Rice Futures Trading Activity & Spot Price Volatility

- Theory
- Empirical Work
- Rice Futures Market
- Econometrics
- Results

Theory

- Why should the level of futures trading activity affect spot price volatility?
  - Manipulation and technical factors distort futures prices, and traders in the futures market act on false signals
  - Lack of speculation in the futures market and pure hedge trading in that market could lead to instability in the spot market
  - traders in the futures market are not as well informed as the participants in the spot market

Empirical Works

- Bessembinder et al (1992) Equity Markets
  - Anticipated futures trading activity lowers spot price volatility
  - Unexpected futures trading activity increases spot price volatility
- Yang et al (2005) Agricultural Commodity Markets
  - Unexpected increase in futures trading volume Granger causes spot price volatility
    - This causality is weak when it comes to open interest
  - Unexpected increase in futures trading volume explain a significant variation in spot price volatility (FEVD)

Expected vs. Unexpected Trading Activity

- Why separate commercial and non-commercial trading activity? (Figlewski 1981)
  - Commercial interest is informed
  - Non-commercial interest is not as well informed
  - Theory (Kyle 1985 Admati & Pfleiderer 1988):
    - Order imbalances generate smaller price volatility when market has a large number of informed traders
  - Theory (Epps & Epps 1976)
    - The more traders disagree (less informed) on the valuation effect of new information, the higher the volatility and volume

Rice Futures Market History

- Dojima rice futures market in Osaka 1730-1869
- New Orleans futures market 1981-1983
- Chicago Cotton & Rice Exchange 1986-1994
- CBOT 1994 to present

Rice Futures on CBOT

- Thin trading relative to other major grains
  - Trading volume of corn & wheat contracts expiring May 2010 were 1183 & 2783 and that of rice was 321 (March 18th 2010)
- Increase in non-commercial interest
  - 23% of long open interests in 1994
  - 55% of long open interests in 2009
- Decrease in share of non-commercial short positions

Raw Data

- Weekly rice spot prices (1999-2009)
  - U.S. No. 2 Long Grain Paddy rice
- Futures volume & open interests from Datastream (1999-2009)
  - Volume and open interests from the nearest contract, and rolled over on the last trading day of that contract

Methodology

- Estimate spot price volatility-GARCH (1,1)
- Divide futures trading activity into open interest & trading volume
  - Isolate the unexpected part of the trading volume and open interest
- Subtract the four week moving average from the weekly average to detrend
- Use ARIMA model to separate the expected and unexpected movement in trading volume and open interest
  - Use BIC to determine the most appropriate ARIMA model
    - ARIMA (11,0,9) to estimate expected TV
    - ARIMA (1,1,4) to estimate expected OI

Methodology

- Use Granger Causality test to see if either unexpected trading volume or open interest cause cash price volatility
  - Bivariate VAR model
- Forecast Error Variance Decomposition to determine the magnitude of variability in cash price volatility due to level of trading activity
  - Bivariate recursive VAR model

Results

Granger Causality Test	
	UTV→CV
χ^2	11.45 (+) 4 df sig. @ 5%

Forecast Error Variance Decomposition		
Impulse	Response	
CV	CV	96.1%
UTV	CV	3.9%

$$CV_t = \alpha_o + \sum_{p=1}^{4} \beta_p CV_{t-p} + \sum_{q=1}^{4} \lambda_q UTV_{t-q}$$

Results

Granger Causality Test	
	CV→UTV
χ^2	5.285 (-) 4 df

Forecast Error Variance Decomposition		
Impulse	Response	
CV	UTV	1.6%
UTV	UTV	98.4%

$$UTV_t = \alpha_o + \sum_{p=1}^{4} \beta_p CV_{t-p} + \sum_{q=1}^{4} \lambda_q UTV_{t-q}$$

Results

Granger Causality Test	
	UOI→CV
χ^2	0.91066 (-) 4 df

Forecast Error Variance Decomposition		
Impulse	Response	
CV	CV	99.7%
UOI	CV	0.3%

$$CV_t = \alpha_o + \sum_{p=1}^{4} \beta_p CV_{t-p} + \sum_{q=1}^{4} \lambda_q UOI_{t-q}$$

Results

Granger Causality Test	
	CV→UOI
χ^2	21.609 (+) 4 df sig. @ 1%

Forecast Error Variance Decomposition		
Impulse	Response	
UOI	UOI	95.1%
CV	UOI	4.9%

$$UOI_t = \alpha_o + \sum_{p=1}^{4} \beta_p CV_{t-p} + \sum_{q=1}^{4} \lambda_q UOI_{t-q}$$

Results (different order)

Forecast Error Variance Decomposition		
Impulse	Response	
CV	CV	93.2%
UTV	CV	6.8%
CV	UTV	0.7%
UTV	UTV	99.3%

$$CV_t = \alpha_o + \sum_{q=1}^{4} \lambda_q UTV_{t-q} + \sum_{p=1}^{4} \beta_p CV_{t-p}$$

$$UTV_t = \alpha_o + \sum_{q=1}^{4} \lambda_q UTV_{t-q} + \sum_{p=1}^{4} \beta_p CV_{t-p}$$

Results (different order)

Forecast Error Variance Decomposition		
Impulse	Response	
CV	CV	99.5%
UOI	CV	0.5%
CV	UOI	4.0%
UOI	UOI	96%

$$CV_t = \alpha_o + \sum_{q=1}^{4} \lambda_q UOI_{t-q} + \sum_{p=1}^{4} \beta_p CV_{t-p}$$

$$UOI_t = \alpha_o + \sum_{q=1}^{4} \lambda_q UOI_{t-q} + \sum_{p=1}^{4} \beta_p CV_{t-p}$$

Futures & Spot prices

Granger Causality Test	
	FV→CV
χ^2	2.166 (-) 4 df

Forecast Error Variance Decomposition		
Impulse	Response	
CV	CV	99.5%
FV	CV	0.5%

$$CV_t = \alpha_o + \sum_{p=1}^{4} \beta_p CV_{t-p} + \sum_{i=1}^{4} \delta_i FV_{t-i}$$

Futures & Spot prices

Granger Causality Test	
	CV→FV
χ^2	6.0864 (-) 4 df

Forecast Error Variance Decomposition		
Impulse	Response	
CV	FV	10.9%
FV	FV	89.1%

$$FV_t = \alpha_o + \sum_{p=1}^{4} \beta_p CV_{t-p} + \sum_{i=1}^{4} \delta_i FV_{t-i}$$

Futures & Spot prices

Forecast Error Variance Decomposition		
Impulse	Response	
CV	CV	97.5%
FV	CV	2.5%
CV	FV	8.08%
FV	FV	91.9%

$$CV_t = \alpha_o + \sum_{i=1}^{4} \delta_i FV_{t-i} + \sum_{p=1}^{4} \beta_p CV_{t-p}$$

$$FV_t = \alpha_o + \sum_{i=1}^{4} \delta_i FV_{t-i} + \sum_{p=1}^{4} \beta_p CV_{t-p}$$

Appendix

- ARIMA (11,0,9)

$$Y_t = \mu + \phi_1(\hat{Y}_{t-1} - Y_{t-2}) + \phi_2(Y_{t-2} - Y_{t-3}) + \ldots\ldots + \phi_2(Y_{t-11} - Y_{t-12}) - \theta_1 e_{t-1} - \theta_2 e_{t-2} - \ldots\ldots - \theta_9 e_{t-9}$$

- ARIMA (1,1,4)

$$Y_t = \phi_1(Y_{t-1} - Y_{t-2}) + Y_{t-1} - \theta_{t-1}$$

Appendix

- Recursive VARs

$$CV_t = a_o + \sum_{p=1}^{4} \beta_p CV_{t-p} + \sum_{q=1}^{4} \lambda_q UTV_{t-q} + error_t$$

$$UTV_t = a_o + \sum_{p=1}^{4} \beta_p CV_{t-p} + \sum_{q=1}^{4} \lambda_q UTV_{t-q} + \phi_t CV_t + error_t$$