Have U.S. Farm Input Prices Followed U.S. Crop Prices?

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Background

The sharp drop in crop prices since 2012 has focused attention on the question, "Will input prices follow crop prices lower?" To provide historical perspective on this question, this article updates and recasts a November 14, 2014 *farmdoc daily* article, "U.S. Farm Input Price Dynamics, 1981-2013." Input prices are found to change in the same direction as crop prices, but the relationship varies by input. The relationship grows over time, with the adjustment process taking around 5 years. However, changes in crop prices explain only part of the change in input prices.

Data and Analysis

This study uses indexes for all crop prices received by U.S. farms and prices paid by U.S. farms for 6 input categories - ag services and rents, chemicals, fertilizer, fuels, machinery, and seed. It would be nice to examine rent separately, but such data does not begin until 1990 while price indices for ag services and rents start with 1971. The price indices for rent, and ag services and rent have a high but not perfect correlation. Thus, findings can vary for these two input categories. Annual price indices end with 2014, but 2015 is included by averaging the monthly indices for January through July. The price data are from the U.S. Department of Agriculture, National Agricultural Statistics Service Quick Stats website. Because general price inflation likely impacts inputs differentially, price indexes are deflated by the Gross Domestic Product (GDP) implicit price deflator. This deflator is usually considered the best measure of general price inflation in a country's economy. Source is the Federal Reserve Bank of St. Louis, Federal Reserve Economic Data (FRED) website. The deflated price indices have a benchmark value of 100 for 2011.

The association between real (inflation-adjusted) change in U.S. crop price and real change in U.S. input price is calculated for time windows of 1 to 10 years in length. These windows allow assessment of immediate, short term, and longer term price changes. To accommodate the 10-year time window, the analysis starts with 1981. Price change is calculated as the real price index at the end of a time window divided by the real price index at the beginning of the time window. One is subtracted from this ratio to generate the percent change in real price over the number of years in the time window.

Findings

Figure 1 presents the average year-to-year percent change in the real price index of the 6 inputs since 1981. Of the 35 year-to-year changes, 16, or 46%, are negative. Consecutive year-to-year declines are observed for 1982-1988, 1991-1993, 1998-1999, and 2014-2015. The annual declines over the 1982-1988 period sum to -23%. The decline in 2015 is the second largest since 1981 (-6.6% vs. -7.6% in 1986), although it is important to note that 2015 is not complete. Fuel is the main contributor to the decline in 2015 as its real price index is down 32% relative to 2014. However, even excluding fuel, average real price change for the other 5 inputs so far in 2015 is -1.5%. Key messages from Figure 1 are that (1) declines in real prices of crop inputs are common and (2) multiple year declines are not uncommon.

Figure 1. Average Percent Change from Prior Year of Deflated Price Indices for Seed, Fertilizer, Chemicals, Fuels, Machinery, and Ag Services and Rent, U.S., 1981-2015
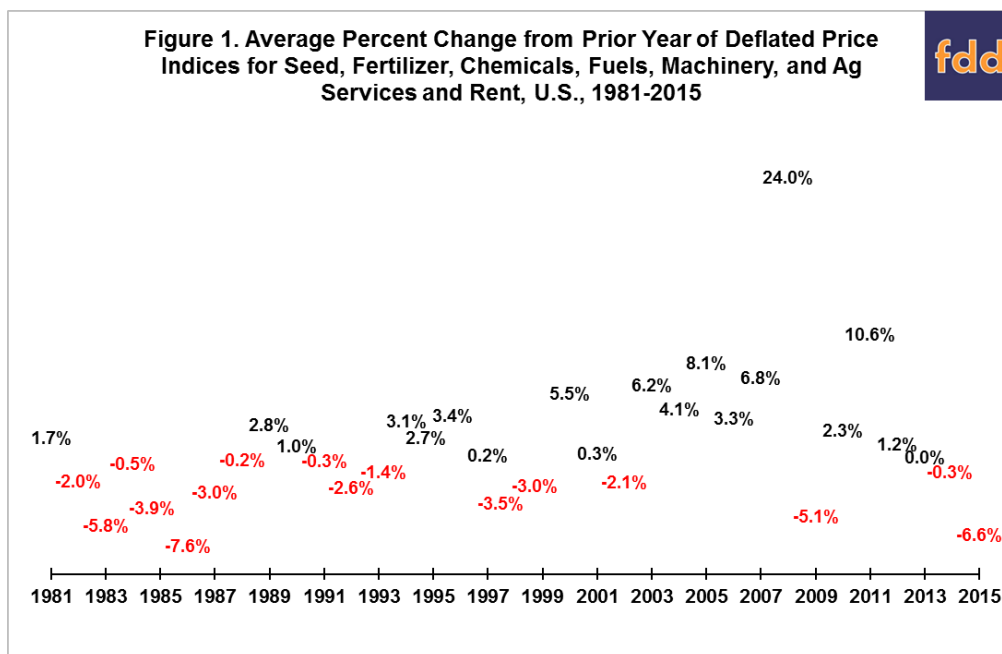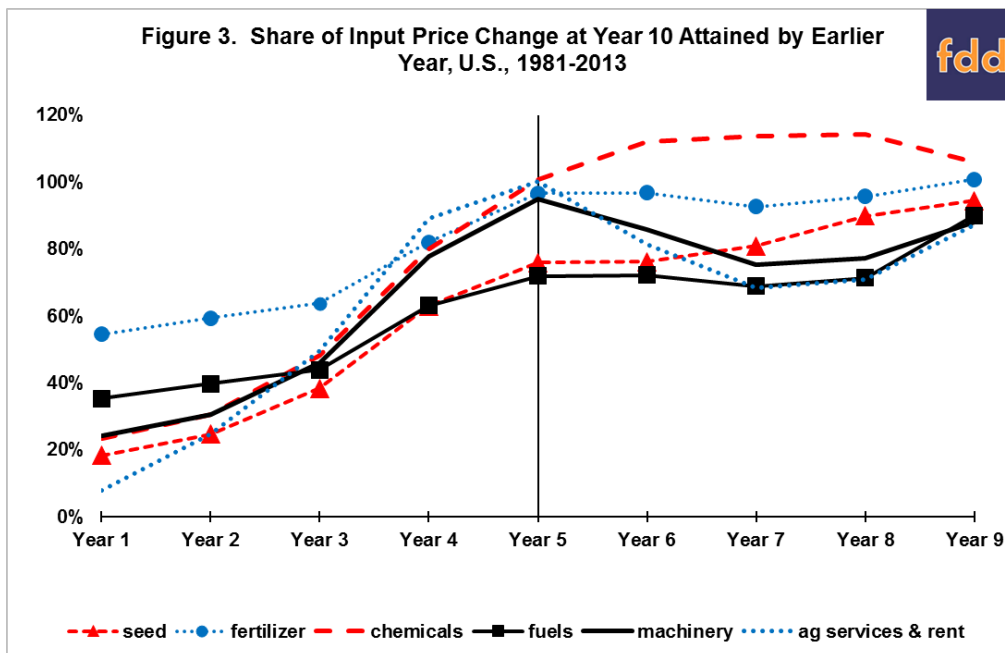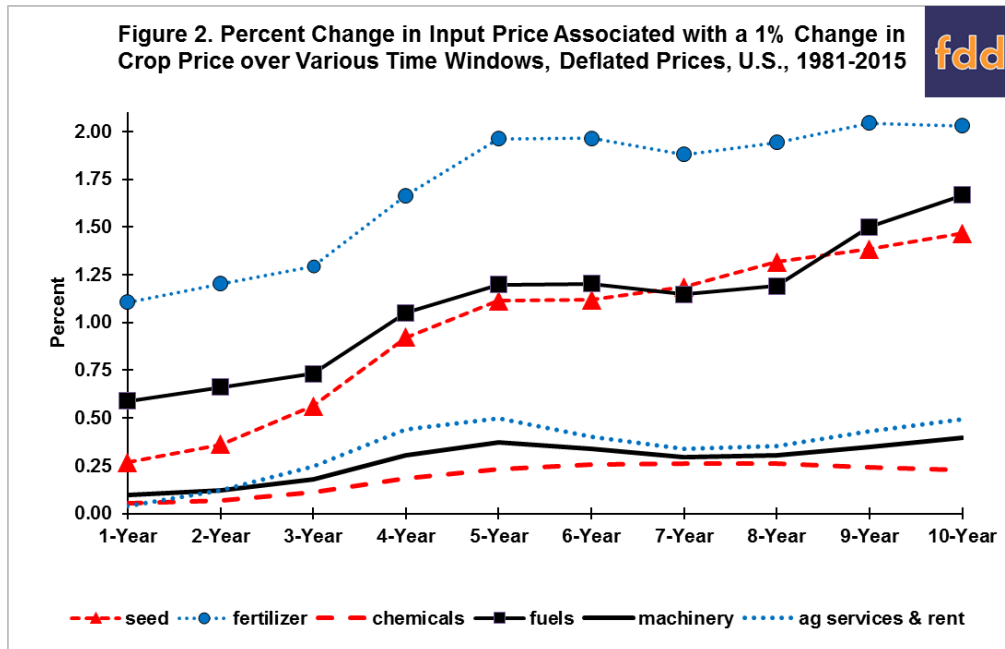
Figure 2 presents by input the percent change in real input price associated with a 1% change in real crop price. These values are the slope coefficients from a regression analysis of percent change in real input price index regressed on percent change in real price index of crops. For all 6 inputs, the percent change in real input price associated with a 1% real change in crop prices is positive and increases as the time window increases from 1 to 5 years. Thus, the normal historical relationship is for changes in input prices to be in the same direction as changes in crop prices and for Input prices to become more responsive to a change in crop prices as the time period increases from 1 to 5 years. To further examine the latter point, Figure 3 presents by input percent change in real price at shorter time windows relative to its percent change in real price at 10 years. One reason for creating this figure is that productivity increases have varied by input. The higher the increase in an input's productivity, the higher the price that farms can pay for the input, given all other factors. Thus, inputs are unlikely to have the same adjustment to a change in real crop price. Hence, it is not surprising that a variety of price adjustment paths exist in Figure 2. Despite this variety, each input's price adjustment is largely completed by year 5 (see Figure 3).

Over all time windows, the real price of fertilizer, fuels, and seed responds more to changes in the real price of crops than does the real price of ag services and rents, chemicals, and machinery. Moreover, for time windows of 5 or more years, the real prices of fertilizer, fuels and seed change as much as and often more than the real price of crops.

Factors other than change in crop prices affect the change in input prices over all time windows, but especially shorter time windows. To illustrate, the variation in percent change in real price index of an input explained by the variation in the percent change in real price index of crops at the 1 year time window is 1% (ag services and rent), 4% (chemicals), 13% (fuels), 15% (machinery), 19% (seed), and 41% (fertilizer). At the 10 year time window, the shares are 30% (chemicals), 39% (machinery), 42% (ag services and rent), 50% (fuels), 77% (seed), and 81% (fertilizer). While the shares are notably larger at 10 years, they tell us

that even after 10 years and except for fertilizer and seed all other factors are as important as and usually more important than the change in crop prices.

Figure 2. Percent Change in Input Price Associated with a 1% Change in Crop Price over Various Time Windows, Deflated Prices, U.S., 1981-2015

Figure 3. Share of Input Price Change at Year 10 Attained by Earlier Year, U.S., 1981-2013

Summary Observations

This assessment is simple. Many potential factors that could affect input prices are not examined. In addition, the past never perfectly predicts the future. Each period has unique factors, although it is often not clear at the time what the current period's unique factors are. Nonetheless, simple assessments using historical data can help draw the box that surrounds an issue; in this case the adjustment of crop input prices to changes in crop prices. Given the important caveats noted earlier in this paragraph, this simple assessment suggests the following implications.

► Historically input prices and crop prices have normally adjusted in the same direction.

■ A natural farm profit hedge exists as decreases (increases) in real crop prices usually are associated with decreases (increases) in real input prices. This natural profit hedge reduces the risk of farming.

► Degree of price responsiveness varies by input, with the price of fertilizer, seed, and fuels being more responsive than the price of ag services and rent, chemicals, and machinery.

■ The natural profit hedge thus varies by crop. Using 2013 and 2014 cost of production data from USDA, the share of total costs accounted for by fertilizer, seed, and fuel (plus lube and electricity) varies from 41% for corn to around 25% for soybeans, wheat, sorghum, barley, and oats. Thus, corn has the strongest natural profit hedge among the crops with USDA cost of production data.

► Most of the input price adjustment process to changes in real crop price occurs within 5 years.

■ Farms need a 5-year survival strategy for crop price declines.

■ Farm programs and crop insurance can help, but if their help is more than temporary input suppliers become non-trivial beneficiaries as they can avoid adjusting input prices downward.

● This observation may be one reason that, since World War II, all major declines in crop prices that persisted over multiple years led to downward adjustments in price support levels. Such downward adjustments occurred during the 1950s and 1960s in response to the on-going surpluses after World War II and via the 1985 farm bill in response to the high price supports enacted in the 1981 farm bill. It will be interesting to see if the same situation emerges with regard to the higher reference prices enacted in the 2014 farm bill.

► Despite the importance of the above implications, factors other than crop prices affect input prices. Focusing solely on crop prices may lead to missed opportunities and pitfalls.

► Relative price unresponsiveness of ag services and rent bears special mention.

■ Government is slowly withdrawing the extent of long term support for farm income. Farmers will thus need to redesign rental arrangements to share more of the risk and return to land with land owners. Flex rent leases will likely receive increased attention (*farmdoc daily*, September 9, 2015). This observation raises the following farm policy question, "Should farm policy facilitate private market sharing of risk between farmers and land owners by providing lower government payments for land with a fixed cash rent?"

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