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We welcome you to the 1st Quarter, 2009 issue of Choices. You will find a timely theme and two interesting individual articles which present analyses of topics important to agricultural, food, rural, and environmental issues and policies.

The theme addresses how the current economic crisis and volatility in financial and commodity markets is likely to impact the agricultural sector from producers through the supply chain. Guest editor David Schweikhardt brings together seven articles covering topics ranging from the financial crisis and bailout efforts driving the macroeconomic environment, to farm level challenges in managing risk and obtaining credit, to the policy implications for the agricultural sector, and a proposal to mitigate future price volatility through a virtual grain reserve coordinated internationally to reduce impacts on poor consumers worldwide. Authors address questions about whether indeed we face greater uncertainty in agriculture's future, what farmers may need to do to deal with apparent increased instability in markets for their products and for the inputs they use, and policy issues needing attention.

A separate submitted article closely related to this theme analyzes the potential for changes in policy related to ethanol production to ease pressures in corn markets. The assumption is that it is desired to hold corn prices at lower but more predictable levels than experienced over the last...
year. A second submitted article is focused on structural change in agricultural production, with increasing size of operation to take advantage of scale and scope economies. The authors analyze the implications of farm consolidation, growth in size, diversification, and relationships to the policy environment. While the study reported here focuses on agricultural operations in the state of Washington, implications are readily drawn for the entire United States.

We encourage submissions of proposals for future themed sets of papers, individual articles, and timely policy issues analyses. Submit theme proposals and policy issues proposals to Walter J. Armbruster at walt@farmfoundation.org, and individual papers for the quarterly *Choices* to Clement Ward at clement.ward@ok-state.edu. We look forward to working with you to address important economic and policy issues affecting food, farms, resources, and rural communities.
Theme Overview: Agriculture in a Turbulent Economy—A New Era of Instability?

David B. Schweikhardt

“Despite its many ingredients, most of the farm problem boils down to issues affecting the level of farm income.”

--Theodore W. Schultz

Agriculture in an Unstable Economy

The theme title is posed as a question rather than the descriptive statement generally used in past themes in Choices. The reason for this difference is based on the timing of this topic. World agriculture has recently passed through a brief period of extreme turbulence. Having passed through this period, it remains unclear whether the period is an outlier of long-term trends or a portent of things to come. In addition, this period is now being followed by an international financial and economic crisis that may yet result in extreme conditions of some other form. Thus, no definitive answer can be given about the question posed here.

Unlike the farm problem in Schultz’ day, when the absolute level of farm income dominated the policy debate, today’s policy issues frequently center on the variability of commodity prices and farm income. In addressing the question posed by this theme, two issues are relevant. First, is there a new era of instability in agriculture? It can be easily argued that it is too early to tell whether the events of the past decade signal the beginning of a new era or merely an outlier within past trends. Nevertheless, stakeholders and policymakers are likely to debate this question in the near future. Such a debate is more likely to reach a reasonable outcome if it is informed by economic analysis.

Second, are there new or larger portions of the ingredients that contribute to the instability of the agricultural sector and the food system at large? World agricultural markets, despite the continuing presence of trade barriers, have become highly integrated across national borders. After years of speculation about whether agriculture could be a significant supplier of energy, the development of the ethanol market as a major user of agricultural commodities is now a reality. The effects of macroeconomic conditions on agriculture are likely to be become increasingly evident as the global financial crisis unfolds. These and other ingredients pose the possibility that a new era of instability is emerging in agriculture.

The papers presented here examine these questions in the light of events over the past decade. The topics include consideration of whether agricultural commodity prices have reached a new plateau and whether the integration

Articles in this Theme:

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- The Emergence of an Agro-Energy Sector: Is Agriculture Importing Instability from the Oil Sector?
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- Are Our Agricultural Risk Management Tools Adequate for a New Era?
of agricultural and energy markets exposes the agricultural sector to the instability of the energy sector. Other papers examine the role of national policy decisions, commodity market regulation, macroeconomic factors, and evolving credit markets as sources of farm income and asset price instability. Finally, the adequacy of existing risk management tools is examined.

In the first paper, Scott Irwin and Darrel Good examine recent changes in agricultural commodity prices through the lens of past episodes of increased prices. Comparing recent prices to the historical evidence, they reach the conclusion that a new era of agricultural price volatility has arrived with both a higher average price and wider variation in prices. Such an outlook, they conclude, could have far-reaching effects for virtually every market participant in the food system.

In the second paper, Andrew Muhhammad and Ellene Kebede examine the question of whether the development of the ethanol market has resulted in the integration of oil and corn prices in such a manner that the agricultural sector is now importing instability from the oil sector. Based on an emerging body of literature on the subject, Muhammad and Kebede conclude that such integration has occurred. Such an unintended consequence could, of course, add a significant new ingredient to the instability of the farm sector by adding to the level and variability of commodity prices.

In the third paper, Joachim von Braun and Maximo Torero dissect the commodity price spike of 2007–2008 by examining the role of policy-induced instability in the price spike. In particular, they examine the role of changes in national trade policy—temporary erection of export barriers and reductions of import barriers—in adding upward pressure on commodity markets. Second, they examine the possibility that speculative activity contributed to the price spike. Both cases underscore the role of public policy in a market economy—every market operates within an institutional framework that determines the economic performance of that market. In that vein, von Braun and Torero then consider institutional innovations intended to increase the stability of commodity markets.

In the fourth paper, William Liefert and Mathew Shane examine the impact of the ongoing global financial crisis on the farm sector. Examining both the direct (credit availability) and indirect (economic growth and exchange rate) consequences of macroeconomic policy, they find that the indirect effects are likely to have a larger impact on the farm sector than the direct effect. If Liefert and Shane are correct in this assessment, the full impact of the financial crisis has not yet been felt by the agricultural sector.

In the fifth paper, Mitch Morehart considers the impact of macroeconomic policy on the value of farmers’ largest asset—land. Examining alternative macroeconomic scenarios, Morehart finds that the outlook for land values can be highly sensitive to macroeconomic conditions. Such a finding is particularly important given the almost unprecedented uncertainty about macroeconomic conditions during and after the ongoing credit crisis. Again, the farm sector could be exposed to instability from a source outside the farm sector that is, in large part, a policy-induced creation.

In the sixth paper, Paul Ellinger examines the financial crisis from yet another dimension—that of the financial sector serving agriculture. As Ellinger notes, the initial shock waves of the financial crisis were centered in nonagricultural lending institutions. Thus, the initial impact of the financial crisis on agricultural lenders was minimal. As time has passed, however, the potential impact of the crisis on agricultural credit markets could be larger in the near future.

In the final paper, Keith Coble and Barry Barnett consider the issue of whether the farm sector’s existing risk management tools are adequate for managing risk in a new era with greater volatility. They urge caution in concluding that agriculture has reached a new era of instability. Even if the recent years are simply an outlier of past trends, however, they conclude that the existing risk management tools are a patchwork, often designed in response to the political pressure arising from past farm income “crises.” As a result, the issue of institutional innovation in risk management will continue to be a possibility in agriculture regardless of the answer to the question of whether we have entered a new era of instability.

As a collection, these papers underscore the complexity of understanding future economic conditions in the agricultural sector. Moreover, such complexity adds to the difficulty of anticipating the consequences of alternative policy institutions. Such is the nature of public policymaking, however, and the policy issues examined in these papers are likely to remain on the food policy agenda, in both national and international forums, for the foreseeable future.

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Market Instability in a New Era of Corn, Soybean, and Wheat Prices

Scott H. Irwin and Darrel L. Good

JEL Classifications: Q11, Q13

Prices of corn, soybeans, and wheat started moving higher in the fall of 2006 and then surged to new record highs in the spring and summer of 2008. The main factors powering the surge included demand growth from developing nations, U.S. monetary policy, diversion of row crops to biofuel production and weather–related production shortfalls (Trostle, 2008). Prices have declined markedly in recent months from the highs reached in the spring/summer of 2008. Market specific factors, such as larger U.S. crop prospects than feared when Midwest flooding peaked in June, contributed to the sharp drop in prices, but the biggest factor by far has been demand pressure brought on by the severe problems in U.S. and global credit markets.

The volatility of crop prices has stressed both market participants and market institutions, in some cases literally beyond the breaking point. High profile examples include the bankruptcy of VeraSun, one of the largest ethanol manufacturers in the United States, and Pilgrim’s Pride, the second largest poultry processor in the United States. Several questions are prominent in this highly uncertain economic environment. Are higher prices here to stay? Will prices continue to be as volatile in the future as in recent years? What are the likely impacts on different market participants and how easily can they adapt to the ongoing structural changes?

In this article, we first analyze the history of nominal corn, soybean, and wheat prices for clues as to the likely level and variability of prices in the future. We focus specifically on 1973–1975 as the last comparable period of structural change and use the shifts observed during this period as a template for the currently emerging era. The experience of this earlier time period is combined with an assessment of current market fundamentals to generate expectations about future price behavior. We follow this analysis with a discussion of the implications for three groups of market participants.

Price Behavior in the New Era

Insight regarding the probable magnitude and volatility of prices in the future can be provided by the previous shift in nominal price levels that occurred beginning in 1973. The first period examined is January 1947 through December 1972 and the second is the period from January 1973 through November 2006. These periods were selected because each is thought to represent a structural shift in market conditions from the previous period, resulting in a higher level of nominal prices. The first period starts immediately after World War II when price controls were lifted and the postwar rebuilding effort began. The second period begins with the changes brought about by shifts in exchange rate policies, grain purchases by the former Soviet Union, and a period of escalating energy prices and more rapid inflation.
Figures 1 through 3 depict the average monthly farm price of corn, soybeans, and wheat, respectively, in Illinois from January 1947 through January 2009. These charts clearly illustrate the change in the nominal price levels that occurred in the early 1970’s and the extreme volatility in prices during the early years of both periods. The charts also present the average nominal price for each commodity in the post–World War II and post–1972 eras. Note that the post–1972 era is assumed to end in November 2006. For all three commodities, nominal price levels appear to have jumped to a new level, rather than a temporary spike, late in 2006.

As shown in Table 1, the average monthly price of corn increased by 89% from the post–World War II period to the post–1972 period. The average price of wheat increased by a similar amount, 79%. The largest increase, 134%, was for soybeans as that crop transitioned from a minor to a major crop in the United States. As a starting point, if average monthly nominal prices in the new era that appears to have begun in late 2006 increase by a similar amount to those over the post–1972 period, averages would project to about $4.60 for corn, $5.80 for wheat, and $14.40 for soybeans.

Table 1. Summary of Nominal Monthly Average Corn, Soybean, and Wheat Prices in Illinois (January 1947 – December 1972 and January 1973 – November 2006)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>CORN</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Monthly Price</td>
<td>1.28 (1.81)</td>
<td>2.42 (3.24)</td>
<td>89</td>
</tr>
<tr>
<td>Highest Monthly Price in First 5 Years</td>
<td>2.57 (2.94)</td>
<td>3.54 (5.66)</td>
<td>(1.46) Na</td>
</tr>
<tr>
<td>Lowest Monthly Price in First 5 Years</td>
<td>0.99 (1.74)</td>
<td>1.60 (1.84)</td>
<td>(0.66) Na</td>
</tr>
<tr>
<td><strong>SOYBEANS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Monthly Price</td>
<td>2.63 (4.24)</td>
<td>6.15 (10.20)</td>
<td>134</td>
</tr>
<tr>
<td>Highest Monthly Price in First 5 Years</td>
<td>4.24 (1.62)</td>
<td>10.20 (1.75)</td>
<td>(1.66) Na</td>
</tr>
<tr>
<td>Lowest Monthly Price in First 5 Years</td>
<td>0.99 (0.81)</td>
<td>1.60 (0.71)</td>
<td>(0.66) Na</td>
</tr>
<tr>
<td><strong>WHEAT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Monthly Price</td>
<td>1.81 (2.94)</td>
<td>3.24 (5.66)</td>
<td>79</td>
</tr>
<tr>
<td>Highest Monthly Price in First 5 Years</td>
<td>2.94 (1.62)</td>
<td>5.66 (1.75)</td>
<td>(1.66) Na</td>
</tr>
<tr>
<td>Lowest Monthly Price in First 5 Years</td>
<td>1.74 (0.96)</td>
<td>1.84 (0.57)</td>
<td>(0.71) Na</td>
</tr>
<tr>
<td>Wheat/Corn Price Ratio</td>
<td>1.41</td>
<td>1.34</td>
<td></td>
</tr>
<tr>
<td>Soybean/Corn Ratio</td>
<td>2.05</td>
<td>2.54</td>
<td></td>
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</tbody>
</table>

Note: Number in parentheses is the ratio of the high or low price in the first 5 years of the period to the average price for the entire period. Na denotes ‘not applicable.’
The relationship between projected corn and wheat prices appears reasonable, reflecting a wheat/corn price ratio of 1.26. That ratio is somewhat lower than in either of the two prior periods, but consistent with the trend towards a lower ratio. The projected average monthly price of soybeans is likely too high relative to the other two crops as it reflects a soybean/corn price ratio of 3.13. That ratio is well above historic relationships and above the ratio that makes the two crops competitive from a production standpoint. A ratio of 2.3 would more closely reflect differences in current production costs and would result in an average soybean price projection of $10.58.

The expectation of higher nominal prices raises the issue of the potential for a positive supply response that would exceed that needed to keep per capita crop production constant. That type of supply response was evident in the early 1970’s as the initial price increase exceeded costs of production. However, the initial supply response, along with higher production costs, resulted in a return to more typical levels of net profits to crop producers. The supply response, then, was temporary. The same scenario appears to have unfolded over the 2007 and 2008 crop years.

In addition to the average monthly price, history provides some insight into the likely nominal ranges in monthly prices during the first few years of the current price era. As indicated in Table 1, the lowest monthly price of corn in the first five years of the previous two periods ranged from 66 to 77% of the average of the monthly prices over the entire period. The highest monthly price in the first five years ranged from 146 to 201% of the average. For soybeans, the lowest monthly price during the first five years ranged from 71 to 81% of the average of the monthly prices for the entire period, and the high ranged from 161 to 166% of the average. For wheat, the lowest monthly price ranged from 57 to 96% of the average of the entire period, and the highest monthly price ranged from 162 to 175% of the average.

The average of the percentage price ranges during the first five years of the previous two periods and an average of $4.60 for corn, $10.58 for soybeans, and $5.80 for wheat projects to nominal ranges in average monthly prices over the first few years of the current era of $3.30 to $8.00 for corn, $8.05 to $17.30 for soybeans, and $4.45 to $9.75 for wheat. Using the percentage price ranges only during the first five years of the most recent period results in projected monthly price ranges for the current period of $3.00 to $6.70 for corn, $7.51 to $17.56 for soybeans, and $3.30 to $10.15 for wheat. The primary differences between using the most recent period rather than the average of the two are the projection of the high price of corn and the low price of wheat. We use the projections based only on the most recent period to project the likely range of prices in the future. To aid the reader, average prices and ranges projected for the future are presented both in Table 2 and Figures 1–3.

In the period from December 2006 through January 2009, the average monthly price of corn in Illinois was $4.05, in a range of $3.00 to $5.71. The average monthly price of soybeans was $9.69, in a range of $6.21 to $14.10. The average monthly price of wheat was $5.82, in a range of $3.97 to $10.40. To date, then, the average monthly price of corn and soybeans has been lower than projected for the new era. The average price of wheat has been near the projected average for the period.

The lowest average monthly price of soybeans since December 2006 is lower than the lowest price projected from performance in the first five years of the previous period. The lows were in December 2006 and January 2007, perhaps indicating the designation of the new price era should be a few months later than December 2006. The highest average monthly price of wheat projected by past performance ($10.15) was exceeded in March 2008 ($10.40). Prices have declined sharply since then. Average monthly corn prices since December 2006 have been within the projected range.

Are the average price level projections for the current era consistent with known fundamentals? The question centers on corn prices. While the methods employed here are quite simple, the average nominal price level projected for corn ($4.60) is consistent with other price projections that use sophisticated econometric models (e.g., Babcock, 2008). Compared to the futures market, which is currently projecting prices between $4.00 and $4.20 through 2011, our projection of the average corn price may be somewhat high.

Current market fundamentals center on large amounts of corn used for ethanol production. Through last fall, ethanol production was largely driven by high crude oil prices. With the collapse of crude oil prices to $40/barrel and below, ethanol production now appears to be driven by govern-

### Table 2: Projections of Nominal Monthly Average Corn, Soybean, and Wheat Prices in Illinois, Post–December 2006

<table>
<thead>
<tr>
<th></th>
<th>Corn</th>
<th>Soybeans</th>
<th>Wheat</th>
</tr>
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<tbody>
<tr>
<td>Average Monthly Price</td>
<td>4.60</td>
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</tr>
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<td>17.56</td>
<td>10.15</td>
</tr>
<tr>
<td>Lowest Monthly Price</td>
<td>3.00</td>
<td>7.51</td>
<td>3.30</td>
</tr>
</tbody>
</table>
ment mandates for renewable fuels. Whether market-driven or policy-driven, the result is that corn prices and ethanol prices are closely tied together. This is demonstrated in Figure 4 which shows weekly corn and ethanol prices at Iowa ethanol plants since the start of the 2007/08 marketing year.

Not only do ethanol prices explain about 90% of the variation in corn prices, but the relationship is evident over the entire wide range of ethanol prices during the last couple of years.

At the margin, the simplest way to think about corn prices now is the value of corn to an ethanol producer (Babcock, 2009). This value is a function of the price of ethanol, which in turn is a function of the structure of biofuel subsidies and the price of gasoline. Our current biofuel policies (i.e., ethanol blending credit, import tariff, and renewable fuel mandate) appear to be sufficient to support corn prices near $4.00/bushel for the next several years. A rise in crude oil prices back to $80/barrel would also support corn prices near $4.00 (Perrin and Roberts, 2009). All else constant, the price of soybeans and wheat will have to be competitive with this level of corn prices to avoid large declines in acreage allocations.

The linkage between energy and corn prices formed so quickly that it is easy to overlook the profound nature of this change. For at least the last half-century, the fundamental value of corn was determined by its feeding value to livestock (e.g., Good, Hieronymus, and Hinton, 1980). While feeding value is still a factor in determining corn prices, it is now dominated by energy value. This means that uncertainty in energy markets and about energy policy is directly transmitted into grain markets. And this is added on top of the traditional weather and disease risks that are so familiar in these markets. The combination of new and traditional sources of risk supports the wide trading range of corn, soybean, and wheat prices shown in Figures 1–3.

**Implications for Market Participants**

The average price and the range in prices of corn, soybeans, and wheat over the next several years have important implications for producers, merchandisers, and end users of these crops. Following is a brief review of some of these implications for the three segments of the industry.

There are several important “take-home” points for producer’s struggling with the question, “What is a good price for corn, soybeans and wheat?” First, it is likely that a permanent shift has occurred in the level of corn, soybean, and wheat prices. The main point of debate is the size of the shift. Second, peak prices since December 2006 for all three commodities were well above average prices projected for the new era. This does not mean even higher prices cannot occur in the near future, but it does provide useful perspective on just how high prices did move. Third, prices can still move to “low” levels in this new era, particularly in relation to production costs, and they can stay there for considerable periods of time. For example, corn prices could easily return to the low $3 range for a period of time, soybean prices to the low $8 range, and wheat prices to the mid $3 range.

Both the level of price and the pattern of price movements have financial and decision making ramifications for producers of corn, soybeans, and wheat. The average price of these commodities will obviously be a major factor determining the level of profitability for producers and, therefore, the value of land used for the production of these commodities. The annual variation in price level, then, will influence the annual variation in profitability.

The inter-year variation in prices may also have important implications for decisions relative to pricing annual production. Prospects for large ranges in annual price movements suggest that producers may find more value in the use of futures options contracts to protect profitable price levels, but also capture higher prices should they occur. In addition, expectations for large ranges in prices may continue to limit the forward pricing opportunities offered by grain merchandisers. Such limitations emerged in 2008.
Those limitations may take the form of shorter time horizons for forward contracting production and/or in weak basis levels for forward contract bids. Fewer pricing opportunities from merchandisers, then, might require producers to manage price risk directly with the use of futures and options contracts. Direct use of futures and the related risk of margin requirements have obvious cash flow and credit implications for producers. In some instances, merchandisers may continue to offer a full array of pricing alternatives, but require producers to participate in the margining of the underlying futures and options positions.

Price levels will also be important in determining producer eligibility for price support payments under provisions of current legislation. At the levels projected in the previous analysis, prices of corn, soybeans, and wheat would remain above the levels that trigger loan deficiency payments. In addition, corn and soybean prices would remain above the levels that would trigger counter cyclical payments under the traditional program ($2.35 for corn and $5.36 for soybeans). Counter cyclical payments would more likely be triggered under the new Average Crop Revenue Election (ACRE) program. Analysis of the appropriate yield and price data in Illinois, for example, from 1977 through 2007 revealed that if the ACRE program had been in place during that period, the state level revenue guarantee would have triggered counter-cyclical payments in 10 of the 31 years for corn and five of the 31 years for soybeans (Schnitkey and Paulson, 2009).

Finally, price levels will have implications for the level of revenue protection provided by crop revenue insurance, for producers’ choice of crop insurance product, and for the frequency and magnitude of crop insurance payments. Under current rules, minimum prices for crop revenue insurance products are established in February each year. The level of prices during February then should influence the selection of insurance products and the level of coverage selected for the product. Again, under current rules, prices during October or November, along with actual yields, determine the indemnity payments, if any, for the various insurance products.

Merchandisers

The level of and magnitude of variability of crop prices have at least three important implications for merchandisers (grain dealers and elevators). First, the general level of prices will influence the amount of capital or credit that will be required of dealers to buy and inventory crops. Higher prices, then, would increase the capital requirement to own a fixed amount of inventory for a specific length of time. If capital or credit limitations emerge, dealers may choose to own smaller inventories or own inventories for a shorter period of time.

Second, the magnitude of volatility in prices within a marketing year will influence the amount of capital or credit needed to maintain margin accounts on hedged ownership. For short hedgers, futures price increases subsequent to acquiring crop ownership would require margin payments in order to maintain hedged positions. Large margin requirements that increase borrowings would increase the cost of merchandising. Inadequate capital or credit might prevent merchandisers from maintaining otherwise profitable market positions, limit contract alternatives for producers, or require producers to participate in the capitalization of futures market positions.

A third implication of volatile prices for merchandisers is the risk of nonperformance on producer contracts. Producers who contract for delivery at an agreed upon price may be more reluctant to deliver on those contracts if spot prices are much higher at the delivery period. Fortunately, instances of non-performance are rare and that would likely be the case in the future, but such risk may be higher than has traditionally been the case.

End Users

For end users of corn, soybeans, and wheat, the most important implication of the magnitude of price volatility is on the timing of purchases. This is especially the case for end users who are not able to profitably price the end product at the same time that forward contracts for crops are made. The implication is that where simultaneous pricing of crops and end products is possible, there will be a tendency to maintain a balanced position rather than speculating on prices in either the input or output market. For those who are not able to forward price output at the same times as forward contracting crops, there will be a tendency to operate in the spot market for both products, minimizing the risk of either net short or net long positions.

Concluding Thoughts

We believe there is compelling evidence that a new era of crop price levels and volatility has begun. There is considerable uncertainty about the new level of average nominal prices and we do not have a better crystal ball than anyone else. We are more confident that the recent wide trading range of corn, soybean, and wheat prices is here to stay. Market participants and market institutions have been greatly stressed in many cases by the large swings in prices. It is important to keep in mind that we have been here before. The changes in crop markets during the mid–1970s are comparable to those we are experiencing today. Like then, we anticipate that market participants will adjust to the new pricing environment with surprising speed.
For More Information


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The Emergence of an Agro-Energy Sector: Is Agriculture Importing Instability from the Oil Sector?

Andrew Muhammad and Ellene Kebede

JEL Classifications: Q11, Q42, Q48

The growth in U.S. ethanol production has been explosive. Excluding December, total U.S. production in 2008 was 199.6 million barrels which was a 43% percent increase over the previous year. Since 2000, output has grown by 460%, and since the passage of the Energy Policy Act of 2005, 130%. From 1981 to 2008, U.S. ethanol production has grown by more than ten times. Although ethanol can be produced from grain or cellulose-based feedstock, commercial ethanol production in the U.S. is mostly corn-based. Consequently, the growth in ethanol production has resulted in changes in corn usage. For instance, only 6% of U.S. corn production was used in energy production in 1990. By 2007, this increased to 23%.

The use of corn in fuel production has resulted in price increases in the U.S. grain sector and is often cited as the cause of food price inflation in recent years. Needless to say, ethanol is not the sole culprit. Other factors, such as contractions in international grain supplies, increased food demand in developing countries, and the depreciation of the U.S. dollar have also played a role. However, the increase use of corn in energy production has led to greater integration between energy and agriculture where oil and corn prices appear to move in tandem. Soybean and wheat prices have also followed this same pattern.

Given the industrialization and mechanization of U.S. agriculture, energy is an important resource used in production. Depending upon the intensity of energy use, economic theory suggests that higher real energy costs should decrease supply (holding other factors constant) which should lead to an increase in the price of agricultural commodities. Price inflation of this type is cost-push and depends upon energy use relative to other inputs and resources. With the expansion of U.S. ethanol production, there has been a reversal of roles of sorts. Whereas in years prior, the primary relationship between energy and agriculture was the use of energy in agricultural production, in more recent years, agricultural commodities, particularly corn and soybeans, have become increasingly important as inputs in energy production. In this instance, oil price spikes not only increase the cost of agricultural production, but also increase demand for alternative fuels thereby increasing the demand for commodities used in producing alternative fuels. Consequently, not only is there cost-push price inflation, but there is also demand-pull price inflation in those commodity sectors important to alternative fuels production.

In 2008, record high prices for corn, soybeans, and other food and feed grains, and record high oil prices occurred simultaneously. In addition, there has been a strong correlation between agricultural prices and oil prices in recent years. Given the observed interrelatedness between oil and agriculture, two questions arise. Is the agricultural sector importing price instability, or possibly stability, from the oil sector? Is the relationship between the oil and agriculture sectors temporary or permanent? No one can say with certainty that our recent experience marks a new era and the beginning of an Agro-Energy sector. This will only be known with the passage of time. As this article will confirm, however, the increase in U.S. ethanol production has resulted in a stronger relationship between oil and agriculture, particularly since the passage of the Energy Policy Act of 2005.
The Corn and Crude Connection

The substantial rise in oil prices is often cited as the cause of the increase in U.S. ethanol production. However, energy policy has also played an important role in expanding both production and demand for biofuels. Key legislation includes the banning of Methyl Tertiary-butyl Ether (MTBE) as a gasoline oxygenate and the Renewable Fuel Standard (RFS) of the Energy Policy Act of 2005. In addition, tax incentives contributed to the expansion of the alternative fuels industry. The Energy Policy Act of 2005 amended the Clean Air Act and established a National Renewable Fuel Standard (NRFS) program to ensure that, beginning in 2007, gasoline sold in the United States contains a minimum volume of renewable fuel (USEPA, 2006). The NRFS program from 2007 to 2012 sets forth a seven-year phase-in of renewable fuel volumes, beginning with 4 billion gallons in 2006 and reaching 7.5 billion gallons in 2012 (Renewable Fuel Association, 2007). This policy provides a subsidy in the form of a volumetric tax credit for ethanol blenders, credit for ethanol plants producing less than 60 million gallons per year, and an income tax deduction for fuel-flexible vehicles. In December 2007, President Bush signed into law the Energy Independence and Security Act of 2007 (EISA) which mandates renewable fuels production level until 2022. EISA requires the production of 12.95 billion gallons of renewable fuels by 2010 and 36 billion gallons by 2022. Beginning in 2015, however, corn based ethanol is capped at 15 billion gallons.

Prior to 2005, there was little relationship between oil and corn prices (Figure 1). Empirical research shows that from 1990 through 2004, the relationship between oil and corn prices was statistically weak and that less than 2% of the change in corn prices could be explained by oil price movements. From 2005 to 2008, the relationship between oil and corn was more profound, over 60% of the change in corn prices was explained by oil prices. This relationship between oil and corn prices did not exist prior to the passage of the Energy Policy Act of 2005 and is likely due to the change in ethanol use. Prior to the Energy Policy Act, ethanol was mostly used as a gasoline oxygenate. Since the enactment of renewable fuel standards, ethanol is used more as fuel.

From 2000 to 2005, U.S. ethanol production grew by over 140%, which is greater than the production growth from 2005 to 2008. During this period, the relationship between oil and corn did not appear to exist and, in 2004, corn and oil prices actually diverged where corn prices decreased while oil and energy prices increased. It was only with the passage of the Energy Policy Act of 2005 that the direct relationship between corn and oil prices emerged.

Figure 1 is particularly revealing when considering if the relationship between agriculture and oil is temporary or structural. There has been a strong correlation between oil and corn prices since 2005 when both prices were rising (corn and oil prices even peaked around the same time). The substantial fall in oil prices in late 2008, however, did not produce an equally substantial fall in U.S. corn prices. Thus, the relationship between corn and oil may be less profound when oil prices decrease.

Corn and Other Agricultural Commodities

The relationship between corn and other agricultural commodities such as soybeans, wheat, beef, and poultry is due to several factors on both the supply and demand side of the agricultural sector. On the supply side, corn competes with other crops for acreage and livestock for pasture. For instance, from 2006 to 2007, corn acreage increased from 80 to nearly 95 million acres, while soybean acres decreased from 75 to 65 million. With increased corn demand, less acreage is allocated to other crops and grazing, resulting in higher commodity prices in those sectors with significantly reduced acreage (holding other factors constant). On the demand side there is the competition between corn and other crops as inputs in food and feed manufacturing. In this instance, an increase in corn prices increases the demand for competing inputs in food and feed manufacturing, thereby increasing their prices. There is also the use of corn as feed where higher corn

Figure 1. Monthly U.S. Oil Prices (Texas Intermediate Crude) and Corn Prices (Farm Average): 1990-2008.
prices results in higher livestock production costs and a decrease in the supply of livestock products. Holding other factors constant, livestock product prices should increase.

Price indexes for corn, soybeans, wheat, hay and barley from 1996 to 2008 are shown in Figure 2. As with corn, significant price increases occurred for these crops since 2005. From January 2006 to peak prices in 2008, corn prices increased by 174%, soybean prices by 125%, wheat prices by 190%, hay prices by 70% and barley prices by 137%. As noted at the outset, these price increases were not solely due to the growth in ethanol production. Studies have considered the role that ethanol has played in causing agricultural price inflation. Results suggest that only a percentage of these price increases are attributable to ethanol.

Given the importance of corn as livestock feed in the United States, a rise in corn prices increases the cost of feeding livestock, which leads to an increase in livestock product prices. To compare the relationship between feed prices and the price of livestock products such as meat, dairy products and eggs, price indexes for feed and livestock products from 1996 to 2008 are shown in Figure 3. Since corn makes up a significant percentage of feed use in the United States, the increase in feed prices shown in Figure 3 reflects the increase in corn prices in Figure 1. Unlike crops prices, which significantly increased starting in 2005, this was not the case for all livestock products. Since 2005, livestock and meat prices remained relatively flat and started to fall in late 2008. Since 2005, feed prices have increased by 124% while livestock and meat prices increased by 14%, dairy prices by 81%, and poultry and egg prices by 48%.

**Biofuels and Agricultural Prices: Results from Previous Studies**

The rise in agricultural and food prices in recent years was not solely due to the increase in ethanol production. A number of studies have analyzed the factors that contributed to the rise in agricultural and food prices and found that the increase in ethanol production did not fully explain the price inflation witnessed in the last few years (Table 1). The U.S. Department of Energy (DOE) examined the causes of price spikes in the corn and soybean markets, and the retail food sector. International food price inflation was also analyzed. It was found that during the period May 2006 to June 2007, only 23% of the changes in U.S. corn and soybean prices could be attributed to the biofuel sector. However, from June 2007 to July 2008, 54% of corn and 49% of soybean price changes during this period was due to the growth of the biofuels sector. In terms of retail food prices, only 3 to 4% of the rise in retail food prices in 2007 was due to biofuels. In examining the effects of biofuels on international prices from April 2007 to April 2008, it was found that only 23% of the rise in international corn prices was due to biofuels and 31% of the rise in international soybean prices was due to biofuels. Also, only 10%
of the rise in international food prices was due to biofuels. Similar results were found in other studies where the impact of increased biofuels production was greatest in the corn and soybean sectors. In regards to related agricultural crops, Rosegrant (2008) found that 22% of the rise in wheat prices from 2000 to 2008 was due to biofuels production.

**Closing Remarks**

With the enactment of the Energy Policy Act of 2005, a strong relationship between corn and oil emerged. Those agricultural products related to corn were also affected. Because the livestock sector did not experience price inflation of similar magnitude and faced higher feed costs, producers’ profit margins were negatively affected.

While the future relationship between oil and agriculture is uncertain, the ethanol-induced increase in corn demand resulted in an oil/agriculture linkage that had not been seen in prior years. With high energy prices and relatively low corn prices in 2004, ethanol production was an attractive investment. Ethanol was even more attractive given the government incentives and tax credits as well as the renewable fuels mandates which basically guaranteed increased demand in the future. Now that oil prices have fallen, should we expect a sustained relationship between oil and agriculture? The renewable fuels mandate has created a “floor” under ethanol use in the United States and possibly a floor on corn prices. This could explain why the correlation between oil and corn prices was stronger when oil prices were increasing.

**For More Information**


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Table 1. Effect of Biofuels on Food and Commodity Prices.

<table>
<thead>
<tr>
<th>Source</th>
<th>Period</th>
<th>% of Price Change Attributed to Biofuels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June 07 – July 08 ²</td>
<td>Corn: 54 Soybeans: 49 Wheat: --- Food (Retail): --- FMI Index d ---</td>
</tr>
<tr>
<td>Fortenbery and Park, 2008</td>
<td>Apr. 07 – Apr. 08 ²</td>
<td>Corn: 23 Soybeans: 31 Wheat: --- Food (Retail): --- FMI Index d 10</td>
</tr>
<tr>
<td></td>
<td>June 07 – July 08 ³</td>
<td>Corn: 51 Soybeans: --- Wheat: --- Food (Retail): --- FMI Index d ---</td>
</tr>
</tbody>
</table>

¹ Effect of U.S. biofuels production on U.S. prices.
² International Food Policy Research Institute, world prices.

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¹ Effect of U.S. biofuels production on world prices.
² International Monetary Fund’s global food commodity price index.
Exploring the Price Spike
Joachim von Braun and Maximo Torero

JEL Classifications: I30, O12, Q18

The 2007–08 international food price crisis caused hardship on a number of fronts. The steep rise in food prices led to economic difficulties for the poor and generated political turmoil in many countries. The crisis could also result in long-term, irreversible nutritional damage, especially among children. There is a global interest in preventing such events from recurring.

The price crisis was triggered by a complex set of long-term and short-term factors, including policy failures and market overreactions. Rising energy prices until the middle of 2008, subsidized biofuel production, income and population growth, globalization, and urbanization are among the major forces contributing to surging demand. On the supply side, land and water constraints, underinvestment in rural infrastructure and agricultural innovation and access to inputs, as well as weather disruptions, are impairing productivity growth and the needed production response. Between 2000 and 2007, cereal demand exceeded cereal production and cereal stocks have consequently declined. Demand for agricultural commodities for food, feed, and fuel use is likely to continue to escalate. Climate change risks and rising energy demand could reaccelerate food prices in the future. (von Braun et al., 2008; von Braun 2008a,b,c; Bakary, 2008; Brahmbhatt and Christiaensen, 2008; OECD Policy Report, 2008; Sommer and Gilbert, 2006; UNCTAD Policy Brief, 2008; and World Agricultural Outlook Board, 2008)

Table 1. Explanations for rise in agricultural commodity prices

<table>
<thead>
<tr>
<th>Factors</th>
<th>Mechanism</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand-side factors:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income growth, population growth, and urbanization</td>
<td>Cereal demand has been growing at 2–3 percent per year, thanks to rising incomes in China, India, and, more recently, Sub-Saharan Africa. Meanwhile, yield growth in these cereals has declined from 3 percent in the 1970s to 1–2 percent in the 1990s. This resulted in a significant reduction of cereal reserves to less than 400 million tons in 2007 from 700 million tons in 2000.</td>
<td></td>
</tr>
<tr>
<td>Ethanol/Biofuels</td>
<td>With oil prices at an all-time high of more than US$120 a barrel in May 2008 and with the United States and the European Union subsidizing agriculture-based energy, farmers have shifted their cultivation toward crops for biofuels. Impacts vary from Lipsky (2008) estimating that the increased demand for biofuels accounted for 70 percent of the increase in maize prices and 40 percent of the increase in soybean prices to Rosegrant et al. (2008) estimates of long-term impact on weighted cereal prices of the acceleration in biofuel production from 2000 to 2007 to be 30 percent in real terms.</td>
<td></td>
</tr>
<tr>
<td>Supply-side factors:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased oil/fertilizer prices</td>
<td>Oil prices increased significantly. Affected directly transportation costs and indirectly price of fertilizers (See IMF Fiscal Affairs, 2008).</td>
<td></td>
</tr>
<tr>
<td>Low R&amp;D investments in agriculture</td>
<td>The neglect of agriculture in public investment, research, and service policies during the past decade has undermined its key role for economic growth. As a result, agriculture productivity growth has declined and is too low.</td>
<td></td>
</tr>
<tr>
<td>Droughts/Climate change</td>
<td>Occurring in large grain-producing nations, droughts and climate change have lowered worldwide production. More volatile weather patterns related to climate change increased.</td>
<td></td>
</tr>
<tr>
<td>Other factors:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dollar devaluation</td>
<td>The indicator prices of most commodities are quoted in U.S. dollars, and the dollar went through a substantial depreciation. Even though when adjusted for inflation and the dollar’s decline (by reporting in Euros, for example), food price increases were smaller but still dramatic.</td>
<td></td>
</tr>
<tr>
<td>Large excess of liquidity in non-G7 countries</td>
<td>Large excess liquidity in several non-G7 countries, nourished by the low interest rates set by G7 central banks. Commodity prices are the result of portfolio shifts against liquid assets by sovereign investors, sovereign wealth funds, partly triggered by lax monetary policy, especially in the United States (For details, see Calvo 2008 and Rojas Suarez 2008).</td>
<td></td>
</tr>
</tbody>
</table>

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In addition to the supply and demand fundamentals there is substantial evidence that the crisis was made worse by the malfunctioning of world grain markets and by response of countries to protect their own internal consumption. These reactions begin as consequences, not causes, of the price crisis, but they exacerbate the crisis and increase the risks posed by high prices. By creating a positive feedback loop with high food prices, they take on a life of their own, increasing the prices and their volatility even more, with adverse consequences for the poor and for long-term incentives for agricultural production. Because they impede the free flow of food to where it is most needed and the free flow of price signals to farmers, these market failures impose enormous efficiency losses on the global food system, hitting the poorest countries hardest. This paper tries to understand what was behind the price spike and to propose some alternative policy solutions that could prevent this from happening in the future.

**Causes Behind The Price Spike**

Changes in supply and demand fundamentals cannot fully explain the price spike in the first six months of 2008. As a result, a “price spike” above what is explainable by fundamentals occurred during the first six months of 2008 as depicted in Figure 1.

There are two major explanations behind this price spike. First, ad hoc trade policy interventions, such as export bans or high export tariffs or high import subsidies were partly triggered by the price crisis and exacerbated the crisis symptoms. As of April 2008, 15 countries [Argentina, Bangladesh, Bolivia, Cambodia, China, Egypt, Ethiopia, India, Kazakhstan, Malaysia, Pakistan, Russia, Tanzania, Vietnam, and Zambia] including major producers imposed export restrictions on agricultural commodities, thereby narrowing the global market. For instance, China banned rice and maize exports, while India banned exports of rice and pulses. Argentina raised export taxes on soybeans, maize, wheat and beef; and Ethiopia and Tanzania banned exports of major cereals. Export bans ensured greater food availability domestically, but they also reduced the market for agricultural products, increased price volatility, and worsened market conditions for import-dependent countries. Because they impede the free flow of food to where it is most needed and the free flow of price signals to farmers, these market failures impose enormous efficiency losses on the global food system, hitting the poorest countries hardest. This paper tries to understand what was behind the price spike and to propose some alternative policy solutions that could prevent this from happening in the future.

Secondly, the flow of speculative capital from financial investors into agricultural commodity markets was significant. From May 2007 to May 2008, the volume of globally traded

**Figure 3. Surge in grain and oil prices**

grain futures and options increased substantially (Table 2). Another indicator of speculative activity—the ratio of the monthly volume of futures trading to open interest—also increased substantially. Open interest describes the total number of futures contracts of a given commodity that have not yet been offset by an opposite futures contract or fulfilled by delivery of the commodity. A speculator taking opposite positions in the market within days or weeks will generate an increase in monthly registered volumes but little change in monthly open interest. Therefore changes in this ratio should capture changes in speculative activity. In 2008, soybean and rice ratios of futures to open interest were increasing at 27% and 19% respectively, as wheat ratios continued to grow at 19% and maize ratios declined slightly. In contrast, in 2005 and 2006 at least three commodities’ ratios were declining on average.

We conducted several statistical tests to determine the role of speculative activity in commodity prices. The results suggest that speculation might have been influential.

Our analysis tested to what extent the selected indicators for speculative activity can help forecast spot price movements (Robles, Torero, and von Braun, 2009). The Granger causality test—which determines whether past movements in one variable can help explain current movements in another one—was applied to each agricultural commodity (Table 3). The results show that the size of trading activity in futures contracts—when measured by volume or open interest separately—do not show evidence of affecting commodity prices. The ratio of monthly volume to open interest in futures contracts, however, has an influence in forecasting price movements for wheat and rice. In other words, past changes in this ratio help to forecast future changes in the prices of wheat and rice. In the case of rice, the ratio of noncommercial long positions to total long positions also has an effect on prices. When the same ratio for short positions was analyzed, there was additional evidence that speculation affects prices, with significant results in the soybean market. Finally, when we tested whether net positions of index traders (since 2006 the Commodity Futures Trading Commission provides information on futures and options trading by a new category of traders in selected agricultural markets, the so-called “index traders”) since January 2006 have any influence on commodity prices, we found positive evidence in the case of maize.

There is evidence, therefore, that speculative activity partly explains the price spike since January 2008. Appropriate global institutional arrangements for preventing this kind of market failure are needed.

### What Can Be Done

The price spike episode clearly highlights the need to modify the institutional architecture of international financial and agricultural markets to address their effects on the livelihoods of the poor.

On the export bans there should be no illusion: this problem cannot be addressed country by country, as governments have the legitimate interest to care for their citizens first. The new wave of export restrictions requires urgent international attention. It should not be added on top of the WTO Doha Round. Instead, it should be addressed by an ad hoc forum of a consortium of global players with a code of conduct and mutual trust building in political negotiations. At least, export trade for

---

**Table 1. Growth in the volume of globally traded grain futures and options (May 2007–May 2008)**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Growth in traded volume (%)</th>
<th>Futures</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>0</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Soybeans</td>
<td>40</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>Soybean oil</td>
<td>46</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>17</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Rough rice</td>
<td>48</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>

Source: Chicago Board of Trade 2008.

**Table 2. Evidence of speculation activity affecting commodity price**

<table>
<thead>
<tr>
<th>Indicator of speculation activity</th>
<th>Wheat</th>
<th>Maize</th>
<th>Soybeans</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly volume (futures contracts, CBOT)</td>
<td>+</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Monthly open interest (futures contracts, CBOT)</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Ratio of volume to open interest ([1]/(2]) (futures contracts)</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Ratio of noncommercial positions to total reportable positions (long)</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ratio of noncommercial positions to total reportable positions (short)</td>
<td>+</td>
<td></td>
<td>+</td>
<td>N/A</td>
</tr>
<tr>
<td>Index traders’ net positions (long – short positions)*</td>
<td>+</td>
<td>N/A</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

Notes: + indicates evidence of causality. * indicates that these data combine futures and options positions; data since January 2006 are available.
humanitarian purposes should be reopened now.

On speculation, there are two traditional options. The first is to build up a significant physical, public, globally managed grain reserve. In a globalized world, however, the scale of reserves required under this option would make storage costs excessive. A physical reserve is thus not appropriate as a major global initiative, but only as a minor one to address the need for smooth emergency operations.

The second option is to change regulation of commodity exchanges to limit the volume of speculation versus hedging, to make delivery on contracts or portions of contracts compulsory, and to impose capital deposit requirements when each futures transaction is made. Difficulties could arise, however, in walking a line between ineffective regulations and overzealous ones. Market regulation also raises political economy concerns: regulatory measures could benefit relatively small groups, elites may capture the regulatory agency, international regulatory agreements might not be completed, and countries may lack the institutional capacity to implement and enforce the regulatory measures. Although some improvement in regulation is called for, regulating commodity exchanges in harmony across the globe appears too complex a collective action problem given very different country circumstances.

The two global collective actions we propose—a small, independent physical emergency reserve to minimize the risk of lack of access to the minimum level of grains required for humanitarian assistance, and a virtual reserve and intervention mechanism backed up by a financial fund—would avoid these problems while ensuring that the world can respond to emergency needs for food and prevent extreme price bubbles.

**The Independent Emergency Reserve**

A modest emergency reserve of around 300,000–500,000 metric tons of basic grains—about 5% of the current food aid flows of 6.7 million wheat-equivalent metric tons—would be supplied by the main grain-producing countries and funded by a group of countries participating in the scheme (the G8+5 plus some other major grain-exporting countries). This decentralized reserve would be located at strategic points near or in major developing-country regions, using existing national storage facilities. The reserve, to be used exclusively for emergency response and humanitarian assistance, would be managed by the World Food Program (WFP). The WFP would have access to the grain at precrisis market prices to reduce the need for short-term ad hoc fundraising. To cover the cost of restoring the reserve to its initial level (that is, the difference between the postcrisis price and the precrisis price times the quantity of reserves used by WFP), an emergency fund should be created and its level maintained by the participating countries. The fund should be accompanied by a financing facility that the WFP could draw upon as needed to cope with potentially increased transport costs, as experienced in the 2008 crisis. This arrangement could also be defined under a newly designed Food Aid Convention.

**The Virtual Reserve**

The virtual reserve would be implemented as a coordinated commitment by the member countries (the G8+5 plus some other major grain-exporting countries). Each country would commit to supplying funds, if needed, for intervention in the futures market. The fund would normally consist not of actual budget expenditures, but of promissory, or virtual, financing by the members. These funds would be drawn upon by the high-level technical commission only when needed for intervention in the futures market (much previous evidence has shown a link between futures and spot markets). The intervention mechanism will be two-pronged. First, and perhaps most important, the global intelligence unit will announce price forecasts and specify the price band. This announcement will be a signal—or a threat—to speculators that intervention is likely if futures prices exceed the defined upper limit of the price band. Moreover, the announcement will specify a confidence interval for the upper limit to increase the risk for potential speculators.

Second, if, despite the signal, there is evidence of an emerging price bubble, an autonomous technical commission will then decide whether to intervene in the futures market. This intervention would consist of executing a number of progressive short sales (that is, selling a firm promise—a futures contract—to deliver the commodity at a later date at the specified price) over a specific period of time in futures markets at market prices at a variety of different future positions until futures prices and spot prices decline to levels within the estimated price bands. This increase in the supply of short sales will reduce spot prices and should make speculators move out of the market—in other words, a backwardation will be created (the situation in which, and the amount by which, the price of a commodity for future delivery is lower than the spot price or a far future delivery price is lower than a nearer future delivery price). Moving speculators out of the market will minimize the potential second-round effects of this intervention given that spot prices will return to being consistent with fundamentals, and therefore the lower spot prices should not result in the accelerated use of available supplies.

All futures contracts are ultimately settled either through liquidation
by offsetting purchases or sales (the vast majority of agricultural futures contracts are settled this way) or through delivery of the actual physical commodity. The virtual fund will thus come into play only if there is a need to realize the futures sales, in which case the fund will be used to obtain the necessary grain supply to comply and calm the markets. Usually, this action would not be necessary and the whole operation would stay virtual. The innovative concept behind the virtual reserve is the signal that it gives to markets, including speculators. Its presence alone is likely to divert speculators from entering this market. Nonetheless, the commission must be ready to trade grain when necessary and to assume the costs if in the future it must buy back contracts at a higher price than it sold them for.

Preliminary estimates show that for the virtual reserve to be a credible signal, the fund should be US$12–20 billion. A fund of this size might cover 30 to 50% of normal grain trade volume. Determining the exact size of this fund will require further analysis, however, because commodity futures markets allow for high levels of leverage.

The proposals made here are designed not to stabilize prices generally, but to prevent damaging price spikes. The proposed actions will entail costs, but the modest costs of the required organizational elements must be balanced against the benefits of more effective international financial architecture. These benefits will include prevention of economic hardship, improved market efficiency, stronger incentives for long-term investment in agriculture, and prevention of political instability.

Concluding Comments

The excess price surges caused by speculation and possible hoarding could have severe effects on confidence in global grain markets, thereby hampering the market’s performance in responding to fundamental changes in supply, demand, and costs of production. More important, they could result in unreasonable or unwanted price fluctuations that can harm the poor and result in long-term, irreversible nutritional damage, especially among children.

Appropriate global institutional arrangements for preventing these market failures are missing. A global solution that prevents excessive speculation in food markets may be costly, but given the losses created by food price crises like the one in 2007–08, it will still have large positive net returns. It is clear that the incentives for speculation in food commodities could be reduced by (1) changing regulatory frameworks to limit the volume of speculation versus hedging, (2) making delivery on contracts or portions of contracts compulsory, (3) imposing capital deposit requirements when each futures transaction is made, or all three. These regulatory measures could be implemented case by case or as a platform through an international “alliance of commodity exchanges”. Therefore there is a clear need (a) to undertake a policy debate about exchange regulation and the role of speculative traders and (b) that debate is very likely to include the issue of international harmonization.

A new global institutional arrangement encompassing a “virtual reserve” could be an alternative solution (see for implementation details von Braun and Torero, 2009). This virtual reserve would consist of a coordinated commitment by member countries (the Group of Eight Plus Five plus some other major grain-exporting countries such as Argentina, Thailand, and Vietnam). Each country would commit to supplying funds, if needed, for intervention in the futures market. The innovative concept behind the virtual reserve is the signal that it would give to markets, including speculators. Although its presence alone would likely divert speculators from entering this market, the virtual reserve must be ready to trade grain when necessary. This concept could provide the kind of global collective action that is needed to facilitate well-functioning grain markets and to reduce the harm that can result from excessive price spikes.

There are two major concerns that need to be taken into account. The first is the importance of the global intelligence unit and their challenging role in price forecasting. To be a credible basis for market intervention, price forecasts must contain some new knowledge, widely regarded as credible when released, that is not already reflected in the structure of market prices. This new knowledge is the combination of both the fundamentals component (i.e. supply and demand factors) and a midterm/long-term financial model in which stochastic factors are captured. Secondly, a potential caveat of the proposed virtual reserve concept is that it requires cross-country coordinated institutional design which has the risk that one of the country members won’t comply with the jointly agreed upon commitment. For example, one of the country members doesn’t comply with providing the resources for the “emergency reserve” or with supplying the necessary financial resources for the “virtual reserve”. To minimize this caveat, clear rules for the participating countries should be developed and dispute resolution mechanisms should be in place.
Finally, to evaluate these actions, a comprehensive cost/benefit assessment must go beyond agricultural markets (and must include security and poverty considerations). The system should be exposed to evaluation of effectiveness, and to close monitoring while being implemented.

For More Information


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The World Economic Crisis and U.S. Agriculture: From Boom to Gloom?

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JEL Classifications: E32, F4, Q17

Before the economic crisis hit in 2008, the 2000s had been a good decade for world economic growth. Over 2000–07, world gross domestic product (GDP) grew by 3.2% a year, exceeding annual growth of 2.5% during the 1990s (see Figure 1). Emerging market economies, which include China, India, and Russia, expanded at an especially high 6.5% a year, in part because of the economic reforms many enacted over the past two decades. U.S. farmers benefited from rising world prosperity, which contributed to the growth in real (inflation-adjusted) farm income over 2000–07 of 43% (ERSb, 2009).

The financial crisis that struck the United States in 2008, and quickly spread to the overall U.S. economy and the world, has led to recession in many countries. How might the world financial crisis and ensuing economic downturn affect U.S. agriculture, especially given how important exports are to the sector? This article first examines the cause of the economic crisis, and then its consequences for U.S. agriculture. In the rest of the article, the financial crisis and economic downturn will often be referred together as the economic crisis.

The Cause of the Economic Crisis

The high world growth of the 2000s had two significant features. The first feature is that growth put upward pressure on prices for energy and agricultural goods, whose production can’t be quickly increased in the short run. This is one reason why world energy and agricultural commodity prices soared in 2007–08 (Trostle, 2008).

The second feature is that the growth involved major macroeconomic imbalances between two different groups of countries, mainly the United States and Great Britain on the one hand and various Asian countries on the other, such as China, South Korea, and Taiwan (see Council of Economic Advisors, 2009; Wolf, 2008). (When we discuss this issue in the rest of the article, we’ll usually refer to the two groups of countries as just the United States and the “trade surplus” countries, for reasons that will be explained.) Coinciding with the buildup of the macroeconomic imbalances were major developments in the U.S. and Western financial system, such as the rise of new financial products and practices and reduced regulation. These changes diminished transparency and increased risk. The main cause of the economic crisis was the combination of the macroeconomic imbalances and growing problems in the financial world.

The fundamental world macroeconomic imbalance before the crisis is that the United States undersaved and overconsumed, while the trade surplus countries oversaved and underconsumed. The latter pushed production and exports at the expense of domestic consumption, mainly by keeping their currencies undervalued against those of their major export markets, especially the United States.

The imbalances became self-sustaining. The United States ran large negative trade balances, and the surplus countries large positive ones. These countries also lent the United States their accumulated foreign exchange surpluses,
which helped finance the U.S. trade deficits and kept their currencies from rising in value (appreciating) against the dollar. The capital inflows lowered U.S. interest rates and increased business investment, boosting GDP, consumption, and imports. The capital inflows also expanded investment in equities and property, which led to an asset price boom. The rise in asset prices increased consumer wealth, which further stimulated U.S. consumption spending and imports, and thereby helped sustain the trade deficit.

The big influx of money into the Western financial system enlarged the supply of funds available for loans and investment relative to the profitable opportunities available. Investors and banks responded by making riskier loans, such as for subprime home mortgages in the United States. The increase in delinquent loans for U.S. home mortgages in 2008 precipitated the U.S. financial crisis.

Another major cause of the economic crisis was innovation in the financial world during the 1990s and 2000s (Lewis, 2008; Council of Economic Advisors, 2009), combined with reduced government regulation of financial markets. The securitization (bundling) of different types of loans and development of other new financial products—such as mortgage backed securities, loan default swaps, and collateralized debt obligations, generally called derivatives—lowered transparency and increased risk. In 1999, the U.S. Congress repealed the law that prevented financial institutions from engaging in both commercial and investment banking. Many of the mortgage underwriters and other lenders were not subject to regulation or supervision by the Federal Reserve (Fed) or any other governmental body. To maximize short-run gains, financial firms became highly leveraged, meaning that they kept their reserves low relative to the magnitude of funds lent or invested. This behavior was abetted by the Fed’s policy of keeping the money supply high and interest rates low.

As the home mortgage problem developed, securitization and other derivative products made it very difficult for lenders to assess their own exposure and that of potential borrowers to bad debt. After the collapse of Lehman Brothers in September 2008, lending among banks and other financial firms was sharply curtailed and interest rate risk premiums rose rapidly. Because financial institutions could not borrow easily from secondary financial markets to raise funds, they had to sell assets. This led to a price crash for bonds and equities. All these problems were compounded by financial firms’ earlier extreme leveraging of funds. Given the openness of U.S. financial markets and heavy participation in those markets by foreign banks and financial firms, the U.S. crisis quickly spread throughout the world.

The financial crisis also spread to the “real economy.” The disruption to lending is hurting business investment and debt-financed consumer spending, such as for cars. The drop in equity and real property asset values throughout the world is sharply reducing consumer wealth, also causing consumer spending to fall. The drop in these major components of countries’ GDP—investment and consumption—is driving the current world economic downturn.

Direct Effects of the Economic Crisis on U.S. Agriculture

The economic crisis can have direct and indirect effects on U.S. agriculture. The direct effects will come from changes within the U.S. economy alone. The indirect effects will occur from how the crisis impacts foreign income and trade and world energy prices.

The direct effect of the crisis on U.S. agriculture will probably not be strong. On the demand side, the crisis will lower U.S. GDP, and thereby consumer spending on food. The Economic Research Service (ERS) forecasts a 2009 drop in U.S. GDP of 2.7%, though all macroeconomic forecasts of the crisis’ effect on GDP in the United States and other countries are continually being revised downward. Nonetheless, the negative demand effect on food is likely to be small. Most U.S. consumers have a sufficiently high standard of living that demand for food is not very sensitive to changes in income. Consumers are more likely to eat out less at restaurants so that total consumer expenditure on food at home and away from home will fall, but not the amount of food actually consumed.

On the supply side, the disruption of U.S. financial markets might reduce lending to farmers, including for operating expenses. In recent years, farm borrowing has increased from large regional banks, some of which have moved toward riskier lending behavior (FDIC, 2008). Yet, most of the rural banks that lend to farmers are not closely tied to the financial world that created, and is now suffering from, the financial crisis. Agricultural borrowers and lenders tend to have secure long-term relationships, which should mitigate the crisis’ effect on the flow of loans to farmers.

Indirect Effects

The main indirect effects of the crisis will come from its impacts on GDP and income in overseas markets, especially countries that are large importers of U.S. agricultural goods, on energy prices, which are falling because of the decline in world economic activity, and on the exchange rate of the U.S. dollar vis-à-vis foreign countries’ currencies. Table 1 shows how the crisis is likely to change these and related factors and variables, and how those changes in turn will affect U.S. agricultural producers.
The spread of the crisis beyond the United States is impacting economic growth throughout the world. ERS forecasts that world GDP in 2009 will drop by 1.2%, compared to about 2.5% growth in 2008 and 3% yearly average growth since 1970. Although demand for food in the United States and other rich developed countries is not very responsive to changes in consumer income, this is not the case for developing countries. A major hit to these countries’ GDP could cut spending on food and industrial demand for agricultural products substantially. Countries that are large markets for U.S. agriculture could substantially reduce their imports. By the end of 2008 this was already happening in China, Taiwan, Mexico, Egypt, and Russia (FATUS, 2009).

Just as high world economic growth during the 2000s contributed to the spike in world energy prices in 2007–08, the economic crisis’ negative effect on growth is reducing demand and prices for energy. After peaking at $147 a barrel in July 2008, the price of oil plunged to $35 a barrel at the beginning of 2009 (EIA, 2008 and 2009).

The fall in energy prices will have a negative demand-side effect and positive supply-side effect on U.S. farmers. The negative effect is that prices for biofuels, and thereby for biofuel feedstocks, will drop, which will hurt producers of bulk crops, especially corn in the United States. For example, from July 2008 to January 2009, the price of ethanol decreased from $2.90 a gallon to $1.61 (ERSa, 2009), and the price of corn declined from a peak of over $7 a bushel in summer 2008 to less than $4 in January 2009.

A positive effect for agriculture is that prices will also likely fall for energy-based agricultural inputs, such as gasoline, diesel, electricity, and fertilizer. For U.S. bulk crop producers, energy-based inputs can account for half to two-thirds of operating costs, and a sixth to a third of total costs (ERSb, 2009).

The drop in energy prices will not affect all U.S. agricultural producers uniformly. All farmers will benefit from the price decrease for energy-based inputs. Yet, crop producers who are part of the energy-biofuels relationship will suffer because their output prices will fall. They will probably be net losers, just as they were net gainers from the surge in energy prices over 2007–08. On the other hand, producers of meat and other livestock products will especially benefit, as prices will decrease for not only their energy-based inputs based but also their animal feed.

### Exchange Rate of the Dollar

Another major indirect effect of the world economic crisis on U.S. agriculture will be how it affects the exchange rate of the dollar against the currencies of developing countries that are large importers of U.S. agricultural goods (see Shane, Roe, and Somwaru, 2008). Yet, predicting this effect is challenging.

As we discussed earlier, one of the main causes of the economic crisis was the macroeconomic imbalances that accompanied world growth, in particular undersaving and over-consuming by the United States and oversaving and under-consuming by the trade surplus countries. The main way to correct this problem would be with a realignment of exchange rates, in particular for the currencies of the trade surplus countries to appreciate against the dollar. This would raise prices of their exports in the United States and lower prices of U.S. exports in their countries. U.S. imports and consumption would fall and exports to the trade surplus countries rise, while trade surplus country exports would drop and their imports and consumption rise. The U.S. trade deficit would shrink. In the early and mid-2000s, exchange rates in fact moved in this direction. For example, between 2001 and 2007 the dollar depreciated against the South Korean

### Table 1. Effect of World Economic Crisis on U.S. Agriculture

<table>
<thead>
<tr>
<th>Variable</th>
<th>Direction of change</th>
<th>Effect on U.S. ag producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>World GDP</td>
<td>decreases</td>
<td></td>
</tr>
<tr>
<td>Consumer income</td>
<td>decreases</td>
<td>unfavorable</td>
</tr>
<tr>
<td>Energy prices</td>
<td>decrease</td>
<td></td>
</tr>
<tr>
<td>Bulk crop producers</td>
<td>Output prices</td>
<td>decrease</td>
</tr>
<tr>
<td></td>
<td>Input prices</td>
<td>decrease</td>
</tr>
<tr>
<td>Livestock producers</td>
<td>Input prices</td>
<td>decrease</td>
</tr>
<tr>
<td>U.S. dollar</td>
<td>Short run</td>
<td>appreciation</td>
</tr>
<tr>
<td></td>
<td>Long run -- 2 scenarios</td>
<td>appreciation</td>
</tr>
</tbody>
</table>

Source: Economic Research Service, USDA.
In this scenario, the macroeconomic imbalances between the United States and the trade surplus countries go uncorrected in both the long and short run. The scenario carries the risk of an equally or even more serious economic crisis in the future. The crisis would be sparked not by weaknesses within the world financial system, but rather by worries about the sustainability of the dollar’s value, which could trigger large-scale capital flight from the United States. The United States could have an economic crisis similar to that suffered by various emerging market economies during the last 15 years, such as Thailand and Indonesia in the late 1990s, which could pull the entire world economy down with it.

The second scenario is that the dollar depreciates against the Yuan and other trade surplus country currencies. What allows this to happen is that the trade surplus countries reduce their investment of surplus dollars from U.S. trade back into the United States. This would let the U.S. trade deficit decline through dollar depreciation. An argument in favor of this scenario is that before the crisis the dollar was depreciating, in the aggregate and against the trade surplus countries’ currencies. In this scenario, U.S. agriculture would benefit doubly from renewed world growth and dollar depreciation, both of which would increase foreign demand for U.S. products.

Concluding Comments

The economic crisis will strongly impact U.S. agriculture in the short run. The fall in world GDP and dollar appreciation will significantly reduce agricultural exports and prices, which in turn should lower farm income and employment. However, the crisis will not affect all agricultural producers in exactly the same way. The drop in world energy prices will decrease prices for certain bulk crops because of the biofuels relationship, but the...
For More Information


Foreign Agricultural Trade of the United States (FATUS, 2009), USDA. Available online: www.ers.usda.gov/Data/FATUS/


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Implications of Macroeconomic Instability for Agriculture Income and Land Values

Mitch Morehart

JEL Classifications: Q12, Q14, N50, E60

From 2006 through the first half of 2008, U.S. Agriculture enjoyed a period of economic prosperity not seen since the 1970’s. World economic growth was robust, stimulating food demand; the growing use of major crops such as corn in the production of biofuels increased demand and contributed to overall upward pressure on commodity prices; and a reduced value of the U.S. dollar helped expand exports to record levels. This achievement was reflected by new records for most income and balance sheet measures. Even after adjusting for inflation, 2008’s forecast of net farm income rivals the all-time record established in 1973. Escalating land values and conservative borrowing resulted in consecutive years of record farm equity and historically low debt-to-asset ratios. The economic environment changed quite dramatically in the latter months of 2008. After reaching unprecedented highs during the summer, commodity prices receded to postharvest 2007 levels, prior to the run-up. Input costs continued their surge, with each year’s crop costing more to produce. And perhaps generating the most concern; the emergence of a worldwide financial crisis that has shown no signs of abating so far this year.

Financial and commodity markets worldwide have grown more interdependent, which has strengthened the linkages between the United States and our major trading partners. Because of this increased globalization, international macroeconomic conditions affect the relative demand for and competitiveness of U.S. exports. Fiscal and monetary policies that encourage high domestic growth rates tend to increase our demand for foreign goods relative to the foreign demand for U.S. products, causing a trade deficit. Macroeconomic policies also inform investors worldwide about the future performance of the U.S. economy. These signals influence investors’ willingness to invest in U.S. assets, thus impacting the demand for U.S. dollars.

Beyond greater dependence on world markets, there are many other important differences between 21st century agriculture and the sector that endured the last major financial crisis in agriculture more than 20 years ago. Production is more consolidated on large and complex operations. The production of agricultural commodities is more integrated, with a large share of poultry and hog production taking place under production contract arrangements where risk is shared between the farm operator and the sponsoring firms. Today’s farmers produce higher valued products as a result of technological improvements in agricultural production, food processing systems, and better information on changing consumer preferences. Technological advances also have spurred productivity growth through higher yields. Farmers have improved control over their operations by spending more on management services and increasingly adopting cost saving technologies such as biotechnology seed, water-saving irrigation platforms, and electronic yield monitoring devices.

One outcome of consolidation in the banking industry is that today, large, diversified, commercial banks hold a greater share of total agricultural loans than was the case two decades earlier (Cofer, Jr. 2008). Farm lending has shifted from a primarily collateral basis to greater consideration on the ability to meet debt service commitments. Farm operators have adopted a more conservative approach to financing their operations. Many more farmers now are paying cash for land, equipment, and inputs. Farmers also are reducing their debt load by leasing assets such as land and machinery. A variety of government policies are now in place that provide farms with income support and risk management opportunities. Although revitalized with passage of the Federal Crop Insurance Act of 1980, participation rates were quite low throughout most of the financial crisis of the mid-1980s. Today, federal crop insurance is
Behind the Recent Surge in Farm Real Estate Values

Farmland values have risen dramatically over the past several years raising concerns about their long-term stability and risks associated with a sudden drop in prices. Many remember the last major devaluation of U.S. farmland where inflation adjusted values fell by almost 50% between 1981 and 1987. Farmland values did not begin to grow again until 1993 and after adjusting for inflation had steady increases of 3% per year over the next 10 years. The rate of increase after adjusting for inflation has accelerated significantly since 2004, averaging 10% per year through 2008. A milestone was reached in 2005, with inflation adjusted values fully recovering from the farm financial crisis of the 1980s.

Land markets are inherently local where participants are heavily influenced by nearby social, financial, and economic factors. Generalizing recent events on a national scale obscures many of these local influences, but does reveal some of the most common and strongest influences. Robust growth in farm income during most of this decade buoyed by government support payments is consistent with the expectation of higher returns to farmland from agricultural production reflected in higher land values. Nonfarm factors such as recreation and urbanization potential also influence market value. In states where farmland is in great demand for conversion to urban use, IRS code section 1031 exchanges were an important facilitator for many land transactions. The 1031 exchange provides a tax incentive to farmers who make a profit from selling their land. They can make a like-kind exchange for land elsewhere and forgo paying capital gains. More recently, farmland has attracted investors seeking a shelter from the stock market or looking to hedge against future inflation.

Recession Duration and Recovery Path has Differing Implications for Farm Income and Land Values

Under both alternative scenarios, the recovery to positive domestic GDP growth takes longer than the 18 month period assumed in the reference scenario. In addition, the scenarios have different assumptions for the amount of contraction in the U.S. economy in 2009, with weak dollar scenario at -2.2% and the strong dollar scenario at -3%. As a result, the alternative outcomes for 2009 characterized the downside risk associated with the effectiveness of the U.S. and world macroeconomic policy response to the crisis. The alternative scenarios also have two distinct recovery paths which influence the potential 2009 outcomes, but more importantly, have dramatically different outcomes over the long-term.

With exports declining more than under the reference scenario, the first alternative results in lower commodity receipts. Livestock receipts are projected to be almost 8% below the base 2009 forecast of $135 billion and crop receipts just over 1% below the 2009 reference scenario forecast of $162 billion. Dairy and beef cattle account for most of the decline in livestock receipts, which for dairy represents additional contraction beyond an already bleak 2009 outlook for the reference scenario. Under this scenario, higher feed costs lead to a modest increase in expenses above the reference scenario, as some of the impact is offset by lower interest expense and energy costs. Net cash income is projected to be $64 billion, representing a $13 billion decline from the reference scenario (Figure 1). At this level, net cash income would be $8 billion below the 1999–2008 average. Net farm income is projected to be about $60 billion under this scenario, which would be 16% below the reference case and about $5 billion below the 1999–2008 average.
The second alternative, which represents a slightly longer and initially deeper recession than does the reference scenario, is characterized by a weaker dollar, higher interest rates, and higher costs of foreign inputs. In comparison with the base 2009 results, there were very minimal changes in the 2009 outlook for commodity receipts. Expenses, on the other hand, would be more than 2% higher than under the reference scenario. The outcome under this scenario would be about a $6 billion decline from the reference case for both net cash income and net farm income.

The results of these alternative macroeconomic scenarios also have important implications for farm real estate values. Farm real estate, while influenced to some degree by factors not related to agricultural returns, is sensitive to changes in farm profitability, interest rates, and the rate of inflation. However, at the national level, the decline in farm income is not substantial enough to create major differences from the reference scenario projection of a 2% increase in farm real estate values for 2009. Nonetheless, beginning in 2008, certain areas of the country saw stronger adjustments. In several northeastern states, where nonagricultural factors influence farm real estate more heavily, farm real estate values have dropped by 2 to 5%. California, Florida, and Nevada have experienced some of the largest declines in the rural housing market (Figure 2). Farm real estate values have not grown and some have declined. States where corn and soybeans constitute a major share of agricultural production have seen double digit increases in land values because of bio-fuels expansion. In the strong dollar scenario, where prices and receipts for corn and soybeans fall below those in the reference case, real estate values in states like Illinois, Indiana, and Minnesota, are expected to moderate in 2009. Farm land in these areas is still viewed as a viable counter inflationary investment, and any downward pressure could be buoyed by demand from large pension funds and institutional investors.

Tighter cash margins over the course of the U.S. and world recession will impact debt repayment ability for some farmers. The most severe effects are expected for dairy farms for which relatively large reductions in cash earnings are projected. In 2007, 5% of dairy farms had debt repayment problems, and in the reference scenario that figure could more than double to 13%. In the strong dollar scenario, repayment problems could jump to more than one in five for dairy farm businesses.

Long-term projections for commodity production and prices and for input costs indicate that cash and profit-based net income measures will begin to recover in 2010. The strength of the recovery varies considerably across the alternative scenarios. In the reference scenario, net farm income increases by 11% to reach $80 billion (Figure 3). The strong dollar scenario has a larger relative increase, but starting from a much lower 2009 projection, only reaches $73 billion.
In the weak dollar scenario, net farm income exceeds the reference case in 2010 by $6 billion. The correspondence between the two alternative scenarios and the reference scenario, in relation to net farm income, is maintained until 2012. The strong dollar scenario implies a more dramatic reduction in incomes for 2009 and a slower recovery through 2012. The weak dollar scenario also entails lower income than the reference case in 2009 and 2011, while it trends significantly higher after 2012. In essence, both of the alternative scenarios capture the effects of a prolonged recession relative to the reference scenario assumption.

Macroeconomic policies that prevail during the recovery for the United States and other countries will have a significant impact on farm income growth after 2012. The weak dollar scenario essentially represents a return to the environment that prevailed prior to the credit crisis in 2008 and as a result income growth resumes the path implied under circumstances that promote strong U.S. exports. Meanwhile, the stronger dollar scenario further exemplifies how important exports are to the farmer’s bottom line. Nominal cash receipts in this scenario level off after 2012 and net farm income moves downward. This is primarily the result of a high exchange rate which, in turn, reduces export demand that American farmers rely on to support agricultural prices.

Farm real estate values are projected to return to 5% annual growth over 2010–17 in nominal terms in both the reference and weak dollar scenarios (Figure 4). The annual rate of growth over 2010–17 is projected to be slightly lower in the high dollar scenario (4%). Differences between the scenarios for U.S. farm real estate values are consistent with variation in the key variables that influence the model. For example, growth rates in crops receipts plus government payments are expected to be just over 1% annually in the reference case, slightly lower for the high dollar scenario and over 2% for the weak dollar scenario. When viewed relative to historical trends, crops receipts plus government payments averaged 10% annual growth during 2004–08 and 2.7% during 1994–2003. Interest rates show some differences between scenarios, but by historical standards remain well below the levels of the 1980s.

When adjusted for inflation, the U.S. value of farm real estate does not rise as high, or as uniformly across scenarios. Annual growth over 2010–17 in the reference and weak dollar scenarios is about 3%, while in the strong dollar scenario real estate values fall towards the end of the period, so that average growth rates over the entire period are lower by comparison. During 2004–2008, the value of U.S. farm real estate averaged 10% annual increases when adjusted for inflation. For each of the alternative scenarios, real estate values return to the more modest growth rates experienced during the 1994–2003 period. Inflation adjusted real estate values are consistently below the reference scenario.
The analysis of alternative macroeconomic assumptions identifies the susceptibility of production agriculture to the current world recession. The initial depth of the recession has implications for 2009 financial prospects with the downside risk to farm earnings estimated at $11 billion. The types of policies used to combat the recession along with the response by the rest of the world economies suggest two distinct paths after the U.S. recovery. A path in which the U.S. dollar remains low relative to other currencies extends the type of growth achieved prior to the recession, but at the cost of higher inflation. In real terms, the value of farm real estate would return to rates of annual growth experienced during 1994–2003 period. Under a strong dollar recovery regime, farm earnings would not recover until 2012 and then decline steadily through the remainder of the estimation period. Farm real estate values would initially increase, when adjusted for inflation, primarily because of the low inflation environment brought about by the high dollar, but decline below the alternative scenarios near the end of the period.

For More Information

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The economic fallout of the financial crisis has widely and deeply impacted most economic sectors. The initial declines in housing prices and subprime delinquencies spilled into the financial markets. Because banks and other financial intermediaries are critical conduits for economic investment and growth, the crisis quickly migrated to individuals, small businesses and large firms. The economic feedback loops resulting from the economic slowdown and job losses are certainly impacting the confidence of consumers and the stability of the financial services sector. Moreover, due to the interconnectedness among the major global financial institutions, the crisis spread worldwide. This financial turmoil and economic disruption in the financial markets is clearly unprecedented. Agriculture and institutions lending to agriculture have not been immune to the impacts of the financial crisis. This article provides a summary of some of the financial indicators useful in measuring the extent of the credit crisis and an overview of the current and potential impacts on agriculture.

Financial Market and Economic Conditions
The macroeconomic news continues to top the headlines and reveal the dimensions of the turmoil in credit markets. The delinquency rate for mortgage loans on one-to-four-unit residential properties rose to a seasonally adjusted rate of 7.88% of all loans outstanding as of the end of the fourth quarter of 2008, up 2.06% from one year ago (Mortgage Bankers Association, 2009). Financial system write downs and credit losses have exceeded $1 trillion, and the International Monetary Fund (IMF) has raised its estimate of the potential deterioration in U.S. originated credit assets to $2.2 trillion (IMF 2009). Over the past 12 months, the number of unemployed has increased by about 5.0 million and the unemployment rate has risen 3.3 percentage points to 8.1%. In an attempt to fill the gap in credit availability, the Federal Reserve has undertaken a variety of lending programs, resulting in a doubling of its balance sheet between Aug. 8, 2007 ($902 billion) and March 5, 2009 ($1.943 billion) (Federal Reserve Bank, 2009).

There is some evidence that credit markets have eased moderately since November 2008. A wide range of indicators are often used to measure the liquidity risk and the willingness to lend among financial institutions. Three indicators that provide information are (1) LIBOR-OIS spread, (2) AAA-BAA corporate bonds spreads, and (3) credit default swap (CDS) spreads for U.S. grade financial institutions.

The LIBOR-OIS spread is used as a barometer of stress and illiquidity in the money markets. It is the difference between the three-month (or one-month) London Interbank Offered Rate (LIBOR) and the overnight indexed swap (OIS) rate. In stressful times, LIBOR reflects credit and liquidity risk and thus, the spread is used as a summary indicator of credit market conditions. Historically, the LIBOR-OIS spread was about 10 basis points. It increased to 365 basis points after the Lehman failure on Oct. 10, 2008. By mid-February 2009 the rate had dropped to approximately 100 basis points, high by historic standards, but substantially lower than its peak. LIBOR rates increased slightly in mid-March 2009, reflecting the fact that considerable uncertainty in the market remains.

The AAA-BAA corporate spread is a useful indicator for the price of credit risk. As spreads increase, the cost of borrowing and credit risk also increase. As shown in Figure 1, the spreads peaked in late 2008 at near 3.5% and have dropped slightly to 2.9% during the first week of February 2009 (Federal Reserve Bank of St. Louis 2009).

General economic and systemic risks to financial institutions remain high. Credit default swap (CDS) spreads, a
measure of the price of risk, for high grade U.S. financial stocks have declined to 300 basis points from 500 basis points in October 2008. However, the CDS spreads were below 100 basis points prior to the crisis. In summary, though some easing of the credit conditions is evident, there is substantial credit and liquidity risk in the markets.

Agricultural Financial Markets

In general, the financial condition of farm borrowers was strong entering 2008. Estimated profitability of U.S. farms in 2008 was a record $89.3 billion. However, net farm income is projected to be 20% lower in 2009. The major stress sectors in agriculture are the protein markets, especially pork and poultry. These producers entered 2008 in more stressful liquidity and leverage positions. Continued low profit margins have increased the credit risks for these sectors. A significant example is the bankruptcy filing of Pilgrim’s Pride, the nation’s largest chicken producer.

Agriculture is generally characterized as using a low amount of debt relative to assets. The U.S. Department of Agriculture forecasts total farm debt of approximately $217.1 billion for 2009 (USDA 2009). Total assets in the farm sector exceeded $2.38 trillion, resulting in a farm aggregate debt to asset ratio of only 9.1%. The debt-to-asset ratio in the mid-1980s exceeded 20%. Another financial stress indicator for the United States is the proportion of net farm income used for debt service. The ratio was approximately 30% in the mid-1980s, but was only 10% in 2007. In general, the agricultural sector was in strong financial condition going into 2009. Hence, agricultural credit was generally available during the first quarter of 2009.

From an agricultural credit availability standpoint, Asian and European countries appear to be in a similar situation to the United States. Credit availability for farmers in these countries has been aided through stimulus, government financing programs and subsidies. However, credit availability in Brazil and Argentina is likely to be a constraint for agricultural producers.

The primary U.S. lenders in agriculture are commercial banks, the Farm Credit System, insurance companies, Farm Service Agencies and captive finance companies. The Farm Credit System holds approximately 42% of the real estate debt and 31% of the nonreal estate farm debt. (USDA, 2007) Commercial banks have the highest market share of nonreal estate farm debt (53%) while lending 38% of the farm real estate loans. Commercial banks and FCS hold 83% of the total agricultural debt. The following sections concentrate on these major lenders and identify the areas of concern regarding the availability of credit and potential risks faced by these institutions in the current environment. The impacts are separated into those that were observed immediately after the initial financial crisis and the impacts being felt from the secondary impacts resulting from the economic downturn.

Initial Impact of the Financial Crisis on Agriculture

Relative to other financial intermediaries, agricultural lenders generally remain healthy. Many of the agricultural-related institutions did not participate in higher-risk housing lending procedures nor were they significantly invested in the structured securities that have lost substantial market value. The initial impact of the crisis did impact larger agricultural businesses through lack of working capital financing or trade credit and the large increase in the cost of debt capital. The initial phase of the financial crisis did not have a pronounced effect on the credit availability to much of commercial agriculture, but did impact the securities portfolios of many lenders providing credit to agriculture.

Substantial write-downs in investments related to Fannie Mae, Freddie Mac and Lehman Brothers have occurred across commercial banks, the Farm Credit System, Farmer Mac, and insurance companies. Farmer Mac, the government sponsored enterprise (GSE) which serves as the secondary market for agricultural loans, maintained a substantial investment portfolio and did suffer substantial capital losses due to investments. As a result of their exposure to these positions,
they issued $65 million in preferred stock to increase their effective capital ratio. The reduction in capital has also decreased the extent that Farmer Mac can provide long term standby commitments, an instrument that has been used by Farm Credit System associations to manage risk and capital. An additional area of potential investment valuation vulnerability for commercial banks is the security valuation and the viability of the Federal Home Loan Banks.

Another impact of the initial phase of the crisis was the limited ability of the Farm Credit Funding Corporation to issue longer term bonds. The Farm Credit System uses capital markets to acquire funds by issuing consolidated system-wide bonds and notes. The market generally views Farm Credit debt as being relatively safe and generally requires modest spreads over Treasuries for placement of the debt. The general lack of bond investor confidence coupled with the unintended consequences resulting from the prevalence of new credit facilities and guarantees provided by the U.S. government have resulted in a lower appetite for longer term bonds issued by the Farm Credit System. Management of the Farm Credit System and the Federal Farm Credit Funding Corporation have worked with the FDIC, Federal Reserve, and the Treasury to develop strategies to assure liquidity backstops in the event of a more severe market disruption (Strom 2009).

Commercial banks lending to agriculture are generally dominated by small, community oriented banks that use local deposits as their primary source of funds. In general, the first wave of the crisis did not impact most community banks. However, the largest 15 banks lending to agriculture hold approximately 20% of the farm debt provided by commercial banks (FDIC 2009). These banks were exposed to the initial financial stresses occurring in the credit markets; hence, their agricultural activities were not likely insulated from the effects of the financial market disruptions. Publicly traded banks and bank holding companies also experienced significant changes in market capitalization. Only 19% of the banks providing credit to agriculture are publicly traded or owned by a publicly traded bank holding company. However, almost 35% of the volume of agricultural loans is held by a publicly traded institution. The barbell shape nature of the lending institutions lending to agriculture is an issue that should be reemphasized. General characterizations of the agricultural lenders are often small-community-oriented banks. However, large banks and publicly traded banks have a large portion of the portfolio, especially larger more complex farm operations. Since these banks had to incur some of the costs of the first wave, their lending practices were very likely impacted. Moreover, publicly traded institutions face the continued stress of declines in market capitalization and earnings announcements of the banking sector.

The asset-backed-security market was also crippled by the initial crisis. Asset backed securities are used by many farm machinery companies as a cost-effective method to fund loans to borrowers. Since this alternative was not available, some companies had to use higher cost methods to finance these loans. The government program that may revive this market is the Term Asset-Backed Securities Loan Facility (TALF), a facility that will support the issuance of asset-backed securities (ABS) collateralized by student loans, auto loans, credit card loans, and loans guaranteed by the Small Business Administration (SBA).

### Secondary Impacts of the Financial Crisis

The secondary impacts of the financial crisis on financial institutions have occurred through changes in loan demand, reduced net interest margins, loan downgrades and defaults. Lower farm profit margins and downward pressure on farmland valuations also present stress to institutions providing debt capital to agriculture. The softening of farmland markets is being influenced by (1) reduced demand from lower housing development, (2) the wealth and cash flow impacts of a drop in equity prices for many potential farmland buyers, (3) the increase in risk in agriculture resulting in an increase in capitalization rates, and (4) the lower demand for recreational property.

The number of troubled banks reported by the FDIC has increased from 76 at the end of year 2007 to 252 at the end of 2008 (FDIC 2009). The impacts on commercial banks lending to agriculture are illustrated in Table 1. In general, the capital positions of the smaller institutions lending to agriculture remain strong. Only 33 banks of the 5,997 banks lending to agriculture were classified as undercapitalized by the FDIC. Although this is a low number, there were only 13 on June 30, 2008. The relatively low level of ROA for banks illustrates the stresses exhibited by most banks, especially larger banks. The 5-year average for each of the size groups is approximately 1%. Higher proportions of problem loans at larger banks are also observed. Another area of vulnerability noted by the FDIC is that a number of agricultural banks have exposure to construction and development loans. These higher risk loans have been especially stressed by the current economic climate.

The capital positions of many banks was aided by the U.S. government’s troubled asset relief program (TARP). The initial investment of $125 billion was to be used as eq-
Community investments in large banks while another $125 billion was available for regional and community banks. As of Feb. 9, 2009 almost 400 firms have participated, including more than 530 commercial and savings banks in the United States. The financial commitments of TARP have exceeded $280 billion. As expected, participating banks exhibited lower profitability in 2008. The average rate of return on assets for participating banks in 2008 was 0.009% while the average for nonparticipating banks was 0.42%. Approximately 6% of the 5,997 banks that provided credit to agriculture in 2008 participated in the TARP program. However, participating banks provided 24% of volume of agricultural loans made by all commercial banks.

**Unprecedented Times**

This is truly an unprecedented time in our agricultural and general economies. Policymakers are in uncharted waters as governments are using many monetary and fiscal tools and approaches to relieve the credit stresses and liquidity problems and ultimately restore confidence in the financial markets.

In general, the financial health of lenders to agriculture remains strong. The agricultural lending industry is characterized by strong customer-borrower relationships. The institutions are well regulated in a manner to protect the safety and soundness of the institutions and the safety of the insurance deposit base. At the same time, the economic downturn and declining interest rates have reduced profit margins for agricultural lenders in 2008 and forecasts for margins in 2009. Nonperforming and past-due loans have increased. The strong management and capital positions of agricultural lenders provides a buffer for these economic downturns, but the failure and consolidation of lending institutions, including some in agriculture, are likely to occur. At the very least, the agricultural sector will be forced to compete with other sectors for increasingly scarce capital in the foreseeable future. In doing so, the farm sector will be forced to adapt to sources of instability outside of its control.

**Table 1. Liquidity and Solvency Measures for Commercial Banks**

<table>
<thead>
<tr>
<th>Asset Size ($ Million)</th>
<th>Loan to Deposits</th>
<th>Equity to Assets</th>
<th>Rate of Return on Assets</th>
<th>Nonaccrual Loans to Total Loans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $100</td>
<td>75%</td>
<td>12.1%</td>
<td>0.52%</td>
<td>1.32%</td>
</tr>
<tr>
<td>100–500</td>
<td>85%</td>
<td>10.1%</td>
<td>0.57%</td>
<td>1.80%</td>
</tr>
<tr>
<td>500–1,000</td>
<td>93%</td>
<td>9.5%</td>
<td>0.54%</td>
<td>2.05%</td>
</tr>
<tr>
<td>1,000–10,000</td>
<td>102%</td>
<td>9.9%</td>
<td>0.09%</td>
<td>2.51%</td>
</tr>
<tr>
<td>Greater than 10,000</td>
<td>134%</td>
<td>10.0%</td>
<td>0.00%</td>
<td>2.03%</td>
</tr>
</tbody>
</table>

Source: FDIC, Preliminary Call and Income Reports. Nonaccrual loans are loans where interest income to the bank has been suspended because of loan and collateral problems. 12/31/2008


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**For More Information**


Are Our Agricultural Risk Management Tools Adequate for a New Era?

Barry J. Barnett and Keith H. Coble

JEL Classifications: D80, G11, Q18

This Choices theme is premised on an assumption that agriculture has entered a new era of increased instability. Among the causes posited for this increased instability are the recent integration of the agriculture and energy sectors through bioenergy markets and the macroeconomic consequences of the current recession and credit crisis. While increased volatility in some agricultural commodity prices has been observed recently, whether agriculture has actually entered a new era of long-run increased instability is, we believe, open to some question. History is replete with “new eras” in American agriculture—most of which were amazingly short-lived (Paarlberg, 1964).

Regardless of what has changed, much remains unchanged. Agricultural production is still quite concentrated with less than 6% of the farms in the United States producing 75% of the value of production (Census of Agriculture, 2007). Most U.S. farms still produce undifferentiated commodities for markets where production is characterized by relative ease of entry and exit. And farming is still a risky business.

When examining the risk in agriculture, a common pitfall is to focus strictly on the variability of annual farm net income or even the variability of net income from a specific commodity. While variability in annual net income can threaten the short-run survival of a farm business, it is also important to look more broadly to the variability of both annual net income and asset values from a portfolio perspective. An unreasonably narrow perception has contributed to misunderstandings regarding the risk exposure in agriculture and federal policies that are redundant, too focused on single-year income streams, too commodity-specific, and too likely to create significant resource misallocation.

Portfolios and Risk

Farm households manage a portfolio of assets. Those assets are used in crop and/or livestock production and frequently also in enterprises that are related to farm production such as custom harvesting or initial processing of agricultural commodities. However, not all farm household assets are utilized in agricultural production or enterprises related to agricultural production. Like other U.S. households, farm households invest in financial or real assets that may be completely unrelated to agriculture.

Farms classified by ERS as large-scale family farms account for more than 60% of the value of agricultural production in the United States. On approximately 50% of these farms the farm operator and/or the spouse work off the farm (Hoppe, Korb, O’Donoghue, and Banker, 2007). Table 1 indicates that, for large-scale family farms, both earned and unearned sources of off-farm income account for a significant share of total farm household income.

### Table 1.

<table>
<thead>
<tr>
<th>Off-Farm Income Sources for Large-Scale Family Farms</th>
<th>Large-scale family farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean household income</td>
<td>$125,120</td>
</tr>
<tr>
<td>Farm earnings</td>
<td>$80,250</td>
</tr>
<tr>
<td>Off-farm income</td>
<td>$44,870</td>
</tr>
<tr>
<td>Earned</td>
<td>$33,238</td>
</tr>
<tr>
<td>Unearned</td>
<td>$11,633</td>
</tr>
<tr>
<td>Share of income from off-farm</td>
<td>35.90%</td>
</tr>
</tbody>
</table>

Source: (Hoppe, Korb, O’Donoghue, and Banker, 2007)
Farm households manage their portfolios by making decisions that weigh expected returns (either annual net income or capital gains) against risk exposure (often measured as the variability in returns). Like other investors, farm households desire higher expected returns but dislike risk. However, expected return and risk are usually positively correlated.

Farm portfolios may include only one crop or livestock commodity or may be diversified across several commodities. Specialization often creates economic efficiencies that may increase net returns, but it also typically exposes the farm household to more risk.

Farmers have always been faced with variability in output prices, yields, and input costs. For a single commodity, this variability, along with the correlations among these random variables, has important implications for variability in annual net income. Similarly, the variability in whole farm net income is affected by cross-commodity correlations in these random variables. So an argument that agriculture is entering an era of increased instability in annual net income is implicitly an argument that the variability of the underlying random variables has increased and/or that the correlations have changed.

But the risk exposure of a farm household portfolio is not limited to just variability in annual net income. Like any other investment portfolio, a major risk (and perhaps the most important risk) is variability in the value of the underlying assets—capital gains and losses. For large-scale family farms, 88% of net worth is tied to farm assets and approximately 68% of farm net worth is in real estate (Hoppe, Korb, O’Donoghue, and Banker, 2007). Thus, from a portfolio perspective, variability in land values may be far more significant than variability in annual net income caused by random output prices, yields, and input costs. For example, a 10% decrease in the value of cropland from a base value of $2,500 per acre reduces net worth by an amount that is equivalent to a $1.25 per bushel decrease in the price of a 200 bushel per acre corn crop. It is worth remembering that between 1981 and 1987 the value of farm assets in the United States decreased by 30%. In the Midwest, land values fell by approximately 50% (Barnett, 2000).

**Commodities**

Despite the emphasis in recent decades on “value-added” agriculture and farmers “moving down the supply chain,” much of U.S. agriculture is still based on producing undifferentiated commodities. Further, in some regions of the United States, farmers can quickly enter and exit specific commodity markets. The ease of entry and exit from markets for undifferentiated commodities suggests that while price variability may create short-run economic profits or losses, these profits or losses are not likely to be sustained over the long run. Short-run economic profits will attract new entrants. This increases the cost of limiting resources (typically land) and drives out the short-run economic profit.

**Available Risk Management Tools**

Farm households use various methods to manage their risk exposure. They commonly diversify across commodities or geographic locations. Farm households also manage risk by producing crops that generate multiple harvests over a single growing season, securing off-farm employment, or investing in off-farm assets. Other risk management strategies include using risk-reducing inputs such as irrigation, forward pricing, savings, and maintaining credit reserves.

The federal government also directly provides, or subsidizes the provision of, a host of programs that provide income enhancement and risk management benefits to agricultural producers. Some of these are standing federal programs while others have been authorized on an ad hoc basis. Access to these programs is generally limited to producers of selected crops. For example, standing federal commodity programs (see table 2) are available only to producers of the major program crops (barley, corn, cotton, grain sorghum, oats, peanuts, rice, soybeans, wheat). Federally-subsidized yield and/revenue insurance are available for more than 100 crops produced in the United States. However, with the exception of pilot price insurance programs for swine, cattle, and lambs, livestock producers do not have access to federally-subsidized insurance.

Through the years, various types of federal emergency assistance have been provided to both crop and livestock producers on an ad hoc basis to compensate for production losses, low output prices, or high input costs. However, the availability of such ad hoc assistance is, by definition,
uncertain and often comes many months after the loss has occurred. This makes it effectively impossible for farm households to include ad hoc assistance in risk management planning.

The 2008 Farm Bill created, for the first time since 1980, a standing federal disaster payment program. Payments from the Supplemental Revenue Assistance Program (SURE) are triggered by shortfalls in realized whole-farm (not commodity-specific) revenue.

The Adequacy of Current Federal Policies

Any assessment of the adequacy of current federal risk management (or income enhancement) policies begs the question of “adequacy” for whom—for program crop producers, the broader agricultural sector, or society as a whole? For example, biofuels policies adopted in recent years have benefited some program crop producers but have negatively impacted livestock producers who often do not produce feed crops.

Policymakers are generally averse to radical changes. Thus, federal agricultural policies have changed only incrementally over time. Today’s hodgepodge of government commodity programs and subsidized insurance programs are, in part, a response to the current political climate and, in part, a historical artifact. It is hard to imagine that anyone working from a clean slate would conceive of such a mix of overlapping, and sometimes conflicting, programs.

As an example of federal program redundancy, consider that the marketing loan provides program crop producers with protection against output price risk. Additional price or revenue risk protection is provided through the producer’s choice of participating in either the price counter-cyclical payment program (assuming the producer actually produces the crop on which the counter-cyclical payment will be made) or the Average Crop Revenue Election (ACRE) program. The SURE program provides further protection against revenue shortfalls, and federally-subsidized revenue insurance is also available. So program crop producers can potentially receive compensation triggered by low prices from up to four different federally provided or subsidized programs. Coble and Barnett (2008) show that greater risk reduction per federal dollar spent could be obtained from simpler nonredundant programs.

In contrast, to the many federal programs that protect program crop producers against output price risk, the SURE program and subsidized yield or revenue insurance are the only standing federal programs from which producers can potentially receive compensation triggered by production shortfalls. There are no standing federal programs that protect crop producers against rapidly escalating input costs.

It is also important to note that neither the private sector nor the public sector provide protection against fluctuations in land values. Among the reasons for this are spatial differences in land attributes, the likelihood that the owner has access to proprietary information about the attributes of any particular parcel, and the fact that land value risk is an example of what Skees and Barnett (1999) call an “in-between” risk—neither highly systemic (so that it might be appropriate for futures markets) nor highly idiosyncratic (so that it might be appropriate for insurance markets).

Long Run versus Short Run

Agricultural production requires long-run commitments (e.g., investments in land or equipment) but markets typically offer only limited opportunities for obtaining risk protection that extends beyond a single production season. While many farmers can forward price their outputs and at least some of their inputs within a production season, most output handlers or input suppliers will not offer forward contracts beyond the current production season. For some major crops, futures contracts are available for at least one growing season into the future, but the markets for these contracts tend to be very thin and highly volatile.

From a producer’s perspective, a primary advantage of federally provided or subsidized risk management programs is that they provide longer-run protection than is available from markets. The federal marketing loan program and price counter-cyclical payment program trigger payments whenever realized prices are less than targets that are prespecified throughout the life of the farm bill. The revenue targets for ACRE—and to some degree for SURE—are based on moving averages of historical revenues. For ACRE the revenue targets cannot increase or decrease by more than 10% per year. The federally-subsidized yield and revenue insurance programs also establish targets based on historical moving averages of yield.

While the longer-run protection available from federally provided or subsidized risk management programs is an advantage to producers, it likely imposes significant social costs. Long-run price or revenue guarantees can distort market price signals and lead to the misallocation of resources.

The benefits of federal commodity programs are also bid into land values. Since land is a primary store of wealth for many farm households, the potential for changes in federal policies is likely one of the most important risks currently facing many U.S. farm households. In this period of record budget deficits, any effort to reduce federal outlays for agricultural commodity programs or corn/soybean based bioenergy programs is likely to cause tremendous capital losses for
many farm households. Further, as the economy recovers from the current recession, the Federal Reserve is likely to raise interest rates to forestall inflationary pressures. This will also create downward pressure on land values.

A New Era of Instability?

Has U.S. agriculture entered a new era of instability? Perhaps. It is too early to tell if the long-run variability of output prices or input costs has increased. For some commodities, it seems likely that the integration of agricultural and energy markets has changed correlations among random variables (e.g., output prices and input costs) that affect the variability of annual net income, though the magnitude of those changes is not yet clear. For other commodities, there is likely little or no impact.

Regardless, much is likely to remain unchanged in this “new era.” For the foreseeable future, most U.S. agricultural producers will still produce undifferentiated commodities (that are also produced in many other countries around the world) for markets that are characterized by relative ease of entry and exit. This implies that any period of unusually high profit for producers of agricultural commodities is likely to be short-lived.

Markets will continue to offer an array of mechanisms that producers can use to forward price their commodities within a production season. Due to the potential for supply or demand shocks that cause unforeseen but systemic changes in price, markets are unlikely to provide risk management tools for output prices or input costs that extend much beyond a production season. Any longer-run price or revenue protection will have to be provided by the federal government. However, efforts to provide longer-run agricultural risk management (or income enhancement) programs will conflict with concerns about resource misallocation (and the potential for associated environmental impacts) as well as U.S. trade obligations that extend well beyond the agricultural sector.

Due to efficiencies from specialization, farms are unlikely to revert to the highly diversified multicommodity enterprises of yesteryear. But farm households will continue to diversify their portfolios through off-farm employment and off-farm investments. In many rural areas the opportunities for off-farm employment have never been greater (the current recession aside) while modern financial markets make it possible for agricultural producers to hold a well-diversified portfolio of investments that are largely uncorrelated with the net returns from producing farm commodities. As with any other household, accumulating savings and maintaining credit reserves will also be an important risk management strategy.

The federal measures that enhance farm incomes and reduce the variability in single-year income streams may actually increase the risk inherent in many farm household portfolios. The benefits of these programs are bid into land values. Thus, the accumulated wealth of many farm households is highly vulnerable to reductions in federal transfers—as might be required to meet future federal budget cuts or trade agreement commitments. Further, farmland values are also vulnerable to higher interest rates, and that seems quite likely following on the heels of the current fiscal stimulus.

For More Information


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Ethanol Policy Changes to Ease Pressures in Corn Markets: Could They Work?

Wyatt Thompson, Seth Meyer, Nicholas Kalaitzandonakes, and James Kaufman

JEL Classifications: Q42, Q48, Q18. F13, Q28

The abrupt surge in corn and food prices in 2008 put the U.S. biofuel support policies under increased scrutiny. In the context of an active policy debate, some suggested that allowing more biofuel imports into the United States could soften the impact of ethanol on corn prices. Recent declines in commodity and food prices in the face of an expanding global recession have softened the policy debate. Whether this is a temporary reprieve remains to be seen. Links between biofuel policies and corn markets have been considered elsewhere (Tyner and Taheripour; Collins).

At least two policies are relevant in this context: a) the existing ethanol tariffs, which limit the potential for imported ethanol to displace domestically produced ethanol from corn; and b) the Renewable Fuel Standard (RFS), which leads to certain volumes of corn use as feedstock.

This article considers the potential impacts of policy changes that would allow the ethanol tariff to expire and the RFS mandate to favor feedstocks other than corn. Back-of-the-envelope analysis leads to an expectation of increased imported ethanol, less domestically produced corn ethanol, and thus a lower impact on corn prices—the presumed goal. However, the interaction between commodity markets and policies produce some unintuitive results that suggest the complexity of moderating such price impacts.

U.S. Ethanol Tariffs and Mandates

The current US ethanol specific tariff is a $0.54 per gallon tax on imported ethanol. Domestic ethanol production is also supported through a $0.45 ethanol blenders’ tax credit. The tariff is set, in part, to ensure that the blenders’ tax credits are not transferred to foreign ethanol producers. However, the ethanol tariff has been controversial and some policymakers have suggested that it should not be renewed when it is set to expire at the end of 2010.

The RFS affects the market differently by mandating greater and more diverse biofuel use. The broadest mandate of the RFS requires blenders to use a minimum of 11.1 billion gallons of renewable fuels in 2009, increasing to 36 billion gallons by 2022 (Figure 1A). This increased mandate is not expected to come exclusively from corn ethanol. Other renewable fuels, such as biodiesel, are also required to play a role. Indeed, much of the mandated biofuel use must come, not from corn, but from “advanced” systems. Cellulosic ethanol is considered “advanced” as it can be derived from renewable sources of cellulose, hemicellulose which comprises 20–40% of various agricultural residues, or lignin such as contained in crop residue, grasses, municipal waste, and woody biomass. Focusing on the near future allows us to sidestep the role that cellulosic biofuels might play in the RFS, the feasibility of which has been raised by Khanna. Other “advanced” ethanol systems could also include feedstocks like sugar cane, sugar beets and perhaps even sorghum. The advanced biofuel mandate is part of the overall ethanol mandate. Accordingly, use of advanced biofuels beyond certain levels could displace corn-based ethanol.

Since the type of feedstock used has no bearing on fuel quality or, by extension, on the retail fuel prices paid by consumers, differential production costs would imply different adoption paths for these biofuels in the absence of policy intervention. Forecasts suggest that conventional (i.e. corn) ethanol (CE) will be less costly to produce than “advanced” noncellulosic ethanol (OAE) in the United States which, in turn, would be less costly than cellulosic ethanol. As the RFS is currently understood, it seems likely that ethanol derived from sugar cane (presumably from Brazil) would count towards the advanced biofuel mandate, and in the absence of a tariff might be imported cheaply—perhaps even competitively with CE. Production costs for Brazilian
ethanol have tended to be lower than US CE (Shapouri and Salassi). However, it would likely first be used to satisfy the advanced mandate, which is comparatively more costly for the United States to fulfill.

If in any given year the quantities of ethanol used in the U.S. market fell short of their mandated levels, fuel blenders would be compelled to handle more ethanol to meet the mandated limits. To sell more ethanol they would need to lower the retail price in order to make the ethanol blend more attractive to the retailer and the consumer. Lowering the price of ethanol can generate demand by giving consumers incentives to: 1) shift from straight gasoline to an ethanol blend (where the option exists), 2) increase the amount of fuel they are willing to buy, and 3) to buy vehicles that can use higher blends of ethanol (e.g. E85).

The last effect also depends on the pace of infrastructure development, such as retailers installing pumps to distribute higher ethanol blends. We expect consumer willingness to switch among fuels will over time lead to correlation between gasoline and ethanol prices. However, consumption may not shift quickly in response to large differences in prices (if any increase must come by expanding E85 use) or may respond very quickly (if there is substantial room for greater E10 use) (FAPRI-MU 2008b; Meyer and Thompson).

At the same time that blenders lower retail prices to meet a binding mandate, they would effectively bid up the wholesale price of ethanol through increased wholesale demand. The resulting gap in wholesale-to-retail prices represents a cost to blenders of a binding mandate. Further, because of the different RFS mandates for alternative feedstocks, their differential delivery costs including tariffs imply that this price gap may be larger for one fuel than the other at any given point in time.

### The Effect of U.S. Ethanol Policy Change on Imports

To consider the impacts of potential changes in the ethanol tariff and the RFS, we use the U.S. model of crops and biofuel markets maintained by the Food and Agricultural Policy Research Institute at the University of Missouri (FAPRI-MU 2008b). This partial equilibrium model covers supply and demand quantities, including area planted, production, other domestic uses, trade, stocks, prices, and policies. It has long been used for policy analysis, and focuses on the mechanisms of federal policy (FAPRI-MU 2008a). Here, the U.S. markets are linked to a model of international markets that includes selected countries active in the production of biofuels or relevant feedstocks and details key cross-commodity and cross-market effects in food, feed and land. The Brazilian ethanol market is explicitly modeled and its structure implies significant substitution between fuels and a delayed but strong Brazilian ethanol supply response.

The analysis starts with the construction of a baseline reflecting current market trends and policies (Figure 1A). The ethanol tariff and tax credit are assumed to remain at their 2010 levels—$0.54 per gallon for the tariff and $0.45 for the tax credit—for the period of the analysis. Maintaining the tax credit will tend to encourage consumption, although it may not affect the quantity used if the mandates are binding. Mandates for cellulosic biofuel use and biodiesel are not shown here, although the biodiesel mandate is imposed on the market. Given the near future focus of the analysis and to isolate the impacts of the policy changes of interest, cellulosic biofuel use is assumed to remain small (less than 200 million gallons in 2012) and the corresponding mandate is assumed to be waived.

From this baseline we change the prevailing policy by increasing the OAE portion of the RFS mandate, effectively lowering the role CE can play without reducing the overall ethanol mandate (Figure 1B). We separately eliminate the import tariff, thereby removing the main barrier to imported OAE. Both policy scenarios start in 2009 and all other policies are held constant or at announced levels.

In addition to changing these policies, we also set crude oil prices at different levels and evaluate their conditioning impact. Rising oil prices should lead to higher gasoline prices,
lower relative ethanol prices, and greater consumer demand for ethanol blended fuel. Ultimately this could have a large impact on whether the ethanol mandates are binding or not. We explore four different crude oil price scenarios with the West Texas Intermediate price at $55, $90, $125, and $160 (Figure 2).

Results

We begin by considering the impacts of changes in the RFS. In the base case, before introducing any policy change, consumer demand for ethanol tends to exceed the overall mandated level at least until 2012, if the crude oil price is higher than $90 per barrel. OAE similarly exceeds the required amount, at least through 2012, at all oil prices investigated here.

Against this baseline, we first examine the impacts of an increase in the mandate applied to OAE according to the schedule previously illustrated in Figure 1B. This leads to more OAE imports when ethanol consumption is less than the mandated level, as in the case of $55 oil (Figure 3). At this oil price, all the mandates are binding. An increase in imports to meet the higher OAE requirement then results in an equal reduction in the domestic production as less CE is needed to meet the mandate.

At $90 oil, the higher OAE mandate becomes binding and imports are driven higher. However, the overall mandate becomes nonbinding as more of the mandate is shifted to OAE, so domestic production falls by 0.2 gallon for every gallon of additional OAE imported. At $160 oil, consumer demand is significantly higher than the mandated level as ethanol becomes less expensive than gasoline. Since consumers and not mandates drive demand and imports, the assumed change in policy has a diminished effect.

Next we test the effects of an elimination of the $0.54 tariff in 2009 (Figure 4). The $125 and $160 oil price scenarios generate consumer demand for ethanol in excess of the overall mandate. When this demand is met with less costly ethanol imports there can be a large increase in imports and domestic consumption along with a potential decrease in domestic production. At $160 oil, for example, every additional gallon of OAE imported is associated with 0.2 gallon reduction in domestically produced CE. But here, again, the mandate can play a part in determining the market outcome even though the mandate itself is not changed. If a mandate is binding, as is likely when the oil price is $55, then making imports cheaper affects the decision of whether to import or to produce ethanol domestically, but the total use stays at the mandated level. At this oil price, an additional gallon of imported OAE displaces one gallon of domestically produced CE.

Once again, consumer response to prices matters. At $160 oil, for example, high ethanol demand leads to maximum E10 use but further expansion of ethanol use is tempered by an inherently slower E85 adoption. So a tariff reduction in the context of high oil prices has a smaller effect on the ethanol quantity consumed than if the oil price were $125 and there was still room for expansion in the E10 market.
Overall, the analysis suggests that changes in the mandate and tariff generally result in mild effects on the prevailing U.S. corn prices that tend to be largest when the mandate is binding (Figure 5). The corn price falls by more than $0.10 per bushel for either policy change if the oil price is $55 per barrel. The effect of reorienting the mandate towards, presumably, imported advanced biofuels has no effect on corn prices at a higher oil price because there is no effect on ethanol markets. The import tariff elimination can have an effect at higher oil price scenarios, but the effect tends to be larger when oil price is lower. Whereas imports replace domestic production at a one-for-one rate at low oil prices in either scenario because of the mandate, this is not true at higher oil prices and thus the effect on corn prices fades.

**Suggestions Based on Analysis**

The analysis presented in this paper suggests that the RFS may not impact corn prices with the magnitude that is often assumed. Further, implementation of policies that would presumably mitigate impacts on corn prices requires careful consideration. For example, increasing a mandate has little effect if it is not binding. Conversely, increasing a binding mandate can have large effects. In general, ethanol mandates are more likely to be binding when oil prices are low than when oil prices are high.

Ethanol tariff changes are similarly context-dependent. Tariff effects on corn markets are modest when mandates are not binding, but larger when mandates exceed prevailing demand. However, changes in the ethanol tariff tend to have a larger effect on U.S. ethanol imports and consumption compared to the changes to the RFS mandate explored here.

Our comparison of these two potential policy changes highlights the sensitivity of the impacts to external conditions, such as the oil price. At a low oil price, both policy changes would tend to increase imports and decrease domestic production, with little net effect on overall use. At a high oil price, the impacts could be quite different, as changes in non-binding mandates may have no effect, whereas the lower tariff can increase imports and overall use without any large impact on domestic ethanol production.

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Identifying Growth and Diversification Relationships in Washington Agriculture

Tristan D. Skolrud, Erik O’Donoghue, C. Richard Shumway, and Almuhanad Melhim

**JEL Classification: Q12**

Agricultural production is one of the few remaining examples of a “nearly” perfectly competitive industry, where products are largely homogeneous and firms are price-takers. However, due to the rapid consolidation of farms, even the agricultural production industry is at risk of market-power imbalances which have impacted other industries. Two market forces, economies of scope and economies of scale, could be behind the increase in consolidation.

Farms increase production levels and diversify product mix to exploit scale and scope economies. As a result, they increase in size, creating the potential for the largest farms to exercise market power and adversely affect consumers. Industry consolidation also has potential for negative side effects relating to the environment, especially in confined animal operations.

To anticipate the likely extent of further consolidation, we examine recent growth and diversification trends to analyze whether Washington farms of different sizes have experienced scale and/or scope economies. Scale or scope economies occur, respectively, if average cost decreases with output level or number of outputs produced. We identify and compare scale and scope characteristics for four major agricultural production industries, both for firms existing in 1992 and for firms that entered the industry by 2002. We also compare scale and scope characteristics and trends for Washington State to national trends.

**Industry Selection and Empirical Measurement**

We examined data from the U.S. Census of Agriculture for Washington wheat, apple, beef, and dairy producers. Value of production from each of these industries consistently ranks them among the top five agricultural commodities in the state (USDA 2006). Our data came from the three most recent agricultural censuses—1992, 1997, and 2002. We included all firms in the 1992 census that produced at least one of these commodities and for which the operator selected “farming” as the main occupation. This data sample was comprehensive and only omitted hobby, recreational, and retired farmers. However, this one exclusion removed slightly more than half of all dairy and wheat farms, 2/3 of apple farms, and 4/5 of beef farms.

Firms were ordered by size based on their 1992 agricultural sales, excluding government payments and subsidies. They were divided into nonoverlapping deciles, or cohorts, with cohort one containing the smallest 10% of farms and cohort 10 contained the largest 10%. See Table 1 for mean sales by cohort. Farms retained their original cohort assignment across censuses, regardless of whether they grew, shrank, or otherwise changed over time. This preservation of cohort assignment permitted measurement of cohort-specific growth, a key factor for determining which farm size grew the fastest, and facilitated comparison and

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Data source: Census of Agriculture (USDA, 1992)
analysis across census periods. Each cohort initially had the same number of farms, but those that stopped being farmed caused these numbers to shrink unevenly across censuses.

To assess scale economies and calculate commodity-specific growth tendencies, compound growth rates were calculated for the mean of each cohort in each industry. These growth rates measured the rate at which real sales, a proxy for output, increased. To measure scope economies and calculate diversification tendencies, farms in each cohort were divided into five sales categories based on the percent of total agricultural sales obtained from the sale of the main commodity group: (1) 90% or greater, (2) 75–89.9%, (3) 50–74.9%, (4) 25–49.9%, and (5) less than 25%. For example, if a wheat farm in our sample derived 65% of its sales from grain and oilseeds and 35% of its sales from other products/services, this farm fell into diversification category three. A specialization index was created as a weighted sum of the share of farms in each diversification category, with the mean sales percent for the category used as the weight. This index ranges from zero to one, with a score of one indicating complete specialization and a score of zero indicating complete diversification to other agricultural products/services.

Growth by Industry

A graphical depiction of cohort growth rates for each of the four Washington industries is presented in Figure 1. Growth rates are included for two periods: 1992–1997 and 1992–2002. From the graphs, it is apparent that there was a negative correlation between initial farm size and growth rate in both periods for three of the industries—wheat, apples, and beef. The statistical correlation coefficients documented this observation; for the 10-year period, they were -0.83, -0.64, and -0.63 respectively. The dairy industry was the exception to this pattern; its 10-year correlation coefficient was positive and strong, 0.82.

Wheat farms had the strongest negative correlation between farm size and growth rate. They were also the only industry to have positive growth rates in all cohorts. For this industry, smallest farms grew the fastest, and largest farms were among the slowest-growing.

In both the wheat and apple industries, the smallest cohort of farms set the bar for growth. In the apple industry, only the growth rates of the smallest two cohorts were substantially different from the others for the 10-year period (see Panel B of Figure 1). In fact, growth rate in this industry was not strongly related to initial farm size for mid-to-large cohorts. While the correlation between growth rates and farm size was also negative for beef farms, the cohort pattern was quite different—cohort four had nearly three times the growth rate of any other cohort.

The growth pattern for dairy farms differed in even more important ways from the other industries. Besides a strong positive correlation between farm size and growth rate, surviving farms in the smallest cohort shrank by 4%. Nearly all growth of farms in this industry occurred in the largest three cohorts.
Specialization
As was the case with growth patterns, Washington wheat, apple, and beef farms followed a specialization pattern that contrasted sharply with the pattern exhibited by dairy farms. For wheat farms, the level of specialization was negatively related to farm size in all censuses, and the correlation decreased in strength over time (see Panel A of Figure 2). While the largest cohorts were the most diversified, the smallest cohorts tended to diversify more rapidly over time. The specialization scores in 1992 ranged from 0.86 for cohort one to 0.31 for cohort 10, with an average specialization score of 0.75. In successive censuses, all but the largest cohort became more diversified. The average score dropped to 0.67 by 2002.

Apple farms also exhibited a negative relationship between farm size and specialization level in each census, but the correlation was not as strong as for wheat farms (Panel B of Figure 2). The specialization scores in 1992 ranged from 0.92 for the third cohort to 0.73 for the tenth, with an average of 0.88, so apple farms were more specialized than wheat farms. They also remained more specialized. Only the smallest two cohorts and the largest cohort became much more diversified by 2002, and the average specialization score dropped only by 0.02 to 0.86.

Beef farms showed the strongest negative correlation between size and level of specialization. Panel C of Figure 2 shows a near-linear relationship between cohorts three–ten and the specialization score. In addition to having the strongest correlation between farm size and index score, beef farms had the lowest levels of specialization with average index scores close to 0.50 in both years. On average, beef farms showed a trivial reduction in average specialization score between 1992 and 2002.

Specialization levels in the dairy industry contrasted sharply to those of the other three industries. Whereas specialization index scores were negatively correlated with cohort size in the wheat, apple, and beef industries, they were positively correlated in the dairy industry (Panel D of Figure 2). Thus, among the four industries examined, dairy is the only one in which specialization increases with farm size. Also, on average, the dairy industry was the most specialized industry in the sample in 1992 but diversified more rapidly than any of the others. It experienced an average drop in specialization index score of 23% from 1992 to 2002.

One important insight gleaned from these results is that, in all industries, higher levels of specialization were generally associated with higher growth rates. Consequently, we infer that economies of scale, rather than economies of scope, appear to have driven farm growth.

Farm Entrants
Most farms that entered the wheat, apple, and beef industries were comparable in size to farms in the smallest incumbent cohorts. In the dairy industry, however, entrants were bi-modally distributed between smallest and largest incumbent cohorts, with relatively few comparable in size to mid-level cohorts. New farms in all industries entered with specialization levels higher than the average incumbent farm. Thus, while many farm entrants failed to fully capture either economies of scale or economies of scope at the time of entry, they entered at sizes for which evidence for the existence of economies of scale and/or scope was the strongest. In all but the beef industry, new farms tended to diversify at a more rapid rate than incumbent farms, which implies they quickly recognized and captured economies of scope after entering the industry.

Comparison to National Trends
Overall, trends in Washington growth rates were similar to national growth rates in each of these industries (Melhim, O’Donoghue, and Shumway 2009). While similarities were greatest between wheat, apple, and beef farms, the national patterns reflected stronger negative correlations between farm size and growth rate for these industries. Growth rate patterns of Washington dairy farms also generally followed the trends of national dairy farms. One exception is that the smallest cohort, which grew by 5% nationally, shrank by 4% in Washington. Washington diversification trends were also similar to national trends for all but the beef industry. However, in all industries, Washington farms were generally more specialized.

The most striking difference between Washington and national trends dealt with the size of entrants in the wheat, apple, and beef industries. Average sizes of national entrants exceeded the average size of their incumbent counterparts while average sizes of Washington entrants were smaller than incumbents. In addition, farms entering the dairy industry nationwide were much larger than the average incumbent and did not follow the bimodal distribution of new entrants in Washington. In contrast, diversification patterns of new entrants in most national industries did not differ much from the pattern seen in Washington, i.e., farms entered the industry at a more specialized level than incumbents and they diversified more rapidly over time.

Implications
Census-documented changes between 1992 and 2002 imply that the wheat, apple, and beef industries in Washington may, in one sense, be converging toward equilibrium farm sizes. While farms in all size cohorts...
are growing, the largest cohorts are growing at slower rates. This finding, which also applies to the nation, could be the result of the largest farms facing diseconomies of scale, or at least diminishing economies of scale, as output expands. However, in the dairy industry, the largest farms are among the fastest growing—evidence that strong economies of scale persist. This finding suggests that further consolidation of dairy farms is probable, which could, in the long run, ultimately distort the near perfectly-competitive nature of this industry, increase the potential adverse environmental impacts from large confined animal operations, and put the economic welfare of some small agriculturally-based communities at risk. Of the four studied, it is this industry that warrants most attention. Further, to address each of these three concerns, policymakers could focus on policies that facilitate the growth and/or diversification of small and medium-sized dairies.

Washington trends are generally comparable to national trends, especially where firm growth is concerned, and imply similar conclusions with respect to future consolidation, growth, diversification, and policy. One exception is that the average new entrant at the national level is larger than the average of incumbent farms, whereas, except for the dairy industry, the average new entrant in Washington is smaller. Diversification trends are mostly similar, but Washington farms are more specialized on average. Another notable exception is that at the national level, beef farms become more specialized over time, a trend not followed by Washington beef farms. Despite all the similarities, the few differences between Washington and national trends document an important fact. National trends are not always the trends of individual regions and states, so policies designed to achieve a specific goal in all areas may need local adjustment.

For More Information

