Supply Shocks, Futures Prices, and Trader Positions

Joseph P. Janzen
Dept of Agricultural Economics and Economics, Montana State University
309A Linfield Hall, P.O. Box 172920
Bozeman, MT 59717-2920, USA
Email: joseph.janzen@montana.edu

Nicolas Merener
Business School, Universidad Torcuato di Tella
1010 Saenz Valiente
Buenos Aires 1428, Argentina
Email: nmerener@utdt.edu


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Joseph P. Janzen* and Nicolas Merener†
*Department of Agricultural Economics and Economics, Montana State University
†Business School, Universidad Torcuato di Tella

Supply Shocks: Rainfall in the U.S. Corn Belt

- Following the adage that “rain makes grain”, we exploit the relationship between rainfall and corn production.
- For U.S., most corn production is rainfed; 87-90% of corn acres non-irrigated over 1993-2014.
- Positive correlation between rainfall and corn yield in corn belt is specific to key stages of crop development in June, July, and August (see Tannura, Irwin, and Good, 2008).
- Rainfall is plausibly exogenous to observed variation in futures prices and trader positions.

Data on daily rainfall at 41 weather stations throughout the corn belt collected from National Climatic Data Center for period from 1993-2014.
- Use production-weighted spatial average across areas.
- Consider four-day forecast rainfall using actual (future) rainfall as proxy.

Futures Prices: CME Corn Futures

- December CME corn futures price is a benchmark for value of new-crop corn.
- December is the most liquid, and commercial traders dominate.
- Corn price is important in many sectors of the economy, particularly the U.S. and global corn markets.
- Corn is also used as an input in the production of other crops, such as feed grains.
- Corn is a staple food for many people worldwide, and its price is closely watched.

Research Question

How do prices and trader positions respond to supply shocks in grain futures markets?

- We know prices fall when supply increases, but the joint response of prices and positions may tell us more.
  - Who has the strongest incentive to trade when supply shifts?
  - Is trading following supply shocks motivated by risk transfer or price discovery?
  - What are the price impacts of various trader groups?

Analytical Framework and Empirical Model

Cheng, Kirilenko, and Xiong (2014) (CKX) consider the joint dynamics of futures prices, F, and hedger and speculator positions (xh and xs). In this model:
- Trader positions each period respond to concurrent shocks to prices (df), trading risk as proxied by the VIX market volatility index (dVIX), and an “idiosyncratic” shock related to the physical market for the commodity (ds).
- VIX is plausibly exogenous to observed variation in futures prices and trader positions.
- Both groups may also respond to corn price (implied) volatility shocks (dIV) and shocks to external markets, especially crude oil, due to financialization effects or fundamental linkages.

Therefore, our adaptation of the CKX (2014) model is:

\[ dx = -\beta_1 dF + \gamma_1 dVIX - \gamma_2 dS + \delta_1 dIV + \delta_2 dOil \]

where (1) and (2) are group demand functions for futures positions driven by structural coefficients (\( \beta_1, \gamma_1, \gamma_2, \delta_1, \delta_2 \) and \( \lambda_1 \) = a market clearing condition.

Because \( F, x_h \), and \( x_s \) are jointly determined, (1) and (2) are unidentified. Using (3), we solve for \( dF \) and \( dS \) as a function of the other shocks which may be considered exogenous:

\[ dF = \alpha_1 + \alpha_2 dVIX + \alpha_3 + \alpha_4 dIV + \alpha_5 dOil \]

\[ dS = \beta_1 + \beta_2 dVIX + \beta_3 + \beta_4 dIV + \beta_5 dOil \]

We estimate the linear response of prices and positions to exogenous supply shocks using ordinary least squares (OLS).

We relate OLS coefficient estimates to structural parameters using (4) and (5). These conditions suggest that price and position responses to exogenous shocks depend on the relative magnitude of the structural coefficients between groups.

If (short) hedgers demand for short positions is increasing linearly in the size of the aggregate physical position, then \( \gamma_2 = 0 \). If hedging demand drives prices and positions, then we expect the coefficient estimate on our supply shock variable to be negative.

Empirical Results

- We consider separate regressions for prices and positions. We also consider potential non-linear response of prices and positions depending on whether rainfall is above or below trend. (Above trend rainfall indicates that crop-year ending stocks will be large, buffering price response.)

Weekly time series regressions of corn returns (\( \Delta \ln Ft \)) on accumulated rain, VIX, Oil and momentum, June to August, 1993 to 2014.
- Weekly time series regressions of net positions on accumulated rain, VIX, Oil, and momentum, June to August, 1993 to 2014.

<table>
<thead>
<tr>
<th>Supply Shocks</th>
<th>Futures Prices</th>
<th>Trader Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall</td>
<td>CME Corn Futures</td>
<td>CFTC Commitment of Traders</td>
</tr>
</tbody>
</table>
| December CME corn futures price is a benchmark for value of new-crop corn. Physical corn underlying CME futures is deliverable at Illinois River shipping stations at center of corn belt. | I.e., Corn belt rainfall is an important driver of supply deliverable during December contract. | Commodity Futures Trading Commission publishes weekly snapshot of long and short futures positions held by various groups of traders.

Trade Positions: CFTC Commitment of Traders

- Two basic groups, commercials and non-commercials, are generally assumed to be hedges (buy and sell physical corn) and speculators (no physical position).
- 2006, data is available on disaggregate groups (commercial, swaps dealer, managed money, and other reportable).

References


Contact: joseph.janzen@montana.edu or nmerener@utdallas.edu