Westfälische Wilhelms-Universität Münster

10th FINANCIAL RISKS INTERNATIONAL FORUM

Speculative Activity and Returns Volatility of Chinese Agricultural Commodity Futures

Martin T. Bohl, Pierre L. Siklos and Claudia Wellenreuther

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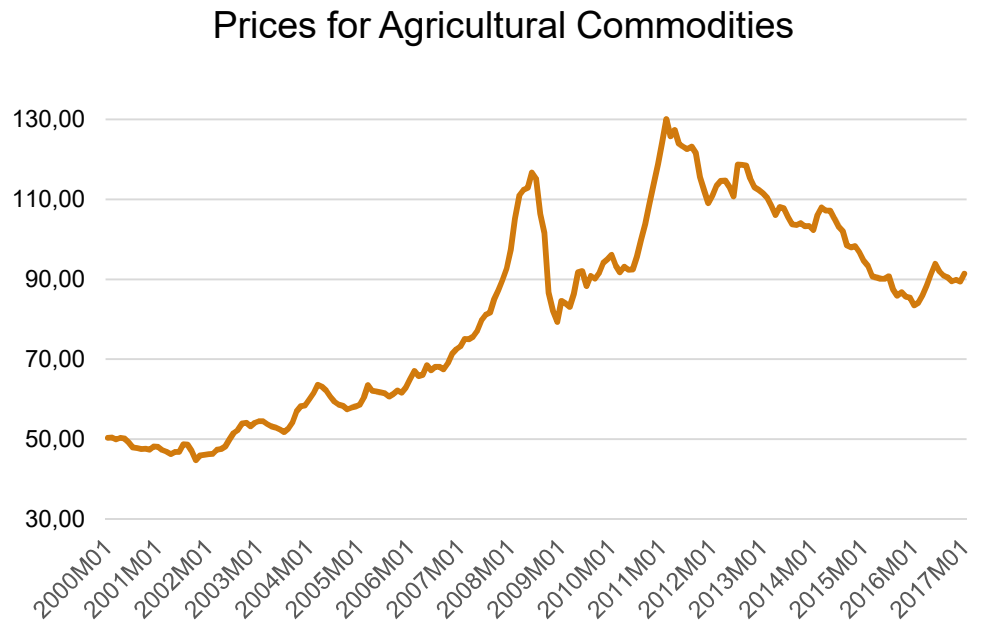
Agenda

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



Data: World Bank

- "Financialization" of commodity markets
- Are speculators to blame?

Introduction

Motivation – Chinese Commodity Futures Markets

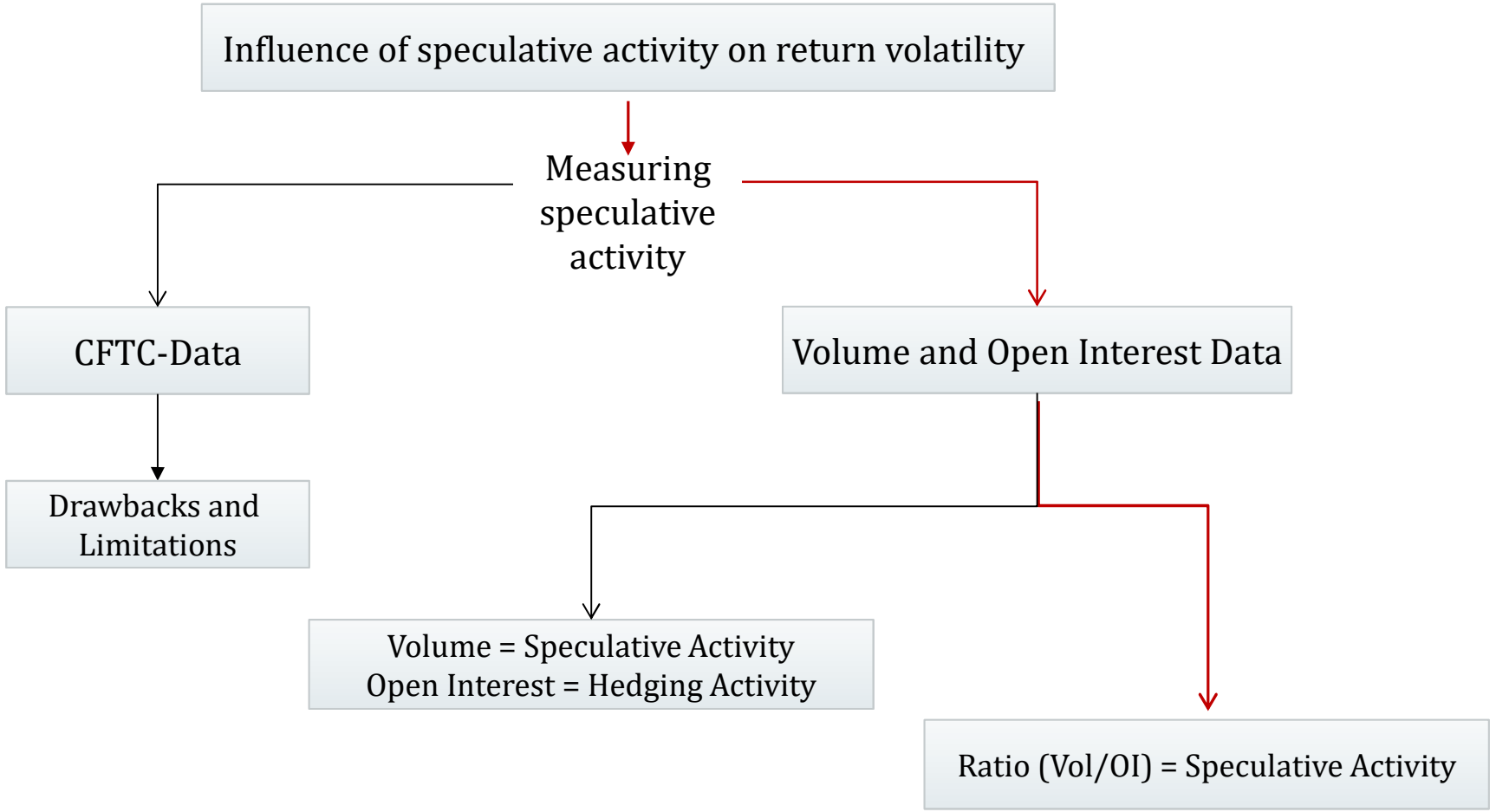
- **Anecdotal evidence**: Trading behavior in Chinese commodity futures markets is highly speculative
- Rapid growth
- Growing global importance

→ **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



Measures Construction

Ratio

$$Ratio_t^{Spec} = \frac{Volume_t}{Open\ Interest_t}$$

(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

$$\boldsymbol{Ratio_t^{Hedge}} = \frac{\Delta \textbf{Open } \boldsymbol{Interest_t}}{\boldsymbol{Volume_t}} = \frac{\boldsymbol{\Delta OI_t}}{\boldsymbol{Vol_t}}$$

$\Delta OI_t = OI_t - OI_{t-1}$ (Lucia and Pardo 2010)

Econometric Methodology

Data

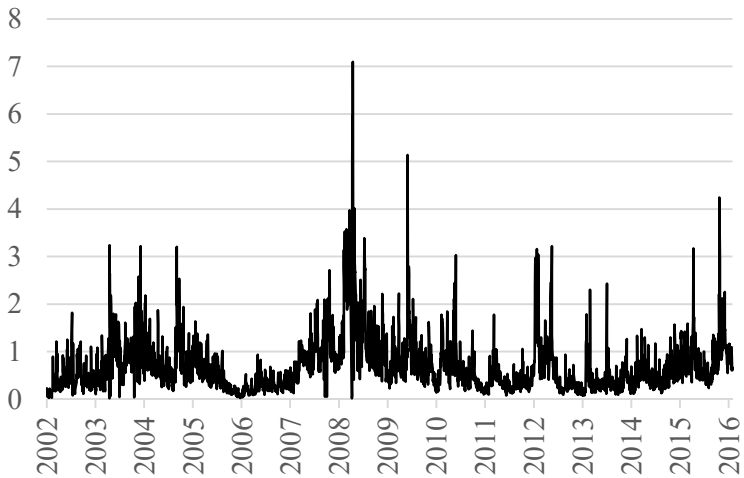
Contract	Futures Exchange	Contract Size	Currency	Sample	Number of Obs.
No. 1 Soybeans	Dalian Commodity exchange (DCE)	10 MT	Chinese Yuan Renminbi	7/01/2002 - 7/29/2016 (daily)	3227
Soybean Meal	Dalian Commodity exchange (DCE)	10 MT	Chinese Yuan Renminbi	01/05/2001 - 07/29/2016 (daily)	3475
White Sugar	Zhengzhou Commodity exchange (ZCE)	10 MT	Chinese Yuan Renminbi	3/03/2006 - 7/29/2016 (daily)	2487

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:

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

- returns: r_t=ln(P_t)-ln(P_{t-1})

Volatility equation: $\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma Ratio_t^{Spec} (Ratio_t^{Hedge})$

GARCH conditions: $\alpha_0 > 0, \alpha_1 \geq 0, \beta_1 \geq 0$ and $\alpha_1 + \beta_1 \leq 1$

Empirical Results
GARCH-Results

Speculation Ratio

	Soybeans	Soybean Meal	Sugar
Constant	0.19***	0.19***	-0.07***
Resid²	0.26***	0.19***	0.18***
Volatility	0.38***	0.53***	0.51***
$Ratio_t^{Spec}$	0.37***	0.37***	0.39***

Hedging Ratio

	Soybeans	Soybean Meal	Sugar
Constant	0.28***	0.42***	0.58***
Resid²	0.3***	0.25***	0.03***
Volatility	0.49***	0.57***	0.58***
$Ratio_t^{Hedge}$	-0.67***	-1.24***	-1.90***

Econometric Methodology

VAR-Model: Lead-lag relationship

Volatility:
$$\sigma_t^2 = a_{1,t} + \sum_{i=1}^{k} b_{1,t}\,\sigma_{t-i}^2 + \sum_{i=1}^{k} c_{1,t}\,Ratio_{t-i}$$

Ratio:
$$Ratio_t = a_{2,t} + \sum_{i=1}^{k} b_{2,t}\,\sigma_{t-i}^2 + \sum_{i=1}^{k} c_{2,t}\,Ratio_{t-i}$$

- Granger-Causality tests
- Impulse Response functions

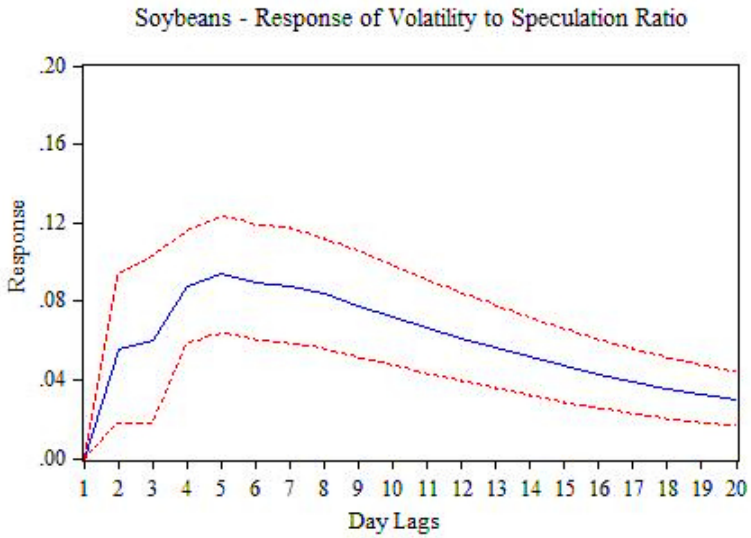
Empirical Results

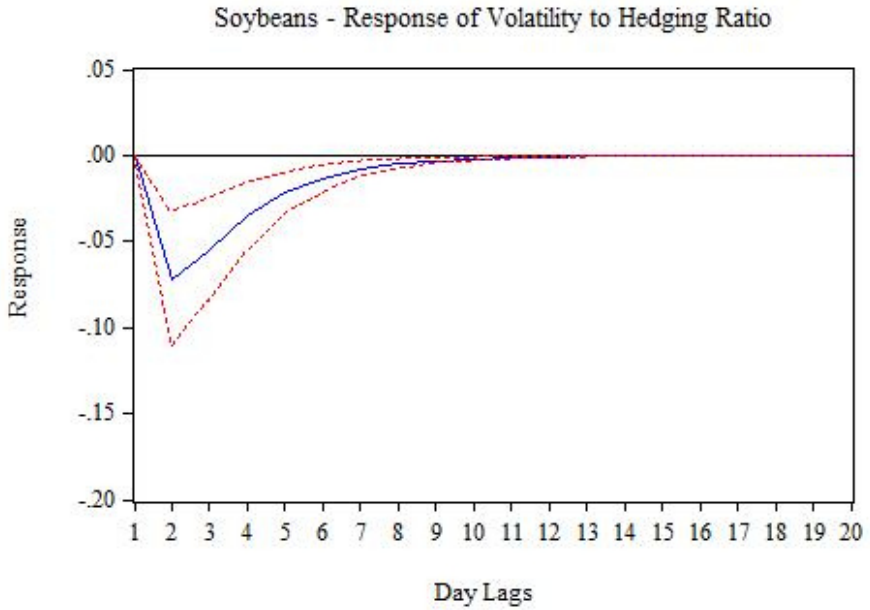
Granger-Causality

Null Hypothesis:	Obs	F-Statistic	Prob.
	Soybeans		
$\mathbf{Ratio_t^{Spec}}$ does not Granger Cause Conditional Volatility	3224	13.0781***	0.00000002
Conditional Volatility does not Granger Cause $\mathbf{Ratio_t^{Spec}}$	Lags = 3	7.57535***	0.00005
$\mathbf{Ratio_t^{Hedge}}$ does not Granger Cause Conditional Volatility	3226	13.8497***	0.0002
Conditional Volatility does not Granger Cause $\mathbf{Ratio_t^{Hedge}}$	Lags = 1	2.83604*	0.0923

Empirical Results

Impulse–Response-Analysis





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

Bessembinder H, Seguin PJ (1993) Price Volatility, Trading Volume, and Market Depth: Evidence from Futures Markets. The Journal of Financial and Quantitative Analysis 28(1):21.

Bollerslev T (1986) Generalized autoregressive conditional heteroskedasticity. Journal of Econometrics 31(3):307–327.

Garcia P, Leuthold RM, Zapata H (1986) Lead-lag relationships between trading volume and price variability: New evidence. J. Fut. Mark. 6(1):1–10.

Granger CWJ (1969) Investigating Causal Relations by Econometric Models and Cross-spectral Methods. Econometrica 37(3):424.

Lucia JJ, Pardo A (2010) On measuring speculative and hedging activities in futures markets from volume and open interest data. Applied Economics 42(12):1549–1557.

Rutledge DJ (1979) Trading volume and price variability: New evidence on the price effects of speculation. Futures markets: Their establishment and performance:137–156.