Extreme food price volatility, market information and food trade: Case of rice, wheat and maize

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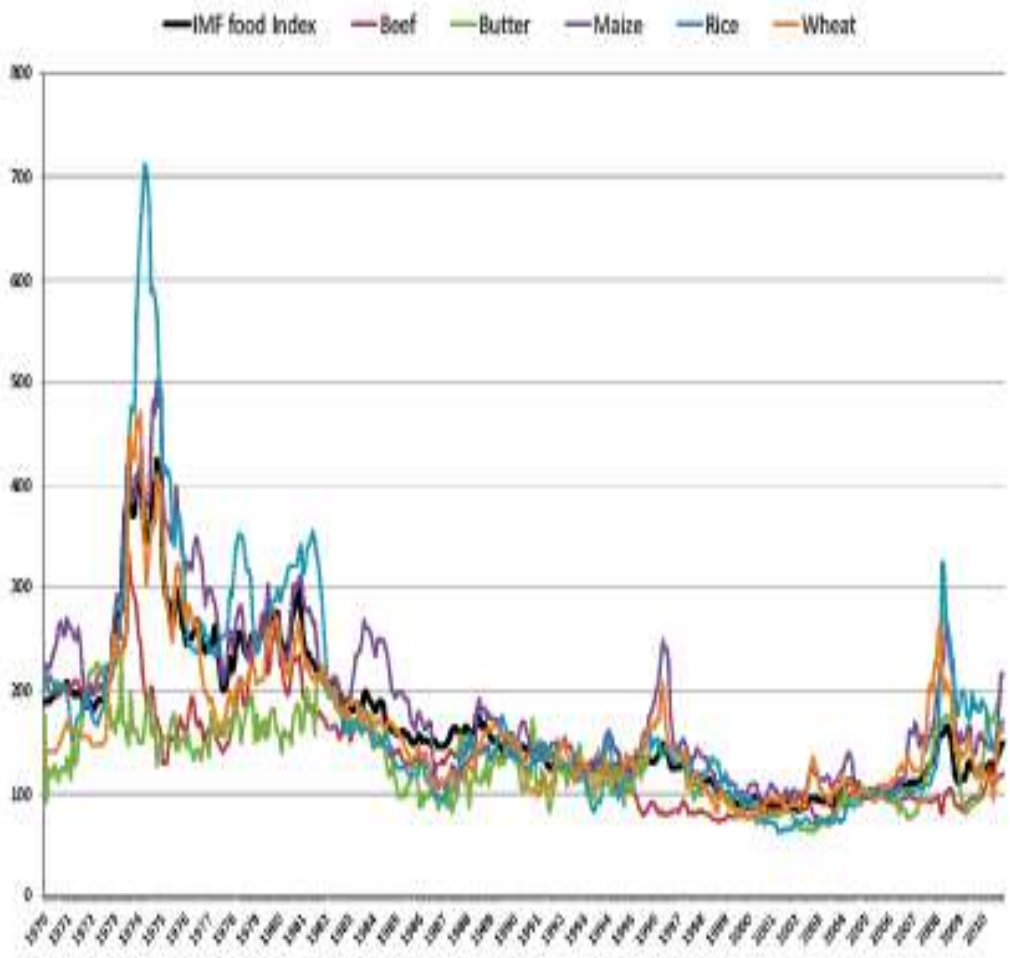
Key Messages

- Food price volatility is inversely related to tradability among three key cereals.
- In the case of rice, the least tradable among the cereals, elimination of extreme price volatility increases rice trade by at least 77 %.
- In the case of 2008 rice crisis, while market fundamentals explain rising rice prices, unevenly distributed and low quality market information in the absence of a mechanism for harmonizing and improving such information led to trade shocks, which in turn cause rice price spikes.
- A capability for harmonizing market information and coordinating policy responses to supply shocks and expected long term food imbalances is needed to manage the risk of extreme food price volatility.

Real World Food Prices: 1970 to 2009



- Real food prices have fallen through time.
- Since early 2000, real food prices seem to have risen.

G20 Report on Food Price Volatility (2011)

How Tradable Are Cereals

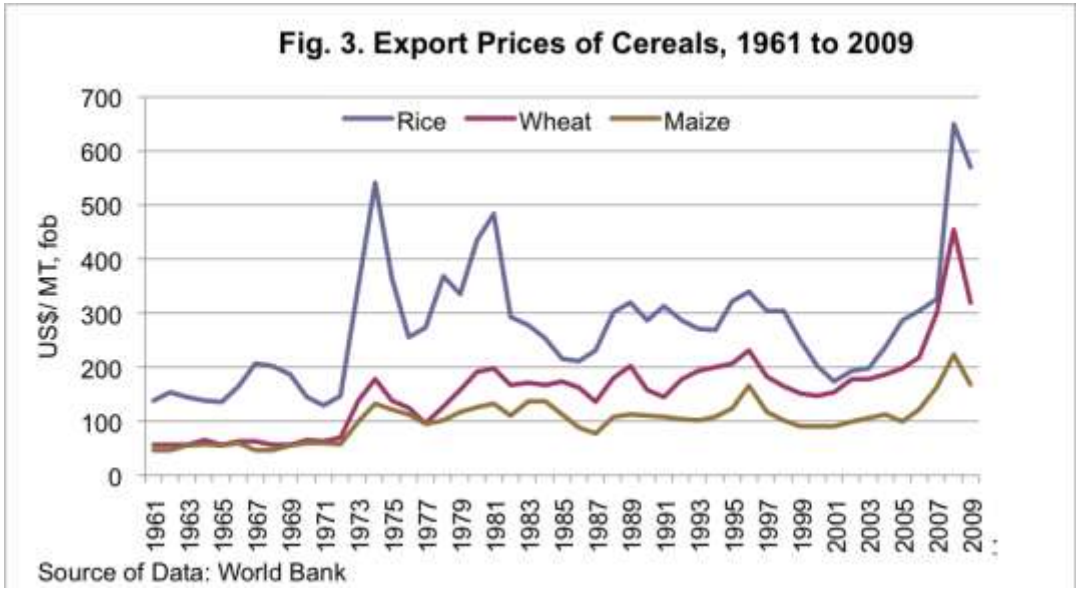
- Covered cereals in this presentation: Rice, maize and wheat, but the focus of it is on rice
- Indicators: Imports to production (MOR) and exports to production ratios (XOR)
- Annual indicators from 1961 to 2007
- Data comes from FAOstat

Relative Tradability of Cereals

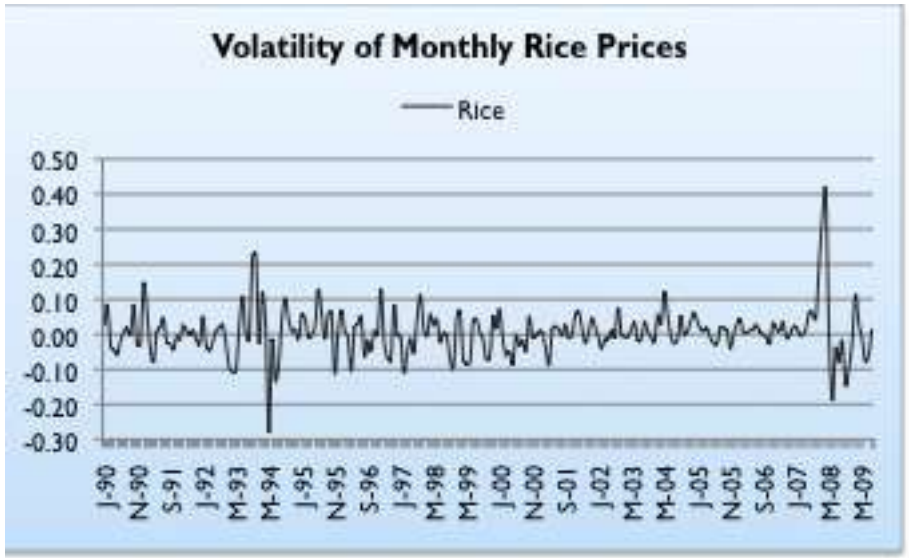
- Wheat is most tradable (average export to output ration or XOR= 18.51 %; to output ratio or MOR=18.3 %)
- Maize is next (XOR=13.64 %; MOR = 12.35 %)
- Rice turned out to be the least tradable (XOR= 3.98 %; MOR=.3.97 %)

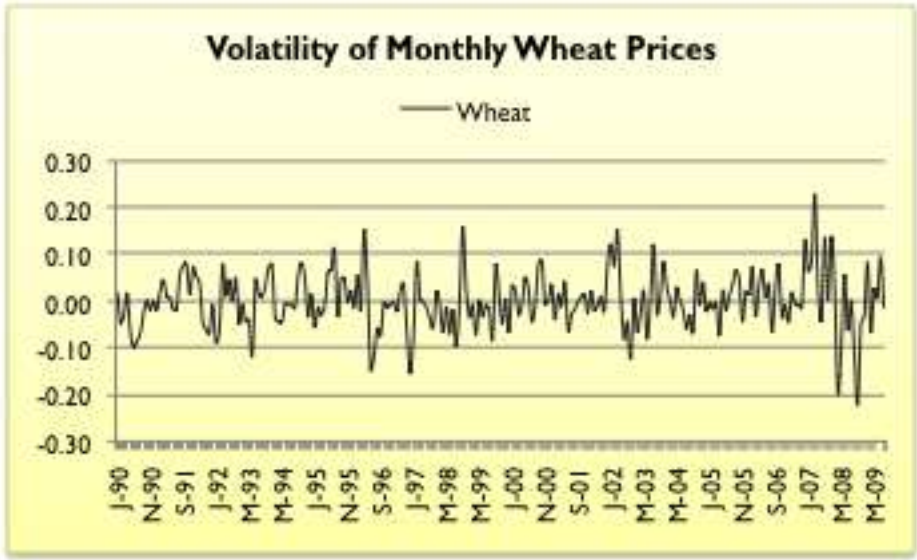
Trends in Cereal Prices

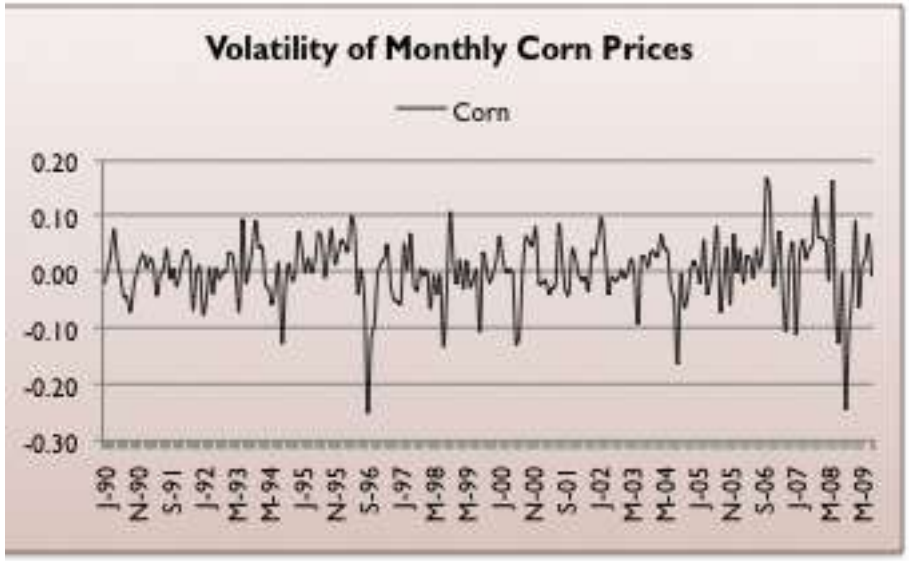
- Price instability causes food insecurity (WB).
- Three broad swings of rice prices namely in the 1970s, 1990s, and in 2008.
- High correlation of cereal prices(Timmer)



Comparative Price Volatility



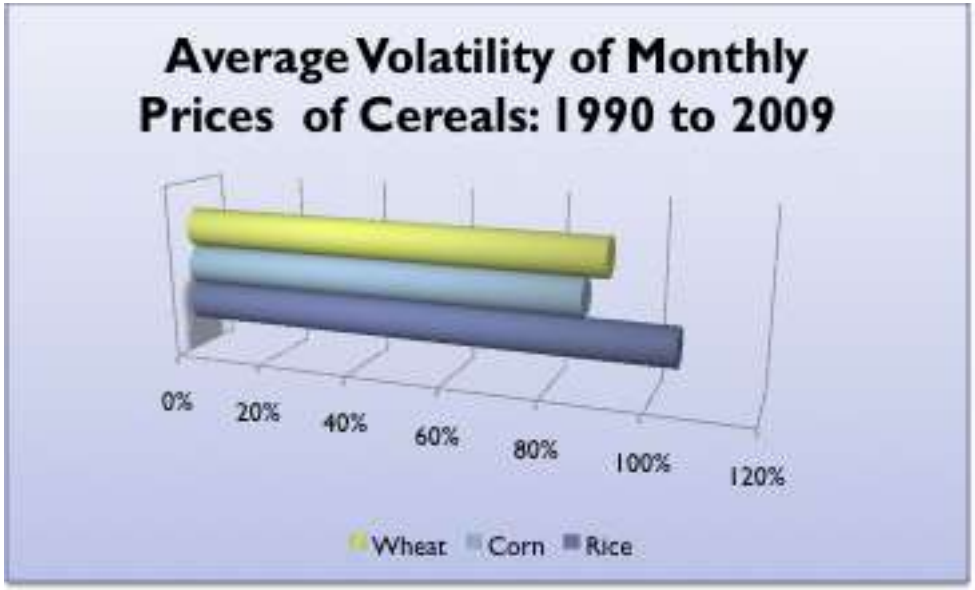




- Monthly rice prices are most volatile
- Variable plotted: natural log of monthly price changes
- Volatility index: standard deviation

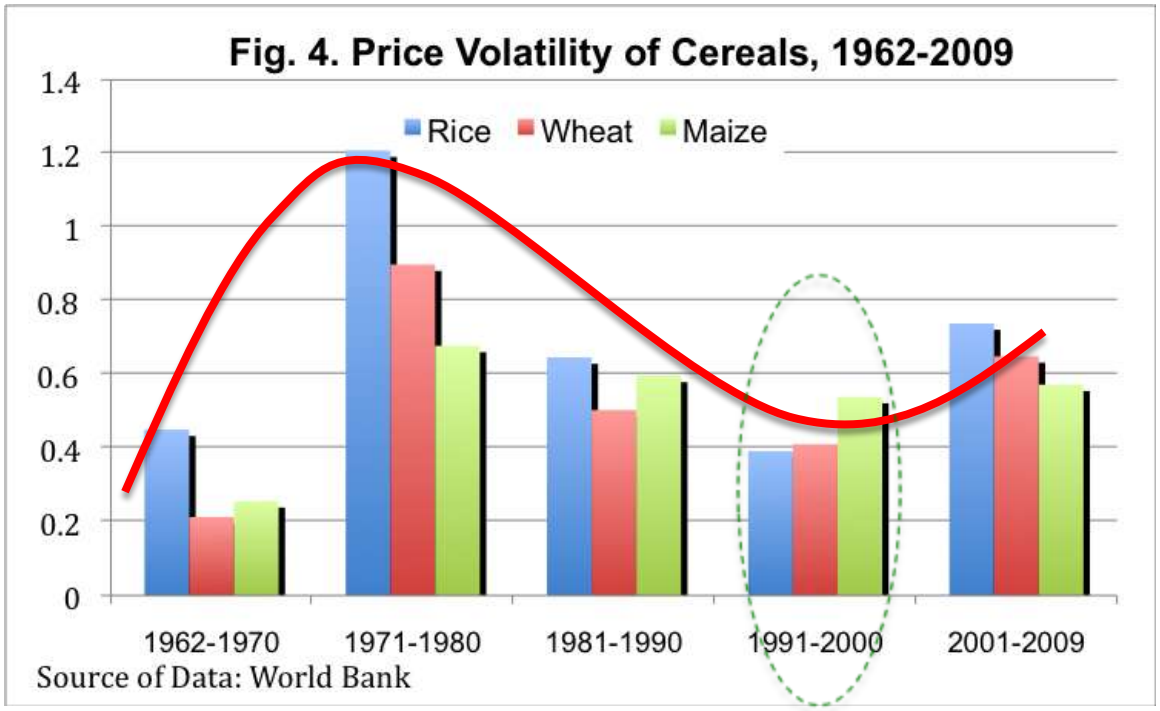
Average Volatility of Monthly Prices of Cereals

- Using monthly prices (data is from IMF), rice has the highest volatility
- Maize and wheat prices follow



Average Volatility of Annual Prices of Cereals

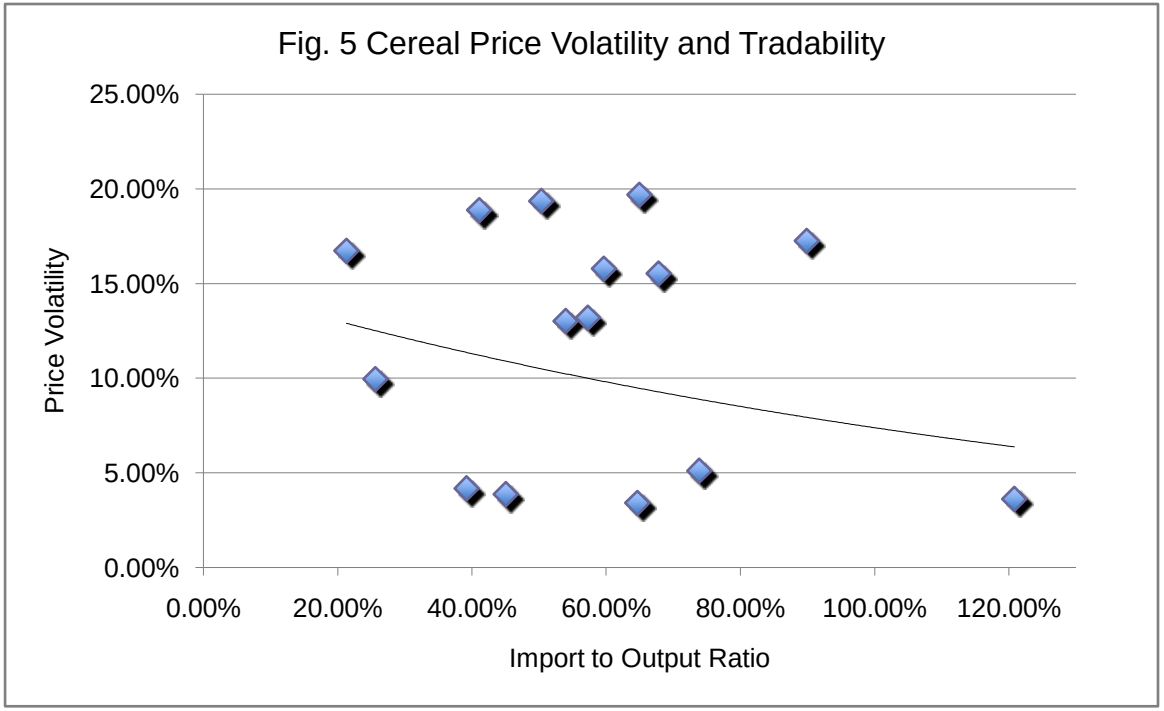
- Using annual prices from 1960s, rice has the highest volatility
- Maize and wheat follow, except in the 1990s



Tradability and Price Volatility

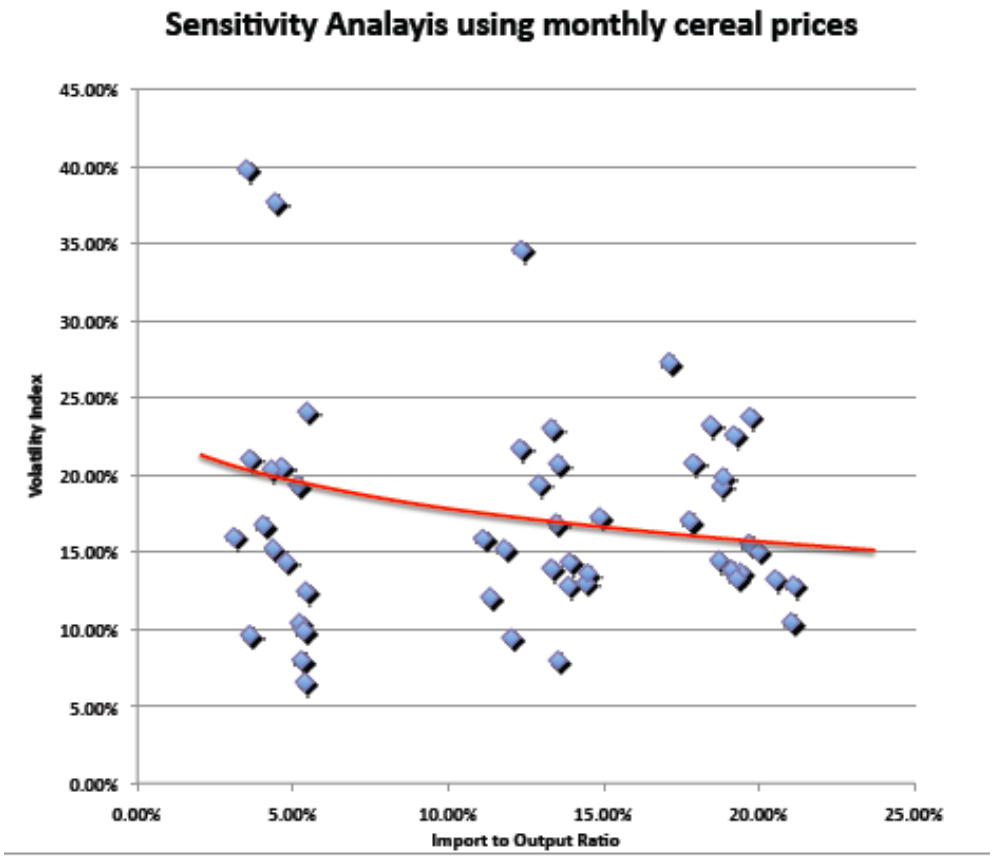
Inverse relationship between tradability and price volatility

- Plot of the decade averages of IORs and volatility indices of the three cereals shows that price volatility is inversely proportional to tradability.
- More trade seems to help stabilize food prices.



Sensitivity Analysis

- Using monthly cereal prices, the inverse relationship appears to hold.



Testing the relationship using a gravity model of trade: case of rice

- A gravity model of trade – econometric model that explains the bilateral trade between two trading partners in a given product, say rice, using the values of explanatory variables.
- In the gravity model of rice trade the following explanatory variables were used:
  - GDPagri of exporting country, GDP of importing country, Population of exporting country, Population of importing country, Distance between trading partners, Price volatility a year lag, Price volatility two years lag, dummy variable for FTA, exchange rate, Similarity of language, Common border, Colony dummy variable, 2008 DV, Constant

Measures of price volatility and trade data

- lnvol5 = ln of the Subervie volatility measure using the moving average deviations of prices from trend in the past 24 months. Trend is estimated using rolling five years.
- lnexvol5 = ln of the extreme price Subervie volatility. Same computation as lnvol5, but includes only those deviations that are in the lower 7% or upper 15% from the mean of the normal distribution of volatilities.
- Bilateral rice trade from COMTRADE database from 1970 to 2009
- 24 exporters and 50 importers.
- These add up to a total trade value of around 78.5% of world rice trade as of 2009.

Testing the relationship: average price volatility

Estimated coefficients of a rice gravity model of trade - average price volatility

	Model A (without trend)			Model B (with trend)		
xij	Coef.	Std. Err.	z value	Coef.	Std. Err.	z value
lgdpagri	0.801	0.08	9.98	0.48147	0.09332	5.16
lgdpjcap	-0.007	0.05	-0.15	-0.247	0.05995	-4.12
lpopi	-0.239	0.10	-2.39	0.02582	0.10644	0.24
lpopj	-0.193	0.07	-2.76	-0.266	0.07036	-3.78
mldistance	-0.224	0.07	-3.41	-0.3178	0.06679	-4.76
mllanguage	0.503	0.33	1.53	0.37196	0.32467	1.15
mlborder	2.731	0.57	4.78	2.62984	0.56226	4.68
mlcolony	0.750	0.49	1.53	0.77136	0.482	1.6
mlfta	0.431	0.13	3.27	0.46229	0.13162	3.51
mlexrate	-0.090	0.01	-12.78	-0.0908	0.00704	-12.9
lnvol5 *	-0.209	0.05	-3.9	-0.2602	0.05393	-4.82
outlier	0.501	0.11	4.72	0.64201	0.1079	5.95
ltrend				0.42543	0.06362	6.69
_cons	7.495	1.07	7.03	7.08952	1.05967	6.69

* Using Subvervie's measure of price volatility (all values)

Random-effects tobit regression	Number of obs	=	14292
Group variable: count	Number of groups	=	961
	Wald chi2(13)	=	707.23
Log likelihood = -32609.002	Prob > chi2	=	0.0000

Testing the relationship: extreme price volatility only

Estimated coefficients of a rice gravity model of trade - extreme price volatility

	Model C (without trend)			Model D (with trend)		
xij	Coef.	Std. Err.	z	Coef.	Std. Err.	z
lgdpagri	0.8197	0.081	10.13	0.5122	0.094	5.450
lgdpjcap	-0.0076	0.048	-0.16	-0.2350	0.060	-3.930
lpopi	-0.2499	0.100	-2.50	0.0036	0.107	0.030
lpopj	-0.1993	0.070	-2.84	-0.2681	0.071	-3.800
mldistance	-0.2624	0.067	-3.94	-0.3522	0.068	-5.180
mllanguage	0.5321	0.330	1.61	0.4024	0.325	1.240
mlborder	2.6638	0.570	4.67	2.5676	0.562	4.570
mlcolony	0.7352	0.489	1.50	0.7596	0.481	1.580
mlfta	0.4362	0.132	3.29	0.4641	0.132	3.510
mlexrate	-0.0887	0.007	-12.40	-0.0892	0.007	-12.490
lexnvol*	-0.2117	0.044	-4.76	-0.2431	0.045	-5.450
outlier	0.5479	0.103	5.34	0.6646	0.104	6.390
ltrend				0.4072	0.064	6.400
_cons	7.2335	1.067	6.78	6.8947	1.061	6.500

* Using Subvervie's measure of price volatility (extreme values only)

Random-effects tobit regression	Number of obs	=	14292
Group variable: count	Number of groups	=	961
	Wald chi2(13)	=	707.23
Log likelihood = -32609.002	Prob > chi2	=	0.0000

What if extreme rice price volatility was avoided

- How much extra trade is induced if extreme riice price volatility is avoided?
- Using the estimated Models, we computed the natural logarithm of the average bilateral rice trade by plugging into the estimated model the mean values of the explanatory variables. We compared the respective trade values with and without price volatility.

What if extreme rice price volatility was avoided

YEAR 2009	Percent Increase in Trade
2009	
Coefficients (subervie no trend)	
Model A	
Estimates of Average w/ zero volatility	**77%**
Coefficients (subervie w/ trend)	
Model B	
Estimates of Average w/ zero volatility	**103%**
Coefficients (extreme subervie no trend)	
Model C	
Estimates of Average w/ zero volatility	**78%**
Coefficients (extreme subervie w/ trend)	
Model D	
Estimates of Average w/ zero volatility	**90%**

Extreme price volatility erodes confidence in trade: case of rice

- As the 2008 rice crisis ended, member states renew commitments and add resources to becoming self-sufficient in rice.
- Self-sufficiency keeps rice trades down, in turn reduces AMS' confidence in trade for their national rice requirements.
- Vicious cycle of low rice trade and higher spending on rice self-sufficiency programs.

Rice Trade Shocks

Country/region	Export/import volumes (millions mt):			Percentage change (%)
	2006/07	2007/08	Change	
Total rice trade	31.44	31.19		
Major exporters				
India	5.74	4.65	−1.09	−18.9
Vietnam[a]	4.07	3.11	−0.96	−23.6
China	1.34	0.96	−0.37	−27.7
Egypt	1.20	0.75	−0.45	−37.7
Sum: supply shocks	12.35	9.48	−2.87	−23.2
Major importers				
Energy exporters[b]	5.43	6.43	1.04	19.2
Philippines	1.82	2.57	0.77	42.8
Bangladesh	0.76	2.04	1.28	166.2
Sum: demand shocks	7.96	11.05	3.09	38.7
Sum: demand and supply side shocks				
Actual change in world rice prices: July 2007 to June 2008				

Headey / Food Policy 36 (2011) 136–146

Uneven and Poor Quality of Market Information

- **However, trade shocks are by themselves endogenous, i.e. part of the normal operations of the market.**
- One fundamental factor is the uneven and poor quality of market information among players.
- Importers with low information level tend to stock up to avoid future price increases. All of them doing the same shift market demand to increase, causing import shocks.

Efficient market hypothesis

- Theory asserts that market prices are "informationally efficient".
- Market players form price expectations rationally
  - Given new information, say a drought in country X, agents adjust price expectations.
  - Forecasts are based on new information.
  - Not all agents need to have accurate price expectations, but as a whole the market is "right".
  - Responses to the shock or new information are random, and are normally distributed.
  - Not one single agent can earn excess profits.
- Expected price movements $E[Pt_{+1}]$ are governed purely by new information.

Grossman and Stiglitz Critique

- Paradox if market prices are informationally efficient, then why do market players invest in gathering market information.
- Grossman and Stiglitz propose in their models agents with varying information to produce "partially informationally efficient" market equilibria.
- Grossman agents invest in gathering information to profit from the information disadvantage of other agents, increasing the information content of market prices, and arrive at a rational expectations market equilibrium prices.
- Such prices aggregate disperse information, while avoiding perfect revelation due to unobservable supply shocks.

Shiller's irrational price bubble

- Observation that volatility of market prices is extreme.
- Excess volatility is a result of psychological beliefs that exert a greater influence on the market than do economic fundamentals
- If prices of an asset begin to rise, positive returns by incumbent investors fuels the spread of over-enthusiasm in the market, attracting public attention
- New uninformed agents come in and bid up prices, feeding the expectation of future returns, and attracting more entry.
- Pessimism sets in, leading to a collapse of the bubble.

Self Fulfilling Crisis

- Exporters anticipating higher prices tend to store stocks.
- Exporting countries likewise fearing shortages restrict exports.
- These actions result in export shocks.
- Combination of short run export declines, and import surges result increase market prices.
- As information is corrected and made more uniform among market players, market reverses.

Peculiarities of the rice market

- Thin trade
- Presence of GtoG trading.
- These do not help in the Grossman-Stiglitz process of aggregating information.
- Thus, irrational price bubbles build up.

Possible Mitigating influence of Accurate Market Information

- If information was more accurate and widely disseminated, the crisis may have been mitigated.
- The rice market in 2008 could have settled at the $600 per ton level.
- There would have been adjustments but the world could have saved more resources.

Regional cooperation

- Intergovernmental bodies, say ASEAN, can invest in sharing and collective analysis of market information and data and serve as a focal information center.
- Credibility of the information center has the potential of harmonizing and upgrading information about the market.
- Produce a public good.

Thank you for listening.