

# Food Prices and Food Security: Overview of Existing Data and Policy Tools and Identification of Gaps

Presented by:

Maximo Torero

AGRODEP Workshop on Tools for Food Prices and Price Volatility Analysis

June 6-7, 2011 • Dakar, Senegal

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# **Food Prices and Food Security: Overview of Existing Data and Policy Tools and Identification of Gaps**

Maximo Torero  
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AGRODEP members' meeting and workshop, June 6 -8, 2011, Dakar,  
Senegal

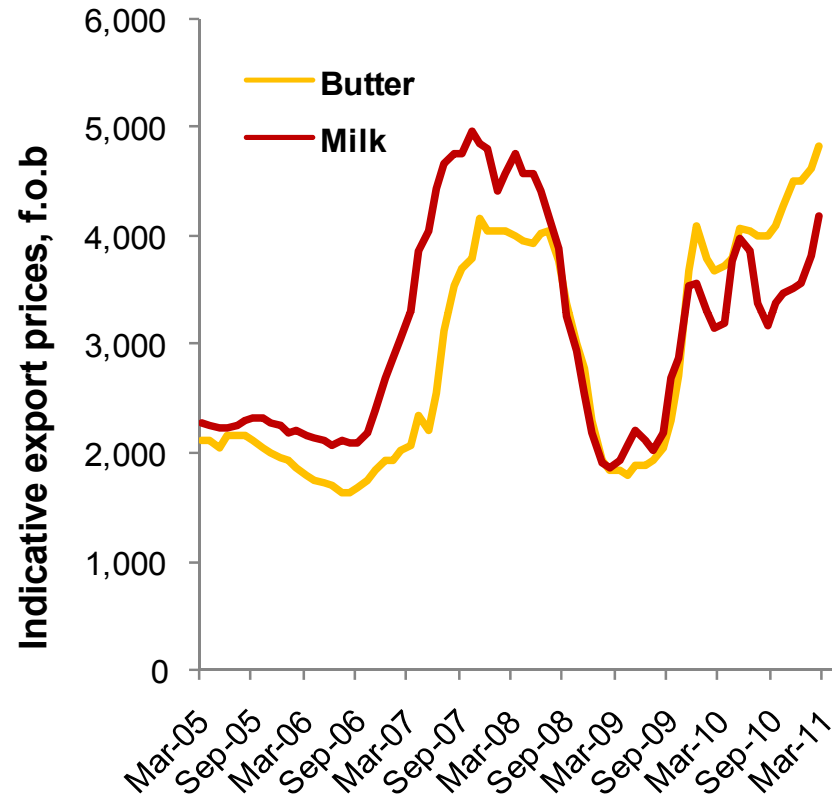
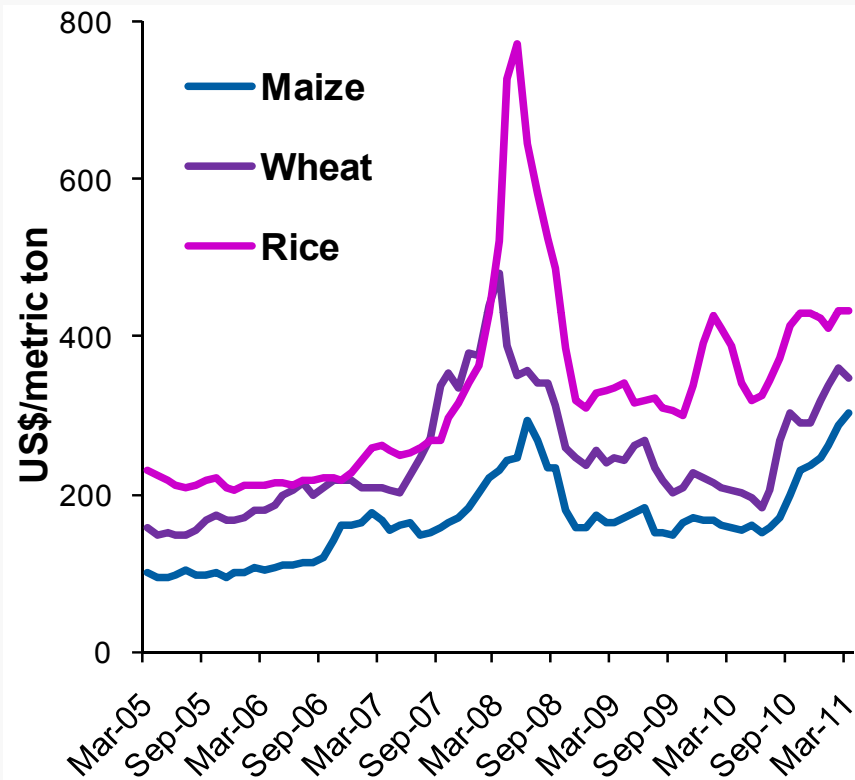
# This presentation

- **Introduction**
- Conceptual framework
- Information needs
- Problems of inadequate information
- Final comments

## We have FOUR crises

- **Slow motion food crisis:**
  - Still no clear progress.
- **Still persistent financial crisis:**
  - “This is not a recovery”, Paul Krugman, 8/28/2010  
NYT
- **Latent fuel crises:** rise and fall of price of oil (variability), impact of food for fuel.
- **Eminent climate change!** More pressure over price variability

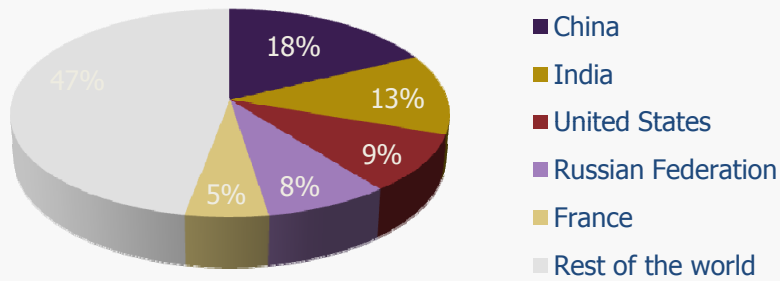
# Evolution of prices



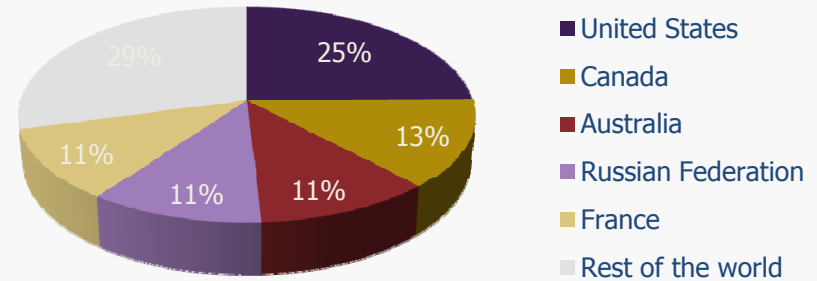
Source: FAO (Food and Agriculture Organization of the United Nations). 2011. International commodity prices database. Available at [www.fao.org/es/esc/prices/PricesServlet.jsp?lang=en](http://www.fao.org/es/esc/prices/PricesServlet.jsp?lang=en). Maize = US No.2, Yellow, U.S. Gulf; Wheat = US No.2, Hard Red Winter ord. prot, US f.o.b. Gulf; Rice = White Broken, Thai A1 Super, f.o.b Bangkok; Butter = Oceania, indicative export prices, f.o.b.; and Milk = Whole Milk Powder, Oceania, indicative export prices, f.o.b.

# High concentration of exports - Wheat

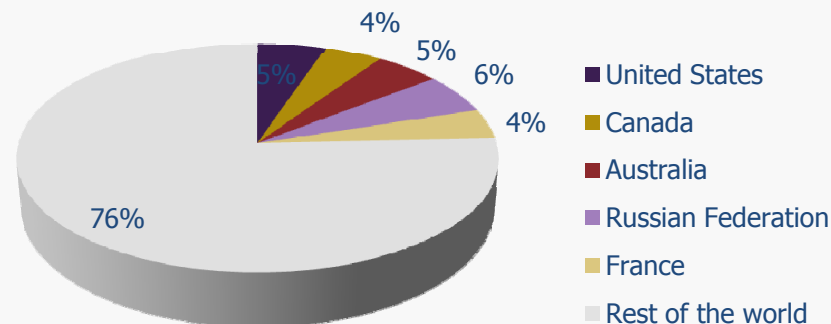
## World production



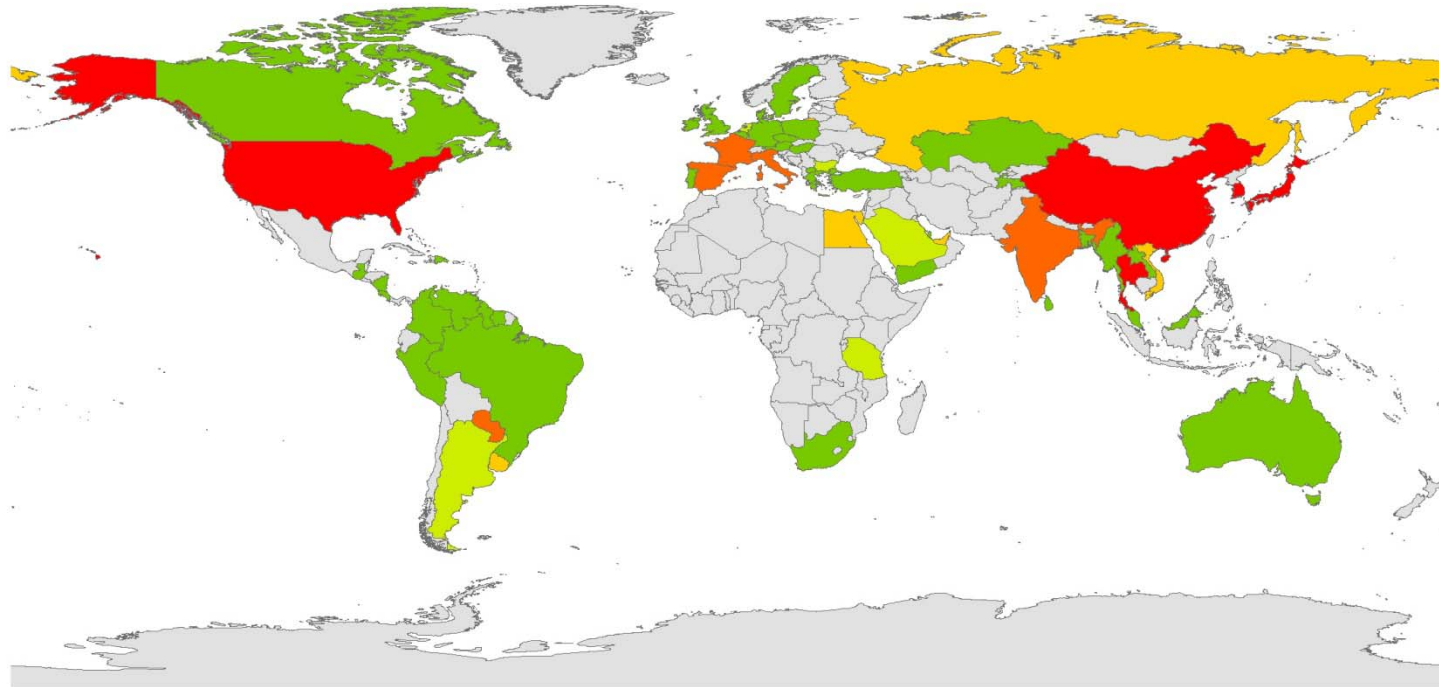
## World exports



## World Imports



# High concentrations of exports - Rice



year	2005		
TOP 5	COUNTRY	EXPORT (1000 TONS)	% TOTAL
1	United States of America	1985.54	68.74
2	Korea	300.00	10.39
3	Japan	198.40	6.87
4	Thailand	100.00	3.46
5	China	99.08	3.43

Source: FAO

## Excessive price volatility is bad for producers

- High price volatility **increase expected producer losses**
- High price volatility increases **misallocation of resources**
- Increased price volatility through time **generates the possibility of larger net returns in the short term**



## Major needs to improve

**Food security** for the poor in developing countries.

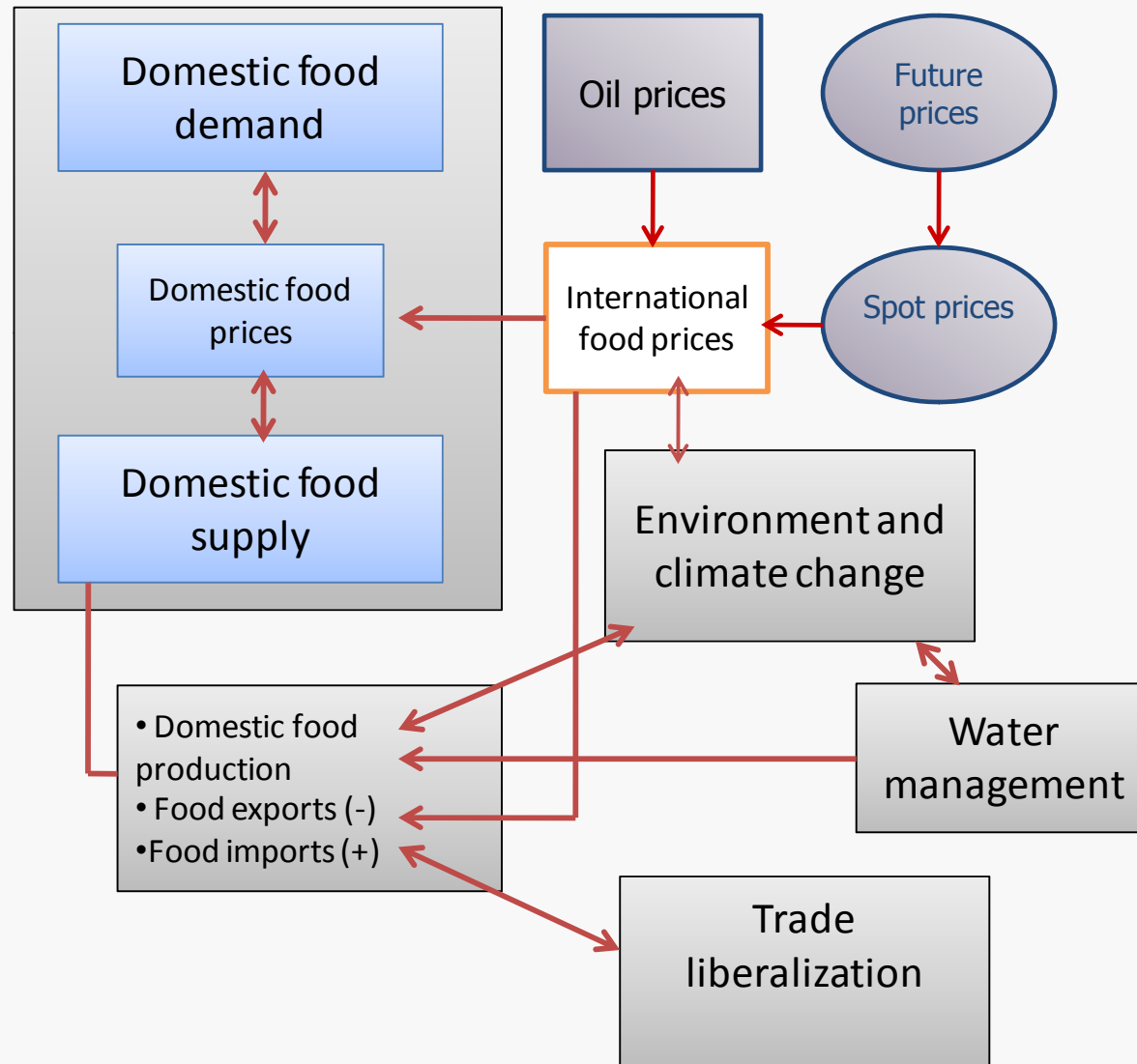
**Understanding** of how key drivers impact food supply food demand, or both.

**Identify appropriate policies** that will **increase resilience** of the food systems of poor people.

# This presentation

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- **Conceptual framework**
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# Linking key medium and long term drivers



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## What information is available

Food Security initiatives	Description
FAO's Global Information and Early Warning System (GIEWS),	Database on global, regional, national, and sub-national food security. Also produces a biannual Food Outlook report that assesses market developments, examines volatility in agricultural commodities, looks at market indicators and food import bills.
Food Security Information for Action Joint EC/FAO Initiative (FSIA)	Develop capacity at all levels for increased usefulness of food security information
FAO statistical database system (FAOSTAT)	Central component in FAO's information system. Covers all aspects of FAO's mandate
Famine Early Warning Systems Network (FEWS-NET)	FEWS-NET collects and analyzes data in order to predict food insecurity and issue early warning alerts on these predicted crises.
WFP's Food-Security Monitoring System (FSMS), Food Insecurity and Vulnerability Information and Mapping System (FIVIMS) and Vulnerability Analysis and Mapping (VAM)	Monitors changes in people's food security situations and can be used to track the food security status of vulnerable households in a given region in a particular country

## Key needed information

- **A web-based information and knowledge clearinghouse**
  - A model to **forecast extreme value of price spikes**
  - Understanding **price transmission** and a **policy tool for measuring price transmission** from global to local prices
  - Understanding the effects of price changes
- **Policy Analysis-support tools**
  - Built capacities at the country level
  - Tracking food policies
- **Identifying best and bad practices for food security**

# This presentation

- Introduction
- Conceptual framework
- Information needs
- **Problems of inadequate information**
- Final comments

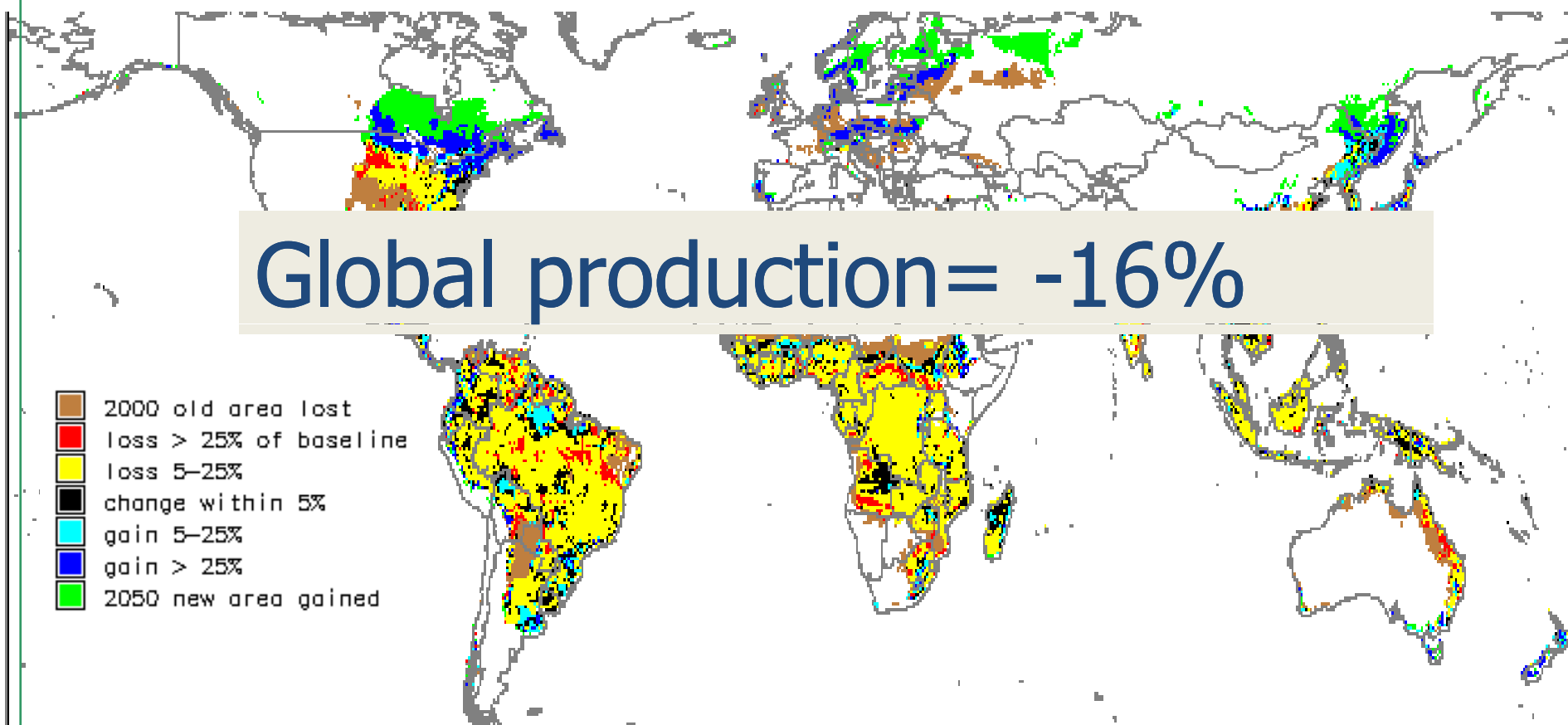
## Problems of inadequate information

- Not taking into consideration climate change
- Lack of appropriate information on extreme value of prices
- Assuming full price transmission to consumers and producers
- Assuming effect in terms of changes in poverty counts
- Assuming export bans were bad but reduction of import tariffs were good
- Assuming no linkages between futures and spot markets
- Lack of knowledge of inter-linkages between future exchanges



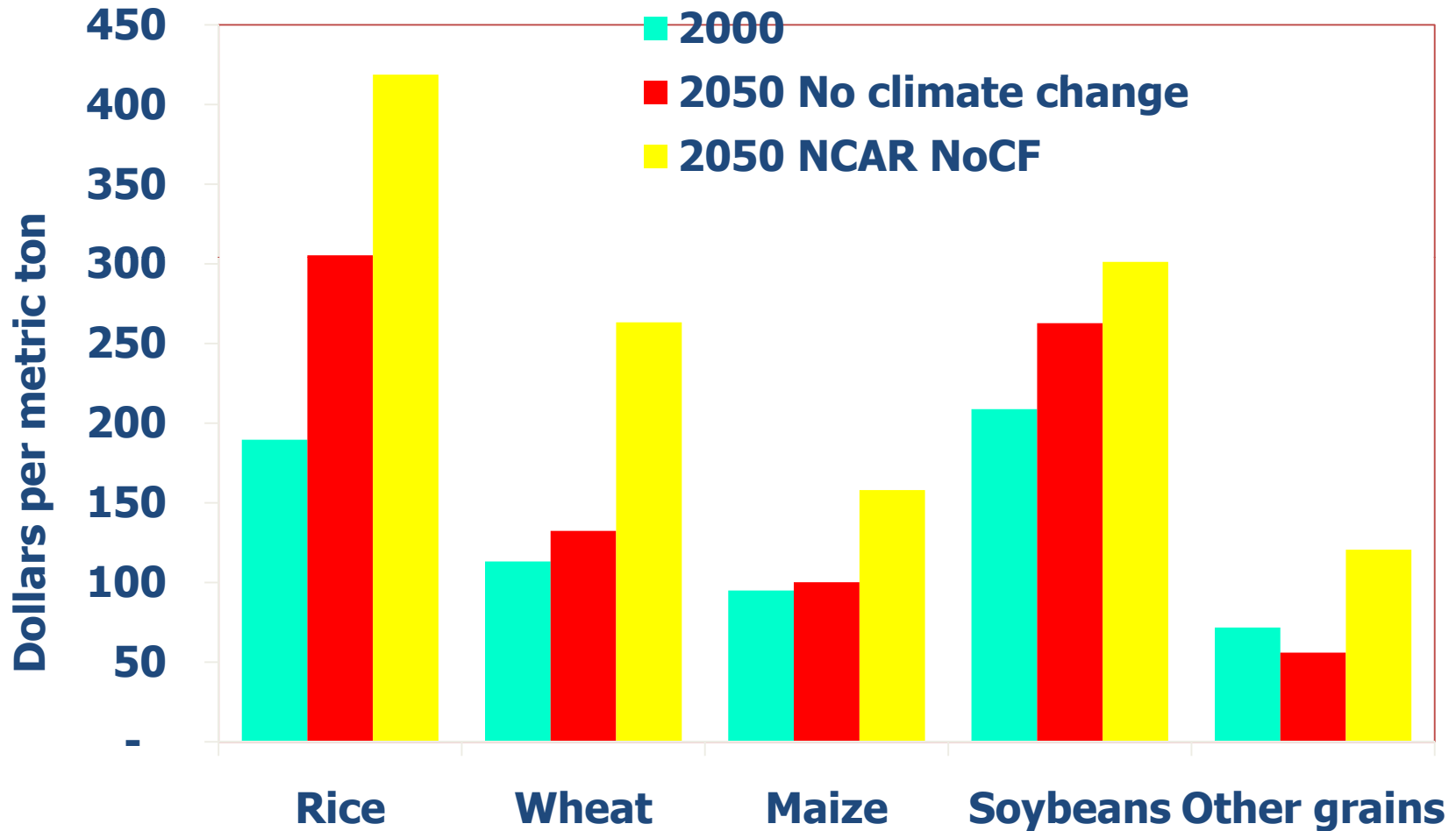
# **Effects of climate change over prices**

# Climate Change Effects on Maize Yield



Source: Hadley GCM, SRES Scenario A2a  
February 2009 results

# Climate change impact: Global food prices

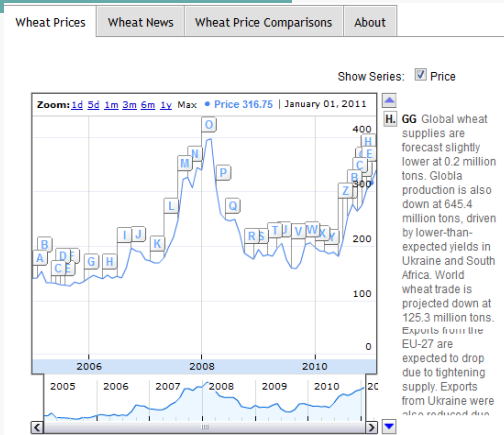


Source: M. Rosegrant (IFPRI) 2009.

**A model to forecast extreme value of  
changes in returns**

# A model to forecast extreme value of changes in returns

AGRICULTURAL ANNOTATED COMMODITY PRICES

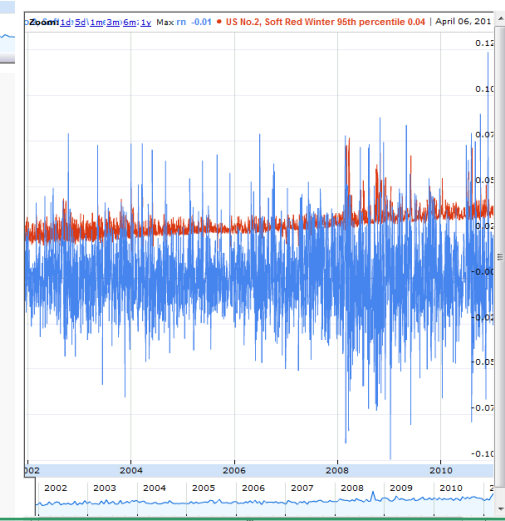


AGRICULTURAL COMMODITY PRICES AND RETURNS

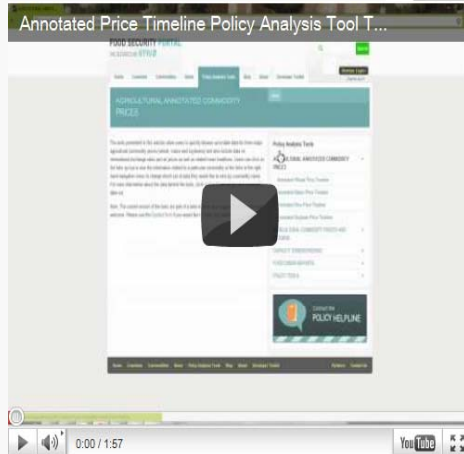
World Wheat Prices, 1998-Present



Soft Wheat Returns



Annotated Price Timeline Policy Analysis Tool T...

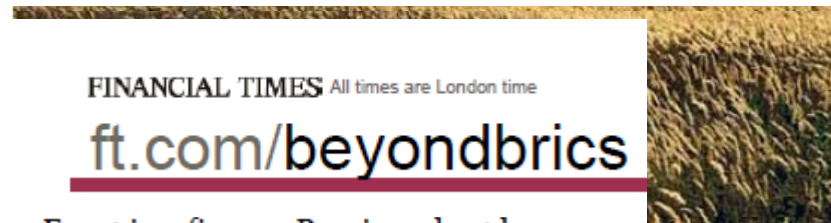


## Wheat Prices Soar After Russia Bans Exports

Steve Baragona | Washington06 August 2010



### Russia bans grain exports because of fire and drought, sending prices soaring



FINANCIAL TIMES All times are London time  
[ft.com/beyondbrics](http://ft.com/beyondbrics)  
Egypt in a fix over Russian wheat ban  
August 6, 2010 4:46pm by Barney Jopson |

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October 15

August 6, 2010

## No Wheat Shortage, but Prices May Rise

By GRAHAM BOWLEY and ANDREW MARTIN



Ariana Eunjung Cha & Janine Zacharia  
Email Author  
Moscow, August 07, 2010  
First Published: 00:11 IST(7/8/2010)  
Last Updated: 00:12 IST(7/8/2010)

### Russia ban sends wheat prices soaring

New York Times  
"No Wheat Shortage, but Prices May Rise"

**Financial Times**  
**Russia grain export ban sparks price fears**  
Published: August 5 2010 10:50

Voice of America  
"Wheat Prices Soar after Russia Bans Exports"

WSJ  
*Wheat Prices* Hit 2-Year Highs Following Russian Ban  
Aug 5, 2010

Economic Times (India)  
"Russian Crisis Won't Impact Global Wheat Supplies, Prices"

The Diane Rehm Show (USA)  
"World Wheat Supplies"

Radio France Internationale, English to Africa service  
"Russia Wheat Ban Raises Food Security Fears"

Radio France Internationale, Latin America Service

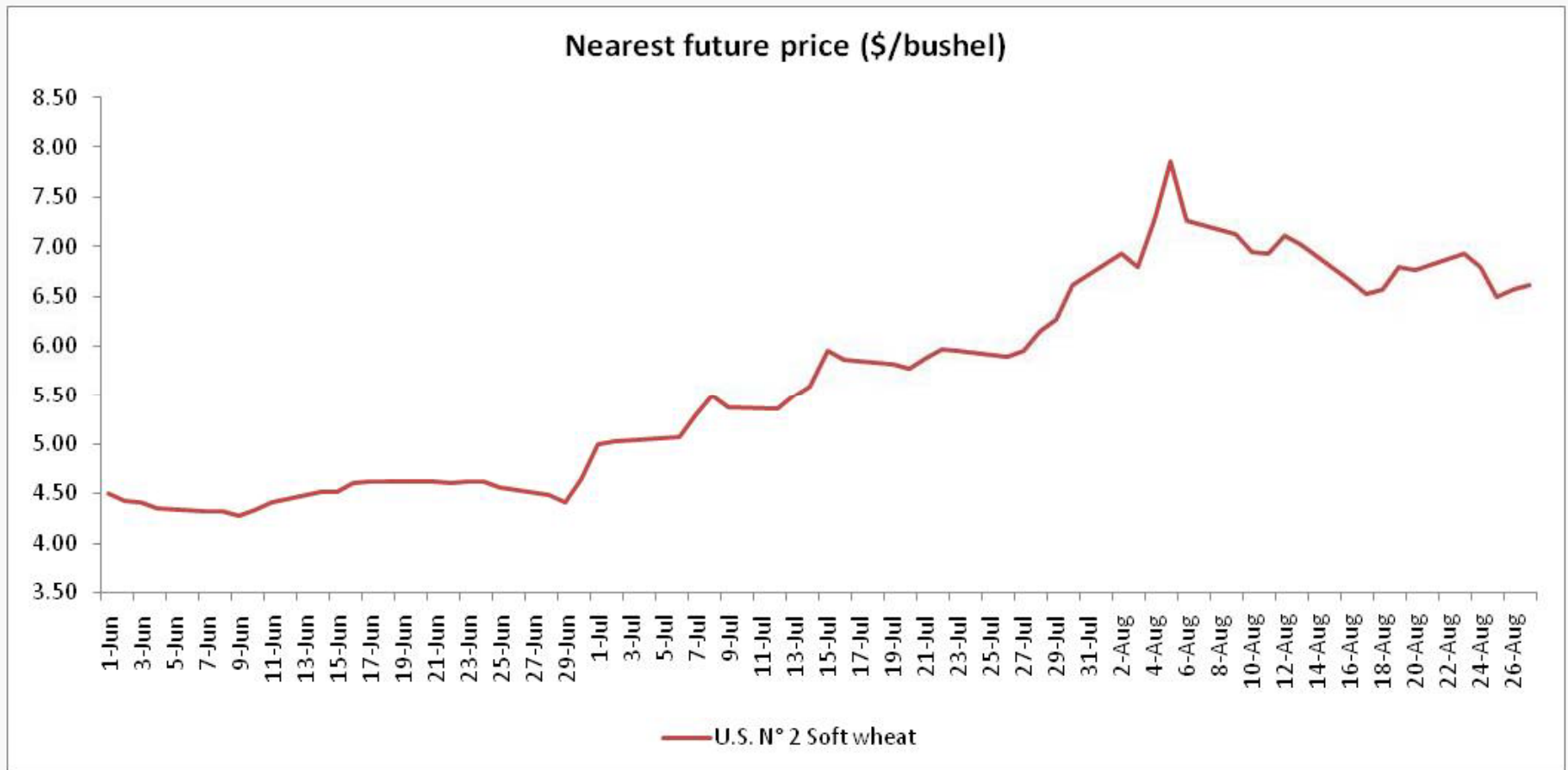
Asia Sentinel  
"Is Another Food Crisis Coming?"

BBC World News America  
"From Farmers to Bakers: What the Wheat Shortfall Means"

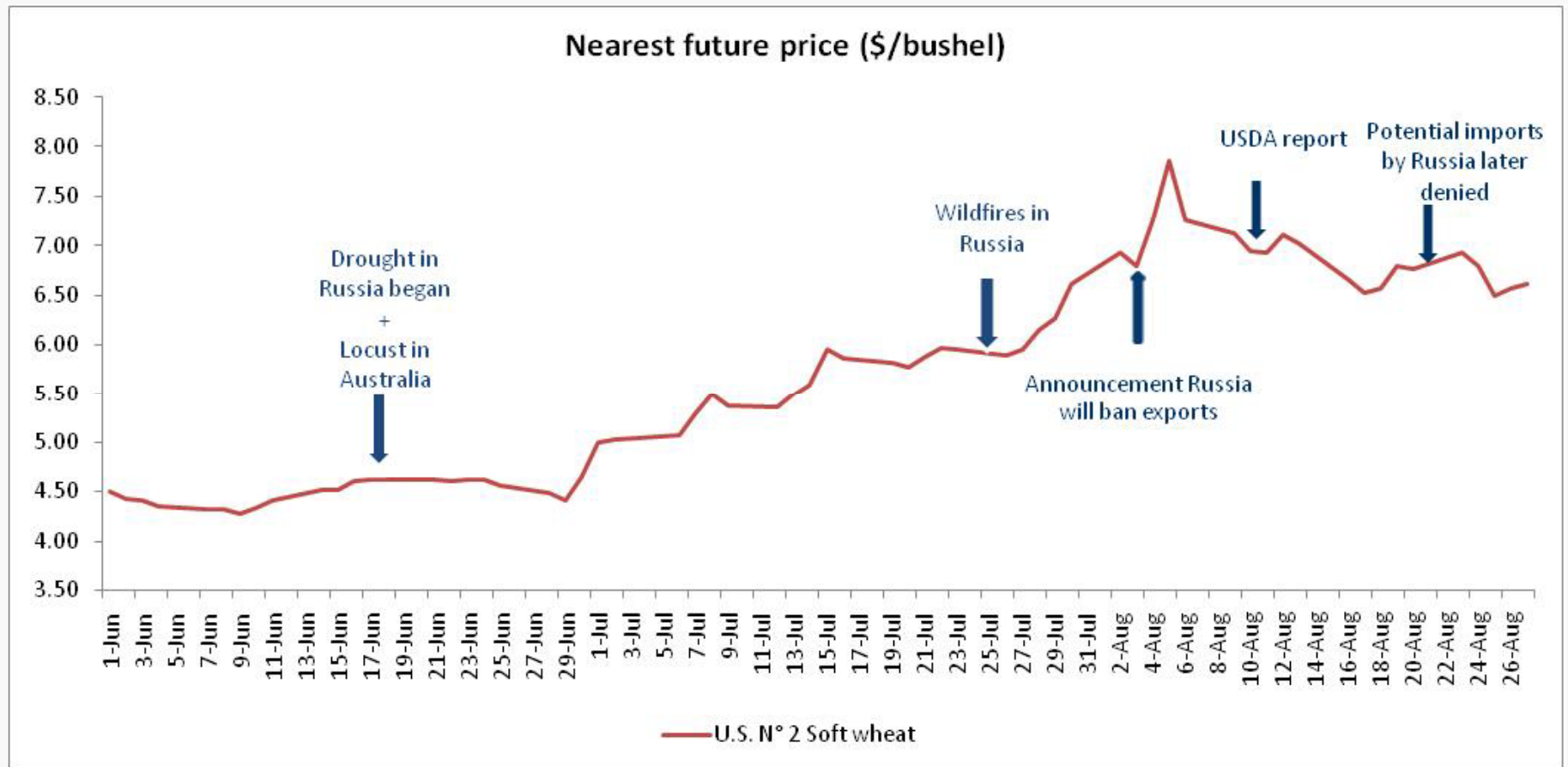
**Financial Times**  
**Prospect of Russian grain imports lifts wheat**  
Published: August 19 20

**Bloomberg**  
**Wheat Prices Jump Most in Week as Argentina, Russia Crops Hurt by Drought**

# CBOT wheat prices

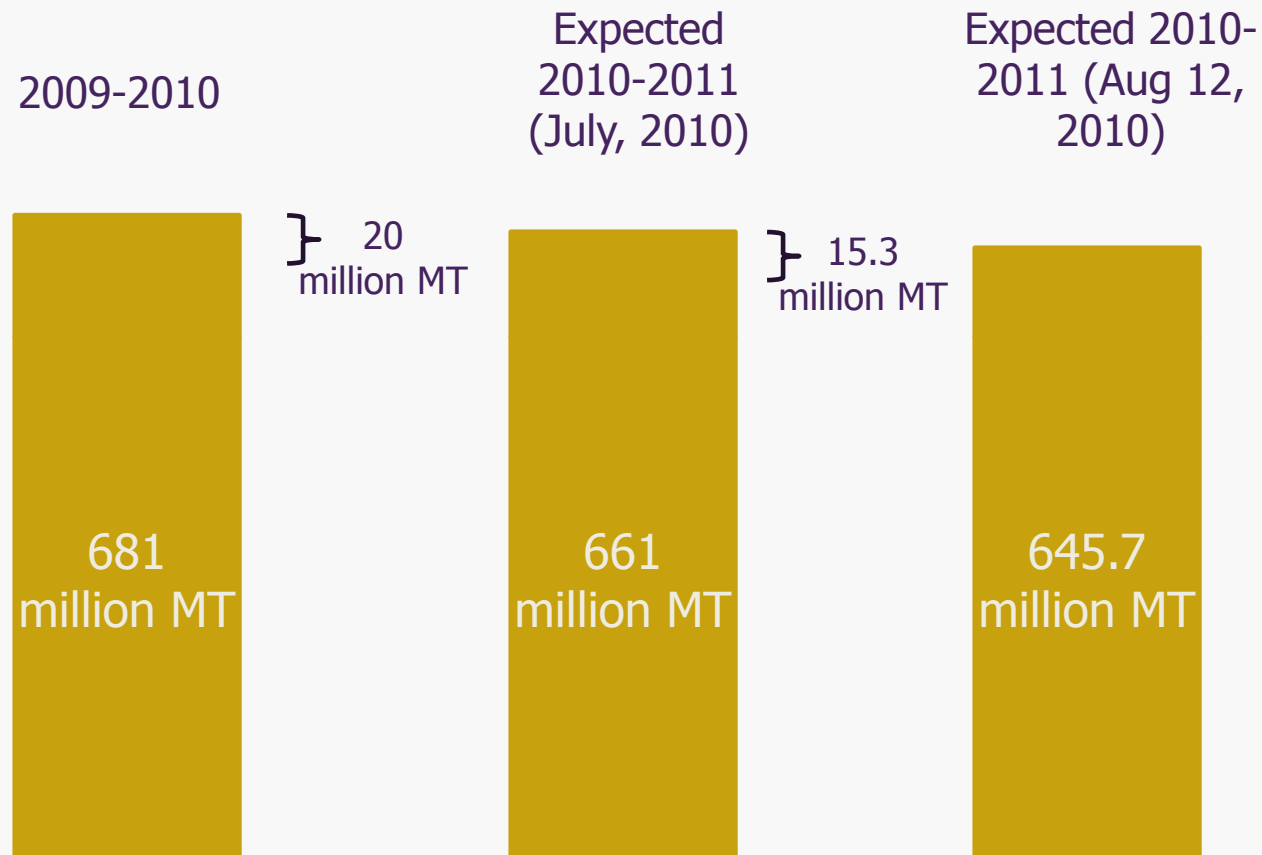


# CBOT wheat prices



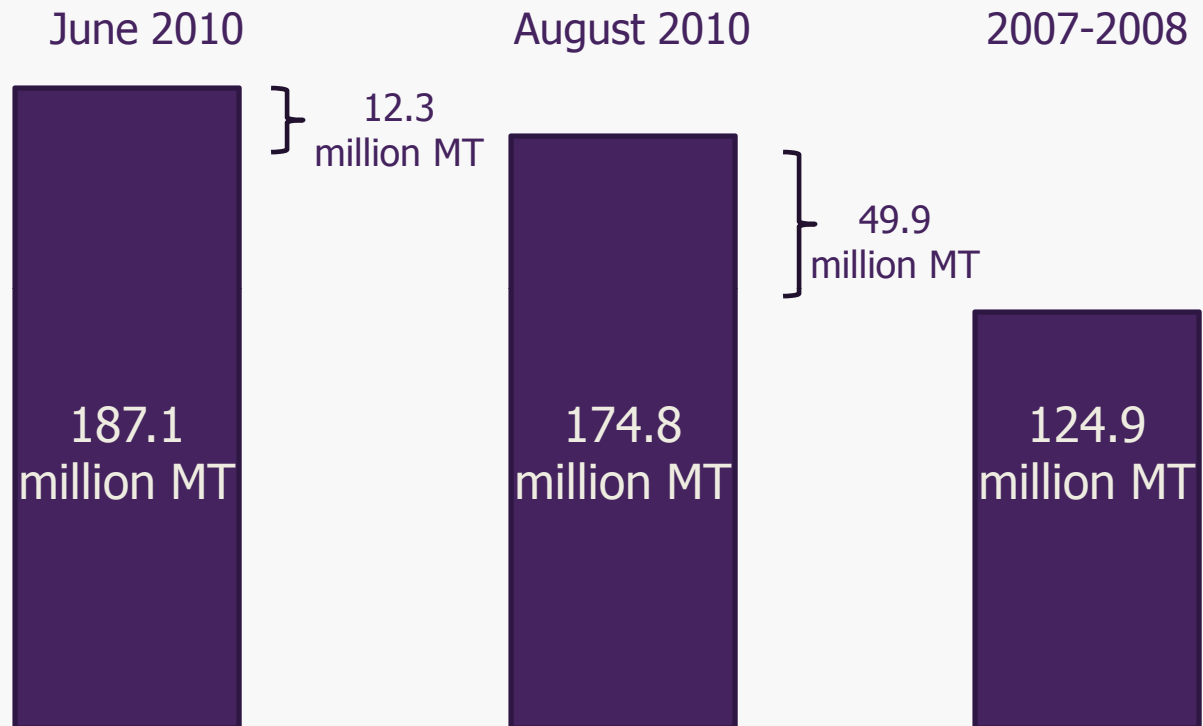


## Global production of wheat



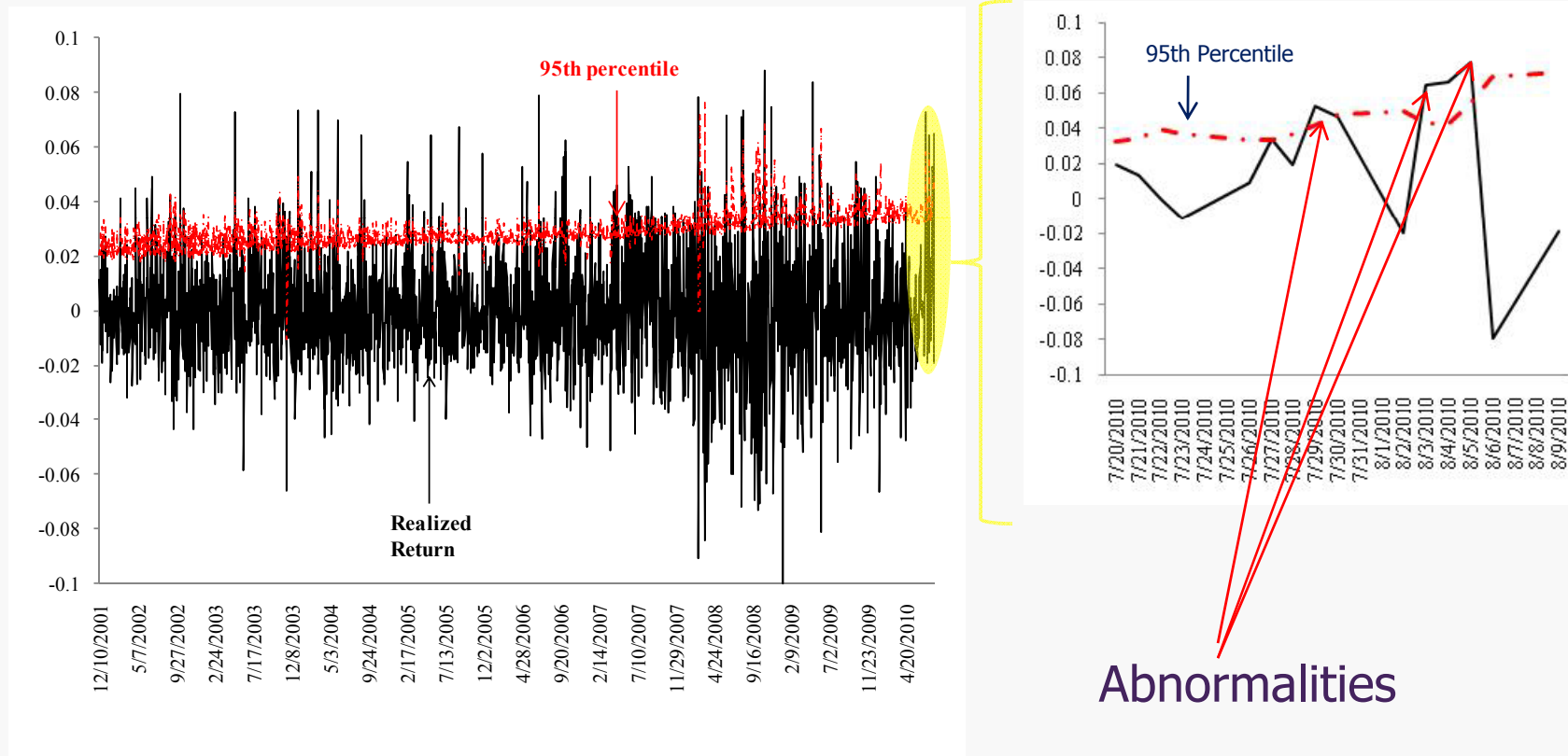
Sources: Wheat Outlook (USDA, July 13, 2010) and World Agricultural Outlook Board (August 12, 2010) .

## Global stocks of wheat



Source: World Agricultural Outlook Board (August 12, 2010).

# CBOT wheat prices – IFPRI model to detect abnormal spikes



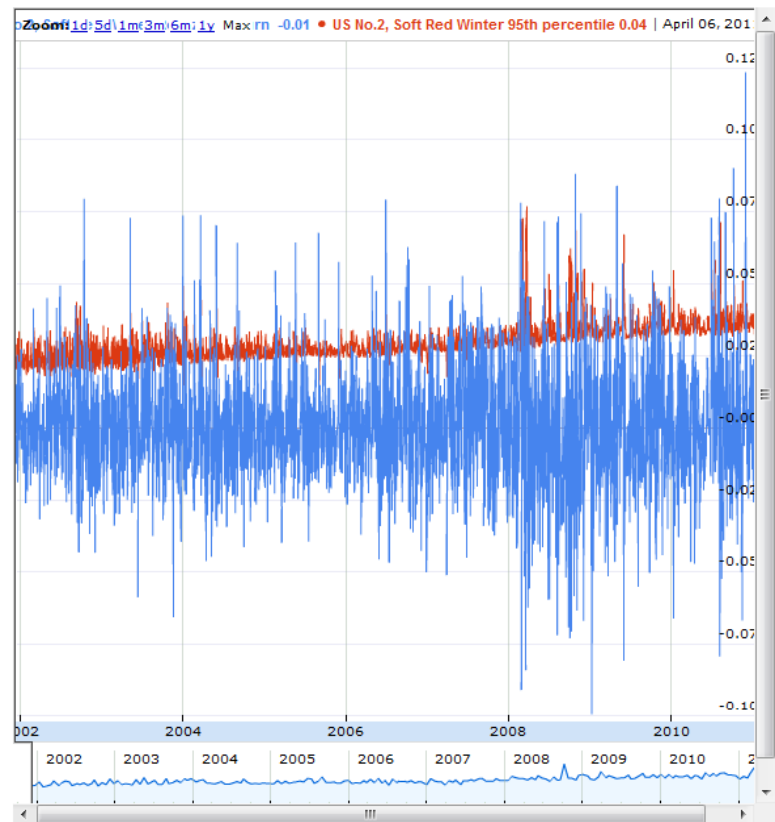
Source, Martins-Filho, Torero, Yao (2010)

# Online Price Tools

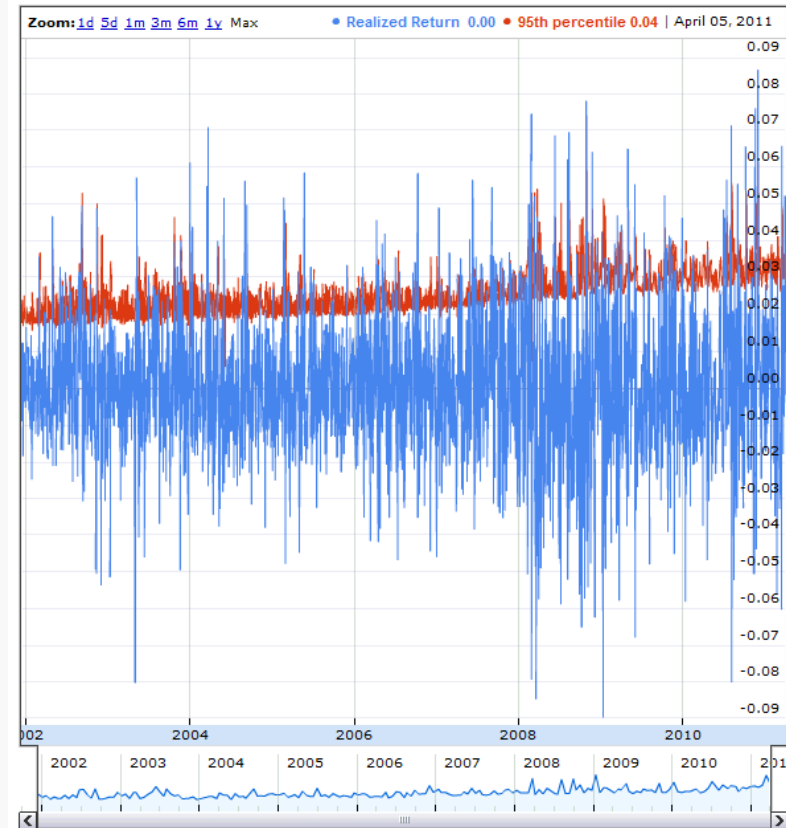
## World Soft and Hard Wheat Returns, 2001-Present

The two graphs below shows the cases in which the value of the realized returns (log returns of future prices contracts expiring between 1 and 3 months) are higher than the forecast the 95% conditional quantile for the log return on the following day based on a model that includes daily returns since 2001. When the blue line (realized return) is over the red line (forecasted 95th percentile returns) it means that the realize return is an abnormality and we expect it to fall under the 95th percentile return in the following day.

### Soft Wheat Returns



### Hard Wheat Returns



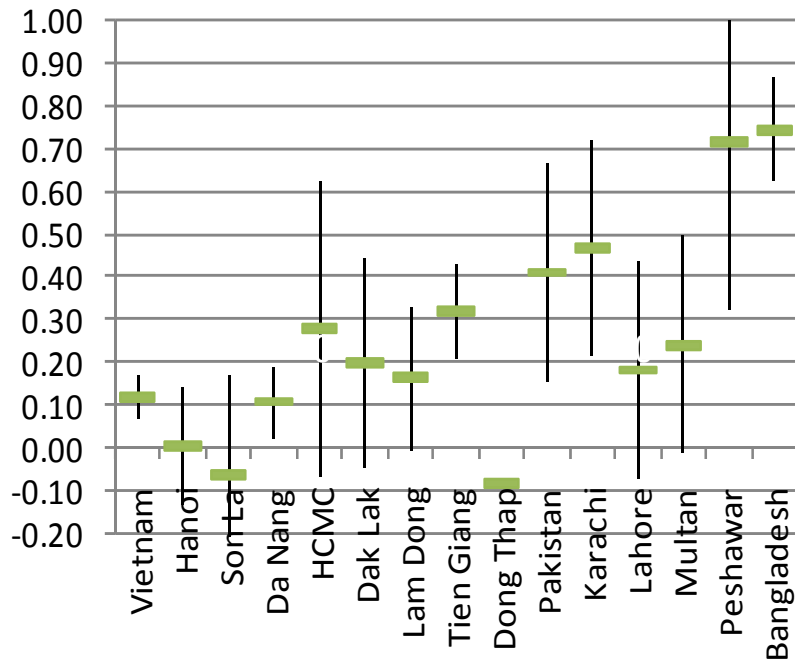
# **Understanding price transmission**

## Transmission from international to national prices

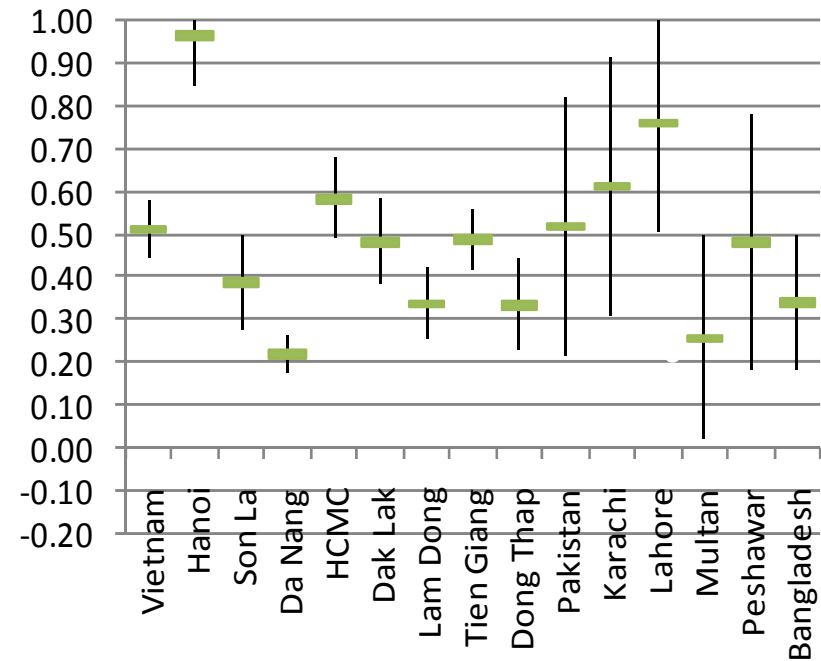
1. We try if there was evidence of co-integration between domestic and international prices
2. We test the existence of co-integration vectors using the Johansen test using as the VAR base model one that includes the domestic price, the international price, the exchange rate, and two lags in all models
3. If the Johansen test indicates that there is a long-run relationship between the two variables, then we estimate the VECM.
4. the vector error correction model (VECM ) to examine the relationship between world food prices and domestic food prices was estimated

# Price transmission to consumers– significant variance across countries

Asia - Price transmission: from international wheat to domestic wheat



Asia - Price transmission: from international rice to domestic rice



Source: Robles (2010)

## Price transmission to producers, and specially small holders take significant longer to benefit from high international prices

Result of test of long-run relationship	
	Johansen test
Yes	13
No	41
Stationary	8
Total	62

Results of test of long-run relationship by crop				
	Prices with relationship	Total nbr. of prices	Percentage	
Maize	4	40	10%	
Rice	8	17	47%	
Sorghum	1	4	25%	
Wheat	0	1	0%	
Total	13	62	21%	

Results of test of long-run relationship by country				
	Prices with relationship	Total nbr. of prices	Percentage	
Ethiopia	1	3	33%	
Ghana	1	7	14%	
Kenya	0	2	0%	
Malawi	3	8	38%	
Mozambique	4	11	36%	
South Africa	0	4	0%	
Tanzania	4	16	25%	
Uganda	0	2	0%	
Zambia	0	9	0%	
Total	13	62	21%	

Source: Minot (2010)



# **Welfare impact of changing food prices**

## Severe impacts on poor

Purchasing power: 50-70% of income spent on food and wages do not adjust accordingly

Assets and human capital: distressed sale of productive assets, withdrawal of girls from school, etc.

- + Level of diet (low) and nutritional deficiencies (high)
- + Level of inequality below the poverty line (high)

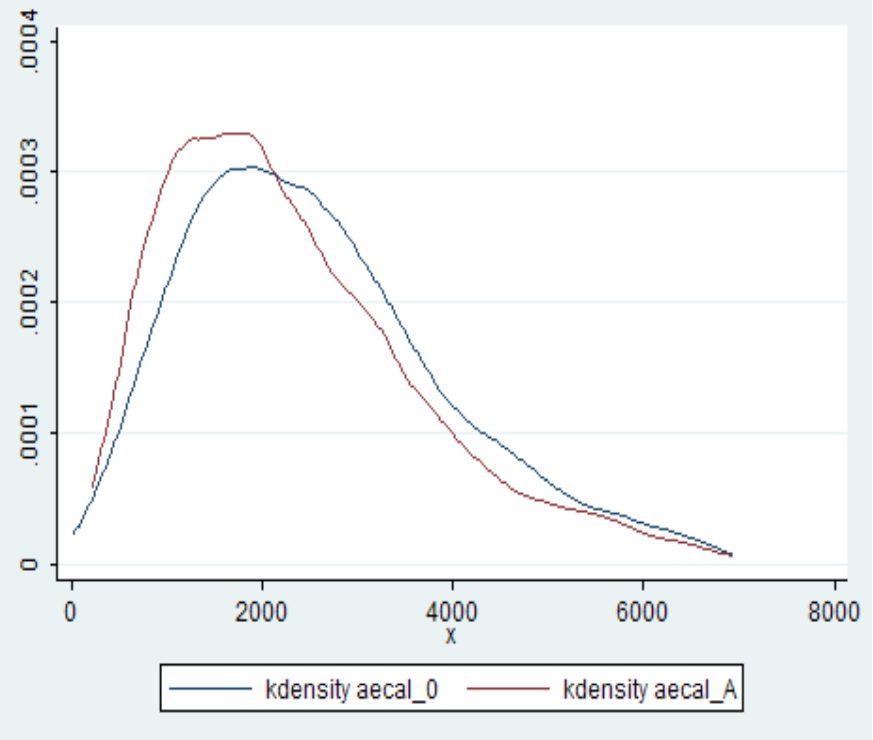
## Negative effects of a 10% price increase in domestic food prices

Country/group	% households negatively affected	Average Income loss
Guatemala	97%	3.5%
20% poorest households	94%	4.3%
Peru	97%	3.3%
20% poorest households	97%	4.2%
Bangladesh	91%	4.8%
20% poorest households	93%	5.6%

# Effects over calorie intake

Country/group	Average % change in calorie intakes (per capita, per day)
Guatemala	
20% poorest households	-8.7
Peru	
20% poorest households	-18.7
Indonesia	
Skoufias et.al 2010 Indonesia	In 1999, households switched away from fruits and vegetables, resulting in significantly lower income elasticity for vitamin A and vitamin C compared to 1996

**Guatemala: Households with 0-2 years old kids (blue before and red after)**



Source: Robles & Torero (2009)

# **Export bans and restrictions**

# Export bans and restrictions

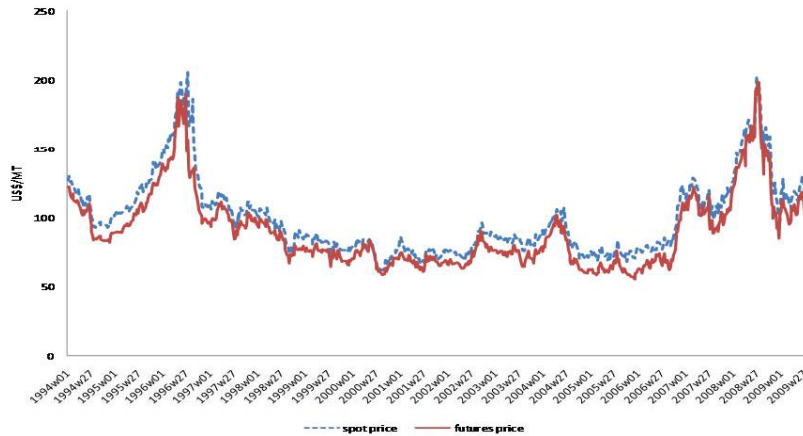
- Changes in trade policies contributed very substantially to the increases in world prices of the staple crops in both the 1974 and the 2008 price surges [**Martin and Anderson (2010)**]
- In 2007-8, insulating policies in the market for rice explained almost 40% in the increase in the world market for rice [**Martin and Anderson (2010)**]
- Simulations based on MIRAGE model showed that this explains around 30% of the increase of prices in basic cereals
- If you raise export taxes in a big agricultural country this will raise world prices (through a reduction in world supply) and it will be bad for small net food importing countries => A problem!
- But reduction of import duties has exactly the same effect: an increase of world prices through an expansion of demand on world markets. But you will not be criticized because it's a liberal policy!
- And when you add augmentation of export taxes in big food exporting countries and reduction of import duties in big food importing countries => real disaster for small food importing countries

# **Relationship between spot and future prices**

# Spots and future move together

## CORN

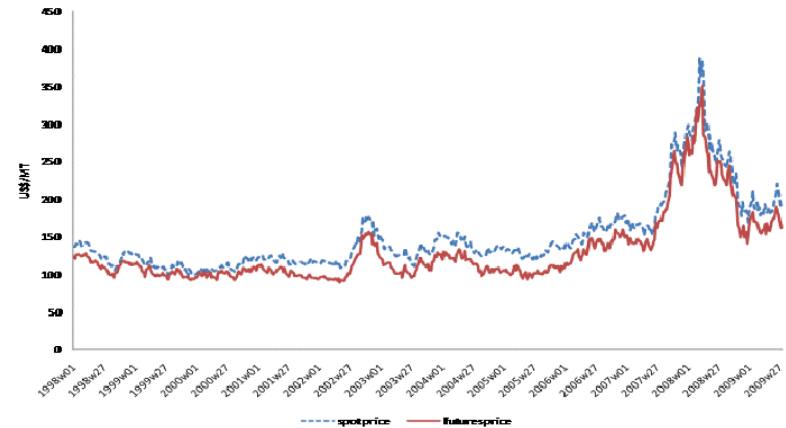
Weekly spot and futures prices, 1994 - 2009



Note: Prices deflated by US CPI, January 1994=1.

## HARD WHEAT

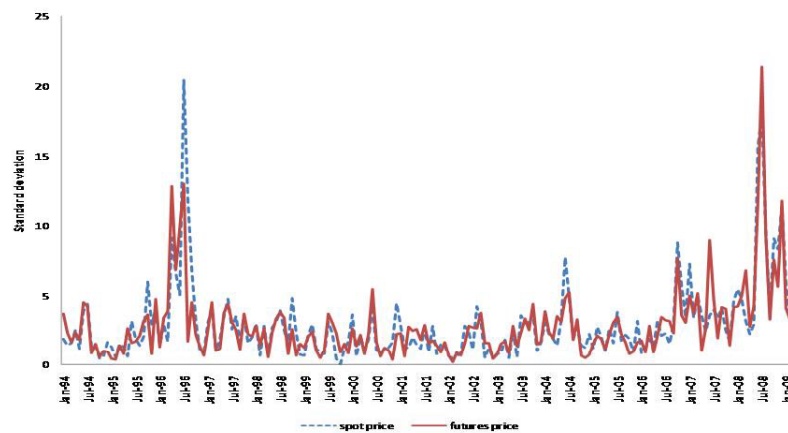
Weekly spot and futures prices, 1998 - 2009



Note: Prices deflated by US CPI, January 1998=1.

## CORN

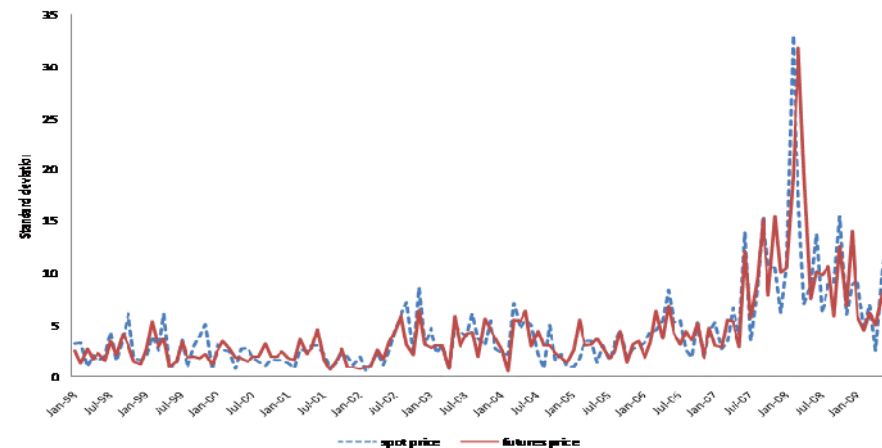
Monthly volatility in spot and futures prices, 1994 - 2009



Note: Monthly volatility based on weekly spot and futures prices.

## HARD WHEAT

Monthly volatility in spot and futures prices, 1998 - 2009



Note: Monthly volatility based on weekly spot and futures prices.



# Granger causality tests

- Granger causality tests were performed to formally examine the dynamic relation between spot and futures markets.
- The following regression model is estimated to test if the return in the spot market ( $RS$ ) at time  $t$  is related to past returns in the futures market ( $RF$ ), conditional on past spot returns,

$$RS_t = a_0 + \sum_{k=1}^p a_{1k} RS_{t-k} + \sum_{k=1}^p a_{2k} RF_{t-k} + e_t$$

where  $H_0: a_{2k} = 0 \forall k = 1, \dots, p$  (i.e.  $RF$  does not Granger-cause  $RS$ ).

- Conversely,  $RF_t$  is the dependent variable to evaluate the null hypothesis that spot returns ( $RS$ ) does not Granger-cause futures returns ( $RF$ ).
- Similar tests are performed to examine causal links in the volatility of spot and futures returns.

# Linear causality test on returns

Granger causality test of weekly returns in spot and futures markets, 1994 - 2009

# lags	H <sub>0</sub> : Futures returns does not Granger-cause spot returns				H <sub>0</sub> : Spot returns does not Granger-cause futures returns			
	Corn	Hard Wheat	Soft Wheat	Soybeans	Corn	Hard Wheat	Soft Wheat	Soybeans
1	167.47***	263.03***	169.85***	15.44***	6.10***	2.20	0.40	0.55
2	116.20***	186.92***	106.61***	21.24***	2.09	0.02	0.01	0.47
3	77.58***	135.27***	75.33***	20.74***	2.24*	0.11	0.27	1.75
4	58.56***	100.84***	57.92***	16.93***	2.08*	0.97	1.50	1.41
5	48.65***	79.91***	46.38***	14.57***	1.66	1.32	1.59	1.28
6	40.63***	65.92***	38.36***	12.41***	1.59	1.21	1.64	1.06
7	34.76***	56.21***	32.90***	11.51***	2.12**	1.45	1.76*	0.96
8	30.95***	49.91***	29.37***	10.35***	1.97**	1.21	1.46	1.06
9	27.62***	44.64***	26.09***	9.38***	1.58	1.10	1.25	1.04
10	24.80***	40.89***	23.44***	9.05***	1.45	1.21	1.21	1.03

\*10%, \*\*5%, \*\*\*1% significance. F statistic reported.

Note: The Schwartz Bayesian Criterion (SBC) suggests lag structures of 2, 3, 2 and 3 for corn, hard wheat, soft wheat and soybeans, respectively. The Akaike Information Criterion (AIC) suggests lag structures of 8, 3, 4 and 5, respectively. Period of analysis January 1994 - July 2009 for corn and soybeans, and January 1998 - July 2009 for hard and soft wheat.

**It appears that futures prices Granger-cause spot prices.**

# **Interlink ages between exchanges**

# Interlink ages between exchanges

**Methodology:** We use three MGARCH models: the interrelations between markets are captured through a conditional variance matrix  $H$ , whose specification may result in a tradeoff between flexibility and parsimony. We use three different specifications for robustness checks:

- Full T-BEKK models (BEKK stands for Baba, Engle, Kraft and Kroner), are flexible but require many parameters for more than four series.
- Diagonal T-BEKK models are much more parsimonious but very restrictive for the cross-dynamics.
- Constant Conditional Correlation Model (CCC) models allow, in turn, to separately specify variances and correlations but imposing a time-invariant correlation matrix across markets.

## **Data:**

- In the case of corn, we examine market interdependence and volatility transmission between USA (CBOT), Europe/France (MATIF) and China (Dalian-DCE);
- for wheat, between USA, Europe/London (LIFFE) and China (Zhengzhou-ZCE); and for soybeans, between USA, China (DCE) and Japan (Tokyo-TGE).
- We focus on the nearby futures contract in each market and account for the potential impact of exchange rates on the futures returns and for the difference in trading hours across markets.

## Interlink ages between exchanges

- The results show that the correlations between exchanges are positive and clearly significant for the three agricultural commodities, **which implies that there is volatility transmission across markets.**
- In general, we observe that the interaction between USA (CBOT) and the rest of the markets considered (Europe and Asia) is higher compared with the interaction within the latter.
- In particular, the results show that the interaction between CBOT and the European markets is the highest among the exchanges considered for corn and wheat. Similarly, the results indicate that China's wheat market is barely connected with the other markets.
- However, in the case of soybeans, China has a relatively high association with the other markets, particularly with CBOT.

## This presentation

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## Final comments

- Markets are INTER-RELATED!
- We need to **improve information to better handle price volatility**
- **We need more and better information on stocks – innovations in how to measure them**
- We need to start in at least in better information and models to identify the extreme price spikes
- We need to develop models to **link food and demand supply with: international prices, water sustainability, climate change and trade**

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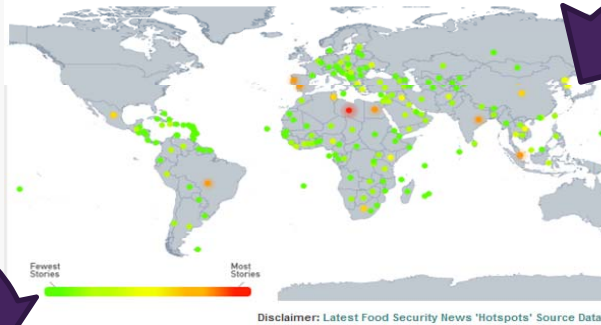
**Country Profiles**  
Data, research, and news on food security

### Global Commodity Prices Mar 11

Maize \$0.29 0%	Oil \$84.96 -13.1%	Rice \$0.43 0%	Soybean \$0.53 -3.6%	Wheat \$0.33 -8.3%
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All crop prices are displayed in US\$/kg. Oil prices are given in US\$/barrel. % Change is based on the previous month.

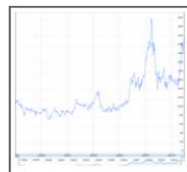
### Latest Food Security News 'Hotspots'



### Tools from FSP



**Terms-of-Trade Effect**  
Impact of changes in world prices for import and export commodities.



**World Maize Prices & Returns**  
Global price data and returns of future prices for maize.



**Wheat Prices & Returns**  
Global price data and returns of future prices for hard and soft wheat.

1 of 2 >>

- April 8, 2011  
FAO Releases Latest Global Commodities Supply and Demand Forecasts
- April 8, 2011  
Global Food Prices Fall Slightly in March; FAO Releases Latest Food Price Index
- April 7, 2011  
Medium-Term Welfare Effects of Higher Food Prices
- April 4, 2011  
GNI per Capita (current \$US)
- April 4, 2011  
GDP (current \$US)

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- April 8, 2011  
U.K., Brazil Urge G20 Action on Volatility in Food Prices - Bloomberg
- April 8, 2011  
Sub-Saharan R&D Agricultural Investment Being Hindered - IFPRI - Food Ingredients First (press release)
- April 8, 2011  
Kenya: Rising Food Prices Will Be Controlled, Says Odinga - AllAfrica.com
- April 8, 2011  
Liberia: Food Security Alert - April 7, 2011 - ReliefWeb (press release)
- April 8, 2011  
UN says food prices might rebound. - Denver Post  
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