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Understanding the Behavior of Biodiesel RINs Prices

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October 10, 2014

farmdoc daily (4):196

Recommended citation format: Irwin, S. "[Understanding the Behavior of Biodiesel RINs Prices](http://farmdocdaily.illinois.edu/2014/10/understanding-behavior-of-biodiesel-rins-prices.html)." *farmdoc daily* (4):196, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, October 10, 2014.

Permalink URL <http://farmdocdaily.illinois.edu/2014/10/understanding-behavior-of-biodiesel-rins-prices.html>

Press reports indicate that EPA deliberations about the final 2014 rulemaking for the RFS are nearing an end. There is some uncertainty whether the final rules will be announced before or after the upcoming November election date, but it certainly appears that the release of the highly contentious 2014 rules is imminent. A *farmdoc daily* article last summer ([August 8, 2014](#)) used RINs prices to project market expectations about the size of the renewable (ethanol) mandate in the final rulemaking. The analysis was based on a conceptual model of the ethanol market where the renewable mandate in excess of the E10 blend wall (the "renewable gap") effectively becomes additional biodiesel mandate. When this happens, D6 ethanol RINs are priced as D4 biodiesel RINs. This is the motivation for focusing on the relationship between D6 and D4 RINs prices to infer market expectations about the size of the renewable gap in the final 2014 rulemaking. While certainly interesting, the analysis leaves open the question of what drives the level of D4 biodiesel RINs prices, which in turn drives the level of D6 ethanol RINs prices when the renewable mandate exceeds the blend wall. The purpose of today's article is to investigate the drivers of the level of D4 biodiesel prices. A particular focus is the behavior of D4 prices in 2014.

We begin by reviewing a conceptual model for pricing biodiesel RINs that has been used in several previous *farmdoc daily* articles (for example, [October 24, 2013](#), [October 30, 2013](#), [October 31, 2013](#)). The model in Figure 1 assumes that biodiesel demand is perfectly elastic (horizontal) for biodiesel prices equal to (ultra low sulfur) diesel prices. This reflects an assumption that biodiesel and diesel are perfect substitutes and that biodiesel is a small enough part of the diesel market that changes in the biodiesel price do not impact the overall demand for diesel fuel. One could go further and adjust biodiesel prices to reflect the lower energy content of biodiesel ([about 12% lower](#)) compared to petroleum diesel. However, given the low biodiesel blends typically used in the marketplace today, it is doubtful that this lower energy content is priced at the retail level. So, we assume no adjustment is necessary. Lastly, the model accounts for the biodiesel blenders credit that has been in place in the past but expired at the end of 2013. The policy effectively shifts the biodiesel demand curve up by the amount of the credit, which is \$1 per gallon. At any given quantity of biodiesel, the effective selling price for biodiesel is increased by the amount of the credit.

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The model in Figure 1 assumes an RFS biodiesel mandate of 1.28 billion gallons, the level in 2013 and the level proposed by the EPA for 2014 and 2015 in its preliminary 2014 rulemaking. That is, the mandated quantity exceeds the small amount of biodiesel that would be produced in the U.S. absent the RFS mandate and no tax credit ($Q1^*$), as well as the larger amount of biodiesel that would be produced absent the RFS mandate but with a tax credit in place ($Q2^*$). In order to get the higher than equilibrium quantity produced in the first scenario, biodiesel producers must be paid a price that is higher (P_{bd}) than the breakeven diesel price (P_{ulsd}). From the perspective of a diesel blender, there is a wedge between the price paid to biodiesel producers and the price charged to consumers for the biodiesel in diesel blends. This wedge, or loss, is the diesel price minus the biodiesel price at the mandated quantity. The wedge also equals the “wet” price of a D4 biodiesel RIN. This terminology is used because a gallon of wet biodiesel generates 1.5 ethanol equivalent RINs. In the second scenario, the upward shift in the demand curve due to the blenders tax credit ends up reducing the wet RINs price by exactly the amount of the tax credit. The mandate is still binding at 1.28 billion gallons, but blender losses are reduced by the amount of the tax credit, and hence, the lower RINs price.

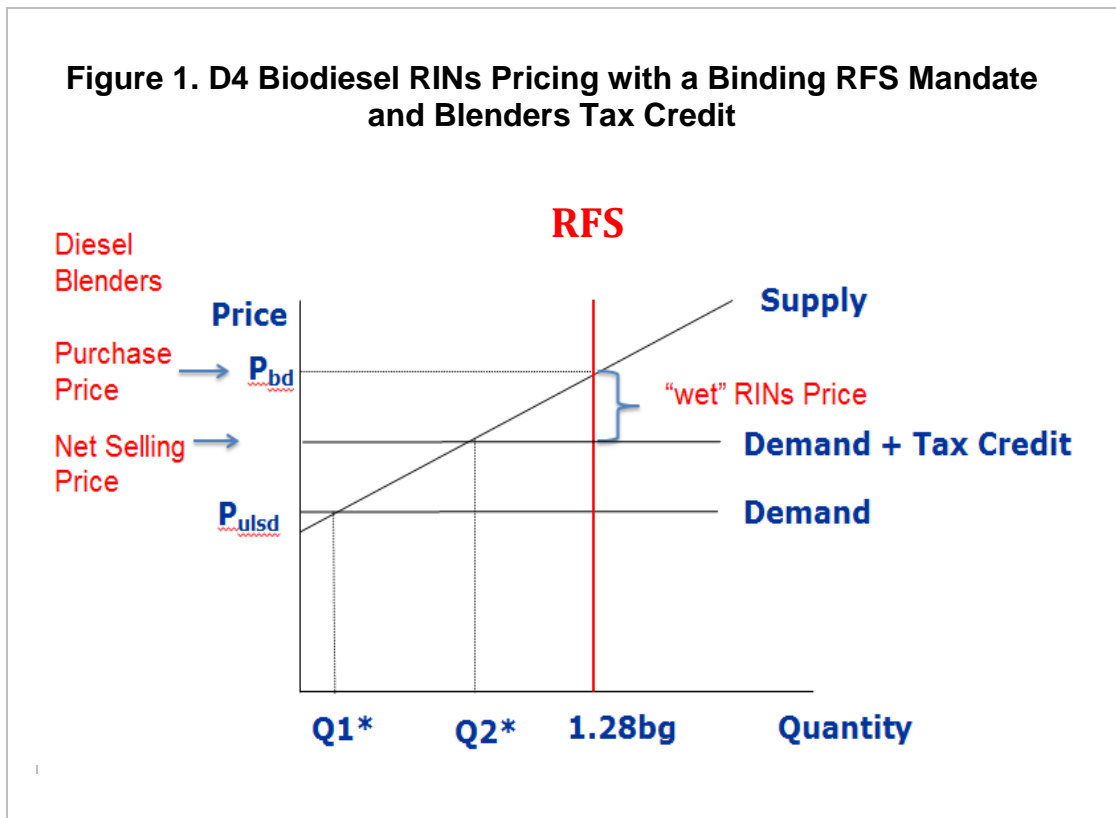


Figure 1 highlights the key variables that determine the price of a D4 biodiesel RIN. The D4 price will vary directly with the steepness (slope) and position (intercept) of the biodiesel supply curve. For example, a parallel downward shift in the supply curve will reduce the RINs price accordingly. The market price of diesel shifts the demand curve up or down, and all else constant, will change the RINs price. For example, if the price of diesel declines this will shift the demand curve down and the price of RINs will increase. The blenders tax credit shifts the demand curve upward and the level of the RFS mandate determines the points of intersection with the supply and demand curves. Note that it is possible with a high enough diesel price (demand) and/or a low enough supply for the tax credit to “unbind” the biodiesel mandate and result in an equilibrium quantity higher than 1.28 billion gallons.

The model in Figure 1 actually predicts the “intrinsic” value of biodiesel RINs. In options market parlance, this refers to the immediate value of exercising an option. This is equivalent to the loss blenders incur today by blending biodiesel, and it is represented by the blending margin. There is a second component of option value that is also relevant. This value is called “extrinsic,” or “time,” value and it reflects the value to an option owner of waiting until later to exercise the option when the intrinsic value may be even

higher than it is today. In other words, time value reflects the chance that blending margins will be even larger (bigger losses) in the future. Using the options analogy we can think of a RINs price as consisting of two components:

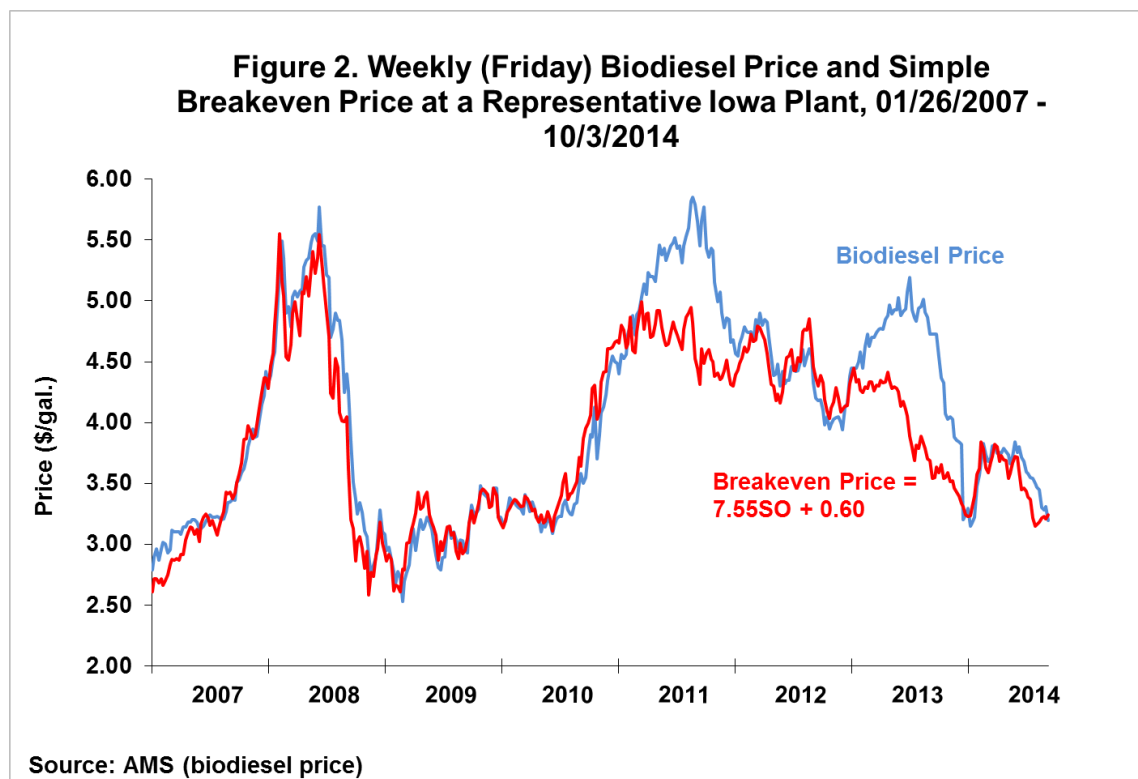
$$\text{RINs} = \text{intrinsic value} + \text{time value}.$$

By substituting for intrinsic value, we can write the value of a D4 biodiesel RINs as:

$$\text{D4 RINs} = -1 \times (\text{diesel price} - \text{biodiesel price}) + \text{tax credit} + \text{time value}.$$

The blending margin is multiplied by -1 in order to generate positive intrinsic values for the RINs “option.” The above equation provides the key to understanding the level of D4 RINs prices. Note that some analysts refer to the time value as the “speculative” component of RINs prices.

With this conceptual background, the drivers of D4 biodiesel RINs prices in 2014 can be analyzed. We start with biodiesel prices. Figure 2 plots the weekly biodiesel price at Iowa plants versus a simplified breakeven profit relationship between soybean oil and biodiesel prices from January 26, 2007 through October 3, 2014. Since soybean oil represents over 80 percent of the variable operating costs of the assumed representative plant (see the *farmdoc daily* article on [March 19, 2014](#) for details), all other costs are lumped into the constant term of 0.60, or 60 cents per gallon of biodiesel produced. The 7.55 slope is just the number of pounds of soybean oil required to produce a gallon of biodiesel. It is readily observed that, outside of the two obvious spikes, the market has generally priced biodiesel based on the cost of soybean oil, a markup for other variable and fixed costs, and zero profits. This implies that biodiesel and soybean oil prices track one another quite closely outside of the two spikes, and this has certainly has been the case in 2014. Biodiesel prices today are relatively low because soybean oil prices have declined precipitously from the highs of 2012 and 2013. In terms of the two seemingly anomalous spikes, we have argued in previous *farmdoc daily* articles (for example, [September 25, 2013](#)) that biodiesel prices were pushed up substantially above breakeven levels due to diesel blenders racing to take advantage of the tax credit before it expired.



The next step of the empirical analysis is to compare the trends in biodiesel and diesel prices, which determine the blending margin for biodiesel. Figure 3 shows weekly wholesale prices of biodiesel and (ultra low sulfur) diesel at Chicago from January 25, 2007 through October 2, 2014. Two trends stand

out. First, diesel prices have traded in a narrow range since 2011, about \$2.75 to \$3.25 per gallon. Second, biodiesel prices have declined sharply since peaking in 2011. Prices in 2014 generally have traded in a range from about \$3 to \$4 per gallon, and in recent weeks, near the bottom of the range. As noted above, the decline in biodiesel prices has been driven by the decline in soybean oil prices. The net effect of these two trends, shown in Figure 4, has been to drive blending losses for biodiesel in 2014 to the lowest levels experienced in the last eight years. The blending margin in 2014 has ranged from about -\$0.25 to -\$0.75 per gallon, compared to margins as large as -\$3 to -\$4 per gallon in the past.

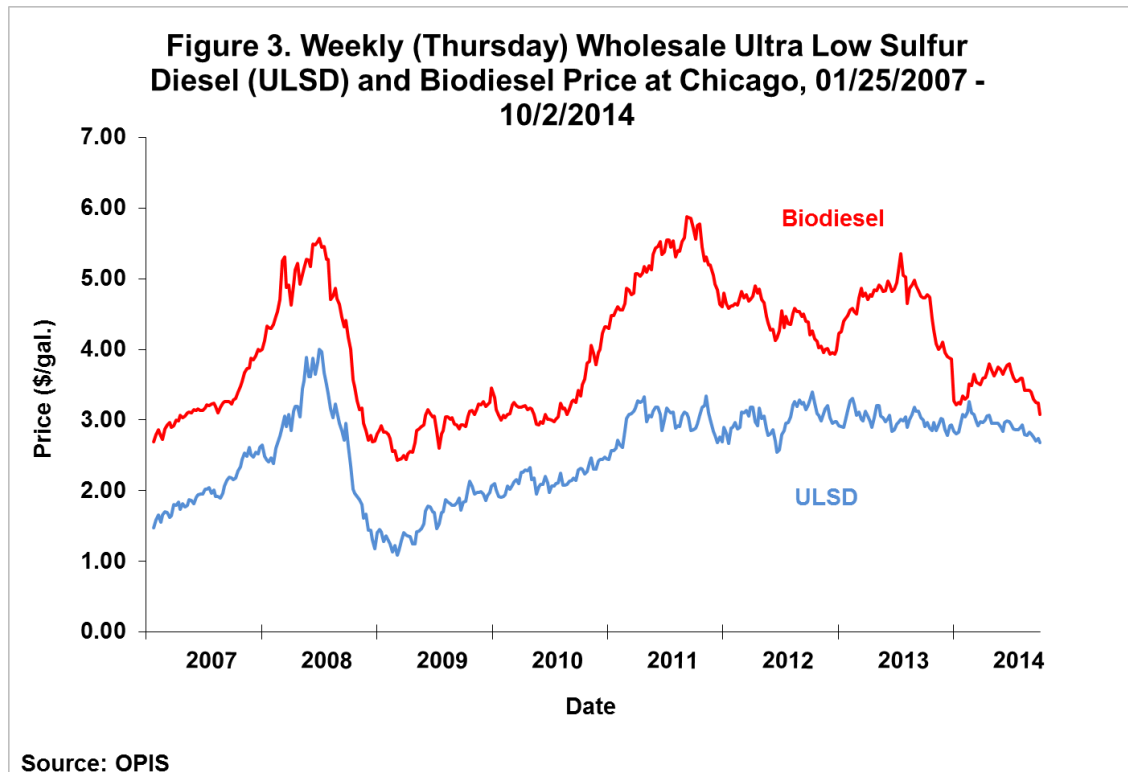


Figure 4. Weekly (Thursday) Blending Margin between Wholesale Ultra Low Sulfur Diesel (ULSD) and Biodiesel at Chicago, 01/25/2007 - 10/2/2014

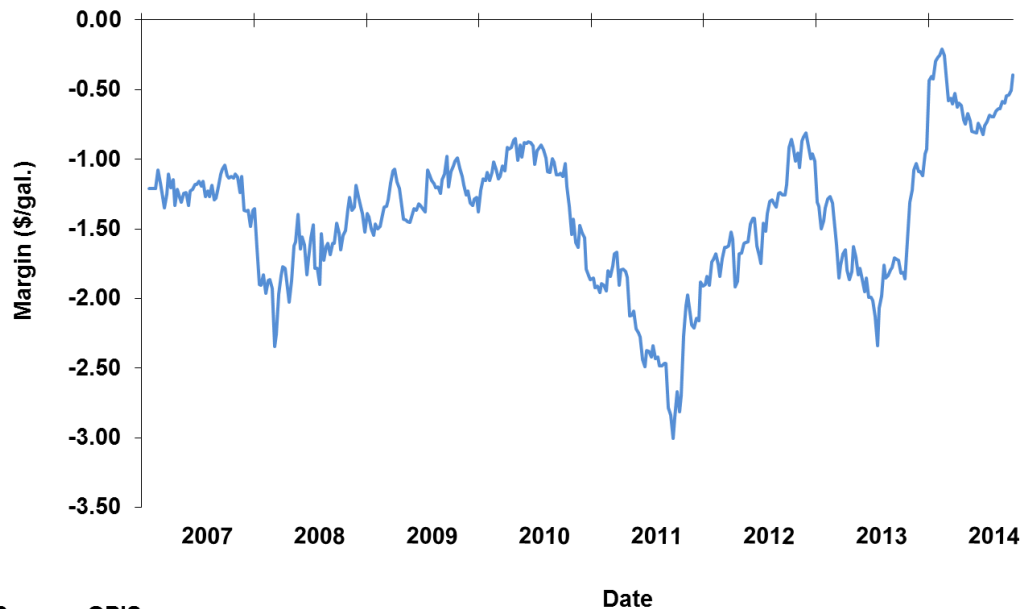
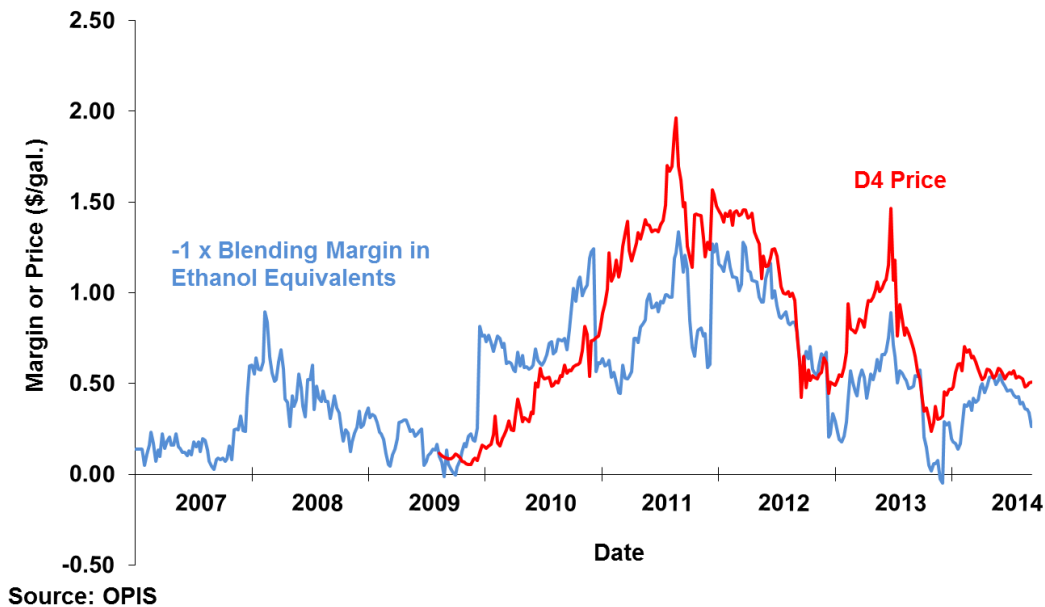


Figure 5. Weekly (Thursday) Blending Margin between Wholesale Ultra Low Sulfur Diesel (ULSD) and Biodiesel at Chicago Net of Blenders Tax Credit and D4 Biodiesel RINs Price, 01/25/2007 - 10/2/2014



With this background we can now check how closely D4 biodiesel RINs prices track blending margins. Figure 5 shows the biodiesel blending margin at the wholesale level in Chicago and the D4 RINs price. As before, the blending margin is presented from January 25, 2007 through October 2, 2014. The available data on D4 prices does not begin until September 3, 2009. Note that the margin shown in Figure 5 is the same as in Figure 4 except the margin in Figure 5 is: i) adjusted for the \$1 per gallon tax

credit when it is place (2007-2009, 2011, 2013); multiplied by -1 to facilitate comparison to the market price of D4 RINs; and iii) divided by 1.5 in order to state the margin in ethanol equivalent units. A regression of blending margins on D4 prices has an R² of 0.84, which indicates that the variation in blending margins explains 84 percent of the variation in D4 prices. So, D4 prices track the movement of blending margins reasonably closely, which makes sense since the blending margin represents the intrinsic, and largest, component of the RINs value.

There is an especially interesting pattern between blending margins and D4 prices related to the tax credit. In the two full calendar years when the blenders tax credit is in place, 2011 and 2013, D4 RINs prices tend to be well above the blending margin, with the difference presumably reflecting the time value of the RINs. The level of time value in these two years is substantial, averaging \$0.51 per gallon in 2011 and \$0.31 per gallon in 2013. This represents about 40 percent of the RINs value in these years. In years when the blenders tax credit is not in place, 2010, 2012, and 2014, D4 RINs prices tend to be either substantially less than the blending margin or very close to the blending margin. Specifically, computed time values averaged -\$0.31, \$0.16, and \$0.17 in 2010, 2012, and 2014 (to date), respectively. It clearly makes no sense for the time value to be negative, as apparently occurred for the entire 2010 calendar year. The most logical explanation is related to market expectations about the blenders tax credit being reinstated retroactively. This turned out to actually be the case for both 2010 and 2012, although the timing differed in each case. An example will help illustrate the point. Assume the following values for 2010: i) blending margin of -\$0.75 (ethanol equivalents with no tax credit), ii) time value of \$0.30, and iii) a 100 percent probability that the tax credit ($\$1/1.5 = \0.67 per gallon in ethanol equivalents) will be reinstated retroactively for 2010. Under these assumptions, the rational value for a D4 RINs is: $\$0.38 = 1 \times [(-1 \times -\$0.75) + \$0.30 - \$0.67] + 0 \times [(-1 \times -\$0.75) + \$0.30]$. If one compares the RINs market value of \$0.38 to the \$0.75 intrinsic value, then something appears to be badly out-of-line. The explanation is that RINs traders take into account the full value of the tax credit when valuing the RINs because they are 100 percent confident that the credit will be reinstated retroactively.

An important implication of the previous analysis is that the market value of RINs will change as traders beliefs about the tax credit being reinstated retroactively change. For example, assume that traders believe there is only a 50 percent chance the credit will be reinstated. The rational value for a D4 RINs in the above example then becomes: $\$0.71 = .5 \times [(-1 \times -\$0.75) + \$0.30 - \$0.67] + .5 \times [(-1 \times -\$0.75) + \$0.30]$. This clearly demonstrates how the market value of a D4 RINs can change substantially as traders revise their expectations regarding the chance of the tax credit being reinstated retroactively. There is a dramatic example of this type of changing belief in 2012. At the end of July 2012, traders apparently believed there was a low probability of the tax credit being reinstated, as D4s traded around \$1.20 relative to a blending margin of about -\$0.85 (ethanol equivalents with no tax credit). Then, in early August the [U.S. Senate Finance Committee approved a bill](#) to extend and reinstate the biodiesel tax credit. Over the subsequent two months D4 RINs lost over half their value, bottoming at \$0.43. Blending margins also dropped over this time period, but by a much smaller amount, which implies that the computed time value of D4s went sharply negative.

With this background, it is interesting to consider the movement of D4 biodiesel RINs in 2014. We know that: i) the biodiesel blenders credit expired at the end of 2013; ii) blending losses for biodiesel have been unusually low in 2014 due to declining biodiesel prices and relatively stable diesel prices; iii) declining biodiesel prices have been driven by declining soybean oil prices; and iv) the time value of D4 RINs has been positive for all but one week in 2014 and averaged \$0.17 (to date). It is also interesting to observe that time value did decline in mid-2014 but then began increasing again. As of October 2, the D4 time value was \$0.24, not far from what might be considered the “normal” range in 2011 and 2013 (when retroactive reinstatement was not an issue). This combination of facts suggests that RINs traders believe there is a low probability of the biodiesel blenders credit being reinstated for 2014, otherwise D4 prices and time values would be much lower. This is surprising in light of the passage last April by the [U.S. Senate Finance Committee of a bill](#) to retroactively restore the tax credit for 2014 and extend it through 2015. A similar event in 2012 led to a collapse in D4 prices. While the ability of the RINs market to anticipate policy changes certainly has been impressive (*farmdoc daily*, [October 10, 2013](#); [February 19, 2014](#); [August 8, 2014](#)), there does appear to be the potential for a precipitous decline in D4 RINs prices if the market is surprised and the tax credit is eventually reinstated.

Implications

Since the level of D4 biodiesel RINs prices drives the level of D6 ethanol RINs prices when the renewable mandate exceeds the E10 blend wall, it is important to understand the drivers of the level of D4 prices. In this regard it is helpful to think of the price of a D4 biodiesel RINs as consisting of two components— intrinsic and time value. The intrinsic value is given by the current biodiesel blending margin, while the time value reflects the chance that blending margins will be even larger (bigger losses) in the future. The typical split between intrinsic and time value of D4 RINs in recent years has been about 60/40. The empirical analysis highlights the key role of three factors in driving D4 prices: i) soybean oil prices; ii) diesel prices; and iii) the \$1 per gallon blenders tax credit. Soybean oil prices are the primary driver of biodiesel prices, which together with diesel prices determine the blending margin. The (negative) blending margin for biodiesel has been unusually low in 2014 due to declining soybean oil and biodiesel prices, as well as relatively stable diesel prices. The on- and off-again nature of the blenders tax credit introduces considerable uncertainty into the pricing of D4 biodiesel RINs. It appears that RINs traders currently believe there is a low probability of the tax credit being reinstated retroactively for 2014, otherwise D4 prices and time values would be much lower. There is the potential for a precipitous decline in D4 RINs prices if the market is surprised and the tax credit is eventually reinstated.

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November 7, 2014 NOTE: This article has been modified from the original version published on October 10, 2014. The rational value of D4 RINs examples omitted the conversion of the \$1 per gallon blenders tax credit from wet biodiesel gallons to ethanol equivalents. The conversion is now included in the formulas. This change does not alter any of the analysis in the article.