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RINs Gone Wild? (round 2)

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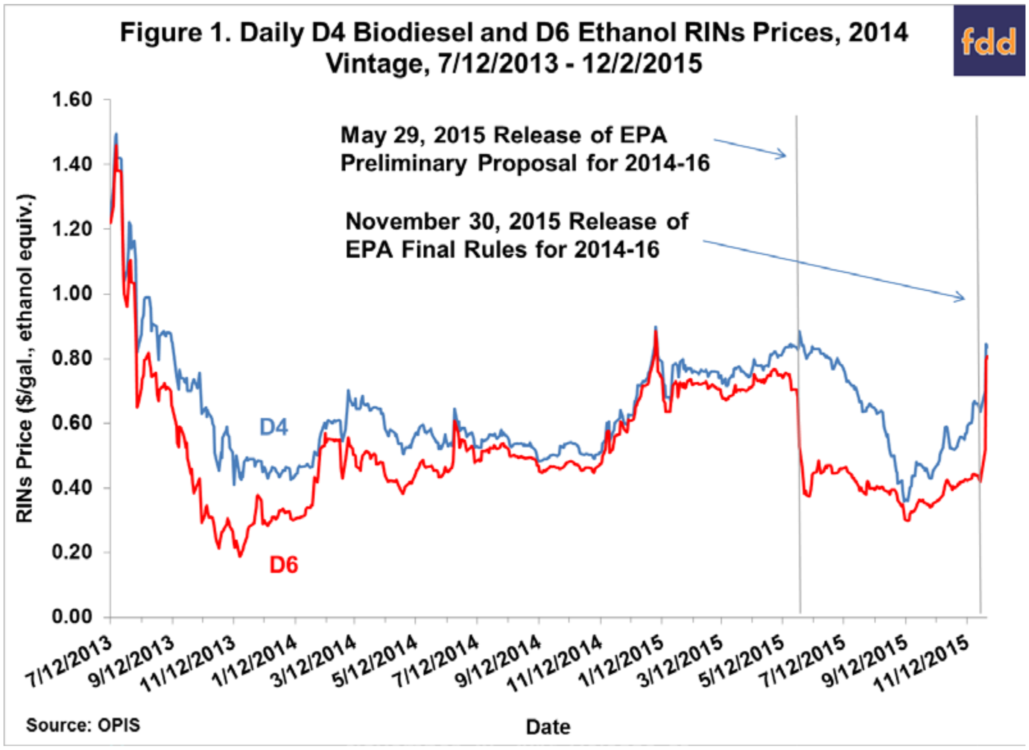
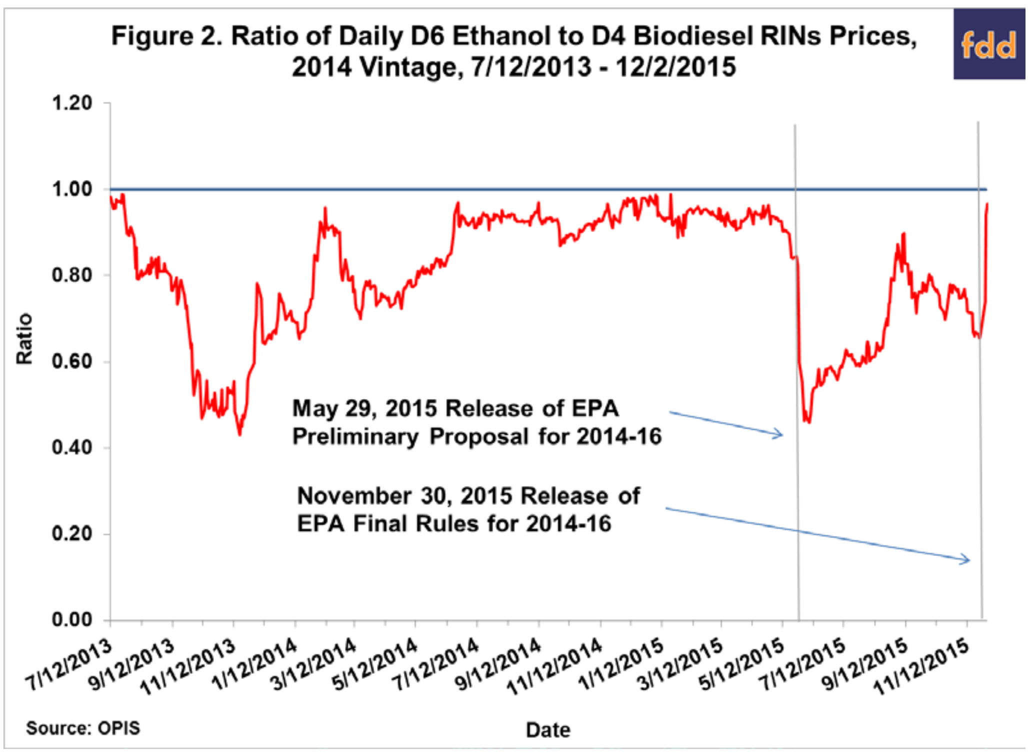
The EPA released the final rulemaking for 2014-2016 RFS standards on Monday, November 30. This release follows preliminary rulemaking released on May 29 of this year. Figures 1 and 2 are based on continuous series of daily 2014 vintage D4 biodiesel and D6 ethanol RINs prices through the close of trading on Wednesday, December 2, and they demonstrate that the final standards were a major shock to the RINs market. In the three trading days since the EPA announcement, the price of D4 biodiesel RINs jumped $0.20 per gallon, or 31 percent, and the price of D6 ethanol RINs increased $0.39 per gallon, or 92 percent. Except for a brief spike in January 2015, the Wednesday price for a 2014 vintage D6 RINs, $0.8075 per gallon, is the highest since August 2013. Equally impressive, the D6/D4 price ratio rose from 0.66 to 0.97 over these three trading days. Since RINs prices represent the marginal cost of complying with RFS mandates, it is important to understand why such large changes occurred. The purpose of this article is to provide an explanation for the recent spike in RINs prices. We begin by delving into the details of the 2014-2016 RFS volume requirements in the November 30 final rulemaking.

2014-2016 RFS Volume Requirements

The RFS statutes require the EPA to establish biofuel volume requirements in four categories for each year from 2008 through 2022: cellulosic biofuel, biomass-based diesel (BBD), total advanced biofuel (which includes BBD), and conventional biofuel. The difference between the total advanced mandate and the total of the cellulosic and biodiesel mandate is referred to as the undifferentiated advanced mandate and can be satisfied by a combination of qualified advanced biofuels. Conventional biofuel is generally assumed to be corn-based ethanol but this is actually not explicitly required by the RFS legislation. Instead, corn-based ethanol has been the cheapest alternative for this category that also meets the environmental requirements of the RFS. For ease of discussion, however, we will refer to conventional biofuel as conventional ethanol. In addition, the conventional portion of the mandate can also be satisfied with discretionary blending of advanced biofuels, so we refer to the conventional mandate as an implied mandate





The first section of Table 1 provides a summary of RFS statutory volume requirements for 2014 through 2017. The biodiesel mandate was established as a minimum of one billion gallons per year from 2012 through 2022, with larger amounts subject to EPA approval. The implied conventional mandate was specified as 14.4 billion gallons in 2014 and 15.0 billion gallons for 2015 and 2016. Note that the statutory ceiling on the implied conventional mandate is 15.0 billion gallons for the remaining life of the RFS. Total statutory renewable fuel requirements increase from 18.15 billion gallons in 2014 to 24 billion gallons in 2017.

Table 1. RFS Volume Requirements for the U.S., 2014-2017

	RFS Statutory				RFS Statutory w/Cellulosic Waiver				EPA Preliminary Proposal				EPA Final Rulemaking			
Category	**2014**	**2015**	**2016**	**2017**	**2014**	**2015**	**2016**	**2017**	**2014**	**2015**	**2016**	**2017**	**2014**	**2015**	**2016**	**2017**
Cellulosic Biofuel	1.75	3.00	4.25	5.50	0.033	0.123	0.230	NA	0.033	0.106	0.206	NA	0.033	0.123	0.230	NA
Biomass-Based Diesel	>1	>1	>1	>1	>1	>1	>1	>1	1.63	1.70	1.80	1.90	1.63	1.73	1.90	2.00
Advanced Biofuel	3.75	5.50	7.25	9.00	2.03	2.62	3.23	NA	2.68	2.90	3.40	NA	2.67	2.88	3.61	NA
Total	18.15	20.50	22.25	24.00	16.43	17.62	18.23	NA	15.93	16.30	17.40	NA	16.28	16.93	18.11	NA
Implied Conventional	14.40	15.00	15.00	15.00	14.40	15.00	15.00	NA	13.25	13.40	14.00	NA	13.61	14.05	14.50	NA

Note: These volumes are stated in billion gallons of ethanol equivalents, except for biomass-based diesel which is stated in billion gallons of "wet" physical volume terms. NA stands for not applicable.

Cellulosic biofuels have been in very limited supply, so the EPA has written down the cellulosic mandate to very low levels relative to statutory levels each year and that write-down continues. The second section of Table 1 recalculates the statutory requirements for 2014 through 2016 based on the cellulosic requirements in the November 30 final rules. The recalculated statutory requirements increase from 16.433 billion gallons in 2014 to 18.23 billion gallons in 2016. We argue that stating the statutory requirements in this manner is more realistic due to the very large write downs in cellulosic standards that have occurred and are likely to continue in the future.

The last two sections of Table 1 show the volume requirements established in the May 29 preliminary rulemaking and the November 30 final rulemaking. The EPA established final volume requirements for 2014 and 2015 based on actual and expected production of biofuels during those two years. The final volume requirements reflect some write-down from the statutory requirements beyond the write-down in the cellulosic requirements. Most notable, and controversial, are the write downs in the implied conventional mandates, from 14.4 to 13.61 billion gallons in 2014, from 15.0 to 14.05 billion gallons in 2015, and from 15.0 to 14.5 billion gallons in 2015. The write downs to the implied conventional mandates across the three years total 2.24 billion gallons. It is interesting to note that the EPA chose not to write down the advanced mandates as much as the write down in the cellulosic mandates, which means that non-cellulosic advanced biofuels meet a part of the original cellulosic mandate. This backfilling of the cellulosic mandates totals 1.27 billion gallons. The net effect of the implied conventional write downs and advanced backfilling is a write down of the total RFS mandate of 153 million gallons for 2014, 693 million gallons for 2015, and 120 million gallons for 2016.

Compared to the preliminary proposal, the final rulemaking requires an additional 350 million gallons of total renewable fuels in 2014, 630 million gallons in 2015, and 710 million gallons in 2016. The biomass-based diesel requirement increases from 1.63 billion gallons in 2014 to 1.9 billion gallons in 2016, and 2.0 billion gallons in 2017 (the only standard set for 2017). The most notable changes between the preliminary proposal and the final rulemaking are associated with the implied conventional requirement, which increased from 13.25 to 13.61 billion gallons for 2014, from 13.4 to 14.05 billion gallons in 2015, and from 14.0 to 14.5 billion gallons in 2016.

Since the RFS requirements are actually enforced in a fractional, or percentage, fashion rather than in a volumetric fashion, it is also important to consider how these fractional requirements changed between the preliminary and final rulemaking. In other words, obligated parties under the RFS must demonstrate that their blending of biofuels as a percentage of total firm production of transportation fuel (petroleum gasoline + petroleum diesel) meets or exceeds the percentage standard established by the EPA. The percentage standard for a given year is simply the mandated national biofuels volume (in ethanol equivalent gallons) divided by total national use of transportation fuel. Table 2 presents the fractional standards in the preliminary and final EPA rulemakings. The fractional standards for cellulosic, biodiesel, and advanced changed very little between the preliminary proposal and the final rulemaking. The biggest changes occurred in the fractional standards for the implied conventional mandates in 2015 and 2016, which increased 0.47 and 0.34 percent, respectively. The fact that the fractional mandates were either stable or increased helps to resolve an important question regarding the current policy target of the EPA in setting the RFS standards. More specifically, if gasoline and diesel use projections differ between the preliminary and final rulemaking the EPA can target fixed volume standards, which means fractional standards will change between the preliminary and final rulemaking, or the EPA can target fixed (or non-declining) fractional standards, which means that volume standards will change. Of course, this is a moot point if gasoline and diesel use projections do not change between the preliminary and final rulemaking. Given that gasoline and diesel use projections for 2015 and 2016 increased between the May preliminary proposal and the November final rulemaking and the fractional mandates were stable or increased, one can infer that the EPA is not targeting fixed volumetric standards when issuing preliminary RFS standards. Instead, the EPA is evidently targeting the fractional mandates.

Table 2. RFS Fractional Requirements for the U.S., 2014-2016

	EPA Preliminary Proposal			EPA Final Rulemaking		
Category	**2014**	**2015**	**2016**	**2014**	**2015**	**2016**
Cellulosic Biofuel	0.019%	0.059%	0.114%	0.019%	0.069%	0.128%
Biomass-Based Diesel	0.142%	0.141%	1.490%	0.141%	0.149%	1.590%
Advanced Biofuel	1.52%	1.61%	1.88%	1.51%	1.62%	2.01%
Total	9.02%	9.04%	9.63%	9.19%	9.52%	10.10%
Implied Conventional	7.50%	7.43%	7.75%	7.68%	7.90%	8.09%

Note: The fractional requirements are computed as the volumetric standard (in ethanol equivalent gallons) divided by total petroleum gasoline and diesel use.

The seemingly arcane issue of targeting fixed (or non-declining) fractional standards or fixed volumetric standards actually matters because, as we have shown in a previous *farmdoc daily* article (June 10, 2015), estimates of the degree of push in the standards above the E10 blend wall are quite sensitive to which policy target the EPA applies. In our earlier analysis, we showed that if the EPA targeted fixed volumetric standards, and therefore did not change the conventional ethanol mandates in the final rulemaking as total fuel usage increased, the magnitude of the push in the ethanol mandates would decline sharply. If the EPA instead targeted fixed fractional standards, and therefore raised the conventional ethanol mandates in the final rulemaking as total fuel usage increased, the magnitude of the push in the ethanol mandates would decline only marginally. Since the EPA set the fractional standards in the final rulemaking either roughly equal to or higher than in the preliminary rulemaking, this implies that the degree of push in the standards above the E10 blend wall did not decline as projections of gasoline and diesel use for 2015 and 2016 increased in recent months.

We updated our earlier analysis of the degree of push in the conventional ethanol mandates for 2014-2016 in Table 3. The degree of push is computed first under the assumptions found in the final EPA rulemaking and then under an alternative scenario with higher gasoline and diesel use for 2015 and 2016. What we have called the push is labeled in Table 3 as the conventional ethanol mandate gap (row 11), and it is computed as the conventional ethanol requirement minus consumption of cellulosic and other advanced ethanol minus the level of conventional ethanol consumption implied by the E10 blend wall. Note that total ethanol use (line 5) is less than the E10 blend wall because ethanol inclusion rates are assumed to be slightly less than 10 percent. This reflects the use of a small amount of E0 in transportation fuel in the U.S. The calculation of the conventional ethanol gap for the final EPA rulemaking in Table 3 is based on several assumptions, including (1) the RFS is implemented as required in the final rulemaking, (2) the estimates and projections relative to gasoline consumption and consumption of cellulosic ethanol, other advanced ethanol, and conventional ethanol included in that rulemaking are used without adjustment, and (3) the level of RINs stocks and biofuels stocks remain constant over 2014-2016.

Table 3. Conventional Mandate Gap Computations under EPA Final Rule and Alternative Scenario for 2014-2016

	EPA Final Rule			Alternative Scenario		
Item	**2014**	**2015**	**2016**	**2014**	**2015**	**2016**
(1) Total Gasoline Use	136.480	139.380	139.960	136.480	140.574	141.980
(2) Total Diesel Use	55.670	54.050	55.260	55.670	54.557	55.921
(3) Total Gasoline and Diesel Use	192.150	193.430	195.220	192.150	195.131	197.901
(4) E10 Blend Wall [(1) X 0.10]	13.648	13.938	13.996	13.648	14.057	14.198
(5) Total Ethanol Use [(7)+(8)+(9)]	13.420	13.810	13.850	13.420	13.928	14.050
(6) Total Ethanol Inclusion Rate [(5)/(1)]	9.83%	9.91%	9.90%	9.83%	9.91%	9.90%
(7) Cellulosic Ethanol Use	0.001	0.004	0.023	0.001	0.004	0.023
(8) Other Advanced Ethanol Use	0.090	0.081	0.226	0.090	0.081	0.226
(9) Conventional Ethanol Use	13.329	13.725	13.601	13.329	13.843	13.801
(10) Conventional Ethanol Mandate	13.610	14.050	14.500	13.610	14.174	14.699
(11) Conventional Mandate Gap [(10)-(9) if >0]	0.281	0.325	0.899	0.281	0.330	0.898
(12) Petroleum Gasoline and Diesel Use	177.140	177.860	179.320	177.140	179.426	181.776
(13) Fractional Ethanol Mandate [(10)/(12)]	7.68%	7.90%	8.09%	7.68%	7.90%	8.09%

Notes: All values stated in terms of billion gallons except (6) and (13), which are in percentage terms. Values for total gasoline, total diesel, and total ethanol use for 2014-2016 under "EPA Final Rule" are obtained from Table V.B.3-1 of the final rulemaking released on November 30, 2015. Total petroleum gasoline and diesel use (12) is net of renewable fuel use (ethanol and biomass-bsaed diesel) and the small refinery exemption, and therefore, does not equal total gasoline and diesel use (3). The small refinery exemption is set to zero for 2015-2022.

Under the final EPA rulemaking, we estimate the conventional ethanol mandate gap to be 281 million gallons in 2014, 325 million gallons in 2015, and 899 million gallons in 2016. These are estimates of the magnitude of the push in the conventional mandate above the E10 blend wall each year. The conventional gaps for 2014 and 2015 require some explanation in light of EPA's argument that the conventional mandates were set at the actual ethanol production level for 2014 and projected production in 2015. This would seem to imply a zero conventional gap in 2014 and a very small gap in 2015 due to projecting ethanol production without complete information for the year. The key to reconciling our estimates of the conventional gap for 2014 and 2015 and the EPA's estimates is to recognize that the EPA bases their estimates on D6 ethanol RINs generation rather than domestic physical ethanol use as we do. One would think that D6 ethanol RINs generation, after appropriate adjustment for export retirements, and domestic physical ethanol use would generate similar estimates of usage. This is not necessarily the case because D6 RINs can also be generated by "grandfathered" biodiesel and renewable diesel producers who meet the 20 percent greenhouse gas reduction standard for ethanol RINs. As shown in this *farmdoc daily* article (August 5, 2015), D6 RINs generation from this pathway has grown rapidly in recent years, totaling 243 million gallons in 2014 and over 400 million gallons in 2015 (both stated in ethanol equivalents). These totals can completely account for the differences between our estimates of the conventionalgap in 2014 and 2015 and the estimates from the EPA. Stated differently, the data in the final EPA rulemaking (which our estimates are based upon) implies a positive conventional mandate gap in 2014 and 2015 based on the physical ethanol market, but this gap, or push above the E10 blend wall, was filled by non-ethanol D6 RINs generation. This highlights the important role that non-ethanol RINs generation has played at the margin in recent years for complying with the conventional ethanol mandate.

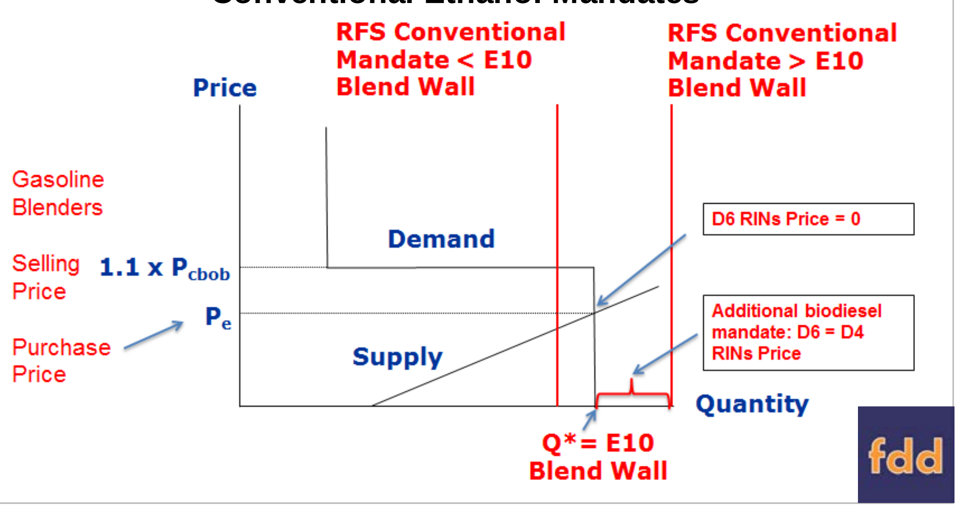
As noted above, the conventional mandate gap for 2016 is estimated to be 899 million gallons. This substantial gap will have to be filled using one or more of the following pathways: (1) drawing down the existing stock of RINs, which the EPA estimates in the final rulemaking to be 1.74 billion gallons, (2) increasing the use of higher ethanol blends, such as E15 or E85, or (3) increasing the use of non-ethanol biofuels such as biodiesel and renewable diesel. For example, if obligated parties under the RFS determined that E85 is the least cost alternative for filling the 2016 conventional gap, a total of 899 million gallons would require consumption of 1.214 billion gallons of E85 (assuming E85 averages 74 percent ethanol). If obligated parties determined that biodiesel and renewable diesel are the least cost alternatives, the total gap of 899 million gallons would require additional consumption of 584 billion gallons of biodiesel and renewable diesel (899/1.54).

The alternative scenario presented in Table 3 increases the growth of gasoline and diesel use above that projected by the EPA in the final rulemaking. This is plausible given recent data on how fast gasoline use in the U.S. is increasing. All other assumptions are the same as under the "EPA Final Rule" computations in Table 3. Gasoline use in this alternative scenario increases 3 percent in 2015 instead of 2.1 percent and increases 1 percent in 2016 instead of 0.4 percent. Diesel use decreases 2 percent in 2015 instead of 2.9 percent and increases 2.5 percent in 2016 instead of 2.2 percent. One might expect increasing gasoline and diesel use to decrease the size of the conventional mandate gap. However, this is not the case because the fractional mandate, shown in the last row of Table 3, is now fixed for 2016. So, if gasoline and diesel use grows as projected under this alternative scenario, the volume of the conventional ethanol mandate also has to grow in order to achieve the fixed fractional mandate. This also means that the conventional mandate gap in volume terms is essentially fixed for 2016 regardless what happens to actual gasoline and diesel use in 2016. Finally, it is interesting to observe that the effective conventional ethanol mandate for 2016 increases to 14.7 billion gallons with only modestly higher growth in gasoline use.

Explaining the Spike in RINs Prices

The review of EPA's final rulemaking for 2014-2016 in the previous section strongly suggests that that the EPA is committed to pushing RFS standards for conventional ethanol past the E10 blend wall and "getting the RFS back on track." The language in the final rulemaking suggests it would not be surprising if the EPA returned the conventional ethanol mandate back to the statutory level of 15.0 billion gallons as soon as 2017. To understand what this policy trajectory implies for RINs prices, we need to first review a conceptual model of ethanol RINs pricing that we have used several times in the past to understand the "message" from the RINs markets (e.g., *farmdoc daily*, August 8, 2014; May 28, 2015; September 23, 2015). The model is presented in Figure 3 and represents the supply of ethanol producers and demand from gasoline blenders at the wholesale level on an annual basis. Complete details on the model can be found in the *farmdoc daily* article from September 23, 2015. One key assumption of the model is that higher ethanol blends, such as E15 or E85, cannot be deployed in a cost-effective manner in the short-run, which leads to the perfectly inelastic segment of the demand curve at the E10 blend wall.

Figure 3. D6 Ethanol RINs Pricing with Alternative RFS Conventional Ethanol Mandates

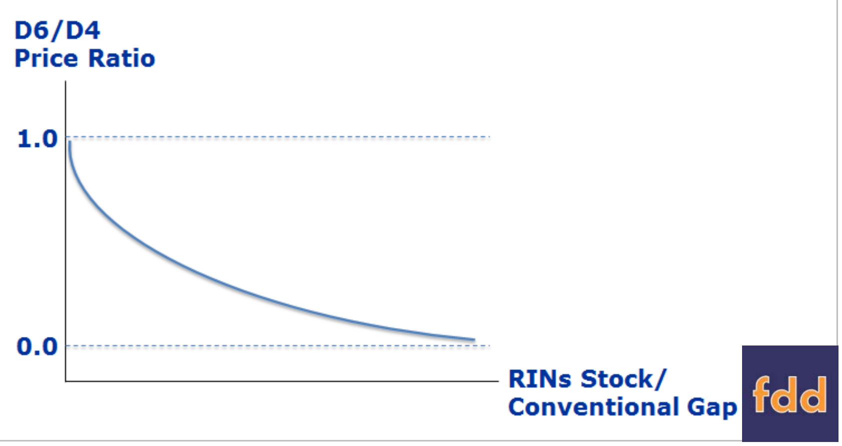


The model in Figure 3 shows that if the RFS conventional ethanol mandate is less than the blend wall, the intersection of market supply and demand results in an equilibrium quantity equal to the E10 blend wall. At this equilibrium point, gasoline blenders make a normal economic profit for blending ethanol with gasoline. Since blenders earn a normal return, the model predicts that the price of an ethanol RIN is zero up to the

E10 blend wall. The situation is entirely different if the conventional mandate is set above the E10 blend wall. In this case, a conventional gap is created that by definition must be filled with something other than E10 ethanol blends. Since higher ethanol blends are assumed not to be cost-effective, the conventional gap effectively becomes additional biodiesel mandate. In sum, the model makes two important predictions: (1) if the RFS conventional ethanol mandate is less than or equal to E10 blend wall, the D6 price is zero, and (2) if the RFS conventional ethanol mandate exceeds the E10 blend wall, the D6 RINs price equals the D4 RINs price since biodiesel becomes the marginal fuel for complying with the conventional ethanol mandate. Equivalently, the model predicts that: (1) if the conventional gap is 0 or negative, the ratio between D6 and D4 RINs prices is 0, and (2) if the conventional gap is positive, the ratio between D6 and D4 RINs prices is 1.

While the model presented in Figure 3 provides important insights about ethanol RINs pricing, it ignores the fact that obligated parties under the RFS have to make compliance decisions in light of mandates over a multi-year horizon and the role of RINs stocks that can be carried over from year-to-year and used to fill the conventional gap as needed. Figure 4, first presented in a *farmdoc daily* article on August 8, 2014, illustrates how these two additional factors might combine to impact the pricing of ethanol RINs. The *y*-axis plots the ratio of D6 to D4 RINs prices. The *x*-axis plots the ratio of RINs stocks to the conventional mandate gap. The RINs stocks correspond to the initial stocks at the start of obligated parties' multi-year planning horizon and the conventional gap (ethanol mandate minus E10 blend wall if difference is positive) is assumed here to be the cumulative sum of the conventional gap over the years in the planning horizon. For simplicity, additions to the stock of RINs over the planning horizon are not considered. If the size of the cumulative conventional gap is large relative to the size of RINs stocks, the ratio on the *x*-axis will be small, reflecting the fact that obligated parties will rapidly use up the stock of RINs to fill the conventional gap. After the stock of RINs is used up the situation resembles the scenario in Figure 3 where the conventional mandate exceeds the E10 blend wall. That is, obligated parties have to incentivize production of biodiesel in order to generate the additional D4 RINs needed to backfill the remainder of the conventional gap over the planning horizon. The end result is that obligated parties rationally bid up the price of D6 RINs close to the level of D4 RINs in expectation of quickly using up the stock of RINs. This pushes the RINs price ratio on the *y*-axis towards one. If the size of the cumulative conventional gap is small relative to the stock of RINs, the ratio on the *x*-axis will be large, and obligated parties have on hand sufficient RINs to fill the conventional gap for a number of years, perhaps the entire length of the planning horizon. If this is the case, than the situation resembles the scenario in Figure 3 where the conventional mandate is less than the E10 blend wall. Since the price of a D6 RINs is zero in this scenario, obligated parties will not be willing to bid anything more than a small amount for D6 RINs and the RINs price ratio on the *y*-axis approaches zero. Outcomes between the two extremes in Figure 4 are less certain, but the proposed convex shape is at least plausible.

Figure 4. Theoretical Relationship between Relative Prices of D6 and D4 RINs and the Stock of RINs Relative to the Conventional Ethanol Gap



With this conceptual framework in hand, we can examine the factors driving the recent spike in RINs prices. The first step is to explain the dramatic rise in D6 prices relative to D4 prices since release of the final EPA rulemaking. A key insight from the conceptual framework represented by Figures 3 and 4 is that the D6/D4 price ratio should be a function of how quickly RINs stocks are expected to be exhausted by the cumulative conventional gap. Expectations that stocks will be exhausted soon should result in a relatively high price ratio and *vice versa*. Referring back to Figure 2, one can see that the D6/D4 price ratio has been highly volatile since the EPA's preliminary rulemaking for 2014-16 was released at the end of May 2015. The ratio plunged below 0.50 immediately after release of the preliminary rulemaking, rose briefly back to 0.90 in early September, and then drifted back down to about 0.65 right before the final rulemaking was released. This suggests market participants views about how long RINs stocks would last changed considerably throughout this time period (see the *farmdoc daily* article on September 23, 2015 for further details). The rapid move back to a D6/D4 price ratio of 0.97 following the release of the final rulemaking provides strong evidence that market participants dramatically revised their projection of when the stock of RINs would be exhausted. A price ratio this close to one suggests that market participants now believe that RINs stocks will be exhausted very quickly due to the magnitude of the conventional gap in 2016 and the likely trajectory of substantial conventional gaps after 2016.

As noted earlier, the EPA estimates RINs stocks available for 2014-16 compliance at 1.74 billion gallons. The estimated conventional gap of 899 million gallons in 2016 would cut this stock level by slightly more than half to 841 million gallons. There are two considerations that may make this closer to a "stock out" than it appears to the casual observer. First, like any other commodity, there is a minimal, or "pipeline," level of RINs stocks that reflect the need of obligated parties to have an inventory of RINs on hand to facilitate compliance or trading with others. In grain markets, the pipeline level of stocks is generally assumed to be 2-3 percent of total use. The total RFS standard for 2016 is 18.11 billion gallons and this benchmark from the grain markets would place the pipeline stock of RINs between about 350 and 550 million gallons. From this perspective, there might be only 300-500 million gallons of RINs stocks above pipeline levels at the end of 2016. Second, the EPA noted in its final rulemaking that their current estimate of the stock of RINs, 1.74 billion gallons, may be too high given uncertainties about compliance demonstration for 2012 deficits that have yet to be resolved and ongoing enforcement activities that may further reduce the number of valid RINs. A reasonable conclusion, therefore, is that the margin between pipeline and ending stocks of RINs in 2016 could easily be only a few hundred million gallons. When combined with an expectation that the conventional mandate gap will be of a similar size or perhaps even larger in 2017, one can understand why market participants now expect the stock of RINs to be exhausted in a matter of months rather than years.

The second step in the analysis is to explain the sharp increase in D4 biodiesel RINs prices since release of the final EPA rulemaking on November 30. Figure 1 shows that the price of D4 RINs jumped $0.20 per gallon, or 31 percent, in the three trading days following the release. There was a modest increase of 100 million gallons, or about five percent, in the 2016 and 2017 biomass-based diesel mandates in the final rulemaking. While this should result in higher biodiesel and renewable diesel prices, and consequently, higher D4 prices all else constant, the price increase relative to the mandate increase implies an extremely inelastic supply relationship. For this reason, other factors are likely to be at work. One factor almost surely is the biodiesel and renewable diesel production that will be needed to backfill the conventional gap once the stock of RINs is depleted down to pipeline levels. Consider that a one billion gallon conventional gap requires the production of almost 400 million gallons of biodiesel and renewable diesel. Another likely factor is the possibility that the biodiesel tax credit will be converted from a blender to a producer credit in 2016 (see the *farmdoc daily* article on August 5, 2015 for details), which would effectively place a $1 per gallon import tariff on imported biodiesel and renewable diesel. This would, in all likelihood, restrict the total supply of biomass-based diesel by eliminating biodiesel and renewable diesel imports to the U.S. We noted earlier that these non-ethanol imports have played an increasingly larger role in filling the conventional mandate gaps in recent years.

A final interesting observation is that the present spike in RINs prices is basically a re-run of the first instance of skyrocketing RINs prices in 2013 (*farmdoc daily*, July 19, 2013). We used the same conceptual model of the ethanol market to show that the spike in D6 RINs prices to $1.45 per gallon in 2013 reflected a large conventional gap created by the 2013 ethanol mandate exceeding the E10 blend wall. The model predicted that the gap effectively became additional biodiesel mandate, which in turn meant that the price of a D6 ethanol RINs should equal the price of a D4 biodiesel RINs. This prediction was borne out by RINs market price movements in 2013 just as it has been in the days since the release of the EPA's final rulemaking for 2014-16.

Implications

The release of the EPA's final rulemaking for 2014-16 RFS standards was a major shock to the market. The price of D4 biodiesel RINs went up 30 percent and the price of D6 ethanol RINs increased over 90 percent in the three trading days following the release. The market was apparently surprised by how much the final conventional ethanol mandates, particularly in 2016, breached the E10 blend wall. In addition, the final rulemaking clearly signaled that the EPA is serious about getting "the RFS back on track," and it would not be surprising if the EPA set the conventional ethanol mandate at the statutory level of 15.0 billion gallons as soon as 2017. The prospect of large conventional mandate gaps versus the E10 blend wall evidently shifted the expectation of market participants from one where the existing stock of RINs would not be exhausted for years to one where the stocks could be exhausted in a matter of months. When the stock of RINs is exhausted, the conventional gaps have to be filled by higher ethanol blends, such as E15 and E85, or biodiesel and renewable diesel. Our theoretical model predicts that the price of a D6 ethanol RINs should equal the price of a D4 biodiesel RINs if biodiesel and renewable diesel are the only feasible options for filling conventional mandate gaps. Consequently, the move of D6 RINs prices to nearly the same level as D4 RINs prices in the days following the November 30 release is an unmistakable sign that the market believes higher ethanol blends are not a feasible source of RINs to fill conventional gaps. Instead, biodiesel and renewable diesel are perceived to be the only viable options for filling the expected conventional gaps. It will be interesting to follow whether this expectation is borne out going forward. The cost of complying with the RFS mandates and impacts on feedstock markets may well depend on the answer.

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