10th FINANCIAL RISKS INTERNATIONAL FORUM

Speculative Activity and Returns
Volatility of Chinese Agricultural Commodity Futures

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Agenda

1. Introduction
2. Measures construction
3. Data and Econometric Methodology
4. Empirical results
5. Conclusion
Introduction
Motivation – Agricultural Commodities

- Dramatic price peaks in 2007-2008 as well as in 2010-2011
- Surge in returns volatility

Prices for Agricultural Commodities

- “Financialization” of commodity markets
- Are speculators to blame?
Introduction
Motivation – Chinese Commodity Futures Markets

- **Anecdotal evidence**: Trading behavior in Chinese commodity futures markets is highly speculative
- Rapid growth
- Growing global importance

→ Quantitative studies on futures markets in China are rare
Introduction

Research Question

Does speculative activity have an influence on returns volatility in Chinese futures markets for agricultural commodities?
Introduction

Influence of speculative activity on return volatility

Measuring speculative activity

CFTC-Data

Drawbacks and Limitations

Volume and Open Interest Data

Volume = Speculative Activity
Open Interest = Hedging Activity

Ratio (Vol/OI) = Speculative Activity
Measures Construction

Ratio

\[ \text{Ratio}^\text{Spec}_t = \frac{\text{Volume}_t}{\text{Open Interest}_t} \]

(Garcia et al. 1986)

- Volume captures speculative activity
- Open interest captures hedging activity
- Measures the relative dominance of speculative activity in comparison to the hedging activity
Measures Construction

Assumptions

- Speculators mainly try to avoid holding their positions over night
  - impact on trading volume instead of open interest

- Hedgers hold their positions for longer periods
  - impact on open interest

(Rutledge 1979, Leuthold 1983, Bessembinder and Seguin 1993)
Measures Construction

Ratio

- To verify the results of the first ratio we use a second ratio

\[
\text{Ratio}_{t}^{Hedge} = \frac{\Delta \text{Open Interest}}{\text{Volume}_{t}} = \frac{\Delta OI}{Vol_{t}}
\]

\[\Delta OI_{t} = OI_{t} - OI_{t-1}\] (Lucia and Pardo 2010)
## Econometric Methodology

### Data

<table>
<thead>
<tr>
<th>Contract</th>
<th>Futures Exchange</th>
<th>Contract Size</th>
<th>Currency</th>
<th>Sample</th>
<th>Number of Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 Soybeans</td>
<td>Dalian Commodity exchange (DCE)</td>
<td>10 MT</td>
<td>Chinese Yuan Renminbi</td>
<td>7/01/2002 - 7/29/2016 (daily)</td>
<td>3227</td>
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<tr>
<td>Soybean Meal</td>
<td>Dalian Commodity exchange (DCE)</td>
<td>10 MT</td>
<td>Chinese Yuan Renminbi</td>
<td>01/05/2001 - 07/29/2016 (daily)</td>
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<tr>
<td>White Sugar</td>
<td>Zhengzhou Commodity exchange (ZCE)</td>
<td>10 MT</td>
<td>Chinese Yuan Renminbi</td>
<td>3/03/2006 - 7/29/2016 (daily)</td>
<td>2487</td>
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</tbody>
</table>
Econometric Methodology

Data

Soybeans Futures Price

Soybeans Speculation Ratio

Data: Thomson Reuters Datastream
**Econometric Methodology**

**GARCH-Model**

AR(1) - GARCH(1,1) - Model:

Mean equation:

\[ r_t = a + b_1 r_{t-1} + \varepsilon_t \]
\[ \varepsilon_t \mid \Omega_{t-1} \sim N(0, \sigma_t^2) \]

➤ returns: \[ r_t = \ln(P_t) - \ln(P_{t-1}) \]

Volatility equation:

\[ \sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma \text{Ratio}_t^{Spec} (\text{Ratio}_{Hedge}^t) \]

GARCH conditions: \[ \alpha_0 > 0, \alpha_1 \geq 0, \beta_1 \geq 0 \text{ and } \alpha_1 + \beta_1 \leq 1 \]
## Empirical Results

### GARCH-Results

### Speculation Ratio

<table>
<thead>
<tr>
<th></th>
<th>Soybeans</th>
<th>Soybean Meal</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>0.19***</td>
<td>0.19***</td>
<td>-0.07***</td>
</tr>
<tr>
<td><strong>Resid²</strong></td>
<td>0.26***</td>
<td>0.19***</td>
<td>0.18***</td>
</tr>
<tr>
<td><strong>Volatility</strong></td>
<td>0.38***</td>
<td>0.53***</td>
<td>0.51***</td>
</tr>
<tr>
<td><strong>Ratioₜ^{Spec}</strong></td>
<td>0.37***</td>
<td>0.37***</td>
<td>0.39***</td>
</tr>
</tbody>
</table>

### Hedging Ratio

<table>
<thead>
<tr>
<th></th>
<th>Soybeans</th>
<th>Soybean Meal</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td>0.28***</td>
<td>0.42***</td>
<td>0.58***</td>
</tr>
<tr>
<td><strong>Resid²</strong></td>
<td>0.3***</td>
<td>0.25***</td>
<td>0.03***</td>
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<tr>
<td><strong>Volatility</strong></td>
<td>0.49***</td>
<td>0.57***</td>
<td>0.58***</td>
</tr>
<tr>
<td><strong>Ratioₜ^{Hedge}</strong></td>
<td>-0.67***</td>
<td>-1.24***</td>
<td>-1.90***</td>
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</tbody>
</table>
Econometric Methodology
VAR-Model: Lead-lag relationship

**Volatility:** \[ \sigma_t^2 = a_{1,t} + \sum_{i=1}^{k} b_{1,t} \sigma_{t-i}^2 + \sum_{i=1}^{k} c_{1,t} \text{Ratio}_{t-i} \]

**Ratio:** \[ \text{Ratio}_t = a_{2,t} + \sum_{i=1}^{k} b_{2,t} \sigma_{t-i}^2 + \sum_{i=1}^{k} c_{2,t} \text{Ratio}_{t-i} \]

- Granger-Causality tests
- Impulse Response functions
## Empirical Results
### Granger-Causality

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Prob.</th>
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</thead>
<tbody>
<tr>
<td>$\text{Soybeans}^\text{Spec}_{t}$ does not Granger Cause Conditional Volatility</td>
<td>3224</td>
<td>13.0781***</td>
<td>0.00000002</td>
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<td>Conditional Volatility does not Granger Cause $\text{Ratio}^\text{Spec}_{t}$</td>
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<td>7.57535***</td>
<td>0.00005</td>
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<td>$\text{Ratio}^\text{Hedge}_{t}$ does not Granger Cause Conditional Volatility</td>
<td>3226</td>
<td>13.8497***</td>
<td>0.0002</td>
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<tr>
<td>Conditional Volatility does not Granger Cause $\text{Ratio}^\text{Hedge}_{t}$</td>
<td>Lags = 1</td>
<td>2.83604*</td>
<td>0.0923</td>
</tr>
</tbody>
</table>
Empirical Results
Impulse–Response-Analysis

Soybeans - Response of Volatility to Speculation Ratio

Soybeans - Response of Volatility to Hedging Ratio
Conclusion

- Speculation ratio – defined as volume divided by open interest - to measure speculative activity
- GARCH and VAR Model
  - Positive influence of the speculation ratio on volatility
  - Negative influence of the hedging ratio on returns volatility
  - **A rise in speculative activity can lead to an increase in price volatility**
- Ratios Granger causes conditional volatility and vice versa
  - Positive in the case of the speculation ratio - negative in the case of the hedging ratio
  - **The amount of speculative activity in relation to hedging activity contains information about changes in futures volatility**
Conclusion

- Results are inconsistent with the results of the current literature → Why?
  
  - In contrast to US markets, Chinese commodity futures markets appear to be characterized by trading behaviour that is extremely speculative
  
  - Speculative activity often exceeds the hedging demand
  
  - Speculation is not harmful in general, but excessive speculation, which is above hedging needs drives returns volatility
References


