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Ethanol Production Profits: The Risk from Lower Prices of Distillers Grains

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A *farmdoc daily* article last week (March 5, 2015) chronicled the history of ethanol production profitability for a representative Iowa ethanol plant since 2007. The analysis focused on the high level of profits in 2014 and the recent sharp decline in those profits in the face of crashing crude oil and gasoline prices. Given the pressures emanating from energy markets, it is no surprise that ethanol prices have also fallen sharply, and this is the main driver of the sharp decline in ethanol production profits. What is less appreciated is the role that distillers dried grains with solubles (DDGS) prices have played in offsetting some of the losses from declining ethanol prices. To see this, note that revenue from a representative Iowa plant on December 5, 2014 consisted of $2.18 per gallon from ethanol, $0.30 from DDGS, and $0.08 from corn oil, which by February 27, 2015 had changed to $.1.25 from ethanol, $0.48 from DDGS, and $0.09 from corn oil. Over that same time period the price of corn only increased $0.14 per bushel. The purpose of this article is to evaluate the risk to ethanol production profits of declining DDGS prices in coming months. A key to the evaluation is a better understanding of the factors that influence the price of DDGS.

We begin by reviewing the estimated weekly (Friday) profits for a representative Iowa ethanol plant, net of all variable and fixed costs, presented in the *farmdoc daily* article last week (March 5, 2015). The profits are presented in Figure 1 with one additional week of observed prices. Recent returns have been very close to estimated total production costs. This comes on the heels of a record 95-week run of positive profits. The relative contribution of distillers grains to gross returns has varied over time as the price of distillers grains has varied. However, since the price of distillers grains tends to be positively correlated to the price of corn, higher returns from distillers grains is also associated with higher ethanol production costs. The net contribution of distillers grains to net returns for ethanol production, then, is a function of the ratio of the price of distillers grains to the price of corn. When the ratio is high, distillers grains provide a larger contribution to net returns and *vice versa*.

Figure 2 presents the ratio of the average price of DDGS to the average price of corn reported for Iowa plants each Friday by the USDA's Ag Marketing Service from January 26, 2007 through March 6, 2015. That ratio ranged from 0.67 to 1.48 and averaged 0.91 for the entire period. Except for the 5-month period from July through November 2014, that ratio has been well above the long-term average since August

2013. The high price of DDGS relative to corn contributed to the historically high profitability of ethanol production in late 2013 and the first half of 2014. The current high ratio is contributing to net returns of ethanol production and has supported returns at near breakeven levels relative to total variable and fixed costs of production even as ethanol prices declined sharply beginning in mid-December 2014.

Figure 1. Weekly (Friday) Ethanol Production Profit Net of all Variable and Fixed Costs at a Representative Iowa Ethanol Plant, 01/26/2007 - 03/06/2015

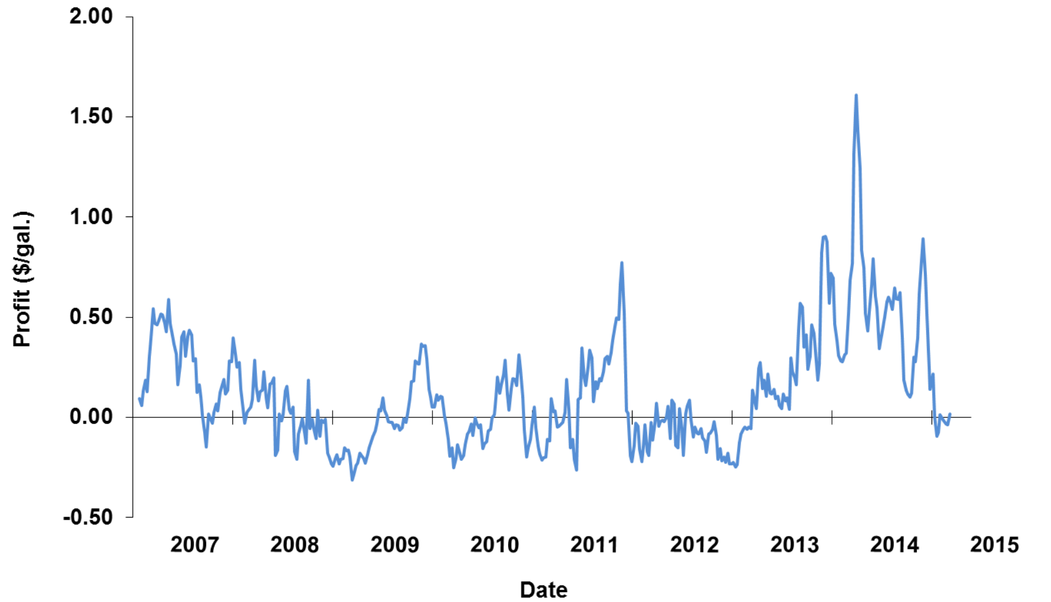
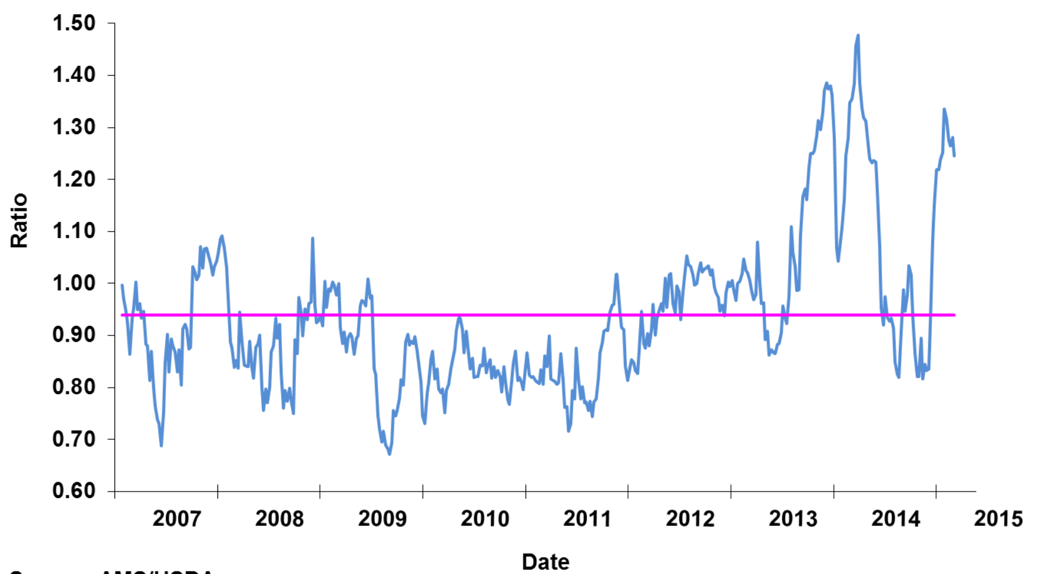


Figure 2. Weekly (Friday) Ratio of DDGS to Corn Price at Iowa Ethanol Plants, 01/26/2007 - 03/06/2015



Source: AMS/USDA

The current high ratio of the price of DDGS and the price of corn, then, raises the obvious issue of the risk of a decline in that ratio. With all other prices unchanged, a decline in the price of DDGS would result in a corresponding decline in net returns. The magnitude of that decline can be illustrated using prices as of March 6, 2015—$169.50 per ton for DDGS and $136 per ton ($3.81 per bushel) for corn. The price ratio was 1.25. If the price of corn remained constant and the ratio declined to 1.0, the price of DDGS would decline by $33.50 per ton, or $0.017 per pound. Assuming that 16 pounds of DDGS are produced per bushel of corn the price decline would result in a decline in returns of $0.27 per bushel. Assuming that 2.8 gallons of ethanol are produced per bushel of corn processed, returns would decline by about $0.10 per gallon. If the DDGS/corn price ratio declined to the long term average of 0.91, returns from ethanol production in this example would decline by $0.13 per gallon. While the declines are relatively small in absolute terms, they would be large enough to drop returns for the representative ethanol plant below the estimated total cost of production. Returns would still exceed estimated variable costs of production, but would cover only about half of the estimated fixed costs.

To evaluate the risk of declining prices of DDGS relative to corn prices requires some understanding of the factors that influence the price of DDGS. In a *farmdoc daily* article on July 12, 2013 we presented the results of a regression model that explained the price of DDGS as a function of the price of corn and the price of soybean meal. We have updated that model based on additional price observations and with some additional insight on the influence of soybean meal prices and the seasonal pattern of domestic demand for distillers grains. Specifically, plotting of the price data suggested that the influence of soybean meal prices on DDGS prices has not been constant over the entire period, with relatively high soybean meal prices since 2011 having a disproportionally larger impact on DDGS prices than did soybean meal prices previously. In addition, research published by the USDA's Economic Research Service pointed to seasonality in the domestic demand for distillers grains based on the desirability of DDGS relative to corn as a forage replacement for beef cows in the winter months. While there is no discernable seasonality in production of ethanol, and therefore in production and consumption of distillers grains, there may be a price effect from the seasonal demand pattern. The updated regression model for March 13, 2007 through March 6, 2015 estimates weekly (Friday) prices of DDGS as a function of corn prices, soybean meal prices, a soybean meal price interaction term, and monthly dummy variables to capture the seasonality of domestic demand for DDGS. The soybean meal interaction variable is computed as the soybean meal price times a dummy variable that equals 1 between January 2011 and September 2014 and 0 otherwise. This term allows soybean meal prices to have a higher impact during the period of relatively high soybean meal prices. While not modeled, it is acknowledged that variation in export demand might also explain some of the variation in prices of DDGS.

Table 1 presents the estimation results for the regression model. The R2 of 0.89 indicates that the regression model explains 89 percent of variation in weekly DDGS prices, a small decline from the explanatory power of our earlier model. The estimated coefficient for corn is 0.66, which means a $1 per ton increase in the price of corn increases the price of DDGS by $0.66 per ton. This is substantially smaller than the 0.85 coefficient that we estimated previously. The first estimated coefficient for soybean meal is 0.13, which means a $1 per ton increase in the price of soybean meal over March 2007-December 2010 and October 2014-March 2015 increases the price of DDGS by $0.13 per ton. Adding the first estimated coefficient for soybean meal to the second provides an estimate, 0.19, of the price impact of soybean meal in the high price soybean meal period, so that $1 per ton increase in the price of soybean meal over January 2011 through September 2014 increases the price of DDGS by $0.19 per ton. The magnitudes of the monthly seasonal effects are also presented in Figure 3, and reflect the seasonal impact relative to December. For example, all else equal, the price of DDGS tends to be $19.92 per ton lower in June than in December. The seasonal effect is generally positive in the winter months and negative from April through October. Overall, the seasonal impact is quite strong and impacts the estimates of the other coefficients in the model.

Table 1. Estimated Regression Model Results for Weekly (Friday) DDGS Prices at Iowa Ethanol Plants, March 13, 2007 - March 6, 2015

Variable	Coefficient	Standard Error	t-Statistic	p-value
Intercept	-2.02	6.86	-0.30	0.77
Corn Price ($/ton)	0.66	0.02	29.69	0.00
Soybean Meal Price ($/ton)	0.13	0.02	8.09	0.00
Soybean Meal Price Interaction ($/ton)	0.06	0.01	7.93	0.00
January	0.23	4.36	0.05	0.96
February	2.89	4.43	0.65	0.51
March	1.81	4.52	0.40	0.69
April	-3.35	4.44	-0.75	0.45
May	-8.90	4.34	-2.05	0.04
June	-19.94	4.40	-4.53	0.00
July	-19.92	4.37	-4.56	0.00
August	-22.13	4.32	-5.12	0.00
September	-18.57	4.44	-4.18	0.00
October	-1.74	4.33	-0.40	0.69
November	2.75	4.36	0.63	0.53
Regression F-Statistic	Significance F			
240.1862596	0.00			
R Square	0.89			
Adjusted R Square	0.89			
Standard Error	18.21			
Observations	413			

Notes: The soybean meal interaction variable is computed as the soybean meal price times a dummy variable that equals 1 between January 2011 and September 2014 and 0 otherwise. The monthly dummy variable for December is omitted to prevent perfect collinearity in the model.

Further detail on the "fit" of the model is presented in Figure 4 which compares actual prices of DDGS to the prices predicted by the regression model. The included variables generally track prices of DDGS reasonably well, but there are periods of large differences between predicted and actual prices, most noticeablbley in 2014. The standard error is a relatively large $18.21 per ton. This means there is roughly a 2/3 chance that the DDGS price will be within +/-$18 of the model price; so, there is certainly room for improvement in explaining the price of DDGS. Still, the current model provides valuable new insights as to the seasonal effects on prices of DDGS and those estimated seasonal effects are especially pertinent to the current situation. We are moving from a period when prices of DDGS tend to be higher than can be explained by corn and soybean meal prices alone to a period when prices tend to be much lower than can be explained by corn and soybean meal prices. This suggests that over the next few months the ratio of DDGS and corn prices could decline measurably from the current high ratio. With corn prices unchanged, the model estimates point to a decline of about $22.00 per ton in the price of DDGS by June. With prices of other components of ethanol profitability unchanged, that reduction would lower net returns by about $0.06 per gallon of ethanol produced.

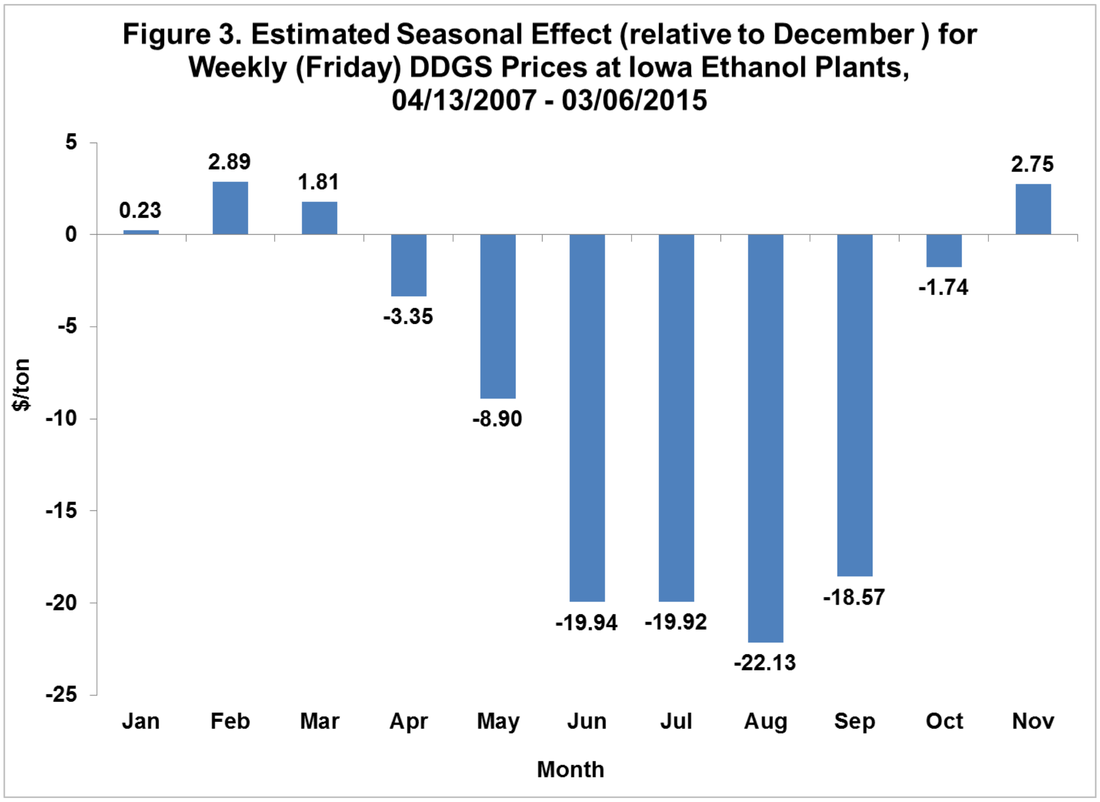


Figure 3. Estimated Seasonal Effect (relative to December) for Weekly (Friday) DDGS Prices at Iowa Ethanol Plants, 04/13/2007 - 03/06/2015
$/ton
5
0
-5
-10
-15
-20
-25
0.23
2.89
1.81
-3.35
-8.90
-19.94
-19.92
-22.13
-18.57
-1.74
2.75
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Month

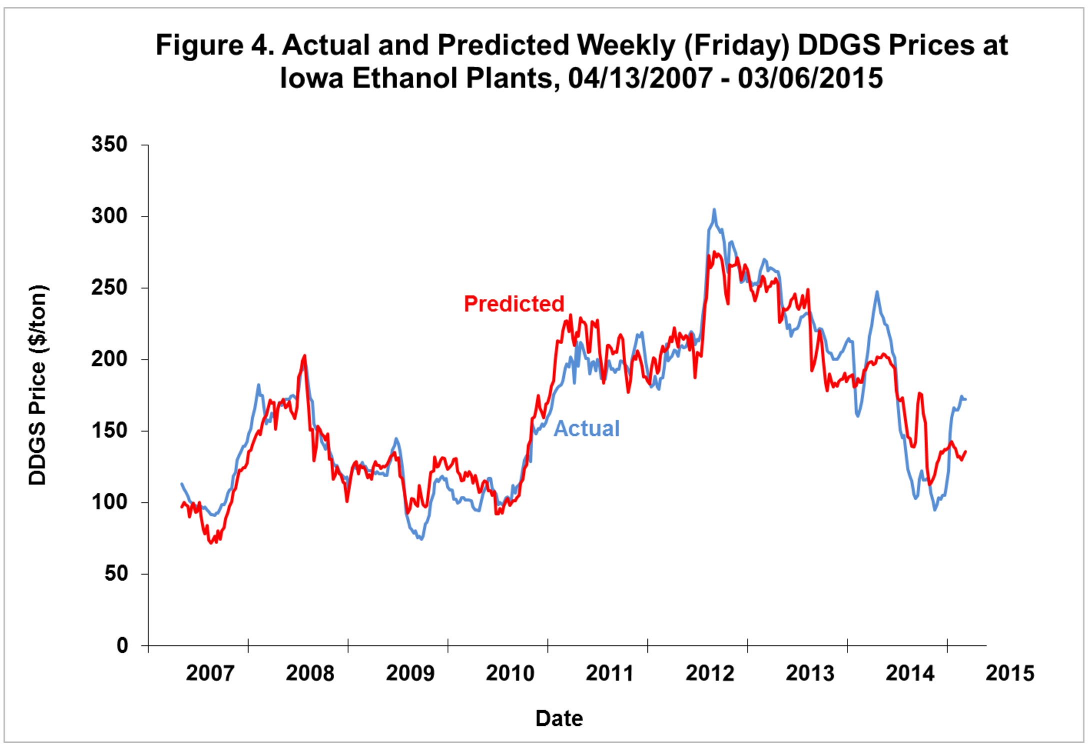


Figure 4. Actual and Predicted Weekly (Friday) DDGS Prices at Iowa Ethanol Plants, 04/13/2007 - 03/06/2015
DDGS Price ($/ton)
350
300
250
200
150
100
50
0
Predicted
Actual
2007
2008
2009
2010
2011
2012
2013
2014
2015
Date

Implications

The analysis presented here suggests that there is risk for a decline in the price of DDGS over the next several months even without a decline in corn or soybean meal prices. Without compensating adjustments in prices of other components of ethanol plant returns and/or costs, such a decline would reduce returns for ethanol plants. Since margins are already very thin, returns for some plants could be reduced below the total cost of production, at least for a period. The silver lining, however, is that domestic and export demand for ethanol is likely strong enough that a large, sustained reduction in ethanol production will need to be prevented. In particular, the RFS, regardless of current uncertainties, represents a safety-net for domestic ethanol demand at least at the level of the E10 blend wall. This suggests that if prices of DDGS decline and there are no other compensating adjustments in the price of corn, ethanol prices will need to be increased in order to motivate sufficient ethanol production.

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