Risk, Infrastructure and Industry Evolution

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Policy Risk for the Biofuels Industry

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Policy Risk for the Biofuels Industry

Risk is by no means new to participants in agricultural markets. Commodity producers have long recognized the importance of output and input price variability, and many exploit futures markets to reduce risk – a tool available to agricultural commodity buyers, as well. Price risks are also addressed by agricultural programs that are designed to pay more as prices fall relative to some benchmark level, such as the marketing loan program, counter-cyclical payments, and insurance programs tied to revenue or price.

Booming biofuel use of selected agricultural commodities as feedstocks has introduced a new element of risk. While many observers debate the contribution of biofuels to rising price levels, the potential that biofuel demand for agricultural commodities introduces a new source of price variability should not be lost. Nor should these risks be viewed too narrowly. Biofuel policy represents a critical source of risk. The new links between motor fuel and agricultural commodity markets must be seen through the prism of subsidies to biofuels, policies that mandate minimum levels of use, and tariffs that reduce imports. New and rapidly evolving energy policy defies easy understanding. Policy changes outpace implementing rules, leaving market participants uncertain about the exact form these policy mechanisms will take. Thus, critical uncertainties about even the current marketing year are not yet resolved.

In this paper, we delineate some of the key policy risks for the biofuel industry. Our objective is to demonstrate how biofuel policies can affect markets in the near- and medium-term future. The assessment is informed by discussions with administration officials in the Environmental Protection Agency, the Departments of Energy and Agriculture, and elsewhere, but is fundamentally our own and follows closely the text of the law and the rules of implementation set out for an earlier version of biofuel policies. Finally, we represent biofuel policies in a large-scale structural model of agricultural commodity and biofuel markets to test how these policies affect markets.

New Links

The petroleum price is a key source of uncertainty for the biofuel sector. This price has long been a source of uncertainty, but recent price increases have occurred at such a pace that projections of the petroleum price have been outpaced time and time again.

The motor fuel market represents a link between petroleum and agricultural markets that was not pronounced in the past. But growing ethanol use led to a new and possibly much more elastic demand for corn in the United States (Tyner, 2007). Focusing on ethanol, the relationship between gasoline and ethanol prices has not been historically stable (Figure 1). The 2006 spurt in ethanol demand led to a high ethanol price relative to the gasoline price (Westhoff *et al.*, 2007). But the potential for the price premium seems to be exhausted (De Gorter and Just, 2007, p.15). Recent events reflect expectations that the marginal consumers will opt to buy based on energy content. If judged based on current futures of wholesale prices (namely the refiner's price of the gasoline input to retail fuels and the Omaha rack price of ethanol), the ratio of ethanol-to-gasoline price ranges from 70 to 80 percent. To consider the consumer's perspective, however, requires adjustments for margins, taxes, and tax credits. Assuming the margins are the same and using a simple average of state taxes for different fuels, the implied ratio of ethanol retail price to gasoline retail price in current futures markets ranges from 65-72 percent. This ratio is quite close to the energy content of ethanol relative to an equal volume of gasoline.

There are two lessons relevant here. First, the pricing of ethanol and gasoline must reflect their new relationship as

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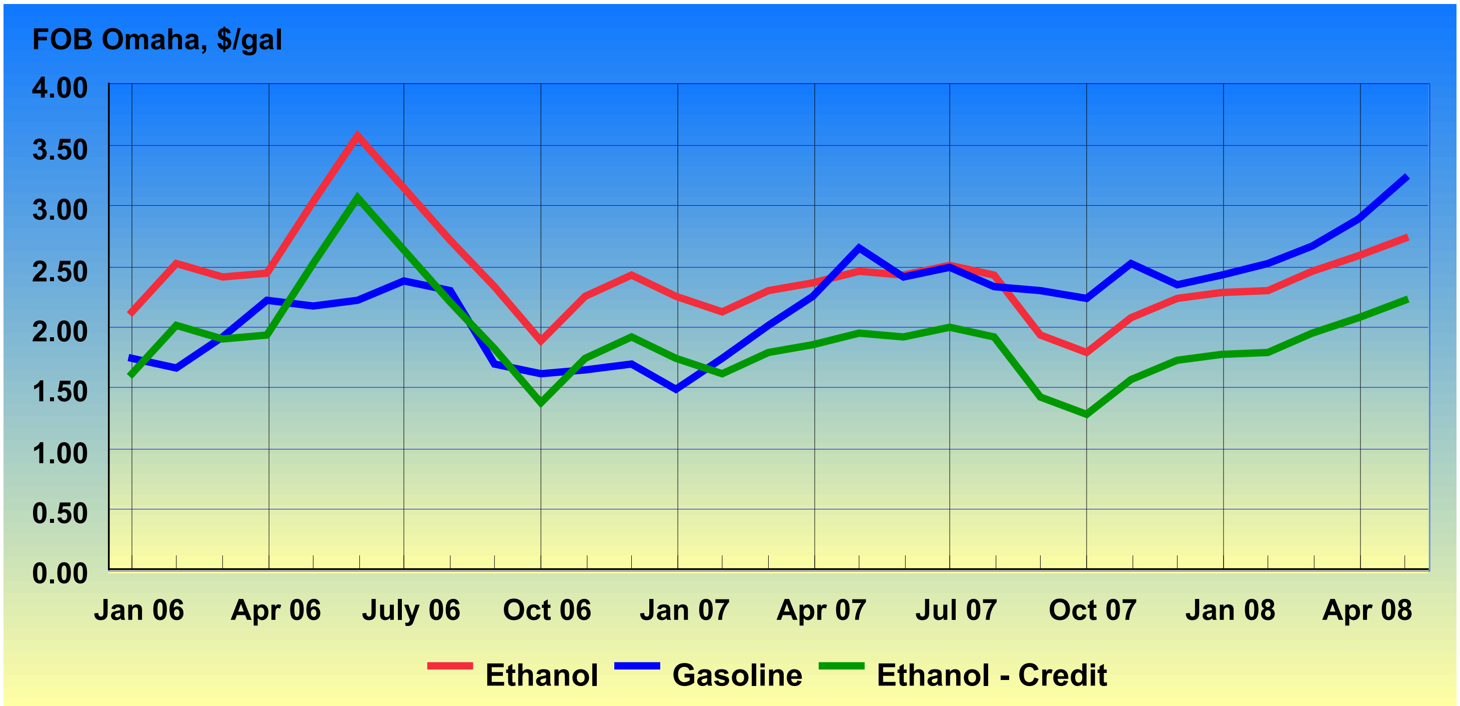

Figure 1. Gasoline and Ethanol Prices
Sources: Nebraska Ethanol Board; Nebraska Energy Office (prices)

substitutes, leading to certain expectations about how demand evolves. Current events suggest that the additive use market is saturated and further expansion in ethanol use will be as a substitute to gasoline. Sharply higher petroleum prices are expected to lead to higher ethanol prices through biofuel demand and, consequently, to more purchases of biofuel feedstocks. Second, assessment of risks based on past relationships alone may be betrayed by changing circumstances. For example, forward-looking analysis that perpetuated the price premium allotted ethanol historically for its role as an additive might mislead. Rapidly expanding biofuel markets have generated new patterns of interaction.

New and changing U.S. biofuel policies may similarly lead to new patterns of interaction. Next, federal biofuel policies are defined to set the stage for assessing how these policies affect markets.

Tax Credits and Tariffs

Federal biofuel policies include tax credits for biofuel use and a tariff on ethanol imports. The ethanol tax credit is $0.51 per gallon of ethanol. For biodiesel, the tax credit amounts to $1.00 per gallon of biodiesel made of virgin oil and half that or $0.50 for biodiesel made of recycled oil. The tax credit is provided to fuel blenders, agents who buy processed fuel inputs and mix them into retail fuels to sell to retailers, based on the amount of biofuels they use. Traders must pay a tariff on ethanol imports that are not within the scope of any preferential arrangement. Set to expire in 2008, The Food, Conservation, and Energy Act of 2008 (U.S. Congress, 2008), enacted in June 2008, extended the tariff through 2010. The tax credit currently set to $0.51 per gallon will likely decrease to $0.45 per gallon for 2009 and 2010, and then it is scheduled to expire (The Food, Conservation, and Energy Act of 2008).

These policies are fairly straightforward and have been in operation for some time. As such, the remaining discussion of federal policies focuses on the mandates, including some speculation about how they will operate. This background sets the stage for analyzing the market price effects of these policies.

Mandates Defined

The Energy Independence and Security Act (EISA) of 2007 (U.S. Congress, 2007) amended the Renewable Fuel Standard (RFS) mandating biofuel use that was first introduced in the Energy Policy Act of 2005. The new RFS is a hierarchy of mandates (Figure 2). The potential market effects of these mandates are sensitive to context, as discussed later, but also on how they are implemented. In this paper, some care is taken to explain one set of expectations regarding how these mandates will operate.

These mandates are not so readily disaggregated as Figure 2 might lead one to believe. The overall RFS can be met by any biofuel that meets any of the categories, plus other biofuels that meet a lower threshold. Likewise, the sub-mandate for advanced biofuel has two sub-mandates of its own, namely for biodiesel and for biofuels based on cellulosic or agricultural waste feedstocks. The overlap means that the "other advanced" is the amount by which the advanced biofuel man-

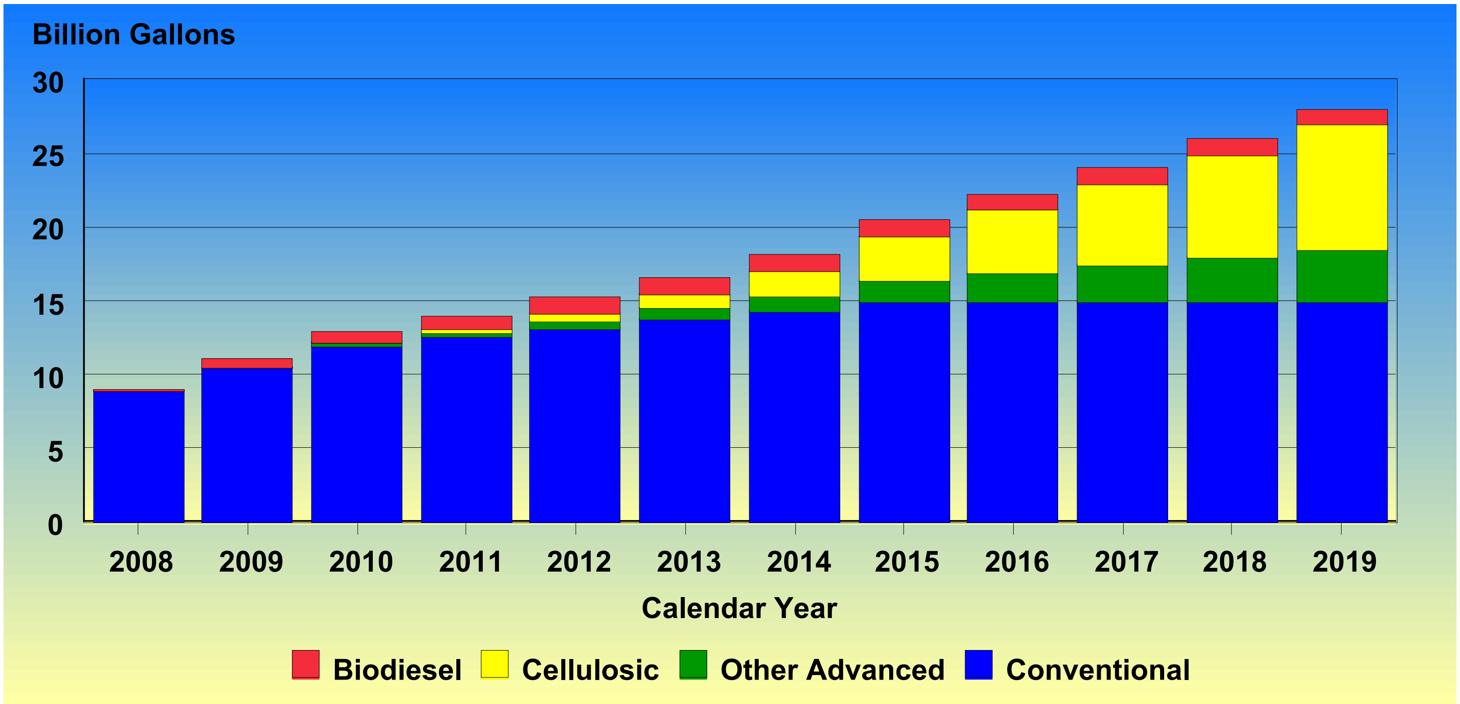

Figure 2. Renewable Fuel Standards of the Energy Independence and Security Act
Source: Energy Independence Security Act of 2007. Note that this graph implies that there are explicit mandates for "conventional" and "other advanced" biofuels, but there are not. These two categories are the remainders of the total and advanced mandates after taking sub-mandates into account, as described in the text.

date that exceeds these two sub-mandates. But if either one of the sub-mandates is surpassed, then there need be less other advanced biofuel. Likewise, the part of the RFS that is not advanced, often called "non-advanced" or "conventional", could be met entirely by advanced biofuels, at least theoretically. The reverse is not true. No conventional biofuel, no matter how abundant, can count against the advanced biofuel mandate, let alone the cellulosic biofuel mandate.

The numbers of the RFS are unlikely to map to exact requirements in any particular year. First, not all fuels are equal, and a gallon of certain biofuels is likely to count as more than one gallon towards the mandate based on the "equivalence value". The EISA introduces a separate mandates for different biofuels differentiated by feedstock. (A biofuel must also meet certain lifecycle greenhouse gas emission reduction targets, with the least stringent requirements for the overall RFS and, hence, for conventional fuels.) These sub-mandates presumably replace the equivalence value system that was used under previous law to add up units of fuel based on differing feedstocks. But that does not remove the problem of comparing units of fuel themselves. The rules to implement the law are expected to continue to use equivalence values so that each unit of biofuel is put on an ethanol basis based on its energy content relative to ethanol. If a biofuel has more energy as compared to ethanol, then it will count more towards the RFS. Biodiesel is likely to have an equivalence value of 1.5 or perhaps more.

There are automatic and discretionary mechanisms for mandate flexibility. The EISA makes room for waivers under conditions that outline in very broad terms what criteria to use. In the event that a sub-mandate is waived, then the broader mandate may also be decreased. For example, a waiver of cellulosic biofuel need not require an offsetting increase in other advanced biofuels. The consequences of a waiver vary by mandate, but may include setting a new and lower mandate or, in the case of cellulosic biofuel, paying a subsidy per unit. (In the analysis below, the cellulosic biofuel mandate is assumed to be waived. As required in the EISA, the waiver leads to a subsidy per gallon of cellulosic biofuel used.) Even without an official waiver, the part of the burden that applies in a particular year may be shifted somewhat forward and backward. Deficits in meeting the mandate on an individual basis are likely to be permitted, but with the provision that the agent makes good on the deficit plus full mandate in the next period. Rollover provisions will likely permit up to 20 percent of one year's mandate to be met by biofuels used in the previous year, provided they were not already counted against the earlier year's mandate.

Mandate Operation

The first incidence of the RFS is on fuel blenders. These agents buy input base fuels, including gasoline that is refined but not yet ready for retail and ethanol, and then sell the mixed fuels to retailers. If judged based on the implementing rules written for its predecessor, then each blender will be responsible to meet the share of the EISA mandates that is determined based on that blender's share of total motor fuel, with certain exceptions. In general, each blender will have to show that its share of the national RFS for each biofuel type has been met.

The mechanism for proving biofuel use will be the Renewable Identification Number (RIN). Each RIN corresponds to a gallon of biofuel[2]. Biofuel makers generate a RIN for each gallon they produce that qualifies to count towards a mandate. In proving that the biofuel qualifies, the determination will also be made as to what level of RFS could be met with the RIN based on the feedstock and the greenhouse gas emission threshold. RINs can be traded independently of the biofuel, and already are. Thus, a blender who does not use any biofuels at all can meet its share of mandates through purchased RINs. Conversely, a blender who uses much more than its share of mandates may find that its profitability is increased by selling extra RINs to competing blenders who chase RINs in order to meet their own share of the mandates. Because blenders can trade RINs, the mandates will be binding or not binding nationally. Local conditions may only determine if the area is a net buyer or seller of RINs.

The hierarchical nature of the mandates necessarily generates a hierarchy in the values of RINs. A sub-mandate can be binding even when a broader mandate is not. For example, the biodiesel mandate may be binding even though the advanced biofuel mandate is met at market prices through some combination of qualified biofuels. In this case, RINs that meet the biodiesel mandate will take on a value that exceeds the value of RINs that meet the advanced biofuel mandate. Similarly, even should the advanced biofuel mandate become binding, the overall mandate may not be binding, in which case the price of RINs that meet the advanced biofuel mandate are bid higher, whereas the price of RINs that meet the overall mandate would not. The converse is not true. A RIN that counts towards a broad mandate but fails to meet the criteria of a sub-mandate only counts towards the broader mandate, so its value may be lower than RINs that can be used for sub-mandates. Thus, the price of RINs that can count towards a sub-mandate necessarily also count towards the broader mandate, so its value will never be less than the price of RINs that meet a lower threshold and count only towards a broader standard, but the price of sub-mandate RINs could be higher.

Policy Risks

Policies change. The new Farm Bill lowers the tax credit that blenders receive per unit of biofuel throughput and extends the tariff on ethanol imports to 2010. Only shortly after the rules to implement the first RFS were disseminated and before the initial levels of the RFS rose very much at all, Congress passed a law to change those minimum targets and the President signed this law. Here, the consequences of the mandates, tax credit, and tariff are explored to highlight how policy changes could influence market outcomes.

The basis of the analysis is a large-scale structural model of agricultural and biofuel markets. Biofuel policies are represented based on how they affect the incentives of market participants, as described elsewhere (FAPRI-MU, 2008b). The context matters, as different conditioning factors may increase the likelihood that the mandates are binding. This assessment benefits from being (1) forward looking and (2) partially stochastic. Both characteristics differentiate this analysis from, for example, Tyner and Taheripour (2008) who consider variations in the exogenous petroleum price over fixed intervals for 2006 base data and De Gorter and Just (2007) who consider the cases of 2006 and 2015 with less formal investigation into changing context. In contrast, this analysis projects market indicators on an annual basis for the next ten years, taking into account short-term fixed factors and adjustment processes, and key exogenous data are varied over ranges determined based on historical variations. This latter element, the partial stochastic simulation process, allows for variations in yields, both trend and year-to-year shocks, key demands, and other variables, including the petroleum price. As a consequence of 10-years of annual data and 500 simulations for varying conditioning factors, the simulation process generates 5,000 observations for each price and quantity, as well as other output such as consumer and government costs.

The elimination of each policy and all policies relative to the baseline that assumes they are continued for the next 10 years can result in large decreases in the ethanol price (Figure 3). Relative to the FAPRI-MU baseline created in early 2008, and based on a much lower petroleum price than recent events warrant, the elimination of the EISA mandates would cause the ethanol price to be 10-15 percent lower, eliminating the tax credit would lead to a reduction of less than 5 percent in the ethanol price, and the tariff elimination would result in a 5 percent lower ethanol price. Removing all three would lead to a 30 percent decline in ethanol prices. A key lesson from these results is that the policy effects may overlap. In the case that the EISA mandates are broadly binding, then eliminating the tax credit, a policy change that would normally decrease the willingness of blenders to push through more biofuels, shifts the burden of costs from taxpayers to consumers with little or no effect on quantities.

The degree to which the mandate is binding is highly situation-specific. The higher petroleum price, observed since the beginning of 2008, has caused increased gasoline prices and, consequently, an increase in consumer willingness to buy substitute biofuels. This event decreases the likelihood

[2]Technically, RINs are issued per batch of production or imports. The digits of the RIN are coded to specify the volume, as well as other characteristics, of the batch of biofuel with which they are associated.

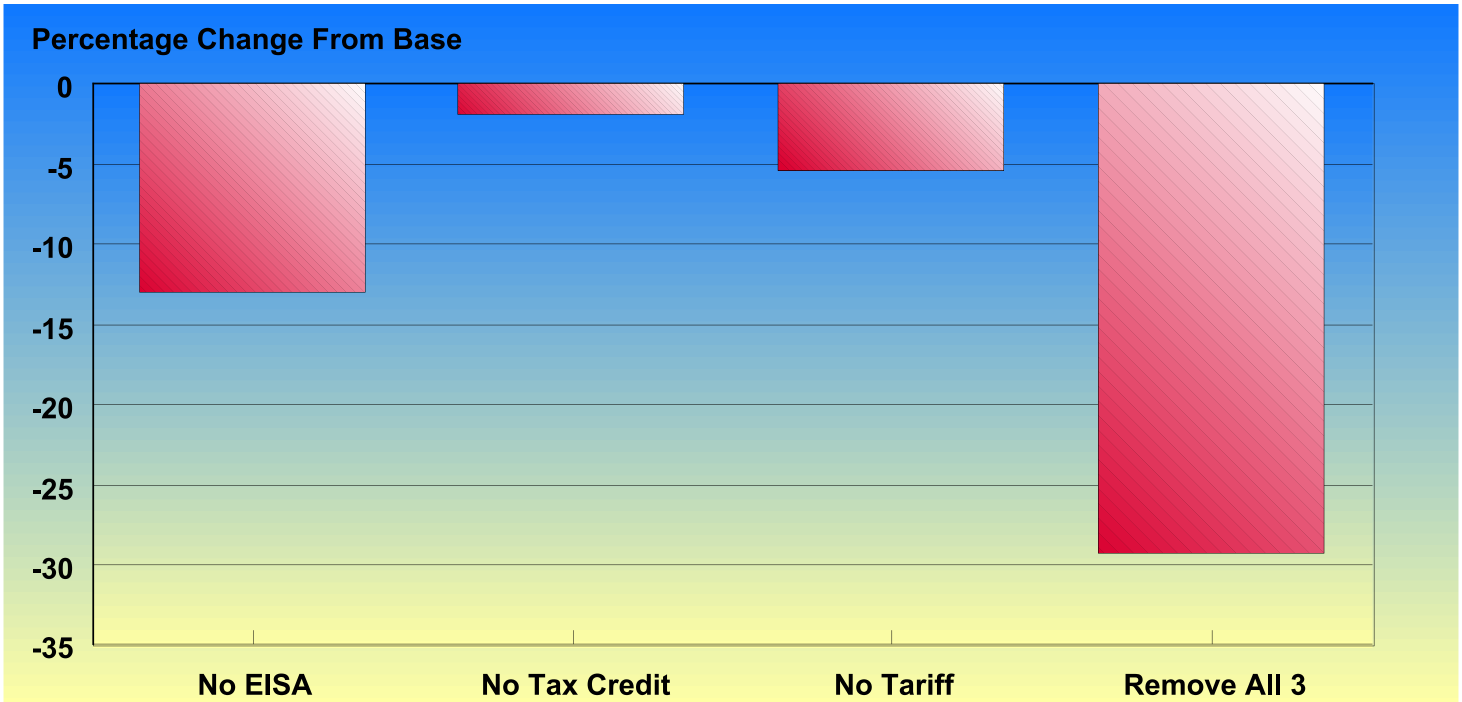

Figure 3. Effect of Removing Biofuel Policies on the Ethanol Price, 2011-2017 Average
Source: FAPRI-MU, 2008a.

that the mandates will be binding. Even more recently, Midwest flooding that may jeopardize the corn crop in some areas caused sharp increases in corn and other agricultural commodity prices. Higher corn prices that decrease the supply of ethanol increase the likelihood that the overall mandate will be binding. The stochastic output can be disaggregated based on the petroleum price to consider the first of these two changes in context. Whereas the overall average 2008-2017 petroleum price in the baseline assumptions is $67 per barrel, the average of the 10 percent highest price series is $107. While well short of current futures prices, which average $130-140 at the time of writing, the $40 difference suffices to highlight the how critical the surrounding conditions are when assessing the effects of the mandates (FAPRI-MU, 2008a).

The risks of policy changes for the biofuel sector vary substantially depending on whether or not mandates are binding (Figure 4). If all policies were removed and the oil price was $67 per barrel, then ethanol production would average 8.9 billion gallons from 2011 to 2017, as opposed to almost 15.6 billion gallons with policies in place. Under the conditions with the higher petroleum price of $107 per barrel, ethanol production would be 17.6 billion gallons with the support and would decrease to 13.1 billion gallons without support. The difference is largely explained by the EISA mandates. The elimination of EISA mandates hardly matters if the petroleum price is high because the mandates are rarely binding, whereas the elimination of EISA mandates explains most of the change if petroleum prices are low because the mandates would likely be binding.

The RIN value is a key indicator of the degree to which a mandate is binding, if at all. As biofuel market participants consider risks from policy changes or from different external conditions, the RIN value must be a key consideration. Even if a mandate is binding and quantities do not change, the RIN value will change first and most for a change in policy or setting. If positive and large, then RIN value would be a key element of profit or cost for blenders, depending if they buy or sell RINs, and would play a critical part in determining the price that blenders are willing to pay for biofuels.

The RIN values will vary inversely with petroleum prices if they are positive and are more likely to be positive as petroleum prices fall (Figure 5). The “core RIN value” is defined as the price gap between the wholesale price at which blenders buy biofuels that meet the corresponding mandate and the wholesale-equivalent of the retail price at which they sell that biofuel on to retailers. That is to say, the core RIN value is the degree to which the mandate is binding and excludes speculative value about the potential to rollover the RIN into the subsequent year and all transaction costs.

Stochastic analysis generates a range of possible RIN values. As EISA mandates grow over time (Figure 2), the degree to which a mandate may be binding is likely to increase over time (Figure 6). The price of the RIN per gallon of biodiesel was expected to be the highest of the three estimated here based on FAPRI baseline assumptions as to ranges of petroleum prices, corn yields, and other variables. The advanced RIN value must necessarily be lower than the biodiesel RIN

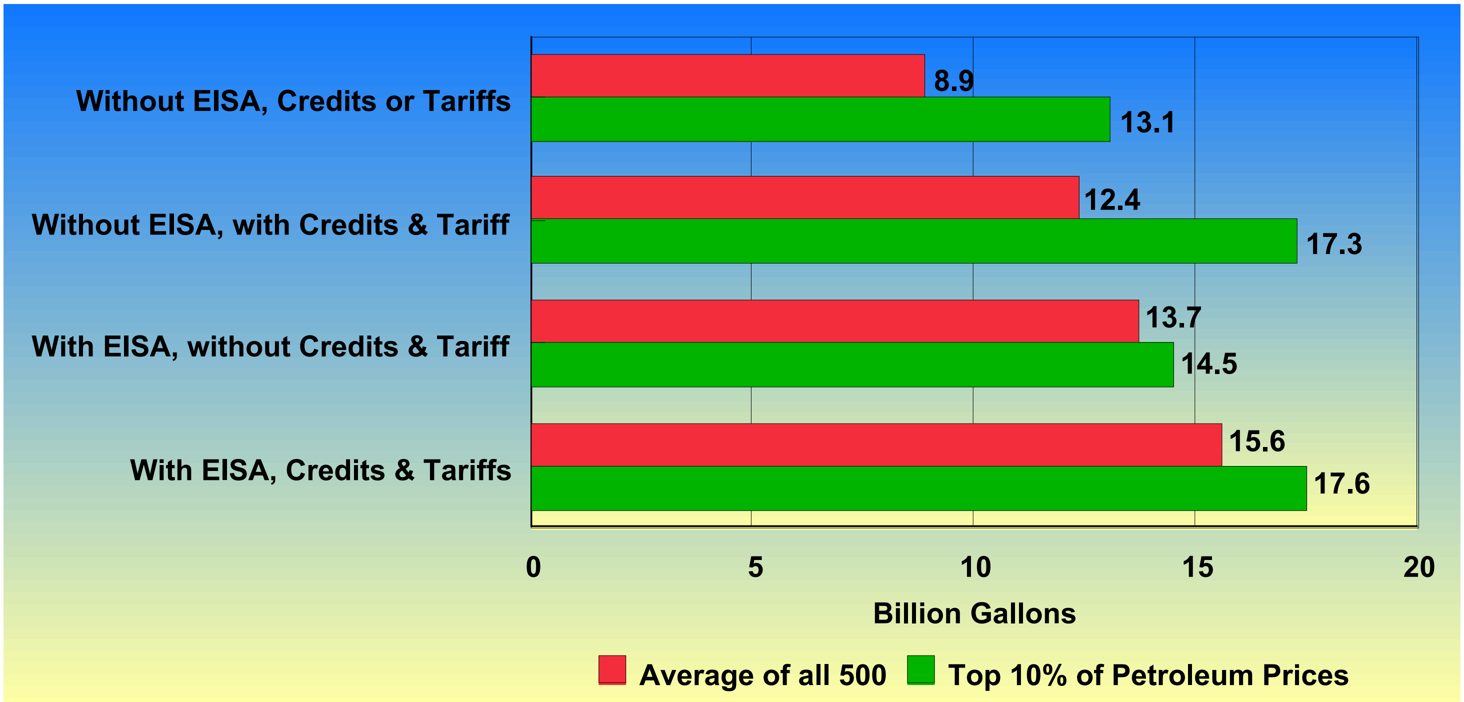

Figure 4. Effect of Removing Biofuel Policies on the Ethanol Production, 2011-2017 Average
Source: FAPRI-MU, 2008a.

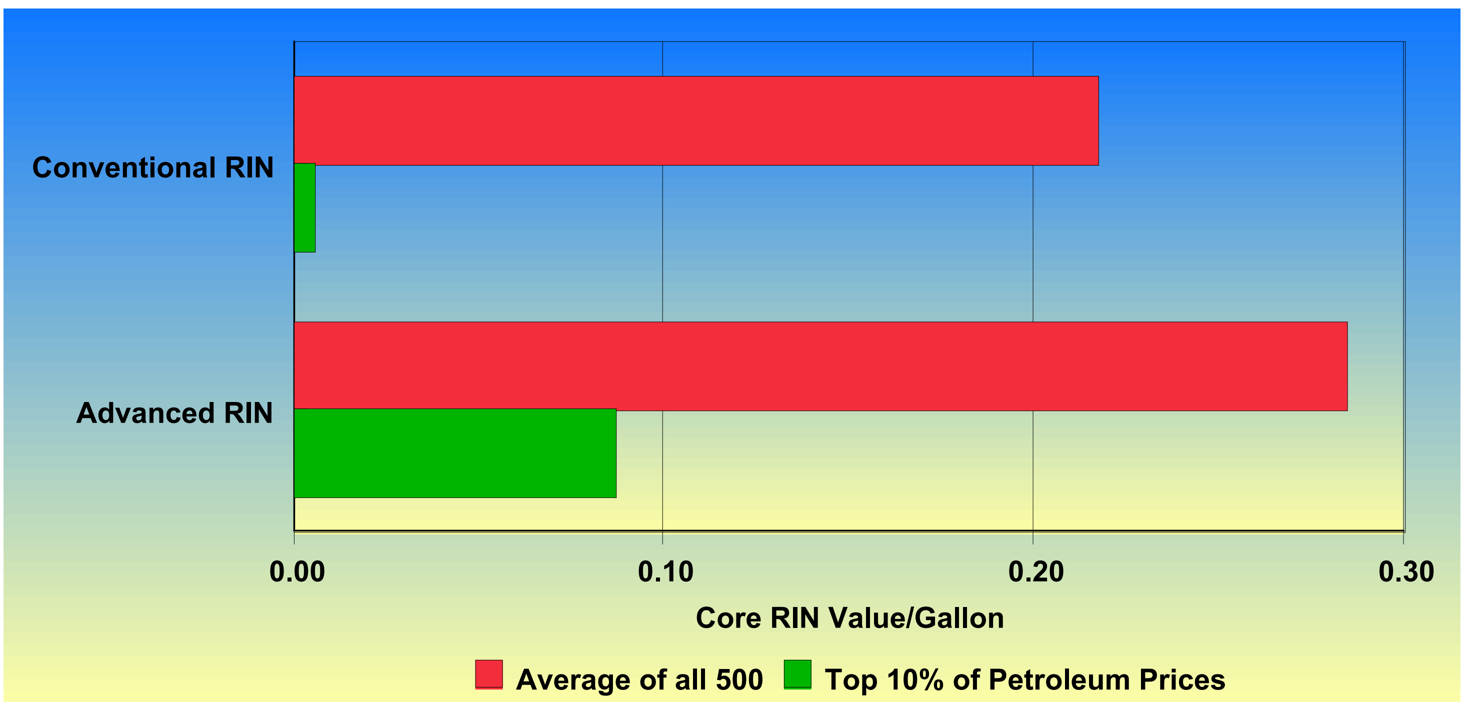

Figure 5. Core RIN Values, 2011-2017 Average.

value because of its position in the mandate hierarchy (and towards which biodiesel counts extra according to its equivalence value). This RIN value is also estimated to tend to be positive after 10-years based on these assumptions. Under the baseline assumptions about petroleum prices and corn yields, RINs that count towards the overall mandate are likely to take only a smaller value per gallon. If the petroleum price were higher, then the RIN values would be lower. In this case, the greater consumer willingness to buy biofuels implies that the mandates tend to be less binding.

Summary

The short-run limits to supply and demand responses to changing biofuel market conditions in the form of large in-

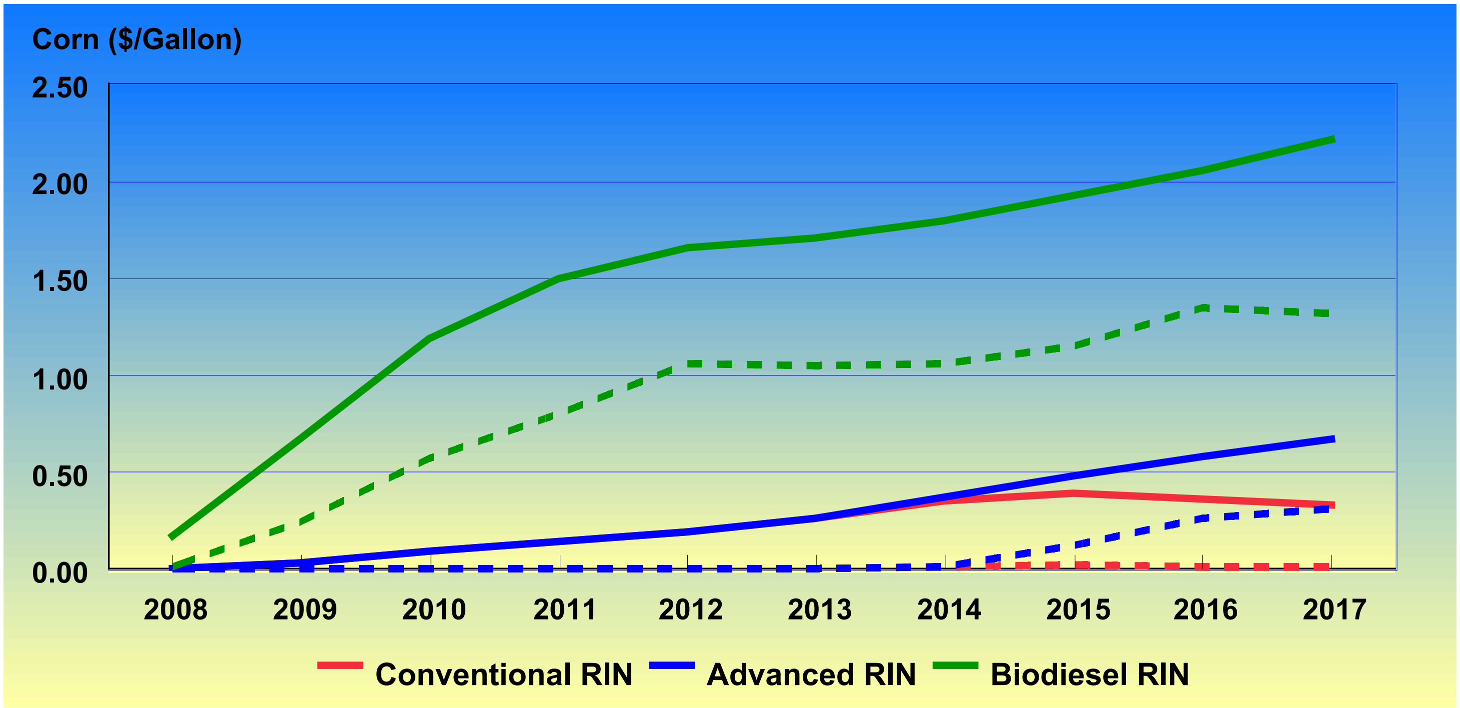

Figure 6. Core RIN Values by Year, for Average and High Petroleum Prices

Note: Solid lines represent annual average RIN core values from 500 stochastic simulations; dashed lines represent RIN core values for the 50 stochastic simulation results associated with the highest petroleum prices.

vestments in biofuel production capital and consumer adoption costs lead to a greater role for expectations. But the links between motor fuel markets and agricultural commodity markets have been recognized. The potential for policies to influence, or even sever, these links is perhaps less well recognized, however, and the potential that biofuel policies represent a new source of risk may not be so well known.

Policies do and have changed. With the ethanol tariff set to expire at end of 2008, the Farm Bill of 2008 extended it to 2010, and also reduced the tax credit. Whereas the mandate requiring minimum levels of biofuel use were introduced in the 2005 Energy Policy Act, the Energy Independence and Security Act of 2007 revised the mandate system only shortly after rules were written to implement the previous ones. Given such a rapidly evolving policy framework, market participants must be aware how policy changes can affect markets.

Mandates can have a defining role on market quantities if binding, but have almost no effect on quantities if they are not binding. Thus, the context is critical to assessing how mandates will affect markets as they grow over time or if they are revised further through new legislative action. Key determining factors, such as the petroleum price and weather-induced supply shocks, must be taken into account to assess whether or not the mandates are binding. More subtly, the effects of other biofuel policies, such as the tax credit, depend on whether or not the mandate is binding.

The Renewable Identification Numbers (RINs) will be a useful measure of the degree to which a mandate is binding and a key element of profitability and costs for market participants if a mandate is binding. As such, they may represent a new potential focus of policy intervention. For example, policy makers may use the RIN value as a measure of the degree to which the mandate affects markets and may introduce some mechanism to address the case of very high RINs. Such a policy might reflect concerns about agricultural commodity market events as much as biofuel markets, although the indirect links between RIN value and crop prices may be judged too imprecise. Such speculation about possible future policy initiatives invites further research.

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