

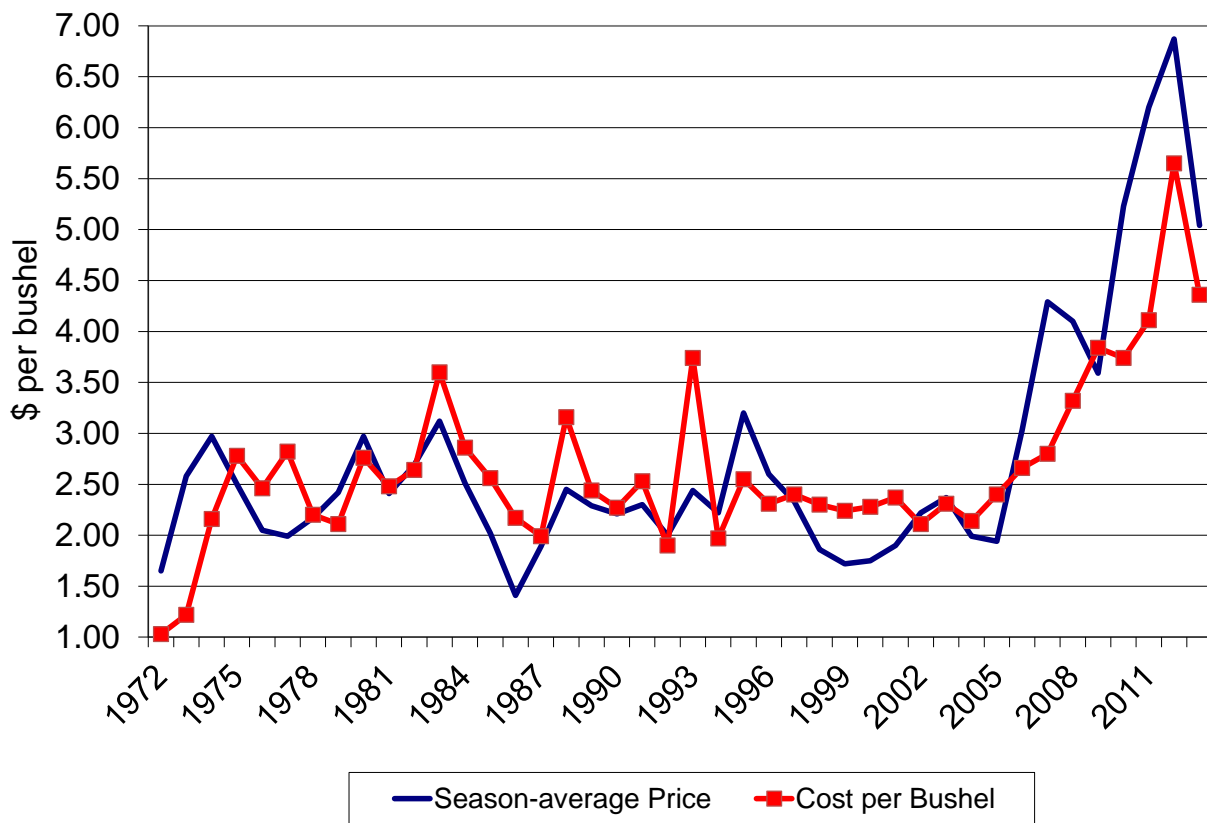
Ag Cycles: A Crop Marketing Perspective

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Over the past seven years, corn and soybean producers in the United States have enjoyed their best run of returns in history. Corn and soybean prices have reached and sustained at levels beyond expectations from a decade ago. USDA's estimates of net farm income have peaked at record levels over the past few years. But like most things that go up, crop prices and returns are likely to decline as we move forward. Agricultural returns tend to be cyclical in nature, a few years of good returns followed by a few years of negative returns. That is the inherent nature of agriculture; it is a competitive industry. And economic theory indicates the long-run profitability of a competitive industry is zero. So we should expect some negative years to balance out the recent good run.

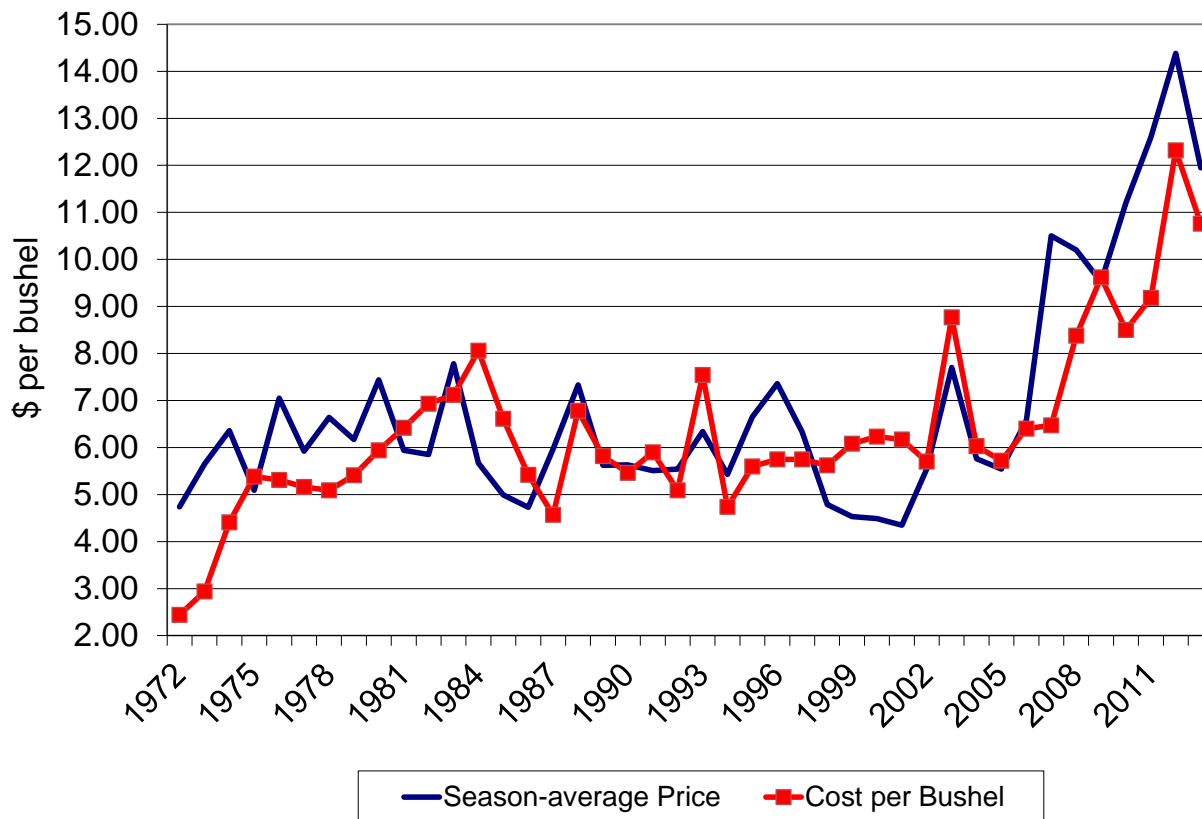
Figures 1 and 2 show the historical per bushel prices and production costs for corn and soybeans in Iowa over the past 40 years. As the figures display, prices and costs can move dramatically from year to year. While production costs on a per acre basis are relatively stable, production costs on a per bushel basis are not, due to the large swings in yields. For example, the drought of 2012 lowered Iowa's corn yield to 137 bushels per acre, 35 bushels less than 2011. That increased the per-bushel costs for corn substantially.

Figure 1. Corn Prices vs. Production Costs



These figures highlight the strong prices and growing production costs we have experienced over the past few years. But these also show we have had significant runs of profitability and loss before. For corn, we can see the profitable runs in the early 1970s and the mid 1990s. Both of these runs were followed by sustained periods of economic losses in the mid 1970s and the late 1990s. When we examine the average return to a bushel of Iowa corn over the entire time period from 1972 to 2012, it is a positive 5 cents per bushel. However, if you looked at 1972 to 2011, the average return was negative. A similar description can be given for soybeans.

Figure 2. Soybean Prices vs. Production Costs



This paper explores the relationship among crop prices, cost production costs, and key economic variables to examine some of the factors that shape the cyclical patterns in crop returns. Given the strong run-up in crop prices and agricultural land values, there has been a tremendous amount of discussion about an agricultural boom and bust. Many have drawn parallels to the mid 1980s when land value declined precipitously in the farm crisis. Could we be looking at a repeat of that time? While there are some strong similarities, there also are some significant differences. One of the key differences is the strength of current crop prices. In the mid 1980s, crop prices and returns were low. Currently, crop prices and returns are near record levels.

But what are the economic conditions that could lower crop prices and returns? One possibility is recession. After all, corn and soybean prices did fall precipitously during the last recession. Figures 3 and 4 display the pattern of corn and soybean prices over the past 44 years and the gray bars highlight when the general economy was in recession. But as the graphs show, crop prices sometimes rise during recessions. During the recessions in the 1970s, corn and soybean prices tended to rise. And while we have experienced some large price swings during recessions, those swings are no larger than those we have experienced during good economic times.

Figure 3. Corn Prices and Recessions

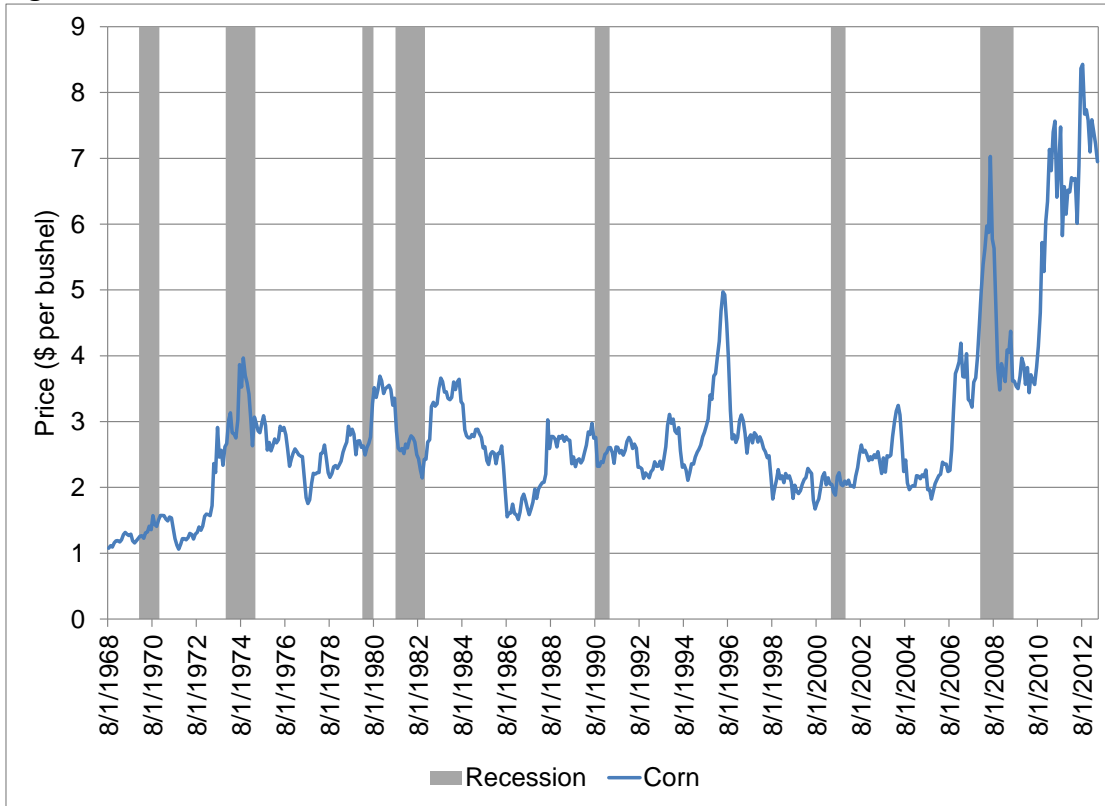
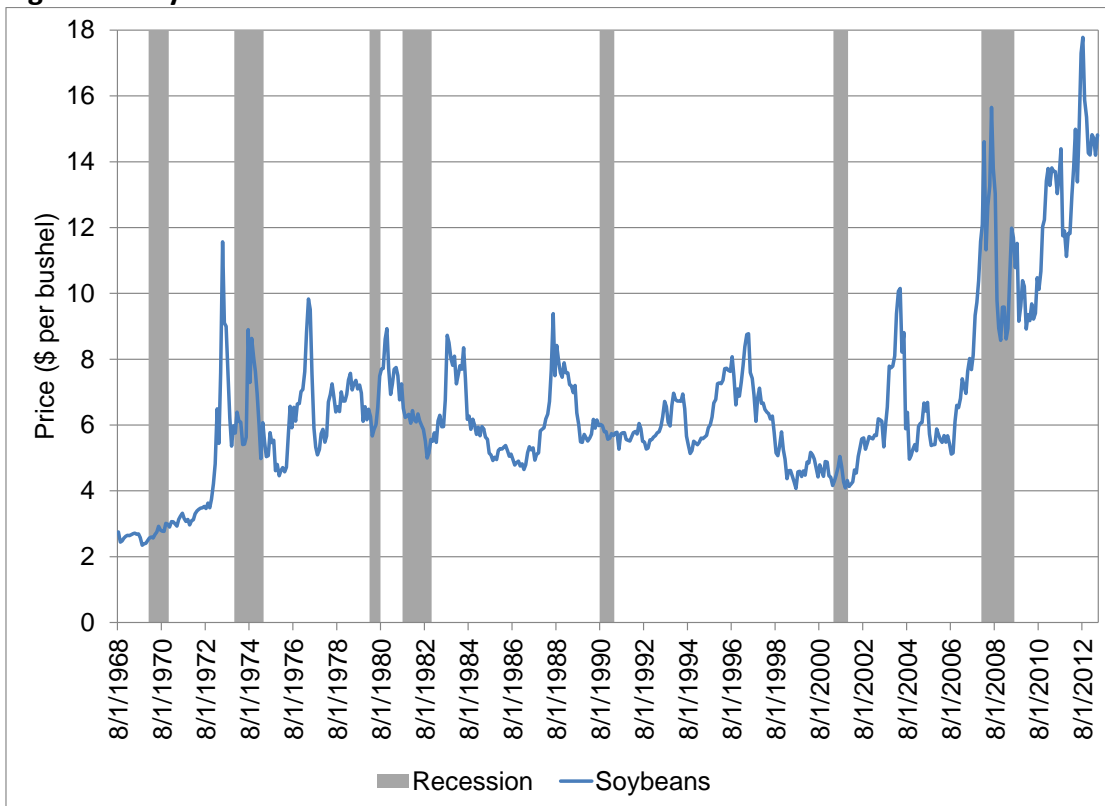


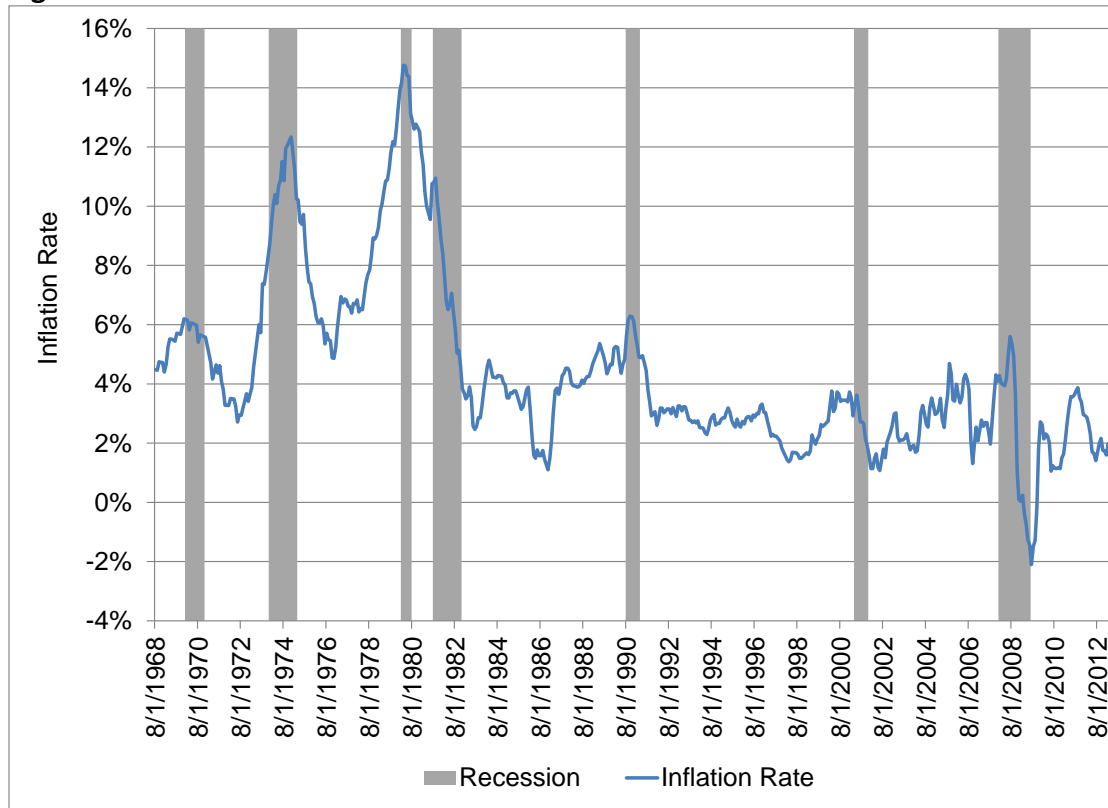
Figure 4. Soybean Prices and Recessions



Two other general economic factors that could influence crop pricing and returns are inflation and interest rates. Figures 5 and 6 show the historical relationship among inflation rates, interest rates and recession. Over the past 40 years, the general trend has been for lower inflation and interest rates. However, during recessions, we tend to see higher inflation and interest rates as the recession starts, and lower inflation and interest rates as the recession comes to a close.

Our last major bout with inflation occurred in the mid 1970s to early 1980s when inflation rates reached well over 10%. Recently, the inflation highs have been in the 6% range. We even experienced some mild deflation (negative inflation, prices moving downward) at the end of the last recession.

Figure 5. Inflation Rates and Recessions



Interest rates over the last 20 years have been fairly low and fairly calm, compared with the patterns in the 1970s and 1980s. In the late 1970s and early 1980s, interest rates over 10% were commonplace. But the 3-month Treasury bill rate has not been above 10% since the summer of 1984. During recessions, we tend to see sizable drops in interest rates as the Federal Reserve helps stimulate the economy. On average, during the last four recessions, interest rates have dropped by 4%. With the last recession, interest rates fell to the lowest levels in 40 years and remain there currently.

Tying these pieces of information together, if we look at the relative changes in corn and soybean prices, inflation rates, and interest rates during recessionary and non-recessionary periods, we find that recessions do have an impact on all of these variables. But the impact is not as large as most would expect, as demonstrated in Figure 6.

Figure 6. Interest Rates and Recessions

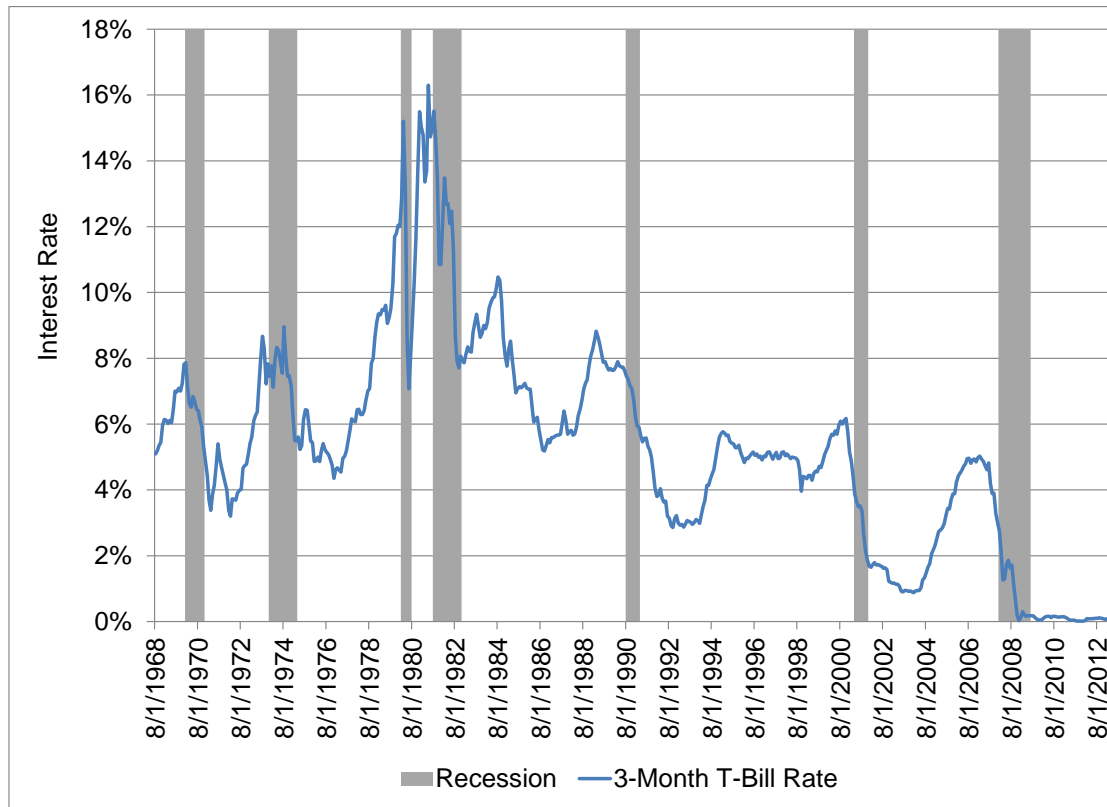


Table 1 shows the average monthly changes in corn and soybean prices, inflation rates, and interest rates over the last 40 years and during recessionary and non-recessionary periods. Corn and soybean prices have averaged nearly a 0.7% increase per month during the period, but most of that growth has occurred in the last six years. Inflation and interest rates have declined, on average, 0.01% per month.

However, if the general economy is in recession, the average increase in corn prices falls to 0.42%. Soybean prices show very little impact from recessions. But inflation and interest rates decline at a much quicker rate. During non-recessionary periods, corn and soybean prices have averaged the same percentage growth, 0.67% per month. Inflation and interest rates also have grown during non-recessionary periods. So while recessions are defined by negative economic growth for the general economy, they seem to be more related to a slowing of growth in the crop sector.

Table 1. Average Monthly Change

	Corn Price	Soybean Price	Inflation Rate	3-Month T-Bill Rate
Average	0.63%	0.66%	-0.01%	-0.01%
Recession	0.42%	0.63%	-0.14%	-0.27%
Not Recession	0.67%	0.67%	0.02%	0.04%

Data from Sept. 1968 to April 2013

To explore the relationships among crop prices, inflation rates, and interest rates, we computed the correlation matrix among these variables (Table 2). Corn and soybean prices are highly correlated (i.e. they tend to move together) as is shown by the correlation of 0.635. The linkages between crop prices, inflation rates, and interest rates are less certain. While there is a positive correlation structure among all of these variables, the strength of those relationships is weak. Based on these correlations, there does not seem to be strong links between crop prices, inflation rates, and interest rates.

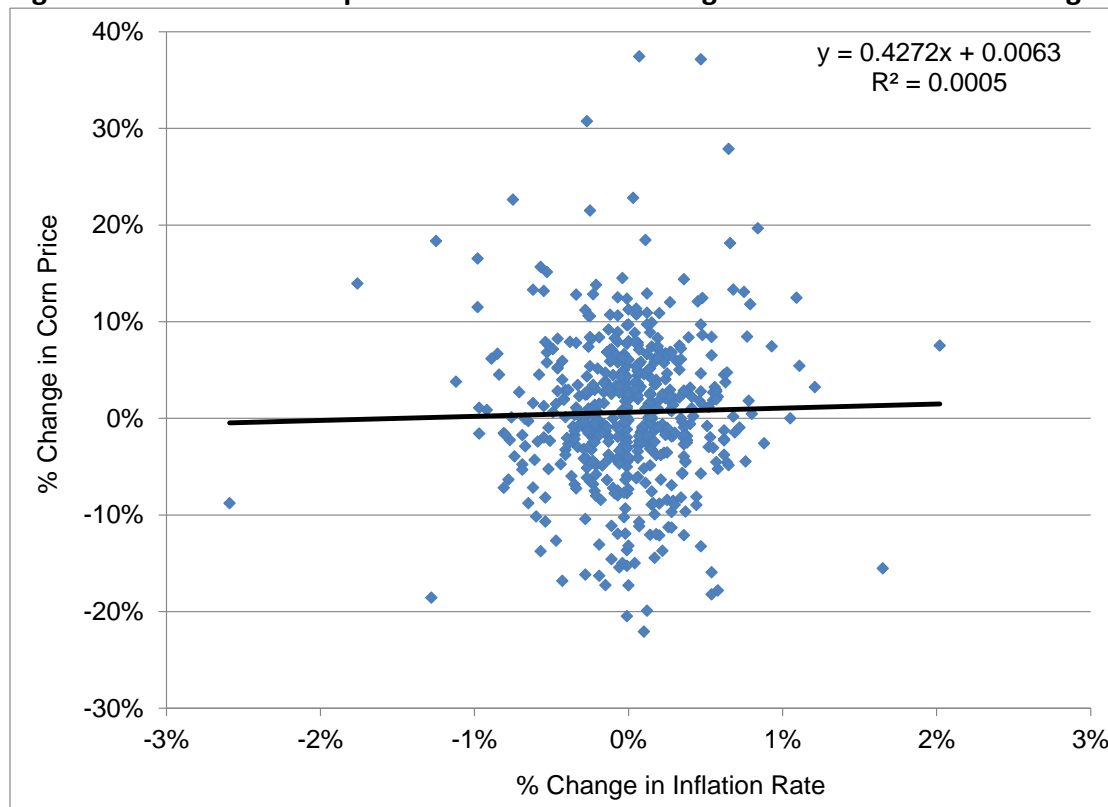
Table 2. Correlation Matrix

	Corn Price	Soybean Price	Inflation Rate	3-Month T-Bill Rate
Corn Price	1.0000			
Soybean Price	0.6350	1.0000		
Inflation Rate	0.0231	0.0863	1.0000	
3-Month T-Bill Rate	0.0470	0.0162	0.1301	1.0000

Data from Sept. 1968 to April 2013

The scatterplots of crop prices versus inflation rates or interest rates confirm the lack of relationships among these variables. As Figures 7-10 show, the relationships among the variables are very weak. The monthly swings in crop prices are much larger than those in inflation or interest rates. If there is a strong linkage among crop incomes, inflation rates, and interest rates, then that relationship must be on the cost side of the crop equation.

Figure 7. The Relationship between Corn Price Changes and Inflation Rate Changes



While there does not seem to be strong relationships for recessions, inflation rates, and interest rates with crop prices, that only accounts for the revenue part of crop income. Recessions, inflation rates, and interest rates could impact crop agriculture more through the cost side of income. Let's explore that possibility.

Figure 8. The Relationship between Soybean Price Changes and Inflation Rate Changes

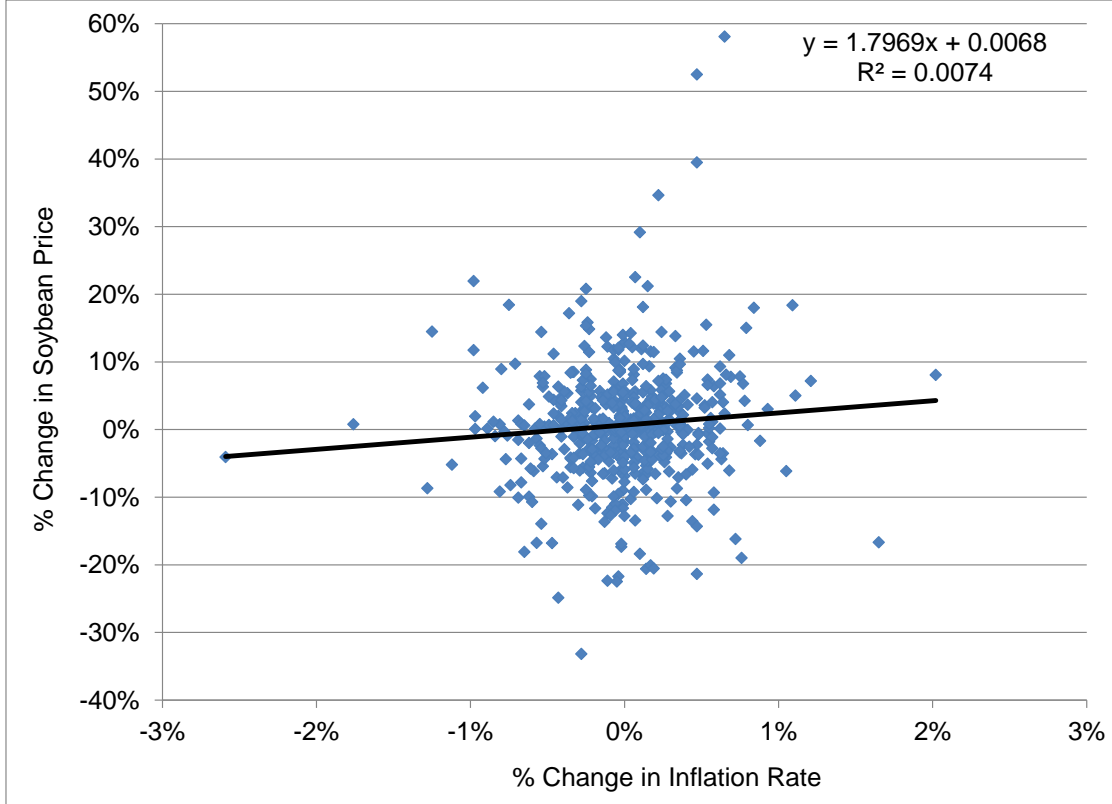


Figure 9. The Relationship between Corn Price Changes and Interest Rate Changes

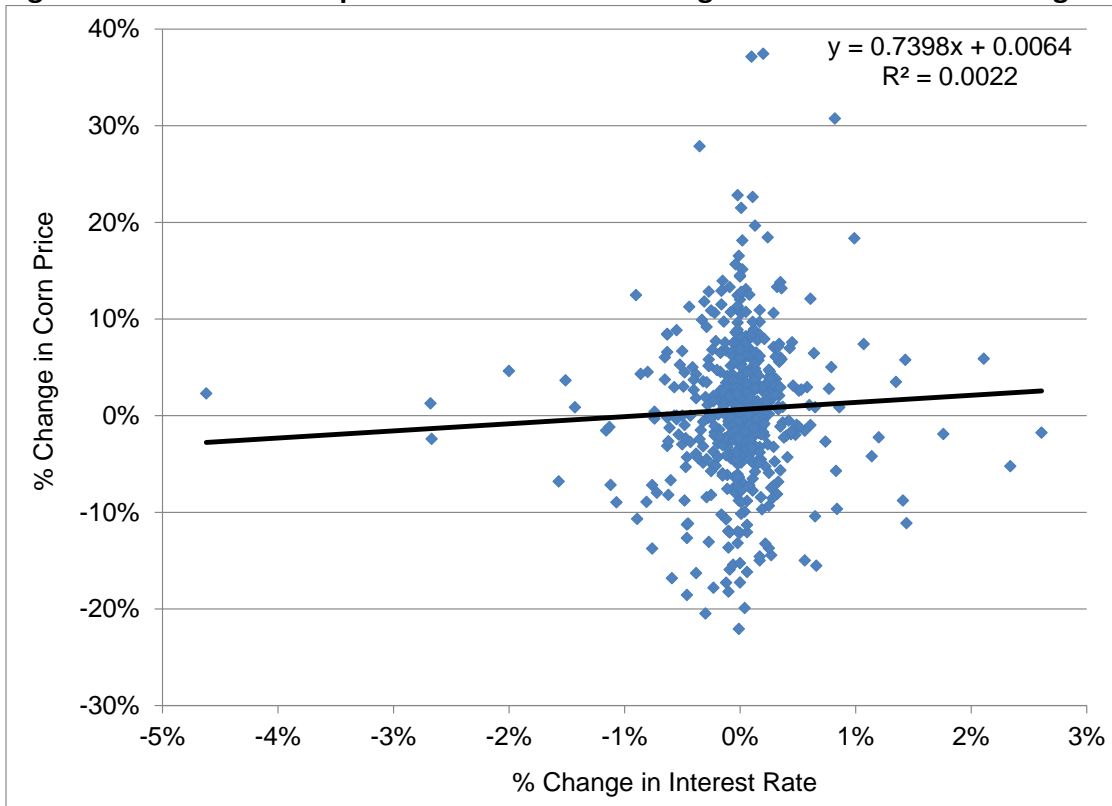
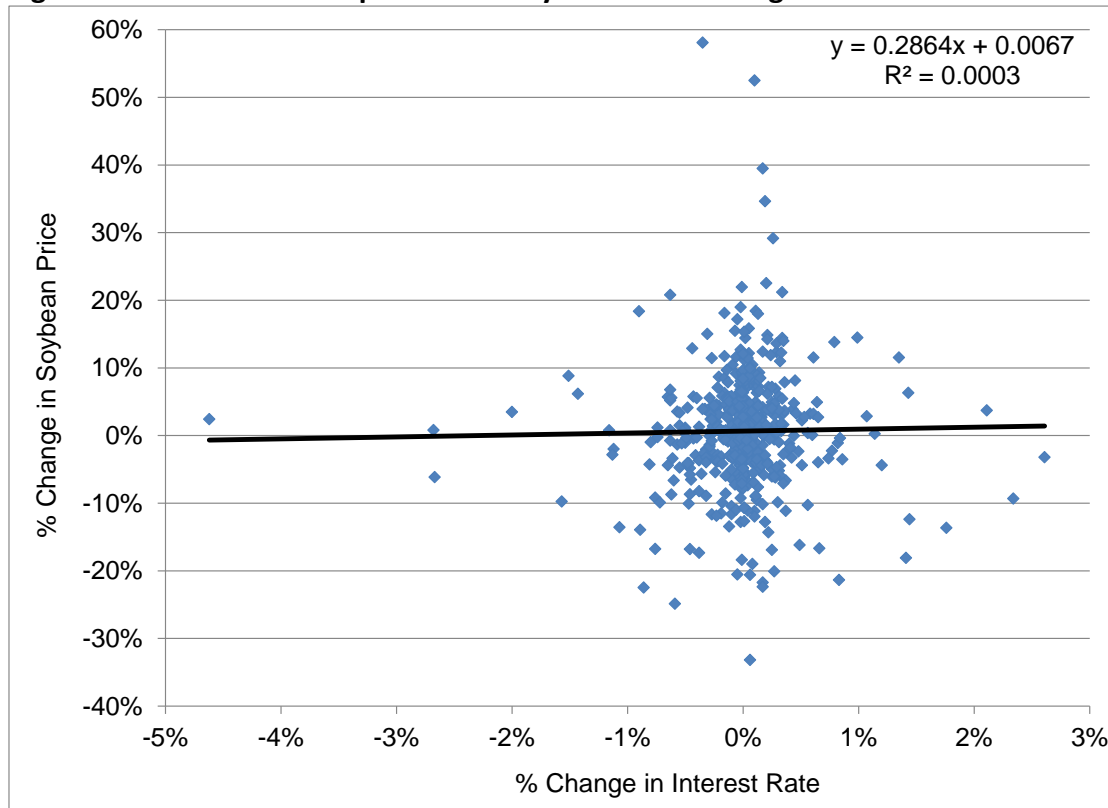


Figure 10. The Relationship between Soybean Price Changes and Interest Rate Changes



Two cost categories that could be highly influenced by recessions, inflation rates, and interest rates are fertilizer and fuel. After land costs, fertilizer and fuel are two of the biggest cost components for crop producers. USDA’s data on fertilizer and fuel prices is not quite as extensive as the crop price data. From 1975 to 1995, USDA captured quarterly fertilizer and fuel prices. Monthly price data has been available since 1995. Figures 11 and 12 show the fertilizer and fuel price series during recessions and non-recessionary times. For fertilizer, some of the largest price swings in history came during the last recession. However, we saw a similar swing in 1975-76, just after the recession in the early 1970s. For fuel, the largest price swings occurred during the 1990-91 recession, when fuel prices spiked by 50% and then retreated by 30%. Just looking at these two graphs, it seems crop costs may be more in line with the general economy than crop prices.

Table 3 shows the average monthly changes for fertilizer and fuel prices, inflation rates, and interest rates over the study period. As with crop prices, recessions seem to be associated with slowdowns in fertilizer and fuel prices. The impact is the largest on fertilizer.

Table 3. Average Monthly Change

	Fertilizer Price	Fuel Price	Inflation Rate	3-Month T-Bill Rate
Average	0.52%	0.94%	-0.04%	-0.02%
Recession	0.14%	0.80%	-0.35%	-0.51%
Not Recession	0.57%	0.96%	0.01%	0.04%

Data is quarterly from April 1975 to Jan. 1995, then monthly from Jan. 1995 to April 2013

Figure 11. Fertilizer Prices and Recessions

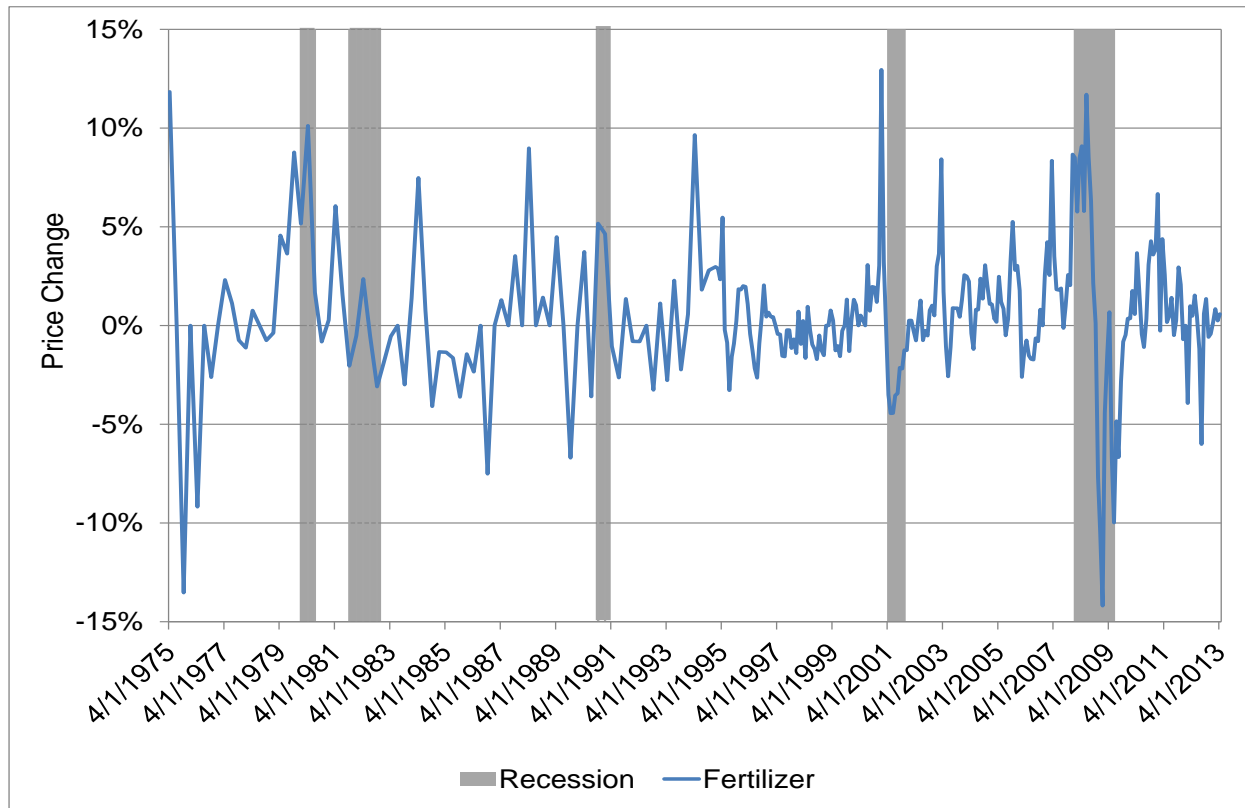
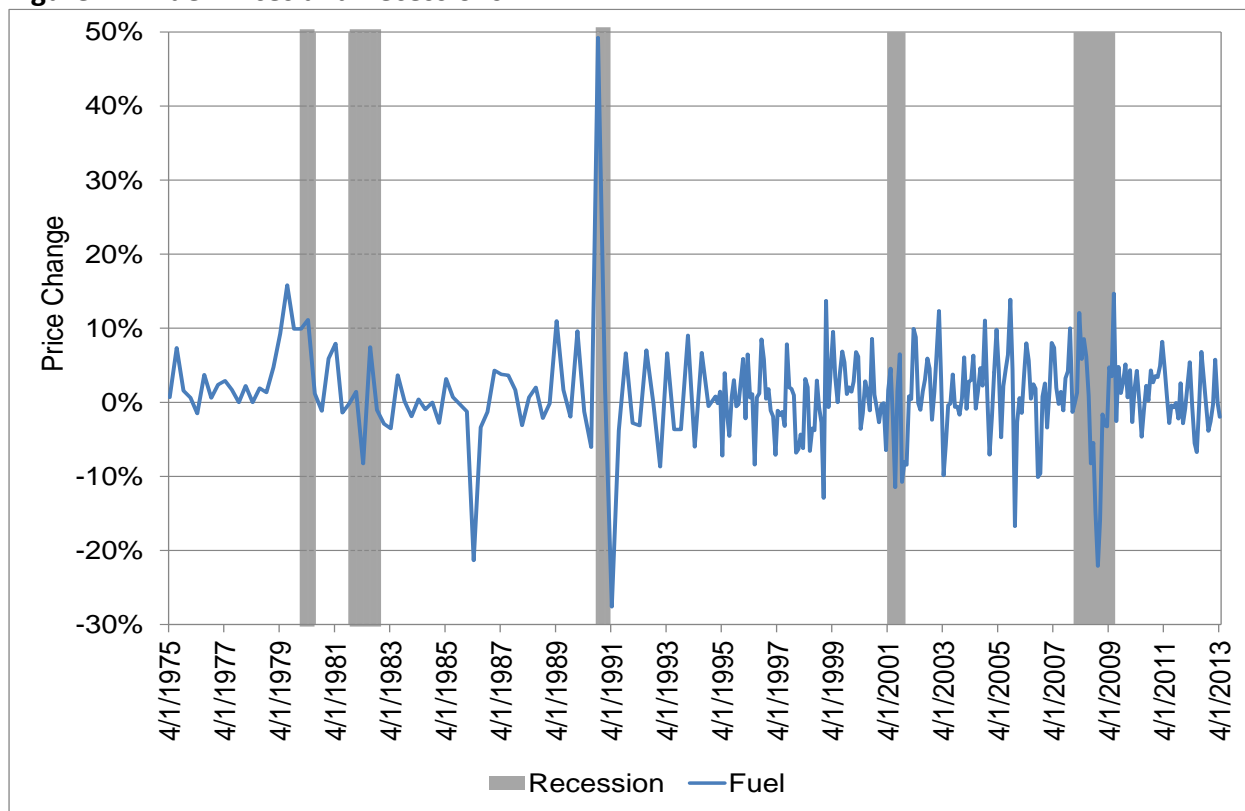


Figure 12. Fuel Prices and Recessions



Based on correlations, fertilizer and fuel prices are more closely tied to inflation and interest rates than crop prices. Figures 13-16 show the scatterplots and the estimates of the typical relationships among these variables. In all cases there seems to be a positive relationship. For example, as inflation rates increase, so do fertilizer prices. The strongest relationship is between fuel prices and inflation rates. That makes sense as fuel price movements are a large component of inflation calculations.

Table 4. Correlation Matrix

	Fertilizer Price	Fuel Price	Inflation Rate	3-Month T-Bill Rate
Fertilizer Price	1.0000			
Fuel Price	0.2342	1.0000		
Inflation Rate	0.2188	0.4806	1.0000	
3-Month T-Bill Rate	0.0896	0.0777	0.2743	1.0000

Data is quarterly from April 1975 to Jan. 1995, then monthly from Jan. 1995 to April 2013

As the equations show, for each one percent increase in inflation rates, we typically see a 1.2% increase in fertilizer prices and a 5% increase in fuel prices. So crop production costs do move in concert with inflation. While fertilizer and fuel prices have a positive relationship with interest rates, it is a very weak relationship (as evidenced by the very low R^2 , R^2 is a measure of how well the equation fits the data points). However, interest rates directly impact production costs through interest charges on operating loans. So inflation and interest rates have a strong pull on crop production costs.

Figure 13. The Relationship between Fertilizer Price Changes and Inflation Rate Changes

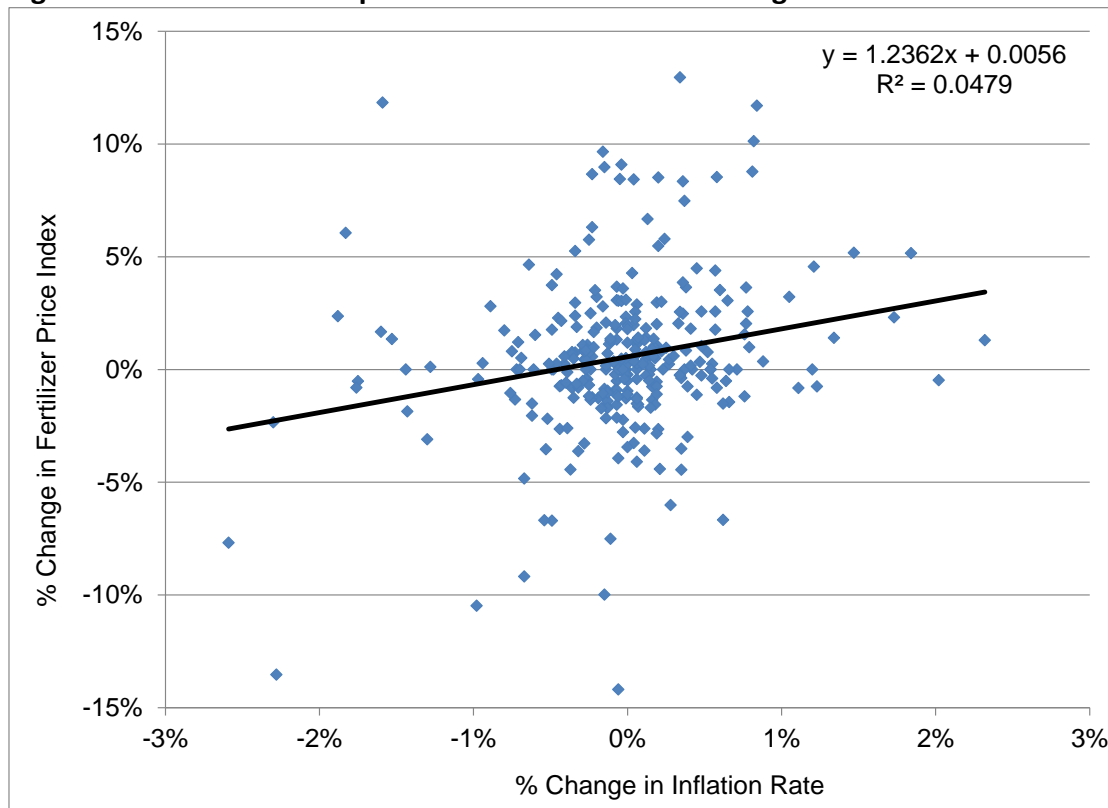


Figure 14. The Relationship between Fuel Price Changes and Inflation Rate Changes

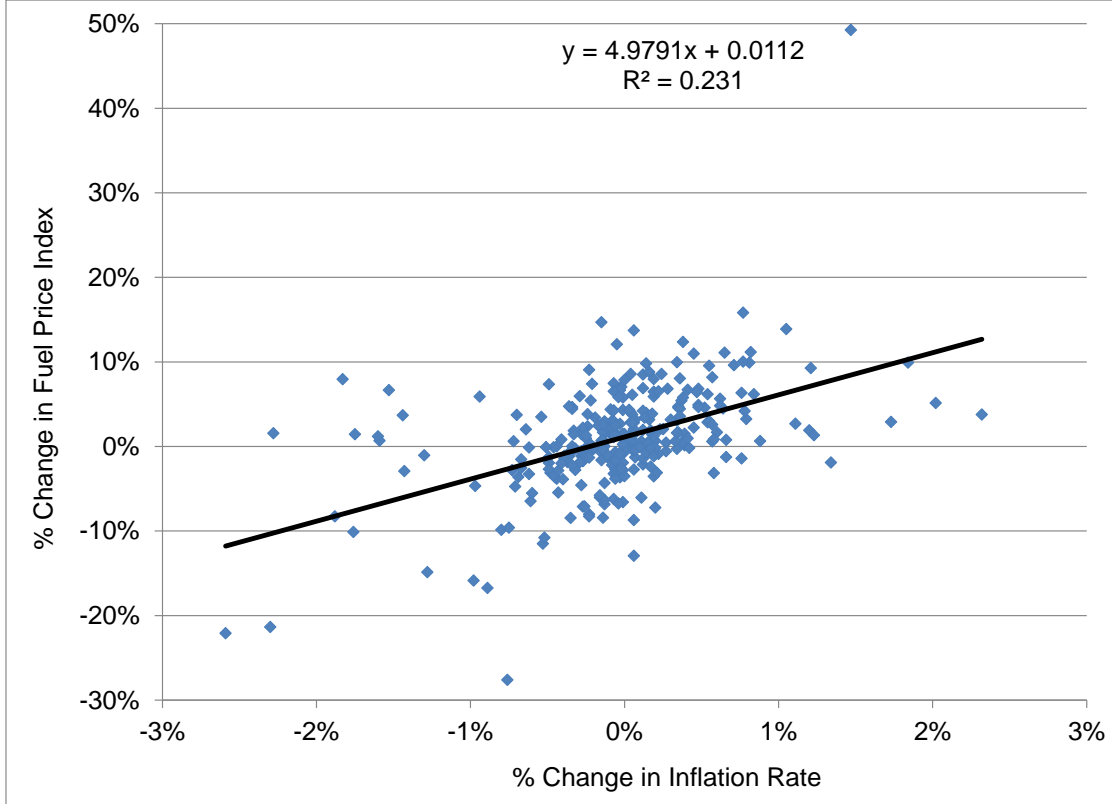


Figure 15. The Relationship between Fertilizer Price Changes and Interest Rate Changes

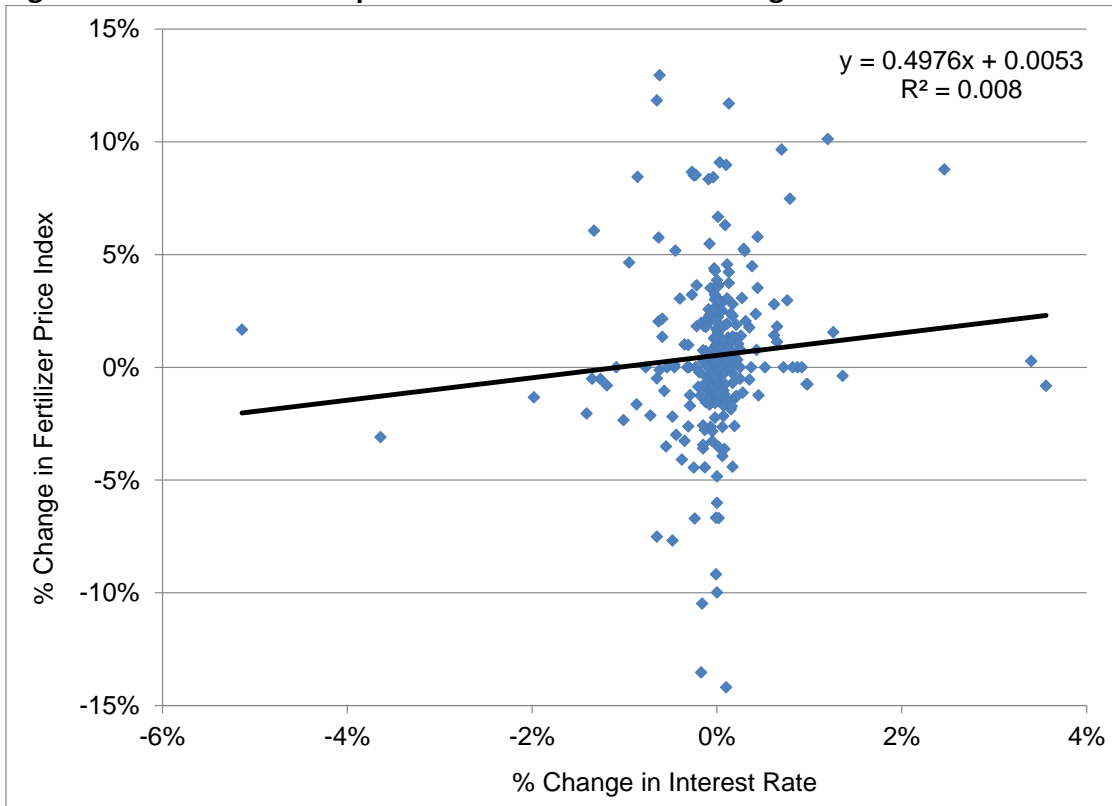
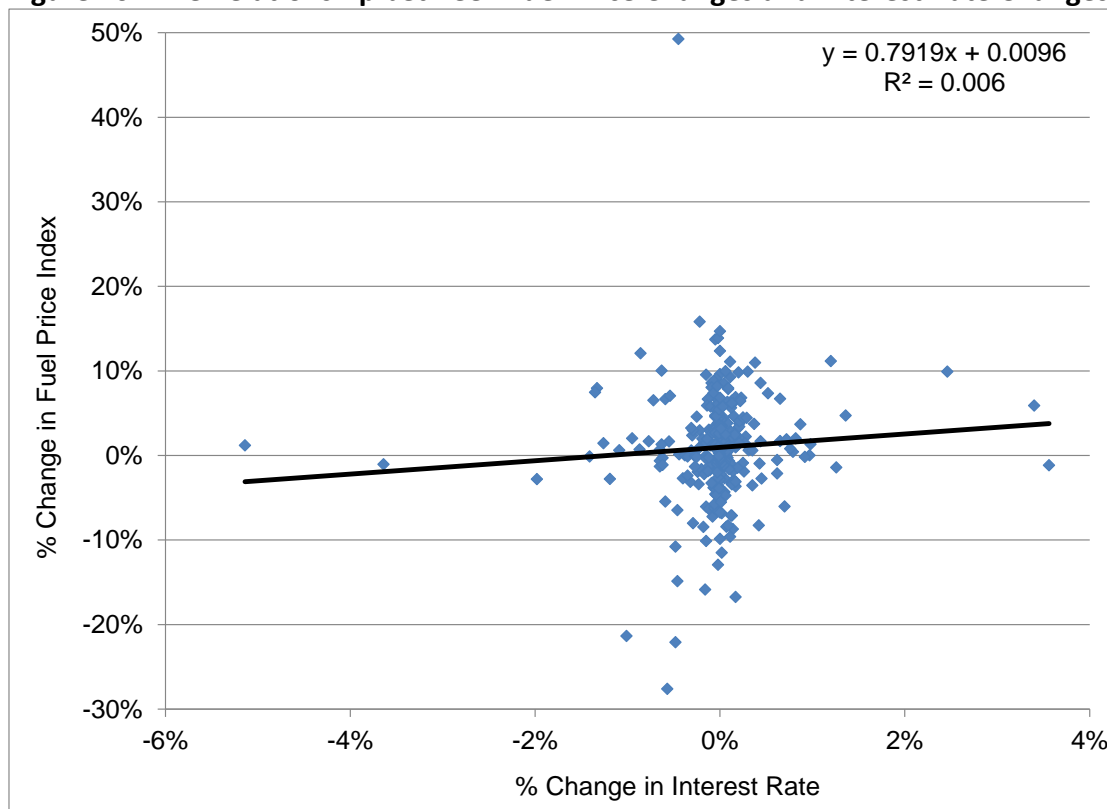


Figure 16. The Relationship between Fuel Price Changes and Interest Rate Changes

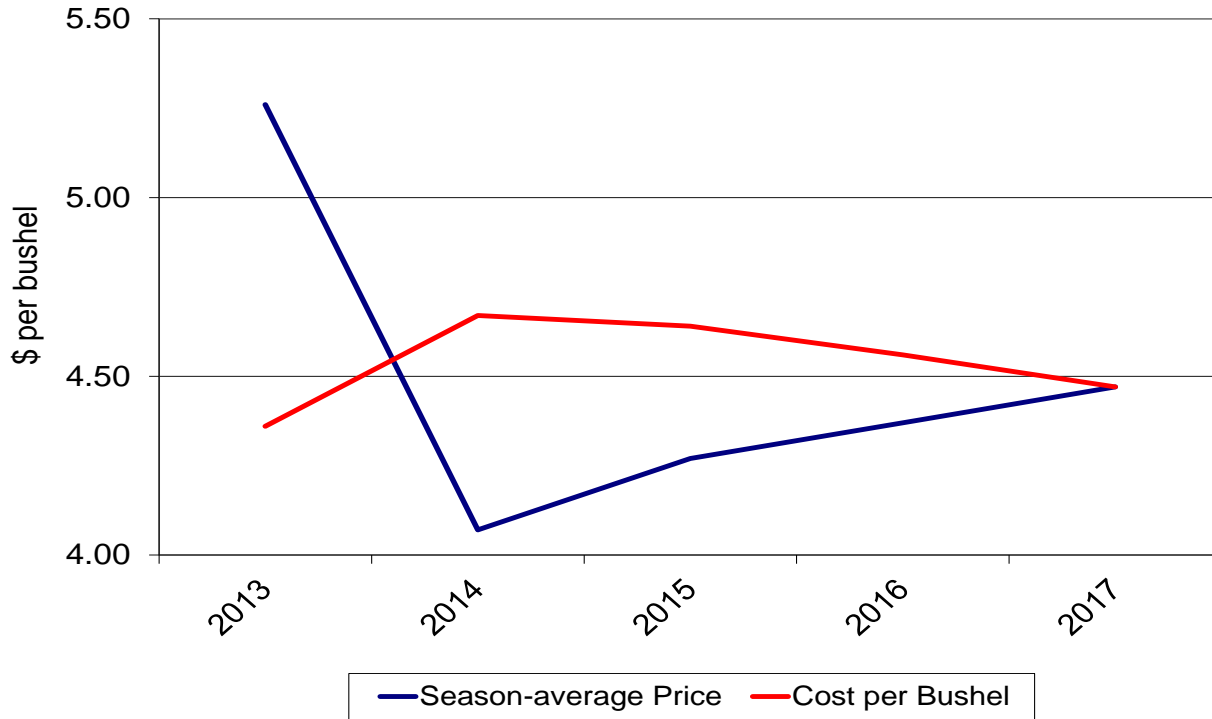


To summarize, crop prices are heavily influenced by the cycles in agricultural production and crop market supply and demand. Crop costs are more influenced by the cycles in the general economy. As crop margins or profitability are computed as the difference between crop prices and costs, these are influenced by both types of cycles. Sometimes, these cycles complement each other. For example, the record crop returns over the past few years were driven by tight crop markets and low interest and inflation rates. An example on the negative side would be the early to mid 1980s when we saw negative crop returns linked with low crop prices and high inflation and interest rates. Other times these cycles offset each other, for example, the late 1980s and early 1990s.

Looking at the current situation, there are several factors pointing to lower crop returns in the near future. Crop prices are under pressure for several reasons. First, corn and soybean planted area are at very high levels, so the potential for record crop production exists. Second, crop demands have been retreating recently under record high crop prices and the lackluster growth in the general economy. This combination of reasons has both the projected prices from USDA and the futures prices from the Chicago Board of Trade on a strong downward slide as we look at the 2013 and 2014 crop seasons, moving from \$7 corn and \$14 soybeans to \$4-5 corn and \$10-12 soybeans.

Crop costs, however, look to continue to rise. First, there is the direct pressure from the increase in planted area and the need for more crop inputs as more land is farmed. Second, as the general economy has shown some signs of picking up steam, inflation and interest rates are expected to rise. So the picture ahead could look like Figure 17, with negative crop returns and a slowdown in the crop sector. So it may be "Back to the Future." Agricultural returns are cyclical in nature, a few years of good returns followed by a few years of negative returns. Agriculture is a competitive industry. And the long-run profitability of a competitive industry is zero.

Figure 17. Projected Corn Prices and Production Costs



Given this outlook, what are the ways producers can protect their financial bottom line? First, create and follow a marketing plan. A marketing plan guides you as you face the ups and downs of a market and reminds you of your goals for the operation. Second, explore sales and input purchases as a joint event. Pair crop sales and input purchases to lock in crop margins when these are profitable. As costs rise, input management will become more important. Just ask your livestock-producing friends, as they have been in this situation for the past several years. Third, protect yourself from interest rate risk by moving to fixed rate loans while interest rates are low. Fourth, continue to use risk management programs, such as crop insurance, to protect against unexpected weather and market events. While prices and costs have changed, the risks to agriculture are still the same set as the last 40 years, if not beyond. So the tools to manage those risks still work, as long as these reflect the current pricing structure. It's not that we need new risk management tools; it's that we need to make sure we are utilizing the existing tools effectively.