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)
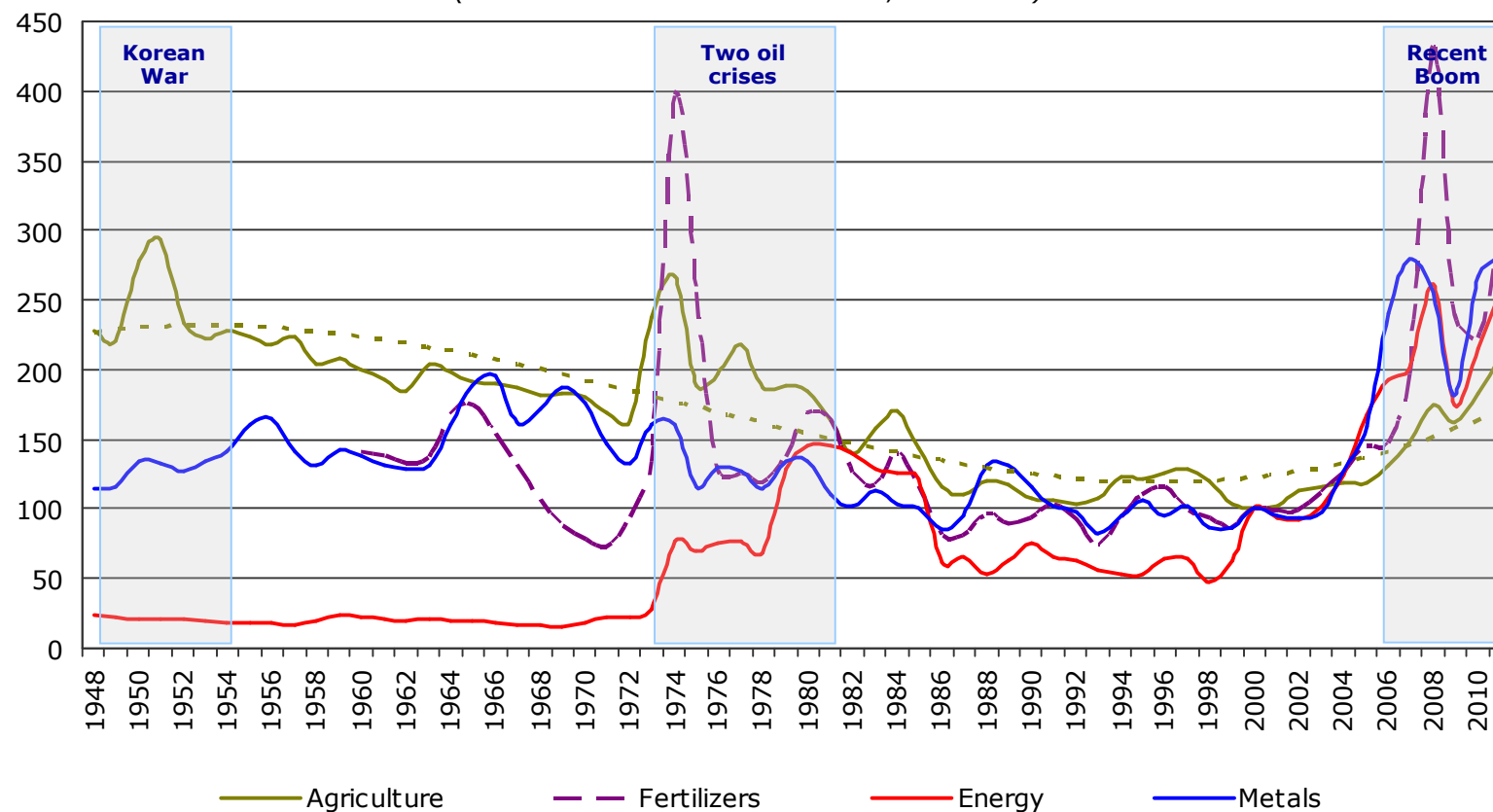
Source: World Bank. Note: 2011 figures as of November 2011.

Nominal commodity prices indices (2005 = 100)

Source: World Bank.

Recent trends in commodity prices

(World Bank nominal price indices, 2000=100)

Fertilisers + 180 %

Energy + 244 %

Agriculture + 61 %
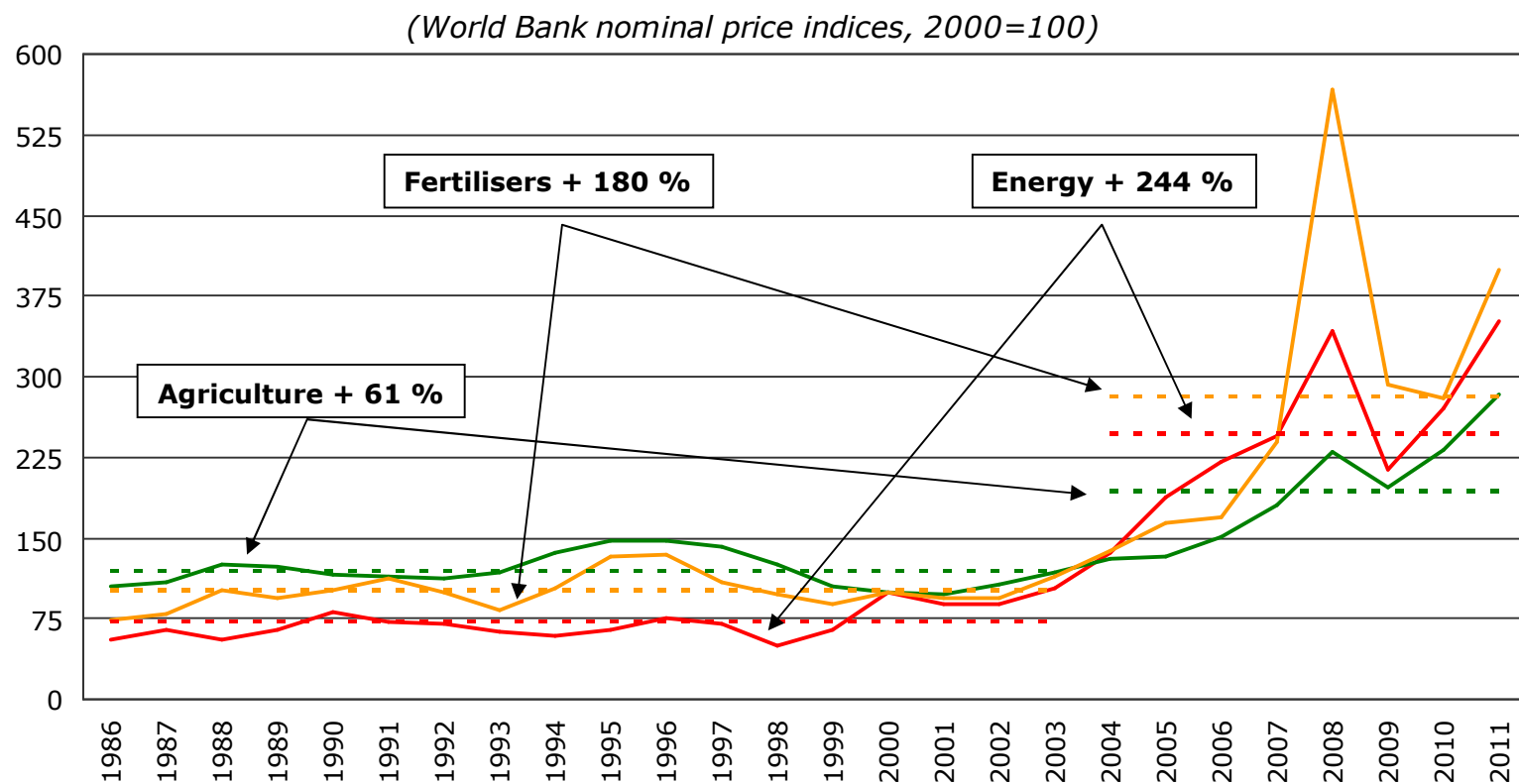
Source: World Bank.

Outline

1. The "price talk" on the causes of price volatility

2. The "price walk" on the causes of price volatility

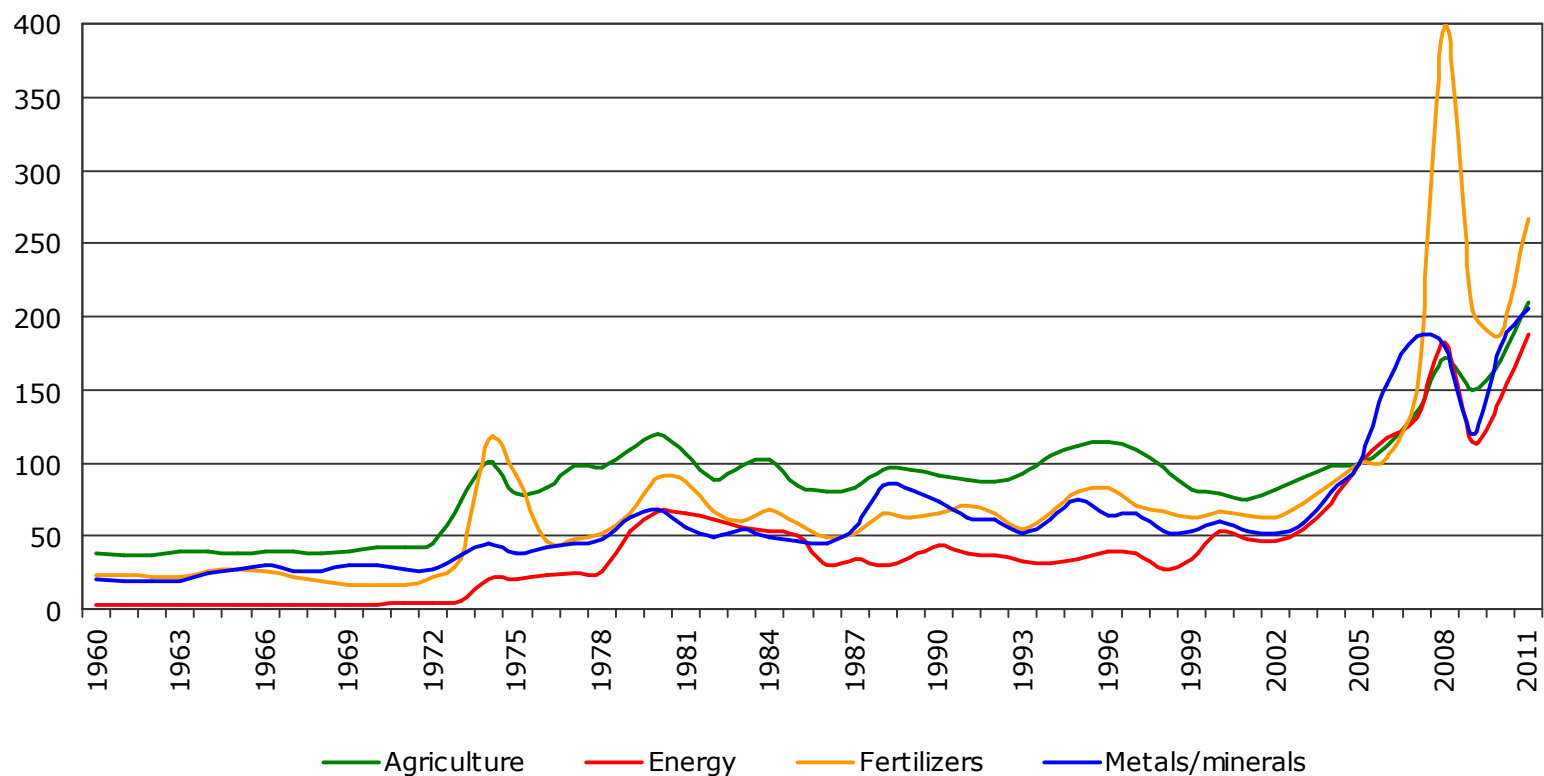3. What to conclude and what to further study

While the commodity price boom has been attributed to many factors...

Common/macro factors

o Economic growth

o Weak dollar

o Fiscal expansion

o Low cost of capital

o Financialisation of commodities

Sector-specific factors

Exogenous to agriculture

o Energy prices

o Weather

o Food demand

o Biofuels

Endogenous to agriculture

o Policies

o Underinvestment

o Low stocks

...the "price talk" attributes the agricultural price boom to a selective few

Common/macro factors

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o **Financialisation of commodities**

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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 <u>rate</u> 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
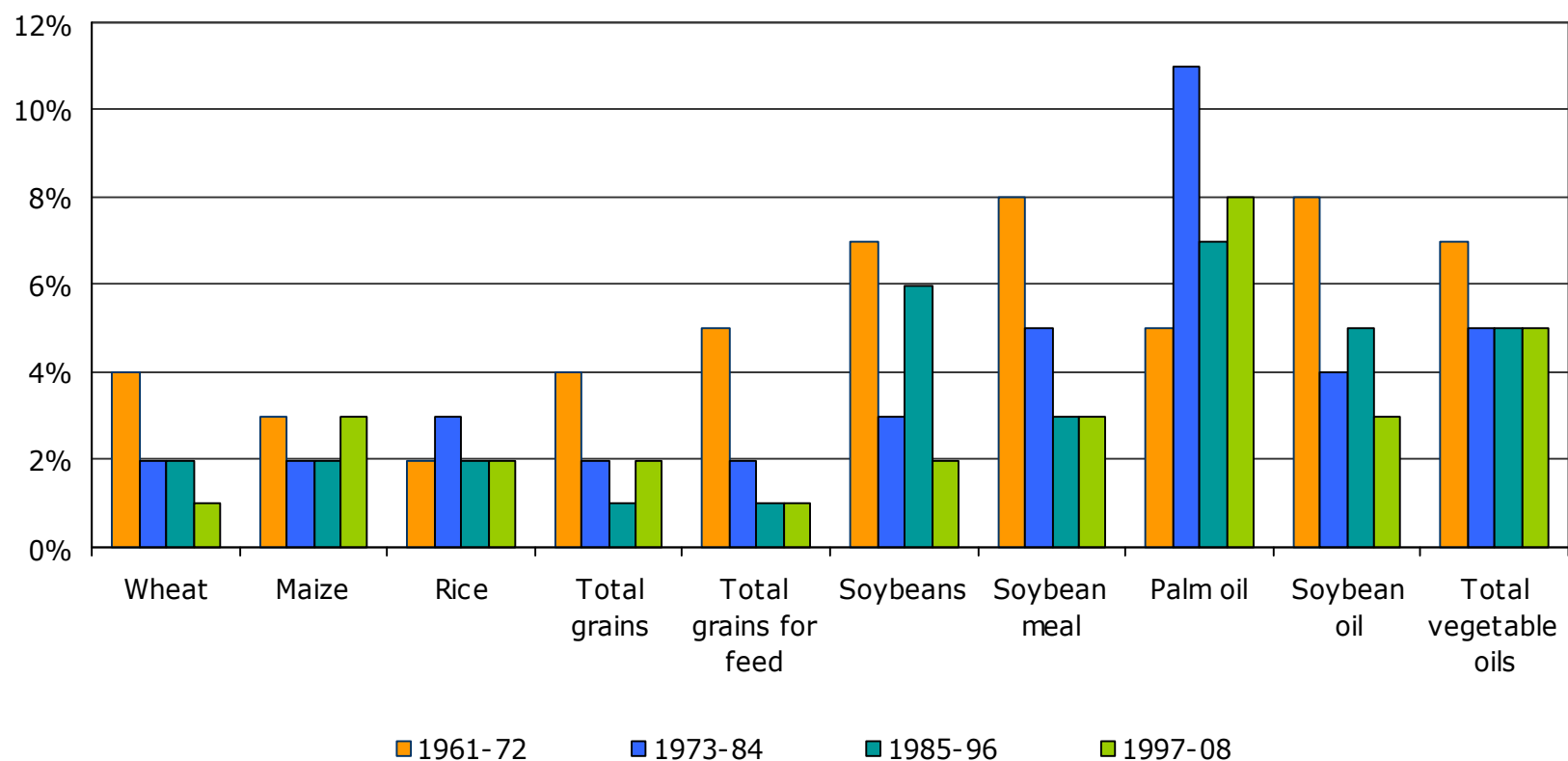
Comparing consumption and yield growth

Annual % rate of growth in period

Legend: ■ 1961-72 ■ 1973-84 ■ 1985-96 ■ 1997-08
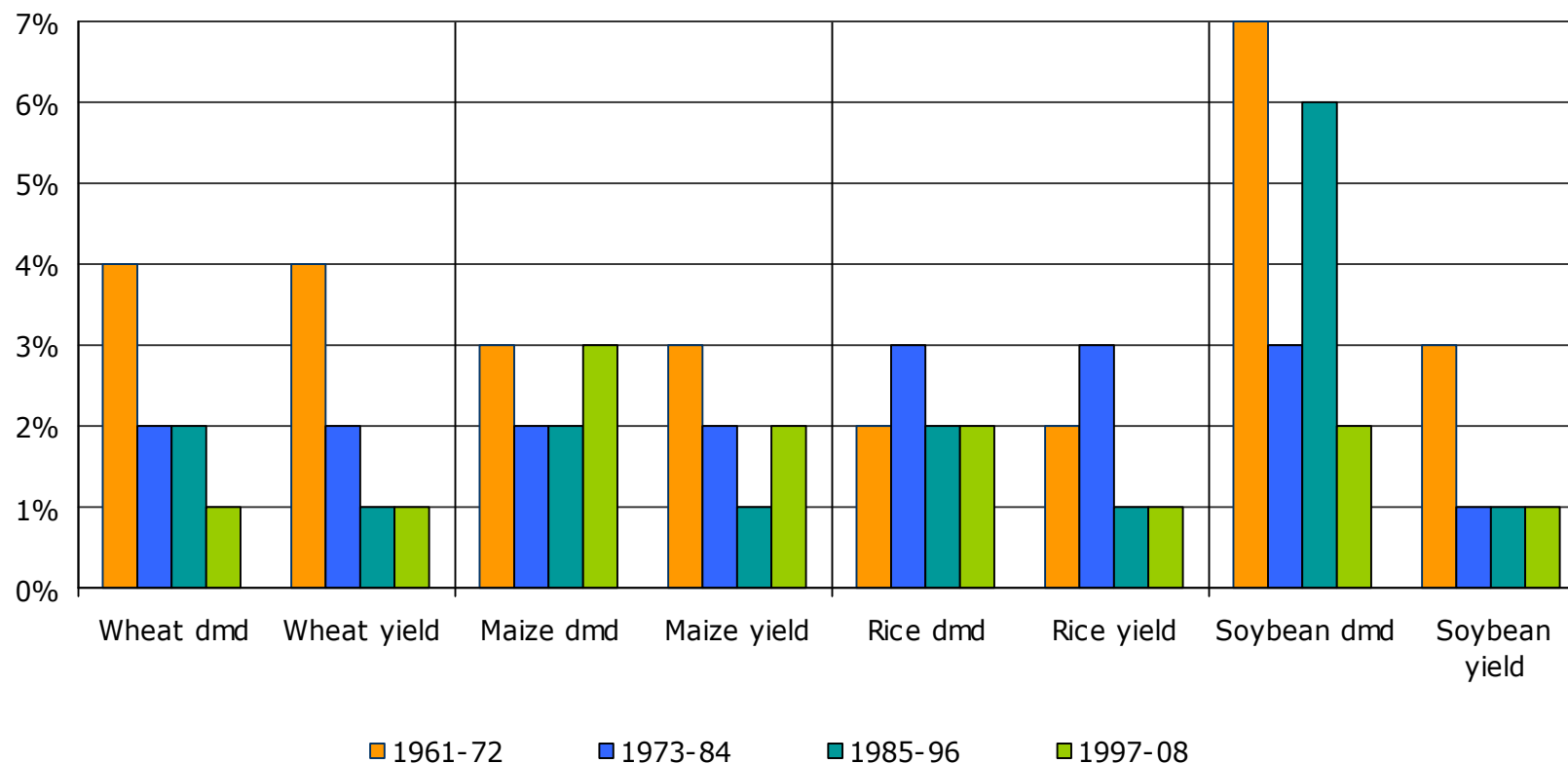
Sources: FAO; European Commission – Eurostat and DG Agriculture and Rural Development; USDA.

World consumption growth rates - livestock

Annual % rate of growth in period
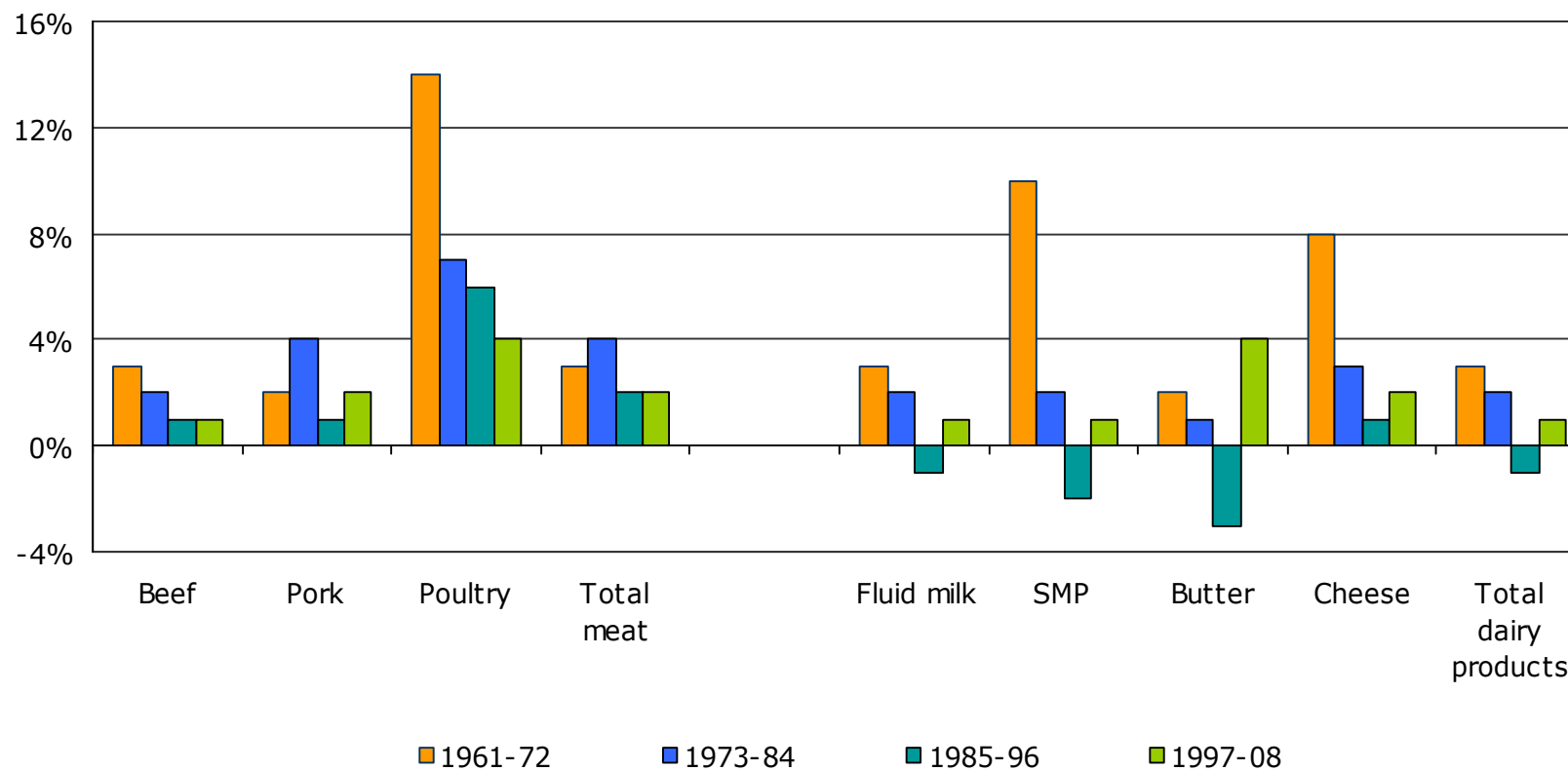
Sources: FAO; European Commission – Eurostat and DG Agriculture and Rural Development; USDA.

Consumption in metals, minerals, energy

Annual % rate of growth in period
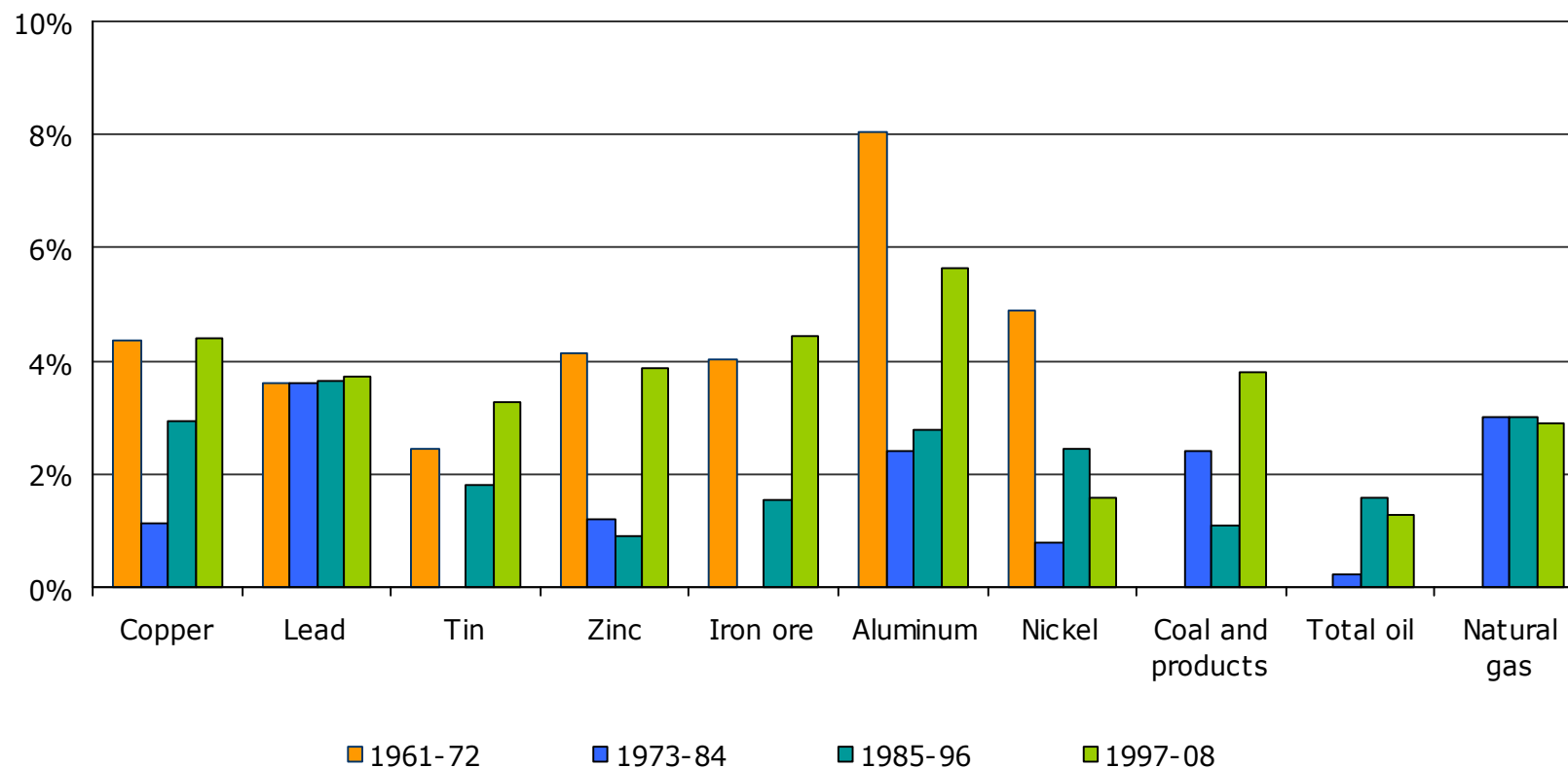
Legend: ■ 1961-72 ■ 1973-84 ■ 1985-96 ■ 1997-08

Per capita cereal consumption

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

Korea   Japan   China   Indonesia   India
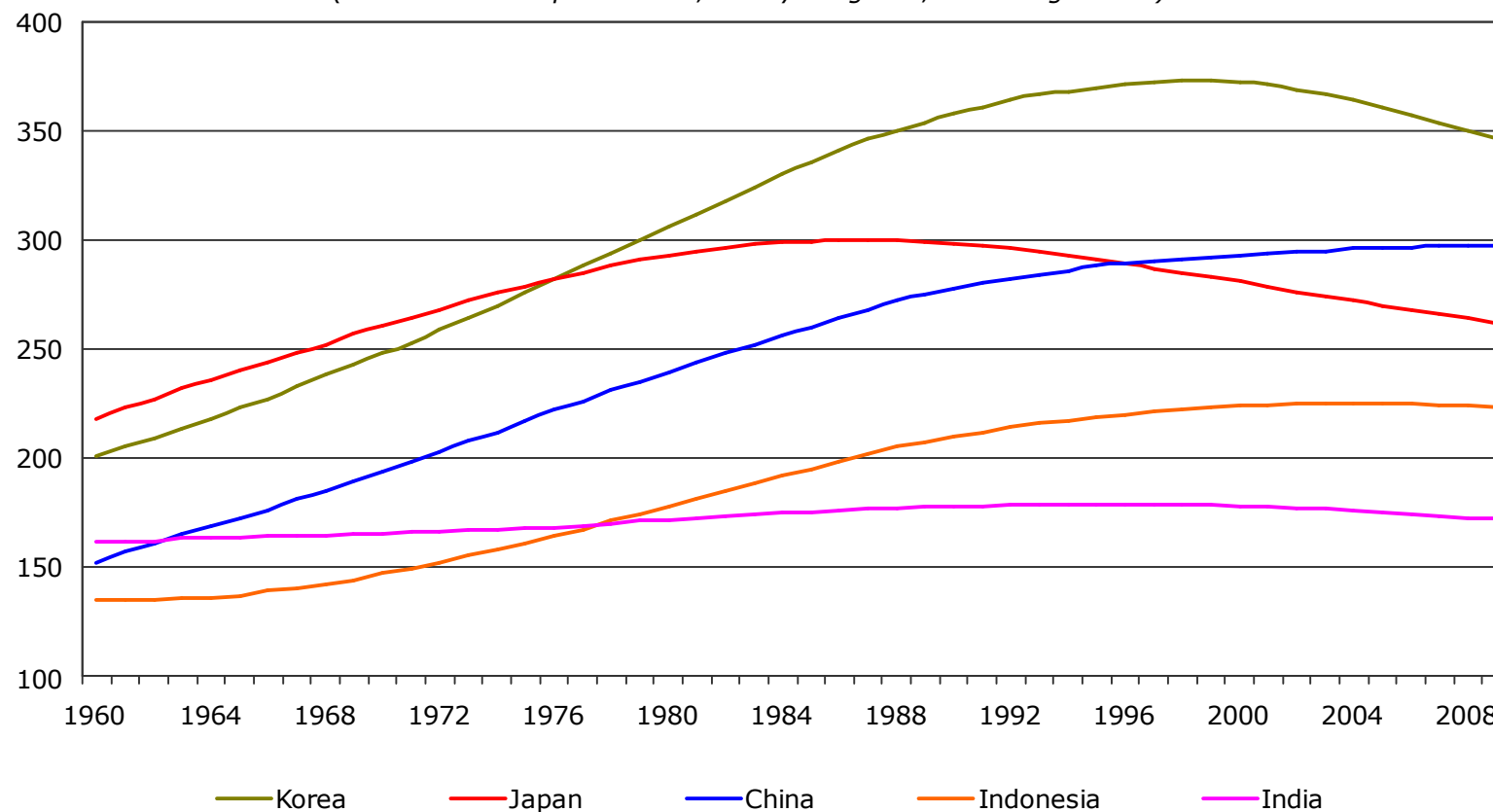
Source: Author's calculation from US Department of Agriculture data

Meat consumption growth in China and India

	China		India	
	1997-2002	**2003-08**	**1997-2002**	**2003-08**
GDP	8.2	10.8	5.3	8.5
Beef	3.8	2.8	-0.5	-2.2
Pork	2.8	1.2	1.0	0.4
Poultry	4.9	4.6	17.6	7.7

Source: EC-DG AGRI.L1 based on FAO and USDA data

Net imports and consumption shares, 1990-99
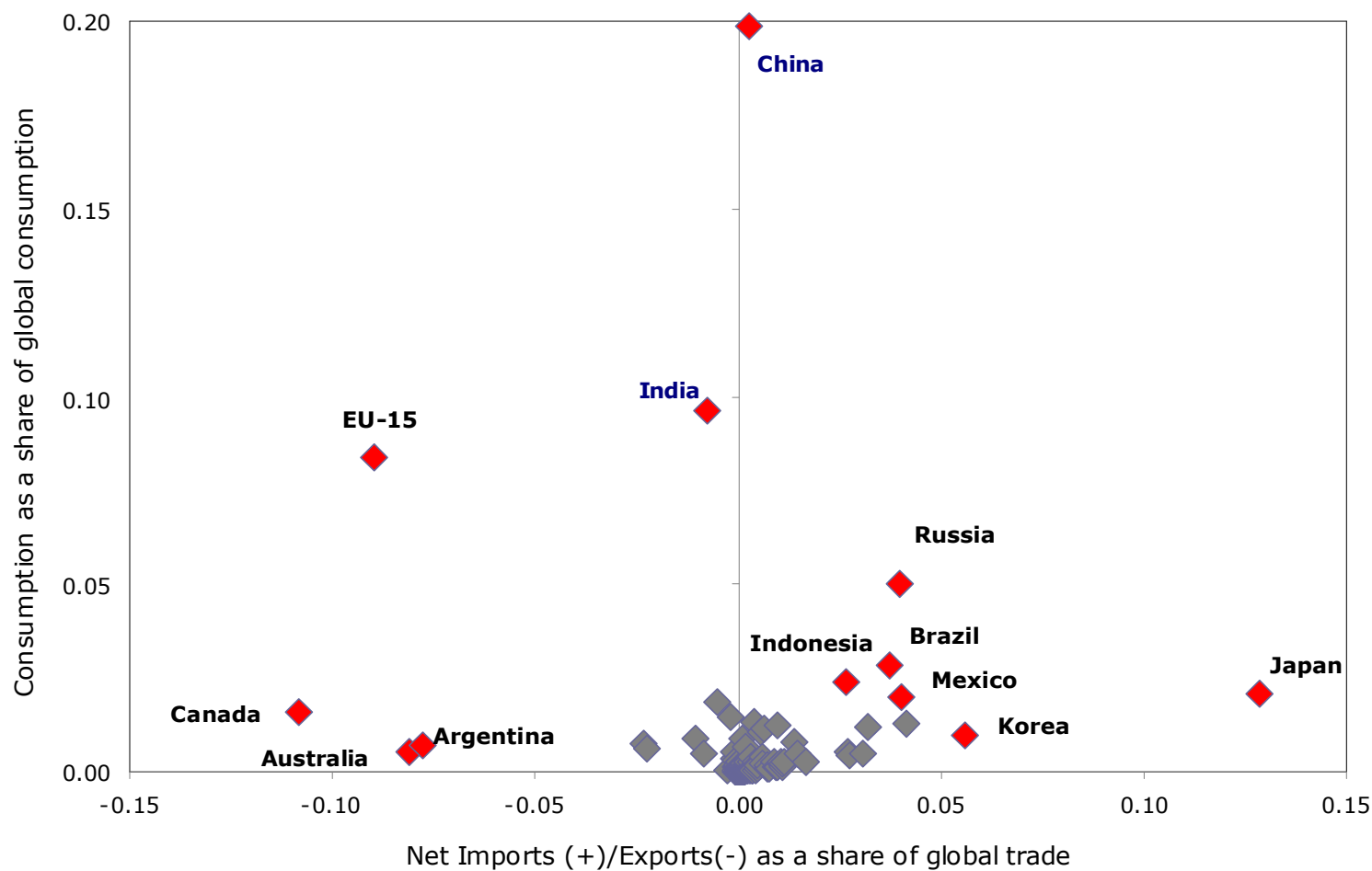
Source: Authors calculations from US Department of Agriculture data
Note: The US is not included in the figure. Its (net) exports and consumption shares were 39% and 13%.

Net imports and consumption shares, 2000-09
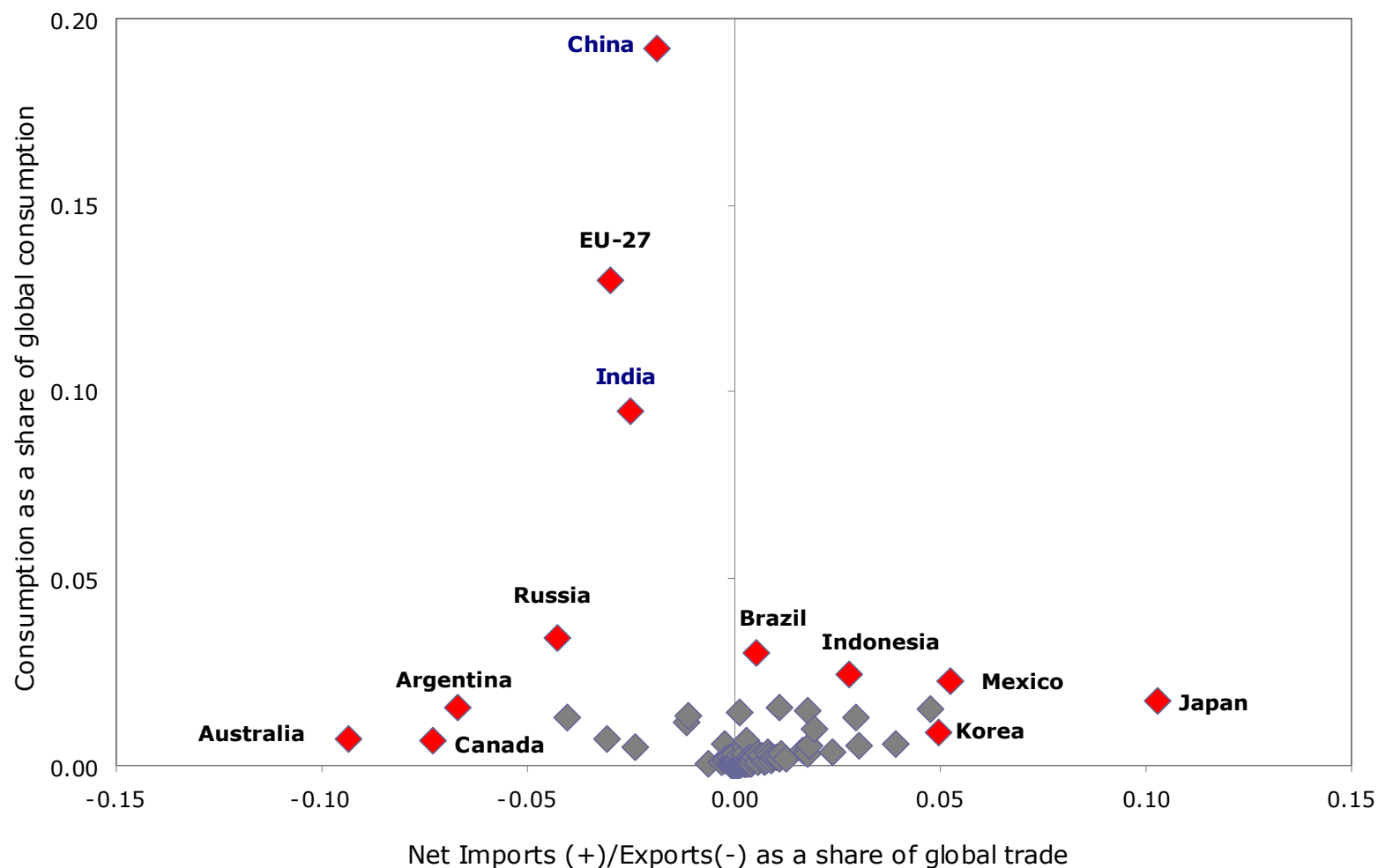
Net Imports (+)/Exports(-) as a share of global trade

Consumption as a share of global consumption

China, EU-27, India, Russia, Brazil, Indonesia, Argentina, Mexico, Japan, Australia, Canada, Korea

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)

Legend: Agriculture (olive line), Energy (red line), Metals (blue line)
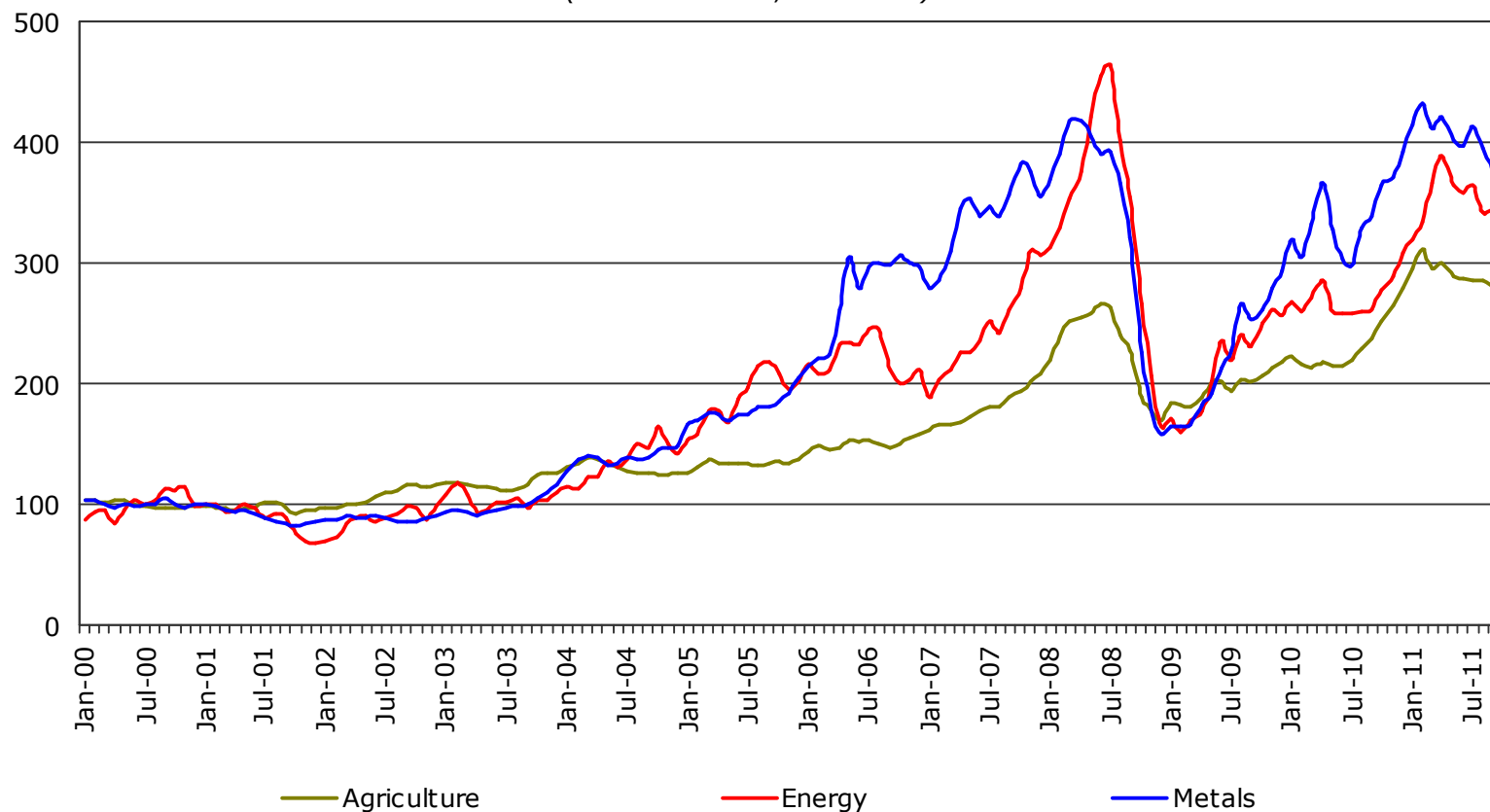
Source: World Bank.

*** Adapted from J. Baffs: Commodity Markets: A New Structure or Deviations from Long Term Trends?***

The 'perfect storm' impacting upon agricultural prices

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

Source: World Bank, based on Barclays Capital, CRED, FRED, IEA, IMF, USDA and WB data.

*** Adopted from J. Baffes: Commodity Markets: A New Structure or Deviations from Long Term Trends?**

A reduced-form econometric model

$$\log(P_{ti}) = \mu + \beta_1 \log(S/U_{t-1}) + \beta_2 \log(P_tOIL) + \beta_3 \log(XR_t)$$
$$+ \beta_4 \log(R_t) + \beta_5 \log(GDP_t) + \beta_6 \log(MUV_t) + \beta_7 t + \varepsilon_t$$

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)
XR_t:	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
$\beta_i s$:	parameters to be estimated
ε_t:	error term

Parameter estimates: Agriculture, 1960-2010

	Maize	Wheat	Rice	Soybeans	Palm oil
S/U ratio	-0.45***	-0.53***	-0.08	-0.17**	-0.38**
Oil price	0.19***	0.24***	0.25***	0.31***	0.45***
Exchange rate	0.02	-0.81***	-2.83***	-1.31***	-1.09*
Interest rate	-0.05	0.05	0.34***	-0.06	-0.04
GDP	-0.01	-0.01	-0.05**	0.01	0.01
Inflation	0.64	0.08	0.62	-0.01	0.04
*Trend*100*	-1.76***	-0.65	-0.76	-1.14*	-2.17**
Adjusted-R²	0.87	0.91	0.76	0.84	0.62
DW	1.03	1.10	1.03	1.27	1.24
ADF	-3.90***	-5.52***	-3.96***	-4.68***	-4.43***

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

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

Source: World Bank. Note: contributions based on the parameter estimated reported earlier.

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

Gap between actual and model-generated prices: wheat
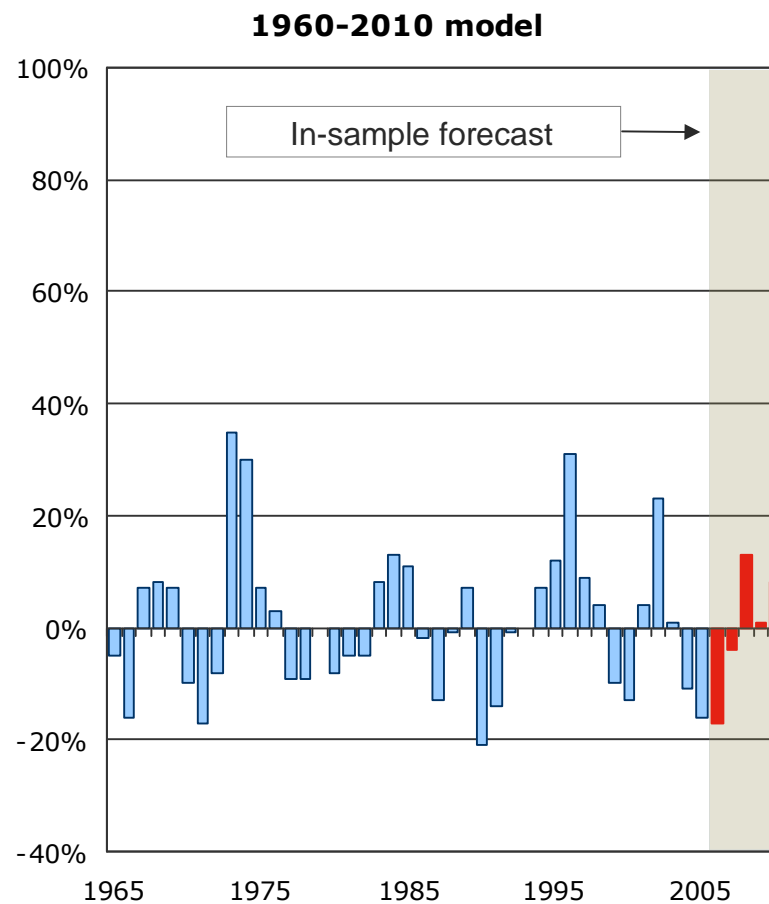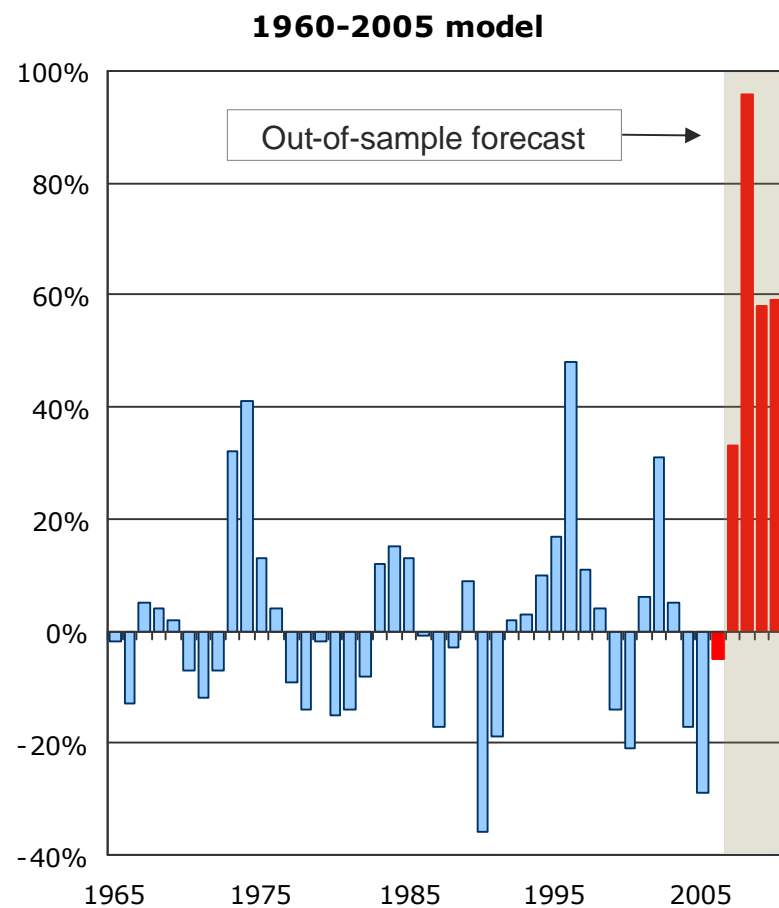
1960-2005 model

Out-of-sample forecast →

1960-2010 model

In-sample forecast →

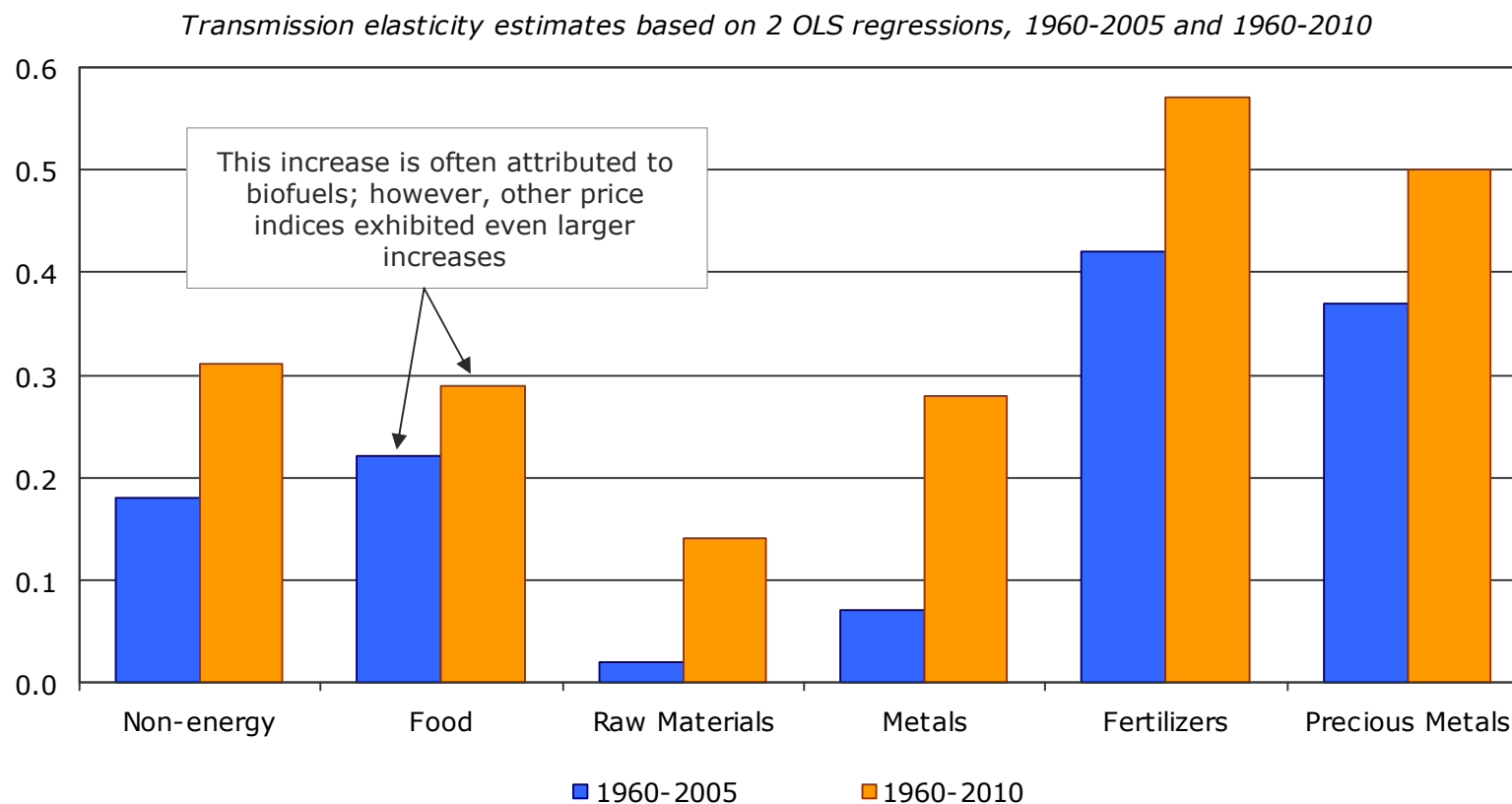*Source: World Bank.*

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

Parameter estimates: Metals (1990:Q1–2010:Q4)

	Copper	Zinc	Aluminum	Led	Nickel	Tin
Stocks	-0.01	-0.16***	0.04	-0.14***	-0.16***	-0.06*
Oil price	0.48***	0.16	0.09*	0.15	0.37***	0.16**
Exchange rate	-0.72	-0.16	-0.67*	-0.92	-2.85***	-0.16
Interest rate	0.02	0.07	0.07***	-0.09**	-0.03	-0.18***
Ind. Prod.	0.96	1.19	2.40***	3.51***	3.11**	4.56***
Inflation	2.64***	1.96***	0.72**	2.82***	0.91	2.65***
Trend	-0.01	0.00	-0.01**	-0.02**	-0.02*	-0.03***
Adjusted-R²	0.91	0.74	0.89	0.92	0.90	0.93
DW	0.59	0.38	0.74	0.73	0.64	1.02

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

■ 1960-2005   ■ 1960-2010

Source: World Bank.

*** 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)

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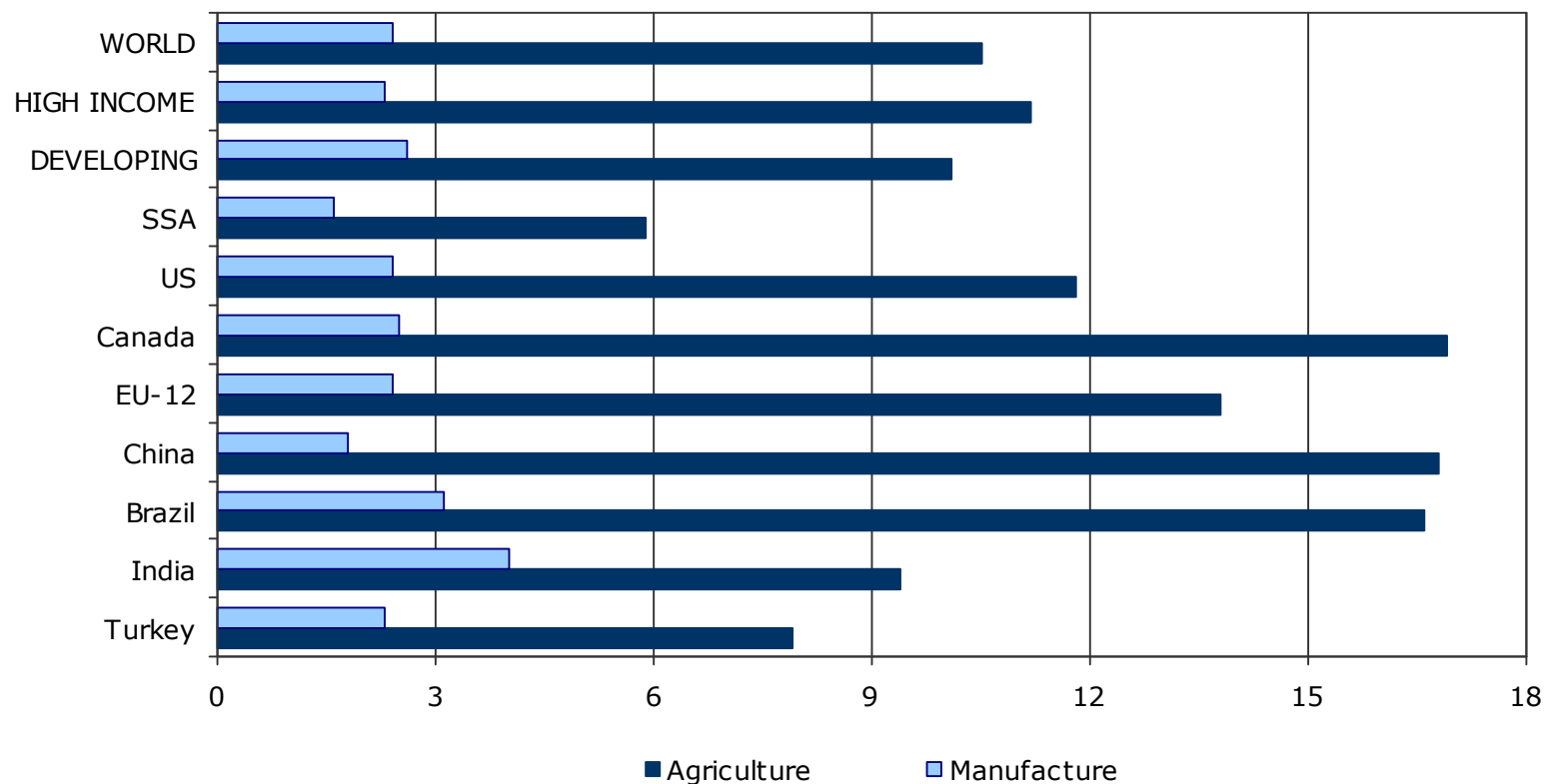
Source: GTAP preliminary release 0, version 8.
Note: Agriculture refers to crops (i.e., it excludes livestock); it includes both direct energy costs (mostly fuel) and chemicals (the most important of which is fertilizer). To avoid double-counting, manufacture does not include the refining sector.

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Diversion of food commodities to biofuels still rising

million of barrels per day equivalent
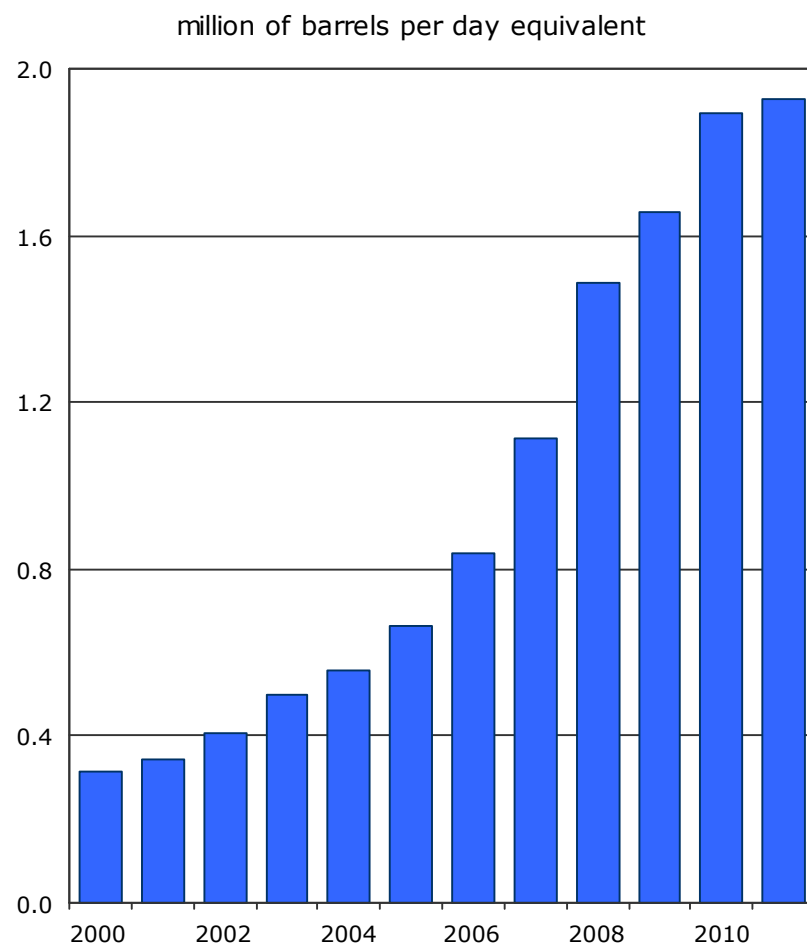
Source: BP Statistical Review

- 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.

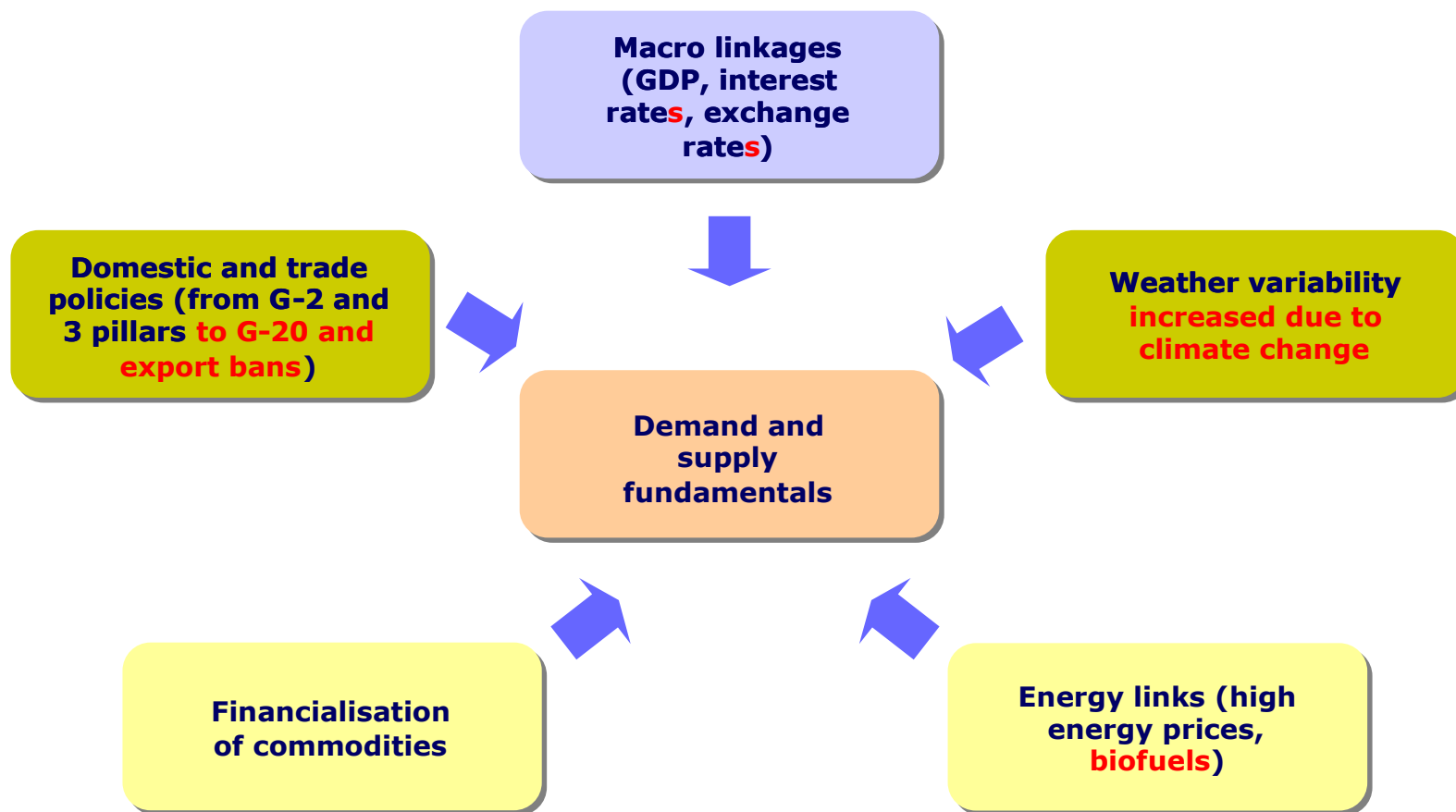# Commodity assets under management still rising

billion US$, year-end

Legend: Precious metals, Base metals, Agriculture, Energy

Chart data:

Year	Precious metals	Base metals	Agriculture	Energy	Total
2006	25	6	45	65	141
2007	41	9	61	86	197
2008	50	6	45	59	160
2009	91	14	66	99	270
2010	148	18	95	115	376
2011P	175	21	102	133	431
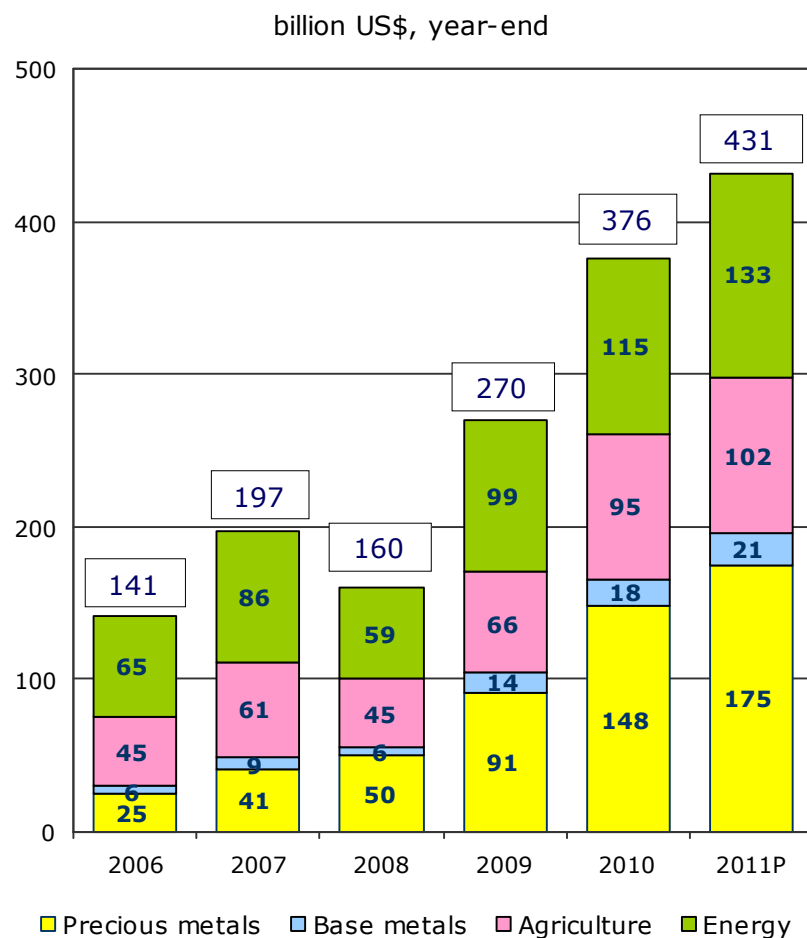
Source: Bloomberg, Barclays Capital

- 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].

Commodity markets – as they are evolving*

Macro linkages (GDP, interest rates**, exchange rate**s**)**

Domestic and trade policies (from G-2 and 3 pillars to G-20 and export bans)

Weather variability increased due to climate change

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