Does the price talk match the price walk?
- a re-view of evidence

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Background information

This presentation is based on previous work (*), updated with additional analysis by

- DG AGRI on world demand patterns (presented by T. Haniotis at G-20 Seminar in Buenos Aires)
- J. Baffes work on the causes of price volatility (presented in the Commission workshop on world market prospects)

Opinions expressed here are personal and do not necessarily reflect a formal position of our respective institutions

* J. Baffes and T. Haniotis, Placing the 2006/08 Commodity Price Boom, WB PRWP5371, July 2010
Outline

1. The “price talk” on the causes of price volatility
2. The “price walk” on the causes of price volatility
3. What to conclude and what to further study
Long term commodity price trends

(World Bank MUV-deflated indices, 2000=100)

Nominal commodity prices indices (2005 = 100)

Recent trends in commodity prices

(World Bank nominal price indices, 2000=100)

Outline

1. The “price talk” on the causes of price volatility
2. The “price walk” on the causes of price volatility
3. What to conclude and what to further study
While the commodity price boom has been attributed to many factors...

**Common/macro factors**
- Economic growth
- Weak dollar
- Fiscal expansion
- Low cost of capital
- Financialisation of commodities

**Sector-specific factors**

*Exogenous to agriculture*
- Energy prices
- Weather
- Food demand
- Biofuels

*Endogenous to agriculture*
- Policies
- Underinvestment
- Low stocks
...the “price talk” attributes the agricultural price boom to a selective few

**Common/macro factors**
- Economic growth
- Weak dollar
- Fiscal expansion
- Low cost of capital
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**Sector-specific factors**

**Exogenous to agriculture**
- Energy prices
- Weather
  - Food demand
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- Policies
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Outline

1. The “price talk” on the causes of price volatility

2. The “price walk” on the causes of price volatility

3. What to conclude and what to further study
Four basic questions on commodity price movements

1. Is price volatility higher than in the past?

2. Is this driven by higher yield variability?

3. Is it due to a sharp increase in food demand?

4. Are prices more responsive to stock changes?

Focus of AGRI analysis: developments in commodities since 1961
Q3: Is volatility due to food demand patterns?

1. The **rate** of demand growth has decreased over the last 50 years for most products and countries.

2. Notable exceptions are vegetable oils, and recently dairy products and maize.

3. Compared to demand growth, crops yields are slowing down faster.

4. Energy and minerals/metals: Demand growth is on the increase since the mid 1980s (iron, aluminium) and the mid 1990s (crude oil).
World consumption growth rates - crops

Annual % rate of growth in period

Wheat  Maize  Rice  Total grains  Total grains for feed  Soybeans  Soybean meal  Palm oil  Soybean oil  Total vegetable oils

Sources: FAO; European Commission – Eurostat and DG Agriculture and Rural Development; USDA.
Comparing consumption and yield growth

Annual % rate of growth in period

Sources: FAO; European Commission – Eurostat and DG Agriculture and Rural Development; USDA.
World consumption growth rates - livestock

Annual % rate of growth in period

Sources: FAO; European Commission – Eurostat and DG Agriculture and Rural Development; USDA.
Consumption in metals, minerals, energy

Annual % rate of growth in period

Sources: FAO; European Commission – Eurostat and DG Agriculture and Rural Development; USDA.
Per capita cereal consumption

*(based on a non-parametric, locally weighted, trend regression)*

Source: Author’s calculation from US Department of Agriculture data
# Meat consumption growth in China and India

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>8.2</td>
<td>10.8</td>
</tr>
<tr>
<td>Beef</td>
<td>3.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Pork</td>
<td>2.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Poultry</td>
<td>4.9</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Source: EC-DG AGRI.L1 based on FAO and USDA data
Net imports and consumption shares, 1990-99

Source: Authors calculations from US Department of Agriculture data
Note: The US is not included in the figure. Its (net) exports and consumption shares were 39% and 13%.
Net imports and consumption shares, 2000-09

Source: Authors calculations from US Department of Agriculture data
Note: The US is not included in the figure. Its (net) exports and consumption shares were 33% and 14%.
Issues on post-2005 developments in commodity markets

• Is this a “perfect storm” that still continues?

• What can simple models tell us?

• What about facts?

• Are we experiencing the emergence of a structural transformation or just deviations from longer term trends? When is a storm that goes on for 6 years no longer considered a storm?
Short-term movements

(Nominal indices, 2000=100)


* Adapted from J. Baffs: Commodity Markets: A New Structure or Deviations from Long Term Trends?
The ‘perfect storm’ impacting upon agricultural prices

<table>
<thead>
<tr>
<th></th>
<th>2001-05</th>
<th>2006-10</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agricultural prices (nominal index, 2000 = 100)</strong></td>
<td>117</td>
<td>198</td>
<td>+ 69%</td>
</tr>
<tr>
<td><strong>Grain/oilseed price volatility (standard deviation of log differences, monthly)</strong></td>
<td>2.3</td>
<td>3.5</td>
<td>+ 52%</td>
</tr>
<tr>
<td>Crude oil price (US$/barrel, nominal)</td>
<td>33</td>
<td>75</td>
<td>+ 127%</td>
</tr>
<tr>
<td>Fertiliser prices (nominal index 2000 = 100)</td>
<td>120</td>
<td>310</td>
<td>+ 157%</td>
</tr>
<tr>
<td>Exchange rates (US$ against a broad index of currencies)</td>
<td>119</td>
<td>104</td>
<td>- 13%</td>
</tr>
<tr>
<td>Interest rates (10-year US Treasury bill)</td>
<td>4.7</td>
<td>4.1</td>
<td>- 14%</td>
</tr>
<tr>
<td>Funds invested in commodities ($ billion)</td>
<td>30</td>
<td>230</td>
<td>+ 667%</td>
</tr>
<tr>
<td>GDP growth (Low and middle income countries, % p.a.)</td>
<td>5.0</td>
<td>5.8</td>
<td>+ 16%</td>
</tr>
<tr>
<td>Industrial production (low and middle income countries, % p.a.)</td>
<td>6.3</td>
<td>7.1</td>
<td>+ 13%</td>
</tr>
<tr>
<td>Biofuel production (million of barrels per day equivalent)</td>
<td>0.4</td>
<td>1.3</td>
<td>+ 203%</td>
</tr>
<tr>
<td>Stocks (total of maize, wheat, and rice, months of consumption)</td>
<td>3.2</td>
<td>2.5</td>
<td>- 21%</td>
</tr>
<tr>
<td>Yields (average of wheat, maize, and rice, tons/hectare)</td>
<td>3.8</td>
<td>4.0</td>
<td>+ 7%</td>
</tr>
<tr>
<td>Growth in yields (% change per annum, average)</td>
<td>1.4</td>
<td>1.0</td>
<td>- 32%</td>
</tr>
<tr>
<td>Natural disasters (droughts, floods, and extreme temperatures)</td>
<td>374</td>
<td>441</td>
<td>+ 18%</td>
</tr>
</tbody>
</table>


* Adopted from J. Baffes: Commodity Markets: A New Structure or Deviations from Long Term Trends?
A reduced-form econometric model

\[ \log(P_{ti}) = \mu + \beta_1 \log(S/U_{t-1}) + \beta_2 \log(P_{tOIL}) + \beta_3 \log(X_{Rt}) \\
+ \beta_4 \log(R_t) + \beta_5 \log(GDP_{t}) + \beta_6 \log(MUV_{t}) + \beta_7 t + \epsilon_t \]

- \( P_{ti} \): the annual average nominal price of commodity (maize, wheat, rice, soybeans, and palm oil)
- \((S/U)_{t-1}\) : lagged stock-to-use ratio
- \(P_{tOIL}\): price of crude oil (average of Brent, WTI, and Dubai)
- \(X_{Rt}\): exchange rate (US$ against a broad index of currencies)
- \(R_t\): interest rate (10-year US Treasury)
- \(MUV_{t}\): inflation (exports price index of manufactures by G-5)
- \(GDP_{t}\): world GDP (global; GDP in US$)
- \(t\): time trend
- \(\beta\) is: parameters to be estimated
- \(\epsilon_t\): error term
## Parameter estimates: Agriculture, 1960-2010

<table>
<thead>
<tr>
<th></th>
<th>Maize</th>
<th>Wheat</th>
<th>Rice</th>
<th>Soybeans</th>
<th>Palm oil</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S/U ratio</strong></td>
<td>-0.45***</td>
<td>-0.53***</td>
<td>-0.08</td>
<td>-0.17**</td>
<td>-0.38**</td>
</tr>
<tr>
<td><strong>Oil price</strong></td>
<td>0.19***</td>
<td>0.24***</td>
<td>0.25***</td>
<td>0.31***</td>
<td>0.45***</td>
</tr>
<tr>
<td><strong>Exchange rate</strong></td>
<td>0.02</td>
<td>-0.81***</td>
<td>-2.83***</td>
<td>-1.31***</td>
<td>-1.09*</td>
</tr>
<tr>
<td><strong>Interest rate</strong></td>
<td>-0.05</td>
<td>0.05</td>
<td>0.34***</td>
<td>-0.06</td>
<td>-0.04</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.05**</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Inflation</strong></td>
<td>0.64</td>
<td>0.08</td>
<td>0.62</td>
<td>-0.01</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Trend*100</strong></td>
<td>-1.76***</td>
<td>-0.65</td>
<td>-0.76</td>
<td>-1.14*</td>
<td>-2.17**</td>
</tr>
<tr>
<td><strong>Adjusted-R^2</strong></td>
<td>0.87</td>
<td>0.91</td>
<td>0.76</td>
<td>0.84</td>
<td>0.62</td>
</tr>
<tr>
<td><strong>DW</strong></td>
<td>1.03</td>
<td>1.10</td>
<td>1.03</td>
<td>1.27</td>
<td>1.24</td>
</tr>
<tr>
<td><strong>ADF</strong></td>
<td>-3.90***</td>
<td>-5.52***</td>
<td>-3.96***</td>
<td>-4.68***</td>
<td>-4.43***</td>
</tr>
</tbody>
</table>

*Notes: Asterisks indicate levels of significance: (*) for 10%, (**) for 5%, and (*** for 1% levels. DW is the Durbin Watson statistic for serial correlation. ADF is the Augmented-Dickey Fuller statistic for unit root.*
What matters most for what prices?

**Contribution of each variable to price changes from 2000-05 to 2006-10, percent**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Maize</th>
<th>Wheat</th>
<th>Rice</th>
<th>Soybeans</th>
<th>Palm oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>S/U ratio</td>
<td>12.0</td>
<td>14.4</td>
<td>0.9</td>
<td>-2.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Oil price</td>
<td>32.6</td>
<td>41.4</td>
<td>27.2</td>
<td>57.0</td>
<td>58.2</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>-0.1</td>
<td>11.5</td>
<td>25.4</td>
<td>19.9</td>
<td>11.9</td>
</tr>
<tr>
<td>Interest rate</td>
<td>0.5</td>
<td>-0.5</td>
<td>-2.0</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>GDP</td>
<td>0.4</td>
<td>0.4</td>
<td>1.2</td>
<td>-0.4</td>
<td>-0.3</td>
</tr>
<tr>
<td>Inflation</td>
<td>13.6</td>
<td>1.7</td>
<td>-8.4</td>
<td>-0.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Trend</td>
<td>-0.3</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.3</td>
</tr>
<tr>
<td><strong>SUM (of the above)</strong></td>
<td><strong>58.7</strong></td>
<td><strong>68.8</strong></td>
<td><strong>44.2</strong></td>
<td><strong>74.3</strong></td>
<td><strong>71.8</strong></td>
</tr>
<tr>
<td>Residual</td>
<td>41.3</td>
<td>31.2</td>
<td>55.8</td>
<td>25.7</td>
<td>28.2</td>
</tr>
<tr>
<td><strong>ALL (SUM + Residual)</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>


* Adapted from J. Baffes: Commodity Markets: A New Structure or Deviations from Long Term Trends?
Gap between actual and model-generated prices: wheat


* Adapted from J. Baffes: Commodity Markets: A New Structure or Deviations from Long Term Trends?
Parameter estimates: Metals (1990:Q1-2010:Q4)

<table>
<thead>
<tr>
<th></th>
<th>Copper</th>
<th>Zinc</th>
<th>Aluminum</th>
<th>Led</th>
<th>Nickel</th>
<th>Tin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocks</td>
<td>-0.01</td>
<td>-0.16***</td>
<td>0.04</td>
<td>-0.14***</td>
<td>-0.16***</td>
<td>-0.06*</td>
</tr>
<tr>
<td>Oil price</td>
<td>0.48***</td>
<td>0.16</td>
<td>0.09*</td>
<td>0.15</td>
<td>0.37***</td>
<td>0.16**</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>-0.72</td>
<td>-0.16</td>
<td>-0.67*</td>
<td>-0.92</td>
<td>-2.85***</td>
<td>-0.16</td>
</tr>
<tr>
<td>Interest rate</td>
<td>0.02</td>
<td>0.07</td>
<td>0.07***</td>
<td>-0.09**</td>
<td>-0.03</td>
<td>-0.18***</td>
</tr>
<tr>
<td>Ind. Prod.</td>
<td>0.96</td>
<td>1.19</td>
<td>2.40***</td>
<td>3.51***</td>
<td>3.11**</td>
<td>4.56***</td>
</tr>
<tr>
<td>Inflation</td>
<td>2.64***</td>
<td>1.96***</td>
<td>0.72**</td>
<td>2.82***</td>
<td>0.91</td>
<td>2.65***</td>
</tr>
<tr>
<td>Trend</td>
<td>-0.01</td>
<td>0.00</td>
<td>-0.01**</td>
<td>-0.02**</td>
<td>-0.02*</td>
<td>-0.03***</td>
</tr>
<tr>
<td>Adjusted-$R^2$</td>
<td>0.91</td>
<td>0.74</td>
<td>0.89</td>
<td>0.92</td>
<td>0.90</td>
<td>0.93</td>
</tr>
<tr>
<td>DW</td>
<td>0.59</td>
<td>0.38</td>
<td>0.74</td>
<td>0.73</td>
<td>0.64</td>
<td>1.02</td>
</tr>
</tbody>
</table>

Notes: Asterisks indicate levels of significance: (*) for 10%, (**) for 5%, and (***) for 1% levels. DW is the Durbin Watson statistic for serial correlation.
The energy link strengthened for all key price indices after 2005

Transmission elasticity estimates based on 2 OLS regressions, 1960-2005 and 1960-2010

This increase is often attributed to biofuels; however, other price indices exhibited even larger increases


* Adopted from J. Baffes: Commodity Markets: A New Structure or Deviations from Long Term Trends?
Energy remains one of the key drivers of agricultural prices

(cost of energy component measured in 2007, percent)

Source: GTAP preliminary release 0, version 8.
Note: Agriculture refers to crops (i.e., it excludes livestock); it includes both direct energy costs (mostly fuel) and chemicals (the most important of which is fertilizer). To avoid double-counting, manufacture does not include the refining sector.
Outline

1. The “price talk” on the causes of price volatility
2. The “price walk” on the causes of price volatility
3. What to conclude and what to further study
The largest demand shock of the past decade (6-fold increase).

Biofuel production shares in 2010: US (47 %), Brazil (28 %), EU (14 %). Ethanol (84 %), biodiesel (16 %).

Their effect on prices less than originally thought (the debate used to be heated and highly political, less so now).

Biofuels accounted for 2.2 % of global oil consumption in 2010 (up from 0.4 % in 2000) and 0.7 % of global energy consumption — crude oil accounts for 1/3 of global energy consumption.

Longer term issues: (i) biofuels becoming profitable at current energy prices; (ii) 2nd/3rd generations of biofuels may produce energy at much lower costs, thus putting further upward pressure on food prices. (i) and (ii) imply that energy prices are likely to set a floor to agricultural prices.

Source: BP Statistical Review
Funds invested in commodities have been increasing, expected to reach US$ 430 billion in 2011.

But, they only represent a small fraction of invested assets in investment, pension, and SWFs (estimated about US$ 35-40 trillion).

The debate is heated and highly political while the views are strong, ranging from “these funds have injected liquidity into commodity markets, thus ensuring price stability” to “these esoteric and complex instruments and practices spread as quickly as a deadly virus in a sci-fi flick.”

The empirical evidence is still weak. But, increasingly, more evidence comes in favour of impact (on variability not levels).

Although not expected to affect long term trends, most likely they affect short term price variability [strictly personal views].

Source: Bloomberg, Barclays Capital
Commodity markets – as they are evolving*

- **Domestic and trade policies** (from G-2 and 3 pillars to G-20 and export bans)
- **Weather variability increased due to climate change**
- **Macro linkages** (GDP, interest rates, exchange rates)
- **Demand and supply fundamentals**
- **Financialisation of commodities**
- **Energy links** (high energy prices, biofuels)

*Adapted from J. Baffes: Commodity Markets: A New Structure or Deviations from Long Term Trends?
Some tentative conclusions

Agriculture faces a major cost-driven commodity price boom
- the “baseline” outlook of agricultural markets is full of major uncertainties
- the energy link weighs heavily, directly and indirectly, on production costs
- the terms of trade for world agriculture deteriorated significantly

Price volatility is expected to stay high in the future
- price volatility and co-movement masks market signals
- extreme weather events add to sector uncertainty
- economic crisis impacts upon both supply (costs) and demand (prices)

Policy implications are complex
- agricultural price levels still drive policy debate, but are they relevant?
- cost developments introduce more complexity in income policy debate
- potential tension arises between economic and environmental targets