



## The Relationship between Stocks-to-Use and Corn Prices Revisited

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The 2014-15 marketing year average farm price of corn, currently projected by the USDA to be in a range of \$3.55 to \$3.85, will likely be the lowest marketing year average since 2009-10 and about \$2.00 per bushel less than the average of the previous four years. Lower prices have resulted in much narrower operating margins for many corn producers and have resulted in a substantial slowdown in machinery and equipment purchases and some downward pressure on cash rent levels and land values. Corn prices during the 2015-16 marketing year will be pivotal in determining if these financial pressures continue, worsen, or are reversed.

At this juncture there are differences of opinion about the likely level of prices during the year ahead, with most expecting prices to provide minimal relief from narrow operating margins being experienced this year. USDA projections from the [February Outlook Forum](#) include an average farm price for corn of \$3.50. Last month's projections from the [Food and Agricultural Policy Research Institute](#) (FAPRI) at the University of Missouri include an average farm price for corn of \$3.93. Our own projection from [an April 1 webinar](#) is an average price of \$4.25. Price projections differ because of different expectations about the supply of corn, the strength of corn demand, and the interaction of supply and demand to determine price.

In this article, we re-examine the historical relationship between the domestic ending stocks-to-use ratio and the U.S. average farm price of corn during the marketing year. This relationship has often been used to reflect the interaction among corn supply, demand, and price, but has seemingly fallen out of favor with the new era of prices that began in 2006-07 (*farmdoc daily*, [March 29, 2011](#); [February 27, 2013](#)). We next extend the analysis to the relationship between the world ending stocks-to-use ratio of all coarse grains and the U.S. average farm price of corn during the marketing year. This relationship is examined to determine if corn prices are better explained by world feed grain supply and demand interaction than domestic corn supply and demand interaction.

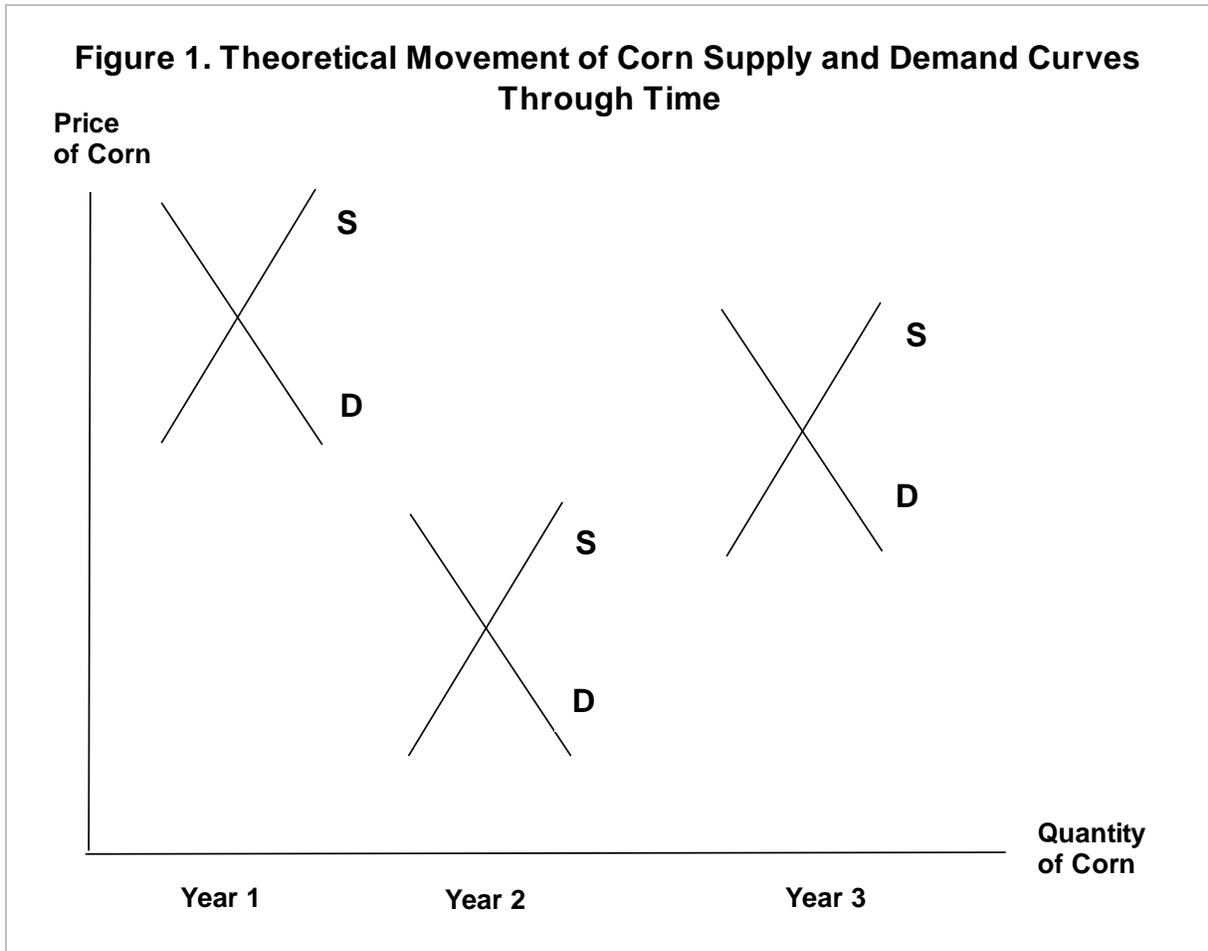
### Analysis

In the classical supply/demand framework, the average price of corn in any particular marketing year represents the equilibrium price determined by the intersection of the supply and demand curves. Note that the curves shown in Figure 1 represent total corn supply from production and imports and total demand for

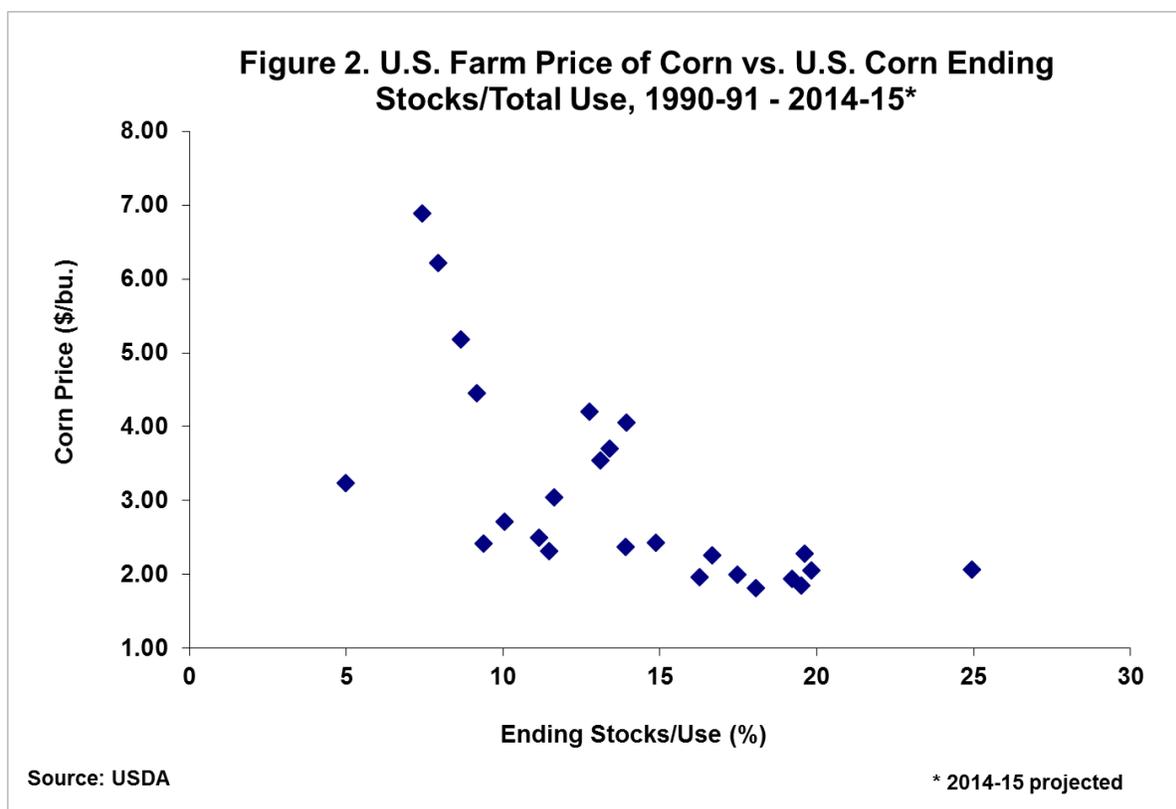
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feed, industrial uses including ethanol, exports, and ending stocks. Over time, the equilibrium price changes as the demand curve, supply curve, or both shift. Those equilibrium prices, then, can be examined with the stocks-to-use ratio used as a proxy for the interaction of supply and demand in quantity terms.



The average marketing year price and ending stock-to-use ratio for the period 1990-91 through 2014-15 is shown in Figure 2. For the current year (2014-15), the projection of year ending stocks and the mid-point of the range of the projected average farm average from the [April 9 WASDE report](#) is used. As expected, there is a general negative relationship between the stocks-to use ratio and the average farm price. That is, a low stocks-to-use ratio is associated with a high price and *vice versa*. It is clear, however, that the relationship is not especially strong over the entire time period. We argue that the relationship should be viewed in the context of two different eras. The first era spans from 1990-91 through 2005-06 and consists of the lower and more horizontal cluster of points in Figure 2. The second era spans from 2007-08 through 2014-15 and it contains the upper and more steeply sloped cluster of points in Figure 2. Note that 2006-07 is treated as a transition year in this division of eras.



As we have argued for some time now (e.g., Irwin and Good, 2009), the two eras represented in Figure 2 are mainly differentiated by the substantial increase in ethanol demand for corn that began in 2007-08. That is, the outward shift in the demand curve resulted in higher prices, for a given level of supply, than was the case in the period prior to 2007-08. While the corn supply curve likely did not shift at first, there was undoubtedly movement along the supply curve as higher prices resulted in expanded corn acreage. The resulting large outward shift in the demand curve and movement along a relatively inelastic (price insensitive) supply curve meant that a stocks to-use ratio of a given magnitude was associated with a higher price in the latter era than in the former era. Given more time to adjust there has also undoubtedly been some rightward shifts in the corn supply curve, but the available evidence suggests that the elasticity of acreage supply is fairly small even in the intermediate- to longer-run. See the study by Carter, Rausser, and Smith (2014) for an in-depth treatment of these issues.

Next, we estimate the relationship between the average marketing year price and ending stock-to-use ratio for the two different eras over 1990-91 through 2014-15. A reciprocal regression specification is used, so that:

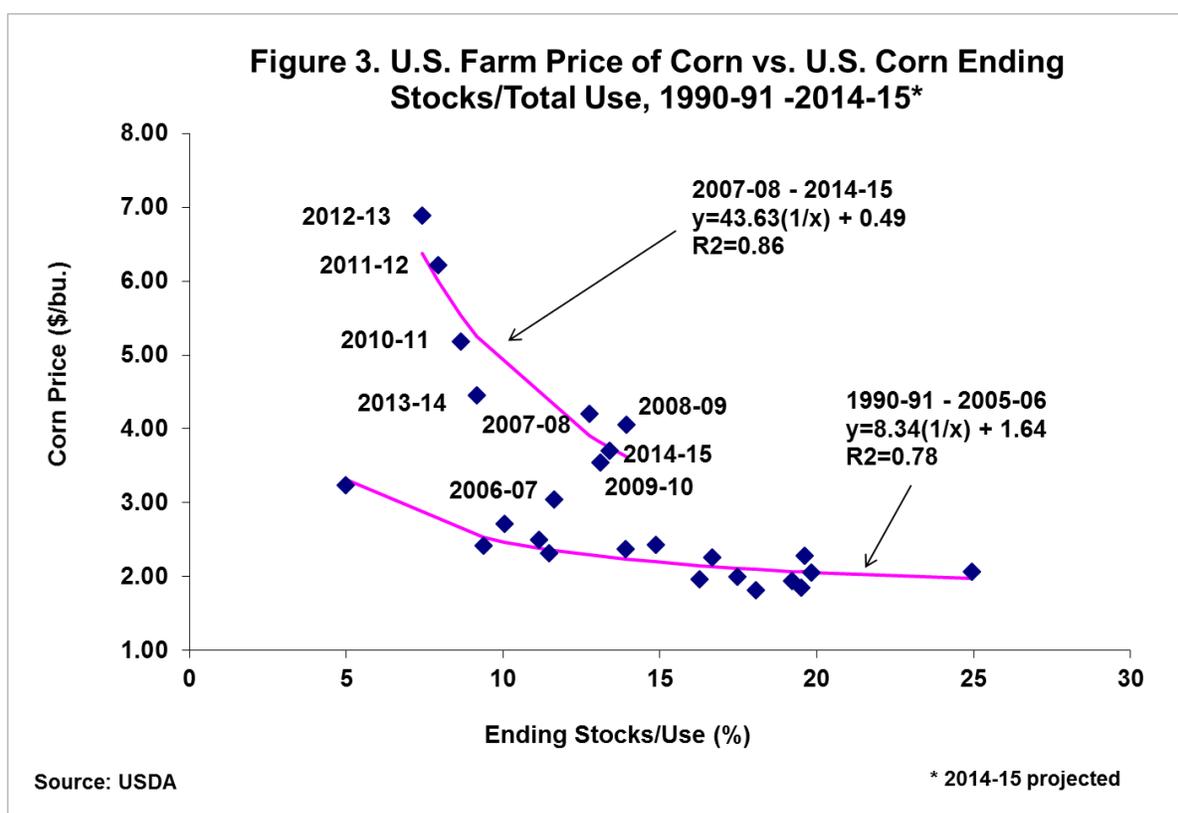
$$\text{Corn Price} = a + b (1/\text{Stocks-Use Ratio}).$$

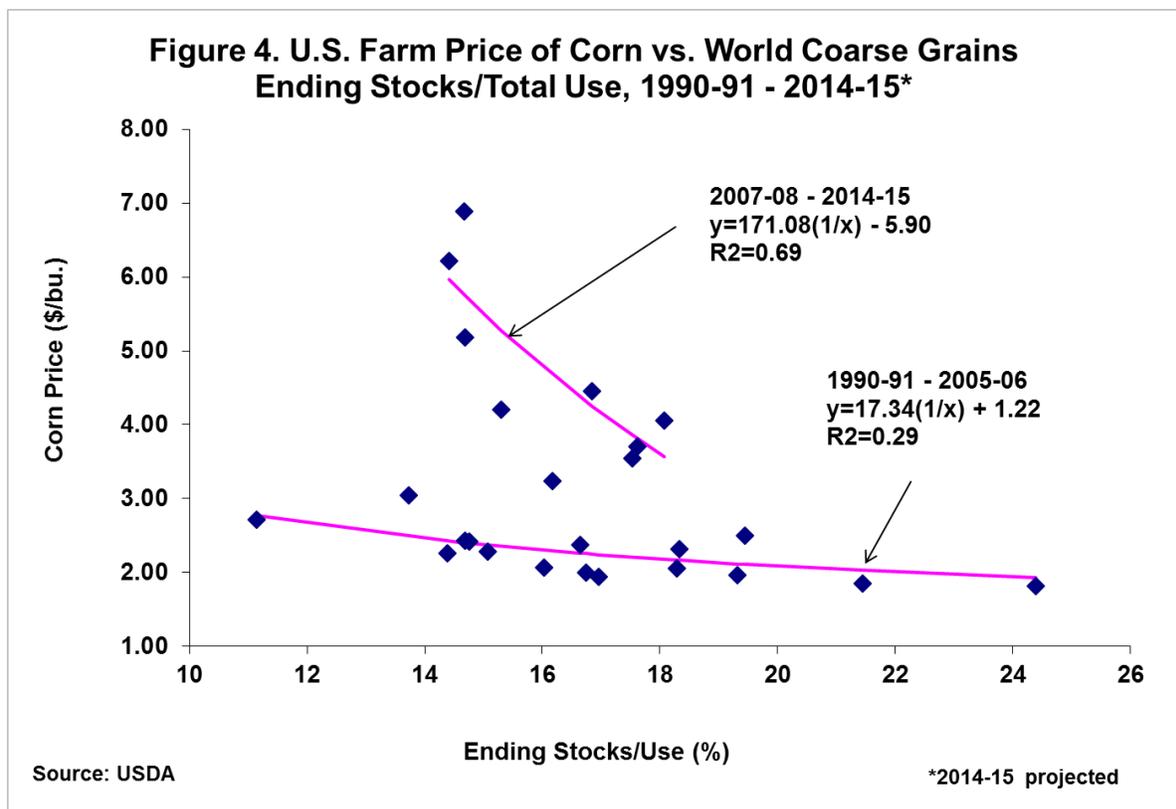
This specification is simple and imposes a curvilinear relationship between price and the stocks-to-use ratio. That is, the curve becomes steeper and steeper as the stocks-to-use ratio declines, and *vice versa*. Figure 3 shows the same data points as in Figure 2 along with the estimated reciprocal regression lines for the two periods. Separating the observations into two eras results in a good “fit” between the stocks-to-use ratio and the average marketing year farm price. The fit is particularly good in the latter period, with the stocks-to-use ratio explaining 86 percent of the annual variation in the marketing year average price from 2007-08 through 2014-15. As expected, the estimated regression line is much steeper for the second era compared to the first.

Since U.S. corn must compete in the world market with all other coarse grains, it could be argued that U.S. corn prices might better be explained by the world stocks-to-use ratio of coarse grains. We examined the relationship of that ratio to the average U.S. farm price of corn over the same time periods and found that the fit is definitely not as good as the stocks-to-use for U.S. corn alone (Figure 4). It appears, then, that the global supply and demand for coarse grains is best captured in the export demand for U.S. corn, which in turn is reflected in the domestic stocks-to-use ratio.

It is tempting to view the relationships in Figures 3 and 4 as tracing out demand curves for corn and coarse grains, respectively, but it should always be kept in mind that the individual price observations reflect the interaction of both supply and demand in each of the marketing years. The stocks-to-use ratio is therefore only a proxy for the true relationship.

While the stocks-to-use ratio is technically only an indicator of supply relative to demand in quantity terms, it does not mean that that it should be dismissed out-of-hand when developing price forecasts. The real question is whether there is any value in that relationship in terms of explaining and projecting the average farm price of corn. In our experience, the relationship is useful so long as the underlying supply and demand curves are judged to be shifting within a “normal” range. In essence, the kind of demand jump that occurred for corn in the mid-2000s is ruled out. The relatively good fit of the relationship over 2007-08 – 2014-15 also provides empirical support for the usefulness of the stocks-to-use ratio.





### Implications

We estimated the relationship between the U.S. stocks-to-use ratio for corn and marketing year average prices for two eras—1990-91 through 2005-06 and 2007-08 through 2014-15. Separating the observations into two eras results in a good “fit,” particularly in the latter period, with the stocks-to-use ratio explaining 86 percent of the annual variation in the marketing year average price from 2007-08 through 2014-15. As expected, the estimated regression line is much steeper for the second era compared to the first. We argue this can be mainly traced to the substantial increase in ethanol demand for corn that began in 2007-08. The outward shift in the demand curve resulted in higher prices for a given level of supply than was the case in the period prior to 2007-08. The relationship of the average U.S. farm price of corn to the world coarse grains ending-stocks-to-use ratio over the same time periods was estimated and the fit was definitely not as good as the stocks-to use for U.S. corn alone. Despite the fact that the stocks-to-use ratio is technically only an indicator of supply relative to demand in quantity terms, we argue that the relationship has value in explaining and projecting the average farm price of corn. In an article next week, we will develop a prospective U.S. corn balance sheet for the 2015-16 marketing year and draw price implications based on the domestic ending stocks-to-use model.

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