Impact of Expanded United States Sugar Imports from CAFTA Countries on the Ethanol Market

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Abstract

The need to decrease the United States' dependency on oil has pushed ethanol to the forefront of energy sources. In the U.S., corn is used to make ethanol. Corn-based ethanol production has been profitable over the past few years, but there has been a near doubling of corn prices in late 2006 and early 2007 (Outlaw, et. al., 2007). The trend is a constant rise in prices, which has given way to ethanol production by other sources of raw materials like sugarcane. Sugarcane ethanol is the most cost-efficient biofuel available anywhere in the world, and in the United States, the government supports sugar prices. Through the US sugar policy, sugar prices are controlled, and foreign imports are severely limited. Brazil is leading the way in sugarcane ethanol, and its neighbors in Central America are following suit. In 2006, the Central American Free Trade Agreement (CAFTA) was established. The agreement allows sugar imports into the U.S. from these countries duty free. Those countries have extreme ethanol growth potential with low production costs and large sources of sugarcane. This paper uses GIS and statistical tools to determine the impact of the expanded U.S. sugar imports from CAFTA-DR countries on the U.S. ethanol market in terms of production and regional concentration. To estimate the relationship between ethanol production and sugar imports, an OLS regression model has been developed with monthly U.S. ethanol production as a function of imported sugarcane, gas, ethanol , and corn prices; covering January 2000 to September 2008.

Keywords: Ethanol, Sugarcane, Sugar, CAFTA-DR, Alternative Fuels, Biofuels

I. Background

At the dawn of the automobile age, Henry Ford predicted that "ethyl alcohol is the fuel of the future" (Rohter, 2006). He couldn't have been more accurate. The past few years have spawned more than just an interest into ethanol fuel. The need to decrease the United States' dependency on oil has pushed ethanol to the forefront of energy sources.

During the 2006 State of the Union Address, President Bush announced his goal for replacing "more than 75% of our oil imports from the Middle East by 2025". According to the Department of Energy, meeting that goal will require 60 billion gallons of biofuel a year. A year later, the President accelerated the timetable and called for "20 in 10" (EFC-UNF, 2007). He stated,

> ***"Tonight, I ask Congress to join me in pursuing a great goal. Let us build on the work we've done and reduce gasoline usage in the United States by 20% in the next 10 years…. To reach this goal, we must increase the supply of alternative fuels, by setting a mandatory fuels standard to require 35 billion gallons of renewable and alternative fuels in 2017."*** **(President George Bush, 2007)**

Ethanol accounts for about 14% of corn use and about 3.5% of overall gasoline usage in the 2005/2006 harvest year (OCE–USDA, 2007). Corn-based ethanol production has been very profitable over the past few years, but the near doubling of corn prices in late 2006 and early 2007 has significantly reduced ethanol plant profitability (Outlaw, et. al., 2007). Other sources for ethanol production are becoming more viable, and cost-efficient.

In the United States, corn is used to make ethanol, but it is not the most efficient resource. Sugarcane ethanol is the most cost-efficient biofuel available anywhere in the world. For every unit of fossil fuel used in its production, nine units of renewable energy are generated with a reduction of about 90% in greenhouse gas emissions when compared with gasoline (Reuters, 2008).

Brazil's ethanol yields nearly eight times as much energy as corn-based options, according to scientific data (Rohter, 2006). They are the world's second largest producer of ethanol, and the most cost-efficient due to sugar, a resource that's abundant in their region.

The ethanol industry in Central America and the Caribbean has extreme growth potential as well. The region has low production costs, and large sources of sugar cane (especially in Guatemala, one of the world's largest sugar producers). The geographical proximity to the United States and the tariff-free access to the U.S. market under CAFTA are important factors in the industry's growth (Alexander & Torres, 2006).

The next few years will be vital to the stability of the ethanol market. With these changes in ethanol, there is a natural effect on the sugar industry. For the United States, it means increased competition for production, especially with the free trade agreements in that area; and for Latin America, it means increased export potential, not only to the U.S., but to other market areas as well. The U.S. sugar industry's impact on the ethanol market from CAFTA-DR and Mexican imports is the focus of this paper.

U.S. Sugar

Sugarcane, a perennial tropical crop, is processed into raw sugar, molasses, and ethanol. It can be harvested 4 to 5 times before reseeding. In the United States, the government has supported sugar prices for more than 200 years. Through the US sugar policy, domestic sugar

prices are controlled by the government, and foreign imports are severely limited; all to ensure that prices would be kept high and quotas kept low.

In 1789, the federal government imposed an import tariff to raise revenue; the Sugar Act of 1934 regulated domestic sugar production, imports, and prices; and the federal government agreed to purchase raw cane sugar and refined beet sugar for a specific price per pound if commercial prices were not high enough in the Agriculture and Food Act of 1981 (EAI, 2007). All of these subsequent acts helped shape the U.S. policy today, which has replaced the quota system with a tariff-rate quota (TRQ) system and a non-recourse loan program.

Under a TRQ, a certain amount of import access is provided at a lower, preferential tariff rate (in-quota tariff). For imports outside the TRQ, the (over-quota) tariff rate is much higher, 16¢ a pound-tariff on all over-quota shipments (Haley & Ali, 2007). The 2002 Farm Bill gave the Secretary of Agriculture the power to operate the sugar program at no net cost to the US Treasury by avoiding sugar loan forfeitures in the non-recourse loan program (ASA 2005). This program allowed sugar producers to use their sugar as collateral for a loan from the government at the price-support loan rate. Loans can be taken for up to 9 months, so processors can then pay growers for their sugar, typically about 60% of the loan. The program permits processors to store the sugar rather than sell it for lower-than-desired prices; and when the sugar is sold, the loan is repaid (Haley, 1998).

The most recent Farm Bill, the *Food, Conservation, and Energy Act of 2008* has made some very serious additions to the former bills in regards to sugar. For the first time in over 20 years, the bill has raised the loan rate for sugar by a ¼ of a cent per year for three years. This takes the rate to 18.75 cents for cane sugar and 24 cents for beet sugar. The sugar industry is guaranteed a minimum of 85% of domestic market share. The 2008 Farm Bill also established a sugar-to-ethanol program which will provide sugar to biofuel producers at competitive prices

(HCA, 2008). Its only drawback is that it's allowed only during times of excess sugar supply. The program mandates the Secretary of Agriculture to pull enough sugar off the market to keep the price of sugar above the loan rate and the U.S. sugar program, as a whole, balanced (Ebert, 2007).

U.S. & Ethanol

In 2005, the United States produced almost 4 billion gallons of ethanol, and in 2006, almost 5 billion gallons. While this was a significant increase, further expansion in the industry is continuing with production expected to exceed 10 billion gallons by 2009. Even with less than full capacity utilization in the industry, ethanol production will grow to more than 12 billion gallons by 2015 in USDA's 2007 long-term projections, well above the renewable fuels standard mandated by the Energy Policy Act (Westcott, 2007).

The United States consumes about 140 billion gallons of gasoline a year. That's equivalent to 200 billion gallons of ethanol because of ethanol's lower energy content. Replacing 25% of current U.S. gasoline use would require about 50 billion gallons of ethanol per year. It is clear that enough cellulosic biomass is available on an annual basis to produce that much fuel and much more in the future (EFC-UNF, 2007).

Ethanol Producer magazine reported that in early 2007, there were 118 ethanol plants operating in the United States with 60 additional plants under construction (Outlaw, et. al., 2007). Of those 118, only one uses sugarcane, located in Louisiana.

The demand for ethanol in the United States has been increasing due to high prices of petroleum-based fuels and reduced use of methyl tertiary butyl ether (MTBE), an oxygenating gasoline additive (Haley & Ali, 2007). This increase in ethanol demand has increased corn

prices, so much so, that it has generated interest in using U.S. sugar crops as feedstock for producing the fuel.

CAFTA-DR & Ethanol

The United States and five Central American countries, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua, began negotiations for a trade agreement, CAFTA, on January 27, 2003. Negotiations to fully integrate the Dominican Republic into CAFTA, forming CAFTA-DR, were concluded on March 15, 2004. All seven countries signed the trade agreement August, 2004. The role of CAFTA-DR is to reduce high tariff rates to levels that will allow a freer flow of goods and services with the U. S., as well as, to lock in the lower applied rates for many products to ensure permanent US access to the market (Paggi, et al. 2005). Market access is the key to this agricultural agreement.

CAFTA-DR has created an immediate expansion of sugar imports into the U.S. from CAFTA-DR countries in addition to the access they were already receiving. The United States has an opportunity to boost new industries in these nations by emphasizing the importance of involving Central American and Caribbean countries in the ethanol equation. Jamaica, which was the first nation to sign a bilateral agreement with Venezuela under the PetroCaribe Pact, is also Brazil's leading choice as an intermediate destination for the refinement of ethanol destined for the United States (Cohen, 2007).

The ethanol industry in Central America and the Caribbean has extreme growth potential with low production costs and important sources of sugar cane (especially in Guatemala, one of the world's largest sugar producers). The geographical proximity of these countries to the U.S. and the tariff-free access to the U.S. market of up to 7% of U.S. ethanol production under CAFTA are also important factors in the industry's growth (Alexander & Torres, 2006). The

Renewable Fuels Association reported that under the Caribbean Basin Initiative, Jamaica, Costa Rica and El Salvador are the second, third, and fourth largest exporters of ethanol to the U.S., respectively.

II. Econometric Model

In this paper, we estimate the supply of domestic ethanol as a function of gasoline prices, ethanol prices, imported sugarcane prices, and corn prices as in the model below:

$$(1)\ Q_E = f(G_P, E_P, SC_P, C_P)$$

where all variables are real and expressed in natural logs. For the estimation of this model, the log form is often preferred because it's easier to interpret the coefficients as elasticities.

Q_E → Ethanol Production Volume

G_P → Gasoline Prices

E_P → Ethanol Prices

SC_P → Sugarcane Prices

C_P → Corn Prices

III. Data and Estimation Procedures

The multiple regression model is applied to U.S. monthly data of prices from January 2000 to September 2008. The dependent variable, the quantity of ethanol produced and was regressed on domestic gasoline prices in gallons, G_P, domestic ethanol prices in gallons, E_P, imported sugarcane prices from CAFTA-DR countries in USD per kilogram, SC_P, and domestic corn prices in USD per bushel, C_P using SPSS version 16 software.

Data on ethanol production and gasoline prices were collected from the United States' Department of Energy's (DOE) Energy Information Association (EIA) at (http://www.eia.doe.gov). The data on domestic ethanol prices were obtained from the United States Department of Energy's Energy Efficiency and Renewable Energy at (http://www.eia.gov). Data on imported sugarcane prices were retrieved from the United States International Trade Commission's Interactive Tariff and Trade Data Web at (http//dataweb.usitc.gov). The data on domestic corn prices were collected from the United States Department of Agriculture's (USDA) National Agricultural Statistical Service (NASS) at (http://www.nass.usda.gov).

The descriptive statistics of the variables are provided in Table 1. The average ethanol production is 1,181,988 gallons. The gasoline and ethanol prices can be as low $1.09 per gallon and $1.39 per gallon, respectively, and as high as $4.06 per gallon and $4.62 per gallon, respectively. The prices of imported sugarcane and domestic corn can be as low as $0.14 per kilogram and $1.52 per bushel, respectively, and as high as $0.51 per kilogram and $5.47 per bushel, respectively.

IV. Results

To examine the validity of the multiple regression model with respects to ethanol production in the United States from January 2000 to September 2008, monthly, equation (1) is estimated using SPSS 16. Table 2 presents the results of the estimated coefficients and other statistics. The F statistic is significant at ($p < 1.0356\text{E-}252$) with R^2 of 0.88. All variables are also significant at the 1% level.

The coefficients of gasoline and ethanol prices are positive and statistically significant at ($p < 0.0015$) and ($p < 0.0000059$), respectively. The elasticity of 0.0241 for gasoline implies a 1

percent change in gasoline price will increase ethanol production by about 0.024 percent. The own price elasticity of 0.0396 for ethanol implies a 1 percent change in ethanol prices will increase ethanol production by about 0.0396 percent.

The coefficient of the price of imported sugarcane from the CAFTA-DR countries is positive and statistically significant at ($p < 0.0000916$). Although the coefficient is significant, it is also positive rather than the expected negative sign. Even though the model performed well due to the highly significant *F* statistic, the positive coefficient of imported sugar prices casts a shadow on it. Further research has indicated that sugarcane in the United States has not yet been used in the ethanol process. Therefore, there is not enough data for the model to capture the changes.

The coefficient of corn prices is positive and statistically significant at ($p < 0.00134$). The elasticity of 0.014 for corn prices implies a 1 percent change in ethanol production will increase corn prices by about 0.014 percent.

V. Conclusions

The law of supply teaches that when the price of a good increases, the quantity of that good offered will increase as long as all other factors remain unchanged. Ethanol producers have increased ethanol production over the past few years in lieu of the renewable fuels mandates. This increase in ethanol production can be said to be based of the prices of gasoline, ethanol, and corn.

The results of the econometric model of multivariate regression indicates that gasoline, ethanol and corn prices have a positive effect on ethanol production, while imported sugarcane prices from the CAFTA-DR region has casted a shadow on such a highly significant model

showing a positive sign when a negative one was expected. There are ethanol facilities under construction at present to use sugarcane in their ethanol production process. A review of this model after the usage of sugarcane ethanol production is needed.

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Table 1. **Descriptive Statistics of Variables (N = 105)**

Variable	Units	Mean	Standard Error	Minimum	Maximum
Ethanol Production	*Gallons*	1,181,988	2,818	1,132,771	1,231,351
Gasoline Prices	*Dollars/Gallon*	$2.05	0.07	$1.09	$4.06
Ethanol Prices	*Dollars/Gallon*	$2.41	0.08	$1.39	$4.62
Sugarcane Prices	*Dollars/Kilogram*	$0.36	0.01	$0.14	$0.51
Corn Prices	*Dollars/Bushel*	$2.51	0.09	$1.52	$5.47

Table 2: Results of Multiple Regression

	Estimate	Standard Error	P-value
Intercept	13.935652763	0.004317900	1.0356E-252
Gasoline Price (dollars/gallon) ln	0.024059755	0.007377069	0.001516590
Ethanol Prices (dollars/gallon) ln	0.039629406	0.008281522	0.000005907
Sugarcane (Dollars/kilogram) ln	0.013963878	0.003425034	0.000091666
Corn ($ per bushel) ln	0.014062487	0.004261452	0.001340928