Price Volatility and Spillovers in Food and Fuel Markets

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Motivation
- In recent years, prices of agricultural commodities have experienced major spikes and greater volatility.
- The growth of the biofuels market has led many researchers to examine the relationship between food and biofuel prices.
- Evidence suggests that there is a closer relationship between food and fuel prices, which can be attributed to U.S. biofuel policy.
- However, there have been comparatively few studies that have examined the extent to which price volatility is transmitted across different markets.
- In addition, no study as far as we know has investigated the effect of a binding blend wall on nature of the relationship.

Our objective is to characterize the nature of price volatility spillovers between the corn, crude oil and ethanol markets across a time period that includes both a non-binding and binding blend mandate.

Background
- U.S. policy has played an important role in promoting the production of corn as the primary feedstock for ethanol.
- One of the key policy instruments has been the Renewable Fuel Standard (RFS), which mandates a minimum quantity of biofuel to be used each year.
- In November 2013, the Environmental Protection Agency (EPA) announced that the RFS was no longer tenable and that the blend wall had been reached.

Results I

Cointegration results
- Only ethanol and crude oil prices are cointegrated.
- Ethanol price responds to the error correction term but crude oil price does not, which suggests that ethanol price follows the crude oil market but not vice versa.
- Ethanol and crude oil prices respond to corn prices.

Volatility for single markets
- Volatility persistency B(j): ethanol and oil are both very high and corn is relatively low.
- Vulnerability to market shocks A(j): ethanol is relatively high, other two are low.
- Asymmetric effects (i.e., impacts of negative market shocks on volatility C(j)): All three have large asymmetric effects. Corn C(2,2)> oil C(3,3)> ethanol C(1,1).

Results II

Market interdependency (dynamic correlations)
- Ethanol & oil: Strong in 2009, and relatively weak other than that period.
- Corn & oil: Strong between 2008/09, drop to about zero since 2013.

Spillover results
- Ethanol → corn: none
- Ethanol → crude oil: none
- Corn → ethanol: previous corn volatility affects current ethanol volatility
- Corn → crude oil: none
- Crude oil → corn: previous crude oil volatility and previous crude oil market shocks affect the corn market. Effects are asymmetric.
- Crude oil → ethanol: previous crude oil volatility and previous crude oil market shocks affect the ethanol market. Effects are asymmetric.

Data
- We use weekly price data between October 2005 and December 2014 for corn, ethanol and crude oil.

Methods
- Our empirical approach consists of three steps:
  1. Identifying a long run price relationship;
  2. Estimating a conditional means model that shows the relationship between price changes; and
  3. Estimating a conditional variances model that shows the relationship between price volatilities.
- Step 1 involves conducting Johansen trace tests for cointegration among the three unique pairs.
- Steps 2 and 3 are estimated simultaneously using a t-BEKK model (Engle and Kroner, 1995), which has the form:

\[ A \log(P_t) = c_0 + \sum_{i=1}^{k} \theta_i A \log(P_{t-i}) + \gamma ECT_{t-1} + \varepsilon_t \]

\[ H_t = KK^* + A \varepsilon_{t-1} \Gamma \varepsilon_{t-1} + B^* H_{t-1} B + C^* \varepsilon_{t-1} \varepsilon_{t-1}^T C \]

- Where \( c_0 \sim (0, H_0) \), \( K \) is a lower triangular matrix; A, B and C are square matrices; and \( \varepsilon_t \sim \min(c, 0) \).

Conclusions
- We find similar results to existing studies regarding the nature of spillover effects between the corn and crude oil markets.
- Using a more recent dataset, the key result we find is the absence of a relationship between ethanol and corn and ethanol and crude oil. This is in contrast to the existing literature.
- We believe this result is due to the reaching of the blend wall mandate some time in late 2013.
- If the blend wall mandate continues to be met, this suggests that the close relationship between the ethanol and traditional food and fuel markets may be weakening.

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