



## Could a Variable Ethanol Blenders' Tax Credit Work?

*Scott Irwin, Darrel Good, and Mindy Mallory*

*October 4, 2010*

*APBR 10-01*

### **INTRODUCTION**<sup>1</sup>

The U.S. biofuels industry is the recipient of a number of economic incentives from the federal and various state governments. For the ethanol industry, the Volumetric Ethanol Excise Tax Credit (VEETC) is the major federal tax incentive that supports the use of ethanol. Known more popularly as the "ethanol blenders' credit," this incentive has been widely debated in recent months for several reasons. First, the blenders' credit is scheduled to expire at the end of 2010. Second, pressure to reduce the fiscal deficit of the federal government has focused attention on many tax incentive programs, including the blenders' credit. Third, recent economic analysis has questioned the need for a blenders' credit in the presence of biofuels mandates (Babcock, 2010).

The purpose of this policy brief is to analyze how a variable ethanol blenders' credit might work in comparison to the current fixed per gallon credit. We first review some specifics regarding the current fixed credit policy and then discuss basic issues pertaining to a variable credit policy. We follow this with a comparison of the historical performance of two variable blending policies and the present policy.

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<sup>1</sup> The authors thank Dermot Hayes, Barrett Kirwan, and Wally Tyner for helpful comments on an earlier draft of this brief.

### **ETHANOL BLENDERS' CREDIT**

In one form or another, a tax credit for blending of ethanol with conventional gasoline has been on the books since the Energy Policy Act of 1978 (Tyner, 2008). The current Volumetric Ethanol Excise Tax Credit (VEETC) was created by the American Jobs Creation Act of 2004 and initially provided blenders and marketers of motor fuel with a federal tax credit of \$.51 per gallon of ethanol blended with gasoline. That credit was reduced to \$.45 per gallon beginning in January 2009. Since imported ethanol is also eligible for the tax credit, imports are subject to a tariff of \$.54 per gallon.<sup>2</sup>

The original policy objective of the ethanol blenders' credit was straightforward—stimulating the production of ethanol, and by implication, increasing the demand for corn (Tyner and Qear, 2006). The policy objective of the blenders' credit is less clear with the addition of mandated levels of biofuels production. Those mandates, which require a minimum level of biofuels to be blended into the U.S. transportation fuel supply on an annual basis, were established by the Renewable Fuel Standard (RFS) of 2005 and amended by the Energy

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<sup>2</sup> The Renewable Fuels Association provides a useful description of the role of this ethanol blender's credit at <http://www.ethanolrfa.org/pages/federal-tax-incentives-veetc>.

Independence and Security Act of 2007.<sup>3</sup> When a mandate is in place, Babcock (2010) and others show that the ethanol blenders' credit either serves to simply transfer costs of meeting the mandate from blenders to taxpayers when the mandate is "binding" or increases demand for ethanol even further when the mandate is "non-binding." Binding (non-binding) in this case means that the market equilibrium quantity in the absence of the mandate is less than (more than) the mandated quantity.

The VEETC is scheduled to expire on December 31, 2010. Legislation to extend the tax credit was introduced in the House and Senate in the spring of 2010, but such legislation has not yet been enacted. Debate about the need for a continuation of a blender's tax credit continues. Part of the debate includes the concept of a variable tax credit that would benefit blenders when they needed it most

### **VARIABLE BLENDERS' CREDIT**

The simultaneous operation of a blenders' tax credit and a mandate places the spotlight squarely on the behavior of ethanol blenders. As mentioned above, when the mandate is binding the tax credit enhances the cost competitiveness of blending ethanol with gasoline and therefore provides blenders with at least some protection from volatile fuel prices as they meet the RFS mandate. The essence of the concept of a variable tax credit is that blenders of ethanol would only receive a tax credit when it is needed to maintain the profitability of blending ethanol, but would not receive a credit when the economics of blending are favorable absent the tax incentive. As a result, the magnitude of the tax credit could

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<sup>3</sup> The RFS required a minimum of 9 billion gallons of renewable biofuel consumption annually beginning in 2009. The mandates increase annually to a maximum of 15 billion gallons in 2015 and continue at that level through 2022. Requirements for advanced biofuels (mostly cellulosic biofuels) began at 600 million gallons per year in 2009 and increase to 21 billion gallons by 2022.

vary inversely through time with the economics of blending. This concept is most closely associated with Tyner and his co-authors at Purdue University (e.g., Tyner and Quear, 2006).

The concept of a variable tax credit is consistent with the structure of many of the traditional price and income support programs that have been available to U.S. crop producers. These programs are characterized by the establishment of price targets, with support payments made when market prices fall below the target and no payments made when market prices are equal to or exceed the targets. This concept is maintained with newer programs such as the Average Crop Revenue Election (ACRE) program which establishes gross revenue targets for triggering support payments. Some recent proposals for dairy income support programs have introduced the concept of basing support payments on margins, such as the difference between gross income and feed costs of milk production. In contrast, the current VEETC is similar to the direct payment program for crop producers. However, the direct payment to crop producers is a fixed annual payment rate based on historical production levels whereas VEETC is a fixed payment rate based on gallons of ethanol actually blended. Neither payment is based on an explicit determination of an economic need for the payment.

It is interesting to note that the State of California recently launched an ethanol incentive program that has variable features (Bevill, 2010). The Ethanol Producers Incentive Program (CEPIP) offered by the California Energy Commission bases payments on estimated margins for ethanol producers located in California. The CEC estimates the ethanol "crush spread" by first dividing the nearby Chicago Board of Trade (CBOT) corn price by 2.74 and then subtracting this figure from the Los Angeles ethanol price. If the monthly average is less than 55 cents per gallon, eligible ethanol producers receive a payment equal to the difference between 55 cents and the

average crush spread for the month times the number of gallons produced, up to 25 cents per gallon. A unique feature of this program is that producers are required to pay back part of the incentive payments when the crush spread is greater than \$1 per gallon.

A key issue in the development of a variable blenders' credit is a clear understanding of the objective of the program. If the objective of the ethanol blenders' credit is to provide support to blenders during periods of an unfavorable blending margin in order to ease the burden of meeting the RFS mandate, then the best basis for a variable credit rate should be highly correlated with the blending margin. This contrasts with the California CEPIP program where the objective is direct support of ethanol producers.

Tyner, Taheripour, and Perkis (2010) propose a variable ethanol blenders' credit based on the price of crude oil, with the magnitude of tax credits inversely related to the price of crude oil. A variable rate based on crude oil prices assumes that crude oil prices are highly correlated with gasoline prices and that blending margins (mostly the difference between ethanol and gasoline prices) are highly correlated to the price of gasoline. Under these conditions, blending margins could be directly correlated with crude oil prices. Empirically however, there may be other products with prices more likely to correlate highly with blending margins than crude oil prices. Crude oil is refined into many products and using crude oil prices as the basis of a variable blender's credit may result in a variable credit that is not related to the ethanol blender's margin. The price of RBOB (Reformulated Blendstock for Oxygenate Blending) gasoline may be a superior choice, for example, since it eliminates the influence of other factors on the spread between crude oil and gasoline prices.

We examine in Figures 1 and 2 and Table 1 the correlation among crude oil, gasoline and ethanol prices with ethanol blender's

margins. To do this analysis we use NYMEX nearby crude oil futures prices, bulk RBOB gasoline prices at Chicago, and bulk ethanol prices at Chicago.<sup>4</sup> The Chicago market is one of the most important spot fuel markets in the U.S. and, therefore, should be reasonable proxy for price movements in other U.S. markets. Weekly price observations (Thursdays) are presented for the period January 25, 2007 through September 2, 2010. Figure 1 illustrates that crude oil, gasoline, and ethanol prices generally move together, but at times there are relatively large differences between the prices. Specifically, Figure 2 illustrates the difference between the bulk (wholesale) price of gasoline and ethanol, which is a large determinant of the ethanol blending margin. During this nearly four-year period, wholesale gasoline prices ranged from \$1.40 per gallon above the price of ethanol to \$.80 below the price of ethanol. Those extremes occurred in a very short period in 2008 and 2009.

Price relationships over the period are examined in more detail in Table 1. This table presents the correlation among the prices of ethanol, gasoline and crude oil. In addition, the correlation of those prices to the blending margin (difference between gasoline and ethanol prices) is calculated. The price and margin correlations are calculated for the entire period and for three sub-periods. The periods January through December 2007 and April 2009 through August 2010 were periods of relatively stable prices, while the period January 2008 through April 2009 was a period of rapidly changing prices.

For the entire period, there was a strong positive correlation between the prices of crude oil and gasoline. That correlation was .89, where 1.0 equates to perfect positive correlation. However, the correlation was very weak (.33) in 2007. Ethanol and

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<sup>4</sup> The source for the bulk RBOB gasoline and ethanol prices is OPIS (<http://www.opisnet.com/>).

gasoline prices were also highly correlated (.70), as were ethanol and crude oil prices (.70), for the entire period. But, those correlations were mostly negative during the two periods of relatively stable prices. The blending margin was highly correlated to the price of gasoline for the entire period (.82) and for each of the sub-periods. The correlation between crude oil prices and the blending margin was not as strong (.66) and was very weak during the two periods of relatively stable prices. The price relationships over the entire period and for each sub-period suggest that there might be some merit in basing a variable tax credit on the level of gasoline prices, but there is uncertainty as to the merit of basing the credit on the price of crude oil. The correlation between crude oil prices and the blending margin was only high (.85) during the period of rapidly changing prices (January 2008 through April 2009).

### **AN ALTERNATIVE PROPOSAL**

The statistical analysis in the previous section indicates that basing a variable tax credit on the level of gasoline prices might be an improvement over basing a credit on crude oil prices. However, since the correlation between gasoline prices and blending margins is not perfect the “correct” rate might not always be applied. A better alternative might be to base a variable tax credit directly on the calculation of the blending margin. The challenge to using this approach is to correctly calculate the blending margin.

In reality, blending margins are influenced by more than the difference between ethanol and gasoline prices. Transportation fuel is a blend of ethanol and a number of petroleum products, such as methane, butane, and naphtha (Leffler, 2008, Ch. 14). The blend of these petroleum products changes seasonally (due to weather and changes in emissions requirements) and as the relative prices of the various products change. Much like the price of feed ingredients in a least-cost feed ration, changes in the price of these other

petroleum products can influence the value of ethanol in the blend. For the purposes here, we adopt the assumption that the blending margin can be represented as the difference between gasoline and ethanol prices. While this is clearly a simplifying assumption, we do note that this difference is widely-used in the energy business to represent the profitability of blending ethanol with gasoline (before consideration of the credit).

An additional complicating factor is that prices of gasoline and ethanol can vary by region of the country so that margins may not be equal over space. Policy-makers and industry participants would have to agree to a specific methodology for calculating margin. Other issues to be considered include whether there would be a cap on the tax credit (perhaps the current \$.45 per gallon), the appropriate time period for calculating and applying the tax credit, and whether the import tariff would be influenced by the tax credit. Given the objectives of current biofuels policy and to ensure that mandates are met, the policy could also include a minimum blending credit, particularly if a cap is imposed.

Figure 3 shows monthly average levels of the current ethanol blenders' credit and two simulated variable credit policies over February 2007-August 2010. The per gallon tax credit is calculated under the existing rules of a fixed tax credit (\$.51 per gallon before 2009 and \$.45 per gallon since 2009), a variable tax credit based on the price of crude oil, and variable tax credit based on the blending margin. The line in Figure 3 labeled TTP is based on Table 1 in Tyner, Taheripour, and Perkis (2010). This proposed policy has a sliding scale based on the price of crude oil.<sup>5</sup> The line labeled

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<sup>5</sup> Specifically, there is no credit when the price of crude oil is above \$80/barrel; a credit of \$.19 per gallon when the price of crude oil is between \$70 and \$80/barrel; a credit of \$.38 per gallon when the price of crude oil is between \$60 and \$70/barrel; a credit of \$.57 per gallon when the price of crude oil is between \$50 and \$60/barrel;

IGM is our proposed policy based on the blending margin. When the margin (gasoline minus ethanol price) is greater than zero no credit is paid. When the margin is negative the credit equals the negative margin (in absolute value) up to a cap of \$.45 per gallon. Alternatives were also considered allowing for minimum margins (e.g., 10 cents), but results were not substantially different.

Figure 3 demonstrates that either of the variable tax rate policies tended to have lower per gallon credits than the existing fixed rate policy during the time period examined. While the overall pattern of payout for the two variable rate policies is similar, the policy based on crude oil prices (TTP) generated a much higher average credit, \$0.24 per gallon, than the policy based on blending margin (IGM), \$0.07 per gallon. The main reason is that the crude oil-based policy made payouts nearly continuously after September 2008, a period when blending margins were positive about two-thirds of the time. The margin-based policy is more efficient, at least historically, in targeting credits to blenders during periods when it is uneconomic for them to blend ethanol.

Figure 4 presents the estimated monthly cost of the three tax credit policies based on the rates calculated in Figure 1 and the actual quantity of ethanol produced in the U.S. each month over February 2007-August 2010. The rising trend of costs for the current fixed tax credit policy is a function of the steadily increasing amount of ethanol produced over this time period. The cost of the current policy (in terms of foregone tax revenue) is estimated to be near \$500 million per month towards the end of the sample period. The highest monthly cost for both of the variable rate policies occurred in December 2009, when the crude oil-based policy was estimated to cost about \$650 million and the margin-based policy about \$450 million. So, even for these policies single month costs can be

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a credit of \$.76 per gallon when the price of crude oil is less than \$50/barrel.

quite large. Summing costs across all months is also revealing. The total cost across all months was estimated to be \$15.5 billion for the current fixed credit policy, \$7.7 billion for the crude oil-based policy, and \$2.4 billion for the margin-based policy.

There are two objections to the variable tax rate policy proposed here that should be noted. The first is that the margin calculations are based on non-public price quotations for ethanol and gasoline. This lack of transparency and public availability is not as severe a limitation as it appears at first glance. Figure 5 compares estimates of the ethanol blending margin computed as before (difference between bulk RBOB gasoline and ethanol at Chicago) and one based on the difference between nearby NYMEX RBOB gasoline and nearby CME ethanol futures prices. Inspection of the plot clearly shows that the two series track each other quite closely despite the distance separating the two delivery locations for the futures contracts (New York and Chicago). The correlation between the two series over the entire time period of 0.92 confirms the impression. This shows that public price quotations are readily available that could be used as the basis for margin calculations in a variable blenders' credit program.

A second concern is the extent to which the price of corn influences energy prices. While the price of corn is unlikely to have a significant influence on the price of crude oil, it is more plausible that the price of corn and the price of ethanol are jointly determined. If this is the case, then a variable blender's credit will influence corn prices, which could in turn influence ethanol prices and the blending margin. The extent to which this is harmful to the objective of the blender's credit only arises if the ethanol-corn price relationship would cause a self-fulfilling increase in the level of the variable blender's credit (i.e., corn price increase causes ethanol price to increase, which in turn causes variable credit and corn price to increase). However, if ethanol and corn prices are jointly determined, it

seems that a positive relationship between the two is most likely. That is, high corn prices imply high ethanol prices and vice versa. If corn and ethanol prices are positively related, then it should have a mitigating effect on government tax credit expenditures by reinforcing a favorable blending margin. Whether or not corn and ethanol prices are jointly determined and maintain a positive relationship is an empirical question, of course, and would need to be considered before implementing the type of blender's credit proposed here.<sup>6</sup>

### **CONCLUDING THOUGHTS**

The answer to the question posed in the title to this brief is clearly yes. A variable blenders' credit policy is more efficient at targeting the subsidy to periods when it is uneconomic for ethanol to be included in gasoline blends and as a result is much less costly than the current fixed rate policy. Of course, it is important to keep in mind that the variable blenders' credit policies considered here are based on simple rules meant to only illustrate the concept.

Several important issues were not addressed in our analysis. To begin, our analysis did not address any issues that might be associated with hitting the ethanol "blend wall," i.e., the current regulatory limit of 10% ethanol in gasoline blends. Since the U.S. Environmental Protection Agency (EPA) appears to be poised to approve a higher mid-level blend (e.g., 15%), at least for some vehicle models, this may not be a significant issue as those higher blends become available at the retail level.

We did not consider whether the amount of ethanol blended over the time period would have varied among the three policies.

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<sup>6</sup> The correlation of the price of corn in central Illinois and the bulk ethanol price at Chicago was 0.79 over January 25, 2007 through September 2, 2010. This indicates that the relationship is more than likely positive. However, the simple correlation by itself does not reveal causation.

Presumably, blending would not have declined below mandated levels, but recent blending totals that exceed mandates may not have been achieved without the incentive of the fixed tax credit. Further, to the extent that the fixed tax rate that was in place was passed through to ethanol and corn producers, the observed prices of corn and ethanol were not independent of the tax credit. That is, different prices and therefore different blending margins might have been observed if the credit was not in place, or if a variable credit had been in place.

Introducing a blenders' credit that is variable in nature may also change the timing of hedging incentives for ethanol blenders. Under a variable credit blenders would not forward contract a negative margin since they would at worst break even in the spot market. Under the current fixed tax credit blenders may be willing to forward contract for a negative margin up to the level of the tax credit. This may have implications for ethanol producers' ability to hedge price risk since it may be harder to find a willing hedge partner. Producers have access to the CME ethanol futures contract, which has seen steady growth in volume and open interest since its debut. However, it is impossible to say if this volume predominantly is coming from ethanol producers, blenders, or speculators and if this volume would be significantly reduced if blenders were not present.

Finally, we did not consider how the reduced expenditures under a variable tax credit would be distributed across the participants in the energy and agricultural markets. Our margin-based policy would have reduced expenditures by over \$13 billion dollars. An important question for future research is whether this cost reduction would have the largest impact on gasoline blenders, ethanol producers or corn producers.

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**Table 1. Correlation of Weekly Ethanol, Gasoline, and Crude Oil Prices and Ethanol Blending Margin, January 25, 2007 - September 2, 2010**

	Ethanol Price	Gasoline Price	Crude Oil Price	Blending Margin
<b>Panel A: January 25, 2007 - September 2, 2010</b>				
Ethanol Price	1.00			
Gasoline Price	0.70	1.00		
Crude Oil Price	0.70	0.89	1.00	
Blending Margin	0.16	0.82	0.66	1.00
<b>Panel B: January 25, 2007 - December 27, 2007</b>				
Ethanol Price	1.00			
Gasoline Price	-0.03	1.00		
Crude Oil Price	-0.46	0.33	1.00	
Blending Margin	-0.61	0.81	0.53	1.00
<b>Panel C: January 3, 2008 - April 23, 2009</b>				
Ethanol Price	1.00			
Gasoline Price	0.91	1.00		
Crude Oil Price	0.96	0.97	1.00	
Blending Margin	0.72	0.94	0.85	1.00
<b>Panel C: April 30, 2009 - September 2, 2010</b>				
Ethanol Price	1.00			
Gasoline Price	-0.45	1.00		
Crude Oil Price	0.02	0.65	1.00	
Blending Margin	-0.87	0.83	0.35	1.00

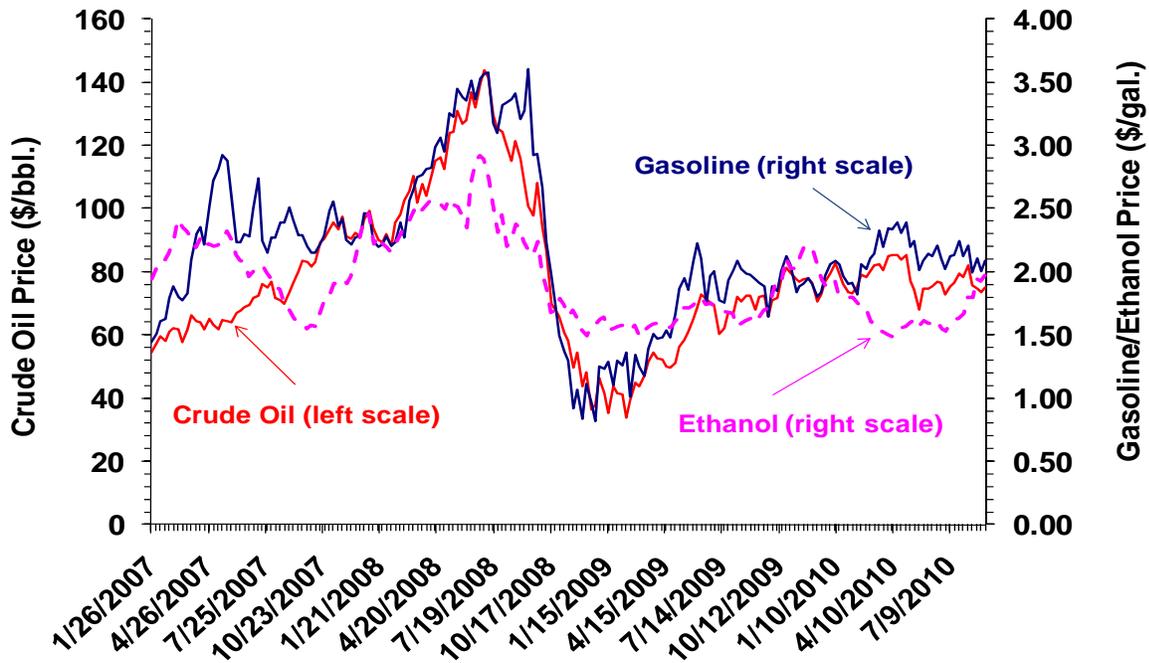


Figure 1. Weekly NYMEX Crude Oil Futures Price, Bulk RBOB Gasoline Price at Chicago, and Bulk Ethanol Price at Chicago, January 26, 2007- September 2, 2010

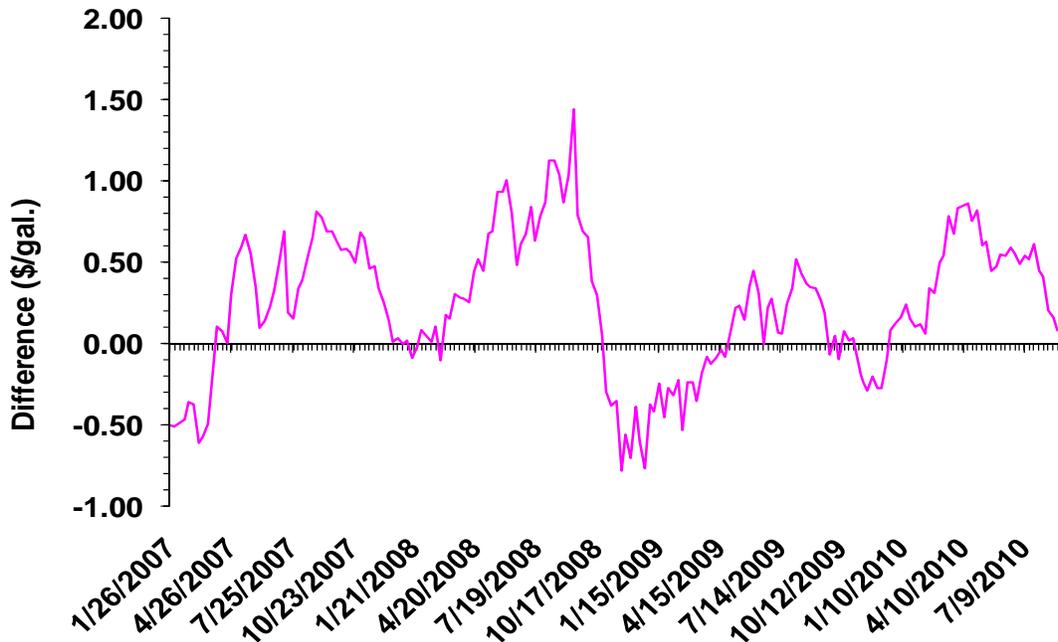


Figure 2. Wholesale Ethanol Blending Margin Computed as the Difference between Bulk RBOB Gasoline and Ethanol at Chicago, January 26, 2007- September 2, 2010

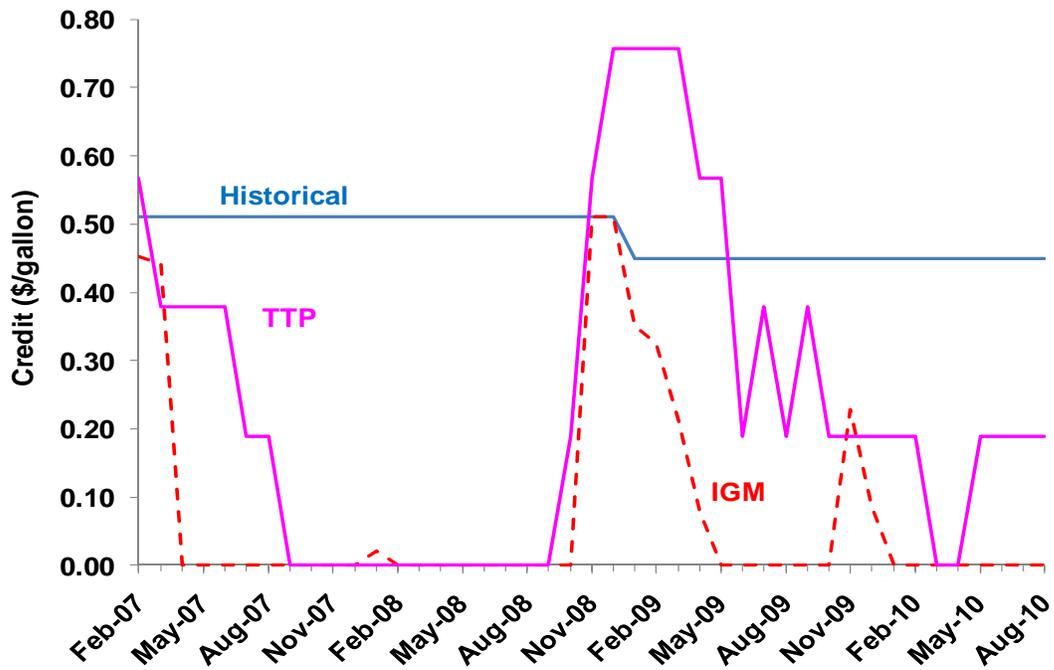


Figure 3. Monthly Average Levels of Historical Ethanol Blenders' Credit and Two Simulated Variable Blenders' Credit Policies, February 2007- August 2010

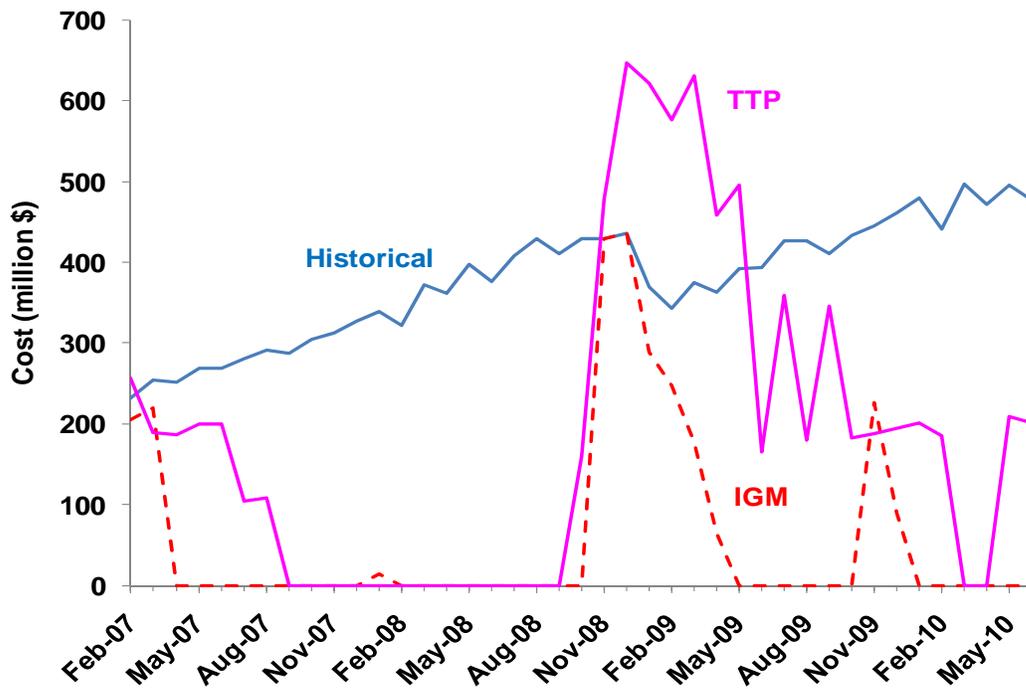
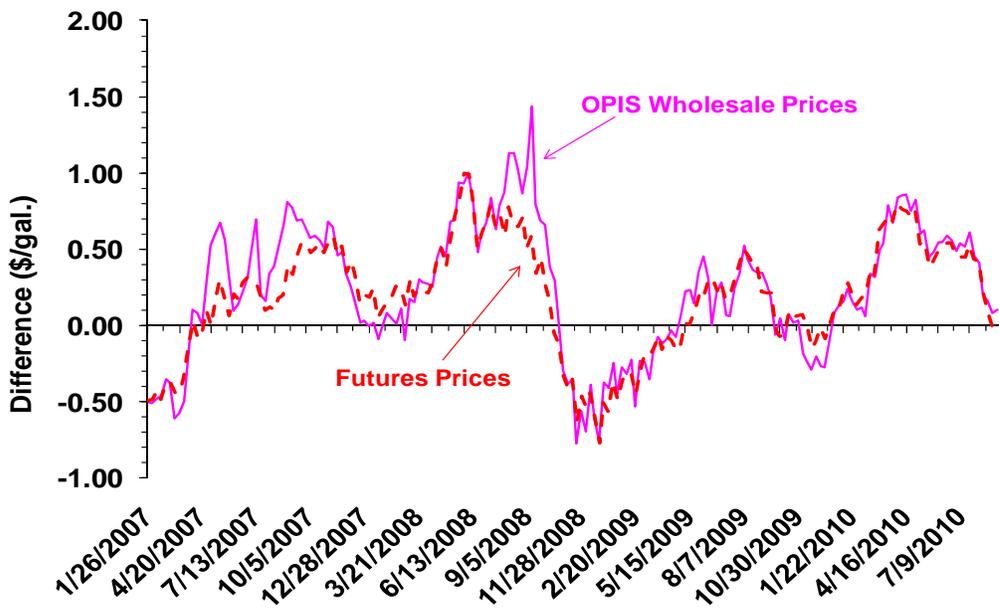


Figure 4. Estimated Monthly Cost of Historical Ethanol Blenders' Credit and Two Simulated Variable Blenders' Credit Policies, February 2007- August 2010



**Figure 5. Wholesale Ethanol Blending Margin Computed as the Difference between Bulk RBOB Gasoline and Ethanol at Chicago and the Difference between Nearby NYMEX RBOB Gasoline and Nearby CME Ethanol Futures Prices, January 26, 2007-September 2, 2010**