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# Projecting Biodiesel RINs Prices under Different Policies

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**Introduction**

In a *farmdoc daily* article last week (August 23, 2017), we developed a simple economic model to predict D4 biodiesel RINs prices based on biodiesel prices, diesel prices, and the biodiesel tax credit. Empirical analysis using historical data shows that the simple predictive model performs quite well as a D4 valuation benchmark. This is an important result because it shows that biodiesel RINs prices are mainly driven by economic fundamentals rather than speculation or manipulation. Here, we use the economic model to project future biodiesel RINs prices under several policy scenarios, including the restriction of biomass-based diesel (BBD) imports, increasing RFS BBD requirements, and converting the blender tax credit to a producer tax credit. This continues the recent series of *farmdoc daily* articles (July 12, 2017; July 19, 2017; July 26,2017; August 9, 2017; August 16, 2017; August 23, 2017) that examine the role that BBD plays with respect to compliance with RFS mandates.

**Analysis**

We begin by reviewing the predictive model of D4 biodiesel RINs prices developed in the *farmdoc daily* article of August 23, 2017. With a $1 per gallon blender tax credit, the predicted biodiesel RINs price is:

$$(1) \qquad D4 = P_{BBD} - (P_{ULSD} + 1),$$

where $P_{BBD}$ is the wholesale price of BBD and $P_{ULSD}$ is the wholesale price of ultra low sulphur diesel. With a $1 producer tax credit, the predicted biodiesel RINs price is:

$$(2) \qquad D4 = (P_{BBD} - 1) - P_{ULSD}.$$

In essence, the predicted D4 price for either model is the negative of the wholesale biodiesel blending margin net of the tax credit. Note that in the remainder of this article we use "biodiesel" and "biomass-based diesel" interchangeably.

Projecting future D4 prices using the models given by (1) or (2) requires predictions of biomass-based diesel and ultra low sulphur diesel prices for the policy scenarios under consideration. This in turn requires estimates of the relevant supply and demand curves for BBD. The *farmdoc daily* article of August 23 shows which supply and demand curves are relevant for each policy scenario and the article of

July 26 provides estimates of the BBD supply curves. We specify BBD demand curves based on an assumed price of diesel and two levels of total BBD RFS requirements.

We start in Figure 1 with our base case estimates of the supply and demand for BBD in the U.S. without an RFS mandate or blender tax credit. The total supply curve is a horizontal summation of estimated BBD net import (imports – exports) and domestic supply curves, where the net import and domestic supply curves were estimated by regressing the annualized monthly net imports and domestic production in 2016 on the average monthly price of BBD. We assume that the wholesale price of biodiesel in Chicago is representative of the national price of all BBD. The estimated total supply curve also reflects soybean oil prices in the range experienced in 2016 and currently prevail. The supply curve would be expected to shift with different levels of feed stock prices. Since we assume that BBD and petroleum diesel are perfect substitutes after adjustment for the lower energy value of most BBD, the demand curve is simply a horizontal line equal to the energy-adjusted diesel price. We assume a wholesale diesel price of $1.60 per gallon, near recent levels, which is $1.48 after adjusting for the lower energy content of most BBD (assumed to be approximately 92 percent of diesel). Since the intercept of the supply curve on the *y*-axis of $2.50 is substantially above the intercept of the demand curve of $1.48, the equilibrium quantity of BBD is equal to zero. In other words, in the absence of RFS mandates and the blender tax credit there would be no BBD produced or consumed in the U.S.

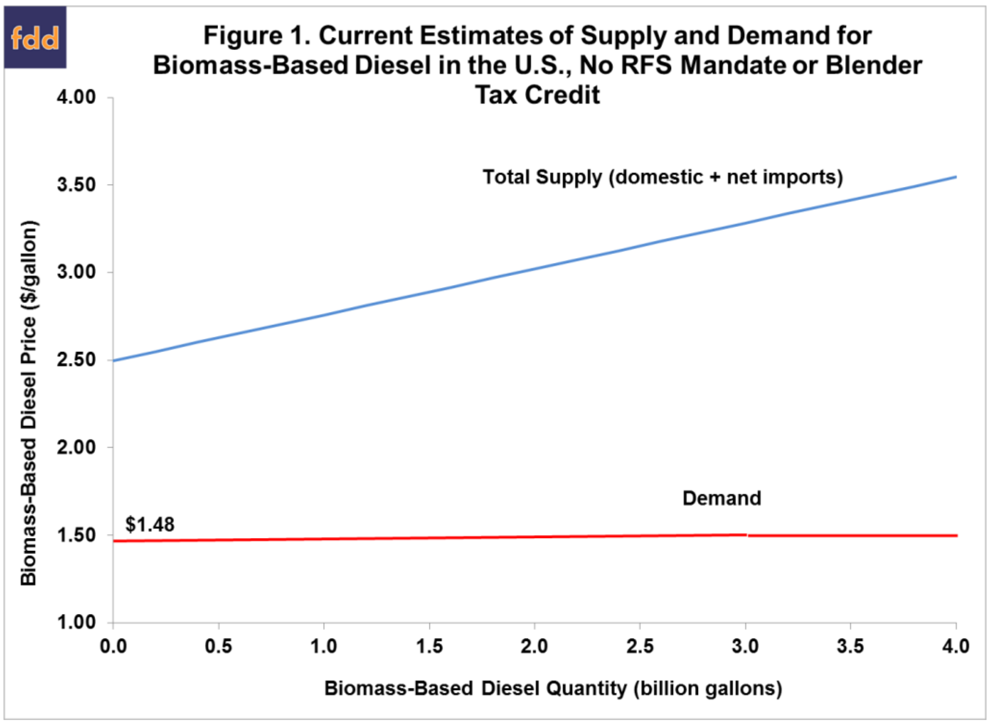
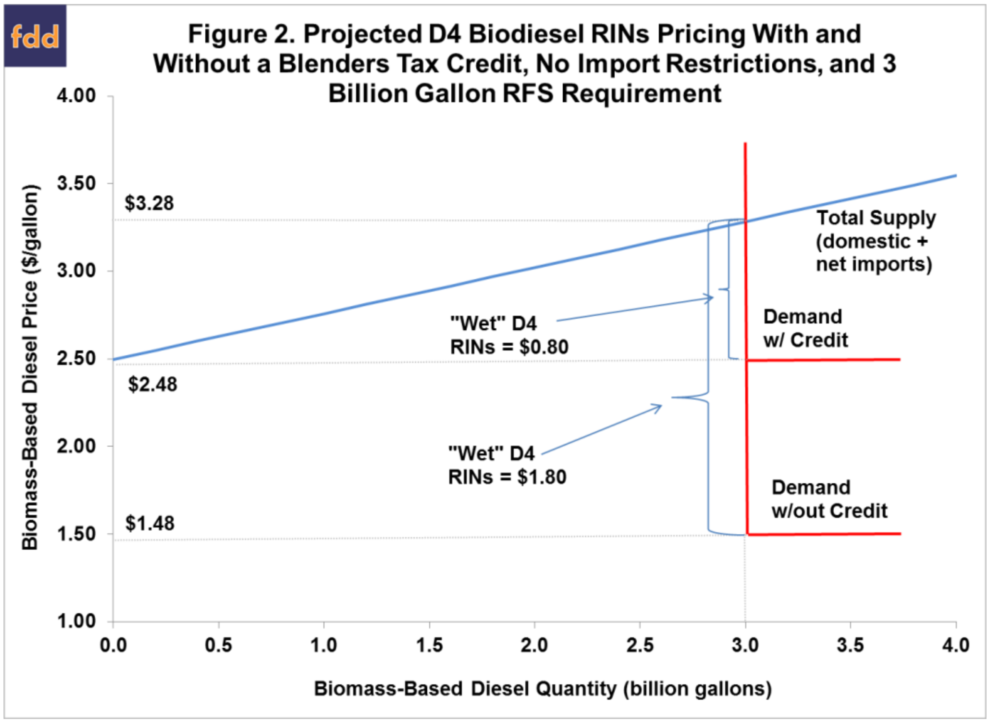


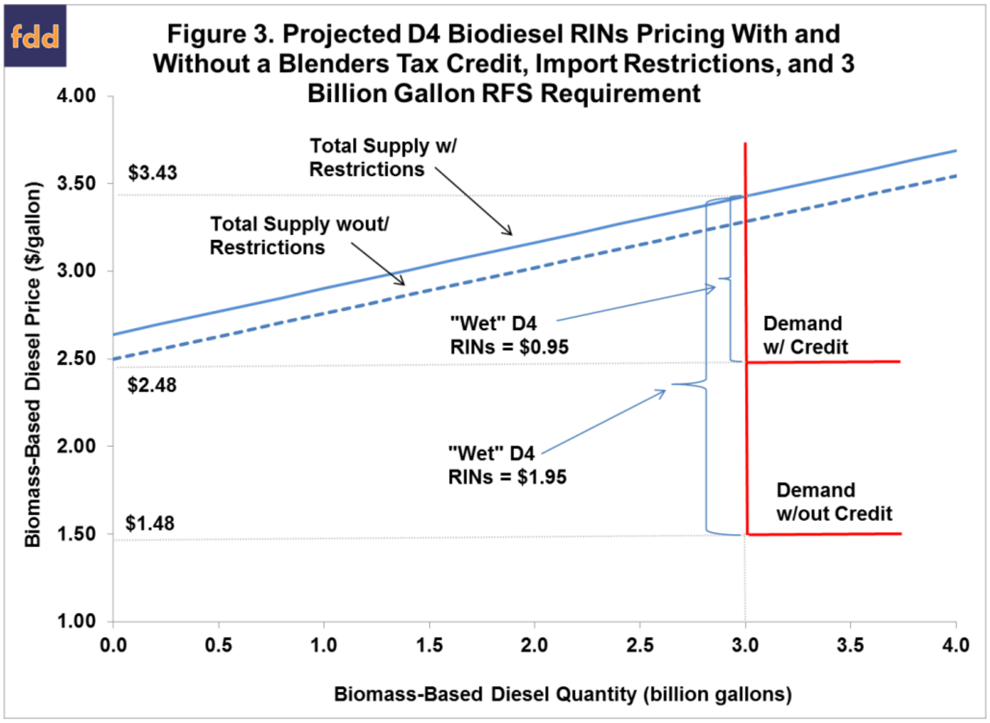

Figure 2 presents our first example of D4 biodiesel RINs pricing with RFS mandates and the blender tax credit. The "L-shaped" BBD demand curves assume a 3 billion gallon total RFS requirement for BBD to comply not only with the advanced mandate but also the conventional (ethanol) mandate due to the constraints on ethanol consumption presented by the E10 blend wall (see the *farmdoc daily* article of July 19, 2017 for further details). This assumed requirement pivots the horizontal segment of the demand curve shown in Figure 1 below 3 billion gallons until this segment is vertical. Projecting the D4 price without a blender tax credit is straightforward. In order to incentivize production of the required 3 billion gallons under the RFS, BBD producers must be paid a price of $3.28 per gallon, which is higher than the (energy-adjusted) demand price of diesel of $1.48 per gallon. This price difference of $1.80 ($3.28 - $1.48) is the equilibrium "wet" D4 RINs price. We use the terminology "wet" here to denote physical gallons of BBD since actual RINs are traded in ethanol-equivalent gallons. The conversion from wet to ethanol equivalent RINs prices is accomplished by dividing the wet price by 1.5, so in ethanol-equivalent terms the projected D4 price without the blender tax credit is $1.20 per gallon. Adding the blender tax credit simply shifts up the horizontal part of the demand curve by $1 per gallon, which reduces the projected wet RINs price by $1 to $0.80 ($0.53 in ethanol-equivalents).




One can think of the projected D4 RINs as representing the price at which a diesel blender is indifferent between actually blending BBD or blending on paper by purchasing the RINs. This allows us to decompose the producer BBD price as $P_{BBD} = P_{ULSD} + D4$. So, at the producer level, the price of BBD equals the energy-adjusted diesel price plus the RINs value. Without a blender tax credit this decomposition is $3.28 = $1.48 + $1.80 and with the blender tax credit it is $3.28 = $2.48 + $0.80. Of course, this is just a restatement of the original pricing model shown in equation (1).

Figure 3 incorporates a policy of restricting BBD imports to the U.S. along with a 3 billion gallon RFS requirement and the blender tax credit. This scenario reflects the possibility of restricting BBD imports from Argentina and Indonesia due to an antidumping and countervailing duty petition filed by U.S. producers with the U.S. Department of Commerce (DOC) and the International Trade Commission in March 2017. The DOC made a preliminary ruling last week and imposed duties in the form of “cash deposits.” The deposit rates range from 50.29% to 64.17% of the value of Argentinian biodiesel and from 41.06% to 68.28% for Indonesian biodiesel. We assume this is sufficient to eliminate all biodiesel imports from Argentina and Indonesia, which totaled about 546 million gallons for 2016, accounting for 48 percent of total BBD imports. This shifts the import supply curve and total supply curve to the left. Specifically, we subtract 546 million gallons from the total quantity supplied at each price level in Figure 3. This has the straightforward effect of raising the producer BBD price by $0.15 to $3.43, which in turn increases the wet D4 RINs price without the blender tax credit from $1.80 to $1.95 and the wet price with the blender tax credit from $0.80 to $0.95.

Figure 4 considers the impact on D4 prices of converting the $1 per gallon biodiesel tax credit from a blender to a producer credit. Proposals to convert the tax credit to a producer basis were introduced into the U.S. Congress starting in 2015 (e.g., *farmdoc daily*, August 5, 2015). Some proposals would allow only domestic U.S. BBD production to be eligible for the credit, while others would allow all North American BBD production to be eligible. If the tax credit is limited only to U.S. BBD producers this would basically place a $1 per gallon duty on all U.S. BBD imports, and in all likelihood, this would eliminate all U.S. BBD imports and make the U.S. a biodiesel “island.” The impact of full conversion to a producer credit on D4 prices is shown in Figure 6 in two steps. The first is to change from the total supply curve used in Figures 1-3 to the domestic supply curve without a producer tax credit because we are assuming that the conversion eliminates all BBD imports from total supply. Since domestic producers receive a $1 per gallon credit, the second step is to shift the domestic supply curve down and to the right by $1. In this new equilibrium, BBD producers must be paid a market price of $2.88 per gallon to incentivize 3 billion gallons of production (the total producer price is $2.88 + $1 = $3.88). The demand curve is unaffected because producers collect the tax credit rather than blenders; and hence, the demand price for BBD remains at $1.48 per gallon. The net effect is a projected wet D4 RINs price of $1.40, or $0.93 in ethanol equivalent terms.



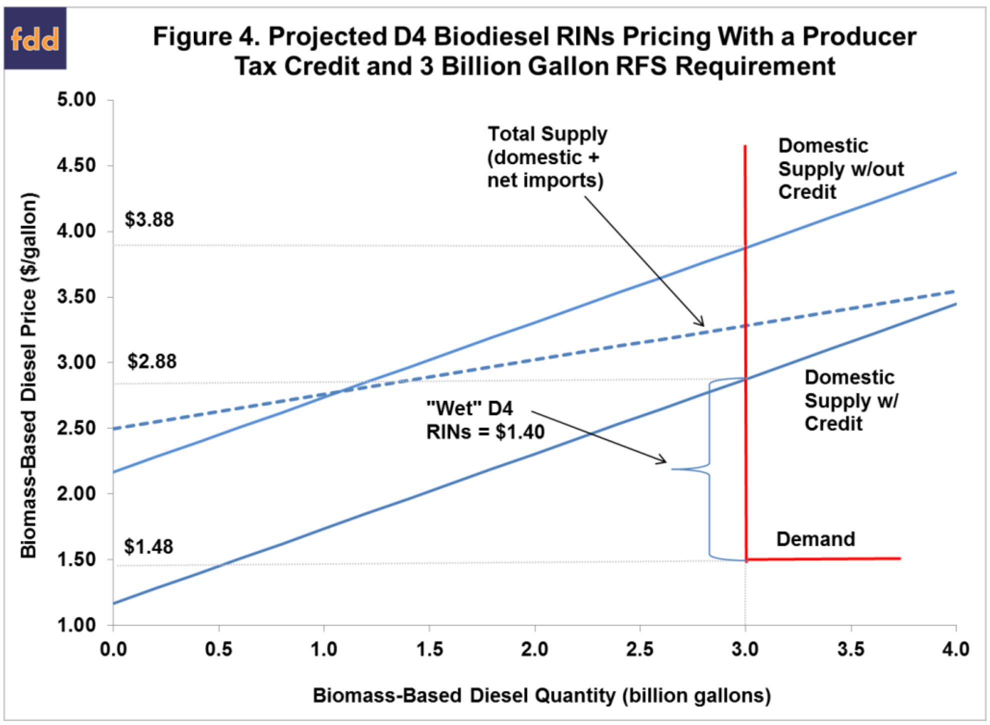




Table 1 shows the details of projected D4 RINs prices for each of the scenarios in Figures 2-4. We also add scenarios for a total annual BBD requirement of 3.5 billion gallons. This reflects the possibility that future mandate volumes could be increased to “backfill” earlier volumes that were reduced based on the EPA's interpretation of its "inadequate domestic supply" waiver authority. A U.S. Appeals Court recently invalidated EPA’s interpretation (*farmdoc daily*, August 9, 2017; August 18, 2017). This simply shifts the demand curves shown in Figures 2-4 to the right by 500 million gallons. The projections in Table 1 show that the addition of backfill mandate volumes has a modest impact on D4 prices relative to the same policy scenarios without backfill volumes. In ethanol-equivalent terms, projected prices for the scenarios with or without a blender tax credit increase $0.09 per gallon and for the scenario with a producer tax credit the prices rises by $0.19. These increases range from about 7 to 20 percent of the projected D4 prices without backfill. While these are certainly non-negligible increases, they are not extremely large either. The fundamental reason why additional backfill volumes (or import restrictions) do not increase

BBD prices substantially is the flatness of the supply curves. Technically, the supply curves are extremely price elastic (see the *farmdoc daily* article of July 26 for further details). For example, only a one percent increase in price is required to increase total BBD quantity by four percent.

**Table 1. Projected D4 Biodiesel RINs Prices Under Alternative Policy Scenarios**

| Scenario | (1) Biomass-Based Diesel Supply Price | (2) Biomass-Based Diesel Demand Price | (3) Wet D4 RINs Price | (4) Ethanol-Equivalent D4 RINs Price |
|---|---|---|---|---|
| 3 Billion Gallons of Biomass-Based Diesel for RFS | | | | |
| No Import Restrictions w/out a Blender or Producer Tax Credit | 3.28 | 1.48 | 1.80 | 1.20 |
| No Import Restrictions w/ a Blender Tax Credit | 3.28 | 2.48 | 0.80 | 0.53 |
| Import Restrictions w/out a Blender or Producer Tax Credit | 3.43 | 1.48 | 1.95 | 1.30 |
| Import Restrictions w/ a Blender Tax Credit | 3.43 | 2.48 | 0.95 | 0.63 |
| Producer Tax Credit | 2.88 | 1.48 | 1.40 | 0.93 |
| 3.5 Billion Gallons of Biomass-Based Diesel for RFS | | | | |
| No Import Restrictions w/out a Blender or Producer Tax Credit | 3.41 | 1.48 | 1.93 | 1.29 |
| No Import Restrictions w/ a Blender Tax Credit | 3.41 | 2.48 | 0.93 | 0.62 |
| Import Restrictions w/out a Blender or Producer Tax Credit | 3.56 | 1.48 | 2.08 | 1.39 |
| Import Restrictions w/ a Blender Tax Credit | 3.56 | 2.48 | 1.08 | 0.72 |
| Producer Tax Credit | 3.16 | 1.48 | 1.68 | 1.12 |

Notes: All prices are in $/gallon. Wet prices correspond to physical gallons of biomass-based diesel. Wet prices are converted to ethanol-equivalent prices by dividing wet prices by 1.5.

Another interesting observation based on the results in Table 1 is that the biodiesel tax credit, whether in blender or producer form, has a much larger impact on projected D4 RINs prices than restricting imports or the addition of backfill mandate volumes. The projected D4 RINs price with a 3 billion gallon RFS requirement and no tax credit is $1.20 versus $0.53 with the credit, which is more than a 50 percent difference. Similar differences are found for the other policy scenarios. This shows how the on- and off-again nature of the biodiesel tax credit is a major driver of the volatility of D4 RINs prices.

Finally, when considering the D4 biodiesel RINs price projections in Table 1 it is important to recognize several potential limitations. First, the estimated supply curves are based entirely on data from 2016. There is a good reason why this is the case (*farmdoc daily*, July 26, 2017), but as a consequence the estimates are based on a small sample of observations and all the potential inaccuracies that may imply. Second, results of our analysis would differ if supply curves are non-linear beyond the largest observed annualized values we used in estimating the linear supply curves. Third, the estimated supply curves reflect soybean oil prices in the range experienced in 2016 and near present levels. The supply curves would be expected to shift up or down if soybean oil prices moved substantially above or below the range that occurred during the 2016 sample period. Fourth, diesel prices were assumed to be near present levels and any shift away from this level will increase or decrease projected D4 prices.

**Implications**

Biodiesel RINs prices play a crucial role in the cost of complying with RFS mandates because biomass-based diesel (BBD) is the marginal gallon for meeting both the advanced and conventional ethanol mandate. We use a simple economic model to project future D4 biodiesel RINs prices under several policy scenarios, including the restriction of BBD imports, increasing RFS BBD requirements, and converting the blender tax credit to a producer tax credit. The analysis leads to several interesting observations. First, restricting biodiesel imports from Argentina and Indonesia or the addition of "backfill" mandate volumes has a surprisingly modest impact on D4 prices, increasing prices between 7 and 20 percent depending on the policy scenario. This modest impact on D4 prices is due to the flatness of the estimated supply curves used in the analysis. Second, by a wide margin, the biodiesel tax credit, whether in blender or producer form, has the largest impact on projected D4 RINs prices. For example, the projected price with a 3 billion gallon RFS requirement and no tax credit is $1.20 versus $0.53 with the credit, more than a 50 percent difference. Third, the D4 RINs market appears to be vulnerable to a substantial sell-off if the biodiesel tax credit is reinstated and extended at some point before the end of 2017. D4 RINs are currently trading near $1.15 in the secondary market, in the upper range of our price projections. With the tax credited reinstated and present soybean oil prices, D4 RINs prices could easily drop into the $0.60-$0.70 range. It appears that RINs traders are betting there is not a very high chance that the biodiesel tax credit will return.

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