

# **THE WORLD FOUR CRISES: IMPLICATIONS FOR THE FOOD SECURITY OF DEVELOPING COUNTRIES**

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## **ABSTRACT**

The 2007/08 international food price crisis, energy crises, economic recession and climate change have and are causing hardship on a number of fronts. It has led to economic hardship among the poor and generated political turmoil in many countries, and it could result in long-term, irreversible nutritional damage, especially among children. There is a global interest in preventing the recurrence of such events and in policies for food security. In this presentation, the following actions to re-prioritize agriculture are proposed:

(a) Global collective actions to avoid extreme price spikes and to ensure that the world can respond to emergency needs for food. One significant contributor to the food price crisis was significant financial resources entering the futures markets, including food commodities markets, leading to a price spike during the first six months of 2008. This episode shows that the international financial architecture needs to be modified to address the problem of price spikes but especially of its effects on livelihood of the poor. Two global collective actions to meet this goal are proposed: First, a small physical food reserve should be established to facilitate a smooth response to food emergencies; and second, a new international coordinated global food reserve should be established to minimize the risk of individual countries trying to achieve grain self-sufficiency by rebuilding their own public reserves which could result in a very inefficient global production system, a large total global reserve, and a very thin global grain market.

(b) Importance of reducing trade barriers and moving ahead the Doha Round. While some progress has been made in reducing trade-distorting policies, many remain, and poor countries cannot match them. The new food situation is changing trade regimes in many countries and this will inevitably have important implications for the current Doha Round negotiations, which should be completed given that it is essential to assure food security.

(c) Scaling up investments and prioritizing them. There is a clear need to scale up investments for sustained agricultural growth. The transition to long term viable investments particularly in support of market access, in agricultural science and technology is urgently needed to transform the crisis into opportunities and to build resilience for food crises in the future. Two instruments appear critical to break this deadlock for the smallholders: one is physical infrastructure –such as roads, electricity, potable water and drainage, water for irrigation and telecommunications - that connects smallholders to markets; and the other is the role of accompanying institutions - such as land titling on the enforcement of property rights; credit markets; and contract farming;

vertically integrated schemes; market information systems; commercial rules and laws; commodity exchanges; warehouse receipt systems; and producer and trader associations on economic coordination - that can reduce the marketing risk and transaction costs in the process of exchange between producers and consumers. These investments not only have high returns in terms of agricultural growth, but also large poverty reduction impact in both rural and urban areas through increased production and employment, and lower food prices. Although its prioritization requires that three dimensions in its analysis in linking smallholders to markets be included: the heterogeneity of small farmers and therefore their specific infrastructure and institutional bottlenecks in connecting to markets, the complementarities of investment in rural institutions and infrastructure (capital intensive and post-harvest technologies) may have in market development and in reducing poverty and the level of market accessibility.

## **KEYWORDS**

Institutions, infrastructure, reserves, price spikes and volatility

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## "THE WORLD FOUR CRISES: IMPLICATIONS FOR THE FOOD SECURITY OF DEVELOPING COUNTRIES"

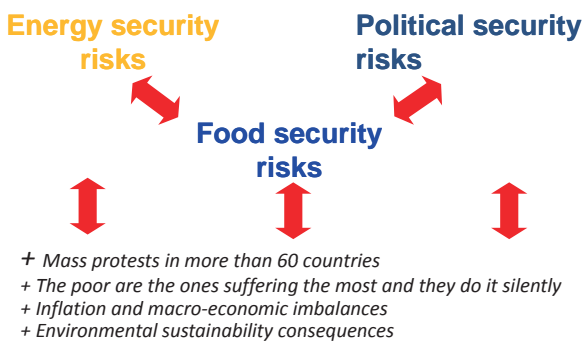
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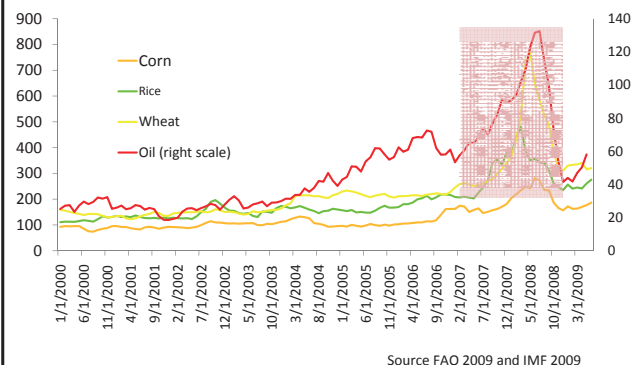
### We have FOUR Crises

- **Food crisis** forced 200 million people into extreme poverty, half of them still there. 1.4 billions of people are still poor in developing countries
- **Fuel crises:** rise and fall of price of oil (variability), impact of food for fuel
- **Financial crisis:** Reduction in exports, commodity prices, remittances, tourism, FDI, aid, and food aid
- **Climate change!** More pressure over price variability

### The food crisis and economic recession tradeoffs + price volatility



### Crises 1: Surge in cereal and oil 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)

**Crisis not over for the poor;  
Nutrition is undermined for the long run**

### Result 1: 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. Finally we use moving averages in first differences to test if the rate of growth of the international prices have explanatory power with respect to the rate of growth of domestic prices

$$d\ln(P_t) = \alpha_0 + \beta_1 d\ln(P_t^*) + \dots + \beta_4 d\ln(P_{t-4}^*) + \gamma d\ln(e_t) + \varepsilon_t \quad \varepsilon_t \sim iid$$

# Result 1: Transmission from international prices to domestic prices- in Latin America – demand side

International price in regression	Mexico	Costa Rica	El Salvador	Honduras	Nicaragua
<i>ln_wheat_int</i>	<i>ln_wheat_bread</i> 0 <i>ln_wheat_cereal</i> 1 <i>ln_wheat_flour</i> 0 <i>ln_wheat_cookies</i> 0 <i>ln_wheat_crackers</i> 0 <i>ln_wheat_pasta</i> 0	<i>ln_bread</i> 0 <i>ln_pasta</i> 2 <i>ln_pasta</i> 1 <i>ln_bread_sweet</i> 1 <i>ln_crackers</i> 2	<i>ln_bread</i> 1 <i>ln_cereal</i> 2 <i>ln_bread_sweet</i> 1 <i>ln_crackers</i> 2	<i>ln_bread_bao</i> 1 <i>ln_bread_bao</i> 1 <i>ln_bread_sweet</i> 2 <i>ln_crackers</i> 2 <i>ln_bread_sweet</i> 1	<i>ln_bread</i> 0 <i>ln_bread_bao</i> 1 <i>ln_bread_bao</i> 1 <i>ln_bread_bao</i> 1 <i>ln_bread_bao</i> 2 <i>ln_wheat_flour</i> 1 <i>ln_crackers</i> 2 <i>ln_candy</i> 1
<i>ln_corn_int</i>	<i>ln_corn</i> 0 <i>ln_tortillas</i> 0 <i>ln_corn_flour</i> 0 <i>ln_corn_cooking</i> 0	<i>ln_corn</i> 1 <i>ln_tortillas</i> 0 <i>ln_corn</i> 1 <i>ln_corn_cooking</i> 0	<i>ln_corn</i> 2 <i>ln_tortillas</i> 2 <i>ln_corn</i> 1 <i>ln_tortillas</i> 0	<i>ln_corn</i> 0 <i>ln_tortillas</i> 0 <i>ln_corn</i> 0 <i>ln_tortillas</i> 0	<i>ln_corn</i> 0 <i>ln_tortillas</i> 0 <i>ln_corn</i> 0 <i>ln_tortillas</i> 1
<i>ln_rice_int</i>	<i>ln_rice</i> 1	<i>ln_rice</i> 2	<i>ln_rice</i> 2	<i>ln_rice</i> 0	<i>ln_rice</i> 2

We report "x" when the coefficient is significant for maximum rank equal to 1,2,...,k-1

International price in VECM	Costa Rica	Panama	Dominican Republic	Ecuador	Peru
<i>ln_wheat_int</i>	<i>ln_bread</i> 1 <i>ln_bread</i> 0 <i>ln_bread_sweet</i> 2 <i>ln_cookies</i> 0 <i>ln_crackers</i> 2 <i>ln_wheat_flour</i> 2	<i>ln_bread</i> 1 <i>ln_flour</i> 1 <i>ln_pasta</i> 2 <i>ln_corn</i> 0 <i>ln_cookies</i> 1 <i>ln_pasta</i> 0	<i>ln_bread</i> 0 <i>ln_bread2</i> 1 <i>ln_spaghetti</i> 2 <i>ln_pasta</i> 1	<i>ln_bread</i> 1 <i>ln_bread_baguette</i> 2 <i>ln_flour</i> 2 <i>ln_cookies</i> 0 <i>ln_pasta</i> 0 <i>ln_spaghetti</i> 0	<i>ln_bread_cereals</i> 2
<i>ln_corn_int</i>	<i>ln_tortillas</i> 0 <i>ln_corn_cereal</i> 0	<i>ln_cereals</i> 0		<i>ln_corn</i> 2 <i>ln_bread_cereals</i> 1	
<i>ln_rice_int</i>	<i>ln_rice</i> 1	<i>ln_rice</i> 0 <i>ln_rice_selected</i> 0 <i>ln_rice premium</i> 0		<i>ln_rice</i> 1 <i>ln_bread_cereals</i> 1	

Source: Robles & Torero (2009)

### Result 1: Transmission from international prices to domestic prices- in Sub Saharan Africa – supply side

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 (2009)

Result 2: Distributional effects													
	Guatemala				Honduras			Nicaragua			Peru		
	Rural	Urban	n	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
<b>Poverty</b>													
<b>Deepening</b>	64.1%	43.7%	54.2%	67.8%	23.4%	45.2%	58.0%	22.8%	37.1%	70.6%	39.8%	50.7%	
<b>Poverty Alleviation</b>	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.3%	0.0%	0.1%	
<b>Poverty Exit</b>	0.1%	0.0%	0.0%	0.2%	0.0%	0.1%	0.7%	0.1%	0.3%	0.0%	0.0%	0.0%	
<b>Poverty Entry</b>	2.2%	2.3%	2.2%	1.3%	1.8%	1.6%	2.3%	3.0%	2.7%	2.3%	1.8%	2.0%	
<b>Non poor worse</b>	33.5%	54.0%	43.5%	29.8%	74.6%	52.7%	38.8%	74.1%	59.8%	26.0%	58.3%	46.9%	
<b>Non poor better</b>	0.0%	0.0%	0.0%	0.7%	0.1%	0.4%	0.2%	0.1%	0.1%	0.7%	0.1%	0.3%	
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
<b>Change in poverty</b>	2.1%	2.3%	2.2%	1.1%	1.8%	1.5%	1.5%	2.9%	2.3%	2.3%	1.7%	1.9%	

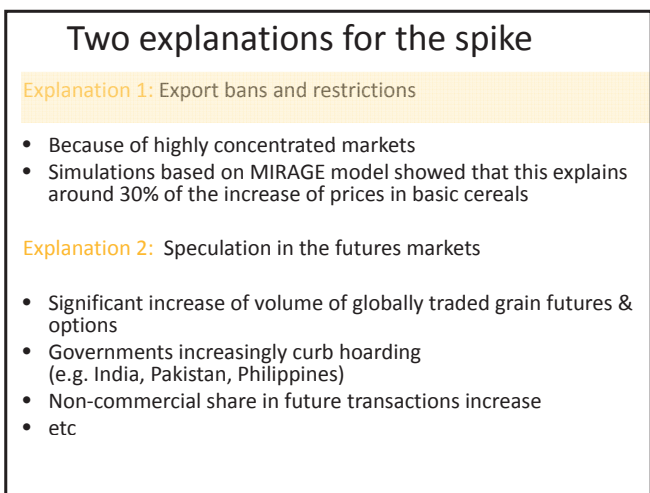
### Result 3: Calorie consumption - Nicaragua

Before (blue) and after (red) of the increase in prices

Households with 0-2 years old kids      National level

The figure consists of two side-by-side density plots. The left plot is titled 'Households with 0-2 years old kids' and the right plot is titled 'National level'. Both plots show the density of calorie consumption (l on the x-axis, 0 to 8000) before (blue line) and after (red line) a price increase. In both cases, the red curve is shifted to the left of the blue curve, indicating a decrease in calorie consumption. The y-axis for both plots ranges from 0 to 0.004.

Source: Robles & Torero (2009)



### Explanation 1: Export bans and restrictions

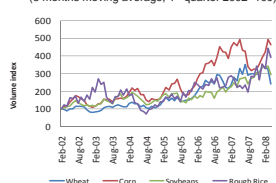
- Because of highly concentrated markets
- Simulations based on MIRAGE model showed that this explains around 30% of the increase of prices in basic cereals

### Explanation 2: Speculation in the futures markets

- Significant increase of volume of globally traded grain futures & options
- Governments increasingly curb hoarding (e.g. India, Pakistan, Philippines)
- Non-commercial share in future transactions increase
- etc

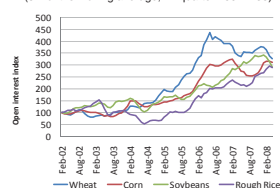
## Explanation 2: On speculation

Futures contracts: Monthly traded volumes  
(3 months moving average, 1<sup>st</sup> quarter 2002=100)



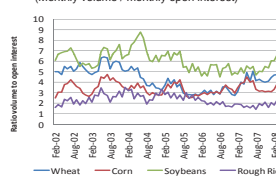
Source: Chicago Board of Trade/CBOT

Futures contracts: Monthly open interest  
(3 months moving average, 1<sup>st</sup> quarter 2002=100)



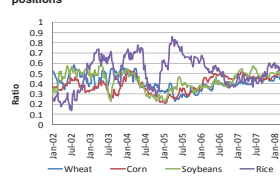
Source: Chicago Board of Trade/CBOT

Futures contracts: Ratio volume to open interest  
(Monthly volume / monthly open interest)



Source: Chicago Board of Trade/CBOT

Futures contracts: Importance of noncommercial positions



Source: Commodity Futures Trading Commission (CFTC)

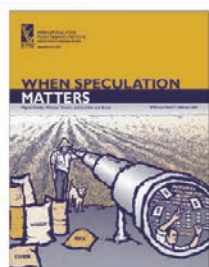
## E2: Evidence of causality – weak to say the least

Indicator of speculation activity	Commodity			
	Wheat	Corn	Soybeans	Rice
1. Monthly volume (futures contracts CBOT)				
2. Monthly open interest (futures contracts CBOT)				
3. Ratio volume to open interest (1)/(2) (futures contracts)	+			+
	(Apr/05 - Oct/07)			(Dec/04 - Jun/07)
4. Ratio non-commercial positions to total reportable positions (long)				+
				(Sep/05 - Mar/08)
5. Ratio non-commercial positions to total reportable positions (short)		+	+	
		(Jan/05 - Jul/07)	(Aug/05 - Feb/08)	
6. Index traders net positions (long – short positions)*		+		N/A
		(Jan/06 - May/08)		

- "+": evidence of causality
- Starting period of evidence of causality in parenthesis
- \* It combines futures and options positions, data available since January 2006.

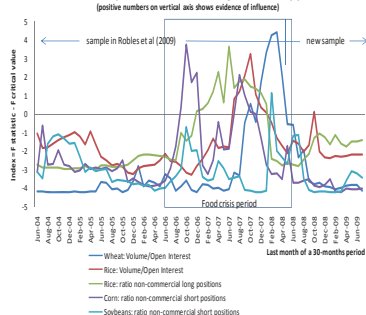
Source: Robles, Torero, Von Braun (2008)

## E2: Evidence of causality



"Changes in supply and demand fundamentals cannot fully explain the recent drastic increase in food prices."

Evidence of speculation influencing commodity prices  
(positive numbers on vertical axis shows evidence of influence)

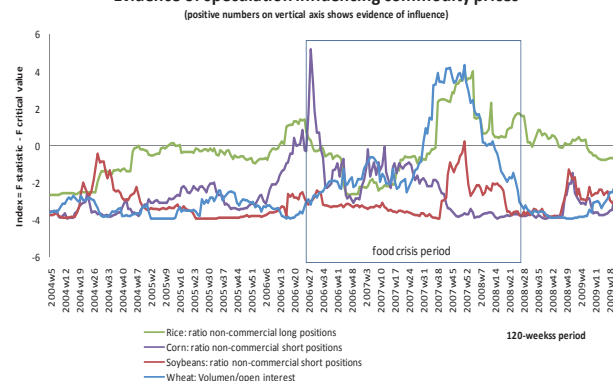


Note: Positive numbers on vertical axis show evidence of influence.

Source: Robles, Torero, and von Braun (2009)

## E2: Evidence of causality – data frequency

Evidence of speculation influencing commodity prices  
(positive numbers on vertical axis shows evidence of influence)



## E2: More on financial activity and/or speculation in futures markets... Inventories?

### The Conscience of a Liberal

Paul Krugman



July 8, 2009, 9:01 am

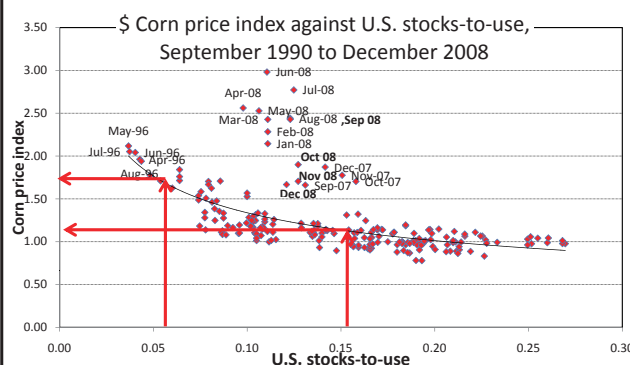
### Oil speculation

Oil speculation is back in the news. Last year I was skeptical about claims that speculation was central to the price rise, because what I considered the essential signature of a speculative price rise — physical withholding of oil from the market, in the form of high inventories — just wasn't showing.

This time, however, oil inventories are bulging, with huge amounts held in offshore tankers as well as in conventional storage. So this time there's no question: speculation has been driving prices up.

## E2: More on financial activity and/or speculation in futures markets...

\$ Corn price index against U.S. stocks-to-use,  
September 1990 to December 2008

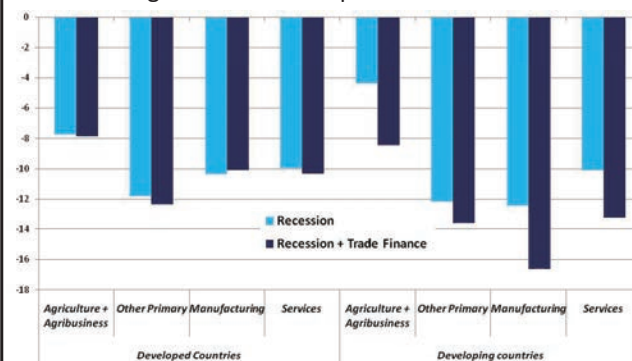


Source: Phillip Abbott (2009)

### Crises 2: The financial crisis and the recession complicates even more the food situation: risks

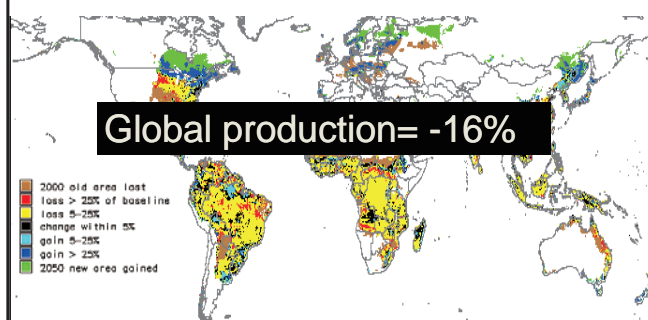
- Less capital available today and in the future for the agriculture
- More debt specially for small holders which had already invested in the expansion of their production
- Shift of attention of policies for agriculture and reduction of public investment
- Reduction of employment and wages of low skill workers
- Reduction of remittances

### C2: Export volumes Looking at 2012 with respect to the Baseline



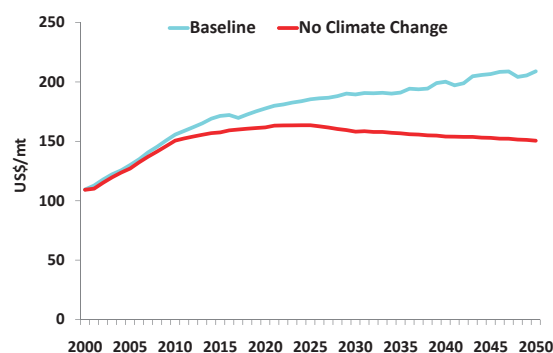
Source: MIRAGE simulations, Laborde and Torero (2009)

### Crises 3: Climate Change Effects on Maize Yield



Source: Hadley GCM, SRES Scenario A2a  
February 2009 results

### C3: Global price of wheat: Baseline and without climate change, 2000-2050



Source: IFPRI IMPACT simulations for HadCM3/SRESB2 scenario (with IMAGE temperature and CO<sub>2</sub> fertilization effects), April 2008 results

### Four priority for policy action needed

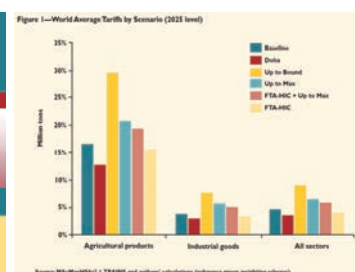
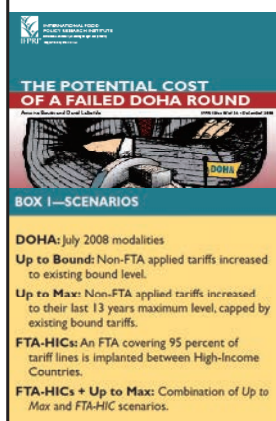
#### At the global level

1. Reduce trade barriers
2. Reduce market volatility and speculation

#### At the country level

3. Expand social protection and child nutrition action
4. Increase efficiency in linking producers to markets, specially small holders

### 1. Reduce trade barriers



**Up to Max: Potential loss 1,064 US\$ billion: 336 of potential trade that would have come by DOHA and 728 billion of trade reduction because of return to protectionism.**



## 2. On market volatility and speculation: What to do?

**Option 1:** Should physical, public, globally managed grain reserves be developed?

Answer: Probably no

Why:

Three main challenges in maintaining strategic reserves:

- **determination of optimum stock, which is politically loaded,**
  - Predicting supply and demand and where the potential shortfalls in the market may be can be extremely difficult
  - Reserves are dependent on transparent and accountable governance
- **level of costs / losses**
  - Reserves cost money and stocks must be rotated regularly
  - The countries that most need reserves are generally those least able to afford the costs and oversight necessary for maintaining them
  - The private sector is better financed, better informed, and politically powerful, putting them in a much better position to compete
- **uncertainties that strategic reserves can bring about in the market place.**
  - Reserves distort markets and mismanagement and corruption can exacerbate hunger rather than resolving problems

## On market volatility and speculation: What to do?

**Option 2:** Should we reform commodity exchanges by:

- limiting the volume of speculation relative to hedging through regulation;
- making delivery on contracts or portions of contracts compulsory; and/or
- imposing additional capital deposit requirements on futures transactions.

Answer: probably NO – we have seen triggers were not activated and also not clear incentives

## On market volatility and speculation: What to do?

We propose a new global institutional arrangement

This arrangement consist of two prongs:

**Prong 1: A minimum physical grain reserve for humanitarian assistance** (emergency reserve of around 300,000 metric tons of basic grains—about 5 percent of the current food aid flows), and

**Prong 2: A safeguard mechanism to manage risk through the implementation of a **virtual reserve** backed up by a financial fund to calm markets under speculative situations**

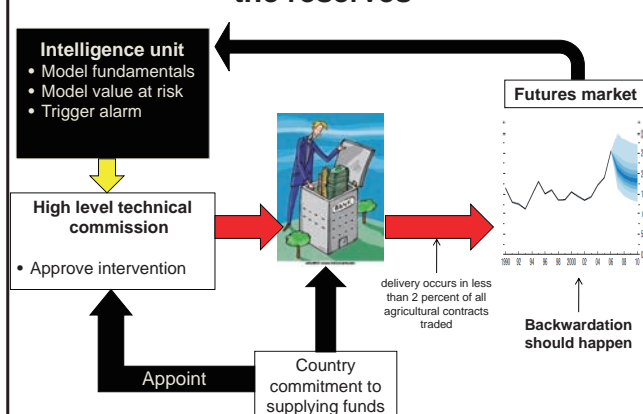
## Prong 2: A virtual global food commodity exchange

- A coordinated commitment by the group of participating countries. Each of the countries would commit to supplying funds if needed for intervention in grain markets
- Determining the size of this fund will require further analysis as commodity futures markets allow for high levels of leverage. For example, a fund of US\$12 to 20 billion might cover 30 to 50 percent of normal grain trade volume
- These resources would be promissory, or virtual, not actual budget expenditures.

## How the virtual reserves will work

- The intervention will take place in the futures market => **A signal of a potential intervention will be announced**
- Intervention will happen when the “global intelligence unit” triggers the alarm that prices are significantly above (95<sup>th</sup> percentile of its conditional value at risk) based on market fundamentals
- The potential intervention would consist of executing a number of silent short sells over a specific period of time in futures markets around the world at a price lower than the current future price.
- The global intelligence unit would recommend the price or series of prices to be offered in the short sales

## What is the institutional design behind the reserves



## Comment 1: Relationship between Spot and futures prices

- Identifying a causal relation between spot and futures prices appears then to be an empirically issue.
- We attempt to do so by using recent price data for corn, wheat and soybeans.
- In particular, we address the following questions,
  - Do changes in futures prices lead changes in spot prices?
  - Or, do price changes in spot markets lead price changes in futures markets?
  - Or, are there bidirectional information flows between spot and futures prices?

## Comment 1: 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 Schwarz 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, 5, 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.

Source: Hernandez & Torero (2009)

## Comment 1: Additional linear causality tests

Tests were also performed on sample sub periods to analyze if the dynamic relation between spot and futures markets has changed across time.

- Causality tests for separate 2-year periods.
- Causality tests for each sample sub period corresponding to a different farm program (1990, 1996, 2002 & 2008 Farm Bills).
- Rolling causality tests: repeated tests over 104-week periods by rolling the subsample period one week ahead until the available data is exhausted.
- Nonparametric causality tests were performed to uncover potential nonlinear dynamic relations between spot and futures markets. The test proposed by Diks and Panchenko (2006) is implemented.

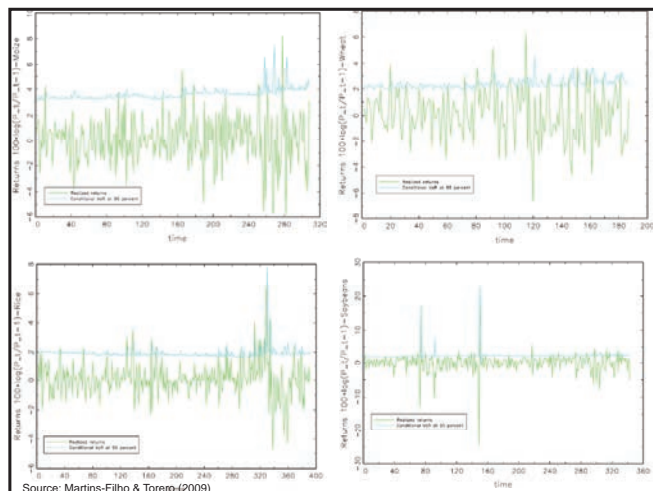
**Overall, it appears that futures markets have generally dominated spot markets in the past years.**

## Comment 2: Identifying spikes to trigger more detail analysis

Dates in which realized returns exceed the 95% conditional quantile. These are not the precise weeks in which returns exceed the conditional, but months where violations were occurring (based on Extreme Value Theory).

<b>Wheat:</b> December 2005 January/February/March 2007 November 2007 July/August/September 2008	<b>Rice:</b> January/February 2003 July/August/September 2003 June/July/August/September 2006 July/August 2007
<b>Maize:</b> October/November 2003 November/December 2006 and January/February/March 2007 May 2008	<b>Soybeans:</b> January 2004 July/August 2005 August/September/October 2008

Source: Martins-Filho & Torero (2009)



Source: Martins-Filho & Torero (2009)

## Comment 2: Estimation of quantiles based on non linear models of commodity price dynamics and extreme value theory

### Stage 1:

We estimate  $m(P_{t-1})$  nonparametrically using the local linear estimator of Fan (1992) and obtain  $\hat{m}(P_{t-1})$ .

We let  $\hat{\epsilon}_t = (P_t - \hat{m}(P_{t-1}))^2$ , and define a nonparametric local linear estimator for  $\sigma^2(P_{t-1})$  by regressing  $\hat{\epsilon}_t$  on  $P_{t-1}$  and obtain  $\hat{\sigma}^2(P_{t-1})$ .

### Stage 2:

In the second stage of the estimation we obtain estimators for  $q_\alpha$ . The estimation is based on a fundamental result from extreme value theory, which states that the distribution of the exceedances of any random variable ( $\epsilon$ ) over a specified nonstochastic threshold  $u$ , i.e,  $Z = \epsilon - u$  can be suitably approximated by a generalized pareto distribution. First stage estimators  $\hat{\mu}_t$  and  $\hat{\sigma}_t^2$  can be used to produce a sequence of standardized residuals  $\left\{ e_t = \frac{P_t - \hat{\mu}_t}{\hat{\sigma}_t} \right\}_{t=1}^n$  which are used to estimate  $F_\epsilon$  for large  $\alpha$  and their associated quantiles  $q_\alpha$ . This estimation procedure is conducted via L-Moments introduced by Hosking (1990) and Hosking and Wallis (1997). Combining the estimated quantile  $\hat{q}_\alpha$  with first stage estimators and using (2) gives estimators for

$\tau_\alpha$ .



### Final Remarks on market volatility

- Markets are INTER-RELATED!
- We all understand that futures assets are zero-net-supply
- The point is whether movements in asset markets can have real effects or not
- As long as transactions by index traders in futures markets motivates transactions by others in the spot market there will be an impact in the spot price and on the real economy
- If there is a lesson from this financial crisis is that the financial sector (which is a market for paper, assets) can have large effects on real markets (goods, factors, etc.)

### 3. Expand social protection and nutrition action

#### **Protective:**

- Cash transfers (conditional)
- Employment programs

#### **Preventive:**

- School feeding
- Early childhood nutrition programs

### 4. Linking producers to Markets

#### **A. Capture heterogeneity**

#### **B. Infrastructure specially today.**

#### **C. Institutional innovations**

### Final remarks on linking farmers to markets

- Infrastructure have positive effects
- There is a need to capture complementarities
- Infrastructure have to be analyzed under the full value chain
- Need for a value chain approach
- Contract farming and farmer associations could be a solution
- We need to capture the heterogeneity of farmers