# U.S. Sugar Policy Options and Their Consequences under NAFTA and Doha

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June 2006

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# Abstract

We analyze the potential impact of continuing the existing U.S. sugar program, replacing it with a standard program, and implementing the standard program with multilateral trade liberalization. Under the North American Free Trade Agreement (NAFTA), duty-free sugar imports from Mexico will undermine the program's ability to operate on a "no-cost" basis to U.S. taxpayers. As the Mexican beverage industry is likely to expand considerably its high-fructose corn syrup use, the sugar thereby displaced will seek a market in the United States. Under these conditions, marketing allotments could not be utilized under current legislation and prices would likely fall to the loan rate. The government would accumulate significant sugar stocks. The replacement of the current sugar program by one similar to other major U.S. crop programs would solve the problem of stock accumulation and accommodate further trade liberalization under a new World Trade Organization (WTO) agreement or future bilateral trade agreements. Our analysis of recent WTO proposals suggests that a WTO agreement is unlikely to impose significant adjustment pressures on the U.S. sugar market beyond those created by NAFTA. The adoption of a standard program would make it easier for the United States to meet its commitments under a new WTO agreement in terms of reductions in trade-distorting amber-box support. Moving to a standard program would increase the costs of the program for taxpayers but would lower costs for sugar users. Given reasonable assumptions about program parameters, the principal program cost would likely be through direct payments rather than through countercyclical or loan-deficiency payments. These costs could be lower than the maximum estimated here, because of limitations on payments to individual producers.

**Keywords:** Doha, NAFTA, policy, sugar, U.S. sugar program.

**Introduction**

Sugar figured early in the history of the United States. One of the first acts of the newly created Congress in 1789 was to impose a tariff on imported sugar in order to raise revenue for the new republic. In 1842 the tariff structure was modified to provide protection to the domestic sugar refining industry and to promote the domestic production of sugar. A federal price support program for sugar, the Jones-Costigan Act, was enacted in 1934. With the exception of two brief periods during the 1970s and early 1980s, the United States has continued to operate a price support program for sugar (see Box 1 for a brief history). The current sugar program, introduced under the Farm Security and Rural Investment Act of 2002, uses import controls and marketing allotments and allows for certain other measures (payment-in-kind provisions) to try to ensure that the government does not accumulate stocks at the price support (loan rate). The current program is supposed to operate at no net cost to the U.S. taxpayer.

Considerable uncertainty exists about the long-run viability of the U.S. sugar program, not least because of the commitment by the United States under the North American Free Trade Agreement (NAFTA) to allow duty-free imports of sugar from Mexico beginning in 2008. Combined with a commitment under the Uruguay Round Agreement of the General Agreement on Tariffs and Trade (GATT) to maintain a minimum level of imports from other suppliers, the NAFTA provisions seem likely to lead to increased sugar imports with resulting downward pressure on U.S. sugar prices. If the effect is sufficiently large, it might be impossible to continue to operate a program of the existing type on a "no-cost" basis. There is also the possibility that imports might increase as a result of other preferential or free-trade agreements that may be adopted by the United States, or through the eventual conclusion of the Doha Round of

international trade negotiations and disputes resolution currently underway at the World Trade

Organization (WTO) (see WTO 2004, 2006a, 2006b, and 2006c, and Box 2). The 2007 farm bill

debate coincides with the WTO negotiations of the Doha Round. The multilateral trade policy

outcome will put bounds on allowable domestic support and trade protection of the U.S. sugar

industry. This dual policy debate provides an opportunity to revisit policy options for the sugar

program. We assess the potential implications of changing sugar trade policy and the domestic

sugar program. We look at the consequences of increased levels of imports for a future U.S.

government program for sugar. We begin by examining the potential impact on the current

program of an increase in sugar imports from Mexico under the NAFTA agreement. We contrast

that impact with the situation in which the current sugar program is replaced by a price and

income support program of the type currently used for other major crops in the United States.

Finally, we evaluate the effect of potential new international trade commitments resulting from a

Doha WTO agreement.

**The Analysis Conducted**

We evaluate three policy scenarios for sugar: (i) the continuation of the existing U.S. sugar

program currently in operation under the 2002 Farm Security and Rural Investment Act—which

we refer to as the *baseline scenario*; (ii) replacement of the current U.S. sugar policy by a

program equivalent to that used for other major crops (wheat, feed grains, upland cotton, rice,

and oilseeds) but in the absence of any changes in trade policies in the United States or other

countries, beyond those already agreed upon—we term this the *standard program scenario*; and

(iii) the replacement of the current policy by a standard program but with further multilateral

liberalization of international trade (in particular, an increase in the sugar tariff rate quota [TRQ]

and reduction in over-quota tariffs) under the assumption that a new agreement on agriculture is

concluded as a result of the current round of negotiations in the WTO—we term this the *trade liberalization scenario*.

Our analysis of these scenarios is based on a multi-market model embedding a detailed model of U.S. crops into a model of the international sugar market. These combined models generate key variables, such as equilibrium prices and quantities, trade flows, and local equilibrium in each country consuming and/or producing sugar. The combined model provides a 10-year trajectory for the sugar market in the United States and other key countries given assumptions about macroeconomic and policy variables. The model captures the interaction between the corn and sugar sub-sectors through high-fructose corn sweetener (HFCS). The international sugar market model reflects trade and domestic policies for sugar in key importing and exporting countries and permits us to capture the effects of changes in these policies on international trade volumes and prices, as well as any feedback effects on the U.S. sugar market. The analysis is conducted for the period 2004/05–2014/15 (federal fiscal years 2005–2015). The principal tables in our report summarize the results using averages for 2008–2015.

We find that duty-free sugar imports from Mexico will undermine the program's ability to operate on a "no-cost" basis to U.S. taxpayers. As the Mexican beverage industry will expand considerably its HFCS use, the sugar thereby displaced will seek a market in the United States. Under these conditions, marketing allotments could not be utilized under current legislation and prices would likely fall to the loan rate. The government would accumulate significant sugar stocks. The replacement of the current sugar program by one similar to other major U.S. crop programs would solve the problem of stock accumulation and accommodate further trade liberalization under a new WTO agreement or future bilateral trade agreements. An analysis of recent WTO proposals suggests that a WTO agreement is unlikely to impose significant

adjustment pressures on the U.S. sugar market beyond those created by NAFTA. The adoption of a standard program would make it easier for the United States to meet its commitments under a new WTO agreement in terms of reductions in trade-distorting amber-box support. The move to a standard program would increase the costs of the program for taxpayers but would lower costs for sugar users. Given reasonable assumptions about program parameters, the principal program cost would likely be through direct payments rather than through countercyclical or loan-deficiency payments. These costs could be lower than the maximum estimated here, because of limitations on payments to individual producers.

Many assumptions are required in order to project the future evolution of the U.S. sugar market. We have drawn upon expert knowledge in the business and academic communities to create a plausible set of assumptions as to how markets might evolve. Alternative assumptions are possible, and year-to-year variation in weather and other conditions could result in outcomes that are significantly different from those presented here, as dramatically illustrated by the 2005 hurricane season. As we have not assigned probabilities to the values that we present or indicated the range of potential variation, our results should be interpreted as projections of plausible futures for the sugar market rather than forecasts.

In what follows, we focus first on the modeling framework underlying the study. Then, in sequence, we describe the key assumptions underlying each scenario and associated results. Conclusions highlight policy implications. Three appendixes provide additional information for the avid reader. The detailed assumptions underlying each scenario are contained in Appendix A. Appendix B presents implications of payment limitations on payments and program cost. Appendix C summarizes further sensitivity analysis results.

**2. Modeling Approach**

The analysis is based on a multimarket model of the U.S. crop sector linked to a modified version of the international sugar model maintained at the Center for Agricultural and Rural Development (CARD) at Iowa State University. The modification centers on the substitution of the detailed U.S. crop sector model for the simpler U.S. sugar component of the original CARD international model. The U.S. component of the model is a large U.S. crop model that explains land allocation decisions among major crops on a regional basis and depends on relative net returns and policy program incentives. The return computation incorporates all major U.S. policy instruments such as direct payments, countercyclical payments (CCPs), loan deficiency payments (LDPs), trade policy, and provisions of the sugar programs such as production allotments, the TRQ scheme for Mexico, and the aggregate TRQ scheme for other countries. The U.S. model provides estimates of sugar and HFCS use, beginning and ending inventories, and government program costs for each of its components (Westhoff).

The CARD international sugar model is a non-spatial, partial-equilibrium econometric world sugar model consisting of 29 countries/regions, including a Rest-of-the-World aggregate to close the model. All major sugar producing, exporting, and importing countries are included. The model specifies only raw sugar production, use, and trade between countries/regions and does not disaggregate refined trade from raw trade. Consequently, there is no category for importers as refiners or toll refiners because the countries that specialize in that role are well known and stable over time. Country coverage includes Algeria, Argentina, Australia, Brazil, Canada, China, Colombia, Cuba, Eastern Europe (Poland, Hungary, Czech and Slovak Republics), Egypt, European Union-15, Former Soviet Union (FSU) (mainly Russia and the Ukraine), India, Indonesia, Iran, Japan, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines,

South Africa, South Korea, Thailand, Turkey, United States, Venezuela, and a Rest-of-World aggregate.

The general structure of any country sub-model includes behavioral equations for area harvested, yield, production for sugar beet and sugarcane on the supply side, and per capita consumption, other uses, and ending stocks on the demand side. The Mexican sub-model further includes HFCS production, trade and use, and HFCS policy distortions. In each sub-model equilibrium prices, quantities, and net trade are determined by equating excess supply and excess demand across countries and regions. Using price transmission equations, the domestic price of each country or region is linked to a representative world price (Caribbean FOB price) through exchange rates and other price policy parameters such as tariffs and transfer-service margins. The model includes cross-price effects in supply of several crops. The model structure can be modified on demand for specific investigations (Beghin et al.). The model accommodates analyses of trade and domestic policy reform scenarios. Trade policies for most countries, as well as domestic policies in several key OECD countries, are parameterized in the model (see Elobeid and Beghin). More information on the international CARD sugar model is available online, including key parameter values (FAPRI).

Data for area, yield, sugarcane, and sugar beet production, sugar production, consumption, and ending stocks were obtained from PS&D View of the United States Department of Agriculture. Cane and beet production is tied to sugar production through extraction rates. Macroeconomic data such as real gross domestic product, consumer price index, population, and exchange rate were gathered from various sources, including the International Monetary Fund and Global Insight (see Appendix A for the baseline macro data).

**3. Baseline Scenario Results**

In the baseline scenario (continuation of the existing sugar program), we assume that the current U.S. sugar program continues to operate through 2015.[1] The cane sugar loan rate is maintained at 18¢ per pound (raw value) and the beet sugar loan rate is at 22.9¢ per pound (refined value). Sugar yields and consumption trends are assumed to develop in line with recent trends. Beet yields are projected to rise from roughly 22 tons per acre in fiscal year 2006 to just over 23 tons in fiscal year 2015 and sugar recovery rates are projected at just under 16 percent and closing at 17 percent. Cane yields over the same period are projected to increase from around 35 tons to over 37 tons per acre, with a slight increase in the recovery rate (from 12.4 to 12.7 percent). Total U.S. sugar and sweetener consumption does not change significantly because of insensitivity to changes in prices and consumer incomes, implying a modest decline in per capita consumption.

In preparing the baseline, we address the likely future trading relationship in sugar and HFCS between the United States and Mexico (see Box 2 for more information). We assume that the current dispute over HFCS will be resolved and that the Mexican tax on soda beverages containing HFCS will be eliminated in 2007/08. This is consistent with a recent WTO ruling and Appellate Report (WTO, 2006b and 2006c). Eventually Mexico will have to remove the tax. From 2007/08 onward, Mexico has duty-free access to the U.S. market for its sugar. The United States has duty-free access to the Mexican market for HFCS, but Mexico's own production of HFCS can also be expected to expand. The resolution of the dispute over HFCS could have a significant impact on its use in the Mexican beverage industry, on Mexico's production of HFCS, and on its imports of the product from the United States. The displacement of sugar by

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[1] The marketing year used in the study is October through September unless otherwise indicated.

HFCS in Mexican beverage production would likely lead to increased sugar shipments to the United States.

To examine the potential implications of different dispute outcomes, we use two variants of our baseline scenario. First, we assume limited displacement of sugar in Mexican beverage production, with a consequent modest increase in shipments of Mexican sugar to the United States. Under this assumption, annual duty-free imports of sugar by the United States from NAFTA partners average 218,000 short tons (raw basis) for 2008-2015.[2] We refer to this scenario as the Low Import Baseline. Alternatively, we assume substantial displacement of sugar by domestically produced and imported HFCS in Mexican beverage production with a resulting significant expansion in U.S. imports of sugar from Mexico. Under this assumption, U.S. duty-free imports from NAFTA partners average 1.36 million tons per year over the period. We refer to this scenario as the High Import Baseline.

The two variants have significantly different implications for the U.S. sugar market. The first two columns of Tables 1-5 contain the average values of relevant variables for 2008-2015 for these two scenarios. Column 5 shows the comparative change in each variable (high import value minus low import value). With modest imports from Mexico, the New York (NY) spot price for raw sugar averages over 20¢ per pound (Table 1). Domestic production is largely constrained by marketing allotments and Commodity Credit Corporation (CCC) stocks are modest. With high imports from Mexico, the raw sugar price declines to less than 19¢ per pound. U.S. sugar production declines by 3.5 percent on average in response to the lower prices, but CCC stocks increase to an average of over 1 million tons (Table 1). The adjustments in

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[2] We assume that there are no significant changes in imports of sugar-containing products from Canada in the baseline. We do not consider the possibility that imports of sugar into Mexico from Central American suppliers could also lead to the displacement of Mexican sugar to the U.S. market. Changes in either of these factors could put further downward pressure on U.S. sugar prices.

production on a state-by-state basis are given in Table 2 for beets and in Table 3 for cane. In line with the conditions of the current sugar program, marketing allotments are suspended and the result is a buildup of government stocks. The magnitude of the price decline is limited by an assumption that the secretary of agriculture would use a payment-in-kind (PIK) program to limit market oversupply.

As a result, government program costs for sugar rise from an average of $8 million per year under the low import scenario to $175 million under the high import scenario. Lower sugar prices result in a modest displacement of HFCS and this leads to slightly higher CCPs for corn. With those expenditures included, total government program costs increase to an average of $187 million per year.

A significant increase in sugar imports from Mexico associated with duty-free access under NAFTA would make it unlikely that the existing U.S. sugar program could continue to be operated on a "no-cost" basis, when the increase in imports is combined with a major displacement of sugar by HFCS in the Mexican beverage industry. In deriving our results we have assumed that the secretary of agriculture exercises the option of operating a PIK program in order to control the buildup of government stocks, but this displaces the problem rather than solving it. It seems unlikely that such a program could be sustained at a high level over the long term because of the uneven effects of a program on the beet and cane components of the industry and such a program's costs. Cane net returns fall much more than their counterparts in beet production (see Tables 2 and 3). Sensitivity analysis presented in Appendix C does not affect this conclusion on the unsustainable nature of the sugar program in its current form. A new farm bill could redefine the allotment formula based on much larger imports, therefore leading to much smaller allowable production, an unpalatable outcome as well.

## 4. Standard Commodity Program Scenario Results

In this standard program scenario we assume that the current sugar program is replaced by one in which the loan rates for beet and cane sugar are reduced, producers are paid a fixed direct payment per ton based on fixed areas and yields, and a single target price is established that is used to determine CCPs if prices fall below the target price. Other aspects of sugar policy, in particular the level of the TRQ and sugar tariffs, are unchanged under this standard-commodity-program scenario. The choice of program parameters was based on extensive discussions with a number of sugar industry experts. The parameters are shown in Table 6 and should be seen as a set of "reasonable" working assumptions about the characteristics of the alternative program.[3]

Again, we examine two cases that correspond to our cases of the baseline scenarios. Column 3 of Tables 1-5 gives the values derived under the assumption of low sugar imports from Mexico; column 4 contains the values under the high import assumption. Columns 6 and 7 of the tables contain the differences in values when each of the two scenarios is compared to its corresponding baseline.

There are several important features to note. First, the NY spot price of sugar falls by roughly 10 percent from each of the respective baseline prices. Under the high Mexican imports scenario, the spot price averages less than 17¢ per pound (Table 1). Second, U.S. sugar production is higher with the standard program in operation, even under the assumption of a substantial increase in the sugar coming from Mexico (Table 1). There are no marketing allotments (or PIK) to constrain domestic production, and many producers find it profitable to produce at prices that are still relatively high in comparison to those that prevail on international markets. Third, sugar consumption (domestic deliveries) increases by roughly 350,000 to

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[3] These policy values were decided before hurricanes destroyed a significant share of the 2005 sugarcane crop. They represent a consensus view of "realistic" values.

400,000 tons compared to the equivalent baseline results. Slightly higher consumption is stimulated by the reduction in sugar prices, and there is some substitution for HFCS; the domestic use of HFCS falls by roughly 230,000 to 250,000 tons. Despite this, the reduction in HFCS use and prices has only a small effect on corn prices, as corn use in HFCS is a small fraction of total U.S. corn use. Finally, the U.S. government does not accumulate stocks because prices remain above the now lower loan rates (Table 1). However, the total cost of the sugar program rises, primarily because of expenditures on direct payments, which average $463 million per year.[4] Because we assume that imports of sugar would rise sharply after 2007/08 in the high import scenario, some CCPs and LDPs are triggered by lower prices in the early years, but U.S. sugar prices then recover to find a new equilibrium just above the loan rate. Averaged over the entire period, these payments amount to roughly $60 million per year. There is also an increase in corn CCPs due to the impact of lower sugar prices on corn prices. Under the high import scenario, the standard program increases corn CCP expenditures by an average of $17 million per year.

## 5. Impact of a Doha Round WTO Trade Agreement

In the trade liberalization scenario, we examine the potential implications for U.S. sugar of a new agreement under the current Doha Round of WTO negotiations. These negotiations were launched in November 2001. It has proved difficult to finalize the agricultural provisions of an agreement. The then chairman of the WTO agriculture committee, Stuart Harbinson, prepared some fairly detailed draft modalities for agriculture in March 2003 (WTO, 2003), but these proposals were not accepted. A less-detailed framework for the modalities was agreed upon in

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[4] These numbers do not reflect payment limitations, which could reduce the cost of the program from that reported here. It is difficult to determine the extent to which payments would be reduced. Appendix B presents some estimates based on the assumption that payment limitations would be binding. Under this assumption, expenditures on direct payments would fall from $463 million to $224 million per year. Actual expenditures would likely be somewhere between these two values.

Geneva on August 1, 2004 (WTO, 2004). Since then, several proposals have been made by countries and groups of countries, with little consensus achieved (Hanrahan and Schnepf). The agreed framework provides general guidelines but lacks the necessary information to lead to quantitative analysis. The Hong Kong Ministerial meeting of the WTO did not produce modalities, and the April 2006 deadline set by the WTO to provide modalities was missed. One is left to pick a set of "reasonable" modalities among the proposals. For this reason, we have chosen to base our assessment largely on elements of the Harbinson modalities and those common to several of the group/country proposals. The final package of reforms is likely to be more modest than our assumptions, which are detailed in Appendix A.

In our analysis, we assume that the Doha Round of trade negotiations is concluded by 2007 and the new agreement is implemented beginning in 2008. It is virtually certain that a new WTO agricultural agreement will embody provisions on (i) increased market access, achieved primarily through reductions in bound out-of-quota tariffs and increases in TRQ quantities; (ii) reductions in and eventual elimination of export subsidies; and (iii) reductions in the amount limits of the most trade-distorting forms of domestic support—amber-box measures—with limitations on other forms of distorting support, particularly blue-box measures, and total support inclusive of amber and blue boxes and *de minimis* support (see Appendix A).

The market access provisions of a new agreement are of the greatest potential significance for the sugar program. As we have shown earlier, the current sugar program would already be under stress if there were to be a significant increase in the volume of sugar imports from Mexico. An increase in access to the U.S. market accorded to other countries, for example, by increasing the TRQ for sugar or reducing over-quota tariffs could lead to additional pressure on the program by stimulating a further buildup in government stocks. In terms of the type of

new sugar program analyzed earlier, the principal issue would seem to be whether the market access provisions under an agreement would cause domestic sugar prices to fall significantly. If that happened, government expenditures on CCPs and LDPs would be considerably larger than the figures reported in Table 5.

In examining the potential implications of a WTO agreement, an additional factor that must be taken into account is the likely impact on international trade and prices of anticipated changes in the sugar program in the European Union. The European Union recently reformed its sugar program, the so-called Common Market Organization (CMO), which was set to expire in June 2006 (Commission of the European Communities, 2004, 2005, 2006). The legality of the older CMO had been challenged successfully in the WTO by several sugar-exporting countries (led by Brazil, Australia, and Thailand). Also, the European Union has agreed to provide duty-free access to its sugar market for the least-developed countries by July 2009 under its Everything But Arms (EBA) initiative. In light of these developments, the European Union reformed its policy. Because the analysis of this paper was undertaken before the new CMO was decided, we made assumptions based on the proposal of the EU Commission to the EU ministers as the basis for our own analysis (Commission of the European Communities, 2004), which ended up being close to the actual policy changes. Some uncertainty remains. Some legal text has yet to be finalized and the Commission is allowing large EU sugar exports to take place until the end of August 2006, irking other sugar exporters (Agranet). Our analysis assumes that the European Union reforms its CMO for sugar beginning in 2006, phasing out its export subsidies. Further, the European Union reduces both its support price and production quota for sugar (see Appendix A for details).

Once quantified, these multilateral changes and EU reforms have an impact on world sugar markets but no effect on the U.S. market. The reduction in EU sugar production and exports associated with the reform of EU sugar policy plus some changes in other countries lead to a moderate increase in world sugar prices. The Caribbean FOB price of raw sugar averages over 4 percent higher than the baseline (without a WTO agreement). Most of the increase in sugar exports stimulated by the agreement is picked up by Brazil and Australia (detailed results available upon request).

In the U.S. market, the new WTO agreement is not calculated to lead to any additional trade changes. The U.S. TRQ already exceeds the assumed requirement that the TRQ equal at least 8 percent of domestic consumption; hence, it would be unchanged under the Harbinson and the G-20 proposals. Given the world prices that we project, the reduced out-of-quota tariff would still remain prohibitive. There are no additional effects of the agreement on Mexico that could have implications for the United States.[5]

While it seems unlikely that there will be any direct implications of a new WTO agreement for the U.S. sugar market, there are some important indirect implications related to domestic support. The change in the sugar program to a standard program would provide a significant credit in reduced trade-distorting amber-box support. Table 7 shows the Aggregate Measure of Support (AMS) for U.S. sugar from 1995 to 2001 (the most recent data available). For the last three years, this averaged over $1.1 billion per year. Providing that U.S. CCPs are classified as a blue-box measure, and direct payments continue to be classified as a green-box measure, the switch to a standard commodity program will yield an AMS "credit" of over $1

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[5] We do not consider any spillover effects on other commodities (e.g., corn) that could be created by a new agreement, but such effects on sugar are likely to be small. In order for a final WTO agreement to be acceptable to other countries, there may be a requirement to provide some additional access for imports of *all* products, including sugar.

billion per year. Only modest LDPs (an estimated average of $23 million per year in Table 5) would fall under the amber-box as measured by government outlays. By contrast, the current sugar AMS is computed using the market price support approach based on the difference between administered and reference prices, which do not reflect current or actual support or market condition, and eligible production. A credit of this magnitude could be important in helping the United States meet its obligations for an overall reduction in agricultural support under a new WTO agreement.

If the sugar program were to become a standard commodity program, the potential contribution of sugar to the blue box through CCPs would be about $52 million. Total current CCPs are about $4.1 billion (Hanrahan and Schnepf). Reductions under the most stringent proposal (U.S. proposal) would cut blue-box support to 2.5 percent of the total value of production, or about $5 billion for the United States. Hence, the sugar CCPs would be "WTO feasible," as the sum of existing CCPs plus the hypothetical sugar CCPs amount to less than the proposed limits and cuts in blue-box support under all proposals.

## 6. Conclusions

Our analysis indicates that the extension of duty-free access for imports from Mexico in 2008 under NAFTA seems likely to undermine the ability of the U.S. sugar program to operate on a "no-cost" basis to U.S. taxpayers. On the assumption that the current dispute with Mexico over the treatment of HFCS will be resolved by that time, it seems likely that the use of HFCS in the Mexican beverage industry will expand considerably and that much of the sugar thereby displaced will seek a market in the United States. Under those conditions, marketing allotments could not be utilized under current legislation and prices would likely fall to the loan rate. The government would probably accumulate significant stocks of sugar.

The replacement of the current sugar program by one similar to that used for other major U.S. crops likely would solve the problem of stock accumulation. It also seems that such a program could more easily accommodate most of the effects of further trade liberalization under a new WTO agreement or future bilateral trade agreements unless a very large TRQ expansion emerges form the Doha negotiations. The latter is not likely. An analysis of recent proposals suggests that a WTO agreement is unlikely to impose significant adjustment pressures on the U.S. sugar market, beyond those that will be created by NAFTA. The adoption of a standard program would, however, make it easier for the United States to meet its commitments on reductions in trade-distorting amber-box support under a new WTO agreement.

The replacement of the current sugar program by a standard commodity program would increase the costs of the program for U.S. taxpayers but would also lower costs for U.S. sugar users. Given reasonable assumptions about possible program parameters, the principal program cost would likely be through direct payments, rather than through CCPs or LDPs. These costs could be lower than the maximum estimated in this report because of limitations on payments to individual producers. The bottom line is that a shift to a "standard" program would not involve significant outlays. Regardless of the starting point, costs are expected to average in the range of $250 to $450 million on an annual basis depending on assumptions. Many of the challenges associated with actually implementing such a program have not been fully addressed. Payment limits are an issue that quickly comes to mind (Roney, 2006a), but others, such as how the processing sector would fund itself or the possibility of other infrastructure financing issues, also loom.

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**Box 1. The Evolution of U.S. Sugar Policy**

The Jones-Costigan Act of 1934 relied upon domestic production and import quotas to support the producer price of sugar. A series of sugar acts with similar characteristics continued in force until December 31, 1974, when record world sugar prices prompted the removal of domestic production restrictions on sugar. High sugar prices did not last. A price support program was instituted in 1977. The Food and Agriculture Act of 1977 created a non-recourse loan program. Sugar processors who agreed to pay sugar producers established minimum prices could obtain a loan using sugar as collateral. They could subsequently repay the loan plus interest if market prices were sufficiently high, or forfeit the sugar to the Commodity Credit Corporation (CCC). In order to reduce the risk that the government would accumulate large stocks, a "market price objective" was established; import duties and fees were applied to regulate the volume of imports and to support domestic market prices. In 1981 a system of country-by-country quotas was introduced to provide greater control over sugar imports.

With the exception of 1980 and 1981, when market prices were high, a series of sugar programs has provided price support through a loan rate system and crucial embodied controls on imports. The Food Security Act of 1985 introduced the requirement that the program be operated at "no cost" to the federal government. The total domestic supply was to be regulated to ensure that the government did not accumulate stocks of sugar. In addition to the existing controls over imports, the 1990 Farm Act provided for the use of marketing controls on domestic sugar in the event that imports were projected to fall below a minimum level of 1.25 million short tons, raw value. Under the Uruguay Round Agreement of the General Agreement on Tariffs and Trade in 1994, the United States agreed to import a minimum quantity of 1.256 million tons of raw and refined sugar each marketing year (October–September). Included in this amount is 24,251 tons of refined sugar.

The 1996 Food and Agricultural Improvement and Reform Act converted import quotas to TRQs. Loans under the loan rate system were non-recourse if the TRQ was set at 1.5 million tons or greater and recourse if the TRQ was less than that amount. Under the recourse loan, the CCC can demand repayment of the loan at maturity, regardless of the market price of sugar. Other changes were introduced in the legislation. The marketing controls on domestic sugar and the no-cost requirement were both eliminated. Additional charges were introduced: penalties for the forfeiture of beet sugar to the CCC; interest charges on loans set at one percentage point about the CCC's cost of borrowing; and marketing assessments paid by processors to help cover program costs.

The current sugar program under the Farm Security and Rural Investment Act of 2002 established loan rates to processors of 18¢ per pound for cane sugar and 22.9¢ per pound for refined beet sugar. Loans are non-recourse and may be taken for a maximum term of nine months. The marketing assessments, forfeiture penalty, and the interest rate premium on loans were all eliminated. The legislation allows for a payment-in-kind program, which had been originally offered for sugar in 2000 and 2001. When such a program is in operation, producers can forgo planting or harvesting sugar in exchange for CCC sugar inventory. The no-cost provision was reinstated. In order to achieve this, marketing allotments were reinstated, but these can only be applied when imports for domestic consumption are less than 1.532 million short tons. Given the destruction of crops by hurricanes in summer 2005, additional imports have been allowed to make up for the unanticipated domestic shortfall without compromising the allotment system. For more information, see Jurenas, and Mitchell.

**Box 2. NAFTA and the Sweetener Markets**

NAFTA—a treaty to establish a free trade area between Canada, Mexico, and the United States—went into effect on January 1, 1994. The provisions relating to trade in sugar with Mexico have significant implications for the U.S. sugar and HFCS markets.

NAFTA allowed for a 15-year transition period for exports of Mexican sugar to the United States. The original agreement provided that during the first six years, duty-free access was allowed for 7,258 metric tons of raw cane sugar. Additional quantities could be exported to the United States if Mexico had net production surplus, defined as domestic sugar production minus consumption, over a two-year period. Beginning in year 7, the maximum duty-free access was to be 150,000 metric tons and would increase by 10 percent in each subsequent year. In order to obtain congressional approval for NAFTA, the Mexican and U.S. governments exchanged "side letters" that modified some of these provisions. The key changes were that Mexico would only be considered a net-surplus producer if its sugar production exceeded domestic consumption of both sugar and HFCS and that duty-free access of up to a maximum of 250,000 tons would be provided from 2001-07 on that basis. There was a subsequent difference of opinion between the two governments on the validity and interpretation of the side-letter provisions, but these provisions have been applied by the United States. For the future, the more important provision of the NAFTA agreement is that tariffs on Mexican sugar, which are being gradually reduced over the transition period, will be zero by calendar year 2008. At that time, Mexico will no longer be subject to the surplus producer condition.

In addition to the conditions attached to sugar, there has been an ongoing dispute with Mexico on imports of HFCS from the United States. NAFTA called for unlimited access of the product to the Mexican market and the progressive reduction of the tariff from 15 percent in 1994 to zero in 2004. There has been a series of disputes with Mexico over imports of HFCS. The Mexican government imposed anti-dumping duties on imports of HFCS from the United States in 1998. These were subsequently challenged through the WTO and through the NAFTA dispute-settlement process. In January 2002, the Mexican Congress imposed a 20 percent tax on soft drinks using HFCS. This was denounced by U.S. producers of HFCS as a violation of NAFTA. In July 2004, the WTO agreed to a request by the United States to establish a dispute settlement panel on the tax measure. In October 2005, the panel report found that the Mexican soft drink tax was inconsistent with article III: 2 and 4, and not justified by article XX of GATT 1994. Mexico appealed the panel ruling in December 2005. In March 2006, the Appellate Body of the WTO ruled against Mexico and upheld the decision of the panel (WTO, 2006b and 2006c).

During this slow legal process, sweetener industries in both countries have held cooperative negotiations to consider their future under joint open borders. These negotiations were aimed at resuming trade without major disruptions. The negotiations were interrupted in 2005-06 but may resume with the approaching end of the WTO dispute (Roney, 2006b).

# Table 1. U.S. Sugar and Sweetener Supply, Utilization, and Prices

| | 1 | 2 | 3 | 4 | 5 = 2-1 | 6 = 3-1 | 7 = 4-2 |
|---|---|---|---|---|---|---|---|
| | Low Import Baseline Scenario | High Import Baseline Scenario | Low Import Standard Program Scenario | High Import Standard Program Scenario | High Import Baseline - Low Import Baseline | Low Import Standard Program - Low Import Baseline | High Import Standard Program - High Import Baseline |
| | (Thousand short tons, raw basis, fiscal year 2008-2015 average) | | | | | | |
| Sugar allotment | 8,564 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Sugar production | 8,591 | 8,287 | 9,088 | 8,630 | -303 | 497 | 343 |
| Sugar imports | 1,847 | 2,984 | 1,767 | 2,919 | 1,137 | -80 | -64 |
| (of which, duty-free NAFTA) | 218 | 1,355 | 138 | 1,290 | 1,137 | -80 | -64 |
| Sugar domestic deliveries | 10,177 | 10,906 | 10,586 | 11,273 | 728 | 409 | 367 |
| Sugar exports | 213 | 216 | 217 | 220 | 3 | 4 | 3 |
| Sugar ending stocks | 2,050 | 2,709 | 2,085 | 2,148 | 658 | 35 | -560 |
| (of which, CCC stocks) | 87 | 1,066 | 0 | 0 | 979 | -87 | -1,066 |
| Sugar-containing product net imports | 563 | 541 | 537 | 518 | -22 | -26 | -23 |
| | (Thousand short tons, calendar year 2008-2015 average) | | | | | | |
| HFCS production | 9,183 | 8,990 | 8,932 | 8,766 | -193 | -251 | -224 |
| HFCS domestic use | 8,951 | 8,167 | 8,692 | 7,939 | -784 | -259 | -228 |
| HFCS net exports | 232 | 823 | 240 | 827 | 591 | 8 | 4 |
| | (Cents per pound, fiscal year 2008-2015 average) | | | | | | |
| N.Y. spot raw sugar | 20.60 | 18.73 | 18.42 | 16.86 | -1.87 | -2.17 | -1.87 |
| Refined beet sugar | 23.64 | 21.05 | 20.63 | 18.45 | -2.59 | -3.02 | -2.60 |
| Retail refined sugar | 44.02 | 41.09 | 40.55 | 37.99 | -2.93 | -3.47 | -3.10 |
| HFCS, 42%, Midwest (cal. yr.) | 12.04 | 11.38 | 11.20 | 10.66 | -0.65 | -0.84 | -0.72 |

## Table 2. U.S. Sugar Beet Production, Prices, and Returns

| | 1<br>Low Import<br>Baseline<br>Scenario | 2<br>High Import<br>Baseline<br>Scenario | 3<br>Low Import<br>Standard<br>Program<br>Scenario | 4<br>High Import<br>Standard<br>Program<br>Scenario | 5 = 2-1<br>High Import<br>Baseline -<br>Low Import<br>Baseline | 6 = 3-1<br>Low Import<br>Standard<br>Program -<br>Low Import<br>Baseline | 7 = 4-2<br>High Import<br>Standard<br>Program -<br>High Import<br>Baseline |
|---|---|---|---|---|---|---|---|
| | (Thousand short tons, raw basis, fiscal year 2008-2015 average) | | | | | | |
| U.S. sugar beet production | 28,350 | 26,970 | 29,688 | 28,362 | -1,380 | 1,338 | 1,392 |
| California | 1,713 | 1,625 | 1,807 | 1,701 | -88 | 94 | 76 |
| Colorado | 689 | 646 | 702 | 659 | -43 | 13 | 13 |
| Idaho | 5,224 | 4,953 | 5,461 | 5,138 | -271 | 237 | 185 |
| Michigan | 3,134 | 2,965 | 3,086 | 2,918 | -169 | -47 | -47 |
| Minnesota | 9,209 | 8,802 | 9,739 | 9,427 | -406 | 531 | 624 |
| Montana | 1,202 | 1,141 | 1,271 | 1,216 | -62 | 69 | 75 |
| Nebraska | 781 | 736 | 809 | 738 | -44 | 29 | 2 |
| North Dakota | 5,202 | 4,970 | 5,633 | 5,444 | -232 | 431 | 474 |
| Ohio | 37 | 35 | 36 | 34 | -2 | -1 | -1 |
| Oregon | 342 | 326 | 332 | 316 | -16 | -10 | -11 |
| Washington | 146 | 139 | 141 | 134 | -7 | -4 | -5 |
| Wyoming | 672 | 632 | 669 | 637 | -40 | -2 | 5 |
| | (Cents per pound, fiscal year 2008-2015 average) | | | | | | |
| Refined beet sugar price | 23.64 | 21.05 | 20.63 | 18.45 | -2.59 | -3.02 | -2.60 |
| | (Dollars per ton, fiscal year 2008-2015 average) | | | | | | |
| Sugar beet price | 40.38 | 37.08 | 36.55 | 33.79 | -3.29 | -3.82 | -3.29 |
| | (Dollars per acre, fiscal year 2008-2015 average) | | | | | | |
| Gross market returns | 920.08 | 844.78 | 833.59 | 769.97 | -75.31 | -86.49 | -74.81 |
| Variable expenses | 488.50 | 488.50 | 488.50 | 488.50 | 0.00 | 0.00 | 0.00 |
| Net market return | 431.58 | 356.27 | 345.09 | 281.47 | -75.31 | -86.49 | -74.81 |
| Loan deficiency payment | 0.00 | 0.00 | 0.00 | 18.33 | 0.00 | 0.00 | 18.33 |
| Countercyclical payment | 0.00 | 0.00 | 0.00 | 12.61 | 0.00 | 0.00 | 12.61 |
| Direct payment | 0.00 | 0.00 | 164.06 | 164.06 | 0.00 | 164.06 | 164.06 |

## Table 3. U.S. Sugarcane Production, Prices, and Returns

| | 1 | 2 | 3 | 4 | 5 = 2-1 | 6 = 3-1 | 7 = 4-2 |
|---|---|---|---|---|---|---|---|
| | Low Import Baseline Scenario | High Import Baseline Scenario | Low Import Standard Program Scenario | High Import Standard Program Scenario | High Import Baseline - Low Import Baseline | Low Import Standard Program - Low Import Baseline | High Import Standard Program - High Import Baseline |
| (Thousand short tons, raw basis, fiscal year 2008-2015 average) | | | | | | | |
| U.S. sugarcane production | 31,279 | 30,673 | 33,471 | 31,566 | -606 | 2,192 | 893 |
| Florida | 15,095 | 14,977 | 16,107 | 15,069 | -118 | 1,012 | 92 |
| Hawaii | 1,779 | 1,085 | 973 | 361 | -693 | -806 | -724 |
| Louisiana | 12,893 | 13,093 | 14,660 | 14,454 | 200 | 1,767 | 1,362 |
| Texas | 1,512 | 1,518 | 1,731 | 1,682 | 6 | 219 | 164 |
| (Cents per pound, fiscal year 2008-2015 average) | | | | | | | |
| N.Y. raw sugar price | 20.60 | 18.73 | 18.42 | 16.86 | -1.87 | -2.17 | -1.87 |
| (Dollars per ton, fiscal year 2008-2015 average) | | | | | | | |
| Sugarcane price | 27.81 | 25.33 | 24.93 | 22.86 | -2.47 | -2.87 | -2.47 |
| (Dollars per acre, fiscal year 2008-2015 average) | | | | | | | |
| Gross market returns | 1014.32 | 910.08 | 890.34 | 804.89 | -104.25 | -123.98 | -105.19 |
| Variable expenses | 748.45 | 748.45 | 748.45 | 748.45 | 0.00 | 0.00 | 0.00 |
| Net market return | 265.87 | 161.63 | 141.89 | 56.44 | -104.25 | -123.98 | -105.19 |
| Loan deficiency payment | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Countercyclical payment | 0.00 | 0.00 | 0.00 | 16.73 | 0.00 | 0.00 | 16.73 |
| Direct payment | 0.00 | 0.00 | 217.57 | 217.57 | 0.00 | 217.57 | 217.57 |

## Table 4. U.S. Corn Use and Price

| | 1 | 2 | 3 | 4 | 5 = 2-1 | 6 = 3-1 | 7 = 4-2 |
|---|---|---|---|---|---|---|---|
| | Low Import Baseline Scenario | High Import Baseline Scenario | Low Import Standard Program Scenario | High Import Standard Program Scenario | High Import Baseline - Low Import Baseline | Low Import Standard Program - Low Import Baseline | High Import Standard Program - High Import Baseline |
| | (Million bushels, crop year 2007/08-2014/15 average) | | | | | | |
| Corn for HFCS production | 539 | 528 | 525 | 515 | -11 | -15 | -13 |
| | (Dollars per bushel, crop year 2007/08-2014/15 average) | | | | | | |
| U.S. corn farm price | 2.329 | 2.326 | 2.325 | 2.323 | -0.003 | -0.003 | -0.003 |

## Table 5. U.S. Government Program Costs

| | 1 | 2 | 3 | 4 | 5 = 2-1 | 6 = 3-1 | 7 = 4-2 |
|---|---|---|---|---|---|---|---|
| | Low Import Baseline Scenario | High Import Baseline Scenario | Low Import Standard Program Scenario | High Import Standard Program Scenario | High Import Baseline - Low Import Baseline | Low Import Standard Program - Low Import Baseline | High Import Standard Program - High Import Baseline |
| | (Million dollars, fiscal year 2008-2015 average) | | | | | | |
| Sugar direct payments | 0 | 0 | 463 | 463 | 0 | 463 | 463 |
| Sugar countercyclical payments | 0 | 0 | 0 | 36 | 0 | 0 | 36 |
| Sugar loan deficiency payments | 0 | 0 | 0 | 23 | 0 | 0 | 23 |
| Sub-total | 0 | 0 | 463 | 521 | 0 | 463 | 521 |
| Other sugar costs (loans, etc.) | 8 | 175 | -1 | -1 | 167 | -9 | -176 |
| Sugar total costs | 8 | 175 | 462 | 520 | 167 | 454 | 345 |
| Corn countercyclical payments | 221 | 233 | 238 | 250 | 12 | 16 | 16 |
| Sugar total + corn CCPs | 229 | 408 | 699 | 770 | 179 | 471 | 362 |

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**Table 6. Parameters Assumed for a Standard Commodity Program for Sugar**

|  | Beet | Cane |
|---|---|---|
| Loan Rate | 16.48¢ per pound | 12¢ per pound |
| Direct payment (per pound) | 3¢ per pound, raw sugar equivalent | 3¢ per pound |
| Target price | 20¢ per pound, raw sugar equivalent | 20¢ per pound |
| Base area | 1.5 million acres | 1.0 million acres |
| Base yield | 3.2 tons per acre, raw sugar equivalent | 4.3 tons per acre |

**Table 7. U.S. Aggregate Measure of Support for Sugar**

| Year | Administered Price | External Reference Price | Eligible Production | AMS |
|---|---|---|---|---|
|  | (dollars/metric ton) | | (million MT) | (million dollars) |
| 1995 | 396.83 | 230.82 | 6.67 | 1,108 |
| 1996 | 374.79 | 230.82 | 6.51 | 937 |
| 1997 | 374.79 | 230.82 | 7.26 | 1,045 |
| 1998 | 374.79 | 230.82 | 7.59 | 1,093 |
| 1999 | 374.79 | 230.82 | 8.20 | 1,180 |
| 2000 | 374.79 | 230.82 | 7.87 | 1,133 |
| 2001 | 374.79 | 230.82 | 7.17 | 1,032 |

**Appendix A. Further Details on Assumptions for Each of the Scenarios**

The major macroeconomic assumptions used in our analysis are summarized in Tables A1-A5.

*Baseline*

In calculating the allotments applied in the two variants of the baseline, we use the following formula: Allotment = Sugar deliveries + 0.185 * (Sugar deliveries + Sugar exports) - Beginning stocks - 1,532,000 tons. The 0.185 factor was that used by USDA in setting fiscal 2005 allotments to reflect a normal stock-to-use ratio.

*Standard Program*

Except for loan rates, beet sugar provisions are expressed in raw sugar equivalents. Countercyclical payment rates for both cane and beet sugar are determined by the following formula: max (0, (Target price - Direct payment rate - NY raw sugar price)).

Program base areas and yields are based on 1998-2001 averages. The sugar beet base area is set equal to 1998-2001 average planted area, while the sugarcane base area is set equal to 1998-2001 average area harvested for sugar and seed. The program yields are set equal to the respective yields of raw sugar equivalent per acre harvested for sugar. Alternative rules could have been used; the rules selected mimic those used in setting program provisions for peanuts in 2002 farm legislation.

Under the marketing loan provisions for other crops, producers have the ability to repay loans based on a loan repayment price if that is lower than the loan rate plus interest. How this loan repayment price would be set for sugar is an important question for which there is no obvious answer. For wheat, feed grains, and oilseeds, posted county prices (PCPs) are the loan repayment rates. PCPs are set using a complicated formula that ultimately ties local county prices to terminal market prices. For cotton and rice, loan repayment rates are tied to adjusted world prices that are linked to world market developments. Neither approach seems directly applicable to sugar. For purposes of our analysis, we assume that the average loan repayment rate for sugar will be 2¢ per pound below the average market price. This is arbitrary but is consistent with the experience in other crops, in which loan repayment rates are almost always at least slightly lower than observed market prices. This ensures that farmers rarely have an incentive to forfeit commodities in lieu of repaying loans.

*Trade Liberalization Assumptions*

Although a framework for reforms was approved by the WTO in July 2004, modalities of the reforms have not been defined. Several countries (the European Union and United States) and groups of countries (G-5, G-10, and G-20) have issued proposals with detailed yet incomplete modalities (Hanrahan and Schnepf). The only proposal emanating from the WTO itself is the Harbinson draft. The latter was not successful either. It is not clear what the final modalities will look like, as negotiations have been difficult. We used the information included in the Harbinson proposal (WTO, 2003) and some additional assumptions from recent proposals (Hanrahan and Schnepf) in evaluating the impact of a WTO agreement. All these proposals have many common elements of reforms but differ on modalities on tariff cuts, treatments of sensitive products, and minimum market access for these products. We reduce the installment period for developing countries to five years, given the constraints on the time horizon used in the baseline for our study; hence, we overstate the degree of reform in developing countries.

There are three types of trade policy reforms under this scenario: tariff-rate quota (TRQ) expansion to a minimum share of a reference consumption level; a decrease in bound tariff using a tiered system; and the elimination of export subsidies, with the value and volume of subsidized exports going to zero.

*Market access—TRQs*

We use the same approach for tariff cuts and minimum TRQ increases. Rather than applying an average increase, we assume that countries will act strategically to achieve a 10 percent average increase with up to a 12 percent increase in marginal TRQs to offset the 8 percent minimum on "key" products. We monitor current levels of TRQ fill in the TRQ expansion. The fill rate is often less than 100 percent but the TRQ expansion may go to low-cost producers. The fill rate could also decrease when the U.S. producer price (and the new EU reference price) decline. We assume that for a quota fill of less than 60 percent the increase in the quota does not lead to an actual increase in sugar imports because the under-fill is so substantial.

Developed WTO members:

TRQ volume increases to a minimum of 8 percent of domestic consumption based on the 2003-04 average (a 1999-2000 average was used in the original Harbinson proposal) in five equal increments. We assume no change in in-quota tariffs.

Developing WTO members:

TRQ volume increases to a minimum of 5 percent of domestic consumption with respect to 2003-04 average consumption (1999-2000 was specified in Harbinson), in five increments. There were 10 increments in the Harbinson proposal but that was shortened here to fit our period of analysis. We assume no change in in-quota tariffs.

As shown in Table A6, the TRQ expansion affects only Colombia, South Africa, and the Philippines. Many countries do not fill their TRQ (less than 60 percent of TRQ filled in recent years), and these countries already have a TRQ higher than 8 percent of their consumption for developed-country WTO members or 5 percent for developing-country WTO members. The combination of these two factors (substantial under-fill and large nominal TRQ) means that only three major countries have an actual import increase under the TRQ expansion.

*Market access—bound tariffs*

We use the minimum tariff line cuts in the Harbinson proposal, not the average reduction, under the assumption that countries will act strategically to meet the average proportional reduction criteria without any consequence for sugar other than the minimum cut. We use applied or MFN rates in our analysis, not the bound rates. We monitor bound and applied rates in each country to determine when there is "water" in the tariffs (tariff redundancy) and thus when an effective tariff change is likely to occur. The bound and applied tariffs for major countries and the implied reductions in applied tariffs are given in Table A7.

Developed WTO members

Bound tariffs cuts are in five equal installments. The minimum line cuts are as follows. For tariffs above 90 percent, minimum line reduction is 45 percent in five equal installments. For tariffs in the range of 15-90 percent, the minimum line cut is 35 percent in five equal installments. For tariffs below 15 percent, the minimum line cut is 25 percent in five equal installments.

Developing WTO members

For tariffs above 120 percent, there is 30 percent reduction per line in five equal installments. For tariffs above 60 and below 120 percent, there is 25 percent minimum line reduction in five equal

installments. For tariffs between 20 and 60 percent, there is 20 percent reduction. For tariffs under 20 percent, there is 17 percent reduction in five installments.

We 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 upon for this group of countries as a whole. As shown in Table A7, the changes in applied out-of-quota tariffs are modest because bound tariffs are very high and many countries have applied tariffs lower than the final bound tariffs that would result from the implementation of a Doha agreement.

*Export subsidies*

This reform component has the strongest impact on the sugar market but through one market participant (the European Union). The changes are as follows.

Developed WTO members

If the sector outlay represents at least 50 percent of all outlays, then there is a 30 percent reduction annually in the previous year's outlay for five years, dropping to zero in year 6. This probably will not apply to sugar. For all other subsidies, there is a 25 percent reduction of the previous year's outlay for five years, then to zero in year 6. The export volume commitment is also cut 30 percent annually from its previous year's level for five years.

Developing WTO members

If the sector outlay represents at least 50 percent of all outlays, there is a 25 percent decrease from the previous year's outlay, annually for five years, then to zero by year 6. Actual cuts in export subsidies for developing countries may be more modest. For all other export subsidies, there is a 20 percent reduction from the previous year's outlay for five years, then to zero in year 6. This keeps us within the 10-year baseline period for our study (the Harbinson proposal had a 12-year implementation period).

As may be deduced from Tables A8 and A9, the reduction in export subsidies is likely to have the largest impact on international markets. The reduction in EU export subsidies induces a one-for-one permanent decrease in production under quota. The affected exports are non-ACP subsidized exports (about 1.273 million metric tons [mmt] of white sugar) but not the 1.6 mmt of ACP re-exports, which are also subsidized but not part of the WTO commitment. These are covered by a 2005 WTO ruling that was appealed and arbitrated but is still unresolved as of May 2006. In fall 2005, the European Union actually antagonized concerned parties by announcing an expansion of exports of C sugar of about 2 mmt by declassifying quota sugar (WTO, 2006a). If ACP re-exports finally count as subsidized exports to be eliminated, the European Union is expected to become an even larger importer because production will fall by an additional 1.27 mmt. We do not include the ACP re-exports as part of the export subsidy reform because these are still part of the unresolved WTO dispute. The elimination of the latter would intensify the necessary reductions in EU sugar production and the resulting increase in world prices.

*Domestic support reductions*

Blue box

Blue box support is cut by 50 percent in equal installments for five years for developed members to 2.5 percent of the value of production, and there is a 33 percent reduction over five installments for developing members (10 years in Harbinson). The G-5 proposal stipulates that blue-box payments should not exceed 5 percent of a reference average production value. This may be relevant for U.S. CCPs if they are shifted to the blue box. The G-20 and G-10 proposals do not address the blue-box support as a separate category.

Amber box/AMS+de minimis

A 60 percent reduction is implemented in equal installments on bound AMS over five years in developed members. There is a 20 percent decrease as a down payment in year 1 and then equal reductions (10 percent of initial support) in the next four years. There is a 40 percent reduction in bound AMS in five equal installments for developing members (given the baseline horizon) with a 20 percent decrease the first year, then a linear decrease in the next four years of 5 percent of the initial support level. De minimis support is reduced by 0.5 point for five years (new de minimis is 2.5 percent). These modalities and schedules translate into little or no actual change for most countries and little change in sugar markets.

Total trade distorting support (amber + blue-box) reductions

This reduction is included in several proposals. This is not an issue relevant for sugar, as its amber-box component would dramatically decrease by about $1 billion.

**Table A1. Population Growth Projections (percent change from previous year)**

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Major Exporters** | | | | | | | | | | | | |
| Australia | 0.92 | 0.89 | 0.86 | 0.84 | 0.82 | 0.79 | 0.77 | 0.76 | 0.74 | 0.73 | 0.71 | 0.70 |
| Brazil | 1.14 | 1.09 | 1.06 | 1.03 | 1.00 | 0.97 | 0.94 | 0.90 | 0.88 | 0.85 | 0.83 | 0.80 |
| European Union-15 | 0.22 | 0.21 | 0.19 | 0.17 | 0.16 | 0.14 | 0.13 | 0.11 | 0.10 | 0.09 | 0.07 | 0.06 |
| European Union-New Member States | -0.07 | -0.06 | -0.06 | -0.05 | -0.06 | -0.06 | -0.06 | -0.07 | -0.08 | -0.09 | -0.11 | -0.12 |
| Mexico | 1.20 | 1.18 | 1.17 | 1.16 | 1.15 | 1.14 | 1.13 | 1.12 | 1.10 | 1.08 | 1.07 | 1.05 |
| Thailand | 0.93 | 0.89 | 0.86 | 0.82 | 0.79 | 0.75 | 0.72 | 0.68 | 0.65 | 0.62 | 0.59 | 0.56 |
| **Major Importers** | | | | | | | | | | | | |
| Canada | 0.93 | 0.91 | 0.90 | 0.88 | 0.87 | 0.85 | 0.84 | 0.83 | 0.82 | 0.80 | 0.79 | 0.78 |
| China | 0.57 | 0.57 | 0.59 | 0.60 | 0.62 | 0.64 | 0.67 | 0.69 | 0.69 | 0.68 | 0.66 | 0.63 |
| India | 1.46 | 1.43 | 1.40 | 1.37 | 1.35 | 1.32 | 1.29 | 1.27 | 1.25 | 1.23 | 1.20 | 1.18 |
| Indonesia | 1.52 | 1.48 | 1.44 | 1.40 | 1.36 | 1.31 | 1.27 | 1.23 | 1.20 | 1.16 | 1.12 | 1.08 |
| Japan | 0.09 | 0.07 | 0.04 | 0.00 | -0.03 | -0.07 | -0.11 | -0.15 | -0.19 | -0.23 | -0.27 | -0.30 |
| Russia and Ukraine | -0.49 | -0.45 | -0.43 | -0.41 | -0.41 | -0.40 | -0.40 | -0.40 | -0.41 | -0.41 | -0.42 | -0.43 |
| United States | 0.93 | 0.92 | 0.90 | 0.89 | 0.87 | 0.87 | 0.87 | 0.86 | 0.86 | 0.85 | 0.85 | 0.84 |

**Table A2. Real GDP Growth Projections (percent change from previous year)**

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Major Exporters** | | | | | | | | | | | | |
| Australia | 3.71 | 3.27 | 2.86 | 2.68 | 2.69 | 2.76 | 2.71 | 2.69 | 2.65 | 2.66 | 2.65 | 2.61 |
| Brazil | 4.00 | 4.10 | 4.08 | 4.03 | 4.28 | 4.30 | 4.15 | 4.19 | 4.06 | 4.02 | 4.06 | 4.10 |
| European Union-15 | 2.05 | 2.26 | 2.39 | 2.13 | 2.09 | 2.08 | 2.10 | 2.10 | 2.10 | 2.10 | 2.07 | 2.09 |
| European Union-New Member States | 5.00 | 4.78 | 4.65 | 4.54 | 4.34 | 4.07 | 3.94 | 4.13 | 4.10 | 3.95 | 4.00 | 4.05 |
| Mexico | 3.63 | 3.65 | 3.66 | 3.67 | 3.68 | 3.69 | 3.70 | 3.66 | 3.69 | 3.72 | 3.76 | 3.80 |
| Thailand | 7.23 | 6.01 | 5.35 | 5.18 | 5.40 | 5.51 | 5.60 | 5.75 | 5.99 | 5.83 | 5.53 | 5.38 |
| **Major Importers** | | | | | | | | | | | | |
| Canada | 3.00 | 3.55 | 3.32 | 3.16 | 3.12 | 3.11 | 3.10 | 3.02 | 2.80 | 2.57 | 2.40 | 2.31 |
| China | 8.64 | 7.23 | 7.01 | 7.02 | 6.79 | 6.78 | 6.56 | 6.35 | 6.27 | 6.27 | 6.37 | 6.26 |
| India | 6.39 | 6.16 | 5.49 | 5.73 | 5.85 | 5.58 | 5.53 | 5.51 | 5.47 | 5.45 | 5.39 | 5.31 |
| Indonesia | 4.73 | 5.00 | 4.81 | 4.76 | 4.63 | 4.61 | 4.72 | 4.87 | 4.76 | 4.80 | 4.82 | 4.62 |
| Japan | 4.06 | 2.55 | 1.97 | 1.86 | 1.76 | 1.66 | 1.61 | 1.61 | 1.63 | 1.66 | 1.71 | 1.70 |
| Russia and Ukraine | 6.30 | 5.27 | 4.58 | 4.57 | 4.26 | 3.82 | 3.82 | 3.48 | 3.66 | 3.88 | 3.89 | 3.83 |
| United States | 4.27 | 3.32 | 2.90 | 3.17 | 2.88 | 2.96 | 3.08 | 3.07 | 3.02 | 3.23 | 3.50 | 3.26 |

## Table A3. GDP Deflator Growth Projections (percent change from previous year)

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Major Exporters** | | | | | | | | | | | | |
| Australia | 2.39 | 2.80 | 1.97 | 1.47 | 2.68 | 2.53 | 2.49 | 2.50 | 2.60 | 2.57 | 2.55 | 2.54 |
| Brazil | 7.42 | 8.22 | 8.02 | 7.33 | 7.87 | 7.63 | 7.56 | 7.49 | 7.41 | 7.34 | 7.27 | 7.20 |
| European Union-15 | 3.16 | 1.64 | 1.71 | 1.61 | 1.76 | 1.89 | 1.90 | 1.92 | 1.89 | 1.89 | 1.90 | 1.89 |
| European Union-New Member States | 1.02 | 6.22 | 2.80 | 2.97 | 2.49 | 2.48 | 2.38 | 2.46 | 2.26 | 2.52 | 2.46 | 2.40 |
| Mexico | 6.05 | 4.41 | 4.39 | 4.34 | 4.34 | 4.33 | 4.33 | 4.34 | 4.34 | 4.36 | 4.37 | 4.39 |
| Thailand | 2.51 | 2.35 | 2.26 | 2.39 | 2.53 | 2.62 | 2.75 | 2.91 | 3.00 | 3.05 | 3.08 | 2.97 |
| **Major Importers** | | | | | | | | | | | | |
| Canada | 2.41 | 1.08 | 1.43 | 1.50 | 1.70 | 1.94 | 1.95 | 1.81 | 1.73 | 1.71 | 1.78 | 1.91 |
| China | 3.67 | 4.90 | 4.05 | 3.75 | 3.38 | 3.10 | 3.11 | 3.23 | 3.39 | 3.38 | 3.27 | 3.26 |
| India | 5.70 | 5.10 | 5.00 | 5.10 | 5.30 | 4.68 | 4.51 | 4.64 | 4.66 | 4.58 | 4.50 | 4.43 |
| Indonesia | 5.33 | 5.43 | 5.29 | 4.32 | 4.00 | 3.95 | 3.92 | 3.96 | 4.02 | 4.05 | 4.08 | 4.10 |
| Japan | -1.70 | -0.34 | 0.37 | 1.12 | 1.46 | 1.66 | 1.85 | 1.96 | 2.04 | 2.11 | 2.12 | 2.11 |
| Russia | 12.42 | 8.99 | 8.11 | 7.36 | 6.70 | 6.23 | 5.91 | 5.46 | 5.25 | 5.16 | 4.97 | 4.91 |
| Ukraine | 8.43 | 7.01 | 5.92 | 5.50 | 5.20 | 4.50 | 4.20 | 4.20 | 4.50 | 4.10 | 4.00 | 4.00 |
| United States | 2.11 | 1.94 | 1.71 | 1.89 | 1.97 | 1.98 | 2.13 | 2.34 | 2.34 | 2.17 | 2.19 | 2.26 |

## Table A4. Exchange Rate Growth Projections - Local Currency per U.S. Dollar (percent change from previous year)

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Major Exporters** | | | | | | | | | | | | |
| Australia | -10.04 | 1.10 | -0.83 | -0.37 | -0.25 | -0.27 | -0.28 | -0.28 | -0.30 | -0.31 | -0.32 | -0.33 |
| Brazil | -1.14 | 6.19 | 5.88 | 6.71 | 4.25 | 4.22 | 3.86 | 3.84 | 3.81 | 3.79 | 3.76 | 3.73 |
| European Union | -8.85 | -1.89 | -0.95 | -3.34 | -1.08 | -0.31 | -0.33 | -0.34 | -0.30 | -0.26 | -0.22 | -0.23 |
| Mexico | 4.75 | 2.41 | 4.37 | 5.79 | 4.33 | 4.62 | 6.35 | 4.81 | 4.44 | 4.11 | 3.73 | 4.43 |
| Thailand | -3.36 | -1.12 | -1.75 | -1.77 | -1.27 | -0.86 | -0.97 | -0.75 | -0.94 | -0.92 | -0.62 | -0.73 |
| **Major Importers** | | | | | | | | | | | | |
| Canada | -4.70 | -1.48 | -3.07 | -3.79 | -1.04 | -0.92 | -0.76 | -0.54 | -0.40 | -0.57 | -0.65 | -0.56 |
| China | 0.00 | 0.00 | -2.35 | -4.36 | -3.51 | -2.02 | -1.00 | -1.00 | -0.36 | 0.28 | 0.20 | 0.12 |
| India | -2.11 | 3.99 | 2.04 | 1.48 | 2.08 | 1.92 | 1.77 | 1.70 | 1.66 | 1.61 | 1.54 | 1.49 |
| Indonesia | 3.23 | -4.47 | -3.13 | 0.57 | 1.05 | 0.99 | 0.95 | 0.92 | 0.93 | 0.97 | 1.00 | 1.02 |
| Japan | -7.67 | -5.81 | -3.35 | -0.49 | -1.10 | -1.55 | -1.37 | -1.02 | -0.75 | -0.50 | -0.28 | -0.07 |

**Table A5. Analysis of the Increase in Sugar Tariff-Rate Quotas (TRQs)**

| Countries | TRQ | Recent fill | Consumption | TRQ expansion | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tmt) | rate | threshold | 2007/08 | 2008/09 | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 |
| Colombia | 57 | 78% | 70 | 60 | 62 | 65 | 68 | 70 | 70 | 70 | 70 |
| European Union 25 | 1,590 | 100% | 1,410 | 1,590 | 1,590 | 1,590 | 1,590 | 1,590 | 1,590 | 1,590 | 1,590 |
| South Africa | 62 | 100% | 129 | 75 | 89 | 102 | 116 | 129 | 129 | 129 | 129 |
| Thailand | 14 | 0% | | 14 | 14 | 14 | 14 | 14 | 14 | 14 | |
| Mexico | 184 | 54% | | 184 | 184 | 184 | 184 | 184 | 184 | 184 | 184 |
| China | 1,945 | 42% | | 1,945 | 1,945 | 1,945 | 1,945 | 1,945 | 1,945 | 1,945 | 1,945 |
| Morocco | 274 | 187% | 82 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 |
| Philippines | 64 | 100% | 100 | 71 | 78 | 85 | 93 | 100 | 100 | 100 | 100 |
| United States | 1,229 | 83% | 777 | 1,229 | 1,229 | 1,229 | 1,229 | 1,229 | 1,229 | 1,229 | 1,229 |
| Venezuela | 132 | 250% | 68 | 132 | 132 | 132 | 132 | 132 | 132 | 132 | 132 |

Notes:

1. If the fill rate is less than 60 percent then no expansion is assumed.

2. Fill rate estimated by using TRQ notification if recent or gain reports if dated notification.

3. TRQ increase is up to 8 percent of average 2002-3 consumption if developed countries fill their TRQ at least at 60 percent

and if the current TRQ is less than 8 percent of consumption.

4. The consumption threshold is only 5 percent for developing members of the WTO.

**Table A6. Bound and Applied Tariffs and Implied Reductions in Applied Tariffs**

| Country | WTO Status | Bound Level Uruguay Final | Doha Modality | Reduction in Doha Modality | Applied Tariffs | Implied reduction in applied tariff |
|---|---|---|---|---|---|---|
| ARGENTINA | Developing | 35 | 28 | 7 | 23 | 0 |
| AUSTRALIA | Developed | 24 | 16 | 8 | 0 | 0 |
| BRAZIL | Developing | 35 | 28 | 7 | 16 | 0 |
| CANADA | Developed | 11 | 8 | 3 | 9 | 0 |
| COLOMBIA | Developing | 117 | 88 | 29 | 20 | 0 |
| CUBA | Developing | 40 | 32 | 8 | 10 | 0 |
| EGYPT | Developing | 20 | 17 | 3 | 5 | 0 |
| EUROPEAN UNION | Developed | 194 | 107 | 87 | 194 | 87 |
| INDIA | Developing | 150 | 105 | 45 | 65 | 0 |
| INDONESIA | Developing | 95 | 71 | 24 | 31 | 0 |
| JAPAN | Developed | 353 | 194 | 159 | 353 | 159 |
| KOREA | Developing | 18 | 15 | 3 | 5 | 0 |
| MALAYSIA | Developing | 17 | 15 | 3 | 0 | 0 |
| MEXICO | Developing | 212 | 148 | 64 | 233 | 85 |
| MOROCCO | Developing | 168 | 118 | 50 | 35 | 0 |
| PAKISTAN | Developing | 150 | 105 | 45 | 35 | 0 |
| PERU | Developing | 68 | 51 | 17 | 25 | 0 |
| PHILIPPINES | Developing | 50 | 40 | 10 | 65 | 25 |
| SOUTH AFRICA | Developed | 105 | 58 | 47 | 65 | 7 |
| THAILAND | Developing | 94 | 71 | 24 | 65 | 0 |
| TURKEY | Developing | 135 | 95 | 41 | 137 | 42 |
| UNITED STATES | Developed | 210 | 116 | 95 | 195 | 79 |
| VENEZUELA | Developing | 105 | 79 | 26 | 20 | 0 |
| CHINA | Developing | 50 | 40 | 10 | 50 | 10 |

Notes:

1. Countries covered individually in the sugar model. Other countries are aggregated under a "Rest of the World" category.

2. Calculations include: Column F=D*(1-E/100); Column G= D minus F; Column I = H minus F.

3. Bound and applied specific tariffs have been converted to an ad valorem equivalent.

4. The EU-25 includes New Member States and all countries incorporate EU tariff policy after 2004.

**Table A7. Export Subsidy Notifications for Major Exporters and Importers**

| | |
|---|---|
| Algeria | Not a WTO member |
| Argentina | Notified no export subsidies in 2002 or 2003 |
| Australia | Notified no export subsidies in 2002 or 2003 |
| Brazil | No subsidy in 1996 reported in 2003 |
| Canada | No export subsidies applied to sugar |
| China | 2004 notification of no export subsidies applied in 2002 or 2003 |
| Colombia | 2001 notification of no subsidies in 2000 |
| Cuba | Notified no subsides applied in 2002. |
| Egypt | 1999 notification of no export subsidies in 1998 and beyond |
| European Union | 1,273.5 tmt white sugar and 499.1 million euros commitments nearly binding in recent years. Implied reduction = volume commitment |
| Former Soviet Union | No subsidies used in Georgia. Russia is not a WTO member |
| India | No subsidies |
| Indonesia | No sugar export subsidy notification |
| Iran | Not a WTO member |
| Japan | 2004 notification of no export subsidies applied in 2003 |
| Malaysia | 2000 notification of no export subsidies used in 1997 and 1998 |
| Mexico | Notified in 2002 that no export subsidies were used in 1996 |
| Morocco | 2003 notification of no sugar subsidies in 2001 |
| Pakistan | 2001 notification of no subsidies on sugar for 2000 |
| Peru | 2003 notification of no sugar subsidies in 2002 |
| Philippines | 2004 notification of no export subsidies in 2002 or 2003 |
| South Africa | Some subsidized exports notified in 2000 and 2002 (2.1% of volume target) . Reduction of exports = 2.1% |
| South Korea | 2002 notification of no sugar export subsidies in 2000 |
| Thailand | 2004 notification of no export subsidies in 2002 |
| Turkey | 2001 notification of no subsidies on sugar for 2000 |
| United States | 2004 notification of no subsidies on sugar in 2002 |

**Table A8. Implied Change in EU-15 Production Quota (thousand metric tons) with the Reduction in Export Subsidies**

| | 2004/05 | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Net baseline quota level | 14,275 | 13,400 | 12,984 | 12,568 | 11,508 | 11,508 | 11,508 | 11,508 | 11,508 | 11,508 | 11,508 |
| Export subsidy reduction | 0 | 0 | 0 | 382 | 267 | 187 | 131 | 92 | 214 | 0 | 0 |
| Net quota in trade reform scenario | 14,275 | 13,400 | 12,984 | 12,186 | 10,858 | 10,671 | 10,540 | 10,448 | 10,235 | 10,234 | 10,234 |

## Appendix B. Impact of Payment Limitations

Payment limits set the maximum amount of commodity program benefits an individual or entity can receive by law. Under the 2002 Farm Act, payment limits per individual or entity are $40,000 for direct payments, $65,000 for countercyclical payments, and $75,000 for loan-deficiency payments/marketing assistance loan gains. Under the Act's three-entity rule, individuals can receive program payments from up to three separate entities engaged in farming operations, effectively doubling the payment limits per individual. The 2002 Farm Act also established a $2.5 million adjusted gross income (AGI) cap. An individual or entity whose AGI exceeds $2.5 million is not eligible for payments unless 75 percent or more of AGI is derived from farming, ranching, or forestry operations.

At a direct payment rate of $164 per acre for sugar beets,[6] a farmer not taking advantage of the three-entity rule would encounter the $40,000 payment limit at 244 or more acres of beets. Taking advantage of the three-entity rule to double the limit to $80,000 would raise the threshold number of beet acres to 488. In the case of sugarcane, at a direct payment rate of $218 per acre, a farmer not taking advantage of the three-entity rule would encounter the payment limit at 183 or more acres of cane. Taking advantage of the three-entity rule would raise the threshold number of cane acres to 366. These thresholds would be lower for farmers already receiving direct payments for other program crops because those payments count toward the limit. Sugar beet farms often produce significant amounts of wheat and, to a lesser extent, corn. Production of other program crops is less common among sugarcane farms, the major exception being rice production by some Louisiana sugarcane growers.

About one-seventh (14 percent) of sugar beet farms have 500 or more acres of sugar beets, and they account for 41 percent of total U.S. sugar beet acreage and 40 percent of total U.S. sugar beet production (Ali). About one-fifth (22 percent) of sugar beet farms have between 250 and 499 acres of sugar beets, and they account for 29 percent of total sugar beet acreage and 30 percent of total production. For sugarcane, about one-fifth (22 percent) of growers have farm sizes of 2,000 or more acres, and they account for 69 percent of total U.S. sugarcane acreage and 71 percent of total U.S. sugarcane production (USDA-NASS, 2002). An additional 45 percent of sugarcane growers have farm sizes between 500 and 1,999 acres, and these growers account for 28 percent of total sugarcane acreage and 25 percent of total production.

The number of sugar beet farms in the United States declined from 8,810 in 1992 to 5,027 in 2002, and average sugar beet acreage per farm increased from 164 to 272 during this

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[6] A direct payment of 3¢ per pound for beet sugar is equivalent to $164 per acre of beets, given the figures we use for program yields and sugar recovery rates. Similarly, a direct payment of 3¢ per pound for cane sugar is equivalent to $218 per acre of cane.

period (USDA-NASS, 1992, 2002). In sugarcane, the trends were less pronounced but similar in direction: the number of sugarcane farms declined from 1,031 in 1992 to 953 in 2002, and average sugarcane acreage per farm increased from 857 to 1,027. If these trends continue, the proportion of total sugar beet and sugarcane acreage operated by farms that could be subject to payment limits would be higher in the future than it is today.

The degree to which payment limits would actually restrict payments to sugar beet or sugarcane growers is uncertain. A 2003 report by the Commission on the Application of Payment Limitations for Agriculture concluded that producers have many options for reorganizing their farm businesses in ways that reduce the effects of payment limits (Commission on the Application of Payment Limitations for Agriculture). The Commission also concluded that payment limits have a very small impact on total direct payments and CCPs for current program crops.

Assuming that producers take full advantage of the three-entity rule but do not otherwise reorganize their farm businesses in response to payment limits, we estimate that 60 percent or more of sugar beet acreage would be farmed by producers subject to payment limits, and at least 95 percent of sugarcane acreage would be farmed by producers subject to payment limits. We estimate that strict payment limits along these lines would reduce expenditures on direct payments by about one-half, from $463 million per year to about $224 million per year ($166 million/year for beets and $58 million/year for cane). CCP and LDP expenditures would be reduced by a similar percentage in the scenarios where they occur (those involving high Mexican imports). Actual expenditures on direct payments would likely fall somewhere between $224 and $463 million per year.

One option for facilitating adjustment by producers to the new program would be to provide transitional payments along the lines of those offered under the recent tobacco and peanut quota buyouts. Transitional payments could be made proportional to current marketing allotments, and producers could be given the option of receiving the payments over a period of years or in one lump sum. The situation is not completely analogous to tobacco or peanuts because quotas for those commodities had an established economic value that marketing allotments for sugar do not have. Nevertheless, the allotments could form a basis for such transitional payments.

**Appendix C. Sensitivity Analysis: How Robust Are The Results?**
In any economic study, a number of assumptions are required to generate the final set of numbers. This study was no exception. Assumptions were needed on everything from future consumer behavior to the responsiveness of producers to changing prices, from the linkages between the farm and retail markets to the future actions of the Mexican government.

To deal with these effects, a common practice is to incorporate a sensitivity analysis on some of the key assumptions: vary some of the assumptions, rerun the analysis, and determine the differences caused by making different assumptions. Some of these important assumptions have already been considered in the body of the report. For example, the Low Import Baseline and the High Import Baseline were both included as baselines because of the uncertainty, and also the importance, of the import issue to this sector.

Two external committees reviewed the work and the report. One was the Farm Bureau Sugar Commodity Advisory Committee (SCAC). The other was an external committee made up

of academics and an industry representative. Both committees raised issues they felt were critical assumptions in the study and asked that sensitivity analyses be conducted in these areas.

The first, raised by the SCAC, related to the path of consumer demand. Through much of the 1990s, domestic caloric sweetener consumption grew year over year. However, with the advent of low-carb diets and other nutritional shifts, consumption trends actually reversed. The SCAC felt that a scenario looking at continued declines in consumption would be appropriate.

The second concern was raised by the panel of industry and academic representatives. For this panel, the focus was more on the underlying economic structure of the industry. The model used to conduct the analysis incorporated relationships between the price of sugar, the prices of HFCS, and domestic consumption. These are clearly a key set of relationships that go a long way in determining the final conclusions. Consequently, it was suggested that a less responsive set of relationships should be examined.

### *Declining Consumption Scenario*

Under the baseline, per-capita deliveries—a proxy for consumption—split the difference between the patterns demonstrated over the last several years. Consumption was essentially assumed to continue to demonstrate a slight decline, falling 2.5 pounds per capita between 2004 and 2015, the last year of the analysis.

For the reduced consumption scenario, per-capita consumption dipped from the 66.9-pound level observed in 2004 to only 55 pounds in 2015. HFCS consumption was assumed to be essentially constant in both. Several justifications could be given for the lower consumption scenario, with population changes, health concerns, and greater availability of non-caloric sweeteners for the cooking and baking sectors being but a few. The exact levels chosen for the decline are somewhat arbitrary but reflect the general sentiments reflected by the SCAC.

As the policy parameters around the scenario continue current provisions, the reduction in consumption must reverberate back onto domestic production. With import levels predetermined by existing agreements (the scenario was run off of the Low Import Baseline), all of the adjustment is forced on domestic producers. By the end of the period, in 2015, sugar production in the United States has fallen 1.7 million short tons below the levels seen under the Low Import Baseline.

Taking this one step further, beet area would need to fall every year by 31,000 acres, while cane area would drop 21,000 acres for the length of the analysis. But to put this in perspective, even under the baseline, i.e., minimal declines in domestic consumption, beet area falls by nearly 10,000 acres per year and cane by nearly a similar amount. Regardless, with a policy design in place to maintain a price by adjusting production, there will be little opportunity for the sector to grow.

### *Less Responsive Demand Scenario*

The second area for sensitivity analysis related to how demand for sugar adjusts to changes in the price of sugar. One of the main areas of change suggested in the underlying study is substitution of sugar for HFCS as sugar prices decline. This becomes a major issue when considering the "standard" proposal. For every penny that sugar prices decline, the cost to the federal government rises by $150-$170 million, so this is not a trivial question.

To test this sensitivity, the basic model's substitution between sugar and HFCS was sharply curtailed, to the point in which there was only one-tenth the adjustment as before. The results of this analysis are summarized in Table C1. Yellow columns indicate the results under

the low substitution assumption. Begin looking at these results by comparing the High Import Baseline to the High Import/Low Substitutability Baseline (columns 2 and 2b). Again, the same underlying assumptions regarding HFCS shipments to Mexico hold; however, in this case, there is only a limited shift by the soft drink industry in the United States back toward sugar from HFCS. Consequently, there is less demand for sugar than seen in the high import scenario. Following from that is a need for an even stronger PIK program to keep stocks from building, boosting the government cost by another $70 million per year.

Now change the policy to the "standard" program analyzed earlier (column 4b). With limited substitutability into HFCS markets, the price for sugar must fall even more to obtain a balance between supply and demand. Under the earlier analysis, the price falls to 16.9¢ from 18.7¢ in the high import scenario. Under the High Import/Low Substitution Baseline, the price declines from 18.7¢ to 16.2¢. This raises the cost of the program from $521 million to $691 million. However, offsetting some of these additional outlays are the higher costs of the PIK under continuation of current policies. This results in a net change in government outlays because of the policy alternative of $451 million—actually less than the outcome obtained under the low import alternative.

**Table C.1. Sensitivity Analysis** — U.S. Sugar and Sweetener Supply, Utilization, and Prices

| | 1 Low-Import Baseline | 2 High-Import Baseline | 2b High-Import, Low-Substit. Baseline | 3 Low-Import U.S. Policy Scenario | 4 High-Import U.S. Policy Scenario | 4b High-Import, Low-Subst. U.S. Policy Scenario | 2-1 High-Import Baseline - Low-Import Baseline | 2b-1 High Imp, Low Subst. Base- Low-Import Baseline | 3-1 Low-Import U.S. Policy - Low-Import Baseline | 4-2 High-Import U.S. Policy - High-Import Baseline | 4b-2b High Imp, Low Sub.. U.S. Pol - Hi Imp, Low Sub. Baseline | (2-1)/1*100 % Change, High vs. Low-Import Baseline | (2b-1)/1*100 % Change, High Imp. Lo-Sub. vs.Low-Imp. Baseline | (3-1)/1*100 % Change, U.S. Policy vs. Low-Imp. Baseline | (4-2)/2*100 % Change, U.S. Policy vs. High-Import Baseline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *(Thousand short tons, raw basis, fiscal year 2008-2015 average)* | | | | | | | | | |
| Sugar allotment | 8,564 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| Sugar production | 8,591 | 8,287 | 8,105 | 9,088 | 8,630 | 8,411 | -303 | -485 | 497 | 343 | 306 | -3.5% | -5.7% | 5.8% | 4.1% |
| Sugar imports | 1,847 | 2,984 | 2,978 | 1,767 | 2,919 | 2,887 | 1,137 | 1,132 | -80 | -64 | -91 | 61.6% | 61.3% | -4.3% | -2.1% |
| (of which, duty-free NAFTA) | 218 | 1,355 | 1,349 | 138 | 1,290 | 1,258 | 1,137 | 1,132 | -80 | -64 | -91 | 522.5% | 520.1% | -36.6% | -4.7% |
| Sugar domestic deliveries | 10,177 | 10,906 | 10,708 | 10,586 | 11,273 | 11,016 | 728 | 531 | 409 | 367 | 308 | 7.2% | 5.2% | 4.0% | 3.4% |
| Sugar exports | 213 | 216 | 217 | 217 | 220 | 221 | 3 | 3 | 4 | 3 | 5 | 1.6% | 1.6% | 1.9% | 1.6% |
| Sugar ending stocks | 2,050 | 2,709 | 2,751 | 2,085 | 2,148 | 2,173 | 658 | 701 | 35 | -560 | -578 | 32.1% | 34.2% | 1.7% | -20.7% |
| (of which, CCC stocks) | 87 | 1,066 | 1,081 | 0 | 0 | 0 | 979 | 994 | -87 | -1,066 | -1,081 | 1124.5% | 1142.2% | -100.0% | -100.0% |
| Sugar-containing product net imports | 563 | 541 | 540 | 537 | 518 | 510 | -22 | -23 | -26 | -23 | -30 | -3.9% | -4.0% | -4.6% | -4.2% |
| | | | | | | *(Thousand short tons, calendar year 2008-2015 average)* | | | | | | | | | |
| HFCS production | 9,183 | 8,990 | 9,288 | 8,932 | 8,766 | 9,232 | -193 | 104 | -251 | -224 | -56 | -2.1% | 1.1% | -2.7% | -2.5% |
| HFCS domestic use | 8,951 | 8,167 | 8,470 | 8,692 | 7,939 | 8,413 | -784 | -481 | -259 | -228 | -56 | -8.8% | -5.4% | -2.9% | -2.8% |
| HFCS net exports | 232 | 823 | 818 | 240 | 827 | 819 | 591 | 586 | 8 | 4 | 1 | 254.7% | 252.4% | 3.3% | 0.5% |
| | | | | | | *(Cents per pound, fiscal year 2008-2015 average)* | | | | | | | | | |
| N.Y. spot raw sugar | 20.60 | 18.73 | 18.69 | 18.42 | 16.86 | 16.17 | -1.87 | -1.90 | -2.17 | -1.87 | -2.52 | -9.1% | -9.2% | -10.5% | -10.0% |
| Refined beet sugar | 23.64 | 21.05 | 21.00 | 20.63 | 18.45 | 17.50 | -2.59 | -2.64 | -3.02 | -2.60 | -3.50 | -11.0% | -11.2% | -12.8% | -12.3% |
| Retail refined sugar | 44.02 | 41.09 | 41.05 | 40.55 | 37.99 | 37.04 | -2.93 | -2.97 | -3.47 | -3.10 | -4.01 | -6.7% | -6.8% | -7.9% | -7.5% |
| HFCS, 42%, Midwest (cal. yr.) | 12.04 | 11.38 | 12.40 | 11.20 | 10.66 | 12.22 | -0.65 | 0.36 | -0.84 | -0.72 | -0.18 | -5.4% | 3.0% | -7.0% | -6.3% |

**Table C.2. Sensitivity Analysis** — U.S. Sugar Beet Production, Prices, and Returns

| | 1 Low-Import Baseline | 2 High-Import Baseline | 2b High-Import, Low-Substit. Baseline | 3 Low-Import U.S. Policy Scenario | 4 High-Import U.S. Policy Scenario | 4b High-Import, Low-Subst. U.S. Policy Scenario | 2-1 High-Import Baseline - Low-Import Baseline | 2b-1 High Imp, Low Subst. Base- Low-Import Baseline | 3-1 Low-Import U.S. Policy - Low-Import Baseline | 4-2 High-Import U.S. Policy - High-Import Baseline | 4b-2b High Imp, Low Sub.. U.S. Pol - Hi Imp, Low Sub. Baseline | (2-1)/1*100 % Change, High vs. Low-Import Baseline | (2b-1)/1*100 % Change, High Imp. Lo-Sub. vs.Low-Imp. Baseline | (3-1)/1*100 % Change, U.S. Policy vs. Low-Imp. Baseline | (4-2)/2*100 % Change, U.S. Policy vs. High-Import Baseline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *(Thousand short tons, raw basis, fiscal year 2008-2015 average)* | | | | | | | | | |
| U.S. sugar beet production | 28,350 | 26,970 | 26,303 | 29,688 | 28,362 | 27,717 | -1,380 | -2,047 | 1,338 | 1,392 | 1,414 | -4.9% | -7.2% | 4.7% | 5.2% |
| California | 1,713 | 1,625 | 1,586 | 1,807 | 1,701 | 1,654 | -88 | -127 | 94 | 76 | 68 | -5.1% | -7.4% | 5.5% | 4.7% |
| Colorado | 689 | 646 | 625 | 702 | 659 | 631 | -43 | -64 | 13 | 13 | 6 | -6.3% | -9.3% | 1.9% | 2.1% |
| Idaho | 5,224 | 4,953 | 4,833 | 5,461 | 5,138 | 4,998 | -271 | -392 | 237 | 185 | 165 | -5.2% | -7.5% | 4.5% | 3.7% |
| Michigan | 3,134 | 2,965 | 2,881 | 3,086 | 2,918 | 2,803 | -169 | -253 | -47 | -47 | -77 | -5.4% | -8.1% | -1.5% | -1.6% |
| Minnesota | 9,209 | 8,802 | 8,597 | 9,739 | 9,427 | 9,290 | -406 | -611 | 531 | 624 | 692 | -4.4% | -6.6% | 5.8% | 7.1% |
| Montana | 1,202 | 1,141 | 1,111 | 1,271 | 1,216 | 1,192 | -62 | -92 | 69 | 75 | 81 | -5.1% | -7.6% | 5.7% | 6.6% |
| Nebraska | 781 | 736 | 716 | 809 | 738 | 696 | -44 | -65 | 29 | 2 | -20 | -5.7% | -8.3% | 3.7% | 0.3% |
| North Dakota | 5,202 | 4,970 | 4,854 | 5,633 | 5,444 | 5,360 | -232 | -348 | 431 | 474 | 505 | -4.5% | -6.7% | 8.3% | 9.5% |
| Ohio | 37 | 35 | 34 | 36 | 34 | 33 | -2 | -3 | -1 | -1 | -1 | -5.4% | -8.1% | -1.5% | -1.6% |
| Oregon | 342 | 326 | 319 | 332 | 316 | 309 | -16 | -23 | -10 | -11 | -10 | -4.6% | -6.7% | -3.0% | -3.2% |
| Washington | 146 | 139 | 136 | 141 | 134 | 131 | -7 | -10 | -4 | -5 | -4 | -4.7% | -6.9% | -3.0% | -3.3% |
| Wyoming | 672 | 632 | 612 | 669 | 637 | 621 | -40 | -60 | -2 | 5 | 9 | -6.0% | -9.0% | -0.4% | 0.8% |
| | | | | | | *(Cents per pound, fiscal year 2008-2015 average)* | | | | | | | | | |
| Refined beet sugar price | 23.64 | 21.05 | 21.00 | 20.63 | 18.45 | 17.50 | -2.59 | -2.64 | -3.02 | -2.60 | -3.50 | -11.0% | -11.2% | -12.8% | -12.3% |
| | | | | | | *(Dollars per ton, fiscal year 2008-2015 average)* | | | | | | | | | |
| Sugar beet price | 40.38 | 37.08 | 37.02 | 36.55 | 33.79 | 32.58 | -3.29 | -3.35 | -3.82 | -3.29 | -4.44 | -8.2% | -8.3% | -9.5% | -8.9% |
| | | | | | | *(Dollars per acre, fiscal year 2008-2015 average)* | | | | | | | | | |
| Gross market returns | 920.08 | 844.78 | 843.46 | 833.59 | 769.97 | 741.99 | -75.31 | -76.63 | -86.49 | -74.81 | -101.47 | -8.2% | -8.3% | -9.4% | -8.9% |

**Table c.3. Sensitivity Analysis**

**U.S. Sugarcane Production, Prices, and Returns**

| | 1 | 2 | 3 | 4 | 5 | 6 | 2-1 | 3-1 | 4-1 | 5-2 | 6-3 | (2-1)/1*100 | (3-1)/1*100 | (4-1)/1*100 | (5-2)/2*100 | (6-3)/3*100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low-Import Baseline | High-Import Baseline | High-Import, Low-Substit. Baseline | Low-Import U.S. Policy Scenario | High-Import U.S. Policy Scenario | High-Import, Low-Subst. U.S. Policy Scenario | High-Import Baseline - Low-Import Baseline | High Imp, Low Subst. Base- Low-Import Baseline | Low-Import U.S. Policy - Low-Import Baseline | High-Import U.S. Policy - High-Import Baseline | High Imp, Low Sub.. U.S. Pol - Hi Imp, Low Sub. Baseline | % Change, High vs. Low-Import Baseline | % Change, High Imp. Lo-Sub. vs.Low-Imp. Baseline | % Change, U.S. Policy vs. Low-Imporvs. Low-Import Baseline | % Change, U.S. Policy vs High-Import Baseline | % Change, U.S. Policy vs. High-Imp. Lo-Sub. Base |
| *(Thousand short tons, raw basis, fiscal year 2008-2015 average)* | | | | | | | | | | | | | | | | |
| U.S. sugarcane production | 31,279 | 30,673 | 30,105 | 33,471 | 31,566 | 30,674 | -606 | -1,174 | 2,192 | 893 | 569 | -1.9% | -3.8% | 7.0% | 2.9% | 1.9% |
| Florida | 15,095 | 14,977 | 14,683 | 16,107 | 15,069 | 14,577 | -118 | -412 | 1,012 | 92 | -106 | -0.8% | -2.7% | 6.7% | 0.6% | -0.7% |
| Hawaii | 1,779 | 1,085 | 1,072 | 973 | 361 | 108 | -693 | -706 | -806 | -724 | -965 | -39.0% | -39.7% | -45.3% | -66.7% | -89.9% |
| Louisiana | 12,893 | 13,093 | 12,858 | 14,660 | 14,454 | 14,328 | 200 | -34 | 1,767 | 1,362 | 1,470 | 1.6% | -0.3% | 13.7% | 10.4% | 11.4% |
| Texas | 1,512 | 1,518 | 1,491 | 1,731 | 1,682 | 1,660 | 6 | -21 | 219 | 164 | 169 | 0.4% | -1.4% | 14.5% | 10.8% | 11.4% |
| *(Cents per pound, fiscal year 2008-2015 average)* | | | | | | | | | | | | | | | | |
| N.Y. raw sugar price | 20.60 | 18.73 | 18.69 | 18.42 | 16.86 | 16.17 | -1.87 | -1.90 | -2.17 | -1.87 | -2.52 | -9.1% | -9.2% | -10.5% | -10.0% | -13.5% |
| *(Dollars per ton, fiscal year 2008-2015 average)* | | | | | | | | | | | | | | | | |
| Sugarcane price | 27.81 | 25.33 | 25.29 | 24.93 | 22.86 | 32.58 | -2.47 | -2.52 | -2.87 | -2.47 | 7.29 | -8.9% | -9.1% | -10.3% | -9.8% | 28.8% |
| *(Dollars per acre, fiscal year 2008-2015 average)* | | | | | | | | | | | | | | | | |
| Gross market returns | 1014.32 | 910.08 | 908.39 | 890.34 | 804.89 | 767.67 | -104.25 | -105.93 | -123.98 | -105.19 | -140.72 | -10.3% | -10.4% | -12.2% | -11.6% | -15.5% |
| Variable expenses | 748.45 | 748.45 | 748.45 | 748.45 | 748.45 | 748.45 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Net market return | 265.87 | 161.63 | 159.94 | 141.89 | 56.44 | 19.22 | -104.25 | -105.93 | -123.98 | -105.19 | -140.72 | -39.2% | -39.8% | -46.6% | -65.1% | -88.0% |
| Loan deficiency payment | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | n.a. | n.a. | n.a. | n.a. | n.a. |
| Counter-cyclical payment | 0.00 | 0.00 | 0.00 | 0.00 | 16.73 | 61.86 | 0.00 | 0.00 | 0.00 | 16.73 | 61.86 | n.a. | n.a. | n.a. | n.a. | n.a. |
| Direct payment | 0.00 | 0.00 | 0.00 | 217.57 | 217.57 | 217.57 | 0.00 | 0.00 | 217.57 | 217.57 | 217.57 | n.a. | n.a. | n.a. | n.a. | n.a. |

**Table c.4. Sensitivity Analysis**

**U.S. Corn Use and Prices**

| | 1 | 2 | 2b | 3 | 4 | 4b | 2-1 | 2b-1 | 3-1 | 4-2 | 4b-2b | (2-1)/1*100 | (2b-1)/1*100 | (3-1)/1*100 | (4-2)/2*100 | (4b-2b)/3*100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low-Import Baseline | High-Import Baseline | High-Import, Low-Substit. Baseline | Low-Import U.S. Policy Scenario | High-Import U.S. Policy Scenario | High-Import, Low-Subst. U.S. Policy Scenario | High-Import Baseline - Low-Import Baseline | High Imp, Low Subst. Base- Low-Import Baseline | Low-Import U.S. Policy - Low-Import Baseline | High-Import U.S. Policy - High-Import Baseline | High Imp, Low Sub.. U.S. Pol - Hi Imp, Low Sub. Baseline | % Change, High vs. Low-Import Baseline | % Change, High Imp. Lo-Sub. vs.Low-Imp. Baseline | % Change, U.S. Policy vs. Low-Imporvs. Low-Import Baseline | % Change, U.S. Policy vs High-Import Baseline | % Change, U.S. Policy vs. High-Imp. Lo-Sub. Base |
| *(Million bushels, crop year 2007/08-2014/15 average)* | | | | | | | | | | | | | | | | |
| Corn for HFCS production | 539 | 528 | 546 | 525 | 515 | 542 | -11 | 6 | -15 | -13 | -3 | -2.1% | 1.1% | -2.7% | -2.5% | -0.6% |
| *(Dollars per bushel, crop year 2007/08-2014/15 average)* | | | | | | | | | | | | | | | | |
| U.S. corn farm price | 2.329 | 2.326 | 2.329 | 2.325 | 2.323 | 2.328 | -0.003 | 0.001 | -0.003 | -0.003 | -0.001 | -0.1% | 0.0% | -0.1% | -0.1% | -0.1% |

**Table c.5. Sensitivity Analysis**

**U.S. Government Program Costs**

| | 1 | 2 | 2b | 3 | 4 | 4b | 2-1 | 2b-1 | 3-1 | 4-2 | 4b-2b | (2-1)/1*100 | (2b-1)/1*100 | (3-1)/1*100 | (4-2)/2*100 | (4b-2b)/3*100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Low-Import Baseline | High-Import Baseline | High-Import, Low-Substit. Baseline | Low-Import U.S. Policy Scenario | High-Import U.S. Policy Scenario | High-Import, Low-Subst. U.S. Policy Scenario | High-Import Baseline - Low-Import Baseline | High Imp, Low Subst. Base- Low-Import Baseline | Low-Import U.S. Policy - Low-Import Baseline | High-Import U.S. Policy - High-Import Baseline | High Imp, Low Sub.. U.S. Pol - Hi Imp, Low Sub. Baseline | % Change, High vs. Low-Import Baseline | % Change, High Imp. Lo-Sub. vs.Low-Imp. Baseline | % Change, U.S. Policy vs. Low-Imporvs. Low-Import Baseline | % Change, U.S. Policy vs High-Import Baseline | % Change, U.S. Policy vs. High-Imp. Lo-Sub. Base |
| *(Million dollars, fiscal year 2008-2015 average)* | | | | | | | | | | | | | | | | |
| Sugar direct payments | 0 | 0 | 0 | 463 | 463 | 463 | 0 | 0 | 463 | 463 | 463 | n.a. | n.a. | n.a. | n.a. | n.a. |
| Sugar counter-cyclical payments | 0 | 0 | 0 | 0 | 36 | 132 | 0 | 0 | 0 | 36 | 132 | n.a. | n.a. | n.a. | n.a. | n.a. |
| Sugar loan deficiency payments | 0 | 0 | 0 | 0 | 23 | 96 | 0 | 0 | 0 | 23 | 96 | n.a. | n.a. | n.a. | n.a. | n.a. |
| Sub-total | 0 | 0 | 0 | 463 | 521 | 691 | 0 | 0 | 463 | 521 | 691 | n.a. | n.a. | n.a. | n.a. | n.a. |
| Other sugar costs (loans, etc.) | 8 | 175 | 245 | -1 | -1 | -1 | 167 | 237 | -9 | -176 | -246 | 2192.1% | 3110.3% | -117.7% | -100.7% | -100.5% |
| Sugar total costs | 8 | 175 | 245 | 462 | 520 | 690 | 167 | 237 | 454 | 345 | 445 | 2192.1% | 3110.3% | 5951.4% | 197.3% | 181.6% |
| Corn counter-cyclical payments | 221 | 233 | 218 | 238 | 250 | 225 | 12 | -3 | 16 | 16 | 6 | 5.5% | -1.4% | 7.4% | 7.0% | 2.9% |