Futures markets - grain price volatility and *global food security*

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Overview

1. Food price volatility and the poor

2. Prices and grain futures markets (US, Brazil, Europe)

3. Speculation

4. New institutional arrangements needed
Commodity price spike, 2007-08

Price spike

Closer linkages between commodity markets – how about over-arching forces?

Source: Data from FAO 2009 and IMF 2009.
Food prices in developing countries remained high – why?

food price as of April 2009
(790 domestic price quotations in 58 developing countries)

- 78% > 12 months earlier
- 43% > 3 months earlier
- 17% Highest on record

Source: FAO 2009.
Why we need to care:
People in low-income countries are sensitive to changes in food prices

Price elasticities of maize demand in Zambia (south)

<table>
<thead>
<tr>
<th>Category</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small farm</td>
<td>-0.60</td>
</tr>
<tr>
<td>Rural nonfarm</td>
<td>-0.58</td>
</tr>
<tr>
<td>Middle and urban rich</td>
<td>-0.16</td>
</tr>
<tr>
<td>Urban poor</td>
<td>-0.24</td>
</tr>
<tr>
<td>National aggregate</td>
<td>-0.64</td>
</tr>
</tbody>
</table>

Source: Dorosh, Dradri and Haggblade 2009.
Why we need to care:
Human costs of volatile prices are high

Price stocks and malnutrition in Sudan (Kordofan) children, Jan 1981-Dec 1986

Must included these effects in sound econ. analysis of price volatility

Joachim von Braun, ZEF, 2010
Overview

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Questions

• Is there a relationship between futures and spot prices?

• whether the price volatility between the international trading centers was carried over during the price changes of 2008?

• what relationships among commodities or marketplaces?
Relationship between Spot and futures prices

• Identifying a causal relation between spot and futures prices appears 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 bi-directional information flows between spot and futures prices?
## Linear causality test on returns

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

<table>
<thead>
<tr>
<th># lags</th>
<th>Corn</th>
<th>Hard Wheat</th>
<th>Soft Wheat</th>
<th>Soybeans</th>
<th>Corn</th>
<th>Hard Wheat</th>
<th>Soft Wheat</th>
<th>Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>167.47***</td>
<td>263.03***</td>
<td>169.85***</td>
<td>15.44***</td>
<td>6.10***</td>
<td>2.20</td>
<td>0.40</td>
<td>0.55</td>
</tr>
<tr>
<td>2</td>
<td>116.20***</td>
<td>186.92***</td>
<td>106.61***</td>
<td>21.24***</td>
<td>2.09</td>
<td>0.02</td>
<td>0.01</td>
<td>0.47</td>
</tr>
<tr>
<td>3</td>
<td>77.58***</td>
<td>135.27***</td>
<td>75.33***</td>
<td>20.74***</td>
<td>2.24*</td>
<td>0.11</td>
<td>0.27</td>
<td>1.75</td>
</tr>
<tr>
<td>4</td>
<td>58.56***</td>
<td>100.84***</td>
<td>57.92***</td>
<td>16.93***</td>
<td>2.08*</td>
<td>0.97</td>
<td>1.50</td>
<td>1.41</td>
</tr>
<tr>
<td>5</td>
<td>48.65***</td>
<td>79.91***</td>
<td>46.38***</td>
<td>14.57***</td>
<td>1.66</td>
<td>1.32</td>
<td>1.59</td>
<td>1.28</td>
</tr>
<tr>
<td>6</td>
<td>40.63***</td>
<td>65.92***</td>
<td>38.36***</td>
<td>12.41***</td>
<td>1.59</td>
<td>1.21</td>
<td>1.64</td>
<td>1.06</td>
</tr>
<tr>
<td>7</td>
<td>34.76***</td>
<td>56.21***</td>
<td>32.90***</td>
<td>11.51***</td>
<td>2.12**</td>
<td>1.45</td>
<td>1.76*</td>
<td>0.96</td>
</tr>
<tr>
<td>8</td>
<td>30.95***</td>
<td>49.91***</td>
<td>29.37***</td>
<td>10.35***</td>
<td>1.97**</td>
<td>1.21</td>
<td>1.46</td>
<td>1.06</td>
</tr>
<tr>
<td>9</td>
<td>27.62***</td>
<td>44.64***</td>
<td>26.09***</td>
<td>9.38***</td>
<td>1.58</td>
<td>1.10</td>
<td>1.25</td>
<td>1.04</td>
</tr>
<tr>
<td>10</td>
<td>24.80***</td>
<td>40.89***</td>
<td>23.44***</td>
<td>9.05***</td>
<td>1.45</td>
<td>1.21</td>
<td>1.21</td>
<td>1.03</td>
</tr>
</tbody>
</table>

*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.


**Source:** Hernandez & Torero (2009)

Joachim von Braun, ZEF, 2010
USA, Brazil, Europe Data

Futures for corn contracts (March 08) at the exchanges of Chicago (CBOT), Paris (MATIF) and São Paulo (BMF/BRAZ)

Source: von Ledebur 2010
Testing volatility

- GARCH Modells (Generalized Autoregressive Conditional Heteroscedasticity)
  - variance is dependent upon innovations and past variance values.
  - Allows modelling of the variance based on actual available information (prices, returns).
Only after calculation of the returns the series 2007-08 are suitable to be used in the model:

\[ r_t = \mu + \varepsilon_t \]

Quelle: Eigene Berechnungen

Source: von Ledebur
## Results

### Estimation results

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Coeficient</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu_1$</td>
<td>0.0012</td>
<td>0.2850</td>
</tr>
<tr>
<td>$\mu_2$</td>
<td>0.0024</td>
<td>0.0475</td>
</tr>
<tr>
<td>$\mu_3$</td>
<td>0.0026</td>
<td>0.0210</td>
</tr>
<tr>
<td>$c_{01}$</td>
<td>0.0026</td>
<td>0.6539</td>
</tr>
<tr>
<td>$c_{02}$</td>
<td>0.0018</td>
<td>0.5760</td>
</tr>
<tr>
<td>$c_{03}$</td>
<td>0.0037</td>
<td>0.5903</td>
</tr>
<tr>
<td>$c_{04}$</td>
<td>0.0047</td>
<td>0.0093</td>
</tr>
<tr>
<td>$c_{05}$</td>
<td>-0.0005</td>
<td>0.9102</td>
</tr>
<tr>
<td>$c_{06}$</td>
<td>0.0000</td>
<td>1.0000</td>
</tr>
<tr>
<td>$a_{11}$</td>
<td>-0.0700</td>
<td>0.4179</td>
</tr>
<tr>
<td>$a_{22}$</td>
<td>0.2332</td>
<td>0.0002</td>
</tr>
<tr>
<td>$a_{33}$</td>
<td>0.4709</td>
<td>0.0000</td>
</tr>
<tr>
<td>$b_{11}$</td>
<td>0.9855</td>
<td>0.0000</td>
</tr>
<tr>
<td>$b_{22}$</td>
<td>0.9216</td>
<td>0.0000</td>
</tr>
<tr>
<td>$b_{33}$</td>
<td>0.8745</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

### Variance CBOT

$$h_{11} = c_{01} + a_{11}^2 \varepsilon_1^2 + b_{11}^2 h_1^2$$

### Covariance CBOT-MATIF

$$h_{21} = c_{02} + a_{11} a_{22} \varepsilon_2 \varepsilon_1 + b_{11} b_{22} h_{21}$$

### Covariance CBOT-BRAZ

$$h_{31} = c_{03} + a_{11} a_{33} \varepsilon_3 \varepsilon_1 + b_{11} b_{33} h_{31}$$

### Variance MATIF

$$h_{22} = c_{04} + a_{22}^2 \varepsilon_2^2 + b_{22}^2 h_2^2$$

### Covariance MATIF-BRAZ

$$h_{32} = c_{05} + a_{22} a_{33} \varepsilon_3 \varepsilon_2 + b_{22} b_{33} h_{32}$$

### Variance BRAZ

$$h_{33} = c_{06} + a_{33}^2 \varepsilon_3^2 + b_{33}^2 h_3^2$$

Source: von Ledebur 2010
Observations and interpretations:

- spill-over effects of the Chicago market on MATIF and Brazil only via the covariance.
- interactions between MATIF and Brazil existed
- import ban on genetic corn into Europe as well as the simultaneous ethanol boom led to changed price development of futures on the Chicago Futures Exchange.
- This resulted in a decoupling of the price development on the exchanges in Europe and Brazil.

Fazit:

- Institutional conditions influenced the markets, or partly isolate them from each other.
- volatility of future prices at different market places do impact each other

Source: von Ledebur 2010
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Speculation? The expansion of options and futures

Grain and oilseed futures and options - Ave. daily volume

Causalities and consequences?

Source: Chicago Board of Trade 2008.
Believes:

- "speculators are either useful or they destroy themselves" (De Jasay)
- All speculators at all times are followers of market fundamentals (i.e. the mayor causality with minor reverse causality)

Difficulties to test and quantify scale of speculation permit believers to dominate the debates.

Regulatory regimes have changed.

Index trading and inclusion of food in commodity asset positions has increased.
Speculation and prices: Evidence of causality

<table>
<thead>
<tr>
<th>Indicator of speculation activity</th>
<th>Commodity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wheat</td>
</tr>
<tr>
<td>1. Monthly volume (futures contracts CBOT)</td>
<td>+</td>
</tr>
<tr>
<td>2. Monthly open interest (futures contracts CBOT)</td>
<td>+</td>
</tr>
<tr>
<td>3. Ratio volume to open interest (1)/(2) (futures contracts)</td>
<td>+</td>
</tr>
<tr>
<td>4. Ratio non-commercial positions to total reportable positions (long)</td>
<td>+</td>
</tr>
<tr>
<td>5. Ratio non-commercial positions to total reportable positions (short)</td>
<td>+</td>
</tr>
<tr>
<td>6. Index traders net positions (long – short positions)*</td>
<td>+</td>
</tr>
</tbody>
</table>

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

Evidence of causality

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

Index = F statistic - F critical value

Food crisis period

Source: Robles, Torero, and von Braun (2009)
The BCDI Index is a composite index of banking, currency, sovereign default, and inflation crises. It was developed by C. Reinhart and K. Rogoff, and presented at Brookings Institution in April, 2009.

Commodity prices, inflation, and monetary policy

Agr. Price booms are better explained by common factors (demand growth, monetary expansion, exchange rate movement) than by market-specific factors, such as supply shocks.

Futures index position = 42.5% of implied price change 2006-08 (analysis by C.L. Gilbert JAgE, 2010)

2000s: monetary expansion spill to commodities
End-2004: oil price spill to food, to effect on core inflation
2004-07: Tighter monetary policy part of trigger to recession (from housing market defaults to decreased consumption and incomes)

Source: Data from US Bureau of Labor Statistics.

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Comprehensive re-evaluation of the costs of volatility needed

1. miss-allocation of resources due to distorted price information and price expectations
2. short-term subsidization for the rescue at the cost of investment
3. Political cost due to protests, violence and destabilization feedbacks in fragile states
4. health and nutrition effects (costs) among the poor, and for the very long run among children
5. Undermined trust in market economy leading to undue preference for regulation and planning
Reversal in grain stock policy - inefficient

Cereal stocks

<table>
<thead>
<tr>
<th>Country</th>
<th>2006</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>149</td>
<td>206.9</td>
</tr>
<tr>
<td>India</td>
<td>25.8</td>
<td>39.4</td>
</tr>
<tr>
<td>EU</td>
<td>44.4</td>
<td>54.5</td>
</tr>
</tbody>
</table>

Source: Based on data from FAO 2009.
• Agricultural market …:
  - Is a concentrated market
  - Is very volatile
  - Affects lives of poor people strongly (much more than oil and minerals)

This argues for appropriate regulation to strengthen market functioning, incl. the functioning of commodity exchanges, to prevent price spike situations
What to do about volatility?

1. *Keep trade open* at times of global and regional food shortage – incentives / rules for trade openness are needed

2. Regulation of food commodity markets (address as part of financial market regulations)
What to do about volatility?

3. Establish grain reserves policy at global level with three components

   e) emergency reserve,

   s) shared physical reserves, and

   v) virtual reserve (a new institution at global level needed)
Institutional design behind virtual reserves

Intelligence unit
- Model fundamentals
- Model dynamic price band
- Trigger alarm

High level technical commission
- Approve intervention

Country commitment to supplying funds

Futures market

Source: von Braun, Torero 2009
Time to act, but who?

Implementation pathways:
• Roles of agencies? (WTO, FAO, IFPRI, WFP, World Bank, IMF, …)
• G20 in 2010
• or at regional levels? (ASEAN, COMESA)
• EU and US roles

The food price volatility issue is part of the global food and agriculture governance deficiencies