

# Commentary on “The Impact of the U.S. Sugar Program” (November 2011 report for Sweetener Users Association)<sup>1</sup>

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## Executive Summary

The Sweetener Users Association (SUA) commissioned an analysis in November 2011 to explore potential consequences of an elimination of the U.S. sugar program. This commentary serves to highlight some major concerns with the analysis, and consequently with the results, interpretations and conclusions emerging from the analysis.

1. The SUA Analysis is seemingly complex, yet makes simple and unrealistic assumptions regarding key drivers of the sugar and Sugar-Containing Product (SCP) markets. Among these, it assumes that any reduction in material cost in manufacturing SCPs is completely passed through to consumers. No evidence supports this, and thus the claim that the elimination of the U.S. sugar program will result in billions of dollars being passed through to consumers is grossly overstated.
2. The SUA Analysis assumes that exports will surge if the U.S. sugar program is removed, completely overlooking the USDA’s existing Sugar Containing Products Re-Export Program, which allows exporters to purchase sugar at the world market price. The SUA Analysis also incorrectly concludes that a reduction in U.S. sugar prices will almost eliminate imports of some SCPs. As a result, the analysis erroneously concludes that production volumes of SCPs will soar and that thousands of jobs will be created. These conclusions are based on inaccurate modeling assumptions.
3. The SUA Analysis yields point forecasts, with no discussion of margins of error, despite likely large (unreported) estimation errors for the dozens of parameters and relationships the model is built around. No test of the model is provided to gauge its accuracy. Model projections for 2012 world and U.S. sugar prices are already far from reality. The analysis ignores ranges of possible scenarios, as well as the volatility of sugar markets that significantly affects business decisions.
4. The SUA Analysis assumes the sugar market would move seamlessly from the current equilibrium to a new equilibrium without the U.S. sugar program. The model overlooks the impact of frictions that can cause stickiness in some cases, and discontinuities in others, leading to potentially very different findings, including a far greater incidence of business failures in the sugar industry.
5. The SUA Analysis anchors its projections on the recent anomalous period in the sugar market, where sugar prices have been at 30-year highs, and processing margins have temporarily spiked. As a result, the differentials between the baseline (current policy) and scenario (no U.S. sugar program) cases are overstated, and magnify purported gains from eliminating the U.S. sugar program.

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<sup>1</sup> This commentary was prepared in September 2012 for the American Sugar Alliance. Professor Triantis served as the Chair of University of Maryland’s Finance Department from 2006-2011. His research has been featured in *Business Week*, *CFO* magazine, *Financial Times*, *New York Times*, and the *Wall Street Journal*. He has consulted on a variety of issues to Fortune 500 companies, as well as to government and multinational organizations.

## **Overview of SUA Analysis**

In November 2011, a report was released entitled “The Impact of the U.S. Sugar Program.” This report, authored by Drs. Beghin and Elobeid from Iowa State University, outlines an analysis prepared for the Sweetener Users Association (hereafter referred to as the SUA Analysis), and presents results obtained from this analysis. The report includes a description of the “Major Modifications to the FAPRI Sugar Models for the SUA Analysis” (section 4.3, beginning on page 12).

While the model integrates a large set of relationships on the supply and demand sides of the sugar market, the model’s apparent complexity belies the simplicity in which some fundamental components are treated, potentially obfuscating the true drivers of the key results, and providing a false sense of confidence in the predictions of the model. This commentary serves to highlight some major concerns with the analysis, and consequently with the results, interpretations and conclusions emerging from the analysis.

## **The Nature of the Model and of Its Predictions**

While models that interrelate various components of an economy are of theoretical interest, one must be very cautious in inferring that complexity translates into a high level of confidence in predictions emerging from such models. The SUA Analysis suffers from many weaknesses, which are grouped together below into five key issues. Each is explained in greater detail in a separate section below.

1. The SUA Analysis is based on a partial-equilibrium model. In simple terms, this means that many aspects of the economy are not modeled explicitly, and simplifying assumptions are instead used to represent those omitted parts of the economic system. Of particular concern is the use of overly simplistic assumptions related to the management of businesses in the sugar containing products (SCP) industries and in sugar growing and production. For instance, the SUA Analysis assumes that any reduction in material cost is completely passed through to consumers as a price decrease, that imports of some SCPs will greatly subsidize based on a lower cost of U.S. sugar regardless of other critical variables, and that employment is directly related to production volume.
2. The analysis uses standard modeling equations for food exports, ignoring that USDA’s existing Sugar-Containing Products Re-Export Program allows U.S. food manufacturing companies to buy sugar at the world price from refiner participants for use in products that will be exported back into the world market. The SUA Analysis erroneously projects there would be a huge increase in exports if the U.S. sugar program were eliminated. Since sugar can already be purchased at the world market price, there should be no measurable change to SCP exports.
3. The SUA Analysis employs a model that is deterministic, yielding point forecasts of various measures (e.g., prices, production, exports, imports, and jobs) for each

of the next ten years. No information is provided regarding confidence intervals for the results. With a large number of input parameters in the model, each of which may be subject to significant estimation error, the overall model results are likely to have low accuracy. Furthermore, the model has not been validated through back testing, and there are already indications that it may lack predictive power. Moreover, the model in general does not capture volatility of prices and quantities such as demand and supply, all of which can have an important effect on business decisions regarding production and employment.

4. The SUA Analysis assumes the sugar market would move seamlessly from the current equilibrium to a new equilibrium without the U.S. sugar program. The model overlooks the impact of frictions that can cause stickiness in some cases, and discontinuities in others, leading to potentially very different findings, including a far greater incidence of business failures in the sugar industry.
5. The SUA Analysis anchors its projections on the recent anomalous period in the sugar market, where sugar prices have been at 30-year highs, and processing margins have temporarily spiked. As a result, the differentials between the baseline (current policy) and scenario (no U.S. sugar program) cases are overstated, and magnify purported gains from eliminating the U.S. sugar program.

### **Critical Oversimplifications in the SUA Analysis**

The partial-equilibrium model that forms the basis of the SUA Analysis imposes questionable simplifications rather than trying to explicitly model particular aspects of the economy. In general, it is understandable why simplifications need to be made in models in order to make the analysis more tractable. However, it is important to be aware of what key elements are ignored or simplified so that one can understand whether these simplifying assumptions may be instrumental in driving particular results. As the Wikipedia entry on partial equilibria notes: “The stringency of the simplifying assumptions inherent in this approach make the model considerably more tractable, but may produce results which, while seemingly precise, do not effectively model real world economic phenomena.” Thus, despite the various components modeled in the SUA Analysis, which may make it appear “seemingly precise”, there are several critical missing or mis-specified components.

- Most importantly, the SUA Analysis does not attempt to carefully model the behavior of SCP companies, which are central to the economic system being considered. One of the simplistic assumptions imposed is that, by assuming a constant profit margin, SCP companies pass on their entire cost savings to customers. By the authors’ own admission, “this approach abstracts from explicitly modeling the food wholesale and retail pricing behavior.” In other words, it is not only a matter of missing how SCP companies price their products, but also understanding the impact of retail sector (e.g., supermarket) pricing behavior. There is no attempt to reconcile the pass-through

assumption with historical retail pricing data that does not support such pricing behavior.

Interestingly, similar claims of passing through lower costs to consumers were also made in discussions surrounding the 2006 EU sugar policy reform. In reviewing the consequences of the policy reform in Europe, Chatenay (2012) cites a European Court of Auditors' report that concludes that most of the cost savings due to price reductions in sugar were added to the profit margins of industrial producers rather than being passed on to the consumer. If the potential gains from lower production costs go to the SCP companies rather than to consumers, the indirect effect of lower prices leading to higher demand will not materialize, and thus neither will the consequential effect of additional jobs being created in the SCP industry, as assumed in the SUA Analysis.

- U.S. SCP food manufacturers and retailers also decide which products to manufacture in the U.S. versus importing from abroad. These decisions are made considering a large number of factors, including labor costs, taxes, various types of regulation, and numerous operational and supply chain issues. Various tradeoffs are made not only on the basis of relative cost advantages, but also in terms of differential risks. As a result, it is hard to fathom that some U.S. SCP food manufacturing sectors would reduce their imports by almost 90% within two years of an elimination of the U.S. sugar program. The fact that the SUA Analysis arrives at this conclusion points to their model making overly simplified assumptions that would drive such results.
- The SUA Analysis also assumes that employment grows and contracts with the scale of production (which in turn is driven by prices). This assumption is again made for simplicity, but without any evidence to support it, despite this being a critical assumption behind the employment results. Companies often cut employment despite increases in production. While production and revenue growth can help to support jobs, if higher competition or cost increases lead to compressed profit margins, or if economic and industry uncertainty is high, employment increases may not materialize.
- The lack of any business modeling also extends to the sugar industry. The authors assume that incentives are given by processors to farmers to increase acreage planted despite declining margins. The authors recognize that this is “somewhat contrived” (page 11) as beet farming and processing are vertically integrated in cooperatives (and this is also frequently true for sugar cane processing as well). The model also doesn't properly capture capacity limitations in the refining industry, and the decision making process involved in planning capacity expansions, which includes a consideration of input and output price volatility, as will be discussed below.

## **Re-Export Program Ignored in SUA Analysis**

The SUA Analysis uses standard equations to model exports of SCPs, presumably consistent with how other exports are typically modeled. This completely ignores the USDA's Sugar-Containing Products Re-Export Program. This program allows U.S. food manufacturing companies to buy sugar at the world price from any of the refiner participants or their agents for use in products that will be exported back into the world market. The purpose of this program, as articulated by the USDA, is to allow U.S. SCP manufacturers to compete on a level playing field in the world marketplace. Thus, export volumes should not be related to the domestic sugar price, and should not change as a result of elimination of the U.S. sugar program.

The SUA Analysis instead finds that removal of the U.S. sugar program would increase the dollar volume of some SCP exports by over 25%. There is no mention of the SCP Re-Export program in the report, and no attempt to incorporate this important feature of the export market in the SUA Analysis. This vital omission drives in large part the overall results of the SUA Analysis. Much higher SCP production volumes are obtained due to the assumption of increased exports, and so is the overall increase in employment.

## **SUA Analysis Uses a Deterministic Model to Capture a Volatile Market**

The SUA Analysis employs a model that is deterministic. The purpose of the model is to provide single point forecasts of various measures (e.g., prices, production, exports, imports, and jobs) for each of the next ten years. This type of analysis is designed to present a single average, or most likely, path of how the world may evolve. There are three key concerns with this type of analysis.

The first concern is that anyone using these results to make a decision – whether for policy decisions at the government level, or for management decisions at a business level – would want to know what confidence intervals surround these forecasts. A prediction that production in the baseline case will increase by 5% and in the scenario case will increase by 10% will be compelling if each of these predictions have a +/- 1% margin of error (e.g., 95% of the time). But, if the margins of error are +/- 10%, the point estimates would be largely uninformative, the production rates in the two cases would not be considered reliably different, and one certainly would not have confidence in basing a major decision on this evidence.

The SUA Analysis provides no information regarding confidence intervals for the results. Nor does it even provide information on confidence intervals for the estimation of dozens (likely more than one hundred) parameters that are needed to generate the forecasts in the model. For instance, there are numerous elasticity parameters that are inputs into the model. These determine, for example, how price changes translate into demand changes in the model. The authors choose a particular set of elasticity estimates without reporting the standard error of each of these estimates, i.e., what level of confidence one should have that the selected input parameter is accurate. If relatively little data is available to

estimate the elasticity parameter, and if the posited relationship that is being estimated is inaccurate (e.g., it should not be linear, or it should be based on other key factors), then estimated parameters are likely to have large standard errors (i.e., low accuracy).

A recent paper by Dr. Beghin (one of the two principal investigators of the SUA Analysis) and two co-authors (Miao, Beghin, and Jensen, “Taxing Sweets: Sweetener Input Tax or Final Consumption Tax?”, 2010) indicates that the standard deviations of “own-price elasticities” (which are also used in the SUA Analysis) are in fact quite high, particularly so for sweetener products. (It should also be noted that the SUA Analysis uses a different own-price elasticity for sweeteners than in Miao, Beghin and Jensen (2010).) With a large number of input parameters in the model, each of which may be subject to significant estimation error, it is unlikely that the overall model results would be accurate, raising questions about the robustness of the model.

It should also be noted that the model used for the SUA Analysis has not been validated for accuracy through some form of back testing. One way in which such validation is conducted in practice is to estimate parameters of the model using one subset of historical data, and then to apply the model to see how well it would have predicted the remaining years of historical data. Such validation provides greater confidence that the model is capable of fitting the data properly. As discussed later in this commentary, there is already indication that the model may not have strong predictive ability even one year into the future.

A second key concern with using a deterministic model is that it does not capture the potentially important effects of volatility on the action of various agents in the model. More volatile input and output prices discourage investment, and increase a business’s cost of capital. Yet, volatility is not captured in the SUA Analysis. This masks an important factor that needs to be considered regarding the elimination of the U.S. sugar program. The world sugar market exposes growers, processors and SCP companies to significantly higher volatility. The resulting downward pressure on production, employment and value creation for businesses are missing from the SUA model, and would have important offsetting effects to the potential benefits claimed from elimination of the U.S. sugar program. Chatenay (2012) identifies higher price and supply volatility as important negative consequences of the change in EU sugar policy in 2006.

The third important concern with the deterministic nature of the SUA Analysis is more subtle than the previous two. By focusing on point forecasts, the decisions made by businesses – such as production volumes or employment – may differ significantly from the average decisions or quantities based on a broader set of possible outcomes. The production quantity in three years based on an expected forecast of the price in three years may end up being quite different than the average production quantity in three years based on a distribution of possible price outcomes at that time.

Consider the following simple example to illustrate this point. Imagine that a company is expecting the profit margin on its product in five years to be on average the same as it is today. As a result, it expects to produce the same volume of the product in five years as it

does today, which let's say is 80 units. However, consider that the average margin actually reflects a 50% chance of the margin going to zero and a 50% chance of the margin doubling. In the former case, a zero margin may result in the company being driven to bankruptcy, and thus output quantity would be zero. In the latter case, the company may be able to increase its output somewhat to take advantage of the much higher margin, but it will likely not double its output, particularly since it may face capacity constraints. Let's assume it increases its production quantity to 100 units. As a result, the average quantity produced across these two margin scenarios will be 50 (i.e., 50% times zero plus 50% times 100). This is much lower than the quantity that would be produced assuming the average price (80 units). This type of non-linearity (convexity) is common in practice and can have a significant effect on measuring future predicted values. Unfortunately, it cannot be captured in the SUA Analysis given the simpler deterministic approach in that model.

Uncertainties surround each component of the SUA Analysis, yet are not captured by the model. Shocks to even one variable can have a profound effect on the overall system. A recent example is the effect of the sharp appreciation of the Brazilian real. This exchange rate shock has significantly increased the cost of production of the world's largest sugar producer. This has resulted in a large upward pressure on sugar prices throughout the world. These types of shocks can have profound disruptive effects on the entire sugar market - on prices, production, trade and employment - and yet are missed by focusing on a deterministic model.

### **SUA Analysis Based on a Frictionless World**

Another important oversimplification embedded in the SUA Analysis is that the U.S. and world sugar markets would move relatively seamlessly from the current equilibrium to a new equilibrium with the existing U.S. sugar program removed. Supply and demand curves will shift and prices and quantities will ride down these curves to the new equilibrium. However, in reality, there are many significant transaction costs that can create stickiness or discontinuities in decisions and market behavior.

As mentioned earlier, small changes in material costs are unlikely to be passed through directly to consumers through lower prices. The term "menu costs" is used in economics, based on the idea that for a restaurant, for example, changing prices would require bearing costs associated with reprinting a menu. This is used as a metaphor for the many significant costs involved with deciding on pricing changes and implementing those changes. The stickiness due to menu costs and other frictions helps to explain why lower production costs often translate into higher profit for a company rather than lower prices for consumers.

In other cases, frictions can lead to discontinuities that are not captured in the model. For instance, the SUA Analysis predicts that after elimination of the U.S. sugar program, sugarcane producers will sustain losses for consecutive years. As will be discussed below, this is under an optimistic assumption that world sugar prices will remain at high

levels. In fact, sugar producers' losses would be much higher based on long-term average prices. Given the frictions that exist in financial markets, sustained losses would likely lead to a sharp increase in the cost of capital (e.g., loan interest rates) or the inability to access credit. Thus, these short-term losses would likely lead to a large number of business failures. Jobs will be lost as plant closures and bankruptcies occur. Furthermore, plants won't easily re-open and jobs won't readily re-emerge even when output prices increase once again – another result of stickiness in markets. These business realities are in sharp contrast to results from the SUA Analysis that indicate that despite sustaining losses, production will decrease only moderately. The lessons learned from the recent policy regime shift in Europe, as detailed in Chatenay (2012), indicate that massive shutdowns and layoffs in the sugar industry are likely with an abrupt change in sugar policy.

### **SUA Analysis Anchored on an Anomalous Starting Point**

It appears from the description of the SUA model that many of the input parameters are estimated using recent data through 2011, though some parameters are based on the latest available data, which may have been less recent, such as 2007 for the variable cost of production. It is important to note that the period since 2009 has been quite anomalous when compared to the behavior of sugar markets over the past two decades. Using this anomalous period as a starting point for the SUA Analysis may lead to projections that will deviate significantly from what will be observed in the future.

The market is in fact already heading in a direction that diverges considerably from the model's predictions. For 2012, the SUA Analysis predicts that the World Sugar Price (ICE contract #11) would be 21.78, while the N.Y. spot raw sugar price (ICE contract #14) would be 38.86, indicating a spread of a little more than 17 cents (all figures are cents per pound). The most recent figures reported online at the USDA's Sugar and Sweeteners Yearbook Tables (for July 2012) are 22.76 (world) and 28.68 (U.S.), for a spread of a little less than 6 cents. By using trends and levels that rely heavily on the recent anomalous period in the sugar market, the SUA Analysis provides inaccurate predictions even for the first year of its projections.

Consider also the processing margins for beet and cane sugar. The baseline projection for beet processing margins is that they will be 33-35 cents per pound for the next ten years (page 47), and the cane processing margins will be 14-15 cents per pound. These appear to be heavily based on recent margins of 33 cents and 14 cents (respectively) during the 2009/10 marketing year. However, margins in the first two years shown (2006/07 and 2007/08) were 10 and 15 cents for beet processing, and 3 and 7 cents for cane processing, less than half the projected margins. The processing margins are assumed to drop by 20 cents (beet) and 9 cents (cane) for the scenario case where the U.S. sugar program is removed. These margin drops would result in negative margins for processors if applied to the more normal processing margins at the beginning of the study period rather than the most recent margins. In other words, the differentials between the baseline and scenario cases are being overstated in such a way as to magnify purported gains from

eliminating the U.S. sugar program. This again results from anchoring the analysis on an anomalous period in the sugar market.

### **Concluding Remarks**

While the SUA Analysis integrates a large set of relationships on the supply and demand sides of the sugar market, the model's apparent complexity belies the simplicity in which some fundamental components of sugar markets are treated. It is based on a large number of simplifications and parameters that are estimated with unknown accuracy. It is hard to gauge the model's ability to predict changes when it has not been adequately back tested, not to mention that the analysis is trying to predict effects from a regime switch that is not even represented in past data. All the various concerns with the SUA Analysis raised above call into question the ability of such a model to predict what would happen if the U.S. sugar program were eliminated. The results, interpretations and conclusions emerging from the SUA Analysis should therefore not be relied upon in making important decisions regarding the future of U.S. sugar policy.

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