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Cornhusker Economics

Price Volatility Transmission between U.S. Biofuel, Corn, and Oil Markets

Market Report	Year Ago	4 Wks Ago	3-2-18
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight.	118.56	124.50	126.50
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	157.84	192.70	195.06
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	130.53	153.27	152.56
Choice Boxed Beef, 600-750 lb. Carcass.	192.88	209.51	221.18
Western Corn Belt Base Hog Price Carcass, Negotiated	NA	72.57	62.20
Pork Carcass Cutout, 185 lb. Carcass 51-52% Lean.	83.53	80.48	77.46
Slaughter Lambs, wooled and shorn, 135-165 lb. National.	139.75	NA	137.80
National Carcass Lamb Cutout FOB.	336.91	365.26	363.22
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	2.98	3.93	4.67
Corn, No. 2, Yellow **Columbus**, bu.	3.21	3.33	3.52
Soybeans, No. 1, Yellow **Columbus,** bu.	9.37	8.87	9.82
Grain Sorghum, No.2, Yellow Dorchester, cwt.	5.07	5.96	5.84
Oats, No. 2, Heavy Minneapolis, Mn, bu.	3.14	2.96	2.97
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	147.50	166.25	150.00
Alfalfa, Large Rounds, Good Platte Valley, ton.	65.00	90.00	98.00
Grass Hay, Large Rounds, Good Nebraska, ton.	65.00	82.50	*
Dried Distillers Grains, 10% Moisture Nebraska Average.	105.00	151.00	152.50
Wet Distillers Grains, 65-70% Moisture Nebraska Average.	43.25	48.00	50.25

* No Market

Many factors have been suggested as sources of increased volatility (unexpected changes) in agricultural commodity prices in recent years. One of the most-stated causes is the increase in corn-based ethanol production and the new food and ethanol linkages (Serra, 2013; Balcombe, 2011; Wright, 2011; Irwin and Good, 2009). The increased links between energy and agricultural markets raise concerns about whether new corn–ethanol links lead to volatility-spillover effects between prices of energy and agricultural commodities. Increased food-price volatility and its detrimental effects have profound economic implications, raising concerns among consumers, producers, and policy makers. High price volatility heightens food security concerns for the poor and income stability issues for farmers. It adversely affects poor consumers' incomes and purchasing power, pushing them further into poverty, undernourishment, and hunger. It makes it difficult for farmers to make production plans and investment decisions. The quick and unexpected changes in food prices can interrupt markets, affecting social stability and government policy. Hence, the massive increase in U.S. ethanol production raises the need for a deeper understanding of its effects on price volatility in food crops from which ethanol is produced. de Gorter, Drabik, and Just (2015) argue that studying these effects is important in order to understand changes in the prices of food, such as corn.

The understanding of price links between energy and agricultural commodity markets has grown but it mostly focuses on price levels (Serra and Zilberman, 2013). However, some argue food price volatility is a greater danger than high food prices (de Gorter, Drabik, and Just, 2015). In addition, while there is little evidence that food and biofuel price increases have the same effects as price decreases (Serra and Zilberman, 2013), the literature on asymmetric volatility interaction is scarce and mostly ignores the impact of asymmetric transmission. With asymmetric volatility spillovers, the burden and benefits of sudden price changes distribute unevenly across markets and could have welfare implications for producers as well as consumers. In this research, we investigate whether U.S. ethanol and corn-price volatility interactions respond differently to price increases and decreases. It is unclear whether ethanol price variation is higher during price increases or whether ethanol price increases have a stronger impact on corn price volatility as price declines. This research helps improve understanding of market dynamics by focusing on the asymmetric volatility transmission between oil, ethanol, and corn prices. Another important contribution of this research is to evaluate whether the frequency of price observations influences the estimation results. The question is whether the use of different-frequency data (i.e., daily, weekly, or monthly) leads to different cross-market volatility interactions. We use high-frequency (daily) futures prices and compare the results with weekly and monthly frequencies.

The energy and agricultural sectors interlink because energy is an input into farm production, processing, and distribution, and a significant portion of the variable costs of agricultural products is in the form of fuel and fertilizer, which directly depend on energy prices. In the last decade, however, crude oil prices and environmental concerns led U.S. policy makers to adopt alternative biofuel sources (i.e., ethanol from corn) (Vedenov, Duffield, and Wetzstein, 2006).

Ethanol, the major liquid biofuel produced in the United States, is made mainly from feedstock such as corn, which comprises more than 90 percent of domestic ethanol (U.S. Department of Energy, Alternative Fuels Data Center, 2016). U.S. corn utilization from 1999 through 2013 indicates corn used in ethanol production has had the largest increase, from 566 million bushels in 1999 to 5 billion bushels in 2013, a 775 percent increase (Taylor and Koo, 2013). The amount of corn used for ethanol grew from less than 1.4 billion bushels (about 13 percent of total use) in 2004 to 5.2 billion bushels (about 38 percent of total use) in 2014 (Taylor and Koo, 2015). A review of agricultural economics literature indicates the importance of energy impacts in determining agricultural commodity prices. The emergence of large-scale ethanol production has further strengthened the links between these two sectors, specifically between corn and ethanol prices (Serra and Zilberman, 2013; Taheripour and Tyner, 2008). The increased price correlation between food and energy markets in recent years (Tyner, 2010) is likely to lead to stronger volatility spillovers between these prices.

Model

By using the multivariate-GARCH models, we can study both volatilities and co-volatilities of several markets (Bauwens, Laurent, and Rombouts, 2006). These models can be specified using different functional forms, but some of these functional forms are more restrictive and do not allow for volatility spillovers across different markets. We used the BEKK (Baba, Engle, Kraft, and Kroner) model developed by Engle and Kroner (1995). The BEKK model refers to the specific parameterization of the MGARCH model, and it is a dynamic conditional model having the attractive property that the conditional covariance matrices are positive definite. The BEKK-MGARCH model is also limited in the sense that it is incapable of capturing the asymmetric volatility patterns in time series data. To overcome this limitation, we follow the Kroner and Ng (1998) procedure and use the asymmetric specification of BEKK-MGARCH model, which allows us to test to see whether price increases and decreases have the same impact on corn and energy prices.

Results

The U.S. biofuel industry grew sharply in the last decade as farmers converted land from other uses to increase corn production to produce ethanol. Consequently, a stronger connection was established between the energy and food sectors. The new corn–ethanol links may increase price volatility, exacerbating the instability of agricultural commodity prices. Energy sector linkages to agriculture are important determinants of farm prices and income, especially in the current corn-based ethanol production environment, oil market volatility, and global economic conditions. These factors are of paramount importance to farmers as well as consumers as agricultural commodity prices have experienced higher price volatility in recent years. There are concerns that the new corn–ethanol links and increased ethanol production raise food price variation, creating a growing interest in measuring these effects and their consequences.

Our results showed that the use of different data frequencies matters in analyzing volatility spillovers. These findings could at least partially explain the inconsistent results of previous studies. This inconsistency is also evident in our empirical results, as some estimates are statistically significant with one dataset but not with others. The results of this study indicate that to capture statistically significant volatility-spillover effects between U.S. food and biofuel markets, working with higher frequency data (i.e., daily) is recommended. However, we cannot generalize this conclusion based on just one study, and more research is required.

Notably, the results show that the corn market responds differently to price changes in the crude oil and ethanol markets. There was evidence of volatility-spillover effects from corn to the ethanol market regardless of dataset frequency used; however, we found volatility-spillover effects from ethanol to the corn market only using the daily dataset. We found asymmetric volatility-spillover effects between food and biofuel markets; these effects were bidirectional, going both ways from biofuel prices to food prices and vice versa, depending on the data frequency. In addition, the ethanol and corn returns volatility responded differently to positive and negative price changes in the crude oil, ethanol, and corn markets.

Overall, this study shows the corn–ethanol links exist and there are asymmetric volatility spillover effects between U.S. biofuel and the commodity sectors, but the statistically significant estimated coefficients for the different-frequency data used indicate those effects are very small, and hence, the impact is low. Therefore, while some have emphasized the seriousness of price variation and regard this issue as a policy priority, its main causes lay somewhere beyond biofuel policies and the new corn–ethanol links, like traditional sources such as oil shocks, climate change, theory of competitive storage, and demand and supply shocks, among others. Future studies are required to investigate the factors that drive the varying and conflicting results of food and biofuel volatility links, using alternative model specifications and different time -span datasets for comparison and contrast.

This article is based on:

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