, the authors offer the possibility that C sugar production would be a way for growers to increase their reference level for compensation in the event of a buyout. If this was the case, this peculiarity would also need to be modeled. After laying out possible interactions between C sugar production and in-quota price and the quota level

itself, Gohin and Bureau calibrate the supply of C sugar using econometric estimates, hoping to better capture the effects of policy reform in the EU, which is integral to accurately assessing multilateral reforms.

In their modeling efforts Gohin and Bureau first construct a baseline scenario. Their baseline assumes an enlargement of the EU and recognizes full implementation of Agenda 2000 and the 2003 CAP reforms. Notably, it leaves out the 2006 EU sugar reforms. In terms of imports, they assume that under the EBA exports will be effectively shifted from ACP to LDC countries. Gohin and Bureau then forward two reform scenarios, 1) the 2006 reform of the sugar sector is implemented, with no other adjustment coming from international pressures and 2) no 2006 reforms, but an ending of all export subsidies in the sugar sector, including C sugar. The results of their simulations are displayed in table 27.

Table 26 EU15 sugar markets under the baseline, after the 2006 reforms, and without reforms but with a ban on exports subsidies

	Baseline 2010	***2006 reform relative to baseline (scenario 1)***	***Total ban on export subsidies relative to baseline without reform (scenario 2)***
		(million tons)	
EU15 production of in quota beet	100.494	90.163 (-10%)	80.605 (-20%)
EU15 production of C beet	8.928	0 (-100%)	0 (-100%)
EU15 production of in-quota sugar	14.288	12.820 (-10%)	11.461 (-20%)
EU production of C sugar	1.310	0 -100%	0 (-100%)
EU15 imports of sugar	2.160	2.160	2.160 (0%)
EU15 exports of sugar	3.052	1.402 (-54%)	0 (-100%)
EU15 consumption of sugar	12.987	13.171 (+ 1%)	13.216 (+1%)
		(euros per ton)	
Domestic price of in-quota beet	46	22 (-52%)	16 (-65%)
Domestic price of C beet	11	NA	NA
Domestic price of in-quota sugar	632	404 (-36%)	357 (-43%)
Export price (white sugar)	225	264 (+17%)	283 (+26%)
		(million euros)	
Export subsidies	1243	196 (-84%)	0 (-100%)
Rents (sector)	2185 (beet) 307 (sugar)	480 (beet) 0 (sugar)	0 (-100%)
Cross subsidy	71 (beet) 138 (sugar)	NA	NA

Source: Gohin and Bureau, 2006

Gohin and Bureau conclude that the 2006 reforms to the EU sugar sector will mean the end of C sugar exports. Additionally, lower prices after the reforms mean that EU sugar tariffs can be significantly cut back (Gohin and Bureau, 2006). Conforming with the trend of results in other studies Gohin and Bureau suggest that the losses to the sugar sector will be significant, although they will be partially compensated through provisions in the buyout. Encouragingly, the 2006 EU sugar reforms should result in savings, for taxpayers, consumers, and result in welfare gains for the EU15 as a whole (Gohin and Bureau, 2006).

Chapter 5: The USDA Sugar and Sweeteners Model

Chapter 5 is organized into five sections. Section 5.1 gives an overview of the model and briefly addresses its fundamental operation. Section 5.2 focuses on price determination in the model while section 5.3 addresses the application of policy in the model and provides a review of the key policy parameters. Section 5.4 delineates supply and use variables of the model, namely, consumption, production, and trade discussing them in more detail. Within the framework the model, comparative statics are employed in section 5.5 to begin the analysis of reform options for the US sugar sector which are presented more thoroughly in chapter 6.

5.1 Model Overview and Basic Model Operation

The USDA ERS sugar and sweetener model models sugar production, consumption and price for the annual long term projections released prior to the USDA February outlook conference. The projection period is from 2008 to 2020. The model is closely tied to US sugar policy and is capable of evaluating reform scenarios for the US sugar sector. A diagrammatical representation of the sugar industry as it pertains to the model is shown in figure 21. The diagram shows the level of detail capable in the model as well as its comparative advantage. The bottom of the diagram shows sourcing from domestically grown cane and beet sugar and imports. Imports are divided between imports from the rest of the world (ROW) and Mexico. Mexico is given special consideration in the model because of the important implications of NAFTA. The Mexican component is further analyzed by its production and consumption of sweeteners. The upper left portion of the diagram reflects the domestic consumption of sweeteners in the US from industrial and non-industrial users. The upper right hand corner of the diagram reflects US production of high fructose corn syrup. This production supplies both US and Mexican market. Breaks are noted in the flow chart by both "US policy" and "MX policy". Because sugar prices in the US are policy dependent supply control policy decisions are integral to the modeling results. Until very recently, Mexican policy placed a prohibitively high tax on products made with HFCS instead of sugar. This was repealed in January of 2007 and will have important ramifications for HFCS demand and supply of imported Mexican sugar to the United States. The overview table of supply

and use variables, section 5.4 p. 127, will exposit which variables are endogenous and exogenous to the model.

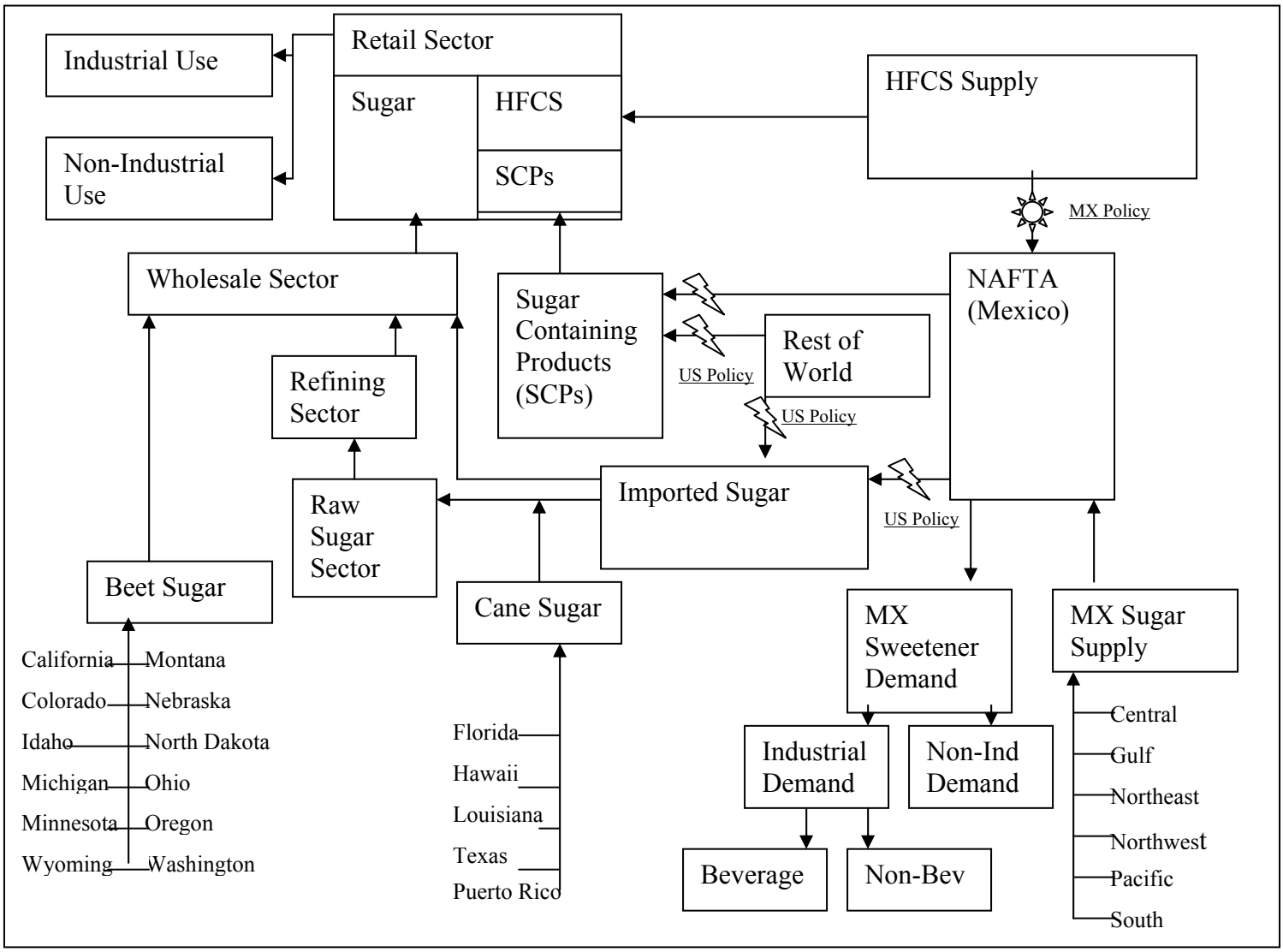


Figure 21 Schematic of ERS Long Term Projections Model

The model equilibrates total supply (beginning stocks, production, and imports) and total utilization (exports, deliveries and ending stocks). Ending stocks are a residual component of the model. The ratio of ending stocks to total use (exports and deliveries) represents the scarcity value of sugar and as such, determines raw and refined sugar price in the model.

5.2 Price Determination

In the USDA model, domestic production of sugar crops, and ultimately domestic sugar, is driven by the price farmers receive for these crops relative to alternative crop prices. This section describes 1) determination of national raw cane sugar and refined beat sugar prices and national Mexican raw cane sugar price, and 2) determination of state and regional producer prices for sugar crops in the US cane and beat producing states and Mexican regional cane prices. These price determinations are described, illustrated in figures and the related model estimation equations are presented.

The price that farmers receive for their sugar crops, beet and cane, is directly related to the refined and raw sugar price respectively. The model is recursive with the production decisions of farmers based on the previous years' price. Next year's price will in turn be influenced by the production decisions of the current year. This is reflective of how the sugar industry functions. While sugar production occurs at or after harvest of the crop; planting occurs in the previous marketing year(s) making these previous prices important.

The sugar price is determined by the intersection of a perfectly inelastic supply curve (meaning all variables in the system are invariant to contemporaneous price changes) of common ending stocks (i.e. both beet and cane sugar) and a negatively sloped price curve that shows the relationship to stocks (i.e. more stocks relative to use implies lower prices). The horizontal segment of the price curve shows the price support function of the loan rate program. Along this segment, stocks are forfeited to the CCC and held outside of normal marketing channels. Prices are determined by the ending year stocks-to-use ratio with stocks appearing on the x-axis. Because, in the US, use is price inelastic, the vertical blue line is uniquely representative of the ending year stocks-to-use.

Figure 22 shows this graphically using the raw sugar price as an example. A graph for refined price determination would take a similar form in that both raw and refined price are based on the same stocks to use ratio and both are subject to a lower and upper bound.

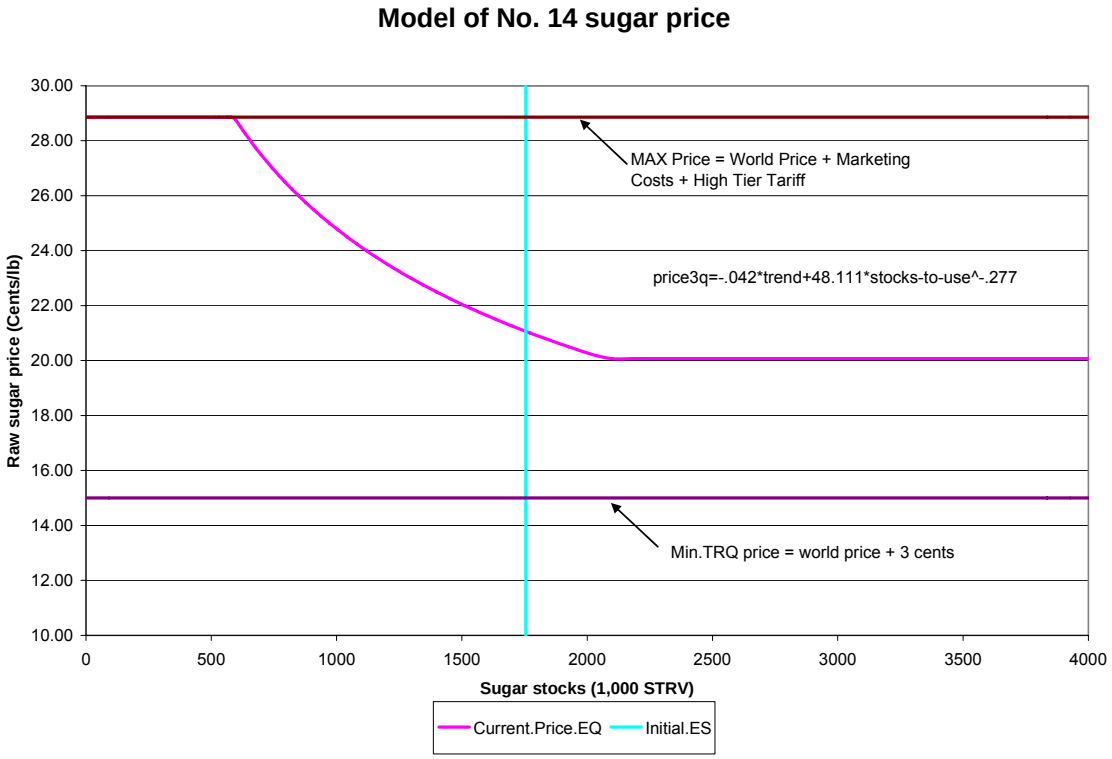


Figure 22 Model of No. 14 Sugar Price Determination

Box 1 on the following page traces through the series of equations in national price determination for raw cane sugar and refined beet sugar. For both raw cane and refined beet, there is a lower bound "price floor" and an upper bound "price ceiling" (eqns. 1 and 2). For both raw cane sugar and refined beet sugar the floor of the price function is equal to the loan rate, which is constant, plus marketing costs, which vary by state (Average national value: $0.2075 cents/lb. for raw sugar and $0.2439 for refined sugar). Marketing costs consist primarily of interest and transportation expenses.

The price ceiling equals the cost at which world market sugar begins to enter the American market, which for raw sugar is equivalent to the world price, assumed to equal $0.12/lb, plus the tariff equal to $0.1536/lb plus marketing costs, for a maximum price of $0.2886/lb. Between the upper and lower bound, both 3rd quarter (_3Q) raw sugar price (eqn. 4) and 3rd quarter refined price (eqn. 5) are a function of the ending stocks to use ratio (STKSUSE) of the previous year. The calculation of the stocks to use ratio is demonstrated in equation xx.

A price equation is also given for Mexico which is based on its own stocks to use ratio. This price is not directly subject to the same policy constraints which provide a price floor and ceiling in the US.

Equation 1 Lower Bound for US
Lower bound: minimum price to avoid forfeiture
-function of the loan rate: raw sugar = 18 cents/lb; refined beet sugar = 22.90 cents/lb
-raw sugar: approximately 20.75 cents/lb, refined sugar: approximately 24.39 cents/pound depending on CCC interest rate, currently 6%

Equation 2 Upper Bound for US
Upper bound: price consistent with incentive to import sugar at the high-tier tariff rate
-Max Price=world price+high tier tariff+ marketing costs

Max raw = 12.00 + 15.36 + 1.50 = 28.86 cents/lb
Max refined = 15.79 + 16.21 + 3.00 =35.00 cents/lb

Between lower and upper bounds:
-Sugar price = function of: ending fiscal year stocks-to-use ratio

Equation 3 Stocks to Use Variable for US
STKSUSE=100*Ending Stocks/Total Use

Ending Stocks = Total Supply - Total Use
Total Supply=Beginning Stocks + Production + Imports
Total Use=Exports (Refined Sugar Under Re-export Program) + Deliveries
Deliveries= Deliveries for human food and beverage consumption + Deliveries for Product Re-export program + Deliveries for Polyhydric Alcohol Production + Livestock Feed

Estimation Equations
Equation 4 Raw Sugar Price (non)-linear
Raw Price_3Q=-0.042*Trend-1.452*D2000+0.966*D2001-1.679*D2005 + 48.111*STKSUSE^-0.277

Coefficient	Std. Error	t-Stat	Prob.
-0.041698	0.01383	-3.014966	0.0071
-1.451933	0.531068	-2.733985	0.0132
0.966235	0.520837	1.855159	0.0792
-1.678959	0.51357	-3.269191	0.004
48.11072	4.843324	9.93341	0
-0.277205	0.036051	-7.689218	0

R-squared	0.872501	**Mean dependent var**	21.6688
Adjusted R-squared	0.838949	**S.D. dependent var**	1.11008
S.E. of regression	0.445488	**Akaike info criterion**	1.426269
Sum squared resid	3.770727	**Schwarz criterion**	1.718799
Log likelihood	-11.82836	**Durbin-Watson stat**	2.680283

Equation 5 Refined Sugar Price linear
Refined Price_3Q = 45.200-3.959*D1994and1995-0.854*STKSUSE -0.116*(Next period expected share of beet sugar of total production and imports)

Coefficient	Std. Error	t-Stat	Prob.
45.20013	2.872567	15.7351	0
-3.958801	1.021891	-3.873997	0.001
-0.854256	0.119098	-7.172735	0
-0.115951	0.050913	-2.27744	0.0345

R-squared	0.759675	**Mean dependent var**	25.74304
Adjusted R-squared	0.721729	**S.D. dependent var**	2.339729
S.E. of regression	1.234239	**Akaike info criterion**	3.415557
Sum squared resid	28.94357	**Schwarz criterion**	3.613034
Log likelihood	-35.27891	**F-statistic**	20.01991
Durbin-Watson stat	2.687203	**Prob(F-statistic)**	0.000004

Equation 6 Mexican Estandar Sugar Price (Real 2000 pesos/mt)
dlog_EstandarPrice=-0.183+0.018*trend+-0.118*dlog_ending year stocks to use ratio)

Coefficient	t-Stat
-0.183	3.273
0.018	2.989
-0.118	2.051

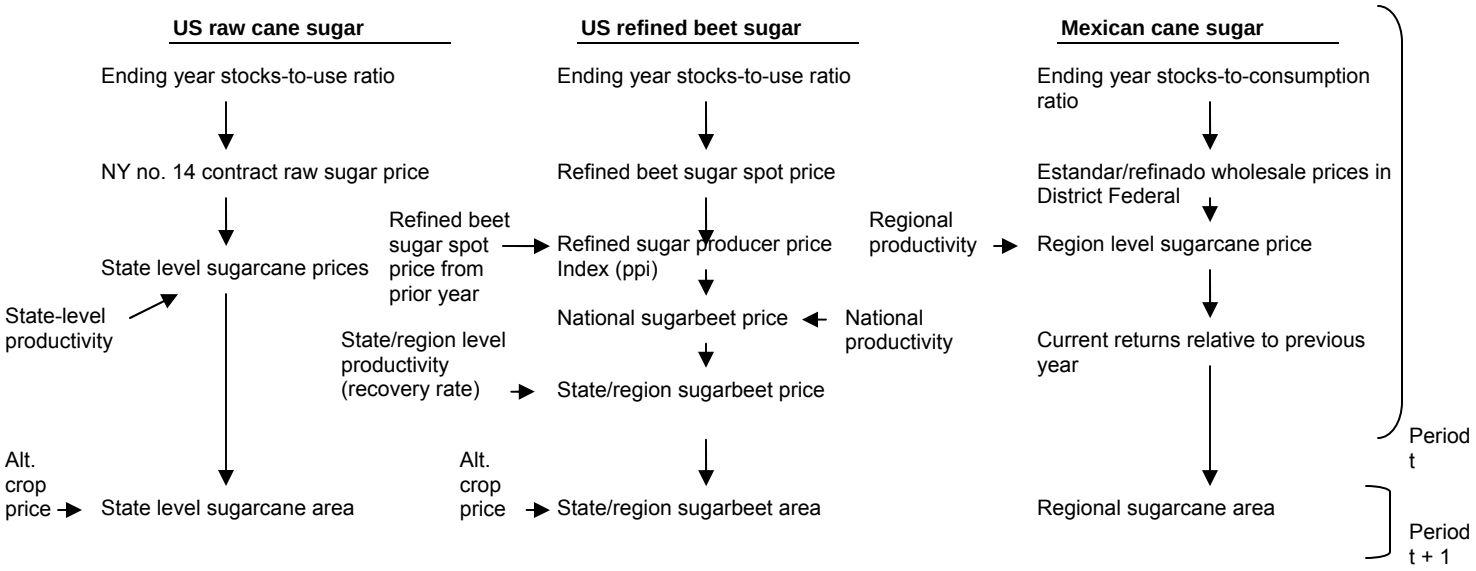
Adjusted R-squared	0.481	**DW**	1.886
Sample Period	1997-2006	**Excluded Year**	2006

Box 1 Sugar Price Determination

[8] D2000 [9] dlog

[8] The notation D2000 indicates the use of a dummy variable for an outlier year
[9] dlog indicates a "log difference" equation

Once the sugar price is determined, as described above, prices to sugar producers can be determined. Box 2 provides an overview of this price determination in the model and subsequent planting decisions made from these prices for US raw cane sugar, US beet sugar and Mexican raw cane sugar. All levels of price determination will be further explained below. Period "t" signals the current time period, while "t+1" signals the coming year. In the model, all price determination from the national to local level is determined in the current time period. Planting decisions are made for the following year based on the current price. These planting decisions will be presented in the context of other supply and use variables in section 5.4.



Box 2 How the Stock-to-Use Ratio in Period t Influences Planting Decisions in Period t+1

5.2a State Level US Sugarcane Price Determination

State-level sugarcane prices are a function of the New York no. 14 nearby futures price and the state-level sugar recovery rate (Box 3). The presence of a futures market for raw sugar makes sugarcane price determination more straight forward than beet price determination. This is because the no. 14 price is market (NYBOT) determined and publicly available. Beet spot price on the other hand represents the low end of a range reported by a non-authoritative magazine (Milling and Baking News). It is unknown how much volume takes place at the spot price while volume on a futures market is known.

Sugar Baseline Model: Linkage between raw cane and State-level sugarcane prices

New York No. 14 nearby futures, 3rd quarter average → State-level sugarcane price

State-level sugar recovery rate → State-level sugarcane price

State	Coefficient on Trend	Coefficient of 3q raw sugar price	Coefficient on Recovery Rate	Coefficient on Autoregressive Term	Adj. R2	DW	Excluded year
Florida		0.529	0.711	0.508	0.577	1.837	
(T-stat)		(6.165)	(6.752)	(2.922)			
Louisiana		0.574	0.608		0.613	1.903	2000
(T-stat)		(5.827)	(4.816)				
Texas	0.007	0.444	0.781	0.275	0.925	1.934	2001
(T-stat)	(3.013)	(8.588)	(10.470)	(2.338)			
Hawaii	0.005	0.799 [1]	0.344		0.615	1.628	
(T-stat)	(3.186)	(7.048)	(2.417)				

Box 3 Linkage between Raw Cane and State-Level Sugarcane Price

Hawaii 3q raw sugar price[10]

5.2b State Level Sugarbeet Price Determination

Box 4 demonstrates how national beet sugar spot prices are used to produce a beet sugar producer price index which is then used to produce a national sugarbeet price. The spot price is the price that is quoted for immediate settlement (payment and delivery). Only a portion of refined beet sugar sales are made on the spot market. Most sales are based on negotiated contract prices. Although these prices are not public, the Bureau of Labor Statistics publishes a refined sugar producer price index (ppi) based on survey data.

In the model, this index is a function of the current year and one year lagged third quarter spot price. The national sugarbeet price is then a function of this beet sugar producer price index and the national beet sugar recovery rate. The latter of these two variables will be discussed in the context of supply and use variables in section 5.2b.

[10] Hawaii 3q sugar price is lagged one year

Sugar Baseline Model: Linkages to Sugarbeet Prices

Beet Sugar Producer Price Index,fiscal year average

	Beet Sugar Producer Price Index: LNPPI=c(1)+c(2)*Trend+c(3)*LN BeetPrice3q+c(4) BeetPrice3q-1					
	Constant	**Trend**	**log(BeetPrice3q)**	**log(BeetPrice3q(-1))**	**Adj. R2**	**DW**
Log(BeetSugPPI)	2.230	0.003	0.348	0.408	0.822	1.630
(t-stat)	8.97	3.044	5.546	5.779		

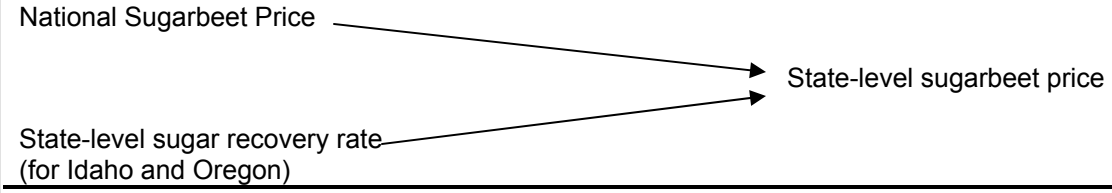
National Sugarbeet Price

	National Sugarbeet Price: dlog(SugBeetPrice)=c(1)* dlog(BeetSugPPIfy)+c(2)* dlog(BeetSugarRecovery)+ar(1)				
	dlog(BeetSugPPIfy)	**dlog(BeetSugarRecovery)**	**ar(1)**	**Adj. R2**	**DW**
dlog(SugBeetPrice)	0.821	0.662	-0.725	0.641	1.901
(t-stat)	5.108	3.414			

Box 4 Linkage between Beet Sugar Spot Price and National Sugarbeet Price

The national sugarbeet price can then be used to determine state-level sugarbeet prices. State beet yield, a productivity measurement to be further discussed in 5.2b, is statistically significant for Idaho and Oregon state-level prices (box 5).

Sugar Baseline Model: Linkage between national and state-level suagrbeet price



Sugar Baseline Model: Linkage from National to State-Level Sugarbeet Prices

State	Constant	Coefficient: Log of National Sugar Beet Price	Coefficient: Log of State Beet Yield	Autoregressive Coefficient	Adj. R2	DW
California	1.154	0.674			0.413	1.538
(T-stat)	2.176	4.622				
Colorado		0.978		0.483	0.561	1.874
(T-stat)		96.559		4.389		
Idaho	2.164	0.638	-0.251	0.416	0.691	2.282
(T-stat)	5.951	8.799	3.857	3.711		
Michigan		0.978			0.724	1.688
(T-stat)		263.900				
Minnesota	-2.851	1.785			0.776	2.135
(T-stat)	4.903	11.166				
Montana	0.950	0.755		0.493	0.633	1.946
(T-stat)	3.005	8.673		4.011		
Nebraska		0.984		0.406	0.610	1.493
(T-stat)		114.216		4.008		
North Dakota	-2.035	1.570		0.268	0.760	1.856
(T-stat)	4.183	11.738		2.445		
Oregon	2.083	0.607	-0.198	0.383	0.434	2.230
(T-stat)	4.148	5.557	2.318	2.984		
Washington		0.972			0.307	1.980
(T-stat)		74.425				
Wyoming	1.141	0.693		0.268	0.538	1.529
(T-stat)	3.402	7.502		2.715		

Box 5 Linkage between National and State-level Sugarbeet Price

5.2c Mexican Regional Cane Price Determination

Box 6 demonstrates how regional sugar price are modeled as a function of the real Mexico City estandar price. For the Gulf region yield is statistically significant. Sugar recovery rate is also significant in modeling state-level sugarcane price for the central and northeast regions.

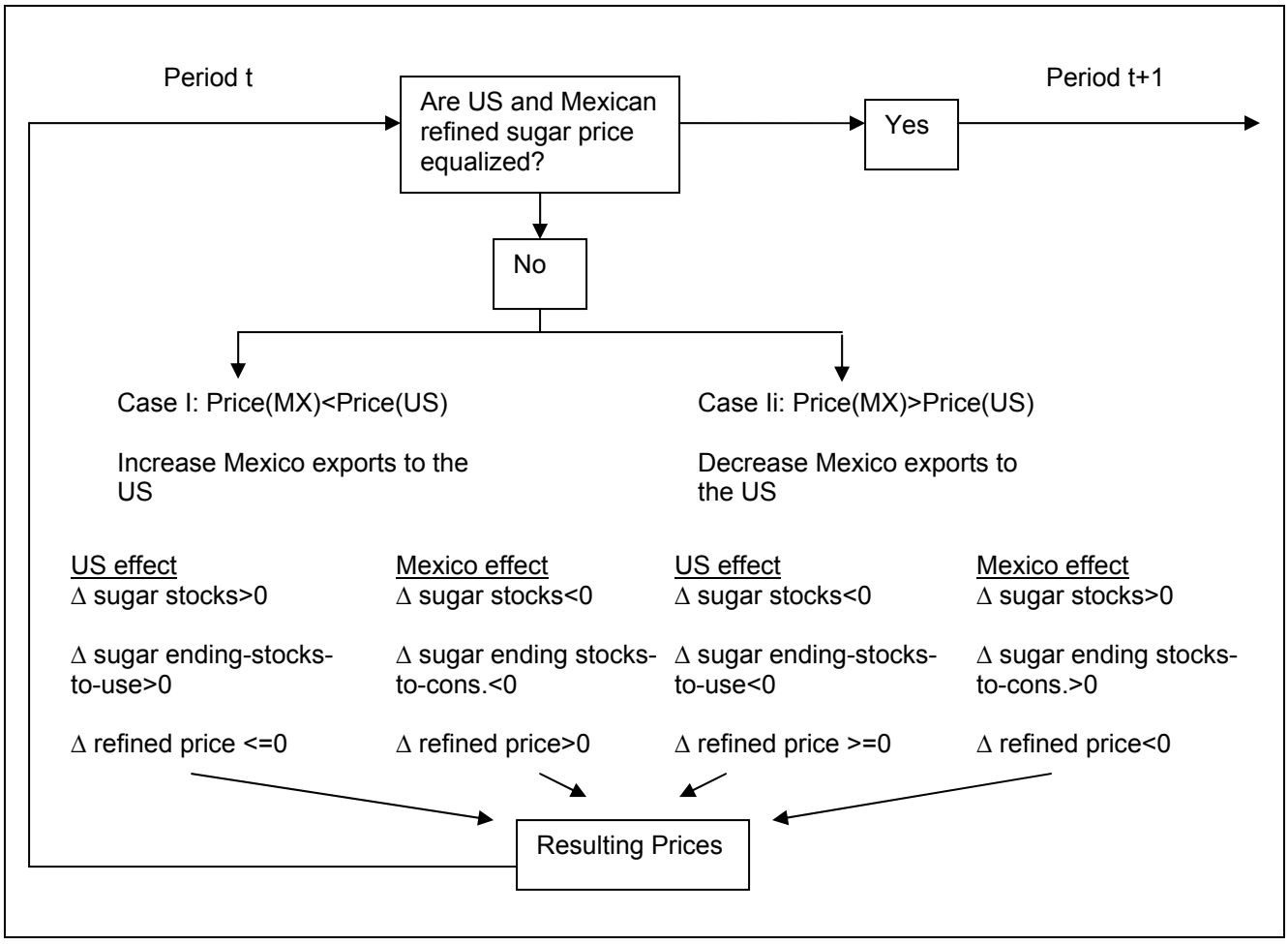
Sugar Baseline Model: Linkage between Estandar Price and State-level sugarcane price

Region	Equation Specification	Constant	Real estandar price	Sugar yield	Sugar recovery	Adj.R2	DW	Sample period	Excluded Years
Central	log		0.675		0.826	0.496	1.646	1994-2005	1999
(T-stat)			8.339		4.545				
Gulf	log	2.434	0.373	0.576		0.513	2.020	1995-2005	2000
(T-stat)		2.635	2.713	2.874					
Northeast	log	2.726	0.379		0.383	0.763	1.715	1994-2005	1998,1999
(T-stat)		2.535	3.224		1.628				
Northwest	log	3.226	0.416			0.939	2.184	1994-2005	1997
(T-stat)		3.308	2.339						
Pacific	log	3.558	0.396			0.814	2.617	1994-2005	1999,2003-04
(T-stat)		8.611	5.276						
South	log	3.968	0.306			0.627	2.449	1994-2005	1999,2003-04
(T-stat)		5.306	2.249						

Box 6 Linkage between Estandar Price and State-level sugarcane price

5.2d Price Equilibration between the US and Mexico

Under the current terms of the free trade arrangement for sugar between Mexico and the US, the two countries will essentially become one market. To account for this, the model can equilibrate prices for the two countries, save marketing costs, by adjusting the stock levels of both the US and Mexico. A graphical interpretation of this iterative process is shown in box 7.



Box 7 Price Equilibration Between the US and Mexico

Figure 23 displays price determination for the United States and Mexico using 2010 as an illustrative year. This illustration is based on the assumption that sugar policy for the US remains unchanged through this period. Specific assumptions about the world sugar price ($0.12 cents per pound) and levels of HFCS substitution in Mexico (50%) are also important to the nature of this graph.

The intersection of the lines for Mexican refinado price and US refined price determines the actual refined sugar price for the two countries as well as the level of NAFTA exports to the US. For 2010 this equates to a price of $0.2439 per lb and NAFTA exports to the US of approximately 894,000 MTRV. Forfeitures of US sugar to the CCC begin where the US refined price curve becomes horizontal. Forfeitures of sugar to the CCC are estimated to be 168,000 MTRV. Calculating government expenditures for this level of forfeitures would be accomplished by finding the product of forfeitures and the raw sugar loan rate of $0.18 per pound for a cost just under $67 million. The comparative static exercises, based on this illustrative figure, in chapter 5.3 will present the graph of refined price determination in the US and Mexico under a differing set of policies and exogenous shocks.

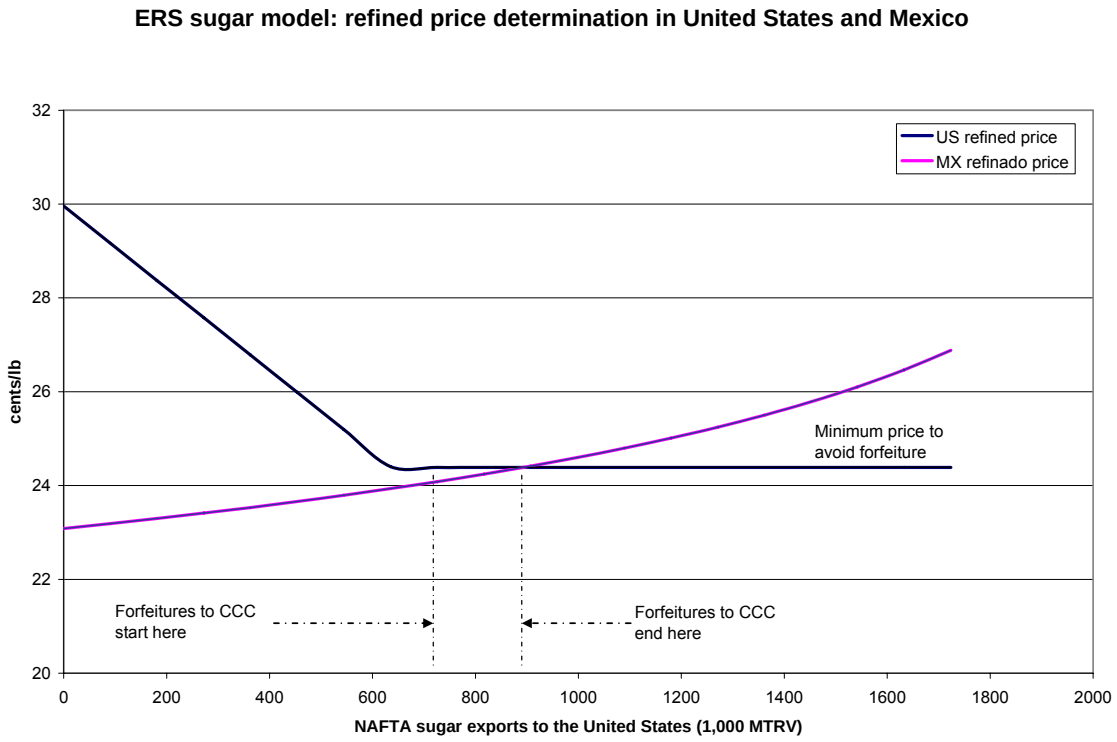


Figure 23 US/Mexico Price Equilibration and Forfeitures

5.3 Policy Overview and Modeling Applications

Chapter 5.3 provides a brief review of US sugar policy, which was discussed in depth in chapter 2, and discusses its application in the USDA model, in particular. Box 8

is a review of four primary policy parameters that were addressed in depth in chapter 2. The Overall Allotment Quantity, Loan Rate, PIK program, and Tariff Rate Quotas are critical policy instruments used to manage the US sugar program and are critical to the operation of the model.

Overall Allotment Quantity (OAQ) – supports the price of sugar by restricting marketing of domestically produced sugar beyond expected demand for food and beverage use.

Loan rate forfeitures – supports the price of sugar by allowing processors to forfeit sugar to the Commodity Credit Corporation (CCC) in full repayment of CCC loans made to processors.

Payment-in-Kind (PIK) – CCC sugar stocks can be transferred to processors in exchange for restricting planting or harvest of sugar crop acres.

Tariff-rate-Quotas (TRQs) – supports the price of sugar by limiting imports of sugar. Import access is subject to minimum commitment levels as per the World Trade Organization (WTO) and by provisions of several Free Trade Agreements (FTAs). Over-quota imports are subject to high tariffs.

Box 8 US Sugar Program Policy Parameters

OAQ

Determination of the Overall Allotment Quantity, as laid out in the 2002 Farm Bill, is shown in box 9. The OAQ is determined by the USDA at the onset of a given year first by summing of expected deliveries for human consumption and reasonable ending stocks, that is, a stocks level yielding an ending fiscal year stocks to use ratio of 14.5%, 1532 million STRV (the sum of the WTO minimum TRQ allocation of 1.256 million and the maximum NAFTA low-duty of 276,000 STRV) and the beginning stocks from the given year are subtracted from this total to find the OAQ. The share of the OAQ given to beets is 54.35% of the total while sugar is allotted 45.65% of the OAQ. Reassignments of OAQ occur when cane sugar or beet sugar cannot meet all their allotment. These reassignments cannot take place between beet and cane sectors. Instead, unfilled allotment from either sector is given to a foreign producer, if the need cannot be met by CCC stocks. The OAQ is suspended if imports are projected to be greater than the sum of 1.532 million STRV and OAQ reassignments.

I. Determination of Overall Allotment Quantity (OAQ):

OAQ = Expected sugar deliveries for human food and beverage use + "reasonable" ending stocks (14.5% of total use) – [1.532 million STRV + beginning stocks]

Beet allotment = 0.5435 * OAQ
-assigned to sugar processors
Cane allotment = 0.465 * OAQ
-assigned to cane producing states and then raw cane processors within states

II. Blocked stocks = Beginning stocks + Production – OAQ

III. Reassignments of OAQ
-applicable when either beet sugar allotment > projected beet production or cane sugar allotment > projected cane sugar production

Unfillable OAQ reassigned to sugar imports for consumption

IV. OAQ Suspension
If sugar imports for consumption are projected to be greater than 1.532 million STRV + OAQ reassignments to imports

Box 9 Determination of OAQ, Blocked Stocks, OAQ Reassignments and OAQ Suspension

[11] Reassignments of OAQ

Loan Rate

Box 10 provides a brief review of the fundamentals of the loan rate program for sugar, which provides the price floor to sugar producers in the US.

Sugar processors who agree to comply with program provisions can pledge a quantity of sugar as collateral and obtain a loan from the CCC

Borrowers receive an established price per pound of sugar pledged for the loan:
18.0 cents/lb for raw sugar
22.9 cents/lb for refined sugar

To qualify for loans, processors must agree to provide payments to producers that are proportional to the value of the loan received by the processor for sugarbeets and sugarcane delivered by producers. USDA has the authority to establish minimum producer payment amounts.

-Loans are taken for a maximum term of 9 months and must be liquidated along with interest charges by the end of the fiscal year in which the loan was made.
-The loans are non-recourse meaning that the CCC 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 reducing excess supply and supporting the market price of sugar.

Box 10 Loan Rate Program

[11] Not modeled: within sector reassignments (i.e., between processors or between States (cane sugar); or reassignments to the CCC (model uses beginning CCC sugar stocks for PIK area planted/harvested reductions)

PIK Adjustment

The PIK program is modeled as an offer and bid process. The CCC offers to trade stocks of sugar it holds in exchange for commitments by processors and producers to not plant/harvest a specified sugarcrop area. Those who commit to the largest area reductions are given the CCC owned sugar. The model determines the amount of acreage processors are willing to exchange on the basis of variable costs. Higher cost processors and producers are willing to exchange relatively more area for the sugar on which they are bidding.

TRQ

The TRQ is set at a minimum of 1.256 million STRV as agreed upon under the URAA plus OAQ reassignments in excess of amounts allocated to expected NAFTA and FTA entries. Sugar within the TRQ is imported at a low duty which is typically waived under preferential trade agreements. Sugar imported above the TRQ is forced to pay a high-tier tariff. In most cases the high-tier tariff is prohibitively high for imports to occur. Outside of NAFTA, FTAs exist which allow for low duty sugar to be imported which are capped at annual levels and contingent on any given FTA country being a net surplus exporter. NAFTA allows for unrestricted market access for Mexican sugar beginning in 2008. In 2006 and 2007 Mexico was granted progressively larger market access and lower over-quota tariffs. Finally, the model also accounts for small quantities of imported raw sugar for the USDA re-export program (box 11).

Tariff-Rate Quota imports:

- Sugar (mostly raw) imported at a low duty
- USDA determines the fiscal year level of the raw and refined sugar TRQs, subject to minimum levels agreed to as part of the Uruguay Round Agreement on Agriculture (URAA)
- Minimum access = 1.139 million MTRV or 1.256 STRV
- Plus OAQ reassignments in excess of amounts allocated to expected NAFTA and FTA entries =MAX(beet OAQ – beet production, 0) + MAX(cane OAQ – cane production,0) – CCC sugar – expected imports from NAFTA and FTAs

High-Tier Tariff imports

- Imported sugar subject to high (in most cases, prohibitively so) tariff rates and price-based safeguard duties

Free Trade Agreement Sugar Provisions, other than NAFTA

- Low duty sugar imported from FTA countries
- Low-duty imports are capped at annual levels
- Imports from FTA countries are subject to country being a net surplus exporter
- Under certain conditions of over-supply in the US market, imports can be exchanged for payment of lost quota rent by the US government

Sugar imports for USDA re-export programs

- Subject to quantitative licensing restrictions, and time commitments of re-export of product as refined sugar or sugar containing product; or as use in production of polyhydric alcohol

Sugar imports under NAFTA

- July 27, 2008 agreement:
  -Duty-free sugar for FY 2007 = 250,000 MTRV
  -Duty-free sugar for Oct.-Dec. 2007 = 175,000-250,000 MTRV
- Over-quota sugar tariff
  -2006: raw = 3.02 cents/lb, refined = 3.20 cents/lb
  -2007: raw = 1.51 cents/lb, refined = 1.60 cents/lb
- 2008 and beyond; no quantitative or price restrictions

Box 11 US Imports

[12] low duty

[12] low duty = 0.625 cents/lb, waived for most countries under Generalized System of Preferences (GSP) or Caribbean Basin Initiative

5.4 Supply and Use Variables: Production and Consumption

This section elaborates on the supply and use variables as they apply to the US and Mexico with emphasis on production and consumption. This section picks up on the planting decisions made by growers as illustrated to be dependent on price in the price determination overview box 2, section 5.2. Box 12 provides a graphical depiction of the balance of supply and use variables for sugar in the US which are written out below. The supply and balance equation shows how ending stocks and deliveries are determined. Determination of ending stocks and deliveries creates a stocks to use ratio which will drive price determination for the coming year, perpetuating the model.

Beginning stocks account for those that are processor or refiner owned and sugar owned by the CCC. US production is accounted for by the sugar processed from sugar beets and sugar processed from sugarcane. There is a downward adjustment on processing capacity for beet sugar and cane sugar if product returns are unable to cover variable costs in the short term and total costs over the long term.

Imports into the United States are the sum of Tariff Rate Quota (TRQ), Free Trade Agreement (FTA) imports, NAFTA imports, imports for re-export and polyhydric alcohol industry as well as High-Tier Tariff Imports. Imports under the TRQ are determined by the minimum market access as negotiated under the WTO which is exogenous and additional TRQ granted under reassignments of Overall Allotment Quantity (OAQ) in the event of domestic supply shortages. FTA imports are composed in the model of imports from CAFTA countries and the Dominican Republic. These imports are relatively small compared with NAFTA imports and potentially, TRQ imports. Imports under NAFTA constitute an important part of the model and are contingent on Mexico exportable sugar surplus. The surplus is largely dependent on HFCS use in Mexico to the extent that as HFCS is adopted in the Mexican beverage industry sugar will be displaced onto the American market. The assumption made about HFCS adoption in Mexico is exogenous. Imports for re-export and the polyhydric alcohol industry are treated as exogenous to the model and are also relatively minor. Finally, high tier or over-quota imports take place only if the US price equals the world price plus the tariff plus marketing costs, an unlikely scenario under current conditions but liable to change if the tariff were reduced.

The utilization side includes deliveries, exports, and ending stocks. Deliveries are divided into four categories in the model; deliveries for human consumption (food and beverage), deliveries under the sugar containing products re-export program, deliveries for the polyhydric alcohol industry, and deliveries for livestock feed. All but deliveries for food and beverage are exogenous to the model. Deliveries of polyhydric alcohol and for livestock feed are small relative to deliveries of sugar containing products and deliveries for food and beverage. Deliveries for food and beverage consumption assume a constant per capita sweetener consumption in the US and are influenced by assumptions regarding imports of sugar-containing products. The model allows for substitution of sugar for HFCS if sugar prices approach the cost of HFCS production.

Exports of sugar from the US occur as refined sugar under the re-export program, which is treated as exogenous to the model and represents a small volume of trade. Under certain conditions, exports of US sugar to Mexico cannot be ruled out. In the model, these exports would occur as negative NAFTA imports. An example of this is given in the comparative static analysis.

Finally, the accumulation of ending stocks is recognized for both private industry, processor and refiner owned, as well as the accumulation of sugar by the CCC. Industry stocks are influenced by the OAQ allocation while CCC stock accumulation occurs if domestic price falls to or below the minimum level to avoid forfeiture.

Beginning Stocks	+ Production	+ Net Imports	= Exports	+ Deliveries	+ Ending Stocks
-Processor/ Refiner Owned **-CCC Sugar** >us in payment-in-kind program (PIK) to reduce planted or harvested sugar crop area and FTA imports	**Sugar Processed from:** **-Sugarbeets** >function of lagged state-level or regional sugarbeet prices, which are derived from beet sugar price >production dependent on available processing capacity >processing capacity dependent on product returns covering minimum average variable costs **-Sugarcane** >function of lagged state-level sugarcane prices, which are derived from cane sugar price >production dependent on available processing capacity >processing capacity dependent on product returns covering minimum average variable costs in short run and average total costs over medium run	**-Tariff-Rate Quota** >Min. WTO access (exog) >Add. TRQ from OAQ reassignments **-FTA Imports** >DR and CAFTA **-NAFTA Imports** >dependent on Mexico exportable sugar surplus: *HFCS Use in Mexico *Either: (1) adjustment of ending stocks to desired level as percentage of domestic consumption or (2) Mexico price=U.S. export parity price **-Imports for re-export and polyhydric alcohol industry (exog.)** **-High-Tier Tariff Import if price=world price+tariff+marketing costs**	**-Refined Sugar Re-export program (exog.)**	**-Deliveries for human food and beverage consumption** >Constant per capita sweetener consumption >Influenced by assumptions regarding imports of sugar-containing products >Possible substitution for HFCS if sugar price approaches the costs of producing HFCS **-Deliveries for Sugar-Containing Products (SCP) export program (exog.)** **-Deliveries for polyhydric alcohol industry (exog.)** **-Deliveries for livestock feed (exog.)**	**-Processor/Refiner Owned** >Influenced by OAQ allocation **-CCC sugar forfeiture** >If price=minimum level to avoid forfeiture

Box 12 Supply and Use Variables, US

Box 13 provides an overview of the supply and use variables for Mexico. These variables function in a conceptually similar was as those of the US. The primary distinction is that ending stocks for Mexico can be adjusted to ensure price parity with the US (5.2d Price Equilibrium Between the US and Mexico) or set to a predetermined reasonable ending stocks rate.

Beginning Stocks	+ Production	+ Imports	= Net Exports	+ Deliveries	+ Ending Stocks
-Processor/ Refiner Owned	**Sugar Processed from:** **-Sugarcane** >function of lagged regional sugarcane prices, which are derived from cane sugar price >production dependent on available processing capacity >processing capacity dependent on product returns covering minimum average variable costs in short run and average total costs over medium run	**-Imports for PITEX sugar-containing product exports (exog.)** **-High-Tier Tariff Imports if price=world price+Tariff+marketing costs**	**-Dependent on Mexico exportable sugar surplus:** *HFCS use in Mexico *Either: (1) adjustment of ending stocks to desired level as percentage of domestic consumption, or (2) Mexico price=US export parity price	**-Deliveries for human food and beverage consumption** >Per capita sweetener consumption is a function of real per capita GDP >Possible substitution for HFCS if sugar price approaches the cost of producing HFCS	**-Processor/Refiner Owned** >Either (1) adjustment to policy determined percentage of Mexican sugar consumption, or (2) residual amount after exports have adjusted to assure refined sugar price parity with the US.

Box 13 Supply and Use Variables, MX

5.4a Sugar Production

Nationwide cane sugar production and beet sugar production similarly are functions of the acreage of sugarcrop harvested and sugar yields per acre (box 14). Cane sugar production is determined at the state level while beet sugar production is determined only at the national level. Cane sugar production in the US (and Mexico) can be disaggregated to the level of the state (region) because of better data on sugar yields per acre. Beet sugar producers, on the other hand, often receive beets from several states. One major processor with facilities in two states does not distinguish production from the two making state yield data difficult to surmise.

Box 14 shows how US and Mexican cane sugar and US beet sugar are calculated by multiplying area harvested after the PIK adjustment by the sugar yield per acre (the calculation of area harvested and the sugar yield will be discussed in detail at the level of the state below).

Sugar (i,j) = (Area harvested (i,j) - cane PIK adjustment (US cane(,j, excluding HI))) * Sugar Yield (i,j)
for i = U.S. cane, j = FL, LA, TX, HI
for i = Mexico cane, j = Central, Gulf, Northeast, Northwest, Pacific, South

Sugar (US beet) = (Σ Area harvested (,j) - beet PIK adjustment) * Sugar Yield (US beet)
for j = CA,CO, ID, MI, MN, MT, ND,NE, OR, WA, WY

Box 14 Sugar Production

5.4ai Calculating Harvested Area

Estimating area harvested for US cane and US beet is a function of a constant, the area adjustment with respect to competing crops and an adjustment for lost processing capacity, as shown in box 15.

Area harvested:
Area harvested (i,j) = Constant * (Area Adjustment wrt(with respect to) competing crops(i,j)) * (Adjustment for Lost Production Capacity(i,j))

Area Adjustment wrt competing crops((U.S. cane, U.S. beet),j,t) = f (sugar crop price (t-1)/Alternative crop price (t-1),….sugar crop price (t-n)/Alternative crop price (t-n))

Area Adjustment wrt competing crops (MX cane,,j,t) = f (net real return (t-1)/net real return(t-2),….net real return (t-n)/net real return (t-(n-1))

Box 15 Harvested Area

5.4ai(1) Area Harvested Equations

Boxes 16, 17, and 18 show the sugarcrop area adjustment equations for US cane, US beet and Mexican cane which are functions of US real cane price, US real beet price and Mexico real cane return respectively. Adjustment elasticities for Louisiana and Hawaii are given at the sub-state level. State level elasticities for Louisiana and Hawaii are determined from these values by taking a weighted average. If an equation is absent from any of these three tables it indicates no statistically significant relationship was found.

Real cane and beet prices are determined by indexing the price of these sugar crops against an array of competing crops and comparing this to a base year. Because sugarcane can be grown and harvested over a three year or longer time period, prices lagged for one or more years can be important for determining how much acreage is available for harvest. For Mexico, where there are few crops competitive with cane, real cane returns are used instead and are simply the difference between real cane price and real production costs.

Sugarcane area harvested equations												
Region	Equation Specification	State cane price indexed by: [13]	Constant	Trend	Real cane price Lag:1yr.	Lag:2yrs	Lag:3yrs	First order autoregres-sive term	Adj. R2	Durbin-Watson (DW)	Sample period	Excluded years[14]
Florida	log difference	All Crop Index	-0.077		0.154				0.503	2.470	1991-2005	2004
T-stat			3.246		1.861							
Central Louisiana	log	Vegetable Crop	7.278	0.146	1.015			0.708	0.960	1.218	1981-2005	1984
T-stat			14.234	7.264	3.297							1990
Central Louisiana	log difference	Vegetable Crop			1.069			0.642	0.469	2.152	1981-2005	1984
T-stat					4.184			3.918				1990
South-Central Louisiana	log	Vegetable Crop	11.739	0.019			0.270	0.783	0.942	1.596	1981-2005	1990
T-stat			76.505	3.089			4.392	4.717				
South-Central Louisiana	log difference	Vegetable Crop					0.229		0.900	1.886	1980-2005	1990
T-stat							4.167					1991
Southeast Louisiana	log	Oil Crop	11.391		0.101			0.868	0.821	2.031	1981-2005	1990
T-stat			120.792		1.789			9.426				
Southwest Louisiana	log	Vegetable Crop	10.415		0.166			1.708[15]	0.990	1.293	1985-2005	1990
T-stat			12.142		0.930			8.733				1997
Texas	log/ distr. lag	Cotton Crop	10.420		0.156	0.110	0.065	0.294	0.473	1.687	1977-2005	
T-stat			296.532		2.385	3.556	1.076	1.720				
Maui Hawaii	log	Fruit Crop	9.898		0.156				0.795	1.784	1977-2005	
T-stat			639.255		3.827							
Kauai Hawaii	log	All Crop	9.590		0.565				0.957	2.253	1985-2005	
T-stat			72.724		1.713							

Box 16 Sugarcane area harvested equations

[13] State cane price indexed by: Prices Received by Farmers, "Agricultural Prices - Annual Summary," NASS, USDA.

[14] Years excluded from analysis by use of indicator (aka dummy) variable for the year

[15] Southwest Louisiana (log) second order autoregressive term coeff. value = -0.745, T-stat. = 3.979

Sugar Baseline Model: Sugarbeet area harvested equations									
Region	*Equation Specification*	*State beet price indexed by: 1/*	*Constant*	*Real beet price Lag:1yr.*	*First order autoregres-sive term*	*Adj. R2*	*Durbin-Watson (DW)*	*Sample period*	*Excluded years 2/*
SanJoaquin Mperial Val. CA	log	Food Crop	11.894	0.486	0.490	0.969	1.785	1982-2005	1996
T-stat.			173.728	4.689	2.271				
SanJoaquin Imperial Val. CA	log difference	Food Crop		0.514		0.350	1.921	1982-2005	1996
T-stat				3.160					
Northwest (ID, OR, WA)	log difference	Potato Crop		0.057	0.597	0.674	1.666	1983-2005	2001 2005
T-stat				2.066	3.085				
Idaho	log	All Crop	12.181	0.168	0.883	0.885	1.145	1982-2005	1996
T-stat			136.689	2.173	13.026				
Central Great Plains (CO, NE, SE WY)	log	Food Crop	12.053	0.496		0.808	1.576	1981-2005	2003
T-stat			384.735	3.353					
Central Great Plains (CO,NE,SE WY)	log difference	Food Crop		0.469		0.628	2.540	1982-2005	1985 2001 2003
T-stat				2.663					
Northern Great Plains (MT, NW WY, W ND)	log	All Crop	11.663	.592 [16]	0.685	0.620	1.859	1984-2005	
T-stat			158.054	3.362	5.612				
Montana	log	All Crop	10.987	0.750 [10]	0.709	0.592	1.717	1984-2005	
T-stat			115.512	3.659	5.622				
Great Lakes (MI, OH)	log	Feed Crop	12.116	0.281	1.149 [17]	0.918	1.796	1983-2005	1996
T-stat			236.816	5.184	6.299				
Great Lakes (MI, OH)	log difference	Feed Crop	0.031	0.293	0.351	0.720	1.576	1983-2005	1996
T-stat			1.974	5.598	1.685				
Upper Midwest (MN, ND)	log	Feed Crop	13.982	0.081	0.945	0.985	2.035	1984-2005	1986 1990
T-stat			53.251	2.557	37.084				

Box 17 Sugarbeet area harvested equations

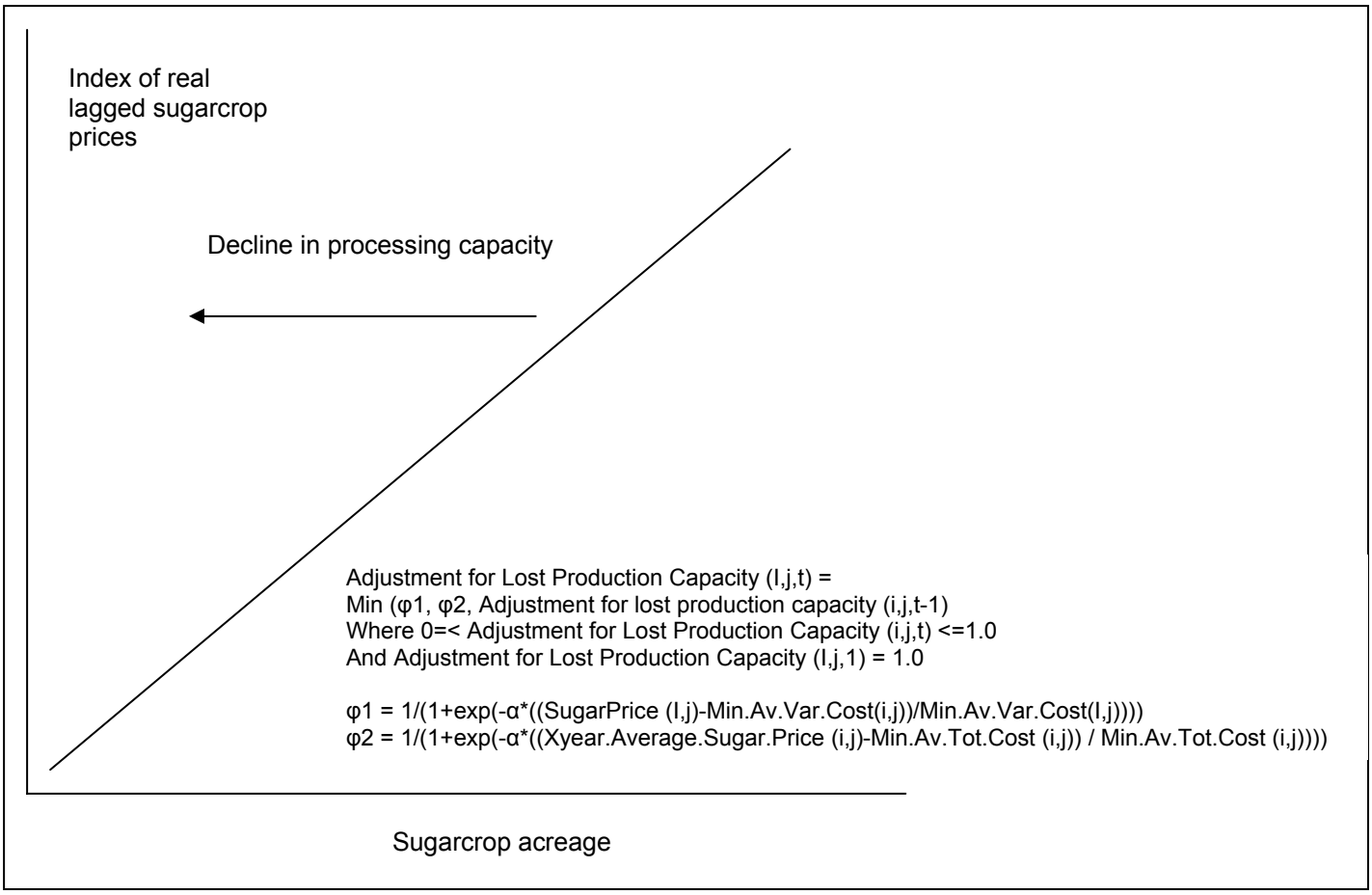
[16] Northern Great Plains and Montana real beet price - Three Year Lag
[17] Second order autoregressive term coeff. value = -0.350, T-stat. = 2.140

Sugar baseline model: sugarcane area harvested equations in Mexico														
Region	*Equation Spec.*	*Constant*	*Calibration*	*Trend*	*LN Real cane returns per hectare*						*Adj. R2*	*DW*	*Sample Period*	*Excluded Years*
					Lag: 1 yr	**Lag: 2 yr**	**Lag: 3 yr**	**Lag: 4 yr**	**Lag: 5 yr**	**Lag: 6 yr**				
Central	log	7.646	1.028	0.007	0.251						0.754	1.928	1989-2006	1994-95
T-stat		9.699		2.599	3.024									
Gulf	log	7.036	1.078	0.032	0.190	0.152	0.114	0.075	0.037		0.943	2.221	1994-2006	log
T-stat		9.002		13.125	6.276	6.711	6.980	5.675	2.359					
Northeast	log	10.289	1.031	0.020			0.038	0.043	0.049		0.802	2.820	1993-2005	2004
T-stat		22.372		5.402			1.186	2.372	1.736					
Northwest	log	9.999	.979				0.431	0.334	0.238	0.142	0.524	1.846	1995-2005	
T-stat		238.416					2.264	2.758	3.578	1.933				
Pacific	log	3.126	.938	0.011	0.095	0.139	0.182	0.226	0.270		0.899	2.315	1993-2006	log
T-stat		3.017		5.486	2.559	5.099	8.050	8.541	7.476					
South	log	6.818	1.084	0.037			0.133	0.136	0.139		0.959	1.960	1993-2005	1994
T-stat		9.058		13.638			3.132	4.950	3.435					

Box 18 Sugarcane area harvested equations for Mexico

5.4ai(2)Processors Adjustments to Price Change

A share of processors in the US and Mexico are modeled to permanently exit the industry if the price of sugar falls below variable cost for one year or if the price of sugar is below the total cost for a multi-year period of some duration. The processing adjustment φ1 is attributed to variable costs and φ2 is attributed to total costs exceeding sugar prices (box 19). As variable and total costs vary by region so do processors adjustments. Processing capacity is then equal to the lesser of its value in the previous period or the minimum value corresponding to the two conditions set out above. Specifying that the capacity proportion cannot exceed its value in the previous period imposes asymmetry on capacity adjustments; e.g. once capacity is lost, it cannot be regained.



Box 19 Processing Adjustment to Low Prices

Figure 22 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 costs areas for cane and beet sugar producers/processors. Costs are reported by their ratio to average total cane costs. 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 22 is also helpful in the understanding of the buyout scenario which is introduced in chapter 6. If the government would offer a buyout of production capacity, growers with a marginal value of production capacity less than that value would accept the buyout, and the production capacity of those growers would be lost.

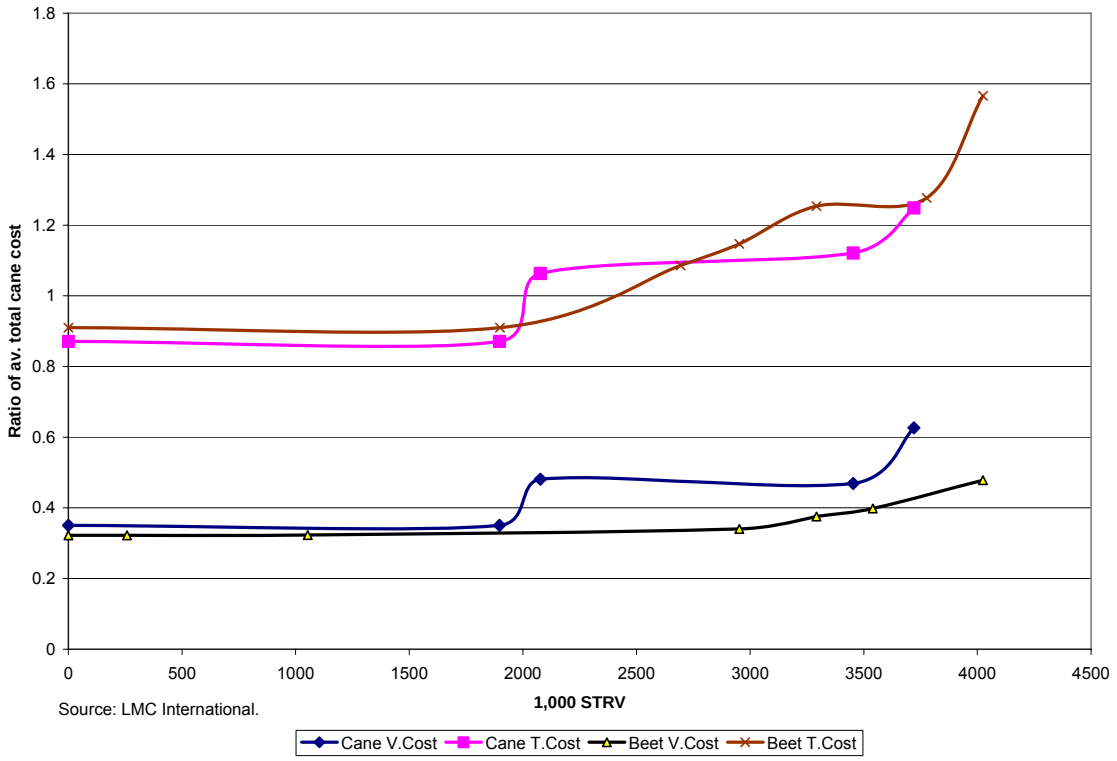


Figure 24 Cumulative US Cane and Beet Sugar Costs of Production

5.4aii Sugar Yields, Sugarcrop Yields and Production

Increases in sugarcane yields and sugarbeet yields are a function of a trend variable and are determined at the level of the state for the US and at the regional level for Mexico. In the case of sugarcane yields, only Louisiana has a trend coefficient that is not equal to zero, meaning that cane yields for Texas, Florida and Hawaii are flat.

The cane sugar yields are a function of trend variables and the cane yield and are determined at the state and regional level for the US and Mexico respectively. The beet sugar yield on the other hand is a function of a trend variable and the weighted average of all state-level sugarbeet yields (Box 20).

Sugar Yield:
Sugar Yield (i,j) = β0 + β1*Trend + β2*Sugarcane yield (i,j)
for i = U.S. cane, j = FL, LA, TX, HI
for i = Mexico cane, j = CE, GU, NE, NW, PC, SO

Sugarcane yield (i,j) = α0 + α1*Trend

Sugar Yield (U.S. beet) = β0 + β1*Trend + β2*(Wt. average of State-level sugarbeet yields)

Sugarbeet yield (j) = α0 + α1*Trend
for j = CA,CO, ID, MI, MN, MT, ND,NE, OR, WA, WY

Box 20 Sugar Yields

Sugar yield as a function of sugarcane yield and trend growth is displayed in box 21. The product of the sucrose extraction rate and state-level harvested area is equal to raw cane sugar production.

Area harvested at State level * Sucrose extraction (sugar/acre) = Raw cane sugar production

(lagged real cane prices, available processing capacity)

Sugarcane yield (trend growth for LA)

Processing efficiency (trend growth)

Sugarcane production

Sugarcane Yield Equation

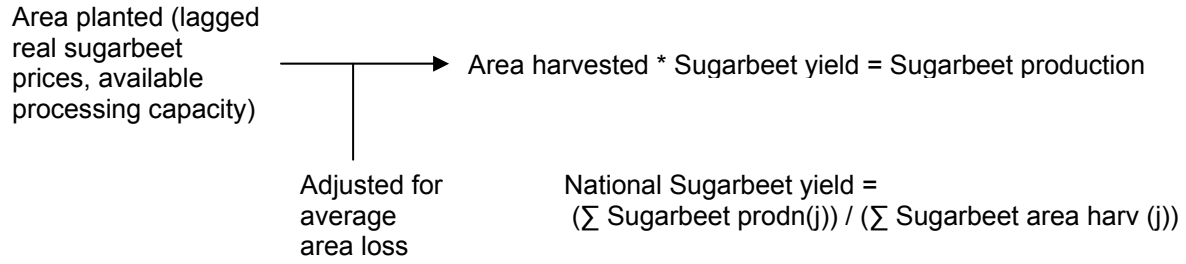
States	Sugarcane yield equation: YD=c(1)+c(2)*D2000toD20006+c(3)*D2005+c(4)*Trend+ar(1)						
	Constant	D2000toD2006	D2005	Trend	ar(1)	Adj. R2	DW
Florida	32.675	4.202	-5.562	--	--	0.417	2.186
(t-stat)	80.004	5.145	2.486	--			
Louisiana	21.417	--	--	0.193	0.375	0.475	1.825
(t-stat)	16.919	--	--	3.251			
Texas	37.382	--	--	--	0.763	0.697	1.728
(t-stat)	12.382	--	--	--			
Hawaii	89.219	--	--	--	0.506	.083	1.455
(t-stat)	11.929	--	--	--			

Cane Sugar Yield Equation

States	Sugar yield equation: YD=c(1)+c(2)*Trend+c(3)*StateCaneYield+ar(1)					
	Constant	Trend	StateCaneYield	ar(1)	Adj. R2	DW
Florida	-0.0753	0.029	0.123	--	0.966	2.356
(t-stat)	3.027	13.053	15.457			
Louisiana	-0.377	0.027	0.102	--	0.948	2.356
(t-stat)	2.164	12.145	13.411			
Texas	-1.773	0.012	0.148	--	0.938	1.854
(t-stat)	5.263	1.686	0.148			
Hawaii	--	0.058	0.110	0.429	0.823	1.906
(t-stat)	--	6.129	49.373			

Box 21 Raw Cane Sugar Production

Box 22 provides an estimation equation for state yields which is multiplied by harvested area to find total sugarbeet production. National sugarbeet yield is calculated by finding the quotient of the sum of all states sugarbeet production over the sum of all states sugarbeet area harvested. Weather and disease events during the growing season cause less beet acreage to be harvested than is typically planted. Box 22 also provides this adjustment for average area loss for the eleven states actively producing sugarbeets.



States	Ratio of area harvested to area planted	Yield equation: YD = c(1)+c(2)*Trend			
		Constant	Trend Coeff.	T-Stat	Adj.R2
California	0.978	26.122	0.344	5.225	0.910
Colorado	0.955	17.780	0.155	5.180	0.418
Idaho	0.991	21.777	0.156	4.260	0.388
Michigan	0.967	7.575	0.361	5.166	0.631
Minnesota	0.979	13.933	0.191	4.511	0.488
Montana	0.986	17.971	0.174	4.635	0.564
Nebraska	0.929	13.613	0.196	2.501	0.260
North Dakota	0.984	13.609	0.200	4.348	0.408
Oregon	0.973	20.116	--	--	--
Washington	0.983	22.582	0.395	9.322	0.819
Wyoming	0.975	18.361	0.089	3.350	0.522

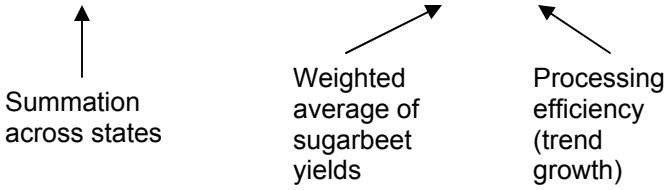
Box 22 Sugarbeet Production

[18] Ratio of area harvested to area planted

Finding the nationwide beet sugar yield is a function of trend growth and the national sugarbeet yield. The nationwide beet sugar yield is then multiplied by the area harvested at the national level to find national refined beet production (box 23).

[18] Crop year average, 1980-2005, excluding PIK years 2001 and 2002

Area harvested at national level * Sugar yield (sugar/acre) = Refined beet sugar production



	National Beet Sugar Yield Equation: YD=c(1)*Trend+c(2)*SugarbeetYield			
	Trend	**Sugarbeet Yield**	**Adj. R2**	**DW**
National Beet Sugar Yield	0.025	0.116	0.893	2.602
(t-stat)	8.999	35.898		

Box 23 Refined Beet Sugar Production

5.4b Consumption

The modeling approach to demand for the US and Mexico is shown in box 24. The growth rate of demand for sugar, sweeteners, and sugar containing products in Mexico and the US is a function of population and income. However, the income elasticity of demand for the US is zero, while that of Mexico is 0.368. For the US, substitution of sugar for HFCS is said to occur as the sugar price approaches production cost of HFCS plus marketing margins. Production costs of HFCS are linked to the cost of corn production which is a function of USDA price estimates and the value of corn byproducts in HFCS production. The inverse rates of substitution between HFCS and sugar use in the US beverage industry based on the price of sugar is demonstrated in figure 25 using 2009 as a sample year.

In Mexico, assumptions made on HFCS use (substitution of HFCS for sugar) are treated as exogenous to the model due to the political sensitivity of the product. The ramifications of the assumptions made regarding HFCS substitution are illustrated in the comparative static analysis in 5.5.

SWT – sweetener
SUG – sugar
HFCS – high fructose corn syrup
SCP – sugar containing product

G(s,p) – annual growth rate: s=food, beverage; p=swt, hfcs, scp
COP(HFCS) – cost of producing HFCS; MIN_MARGIN (HFCS) – minimum acceptable returns over costs
Pref(t) – price of refined sugar, at time t

φ - logistic equation for HFCS = 1/(1+exp(α*((Pref(t-1)-(COP(HFCS)+MIN_MARGIN)/(COP(HFCS)+ MIN_MARGIN)))

Model assumes: HFCS is priced below the price of refined sugar. Ability to price below sugar is limited by the cost of producing HFCS plus the minimum margin over costs. As sugar price approaches HFCS unit production cost plus margin, correspondingly less HFCS is supplied to the market.

G(s,p) = f (population, income)
SWT(s,t) = (1+G(s,SWT))*SWT(s,t-1)
HFCS(t,s)= φ*(1+G(s,HFCS))*HFCS(t-1,s)
SCP(t,s)=(1+G(s,SCP))*SCP(t-1,s)
SUG(s)=SWT(s) - HFCS(s) - SCP(s)

Income elasticities of demand

US		Mexico	
s	p	s	p
0	0	0.368	0.368

HFCS demand is exogenous in the case of Mexico
Totals:
SWT = Σ SWT(s)
HFCS = Σ HFCS(s)
SCP = Σ SCP(s)
SUG = Σ SUG(s)

Box 24 Consumption

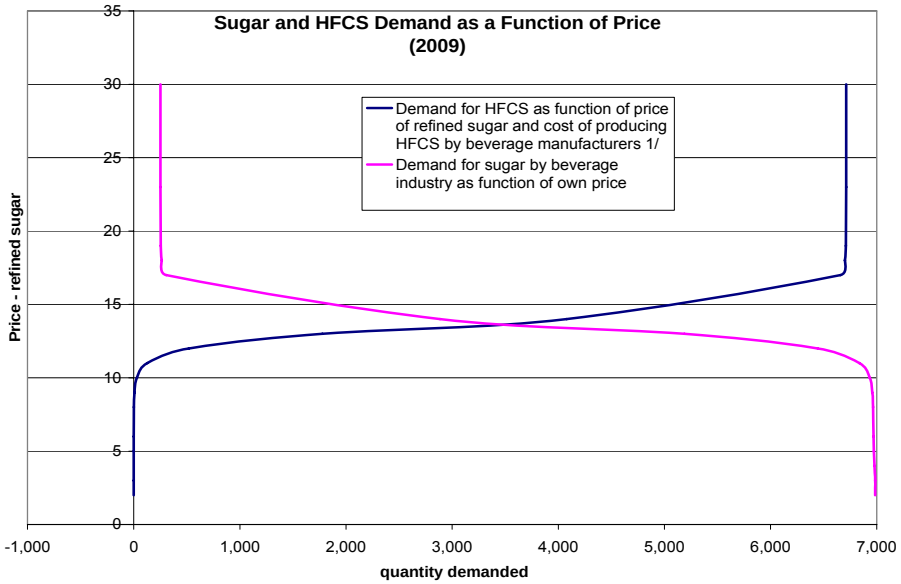


Figure 25 Sugar and HFCS Demand as a Function of Price

5.5 Comparative Static Analysis of Reform Proposals

In this section the initial effects of policy reform and how the model works to predict them are exhibited using a comparative static approach. This is presented in conjunction with the model structure so that the operation can be better understood. A more in-depth discussion of the reform policies and their effects will be given in chapter 6.

As was shown in section 5.2d the estimated cost of sugar forfeitures to the CCC for 2010 is approximately $67 million with a current loan rate of $0.18 cents per pound for raw sugar. The same graphic, figure 26, is used to estimate the loan rate at which government cost will approach zero. We can estimate the necessary loan rate by finding where the horizontal portion of the US price/import representation for sugar (the floor price) intersects the Mexican price/export representation. Figure 26 shows that a loan rate of approximately $0.177 cents per pound plus marketing costs refined basis will eliminate sugar forfeitures to the CCC.

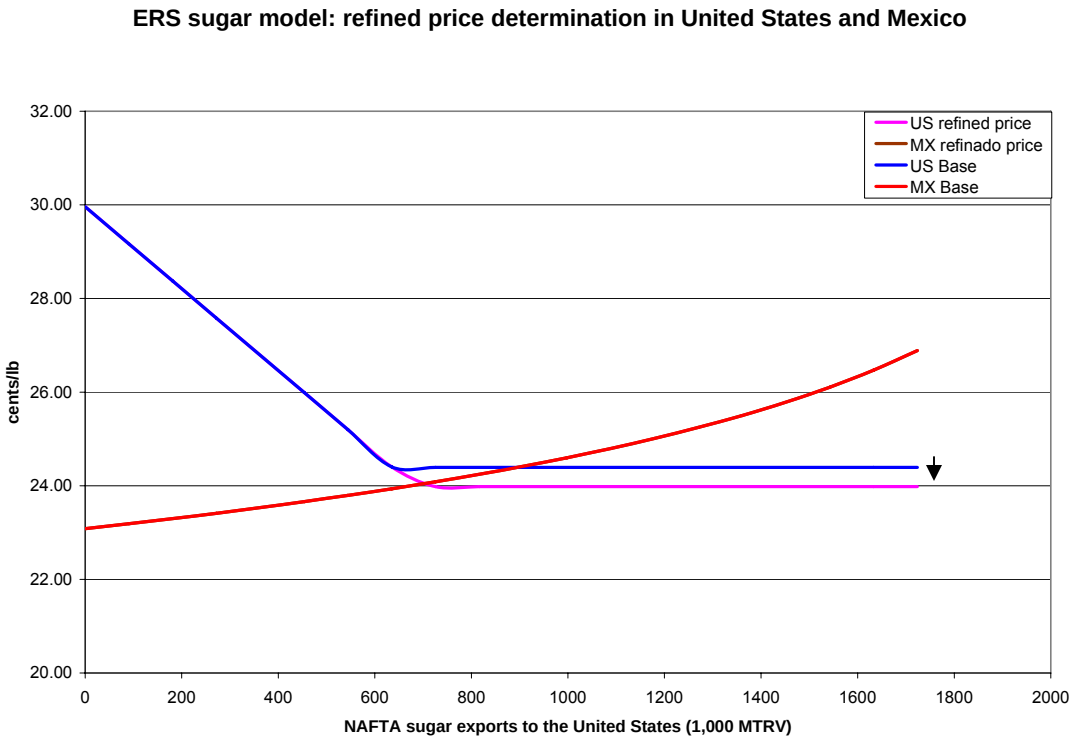


Figure 26 Comparative Static Analysis - Loan rate of 17.7 cents 50% HFCS Substitution in MX

As mentioned earlier, assumptions made about the Mexican proportion of HFCS substitution for sugar are critical to the estimation of policy scenarios. For example, figure 26 assumes HFCS substitution in Mexico at 50%. However, if the level of HFCS substitution is 75% there will be more excess sugar in the common market. Therefore, the loan rate will necessarily be lower in order to prevent forfeitures and government expenditures. Figure 27 shows that if HFCS substitution is 75% the loan rate would need to be set at $0.172 per pound.

Conversely, if HFCS substitution in Mexico were 25%, there would be no forfeitures to the CCC even at the $0.18 per pound level (figure 28). In this scenario, refined prices in Mexico and the US would rise to over $0.25 per pound.

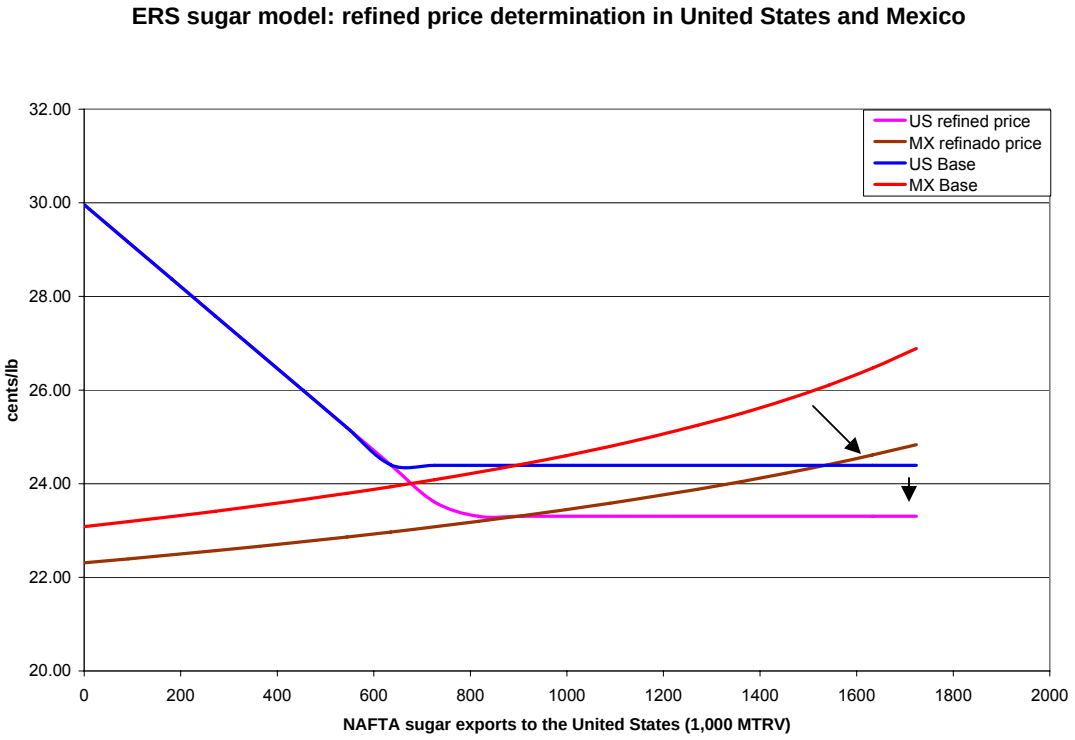


Figure 27 Comparative Static Analysis - Loan rate of 17.2 cents 75% HFCS Substitution in MX

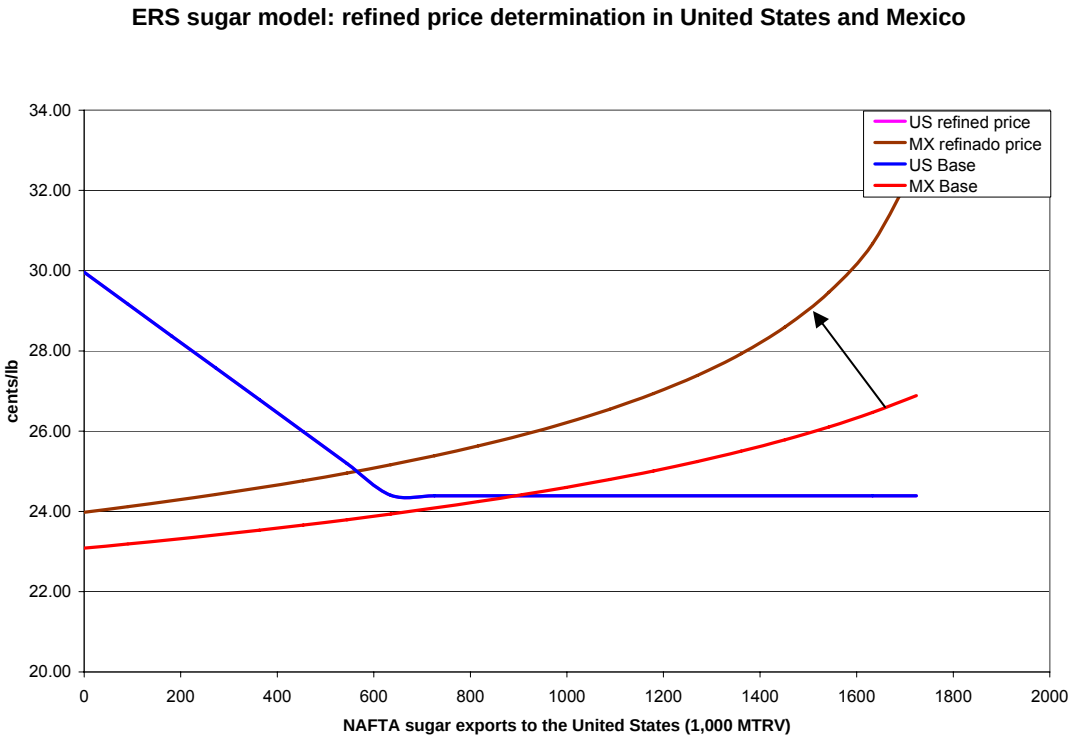


Figure 28 Comparative Static Analysis - Loan rate of 18 cents 25% HFCS Substitution in MX

In all of these scenarios, the world price plus the high tier tariff plus marketing costs, creates a price ceiling for sugar in the US and Mexico. The comparative static approach allows for observation of the interesting effects associated with a reduction in this ceiling, either by reducing the tariff or by changing assumptions in world price. Figure xx shows a reduction of the high tier tariff by 65.5%, to $0.0559 per pound. This puts the landed world price, the ceiling price for US sugar, in line with the loan rate, the floor price for US sugar (figure 29).

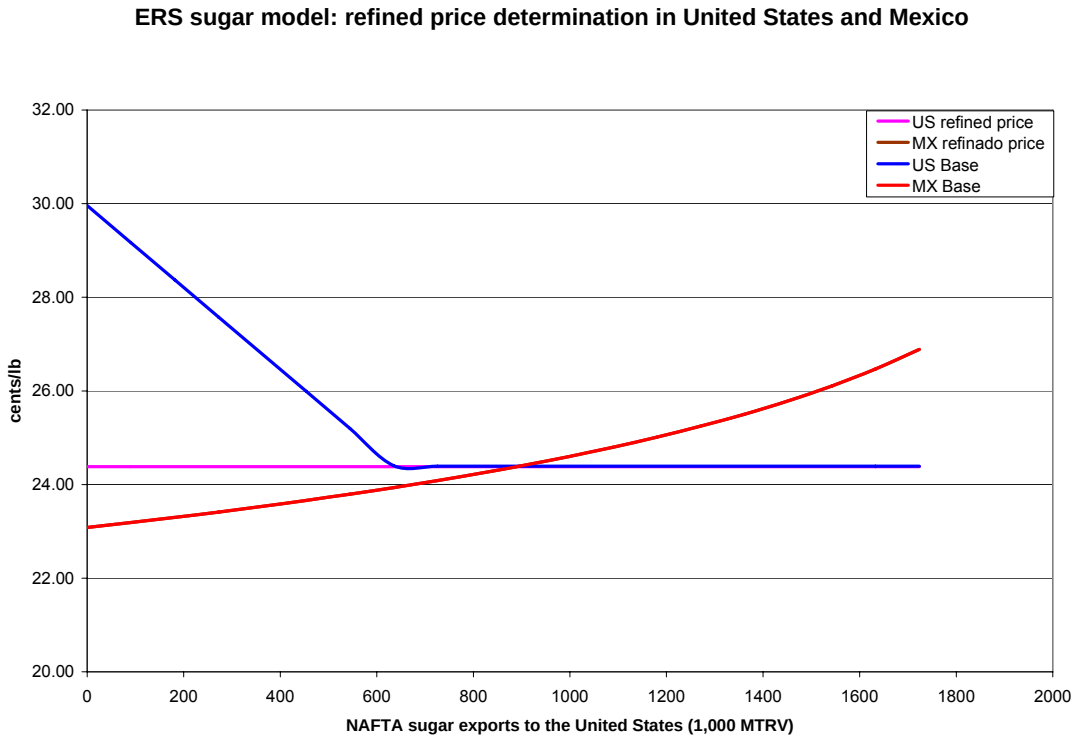


Figure 29 Comparative Static Analysis – Reduction of High Tier Tariff by 65.5%

If the tariff is reduced below this level, the US free market will no longer be consuming any US sugar. Instead, consumption would be some combination of Mexican sugar and ROW sugar and all US producers will forfeit there sugar to the CCC. This illustrates the need for a reduction in the loan rate if a free trade scenario were pursued because, if some combination of the world price, marketing costs, and the tariff brought the ceiling price below the floor price the US would essentially be subsidizing world imports.

Reducing the high tier tariff by 75% would result in all sugar coming from ROW and no US or Mexican sugar being consumed in the US at a 50% HFCS substitution level. Instead, under these scenarios there would theoretically be US exports to Mexico of approximately 200,000 MTRV (figure 30).

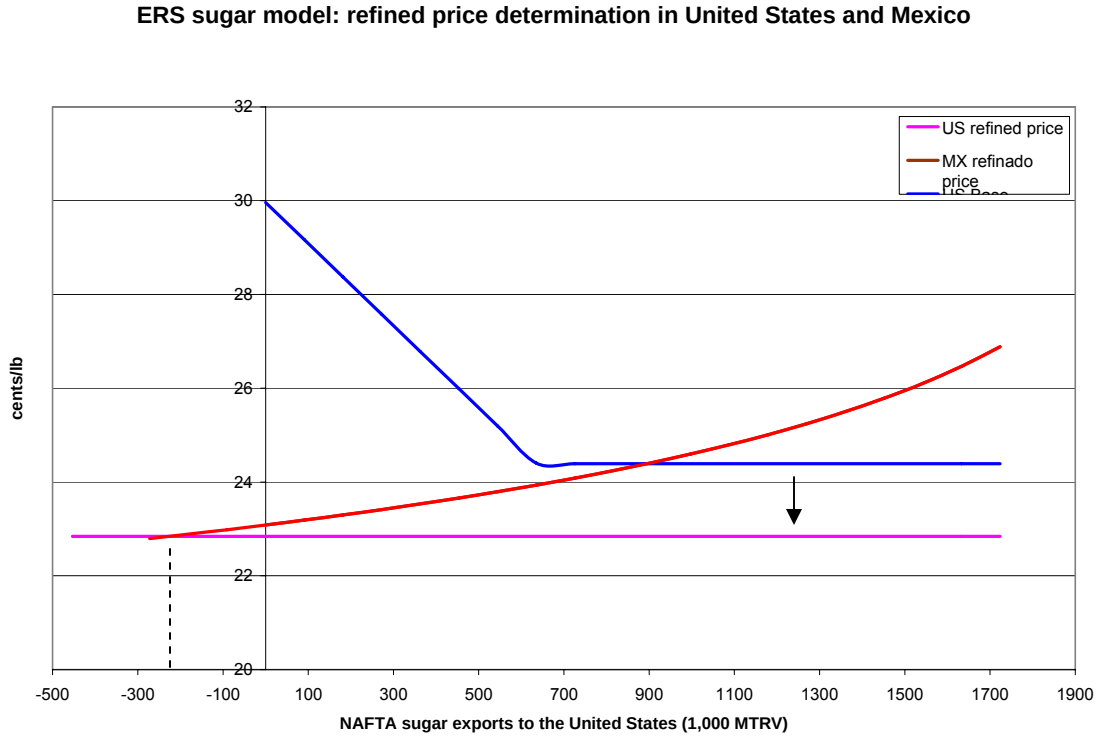


Figure 30 Comparative Static Analysis – Reduction of High Tier Tariff by 75%

Many proposals on reform of the US sugar program have suggested moving the program toward more conventional commodity program. Part of such a proposal may include abandoning the price support concept in favor of an income support approach. Figure xx illustrates this approach coupled with HFCS substitution in Mexico of 75%. With no loan rate, there are no CCC forfeitures although there are costs through direct government subsidies.

Figure 31 shows trade liberalization with ROW, with zero high tier tariff, and an assumed refined world price of $0.1579 per pound. Under this scenario, the US and Mexican price becomes equal to the world price plus marketing costs depicted by the horizontal portion of the pink line. From figure 31 it is clear that Mexico does not export any sugar to the US in this case. This graphical analysis does not show how much sugar consumed in the US would be from domestic sources. However, it can be inferred that under complete liberalization there could be significantly less domestically sourced sugar.

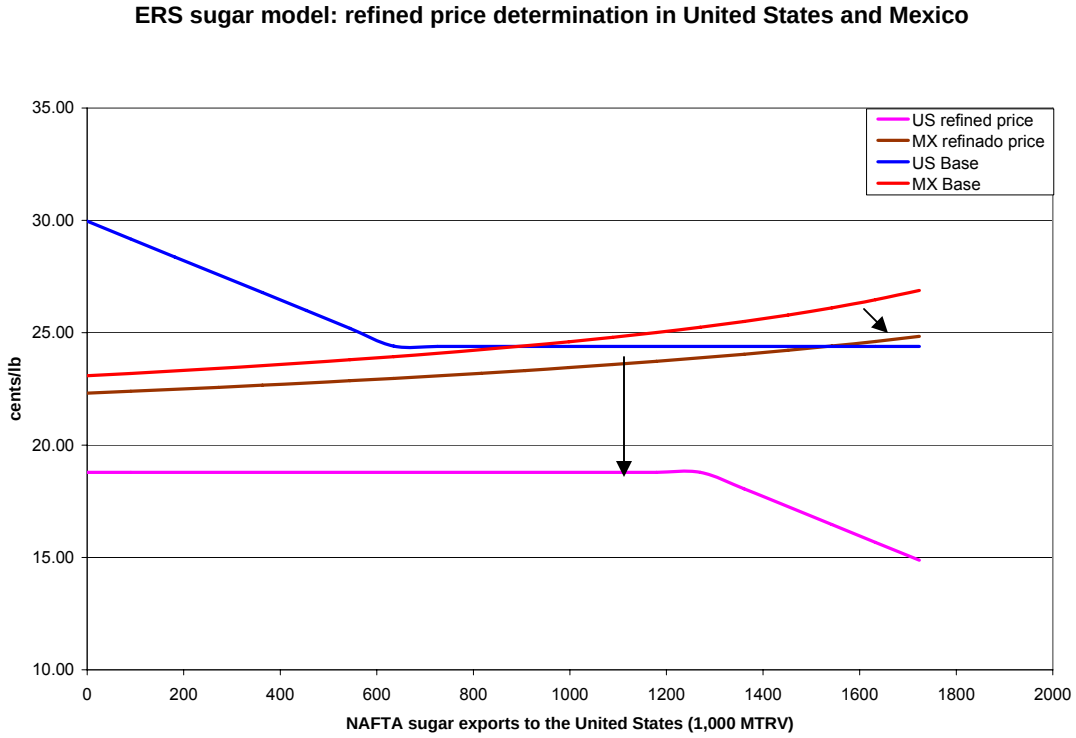


Figure 31 Comparative Static Analysis – Elimination of high-tier tariff

Chapter 6: Sugar Reform Options and Consequences

As discussed in chapters two through four, the pressures for reform of the US sugar program are real and are liable to escalate. As a policy driven model, the USDA ERS baseline model facilitates the comparison of possible policy reform scenarios for the US sugar sector. In this chapter policy scenarios will be introduced and explained in light of their predicted outcomes, goals and level of ambition.

This chapter begins by taking a closer look to the threats posed on the current sugar policy and perspectives on reform. This background will help frame the reform scenarios pursued in this paper which are discussed in 6.2.

The comparative static examination undertaken in 5.4 is a visual representation of only prices and NAFTA exports to the US in the context with a lowering of the loan rate and varying assumptions about the level of HFCS substitution in Mexico. In 6.3, a much more complete analysis will be performed on the reform scenarios introduced with the comparative static approach in addition to introducing and further developing other combinations of reform scenarios and external shocks. Section 6.3 will also model a buyout of high cost producers in the US sugar sector. It will examine motivating factors and financial parameters of an attempted buyout. It will also identify who is likely to participate in a buyout and estimate the effects of a buyout across sectors, across states, and the subsequent effects on the Mexican market. Chapter 6 will conclude with a look at welfare measurements and changes arising from the reform proposals.

6.1 Threats to the Current Program and Perspectives on Reform

Chapter 2 included an in-depth discussion on the threats to the current sugar program. To review, these are spelled out below.

1. **Increased sugar imports**
    - Unrestricted sweetener trade between the United States and Mexico in 2008
    - Free Trade Agreements
        - Already in force: Central America and Dominican Republic
        - Peru, Columbia, South Africa, Thailand and others
2. **Questionable outlook for expansion of sugar demand**
    - Drop in demand since 1999
    - Increased imports of sugar-containing products

- No growth in sugar deliveries from 2005 to 2006, and weakening demand in 2007

3. **Threat to sugar policy of no net cost to the Federal budget**
    - Under the 2002 Farm Act, marketing allotments are suspended if imports for consumption exceed 1.532 million (STRV)
4. **Pressure for global trade reform**
    - US sugar policy as an impediment to the successful conclusion of WTO Doha round
        - Prospective WTO trade liberalization may include:
            - Additional minimum import access commitments
            - Lower over quota tariff rates
            - Restrictions on the level of domestic support
5. **2007 is a Farm Bill year**
    - Sugar program will not be automatically renewed. Discussion on new sugar program must take place in light of these other pressures.

Favored alternatives for the 2007 Farm Bill are as varied as the perspectives surrounding the discussion. Here we identify four different groups with a stake in sugar policy and spelled out the generalized perspective of that group in the ongoing debate. The perspectives of these groups, along with the external pressures for reform, provide the motivation for the reform scenarios introduced in 6.2.

The producers and processors would like to see little if any fundamental change to the sugar program. Namely, they would like to maintain a price support structure with limits on additional imports. The industry favors a price support program, with marketing allotments and criteria for allotment suspension if sugar imports exceed a threshold, which gives the industry a good deal of protection. The price support approach is preferred because it shifts the burden on the user rather than on the taxpayer. To this end, the industry would also prefer that the sugar program operates at no net cost to the federal government, making the policy more easily justified in an era of high government spending.

The sugar users on the other hand would prefer lower sugar prices and an expanded availability of sugar. To achieve this, sugar users would favor a switch to an income support program with a high loan rate, which would support domestic production but force the burden of the subsidy cost onto the federal government. Sugar users would prefer that no sugar be held off the market either through allotments or CCC ownership, mechanisms which decrease supply and increase price. US sugar users are largely

unopposed to policy reform through expanded imports but are interested in the dependability of supply and quality inherent with US production.

The third perspective, that of the administration, is a preference for avoiding program expenditure while accommodating sugar import access. To achieve this, the administration favors a marketing allotment program with no criteria for allotment suspensions. This would keep domestic prices above world price but would limit the amount of production eligible to receive that price. Under the administration proposal, processors would have to hold sugar off the market at their own expense.

Finally, a globalist perspective, would be supportive of reform options leading to partial to full liberalization in the WTO Doha round. Those in this camp may be amenable to a sugar buyout to achieve longer term trade and policy reform.

6.2 An Explanation of the Reform Scenarios and Policy Shocks

The reform options explored in this paper are exposited as a matrix of four policy scenarios and five external shocks (table 27). Policy scenarios include a continuation of the current price support program, a switch to an income support program, an extension of marketing allotments with no criterion for suspension, and an introduction of producer/processor buyouts. Analysis of these policies is undertaken with respect to possible future developments affecting US sugar markets in a post NAFTA climate, namely other Free Trade Agreements or a possible Doha round agreement in the WTO. Throughout the 2008-2020 modeling period world sugar prices are assumed to be 12 cents per pound, a reasonable assumption for modest changes in US import levels or policies, but a simplification that would merit further analysis for large changes in the US situation. A more detailed exposition of the policy scenarios and external shocks is given below.

Table 27 Matrix of policy scenarios and exogenous shocks

	Policy Scenarios							
External Shocks	**USDA – Baseline (BASE)**	**Decreased Loan Rate (LR17)**	**Further Decreased Loan Rate (LR 16)**	**Income Support (IS18)**	**Reduced Income Support (IS17)**	**Further Reduced Income Support (IS16)**	**Administration Proposal (ADM)**	**Baseline Buyout of Production (BUY)**
50% HFCS Substitution (HFCS50%)	HFCS50%BASE	HFCS50%LR17	--	HFCS50%IS18	HFCS50%IS17	--	HFCS50%ADM	--
75% HFCS Substitution (HFCS75%)	HFCS75%BASE	HFCS75%LR17	--	HFCS75%IS18	HFCS75%IS17	--	HFCS75%ADM	--
Increased Imports Access (ACCESS)	ACCESSBASE	ACCESSLR17	--	ACCESSIS18	ACCESSIS17	--	ACCESSADM	ACCESSBUY(1)
Combination of Increased Imports Access and 75% HFCS Substitution (COMBO)	COMBOBASE	COMBOLR17	COMBOLR16	COMBOIS18	COMBOIS17	COMBOIS16	COMBOADM	COMBOBUY(1)
Complete WTO liberalization (GLOBAL)	GLOBALBASE	--	--	--	--	--	--	GLOBALBUY(1) GLOBALBUY(2)

Policy - Price Support Approach (BASE, LR)

More specifically in terms of the policy alternatives, in the price support approach, the current loan rate structure is retained to provide a floor to market prices. The raw sugar loan rate is 18 cents per pound under BASE, making this policy representative of the status quo. If the scenario results indicate federal expenditure stemming from the exogenous shock, the loan rate is reduced by 1 cent increments until federal government expenditure is eliminated.

Policy - Income Support Approach (IS)

The second policy specification, denoted Income Support (IS), replaces price support with income support similar to that of other crops in the US. Income support puts the burden of farm or price support on the tax payer rather than on the user. When discussing income support tools it is important to clarify the terms of price, target price and loan rate. Price is that which is market determined. The loan rate is a support price which is determined statutorily while the target price is the minimum price needed to avoid forfeiture and is equal to the loan rate plus marketing costs. As with the price support approach, the loan rate is initially kept at 18 cents per pound for the Income

support approach providing a basis for comparison between the two scenarios. Also, if scenario results indicate federal expenditure it is reduced by whole cent increments, until expenditures have been eliminated.

Income supports to growers/processors are comprised of three payments; direct payments, counter cyclical payments and loan deficiency payments. To calculate direct payments a payment acreage and payment yield must first be calculated. Direct payment acreage is equal to 85% of the average acreage between 1998-2001. The direct payment yield is equal to the average yield during this same period. Determining the direct payment is done by multiplying, DP acreage by DP yield by DP rate, where the DP rate is statutorily determined. There is typically a limit to the size of direct payments that can be made to a given farmer which is also statutory. In the USDA model a switch to an income support scheme sets the DP rate at zero because the desired outcome is for the scenario to determine payment i.e. the payments to be endogenous to the model. With a DP rate other than zero, the producer/processor would get direct payments regardless of the scenario provisions

Counter cyclical acreage and yield are determined on the same basis of DP acreage and yield. The counter cyclical rate is equal to the target price minus the price or loan rate, whichever is larger, minus the direct payment rate and is never below zero. The Counter Cyclical Payment is equal to the product of CC acreage, CC yield, and the CC rate. For beet sugar, the rate is adjusted to a raw basis by dividing the payment by 1.07. As with DPs, there is a statutory limit on the Counter Cyclical Payments that can be made to any one entity. Because the CCP is independent of production it is decoupled and does not count against the limit on trade distorting support.

The Loan Deficiency Payment is a function of current yield and acreage as well as a LDP rate. The LDP rate is equal to the loan rate minus price and cannot be less than zero. The LDP is then the product of actual yield, actual acreage and the LDP rate and is also subject to limitations. The total subsidy is the sum of Direct Payments, CCPs and LDPs. The unit subsidy is the total subsidy divided by production.

Policy - The Administration Proposal (ADM)

The USDA proposal for policy change (ADM) is a direct result of the impending NAFTA commitment. It calls for eliminating the provision which requires the secretary of agriculture to suspend marketing allotments when sugar imports are expected to exceed 1.532 million short tons. This will allow for the US to absorb potentially significant imports of Mexican sugar without large forfeitures of US sugar to the CCC. Rather, domestic marketing allotments for sugarcane and sugarbeets could be reduced as needed to balance supply and demand. In this manner, the program could operate at no net cost to taxpayers as it generally has in the past.

Policy – Buyout (BUY)

The fourth policy specification is a buyout option. It is implemented for three cases where 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 $0.75 billion, net present value, over the 13-year projection period. It is assumed the Federal government is indifferent between providing this level of expenditure either through price support payments or through a direct buyout that retires capacity at the beginning of the projections 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.

An alternative approach (Buy(2)) is taken with the WTO trade liberalization. In this exogenous event, there are significant reductions in processing capacity in areas with higher marginal values of processing capacity than would be offered by the government

as a sale price based on the projected government expenditures. This would likely be politically unfavorable. Buy(2) raises the buyout sale price to a level equal to the highest marginal value of processing capacity ($203.56) for areas with significant reductions in processing capacity (up to the Northwest).

External Shocks – HFCS50% and HFCS75%

There are five specific external conditions under which the performance of the alternative sugar policy instruments are analyzed. The first, HFCS50%, assumes that Mexico's beverage industry uses corn syrup for 50 percent of its sweetener needs. The external event, coupled with the existing price support program (BASE) is similar to the assumptions utilized for the 2007 USDA long term outlook projections. Under HFCS50%, annual sugar imports from Mexico average between 820,000 and 923,000 STRV.

The second external condition, HFCS75%, assumes that the proportion of HFCS use in Mexico increases to 75%. In this case, annual sugar imports range between 1.2 and 1.5 million STRV annually.

External Shocks - WTO Liberalization (GLOBAL), Increased Import Access (ACCESS) and Increased Import Access with HFCS75% (COMBO)

The complete WTO liberalization shock is modeled on a proposal recently made by the Global Alliance for Sugar Trade Reform. Members of this group come from, Australia, Brazil, Canada, Chile, Columbia, Guatemala, Honduras, India, South Africa and Thailand, most of which are large sugar exporters having a vested interest in a liberalized sugar market. A proposal made by this group for the 5th ministerial meeting in Cancun in September of 2003 had the stated objectives of:

1) Continuing and strengthening special and differential treatment provisions for developing countries as an integral part of all three pillars – market access, export subsidies and trade distorting domestic support
2) Developed countries to initially increase market access on an individual tariff line basis by an amount equal to 20% of domestic consumption
3) Eliminating the application of special agricultural safeguards for developed countries in year one of the agreement
4) Initially, capping out-quota tariffs at a maximum of 25% of the import price

5) Elimination of all forms of trade-distorting domestic support, with 50% of the reduction progressively over the first two years with the balance achieved over the following three years
6) Eliminating export subsidies in equal installments over three years

Of these objectives, goals two through five would require explicit action on behalf of the US. Here, an attempt is made to interpret these provisions and quantify the necessary corrective action. The WTO Liberalization (GLOBAL) external shock encompasses a full reform by these standards. The calculation of the increase required by objective two is shown in table 28 and is equal to 632,129 MTRV if imports are calculated based on the three year average for 2004, 2005 and 2006.

Table 28 Calculation of Increased Import Access Under GLOBAL

	1,000 STRV	1,000 MTRV
Deliveries for food and beverage use:		
FY 2004	9,678	8,780
FY 2005	10,019	9,089
FY 2006	10,169	9,225
3-year average	9,956	9,032
20- percent	1,991	1,806
Refined TRQ	63	57
New raw sugar TRQ	1,928	1,749
Current minimum access	1,231	1,117
Increase	696.795	632.129

Objectives 3 and 4, the elimination of special safeguard duties and capping over quota tariffs at 25% of the import price is shown in table 29. The required tariff reduction to meet this requirement would be 12.17 cents per pound, bringing the new tariff to 3.19 cents per pound, which is implemented over a 5 year period. The 12 cents per pound world price for sugar assumed in the model means that there would be no safeguard duties.

Table 29 Calculation of Tariff Reduction under GLOBAL

	Raw sugar import prices:		U.S. import price:
	world price	marketing	
FY 2004	7.58	1.5	9.08
FY 2005	10.46	1.5	11.96
FY 2006	15.78	1.5	17.28
3-year average:			12.77
25-percent:			3.19
Current:			15.36
Reduction:			12.17
Liberalized raw sugar over-quota tariffs			
Year 1			12.32
Year 2 (50% of tariff reduction)			9.28
Year 3			7.25
Year 4			5.22
Year 5 (100% of tariff reduction)			3.19

Finally, objective 5, the elimination of all forms of trade-distorting domestic support, with fifty percent of the reduction progressively over the first two years and with the balance achieved over the following three years is shown in table 30. By the end of the five year transition period, the loan rate has been reduced to level equivalent to the world price.

Table 30 Elimination of Trade-Distorting Domestic Support under GLOBAL

	Production (1,000 STRV)	Valued at support price	Valued at world price	Support	Loan rates: (cents/pound)
FY 2004	8,649	3,113,724	1,570,701	1,543,023	
FY 2005	7,876	2,835,202	1,883,834	951,368	
FY 2006	7,399	2,663,578	2,557,035	106,543	
3-year average:	7,975	2,870,835	2,003,857	866,978	
Calculations by Year:					
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	**Elimination**	2,003,857	2,003,857	0	12.56

While GLOBAL models a full reform by the standards set by the Global Alliance for Sugar Trade Reform, the ACCESS external shock is less ambitious. Instead, ACCESS incorporates only the increase in market access for imports to 20% of domestic consumption equal to 696,795 STRV. The COMBO event combines the increased

market access of 696,795 STRV under ACCESS with a 75% HFCS substitution rate in Mexico.

6.3 Overview of Modeling Results

Table 31 presents the broadest implications for matrix of exogenous events and policy reform scenarios. During the course of this section, the details and implications for the results will be discussed organized by the exogenous event. 6.3a begins by presenting an analysis of HFCS 50%. 6.3b addresses both HFCS75% and ACCESS together because their results are very similar. 6.3c and 6.3d will discuss the results and implications of COMBO and GLOBAL respectively.

Table 31 Overview of Modeling Results

Exogenous Event	Policy Regime	Av. Prod.	Deliveries For Food And Bev	Av. Total Imports	Av. Imports From Mex.	Av. Raw Sug. Pri.	End. Stocks to Use	Ratio Blocked CCC Stocks to Total stocks	Fed. Expend. (PV)	Prod. Capacity Reduction		
										Beet	Can	Total
		FY 2008-2012 (1,000 STRV)				(Cents/lb)	percent		(1,000 dol.)	percent		
HFCS50%	BASE	8,408	10,631	2,561	820	20.90	16.48%	1.65%	132,195	-2.33%	-1.82%	-2.09%
HFCS50%	LR17.0	8,377	10,642	2,592	851	21.07	15.84%	0.00%	0	-3.70%	-3.06%	-3.40%
HFCS50%	IS18.0	8,420	10,649	2,561	820	20.89	16.28%	0.00%	105,989	-3.75%	-1.90%	-2.87%
HFCS50%	IS17.0	8,377	10,642	2,592	851	21.07	15.84%	0.00%	0	-3.70%	-3.06%	-3.40%
HFCS50%	ADM	8,277	10,616	2,664	923	22.03	15.01%	9.35%	0	-1.05%	-3.47%	-2.19%
HFCS75%	BASE	7,965	10,675	3,063	1,322	20.78	18.40%	10.10%	747,136	-5.38%	-2.10%	-3.83%
HFCS75%	LR17.0	8,118	10,756	2,991	1,250	20.11	18.49%	0.00%	0	-8.03%	-5.25%	-6.72%
HFCS75%	IS18.0	8,245	10,796	2,913	1,172	19.88	19.19%	0.00%	848,619	-8.02%	-2.20%	-5.27%
HFCS75%	IS17.0	8,118	10,756	2,991	1,250	20.11	18.49%	0.00%	0	-8.03%	-5.25%	-6.72%
HFCS75%	ADM	7,732	10,637	3,235	1,494	22.00	16.74%	17.10%	0	-4.56%	-9.71%	-6.96%
ACCESS	BASE	7,921	10,686	3,119	681	20.73	18.62%	10.54%	787,567	-5.60%	-2.10%	-3.94%
ACCESS	LR17.0	8,073	10,774	3,052	614	20.05	18.68%	0.00%	0	-9.46%	-5.39%	-7.54%
ACCESS	IS18.0	8,243	10,824	2,946	509	19.78	19.52%	0.00%	1,074,819	-7.79%	-2.25%	-5.17%
ACCESS	IS17.0	8,073	10,774	3,052	614	20.05	18.68%	0.00%	0	-9.46%	-5.39%	-7.54%
ACCESS	ADM	7,631	10,632	3,330	892	22.17	16.40%	18.20%	0	-4.08%	-9.41%	-6.59%
ACCESS	BUY	7,696	10,631	3,268	831	20.93	16.33%	0.00%	787,567	-13.76%	-7.56%	-10.82%
COMBO	BASE	7,325	10,708	3,747	1,254	20.77	20.65%	19.83%	1,620,858	-6.34%	-2.12%	-4.35%
COMBO	LR17.0	7,766	10,880	3,489	1,051	19.67	20.70%	3.95%	329,830	-11.80%	-6.41%	-9.26%
COMBO	LR16.0	7,831	10,937	3,477	1,039	19.58	20.23%	0.00%	0	-14.70%	-7.32%	-11.22%
COMBO	IS18.0	8,223	10,968	3,248	810	19.27	21.32%	0.00%	2,414,373	-7.11%	-2.54%	-4.95%
COMBO	IS17.0	7,916	10,633	3,427	990	19.49	20.52%	0.00%	321,705	-13.17%	-6.33%	-9.95%
COMBO	IS16.0	7,831	10,937	3,477	1,039	19.58	20.23%	0.00%	0	-14.70%	-7.32%	-11.22%
COMBO	ADM	6,939	10,937	4,010	1,573	23.20	16.63%	27.05%	0	-12.69%	-22.04%	-17.01%
COMBO	BUY	6,457	10,595	4,462	1,561	21.58	14.57%	0.00%	1,620,858	-22.73%	-33.14%	-27.66%

GLOBAL	WTO liberalization	6,557	13,675	7,718	600	17.57	31.04%	0.65%	117,294	-49.81%	-32.09%	-41.47%
GLOBAL	BUY #2	4,400	13,925	9,779	600	17.96	30.04%	0.00%	5,055,183	-55.02%	-54.22%	-54.65%

6.3a HFCS 50%

A substitution of 50% of Mexican sugar use by HFCS is what is projected by USDA and is the exogenous event applied here. The policy regimes of BASE, LR17, IS18 and IS17 all yield similar results. 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 and 16.48 percent. The income support approach is less costly to the federal government than that of price supports at equivalent levels, at a cost of $106 million versus $132 million. Because the government cost is relatively small for both approaches, a buyout is not pursued. When the level of support is dropped to 17 cents per pound, the cost to the federal government becomes zero for both approaches. At 17 cents per pound for both the income and price support approach, we see further reductions in processing capacity, a total drop of 3.7% for beet and 3.06% for cane, for a weighted total of a 3.4% reduction. At the 18 cent per pound level of support, capacity reductions are smaller and are smallest under price supports.

Under the administration proposal (ADM), we see a higher price of 22.03 cents per pound and as a result more Mexican imports. Because the administration proposal uses the traditional formula for marketing allotments of 54.35% for beet and 45.65% for cane, the cane sector bears a higher burden of the capacity adjustment, 3.47% versus 1.05% for beets. The total weighted processing capacity reduction for the ADM proposal is less than all other policy scenarios except for BASE.

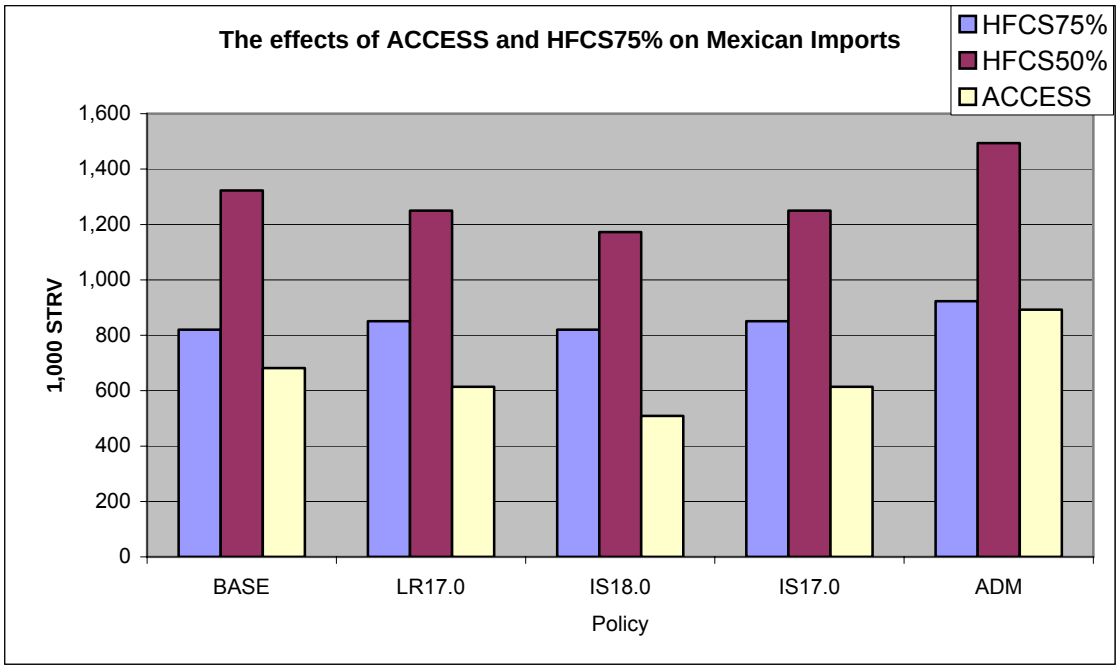
6.3b HFCS75% and ACCESS

Results for HFCS75% and ACCESS are comparable for accompanying policy regimes. For both exogenous events, production is highest under an income support regime at 18 cents per pound, with production values of 7,965 and 7,921 1,000 STRV for HFCS75% and ACCESS BASE. Averaged across all policy regimes for both exogenous events, US production declines by about 384,000 STRV. Production for both policies is lowest under the administration proposal. For the loan rate scenarios, there is slightly

greater production for lower 17 cent per pound loan rate than for 18 cents per pound. This is because a higher loan rate will have a greater associated PIK program reducing production in the year after a forefeiture. Intuitively, Imports have an inverse relationship, being lowest under IS18 and highest under ADM.

An important difference between the HFCS75% and ACCESS exogenous events is their effect on Mexican imports. Under higher levels of HFCS substitution, there is more surplus sugar in the Mexican market and resultantly more imports to the United States. If the US were to increase market access by increasing the TRQ by 696,795 STRV as was done in the ACCESS shock, there would be a reduction in the imports of Mexican sugar in the US. Under this shock, lower priced ROW imports would be taking away Mexican market share as well as US market share. Quantitatively, there is an increase in total imports of 89,000 STRV under ACCESS compared with HFCS75% while imports from Mexico decline by 608,000 STRV (figure 32).

Figure 32 The effects of ACCESS and HFCS75% on Mexican Imports



The results for HFCS75% and ACCESS are similar for the policy scenario results for raw sugar price, ending stocks to use ratio and the ratio of blocked CCC stock to total stocks. Compared with HFCS50%, there is not a big effect on sugar price by the application of these external shocks. The ending stocks to use ratios for HFCS50% are

smaller than for HFCS75% and ACCESS, a reflection of the smaller amount of sugar on the market.

The blocked/CCC stocks to use ratio is a reflection of production that could not be sold in the year it was produced either through forfeiture or the allotment system requiring that it be held off the market. Under the ADM proposal, the allotment is never suspended so blocked/CCC stocks are relatively higher.

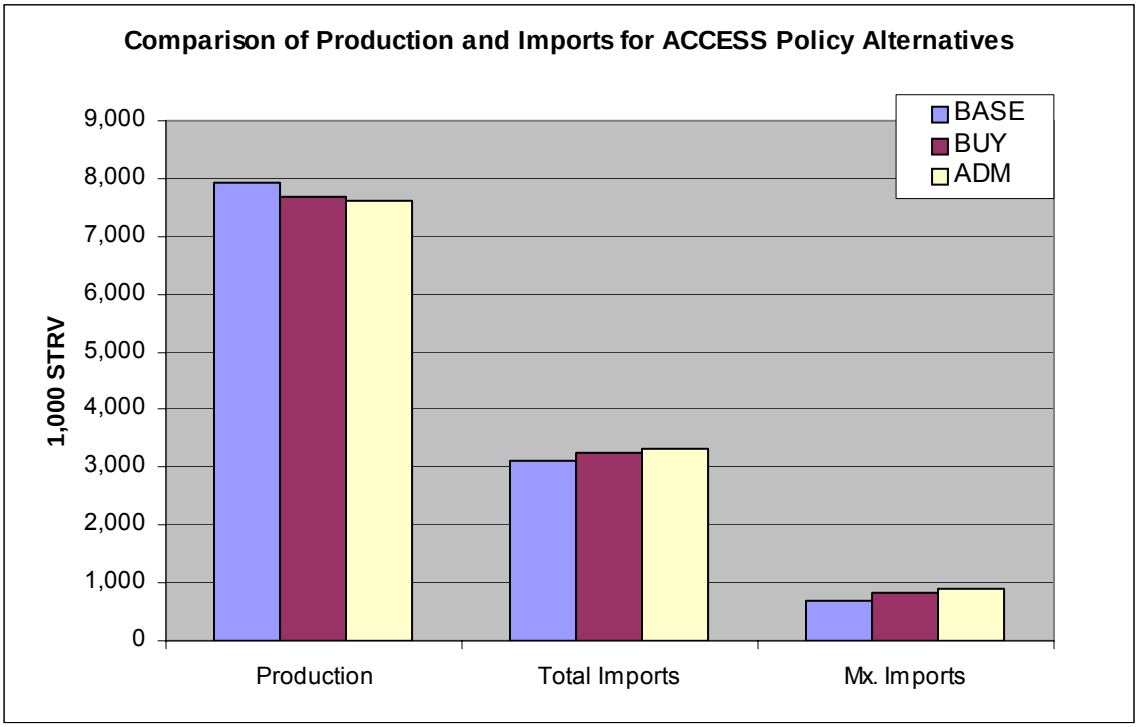
Federal expenditures would be slightly higher under the ACCESS externality than under HFCS75% and both are significantly higher than for HFCS50%. For HFCS75% a switch to an income support approach would increase federal expenditures by 13.5%. Under ACCESS a switch to the income support would increase expenditures by 36.5%

The reduction in capacity shown for HFCS75% and ACCESS show similar effects based in the applied policy scenarios. The ADM proposal shows the highest reduction in processing capacity for both HFCS75% while a switch to a 17 cent loan rate has the largest effect under ACCESS. In both cases, the 17 cents per pound level of support shows the same effect on processing capacity whether implemented as a price support or income support. As mentioned in the analysis of HFCS 50%, the ADM proposal forces a larger share of the adjustment onto cane growers because of the arbitrary allotment formula used between cane and beet.

The buyout is applied to the access proposal and inherently leads to the greatest reduction in processing capacity. A buyout under the ACCESS event would lead to a close to 11% drop in processing capacity with a larger relative share of this coming from beet. The mechanics and a further discussion of the buyout are given below.

Figure 33 provides a visual reference of the repercussions of the policy scenarios, BASE, ADM and BUY (all three of which assume an 18 cent per pound loan rate) for the ACCESS event on total US production, total imports and Mexican imports. For all scenarios, there is an inverse effect on production and imports. BASE provides for the most imports (least exports) and the buyout provides for the least imports (most exports).

Figure 33 Comparison of Production and Imports for ACCESS Policy Alternatives



A Buyout under the ACCESS Event

Table xx shows how the sale price offered by the government for a buyout would be determined for the access scenario and who would likely cede production capacity at that price. In this approach, there is no price discrimination meaning that the most inefficient producers, with the lowest marginal value of production capacity, will receive the same price for their lost production as more efficient producers. The amount that the federal government is willing to spend for the buyout is equal to the net present value of what it would have to spend given the external shock. In the event of increasing the TRQ by 632,129 MTRV (ACCESS) the estimated cost would be $787.567 million.

In this event, the sale price offered by the government would be equivalent to the marginal value of production capacity for the Great Lakes. The entirety of all states and regions with marginal values of production capacity below that cost, namely the Central Great Plains, Northern Great Plains and Hawaii would accept the buyout. The federal government would continue accepting bids for a buyout of production capacity until 90.4% of Great Lakes' growers participated. Offering financial compensation beyond this would not make economic sense for the government, which would be exceeding the

net present cost for normal program operation, or for more efficient producers, who would be undervaluing their production capacity. After implementation of this buyout, 7.288 million STRV of processing capacity would permanently exit the US industry.

Table 32 ACCESS Buyout

I. Net present value of federal expenditure for price support with 18 cent/lb loan rate = $787.567 million

II. Processors detail

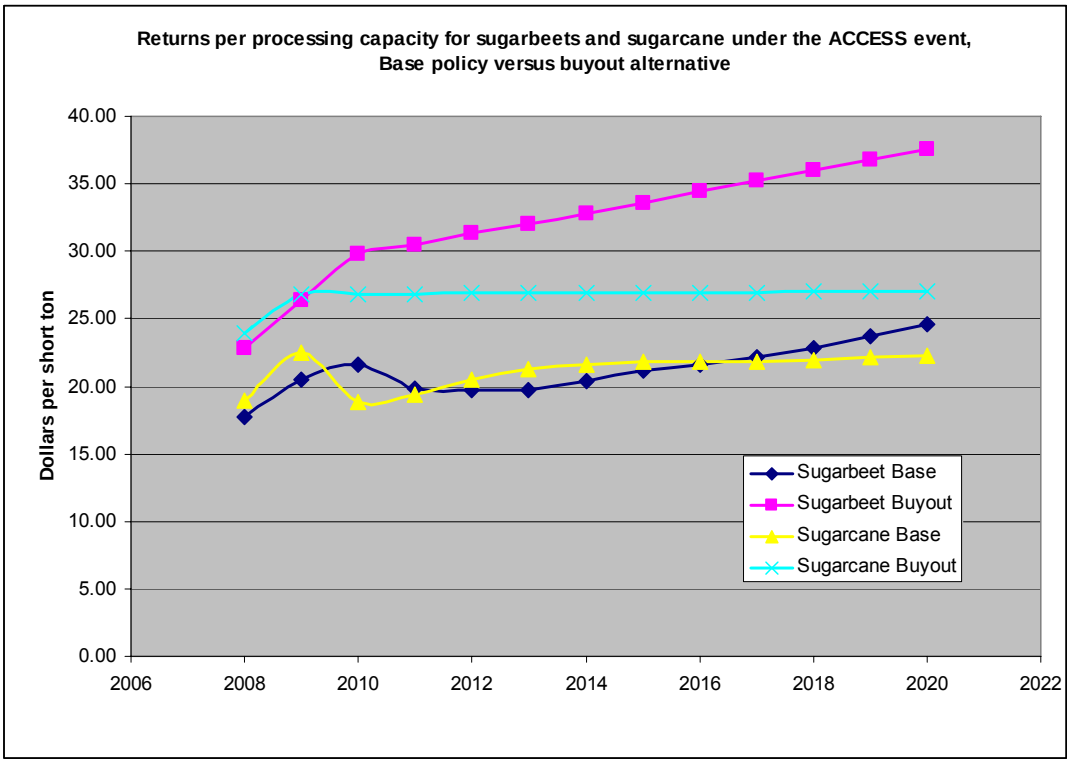
US Producing Region	Net Return (1,000 PV dollars)	Crop processing Capacity (1000 s.tons/year)	Unit Value (Dol./capac. Ton)	Cum Sug. Crop Prod. Capac. (1000 s.tons/year)	Marg. Value Of Prod. Capacity (Dol./Cap. Ton)	Value of Prod. Cap. (1,000 Dol.)	Portion Of Cap. Bought-Out	Cum. Buyout Expend (1,000 Dol.)
	A	B	C=A/B	D	E=C	F=E*D	G	
Central Great Plains	33,570	1,498	22.42	1,498	22.42	33,570	1.000	1,498
Hawaii	86,152	1,527	56.42	3,024	56.42	170,649	1.000	3,024
Northern Great Plains	142,452	1,459	97.63	4,484	97.63	437,739	1.000	4,484
Great Lakes	335,196	3,102	108.07	7,585	108.07	819,732	0.904	7,288
Texas	168,540	1,519	110.96	9,104	110.96	1,010,201		
Louisiana	1,041,620	9,123	114.18	18,227	114.18	2,081,112		
Southwest	248,172	1,707	145.36	19,934	145.36	2,897,663		
Northwest	997,358	4,900	203.56	24,834	203.56	5,055,183		
Florida	3,172,299	11,755	269.86	36,589	269.86	9,873,890		
Upper Midwest	4,248,507	13,977	303.97	50,566	303.97	15,370,514		

III Summary - surrendered capacity

	Capacity sold (1,000 s.tons/yr)	Sale price (Dollars)	Amount received (1,000 Dollars)
Central Great Plains	1,498	108.07	161,844
Hawaii	1,527	108.07	165,012
Northern Great Plains	1,459	108.07	157,681
Great Lakes	2,804	108.07	303,031
Total	7,288	108.07	787,567

After the buyout has been implemented, those producers that did not participate in the buyout, are found to be better off as a measurement of net returns. Figure 34 shows this by comparing the return to sugarbeet and sugarcane processing capacity in the ACCESS event under the base policy and after a buyout. For both beets and cane, there is an approximately three year adjustment period between 2008 and 2010. From 2011 to 2020 the trends for both the BASE and BUY scenarios are consistent. Using 2011-2020 as a reference period we see that the remaining beet growers have on average a 12.5 dollars per short ton higher return post buyout and cane growers have on average a 5.5 dollars per short ton higher return after the buyout.

Figure 34 Returns per Processing Capacity under the ACCESS event, BASE policy vs. BUY Alternative



6.3c: COMBO

The combination of increased substitution of HFCS for sugar in Mexico to 75% and an increase to the TRQ by 632,129 MTRV presents more sizeable challenges to the sugar sector than either of these factors alone. The application of policy scenarios under the COMBO event is approached in the same manner as with the previous exogenous events, with an additional lowering of the price support and income support to 16 cents per pound which would be required to eliminate all government expenditures under the COMBO. Like the ACCESS event, government expenditures are high enough to pursue a buyout.

Facing more pressure from imports, the COMBO event leads to a drop in production more precipitous than for ACCESS or HFCS75%. With the BASE policy regime US production averages 7.325 million STRV compared with 8.408 million STRV under HFCS50%. Total imports under COMBO BASE are 3.747 million STRV versus 2.561 million STRV under HFCS50%. Imports from Mexico constitute about 1/3rd of

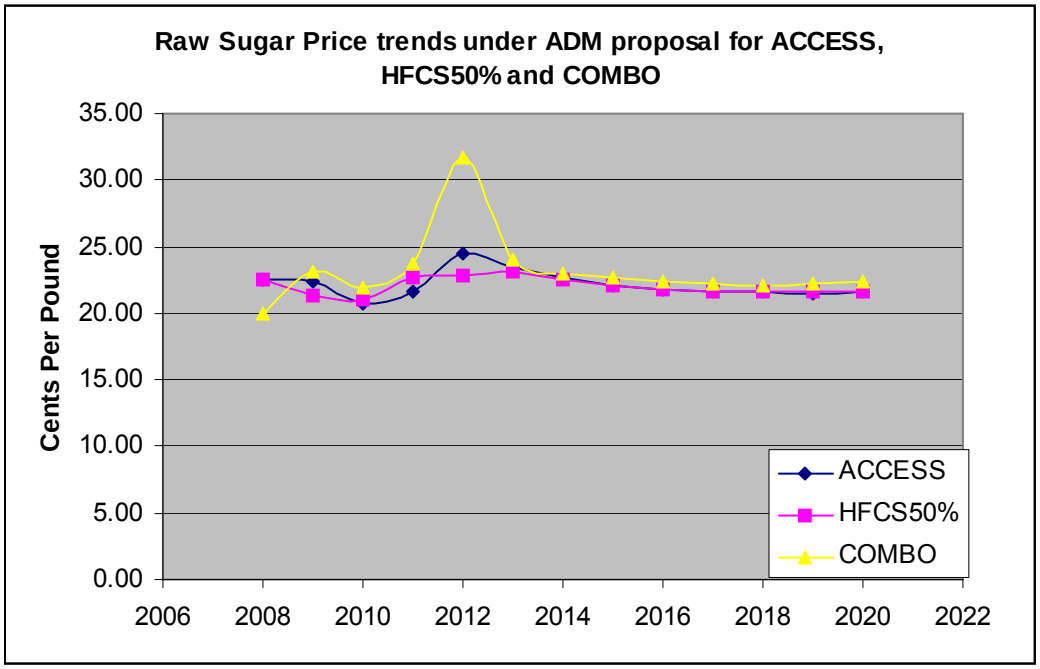
total imports. Under COMBO, production is lowest using the ADM scenario and imports are correspondingly higher.

Prices under COMBO are slightly lower overall than under the other exogenous events implying a higher stocks to use ratio. When there is government expense, the ratio of blocked/CCC stocks under COMBO are far higher than under the previously discussed events, especially under the base scenario.

Federal expenditures are more than double those seen under HFCS75% and ACCESS and far higher than those in HFCS50%. As mentioned earlier, reducing the support level to 17 cents per pound is not sufficient to eliminate federal costs under COMBO. Because it is unlikely that congress would reduce the loan rate by a fraction of a cent, the loan rate of 16 cents per pound was used and was more than sufficient in eliminating all federal expenditure.

Under BASE, the reduction in processing capacity between three and five percent is comparable for COMBO and HFCS75% & ACCESS. Reducing the level of support however, exaggerates the capacity reduction further under COMBO than under the other events. The ADM proposal also has a much greater impact under the COMBO event, reducing total processing capacity by 17% compared with a 2% reduction under HFCS50% and a 7% reduction for HFCS75%/ACCESS. Comparable prices under these events make these results seem exaggerated. However, as an average price, it does not show the initial dip in prices, initially driving out some production, and allowing for a longer term correction (figure 35).

Figure 35 Raw Sugar Price Trends under ADM for ACESS, HFCS50% and COMBO



A Buyout Under the COMBO Event

The combination of an increased TRQ and more displacement of sugar in Mexico takes an expectedly high toll on federal expenditures. The $1.62 billion spent under COMBO BASE becomes the amount that the federal government would be willing to spend in the event of a buyout. The approach taken for a buyout under COMBO is identical to that taken in ACCESS and is shown in table 33.

Table 33 COMBO Buyout

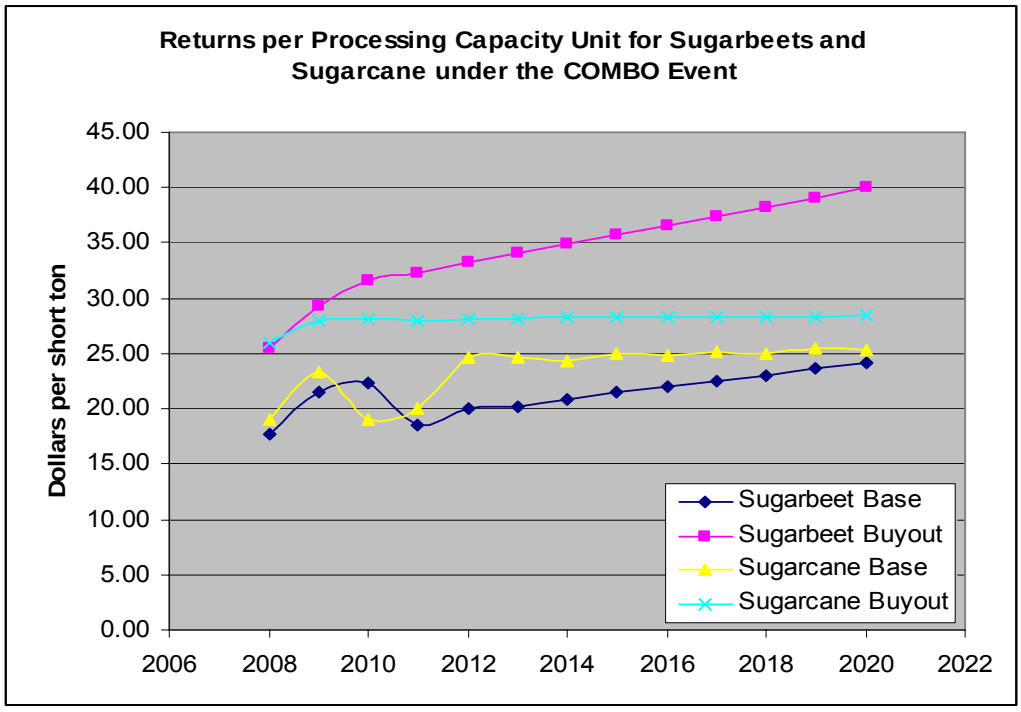
I. Net present value of federal expenditure for price support with 18 cent/lb loan rate = $1,620.858million								
II. Processors detail								
US Producing Region	Net Return (1,000 PV dollars)	Crop processing Capacity (1000 s.tons/year)	Unit Value (Dol./capac. Ton)	Cum Sug. Crop Prod. Capac. (1000 s.tons/year)	Marg. Value Of Prod. Capacity (Dol./Cap. Ton)	Value of Prod. Cap. (1,000 Dol.)	Portion Of Cap. Bought-Out	Cum. Buyout Expend (1,000 Dol.)
	A	B	C=A/B	D	E=C	F=E*D	G	
Central Great Plains	33,570	1,498	22.42	1,498	22.42	33,570	1.000	1,498
Hawaii	86,152	1,527	56.42	3,024	56.42	170,649	1.000	3,024
Northern Great Plains	142,452	1,459	97.63	4,484	97.63	437,739	1.000	4,484
Great Lakes	335,196	3,102	108.07	7,585	108.07	819,732	1.000	7,585
Texas	168,540	1,519	110.96	9,104	110.96	1,010,201	1.000	9,104
Louisiana	1,041,620	9,123	114.18	18,227	114.18	2,081,112	0.558	14,196
Southwest	248,172	1,707	145.36	19,934	145.36	2,897,663		
Northwest	997,358	4,900	203.56	24,834	203.56	5,055,183		
Florida	3,172,299	11,755	269.86	36,589	269.86	9,873,890		
Upper Midwest	4,248,507	13,977	303.97	50,566	303.97	15,370,514		

III Summary - surrendered capacity	Capacity sold (1,000 s.tons/yr)	Sale price (Dollars)	Amount received (1,000 Dollars)
Central Great Plains	1,498	114.18	170,991
Hawaii	1,527	114.18	174,338
Northern Great Plains	1,459	114.18	166,593
Great Lakes	3,102	114.18	354,142
Texas	1,519	114.18	173,427
Louisiana	5,092	114.18	581,366
Total	14,196	114.18	1,620,858

The available funds for a buyout under COMBO are more than double what would be used under ACCESS. Capacity sold under the COMBO buyout (14,196,000 STRV) approaches double the capacity sold under the ACCESS buyout (7,288,000 STRV). As was seen in table 33 above, a buyout under the COMBO event would lead to a reduction in processing capacity of over one-fourth.

Like the ACCESS buyout, growers remaining after the COMBO buyout fare better in terms of their return per sugarbeet/sugarcane processing capacity unit. After a three year adjustment, this welfare gain amounts to an average of $14.50 per short ton for beets and $3.81 per short ton for cane during the period 2011-2020 (figure 36).

Figure 36 Returns per Processing Capacity Unit under the COMBO event



6.3d: GLOBAL

The global event represents the most comprehensive and ambitious reform presented in this discussion. Correspondingly, it has the largest impact on the domestic sugar sector and total imports. Unique to GLOBAL is that average total imports (7.718 million STRV) outweigh domestic production (6.557 STRV). Under GLOBAL, the impacts on Mexican imports are in line with the ACCESS event, in that ROW imports are taking the place of higher priced Mexican imports.

In terms of government baseline expenditures under the GLOBAL event, costs for such a proposal would be relatively low. However, to make it politically realistic, additional costs beyond projected government expenditures may be borne to assuage the transition imposed on the industry. Under GLOBALBASE average production for 2008-2020 drops 22% from the current price support approach while total imports increase 200%. The average raw sugar price under GLOBAL is 17.5 cents per pound, a decrease of 16% from the baseline and the total processing capacity reduction is 41.47%. Processing capacity in all areas except Florida and the Upper Midwest is reduced by more than 50%. This drop in sugar prices is significant enough to lead to substitution of sugar for HFCS, hence the substantial increase in deliveries for food and beverage.

Under GLOBAL, the average annual support afforded to the US sugar sector is $867 million. Elimination of this support over 5 years, with 50% of this reduction occurring in the first two years, implies the following sequence of loan rates: FY 2008: 16.64 cents/lb, FY 2009: 15.28 cents/lb, FY 2010: 14.38 cents/lb, FY 2011: 13.47 cents/lb, and FY 2012-2020: 12.56 cents/lb.

A Buyout under the Global Event

The GLOBAL exogenous shock is remarkable in the extent of the reduction in processing capacity from its application. Table 34 illustrates the extensive effects of GLOBAL, the effects of a partial buyout, identical to the buyout approached in COMBO, and a larger buyout which is offered to all states/regions that are significantly impacted by the WTO liberalization. Calculation of the larger buyout is shown in table 35. Application of GLOBAL reduces sugar production capacity in the US by 21.18 million STRV over the observed time frame. The partial buyout, like the one seen under

COMBO, would reduce production capacity by an additional 1.15 million STRV and the larger buyout would reduce production capacity by another 5.5 million STRV on top of that.

Table 34 Buyout Options under the GLOBAL Event

	Processing Capacity			
States/Regions	***WTO liberalization (GLOBAL)***			
	Base	**No Buyout**	**Partial Buyout**	**Larger Buyout**
		1,000 s. tons/yr		
Central Great Plains	1,498	16	0	0
Hawaii	1,527	52	0	0
Northern Great Plains	1,459	39	0	0
Great Lakes	3,102	75	0	0
Texas	1,519	973	0	0
Louisiana	9,123	4,206	4,206	0
Southwest	1,707	181	181	0
Northwest	4,900	1,076	1,076	0
Florida	11,755	10,817	10,817	10,817
Upper Midwest	13,977	11,950	11,950	11,950
Total	50,567	29,385	28,231	22,767

Table 35 Calculation of Larger Buyout under the GLOBAL (Buy2) Event

I. Net present value of federal expenditure for price support with 18 cent/lb loan rate = $5,055.183 million

II. Processors detail

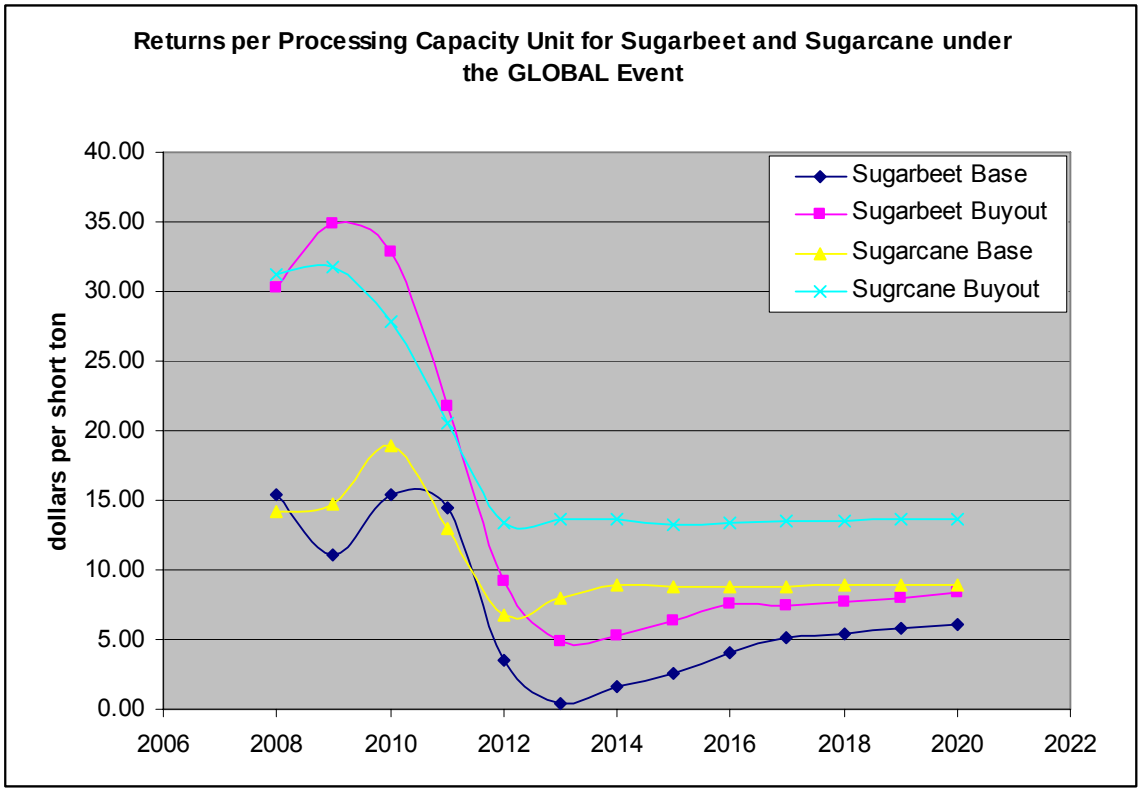
US Producing Region	**Net Return (1,000 PV dollars)**	**Crop processing Capacity (1000 s.tons/year)**	**Unit Value (Dol./capac. Ton)**	**Cum Sug. Crop Prod. Capac. (1000 s.tons/year)**	**Marg. Value Of Prod. Capacity (Dol./Cap. Ton)**	**Value of Prod. Cap. (1,000 Dol.)**	**Portion Of Cap. Bought-Out**	**Cum. Buyout Expend (1,000 Dol.)**
	A	**B**	**C=A/B**	**D**	**E=C**	**F=E*D**	**G**	
Central Great Plains	33,570	1,498	22.42	1,498	22.42	33,570	1.000	1,498
Hawaii	86,152	1,527	56.42	3,024	56.42	170,649	1.000	3,024
Northern Great Plains	142,452	1,459	97.63	4,484	97.63	437,739	1.000	4,484
Great Lakes	335,196	3,102	108.07	7,585	108.07	819,732	1.000	7,585
Texas	168,540	1,519	110.96	9,104	110.96	1,010,201	1.000	9,104
Louisiana	1,041,620	9,123	114.18	18,227	114.18	2,081,112	1.000	18,227
Southwest	248,172	1,707	145.36	19,934	145.36	2,897,663	1.000	19,934
Northwest	997,358	4,900	203.56	24,834	203.56	5,055,183	1.000	24,834
Florida	3,172,299	11,755	269.86	36,589	269.86	9,873,890		
Upper Midwest	4,248,507	13,977	303.97	50,566	303.97	15,370,514		

III Summary - surrendered capacity

	Capacity sold (1,000 s.tons/yr)	**Sale price (Dollars)**	**Amount received (1,000 Dollars)**
Central Great Plains	1,498	203.56	304,850
Hawaii	1,527	203.56	310,817
Northern Great Plains	1,459	203.56	297,009
Great Lakes	3,102	203.56	631,379
Texas	1,519	203.56	309,193
Louisiana	9,123	203.56	1,857,042
Southwest	1,707	203.56	347,534
Northwest	4,900	203.56	997,358
Total	24,834	203.56	5,055,183

As with the other buyouts, a buyout (BUY(2)) under GLOBAL increases the returns per sugarbeet and sugarcane processing capacity unit for the remaining growers. Figure 37 compares the return per processing capacity unit pre and post buyout for both beets and cane. Implementing the buyout(2) under GLOBAL exaggerates an already precipitous drop in returns existing before the buyout although the returns are significantly higher in the first few years post buyout, compared with no buyout, but level off by the 6th year.

Figure 37 Returns per Processing Capacity Unit under the GLOBAL Event



6.4 Welfare Measurements

Table 36 provides for a synopsis of welfare measurements for the matrix of policy scenarios and exogenous events for 2008-2020 discounted at a 5% rate. Sugar net returns for all policy scenarios are highest under the HFCS50% event. Sugar returns are highest, at $10.6 billion, when the price support program is maintained but the level of support is reduced to 17 or 16 cents per pound. Returns for the sugar sector are only very slightly less if a switch to an income support approach is made. With implementation of the

ADM proposal under HFCS50% returns to the sugar sector drop to $10.2 billion. Sugar returns tend to get progressively less across HFCS75%, ACCESS and COMBO, with some policy regimes. Under the ADM proposal this reduction is 37% and is only 8% for BASE. Implementation of the buyout for ACCESS and COMBO yields net returns for sugar at levels 28% and 18% higher than under BASE.

Government expenditures are clearly highest under a switch to the income support approach with an 18 cent loan rate, although the government costs of the current program run a close second. Under the model specification, there is no consumer surplus. In the model, the demand for sweeteners is perfectly price inelastic and any consumer gain from sugar is offset by a consumer loss from HFCS.

Table 36 Welfare Measurements

Policy Regime	Sector Welfare Measures	Exogenous market change			
		HFCS 50%	HFCS75%	ACCESS	COMBO
		1,000 Dollars			
Price support,	Govt Expenditure (-)	-132,195	-747,136	-787,567	-1,620,858
loan rate = 18cents/lb	Beet Net Return	6,005,254	5,307,419	5,174,669	5,048,394
(BASE)	Cane Net Return	4,468,610	4,497,251	4,470,220	4,574,499
	Sugar Net Return	10,473,865	9,804,670	9,644,889	9,622,893
Price support,	Govt Expenditure (-)	0	0	0	-329,830
loan rate = 17cents/lb	Beet Net Return	6,161,262	4,746,730	4,624,462	3,977,891
(LR17.0)	Cane Net Return	4,485,566	3,753,603	3,705,763	3,525,155
	Sugar Net Return	10,646,827	8,500,333	8,330,225	7,503,046
Price support,	Govt Expenditure (-)	0	0	0	0
loan rate = 16cents/lb	Beet Net Return	6,161,262	4,746,730	4,624,462	3,815,929
(LR16.0)	Cane Net Return	4,485,566	3,753,603	3,705,763	3,352,067
	Sugar Net Return	10,646,827	8,500,333	8,330,225	7,167,996
Income support,	Govt Expenditure (-)	-105,989	-848,619	-1,074,819	-2,414,373
loan rate = 18cents/lb	Beet Net Return	5,960,646	4,717,819	4,718,177	4,832,728
(IS18.0)	Cane Net Return	4,475,338	4,209,331	4,199,494	4,148,774
	Sugar Net Return	10,435,984	8,927,150	8,917,671	8,981,503
Income support,	Govt Expenditure (-)	0	0	0	-321,705
loan rate = 17cents/lb	Beet Net Return	6,161,251	4,746,730	4,624,462	3,904,853
(IS17.0)	Cane Net Return	4,485,553	3,753,603	3,705,763	3,430,652
	Sugar Net Return	10,646,803	8,500,333	8,330,225	7,335,505
Income support,	Govt Expenditure (-)	0	0	0	0
loan rate = 16cents/lb	Beet Net Return	6,161,251	4,746,730	4,624,462	3,815,929
(IS16.0)	Cane Net Return	4,485,553	3,753,603	3,705,763	3,352,067

	Sugar Net Return	10,646,803	8,500,333	8,330,225	7,167,996
USDA Farm Bill proposal -- market allotments with no suspension criteria (ADM)	**Govt Expenditure (-)**	0	0	0	0
	Beet Net Return	6,070,728	4,119,554	4,136,884	2,976,682
	Cane Net Return	4,205,841	3,591,847	3,537,221	3,448,562
	Sugar Net Return	10,276,569	7,711,401	7,674,105	6,425,244
Buyout	**Govt Expenditure (-)**			-787,567	-1,620,858
	Beet Net Return			7,963,285	7,284,708
	Cane Net Return			4,410,076	4,042,850
	Sugar Net Return			12,373,361	11,327,558

Chapter 7: Summary and Conclusions

Chapter 7 begins by summarizing the history of the global sugar trade and discusses the US sugar sector and the need for reform in particular. It then reviews the modeling scenarios used in this thesis and the results, comparing these results with the 2005 study commissioned by the AFBF and the 2000 study by GAO, both of which are premised on the same model. The discussion then segues into a comparison of the buyout offered to sugar in this study with buyouts that were successfully implemented in the US for peanuts and tobacco. The chapter concludes with a consideration of paper implications and the possibility for real reform.

7.1 Background Summary

Sugar has long been a contentious commodity in international trade of agricultural products. The development of an economically viable sugarbeet industry in early 19th century France was meant as a direct affront to British and Dutch control of seafaring trade and trade of sugarcane. Now, sugar, as a commodity that can be produced from both tropical and temperate crops serves as a bellwether in agricultural trade negotiations and a commodity that highlights north-south disparities. There is increased pressure from developing countries for market access for their agricultural products while developed countries strive to protect there domestic industries, the interest of farmers and processors and maintain a secure food supply.

7.1a The US Sugar Sector

The United States is amongst 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 being an exception), the United States has both large and well-developed sugarcane and sugarbeet industries. 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 sugarbeet 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 like tobacco, rice, and peanuts, but much less than other crops like corn, soybeans, wheat, and cotton.

The value of the sugarbeet crop since 1978 has constituted about 55.7 percent of the combined sugar crop value. Sugarbeets are currently grown in 11 States grouped into 6 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 no longer takes place in several States, including Ohio, New Mexico, Texas, and Arizona.

Sugarbeet production has grown from about 21.0 million tons in the first half of the 1980s to between 29.0 and 30.0 million tons since 1995. 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 (20 percent in early 1990s to 13 percent in the 2000s) and especially in the Southwest (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, on the other hand, high costs and better alternative 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.

Costs of producing sugar in the United States vary from region to region, and are higher than the world's lowest cost sugar producers. Cost ranges based on estimates made by LMC International are shown in table 37 for U.S. mainland cane producers and for U.S. eastern and western beet sugar producing areas. 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.

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

Table 37 US, Mexico and World Production Costs

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	365.66 - 546.11	16.59 - 24.77
Mexico - Eastern producing regions	384.36 - 457.95	17.43 - 20.77
Mexico - Western producing regions	395.88 - 652.74	17.96 - 29.61
Low-cost producers 2/	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	369.70 - 555.35	16.77 - 25.19
Western U.S. producing regions	411.10 - 718.00	18.65 - 32.57
Weighted World Average	573.10 - 622.20	26.00 - 28.22
High fructose corn syrup 3/		
United States and Mexico	221.20 - 473.20	10.03 - 21.46
1/ Ex-mill, factory basis.	-	-
2/ Seven producing regions (Brazil - North/East, Brazil - Center/South, Malawi, South Africa, Sudan, Swaziland, and Zimbabwe).		
3/ HFCS-55, dry weight.		

7.1b Impetus for Reform

Because the Farm Security and Rural Investment Act of 2002 is set to expire in 2007, there is much attention on the current 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 in 2008. Additionally, imports may increase as a result of expansion of Free Trade Agreements and/or a Doha Round agreement under the World Trade Organization. A second problem is that sugar users are turning away from purchases of sugar by either switching to off-shore production of sugar-containing products or by using new high-intensity sweeteners 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 domestic processors' restricting marketings to prevent oversupply. Under current law, 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 USDA that must accept sugar pledged as collateral as full payment for loans made to processors. The USDA has proposed that a new Farm Bill eliminate the import trigger for the suspension of marketing allotments. The approach still strives to keep domestic sugar prices far in excess 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 that 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 they point to is that with the elimination of the program, the likelihood of negotiating new international agreements that expand trade opportunities is enhanced. The national benefit could be great enough to compensate sugar producers and processors for terminating government support through a buyout of their interest in the program.

7.2 Modeling Scenarios and the Analytical Framework

Using the Economic Research Service long term sugar projections model, this paper analyzed four sugar policy alternatives under a set of five possible scenarios affecting imports. The first policy alternative is retention of the current non-recourse loan program, marketing allotments, and other policy features of the 2002 Farm Act over projection years 2008 to 2020. In the second, 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 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 were then analyzed under the alternative exogenous scenarios of pressure on the U.S. program from increased sugar imports.

The ERS long term sugar projections model is used to generate sugar supply and utilization projections that appear as part of the USDA's official long term projections that are published each year prior to USDA's Agricultural Outlook Forum in February. The model's advantage is that it incorporates substantial policy, production, processing, and consumption detail of the U.S. and Mexican sugar and HFCS sectors.

The United States component models adjustments to the following set of five policy instruments: 1) the non-recourse sugar loan program; 2) tariff-rate quota, including minimum import access commitments (WTO, NAFTA, and DR-CAFTA 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 to voluntarily reduce 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 sugarbeet-producing areas are divided 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).

The model structure is based on 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 sugar yield per-acre projections 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.

Sugar production differs from other field crops in that it requires 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 projections 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 run 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 prohibitively high cost of reopening closed facilities.

U.S. sweetener demand is composed of end use demands by the beverage and food-processing industries, nonfood demanders, and households or non-industrial users. U.S. per capita sweetener demand 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. 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.

Like the United States, Mexican sweetener demand is composed of end use demands by the beverage and food-processing industries, nonfood demanders, and households or non-industrial 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. 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 of sugar in the United States in the model are limited downward under the current loan rate program (lower limit is the minimum price to avoid forfeiture) and are limited upward by high-tier tariff imports (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.

7.3 Modeling Results and Disparities with Previous Studies

In this section the modeling results are summarized and compared with those from the 2005 AFBF study and the 2000 GAO study, both of which are premised on the same model.

7.3a Modeling Results for this Study

This paper has focused on U.S. sugar policy options: continuation of the current price support program; a switch to income support similar to other crops; continuation of price support but with marketing allotments having no suspension criteria; and introduction of producer/processor buyouts. Analysis is presented with respect to future possible developments affecting imports into the U.S. sugar market: increased sugar imports from Mexico, other Free Trade Agreements, 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 into 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 low total Federal expenditure of only $132.2 million, net present value, over the 13 years. 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 off the market. One conclusion is that these external market conditions do not present insurmountable problems to policy design.

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 that makes more sugar available for export or from an increase in minimum import access from expanded FTAs or under a Doha round agreement. In the analysis, it is assumed either that NAFTA imports increase to 1.290 million STRV (HFCS75%) or minimum import access increases to about 20 percent of domestic consumption, i.e., 1.928 million STRV (ACCESS). Results for each of these possibilities yield similar conclusions. With price or income support policies, Federal expenditure is between $747.1 million and $1.074 billion. Processing capacity is reduced about 4%. Reducing support by lowering the sugar loan rate to 17 cents a 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/income support cases. A

direct sugar buyout involving $787 million reduces sugar processing capacity by about 11 percent. Sugar prices average 20.93 cents a pound, and average sugar imports increase slightly 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. Under COMBO, impacts of the policy regime to the sugar sector and the impact on federal expenditure are more significant. With an 18 cent loan rate, net present value of Federal expenditure over 13 years is about $1.6 billion with price support policy or $2.4 billion for the income support approach. Lowering the loan rate to 17 cents a pound reduces Federal expenditure to between $329,830 million and $321,705 million, and lowering the loan rate to 16 cents a pound eliminates Federal expenditure. A 16-cent loan rate implies about 11.2 percent less processing capacity. The marketing allotment approach involves no Federal expenditure but more capacity is lost, about 17 percent. A sugar buyout equaling $1.62 billion reduces capacity by about 27.6 percent with resulting higher prices than under other price or income support policies for those still producing. Average sugar imports rise to an annual average of 4.462 million STRV, which is only 30% less than average production of 6.457 million STRV.

The final analysis (GLOBAL) assumes a comprehensive Doha Round agreement: 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 average annual price of sugar is 17.57 cents a 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 42 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.

7.3b Comparing the Results of Other Studies with the Results of this Study

Chapter 4 introduces alternative studies that attempt to quantify the effects of sugar policy reform in the United States. The 2006 study by Elobeid and Beghin,

"Multilateral Trade and Agricultural Policy Reforms in Sugar Markets" presents interesting results however its scope is much broader than the modeling done in this paper in that it addresses trade reforms for all countries, making an objective comparisons with those results difficult. However, two studies, a 2005 study commissioned by AFBF, "Sugar Policy Options and Consequences", and a 2000 study by the GAO, "Sugar Program: Supporting Sugar Prices has Increased Users' Costs while Benefiting Producers" are close enough in scope to this study to allow for objective comparison of the results. Furthermore, both the GAO and the AFBF study are based on the same CARD model.

The GAO study models the market characteristics for the US and international sugar sector with and without the current sugar program. In their elimination of the sugar program, the GAO study eliminates the TRQ for imported sugar and the loan rate for domestic sugar. Our study never entirely eliminates the sugar program. The GLOBAL event comes the closest to outright elimination of the program in that it eliminates the loan rate, increases the TRQ by 632,129 MTRV, and decreases the over-quota tariff to 3.19 cents per pound. The GAO study eliminates the program immediately and reports the results for the year 1998. This study imposes the reforms gradually beginning in 2008. Nevertheless, a side-by-side comparison of some of the reform results for the two models provides for an informative comparison (table 38).

Table 38 GAO Study Results vs. the Results of this Study

Cents per pound and million STRV	*GAO Study Elimination of TRQ and Loan Rate Program*	*Our Study GLOBAL Event*
	1998	**2020**
US Raw Sugar Price	12.46	17.57
Sugarcane Production	29.5	18.9
Sugarbeet Production	28	15
Raw Sugar Imports	3.3	7.7

In both studies, the outright elimination of the program (GAO) and the GLOBAL reform have the common effects of decreasing the US raw sugar price, decreasing sugarcane and sugarbeet production (at least initially) and increasing imports. However, the reduction in price in the GAO study is much more dramatic, with the US price falling below 12.5 cents per pound while in this study, the price is 17.57 cents per pound.

Additionally, a reform of this magnitude is more consequential in this study, with cane acreage being reduced by 33% and beet acreage being reduced by 50%. The GAO study shows production for both of these crops holding steady. Finally, the GAO study shows imports of 3.3 million STRV while this study shows imports of 7.7 million STRV.

The 2005 AFBF also implements the CARD model. In that study, the authors compare the current program with a switch to an income support approach. As was done in this study, the AFBF study considers two possibilities, high imports from Mexico or low imports from Mexico.

As was the case with the GAO study, the policy parameters and assumptions used for the AFBF study and this study are not the same. Namely, the loan rate for beet and cane in the AFBF study is 16.48 and 12 cents per pound respectively while in IS18 it is 22.9 and 18 cents per pound respectively. Moreover, the AFBF study assumes a direct payment rate of 3 cents per pound while the income support approach in this study assumes no direct payments. Finally, the AFBF study uses the fixed values of 218,000 STRV and 1.355 million STRV to represent the low and high imports from Mexico. In this study, the 50% and 75% HFCS substitution rates in Mexico yield Mexican sugar exports of 820,000-923,000 and 1.2-1.5 million STRV. This means the high import scenarios for the AFBF study and this study are more comparable than the low import scenarios.

Table 39 provides a comparison of the two studies. Sugar production in both studies is comparable although this study yields consistently lower amounts. Sugar imports are significantly higher in this study than in the AFBF study except in the case of the high import, standard program scenario. NAFTA imports are significantly higher in this study under the low import scenario, a direct result of the assumption made, while under the high import scenario, imports are close in value. Sugar domestic deliveries are also similar in both studies. Raw sugar price in this study are consistently higher than in the AFBF approach while beet and cane production are consistently less. Government expenditures are significantly higher in all cases except for the Low Import Baseline Scenario. A major contributing factor to this difference under the Standard Program Scenarios is that the AFBF scenario has direct payments to farmers.

Table 39 AFBF Results vs. the Results of this Study

	Low Import Baseline Scenario		*High Import Baseline Scenario*		*Low Import Standard Program Scenario*		*High Import Standard Program Scenario*	
	Thousand STRV, fiscal year (2008-2015) / (2008-2020) average							
	AFBF	**HFCS50% BASE**	**AFBF**	**HFCS75% BASE**	**AFBF**	**HFCS50% IS18**	**AFBF**	**HFCS75% IS18**
Sugar Production	8,591	8,408	8,287	7,965	9,088	8,420	8,630	8,245
Sugar Imports	1,847	2,561	2,984	3,063	1,767	2,561	2,919	2,913
NAFTA Imports	218	820	1,355	1,322	138	820	1,290	1,172
Sugar Domestic Deliveries	10,177	10,631	10,906	10,675	10,586	10,649	11,273	10,796
Raw Sugar Price	20.60	20.90	18.73	20.78	18.42	20.89	16.86	19.88
Beet Production	28,350	28,052	26,970	25,668	29,688	25,868	28,362	25,104
Cane Production	31,279	28,287	30,673	28,274	33,471	28,212	31,566	27,988
Government Sugar Program Expenditure	8	10.7	175	73.7	462	8.8	520	84.4
Of Which is Direct Payments	0	*NA*	0	*NA*	463	*NA*	463	*NA*

Although the models function differently and are based on differing assumptions, several sources for disparity in the simulation results for the CARD model and the ERS model can be readily identified. First, the ERS model assumes that the barriers to entry for a sugar processing plant are significantly high to prevent a plant from reopening once it has exited production while the CARD model allows for existing plants to reopen and for entirely new plants to be built. This can partly explain higher domestic production in the AFBF study, lower imports and to some degree, lower prices. The CARD model also makes no geographic distinctions in which producers are likely to be affected by a change to program parameters whereas ERS using cost of production differences across regions as reported by LMC which are significant. For a more detailed discussion on the sources of disparity between the CARD model and the ERS model refer to section 4.1b and appendix VI of the GAO study.

7.4 Comparison of a Sugar Buyout with Buyouts of Previous Commodity Programs

One unique aspect of this paper is the pursuit of a buyout of sugar processing capacity. As discussed in chapter 4, buyouts have been used in the past as a politically palatable means of ending or altering commodity programs in the US for peanuts and tobacco and in the EU for sugar. Using ACCESSBUY as an example, the buyout is based on the present value of net returns for the 2008-2020 period, discounted at 5%

annually (table 40). The amount to fund the buyout is capped by the present value of federal expenditures for ACCESSBASE in the same time frame.

Table 40 PV Net Returns under ACCESSBUY

Net Returns PV $1,000	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	PV
Great Lakes	16,200	77,378	25,301	20,930	28,511	30,461	30,809	33,899	36,338	38,697	40,659	43,079	44,875	**333,336**
Upper Midwest	355,855	334,314	413,826	381,017	370,010	374,117	385,692	395,392	407,389	420,341	435,138	450,029	467,890	**3,697,691**
Northern Great Plains	9,390	27,944	13,654	10,143	9,335	8,673	9,168	9,644	10,172	10,867	11,617	12,411	13,412	**115,301**
Central Great Plains	-3,217	21,621	2,071	77	-348	-135	65	306	591	925	1,271	1,667	2,129	**22,028**
Northwest	76,903	69,573	96,959	84,684	80,551	80,865	83,702	86,051	89,049	92,468	96,341	100,365	105,262	**813,164**
Southwest	17,621	15,708	23,819	20,434	19,007	18,867	19,618	20,258	21,046	22,087	23,229	24,471	25,973	**193,148**
Florida	321,833	340,958	323,327	325,796	326,660	326,419	328,003	329,887	331,685	333,344	335,371	337,211	339,048	**3,101,125**
Louisiana	101,565	142,804	99,874	102,119	104,825	104,874	105,858	107,587	109,140	110,652	112,017	113,412	114,615	**1,032,700**
Texas	17,861	21,524	17,183	17,260	17,254	17,074	17,002	17,032	17,064	17,114	17,186	17,261	17,330	**165,803**
Hawaii	12,372	27,167	5,740	11,245	20,056	20,636	20,220	20,494	20,702	20,645	20,746	20,692	20,614	**170,592**

The buyout is implemented so that as much processing capacity can be bought out given the government constraint, $787.5 million for ACCESS, and there is no price discrimination in the amount offered, meaning all who accept the buyout receive the same price (table 41).

Table 41 ACCESSBUY

US Producing Region	Net Return (1,000 PV dollars)	Crop processing Capacity (1000 s.tons/year)	Unit Value (Dol./capac. Ton)	Cum Sug. Crop Prod. Capac. (1000 s.tons/year)	Marg. Value Of Prod. Capacity (Dol./Cap. Ton)	Value of Prod. Cap. (1,000 Dol.)	Portion Of Cap. Bought-Out	Capacity sold (1,000 s.tons/yr)	Sale price (Dollars)
	A	B	C=A/B	D	E=C	F=E*D	G		
Central Great Plains	33,570	1,498	22.42	1,498	22.42	33,570	1.000	1,498	**108.07**
Hawaii	86,152	1,527	56.42	3,024	56.42	170,649	1.000	3,024	**108.07**
Northern Great Plains	142,452	1,459	97.63	4,484	97.63	437,739	1.000	4,484	**108.07**
Great Lakes	335,196	3,102	108.07	7,585	108.07	819,732	0.904	7,288	**108.07**
Texas	168,540	1,519	110.96	9,104	110.96	1,010,201			
Louisiana	1,041,620	9,123	114.18	18,227	114.18	2,081,112			
Southwest	248,172	1,707	145.36	19,934	145.36	2,897,663			
Northwest	997,358	4,900	203.56	24,834	203.56	5,055,183			
Florida	3,172,299	11,755	269.86	36,589	269.86	9,873,890			
Upper Midwest	4,248,507	13,977	303.97	50,566	303.97	15,370,514			

The result is differing levels of compensation for buyout participants. Those with highest marginal value of production capacity, namely the Great Lakes are being

reimbursed less than those with the lowest marginal value of production capacity, the Central Great Plains. Table 42 shows the varying degrees of compensation for the different production regions participating in the ACCESS buyout when a 5% discount rate is used. The Great Lakes region, the most efficient producing region participating in the buyout sets the payment given 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 get greater compensation. 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 a perpetuity, making a buyout attractive for them under any logic.

Table 42 ACCESSBUY Compensation by Region

Discount Rate=5%	***Marginal Value of Processing Capacity***	***Annual payment equivalent needed to compensate 13 years***	***Actual Annual Payment Equivalent***	***Actual Present Value of Payment***	**Actual years compensated for**
Central Great Plains	$22.42	$2.386738	$11.50467	$108.07	**Perpetuity**
Hawaii	$56.42	$6.006234	$11.50467	$108.07	**47.12**
Northern Great Plains	$97.63	$10.39328	$11.50467	$108.07	**15.03**
Great Lakes	$108.07	$11.50467	$11.50467	$108.07	**13**

Except for the perpetuity offered to processors in the Great Plains, the compensation levels offered to sugar processors in the ACCESS buyout would be in-line with those offered to participants in the tobacco and peanut buyouts, where compensation ranged between 17.5 years for flue cured tobacco and 62 years for peanut growers from Virginia and North Carolina (table 43).

Table 43 Peanut and Tobacco Buyout Compensation

Discount Rate=5%	***Average Rent***	***Actual Present Value of Payments***	***Actual Years Compensated For***
Burley Tobacco	$0.41	$5.40	**22**
Flue Cured Tobacco	$0.47	$5.40	**17.5**
Peanuts – Texas	$0.0332	$0.55	**36.1**
Peanuts – Georgia and Alabama	$0.0402	$0.55	**23.6**
Peanuts – Virginia and North Carolina	$0.0289	$0.55	**62**

7.5 Paper Implications and Possibilities for Real Reform

The scenarios and policy shocks presented in this thesis cover the spectrum between comprehensive reform (GLOBAL) and no reform with an expected 50% rate of HFCS substitution in Mexico (HFCS50%BASE). The gamut of options gives a range of results which should allow for room for compromise. The impetus for reform has been set, a 2008 date for free sugar trade between NAFTA countries. Imports from Mexico will lead to lower prices in the domestic market and increasing surrenders of sugar to the CCC, although to what degree depends on the volume of these imports. The expenses incurred by this new dynamic will be a direct violation of the sugar program's no cost provision.

Overall, the results of this study have several basic implications, some already well understood but others less so. First, under the most limited assumption about 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 with reduced US 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 continuation of U.S. policies that keep domestic prices well above world levels, although with less U.S. production. Fourth, under our model structure and assumptions, the use of domestic marketing allotments together with continuation of existing levels of price support (ADM) leads to less production and higher prices than for other price or income support policies. Such an outcome would be controversial so exploring the outcomes under alternative decision rules about the allotment levels merits further analysis. In these and other ways, our assessments to date points 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.

Recent reforms to commodity programs suggest that a politically palatable way of introducing reform is through a buyout. In the case of peanuts, the farm lobby and the

peanut industry seized the favorable circumstances of a budget surplus situation prior to 9/11. For tobacco, reform was more of an imperative in light of a shrinking domestic market and the tobacco master settlement. This thesis forwards the idea of providing a buyout for sugar processing capacity based on estimated federal expenditures being the amount the government would be willing to spend. The compensation offered growers does not price-discriminate and this results in a buyout surplus for the least efficient regions although this was also seen in peanuts, where there was variation in rental rates.

At the political level, the buyout may test the solidarity of the sugar industry, which has, in the past, found political stamina in its wide geographic dispersion. As seen in the modeling of a buyout in this paper, processors in upwards of four states would likely find a buyout economically attractive. On a global scale, sugar reform in the US, that decreases processor subsidies, supports processors in a way that does not distort markets, and reduces tariffs will signal to developing countries that the US is serious about free trade, affording this country more goodwill when it comes to trade of other products. However, the US must also balance international trade and low prices for consumers with food security and a strong rural economy.

Through the implementation of the buyout the US could accommodate more world sugar, which is produced at lower prices than that produced domestically while compensating those who exit the industry. Our modeling results also show that remaining growers would be better off than without a buyout, meaning they would receive higher returns for their product. Nominally, farm programs are designed to support small farmers helping to control risk and keep their farms profitable. In the event of a buyout, small farmers would be the most likely participants. The large vertically integrated sugar processors in Florida and the Red River Valley would continue to produce sugar and make large profits either through income support or price support program that would still remain in place after the buyout. Nevertheless, a buyout would shrink the political sphere of the sugar lobby which may ease further reforms in the future. These reforms could focus on less support for large, profitable corporate farms and more support for smaller family farms, regardless of the commodity produced.

Appendix I The Peterson Proposal on a Domestic Sugar to Ethanol Program

Agricultural policy, especially in a farm bill year, is an ongoing process. Prior to submission of this thesis, in July of 2007, Collin Peterson, chairman of the house agricultural committee introduced legislation to promote the use of sugarcane and sugar beet as feedstocks for ethanol production in the United States as a solution to absorb the excess sugar in the market, following free trade of sugar with Mexico. The legislation establishes rules for 2008 through 2012 crop years. In line with the USDA proposal, the legislation would remove the possibility of an allotment suspension. In addition, the change would increase the cane sugar loan rate by .5 cents per pound and the beet sugar loan rate by .6 cents per pound to 18.5 cents per pound and 23.5 cents per pound respectively.

The legislation would guarantee domestic sugar processors an 85% share of the domestic food use demand forecast with surplus directed toward bioenergy. This provision is in direct contrast to the USDA proposal in which domestic producers are residual suppliers after imports. The amendment would provide market allocation to a new beet entrant who constructed a new factory or reopened a factory closed since 1998 in an amount comparable to other legislation rates. Moreover, base acreage allocation could be transferred to other parcels of land without the approval of the mill where the growers allocation originated.

The amendment requires the Secretary of the USDA to set the TRQ at the beginning of every marketing year and prohibits the secretary from increasing the TRQ prior to April 1 except in the case of natural disasters. This is in contrast to the USDA proposal which gives the Secretary discretion. USDA would also be required to publish a Mexico S&U for sugar and HFCS in the monthly WASDE (World Agricultural Supply and Demand Estimates).

The energy title of the amendment allows for the CCC to buy surplus sugar in the marketplace and sell it to bioenergy producers. As a result, forfeitures are avoided and no costs are incurred in the sugar program. Costs, rather, are borne by this flexibility program. Again, this conflicts with the USDA proposal for the disposal of surplus sugar which involved allotments and tightening down the OAQ to avoid forfeitures. Under the USDA proposal any surplus sugar could only be sold for non-food use or export. The

energy provision introduced by Congressman Peterson would amount to a taxpayer subsidization of sugar ethanol production. As a feedstock for biofuel production, the CCC would likely receive only between 5 and 10 cents per pound for the surplus sugar, far less than what they would pay for it. If the legislation were to pass, the US sugar industry would be guaranteed a continuation of high prices for sugar in the domestic market while the energy provision loophole would allow the sugar program to operate at no government expense.

References:

Abler, Beghin, Blandford, Elobeid & Westhoff (February 2005)
Study for the American Farm Bureau Federation
Sugar Policies Options and Consequences

American Sugar Alliance (January, 2006)
EU Sugar Support Prices, Adjusted for Compensation Payments: Remain Much Higher than US

American Sugar Alliance (July, 2006)
Without WTO Reforms To World "Dump" Sugar Market Distortions:
U.S. Doha Round Proposal Would Render No-Cost U.S. Policy Inoperable, Seriously Damage U.S. Sugar Industry

Geoffrey S. Becker and Jasper Womach (September 2002)
Congressional Research Service
The 2002 Farm Bill: Overview and Status

F Blackburn (1984)
Sugarcane
Longman House

David Blandford (May, 2003)
The WTO and FTAA Negotiations – A European Union Perspective
"Agricultural Competitiveness and World Trade Liberalization: Implications of the WTO and FTAA". North Dakota State University, Fargo, North Dakota

A. Blake Brown and Walter N. Thurman (Forthcoming)
The End of the Federal Tobacco Program: Economic Impacts of the Deregulation of U.S. Tobacco Production
Review of Agricultural Economics

Bart Chilton (November, 2006)
National Farmers Union
Personal Correspondence

Commission of the European Communities (June, 2005)
Commission Staff Working Document
Reforming the European Union's Sugar Policy

Commission of the European Communities (July 2004)
Communication from the Commission to the Council and the European Parliament
Accomplishing a sustainable agricultural model for Europe through the reformed CAP – sugar sector reform

Commission of the European Communities (June 2005)
Commission Staff Working Document
Update of Impact Assessment

Noel Deerr (1949, 50)
The History of Sugar
Chapman and Hall

E.F. DeMan (1870)
The "Beet Root Sugar" Question
London (publisher unknown)

Eric Dohlman and Janet Livezy (October 2005)
USDA ERS
Peanut Backgrounder

A Phillip Draycott (2006)
Sugar Beet
Blackwell Publishing

Amani Elobeid, John Beghin (2006)
Multilateral Trade and Agricultural Policy Reforms in Sugar Markets
Journal of Agricultural Economics 57 (1), 23–48.

F.O. Licht (2006)
World Ethanol and Biofuels Report

Frandsen, S.E., H.G. Jensen, W. Yu and A.W Jørgensen (2003)
The EU Sugar Policy - An Analysis of Price versus Quota Reductions
European Review of Agricultural Economics, Vol. 30 (1) (2003)

Alexandre Gohin & Jean-Christophe Bureau (March 2006)
Modeling the EU sugar supply to assess sectoral policy reforms
European Review of Agricultural Economics Vol. 33 (2)

Stephen Haley & Mir Ali
Sugar Background Report (Forthcoming)
USDA, ERS

Stephen Haley, Andy Jerardo & David Kelch
Sugar and Sweeteners Outlook
USDA, ERS
May, 2006

Glynn James (2004)
Sugarcane
Second Edition
Blackwell Publishing 2004

Leu, Schmitz and Knutson (1987)
Gains and Losses of Sugar Policy Options
American Journal of Agricultural Economics, *Vol. 69, No. 3*

LMC International (2000)
Cost of Production Data

Andreas Margraaf (1749)
Prussian Academy of Sciences

Stephen Marks and Keith Maskus (1993)
The economics and politics of world sugar policies
University of Michigan Press

Brendan McGivern (May, 2005)
Legal Summary of WTO Panel Ruling on EU Sugar Subsidies

McKeaney-Flavell (2006)
The Future of US Sugar Policy

Donald Mitchell (February, 2004)
The World Bank
Sugar Policies: Opportunity for Change

OECD-FAO (2006)
Agricultural Outlook
2006-2015

Official Journal of the European Union (February 2006)
Council Regulation No. 318/2006, 319/2006 & 320/2006

Official Journal of the European Union (February 2001)
Council Regulation No. 416/2001

David Orden, Robert Paarlberg & Terry Roe (1999)
Policy Reform In American Agriculture
University Of Chicago Press

David Orden (May 2006)
Feasibility of Farm Program Buyouts
Presented at the third annual North American Agrifood Market Integration Workshop "Achieving NAFTA Plus," Calgary, Alberta, Canada

David Orden (May 2003)
Sugar Policies and Implications: Integration into an FTAA
Presented at the conference on Agricultural Competitiveness and World Trade Liberalization: Implications of the WTO and FTAA, Fargo, North Dakota

James Pease, John Lehman and David Orden (November 2001)
Proposed End of Peanut Quota Program: Economic Effects on Virginia Producers

Daneswar Poonyth, Patrick Westhoff, Abner Womack and Gary Adams (2000)
Impacts of WTO Restrictions on Subsidized EU Sugar Exports
Agricultural Economics 22 : 233-245

Promar International (May 2005)
Consumers Benefit from Competitive Sugar Prices

Renewable Fuels Association
http://www.ethanolrfa.org/

Jack Roney (April 2005)
American Sugar Alliance
Hearing on the Proposed U.S. Free Trade Agreement with the Dominican Republic and Central America (CAFTA)

A. Schmitz, T.H Spreen, W.A. Messina and C.B. Moss (2002)
Sugar and Sweetener Markets – International Perspectives
CABI Publishing

A. Schmitz and J. Vercammen (1990)
Trade Liberalization in the World Sugar Market : Playing on a Level Field?
CUDARE Working Paper Series

Hossein Shapouri and Michael Salassi (July, 2006)
USDA, ERS
The Economic Feasibility of Ethanol Production from Sugar in the United States

Daniel A. Sumner (December 2005)
The Cato Institute
Boxed In, Conflicts between U.S. Farm Policies and WTO Obligations

United States Department of Energy (February, 2007)
Annual Energy Outlook

US DOE, EIA (2007)
http://www.eia.doe.gov/oil_gas/petroleum/info_glance/petroleum.html

USDA, ERS Sugar and Sweeteners Outlook (January, 2006)
EU-25 Sugar and Sweeteners Policy Reform

USDA ERS (2006)
Sugar and the European Union, Implications of WTO Findings, and Reform

USDA, ERS (2006)
Sugar and Sweeteners Data Tables
http://www.ers.usda.gov/Briefing/Sugar/Data.htm

USDA, FAS (2006)
PS&D
http://www.fas.usda.gov/psdonline/psdHome.aspx

UN FAO STAT
http://faostat.fao.org/

United States General Accountability Office (June 2000)
Sugar Program – Supporting Sugar Prices has Increased Users' Costs While Benefiting Producers

Michael Wohlgenant (1999)
Effects of Trade Liberalization on the World Sugar Markets
FAO

World Trade Organization (April 2005)
Report of the Appellate Body
European Communities – Export Subsidies on Sugar

Jasper Womach (December 2005)
Congressional Research Service
Tobacco Quota Buyout
Testimony to Senate Finance Committee

Vita

Owen C. Wagner

Owen Wagner was born in 1980 in Vienna, Virginia and was raised in Raleigh, North Carolina. He graduated with a B.S. in Agronomy from North Carolina State University. Upon graduation he worked for the USDA, Agricultural Research Service in Miami, Florida and the Cape Cod Cranberry Growers' Association in East Wareham, Massachusetts. In 2005 he began his M.S. program in Agricultural and Applied Economics at Virginia Tech. He would like to continue working in the agricultural field with the end goal of owning his own farm and being his own boss.