

The Economics of Grain Price Volatility

Brian D. Wright

*Department of Agricultural and Resource Economics
College of Natural Resources
University of California, Berkeley*

Plenary Address
14th Annual Conference on Global Economic Analysis
Governing Global Challenges
Climate Change, Trade, Finance and Development
Venice
June 16, 2011

Post- “*Inside Job*” I perceive a need for disclosure:

Recent or current grant support:

- Energy Biosciences Initiative (UC Berkeley, UIUC, LBL, BP, funded by BP)
- USDA
- NIH
- NSF
- USPTO

Disclosure (contd.)

- Current consulting relationships:
 - World Bank
 - FAO
- No recent positions in commodity markets
- No investments in agricultural input or service providers, or significant commodity market or energy market participants.
- I have a modest near-term engagement with a major agricultural bank
- In past year, I was a consultant engaged by two different entities engaged in producing and exporting agricultural products. I am happy to name them, if any audience member wishes to ask.

The 2008 *Blame Game*:

What caused the recent food price crisis?

- Was it the price of crude oil ?%
- Was it the Australian drought? ?%
- Was it China's consumption? ?%
- Was it US and EU biofuels policy? ?%
- A bubble: greedy speculators? ?%

First: The current situation

Review of recent summaries *as presented
in several sources:*

- ① In 2008 and currently, we have had the (CPI-deflated) price spikes in major grains at levels not seen since early 1970s
- ② Recent price spikes were associated with largest harvest shortfalls since 1970s

Review of recent summaries (contd.)

- ③ Higher energy prices led commodity prices
(as in 1970s and other commodity booms)
- ④ Higher energy prices caused higher
commodity prices

Review of recent summaries (contd.)

- ⑤ Climate change is reflected in recent increased harvest volatility
- ⑥ Price spikes are related to growth of the middle-class in certain economies, like China and India, where consumption has increased directly, or via increased feed for cattle.

Review of recent summaries (contd.)

- ⑦ The 2007/08 food crisis was the result of a “perfect storm” in grain markets

This presentation:

Mostly: Getting the facts straight

Some: Arithmetic of commodity balances

A little: How storability changes price behavior

And then: Why has volatility increased?

Finally: Implications for policy

8-Point Summary: Fact Check

- ① In 2008 and currently, we have had the (CPI-deflated) price spikes in major grains at levels not seen since early 1970s

Are recent real maize prices highest since early 1970s?



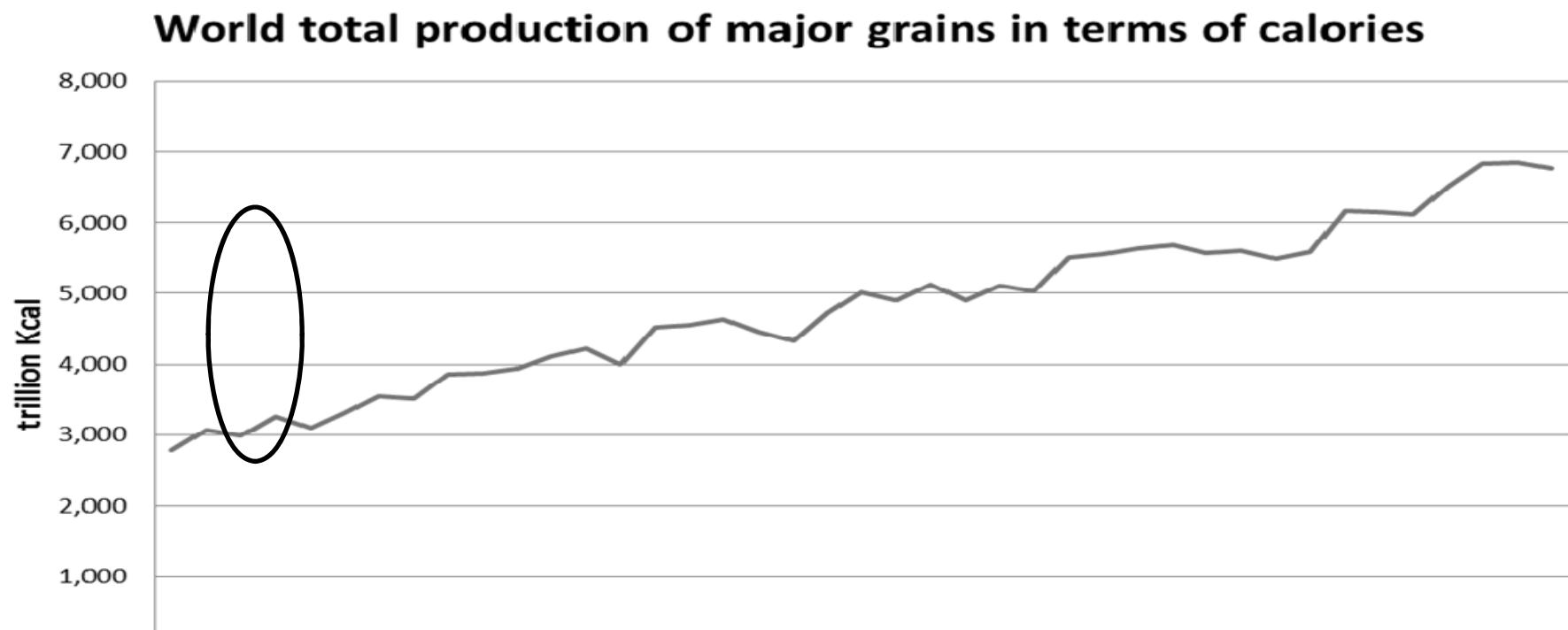
Source: USDA.

Note. Deflated using U.S. CPI, 1982-1984=1.

Fact Check

- ② Recent price spikes were associated with largest harvest shortfalls since 1970s
- *Preliminary question:* Did largest grain production decrease occur in 1970s?

Was largest major grains production shortfall in early 1970s?



Source: Calculated using Data from PSD Online, USDA.

Note. World grains = wheat + maize + milled rice. All quantities converted into Calories assuming, for wheat 3338Kcal per Kg, for maize 3650 Kcal per Kg, and for milled rice 3656 Kcal per Kg).

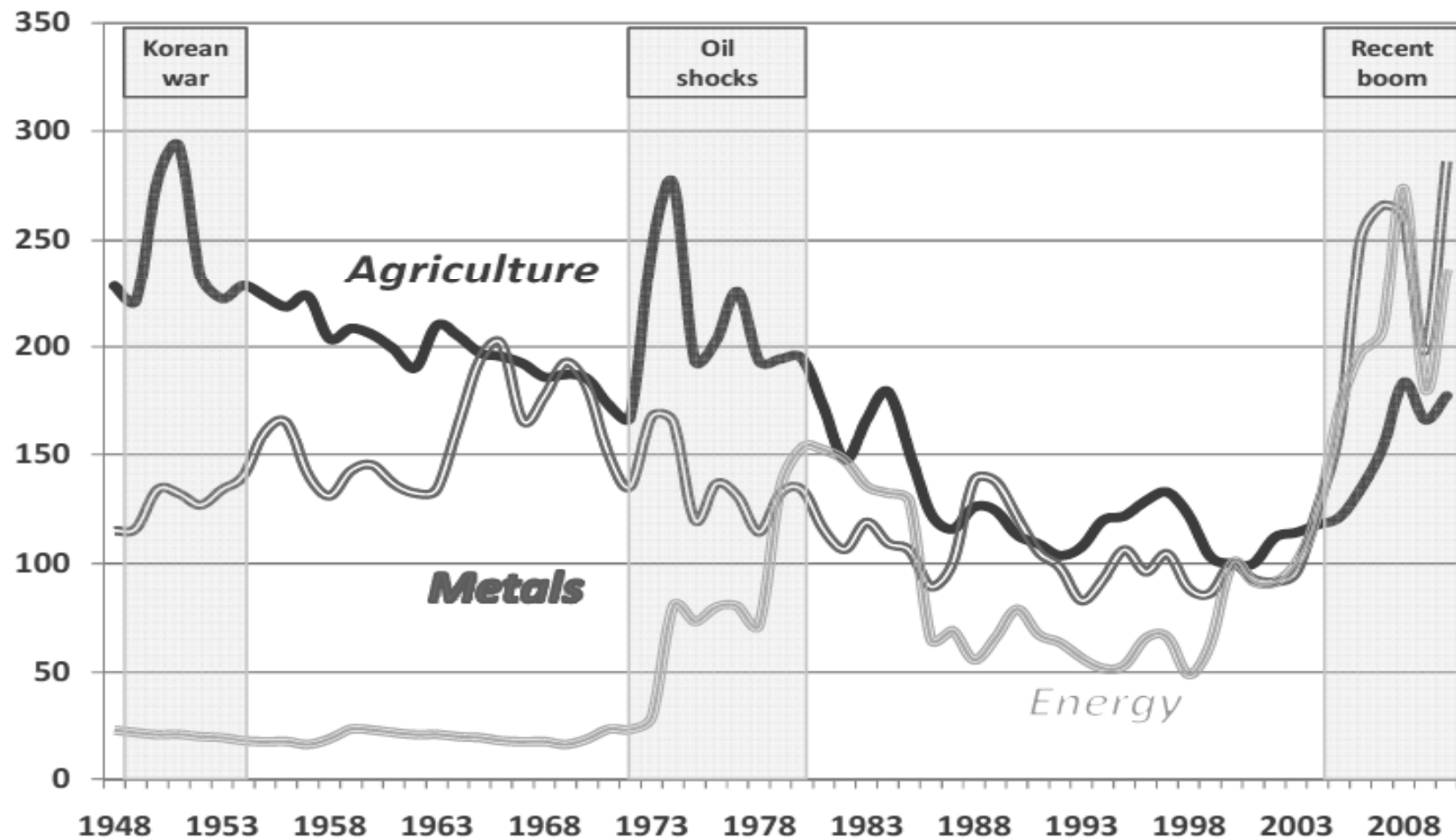
2010/2011 is projection.

Fact Check

- ③ Higher energy prices led commodity prices (as in 1970s and other commodity booms)

Energy as “Boom leader?”

Commodity Price Indices (Real, MUV-deflated, 2000=100)



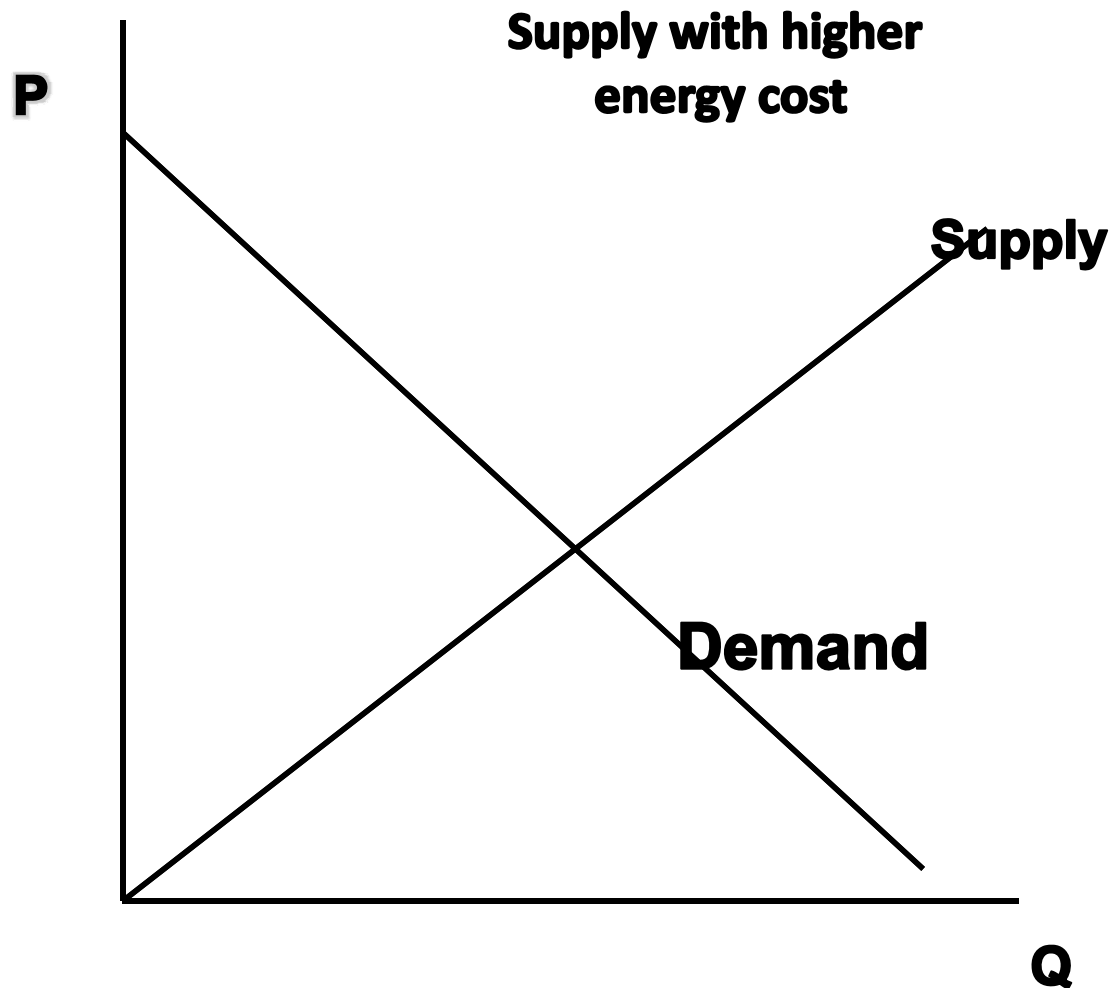
Fact Check

- ④ Higher energy prices *caused* higher commodity prices?

How did energy costs increase grain prices?

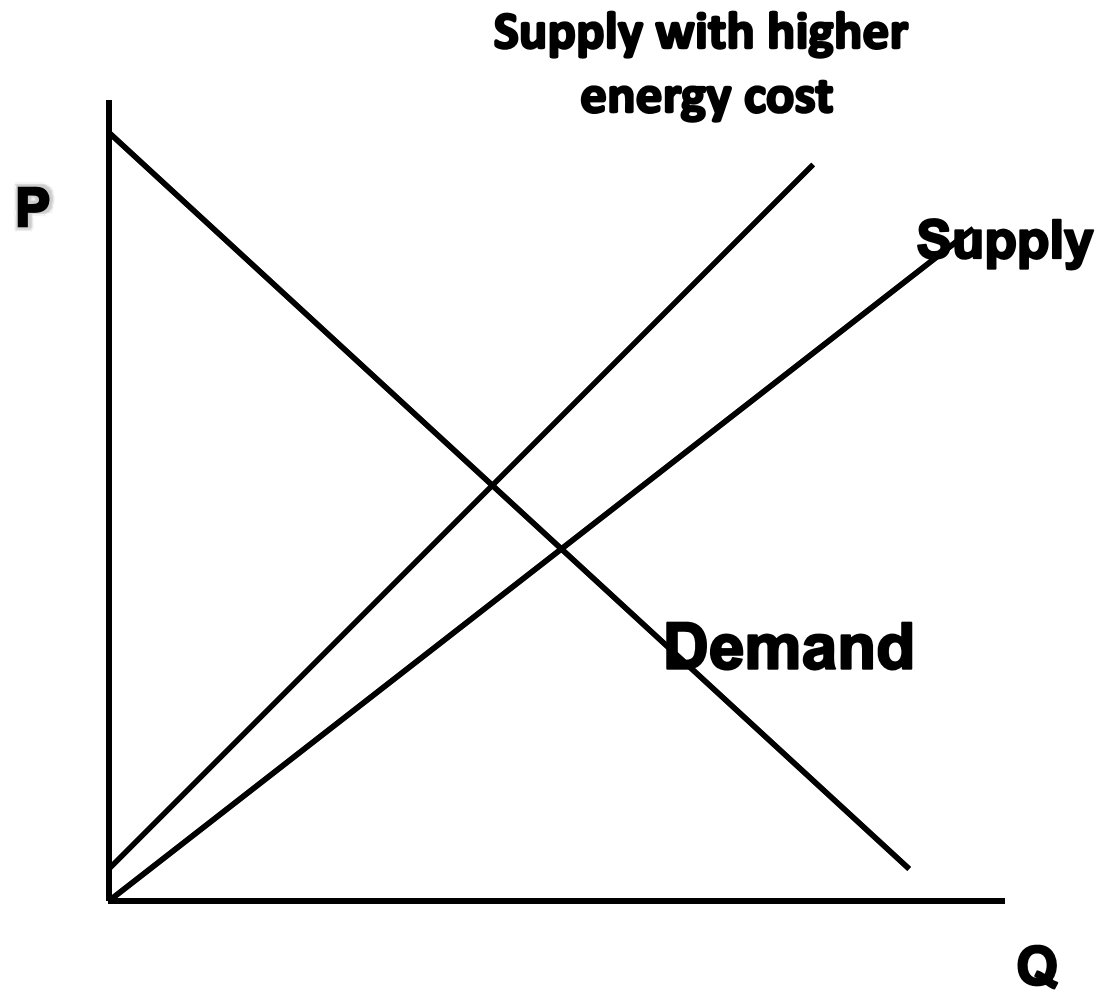
- Via Farm Energy costs?
 - Did farm profits decline?
 - Did planted acres in aggregate decline?
- Via fertilizer market?
 - Fertilizer prices rose – is that sufficient?
 - Did fertilizer use decline?
 - Did fertilizer corps make more profit?

How does energy cost raise product price?



1

How does energy cost raise product price?

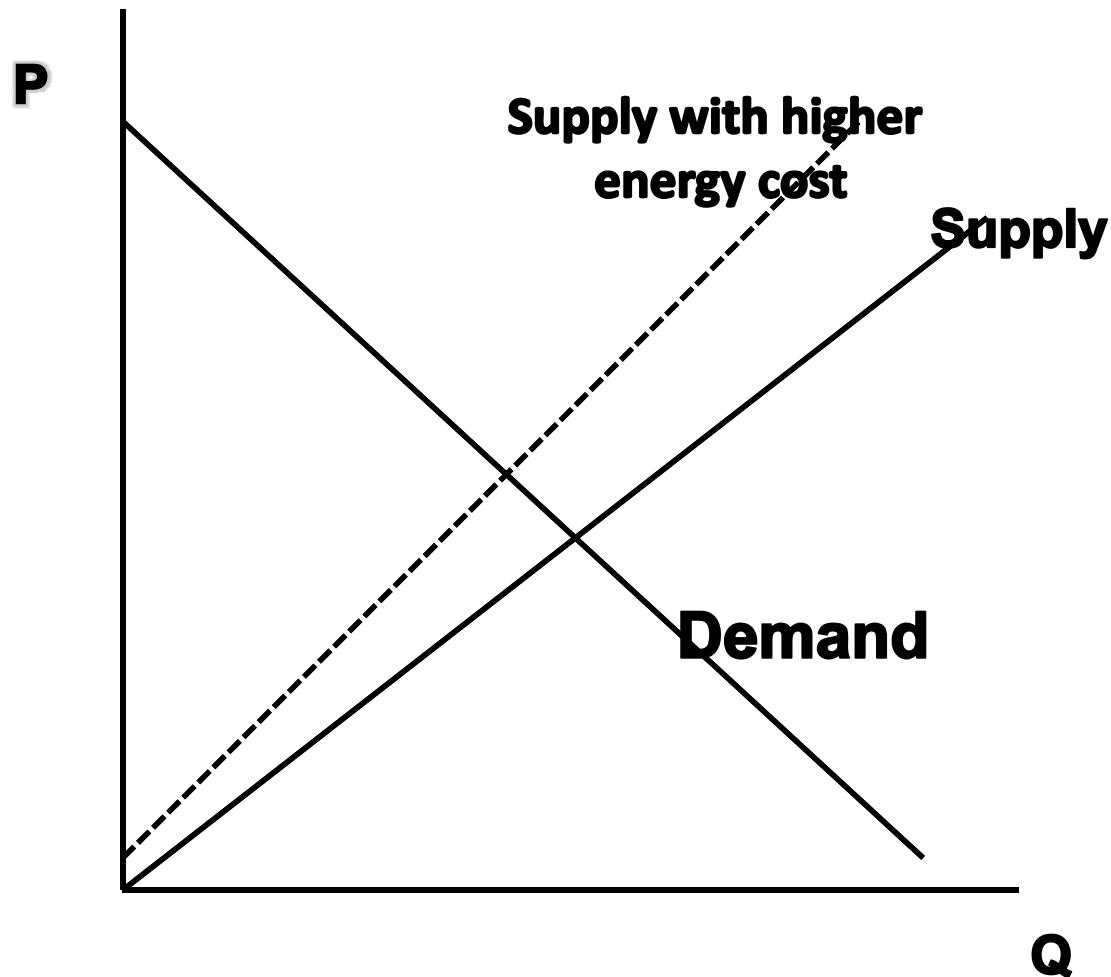


Diapositiva 19

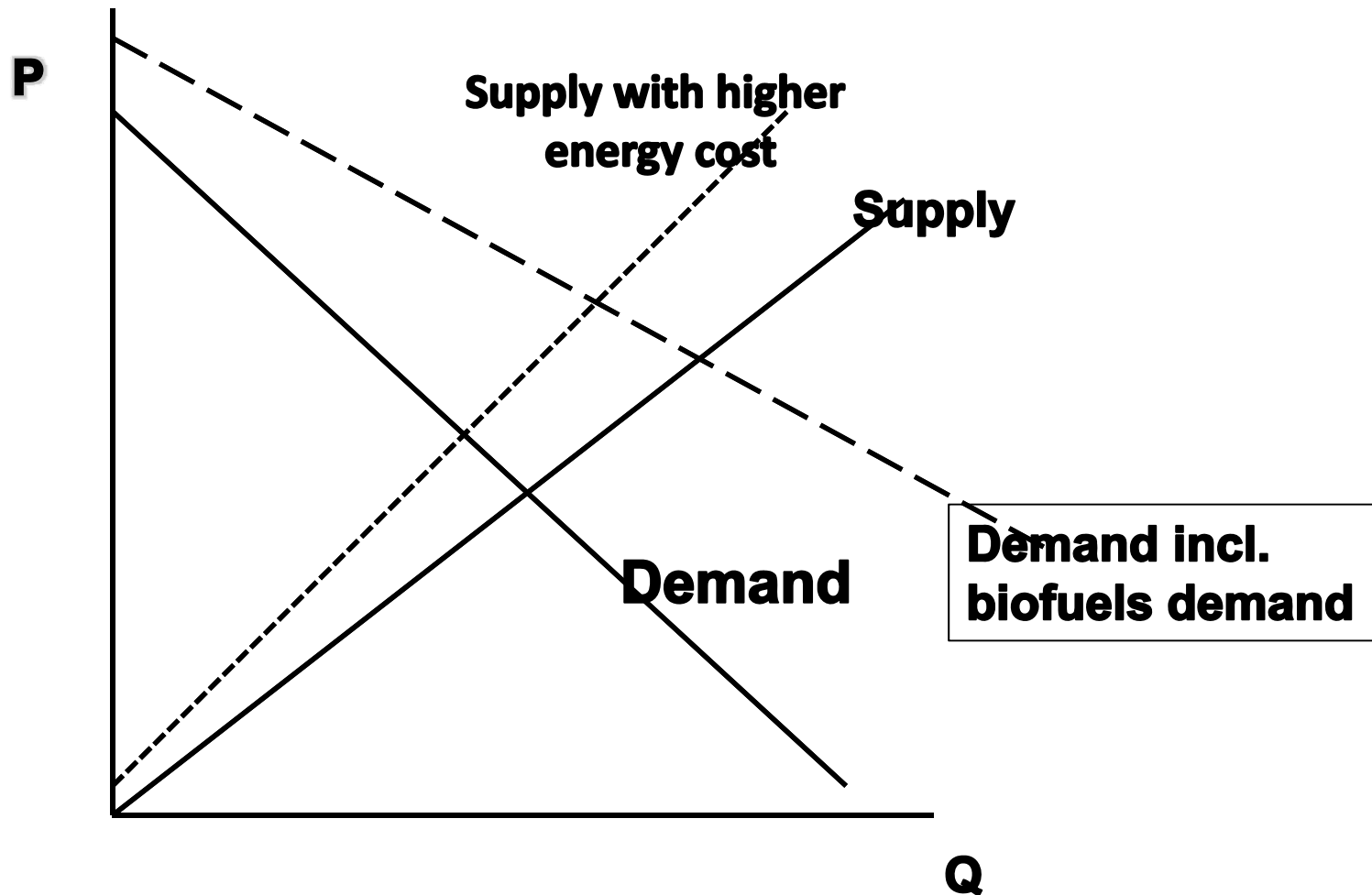
1

Brian Wright; 07/06/2011

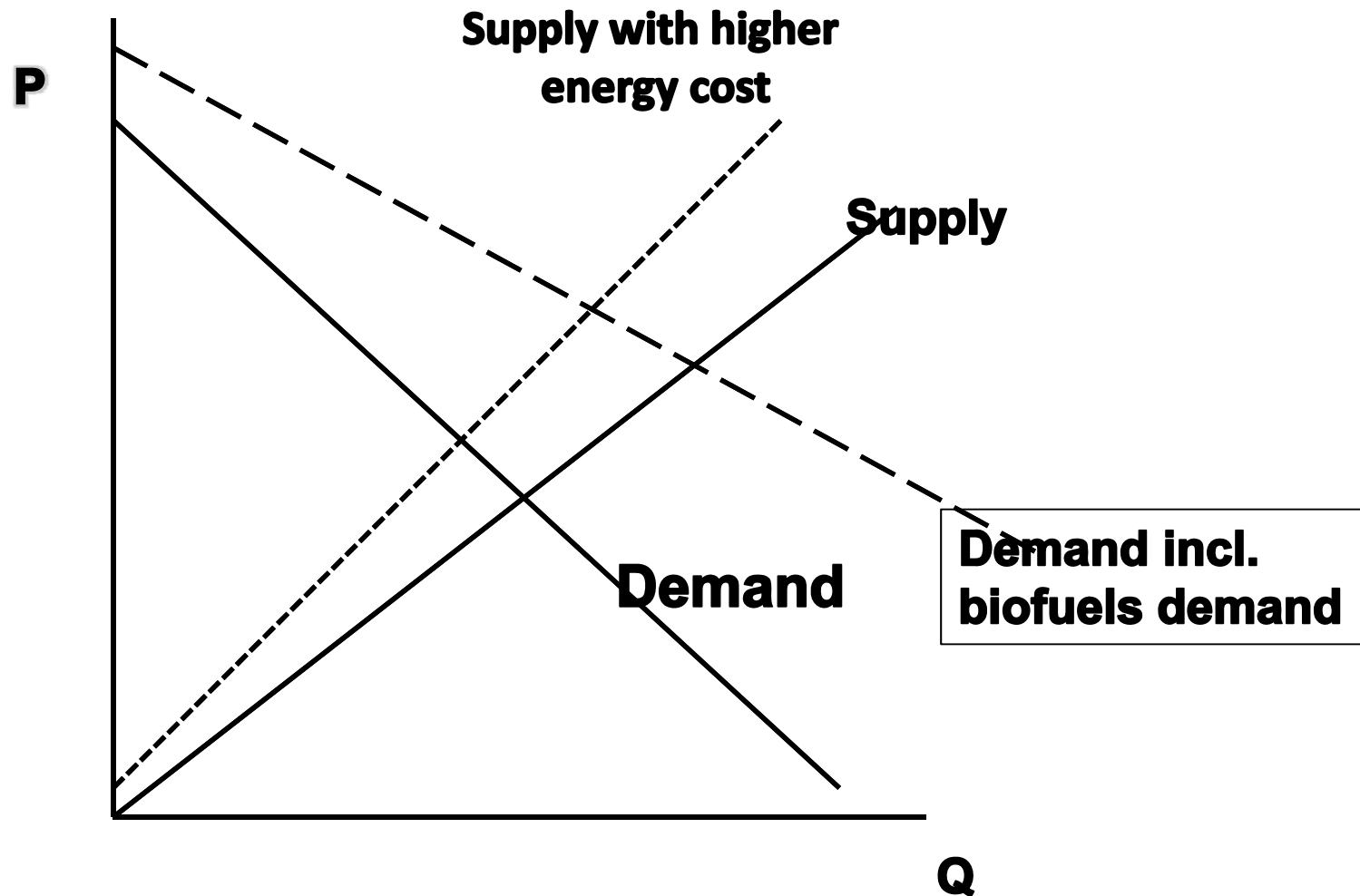
For price rise *and* output rise, *demand* must be driver



For price rise *and* output rise, *demand* must be driver



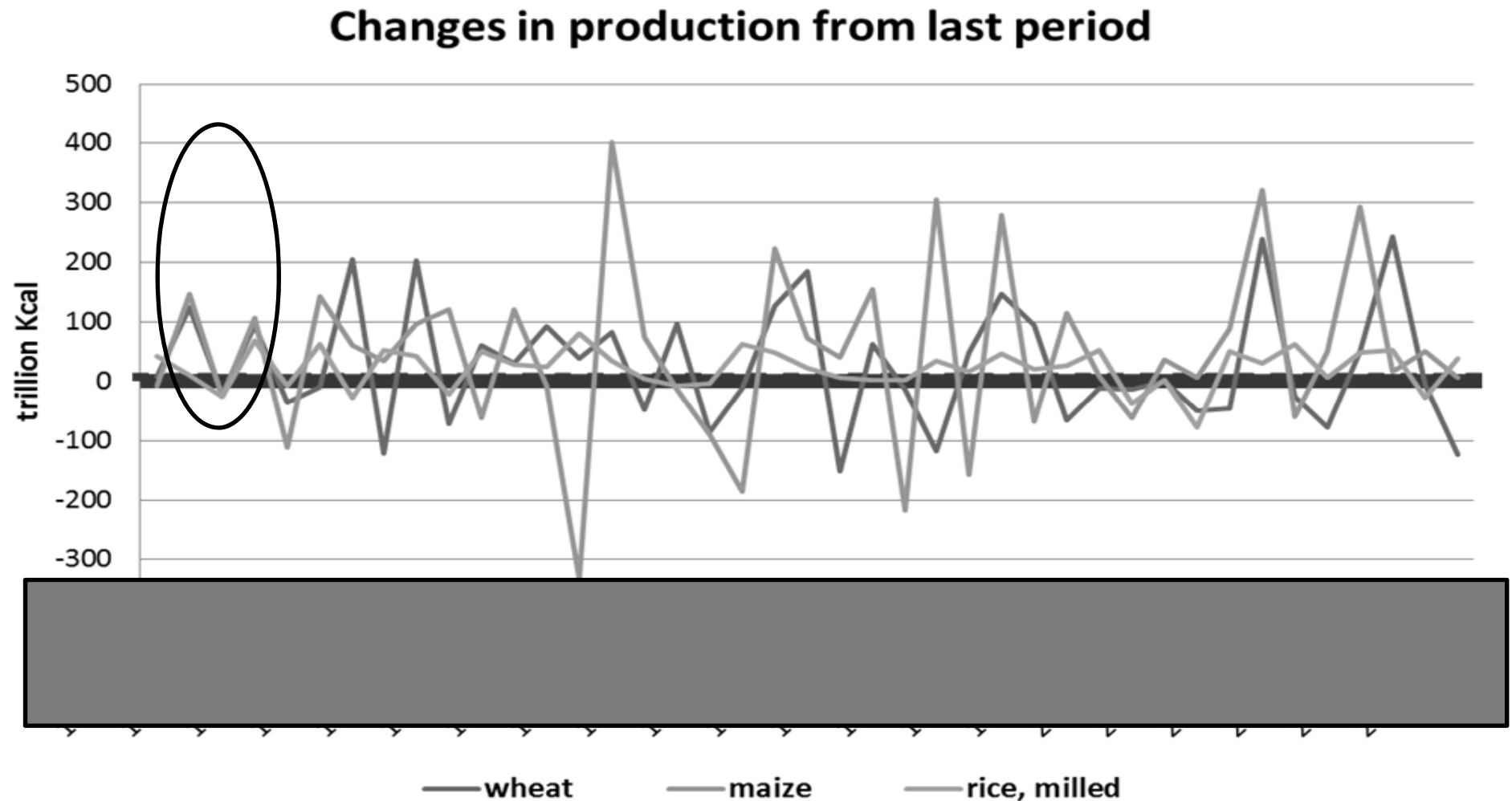
How does energy cost raise product price?



Fact Check

- ⑤ Climate change is reflected in recent increased harvest volatility?

Severe weather events affecting markets?



Source: Calculated using Data from PSD Online, USDA.

Fact Check

- ⑥ Unanticipated increase in beef or pork demand in India and China?

Surprising 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
Chicken	4.9	4.6	17.6	7.7

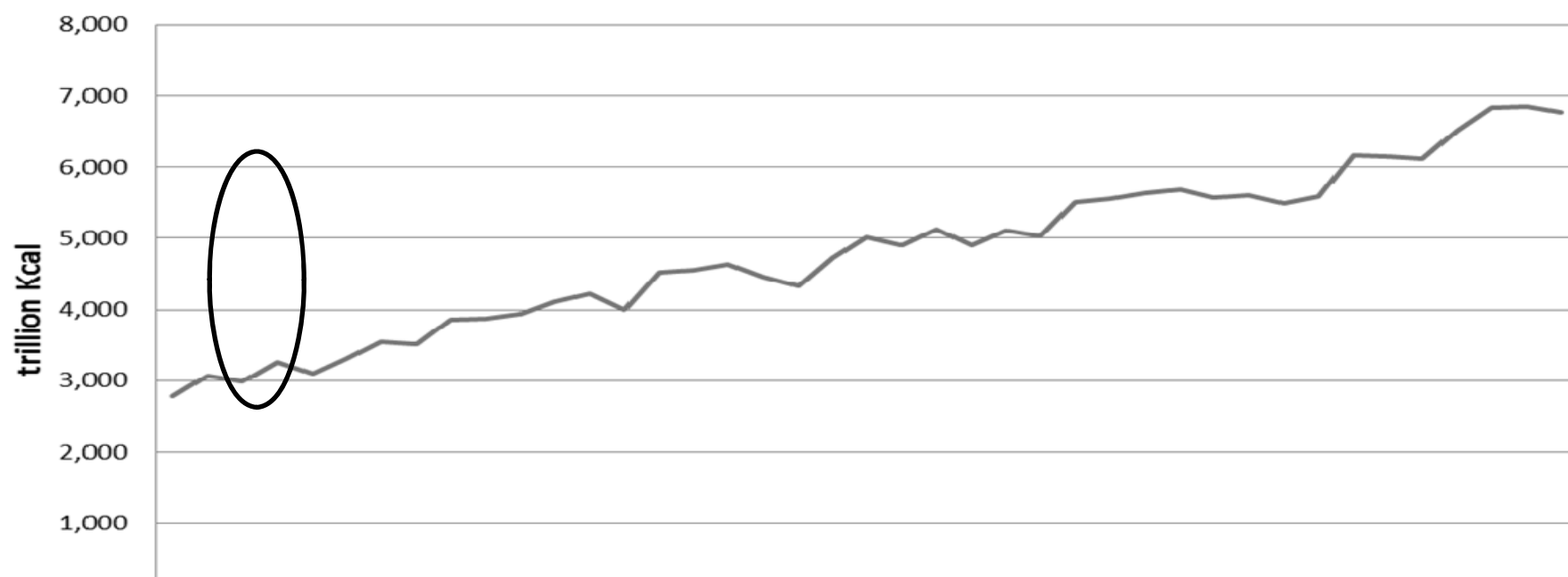
Source: EC-DG AGRI.L1 based on FAO and USDA data

Fact Check

⑦ 2007/08 was a “perfect storm”?

Do recent price spikes reflect low harvests?

World total production of major grains in terms of calories



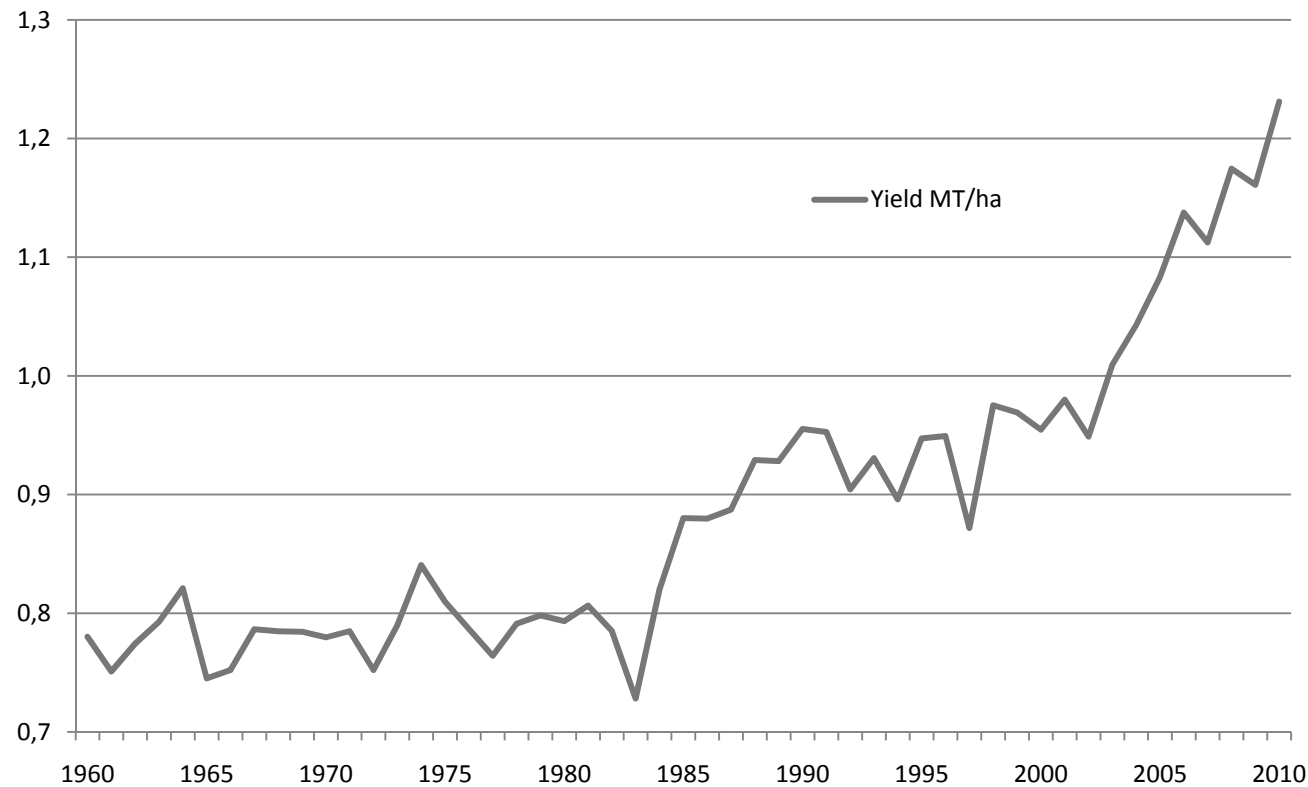
Source: Calculated using Data from PSD Online, USDA.

Note. World grains = wheat + maize + milled rice. All quantities converted into Calories assuming, for wheat 3338Kcal per Kg, for maize 3650 Kcal per Kg, and for milled rice 3656 Kcal per Kg).

2010/2011 is projection.

Unexpectedly low African yields?

Cereals yields, sub-Saharan Africa



Source: USDA

Summary of what we see:

- Distinction: changes in *levels* v. *price spikes*
 - Currently related but distinct
- Price spikes do not match shortfalls in production
- No evident surprising faster demand growth in China and India
- No evidence of increased climate volatility
- Energy **costs** do not explain price spikes
- We have not seen anything **even close** to the “worst case scenario” in global food markets

Current Situation: New Regime?

① Speculation?

① Bioenergy?

To understand price spikes, we need a little storage theory:

- Storers smooth out troughs in price and low-value consumption after high harvests by *“buying low to sell high”*
- Storers smooth **expected** shortages *if cash is available:*
 - *invest in stocks, raise current price, reduce expected shortage*

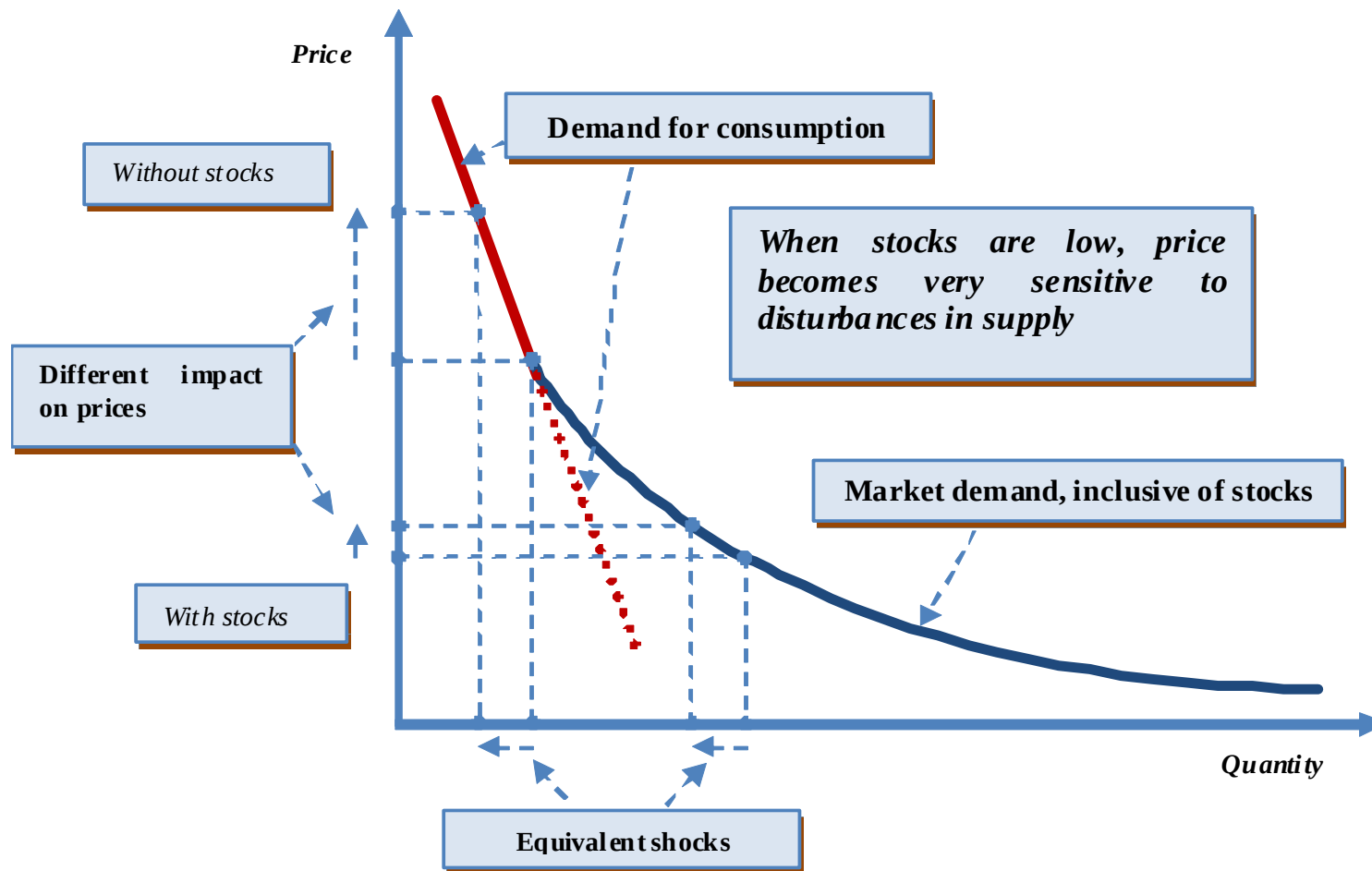
Role of storage arbitrage

Key relations: *Buy when low, sell when high*

$$P(t) + \text{cost of storage} = \frac{E[P(t+1)]}{1+r} \text{ if } \text{stocks} > 0$$

$$P(t) + \text{cost of storage} \geq \frac{E[P(t+1)]}{1+r} \text{ if } \text{stocks} = 0$$

Why is price much more sensitive to shocks when stocks are minimal?



Theory: Effects of storage.

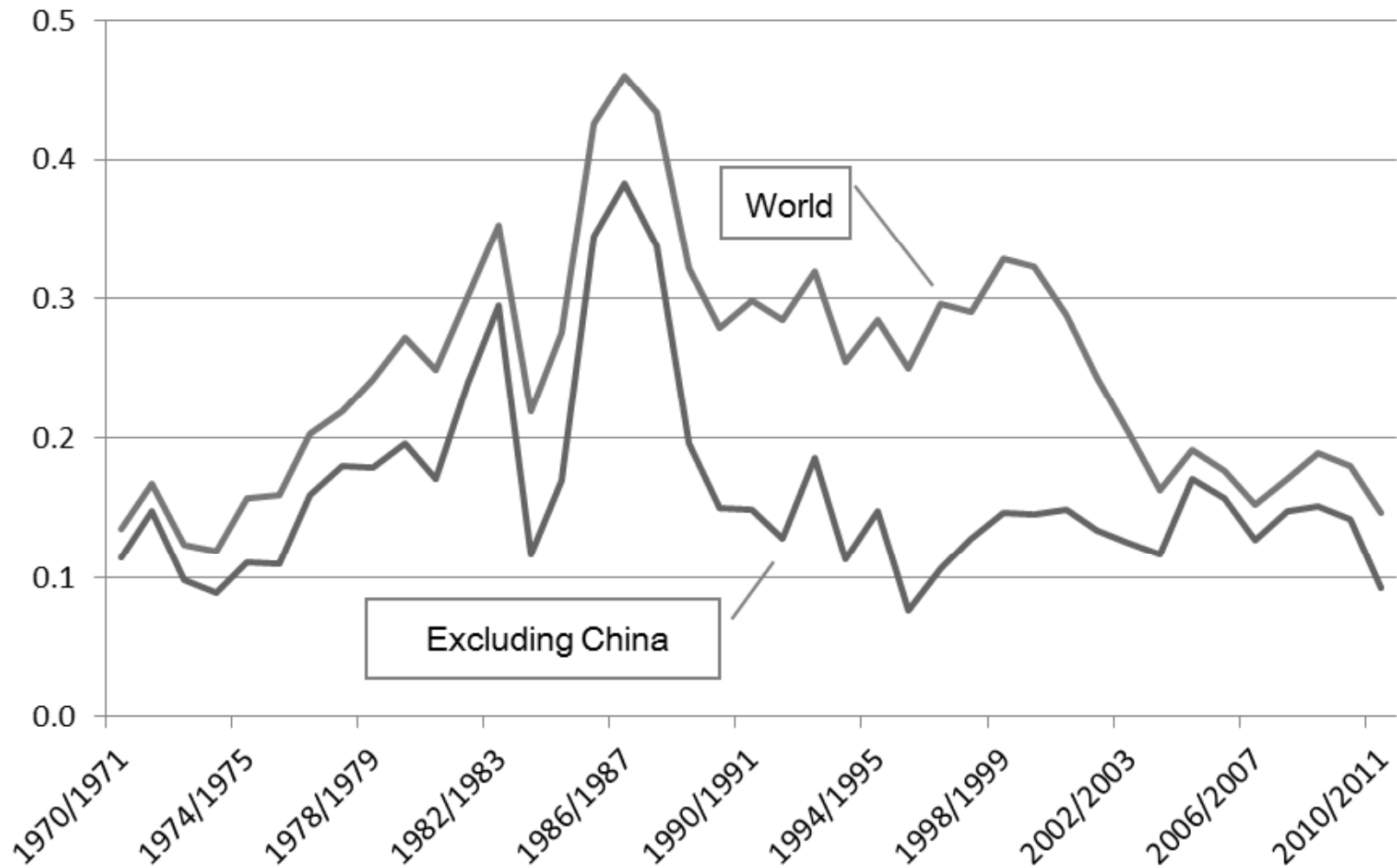
- Storers smooth out peaks after *unexpected* shocks, but *only until their stocks run out*
- *When stocks run out, price spikes are required, to force consumers to respond one-for-one to shocks*



***SPIKES OCCUR ONLY IF STOCKS ARE
MINIMAL***

- Is this true?

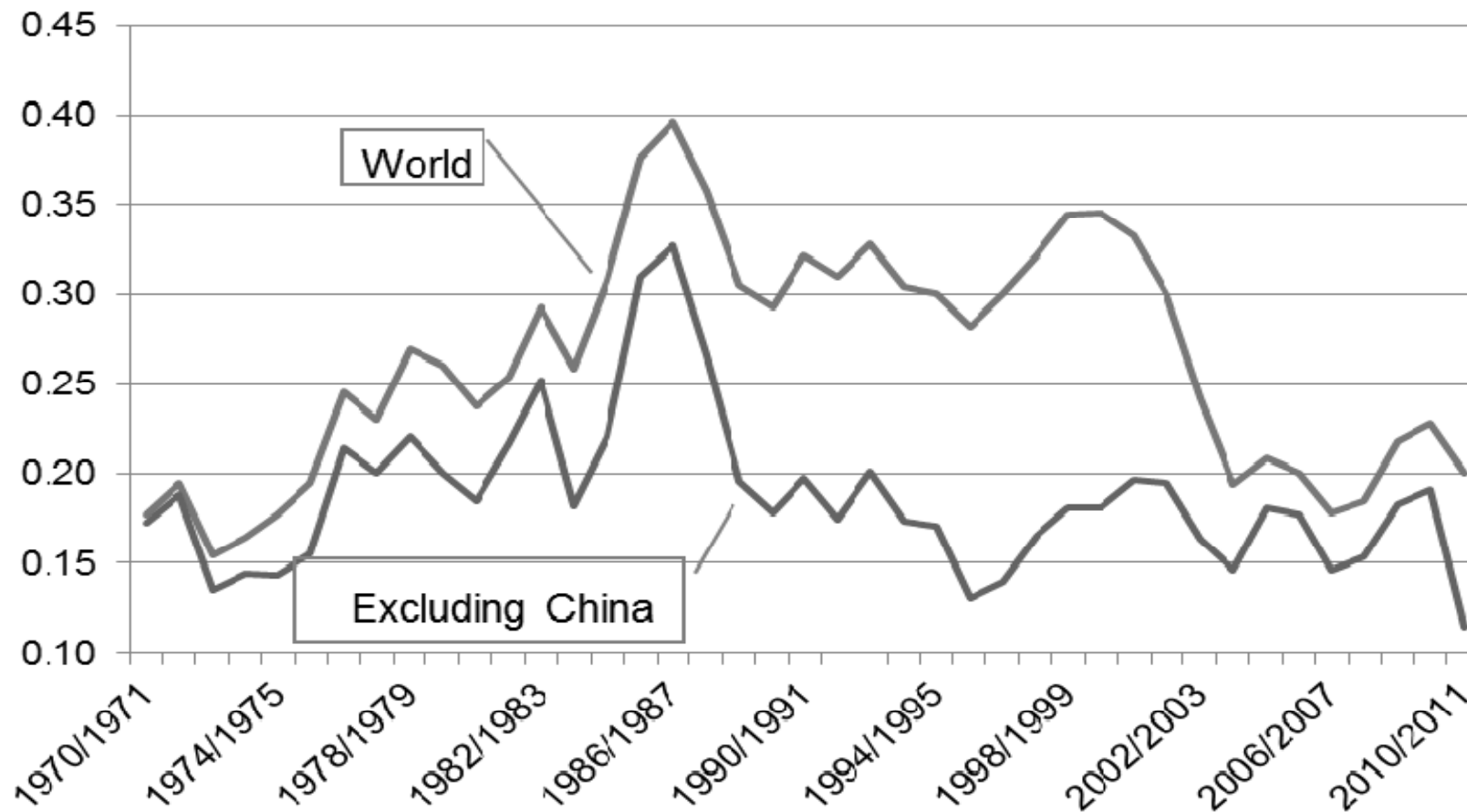
Maize: Stocks-to-use ratios



Source: **USDA**.

Note. The 2010/2011 data is projection.

Calories from major grains: Stocks-to-use ratio predicts spikes

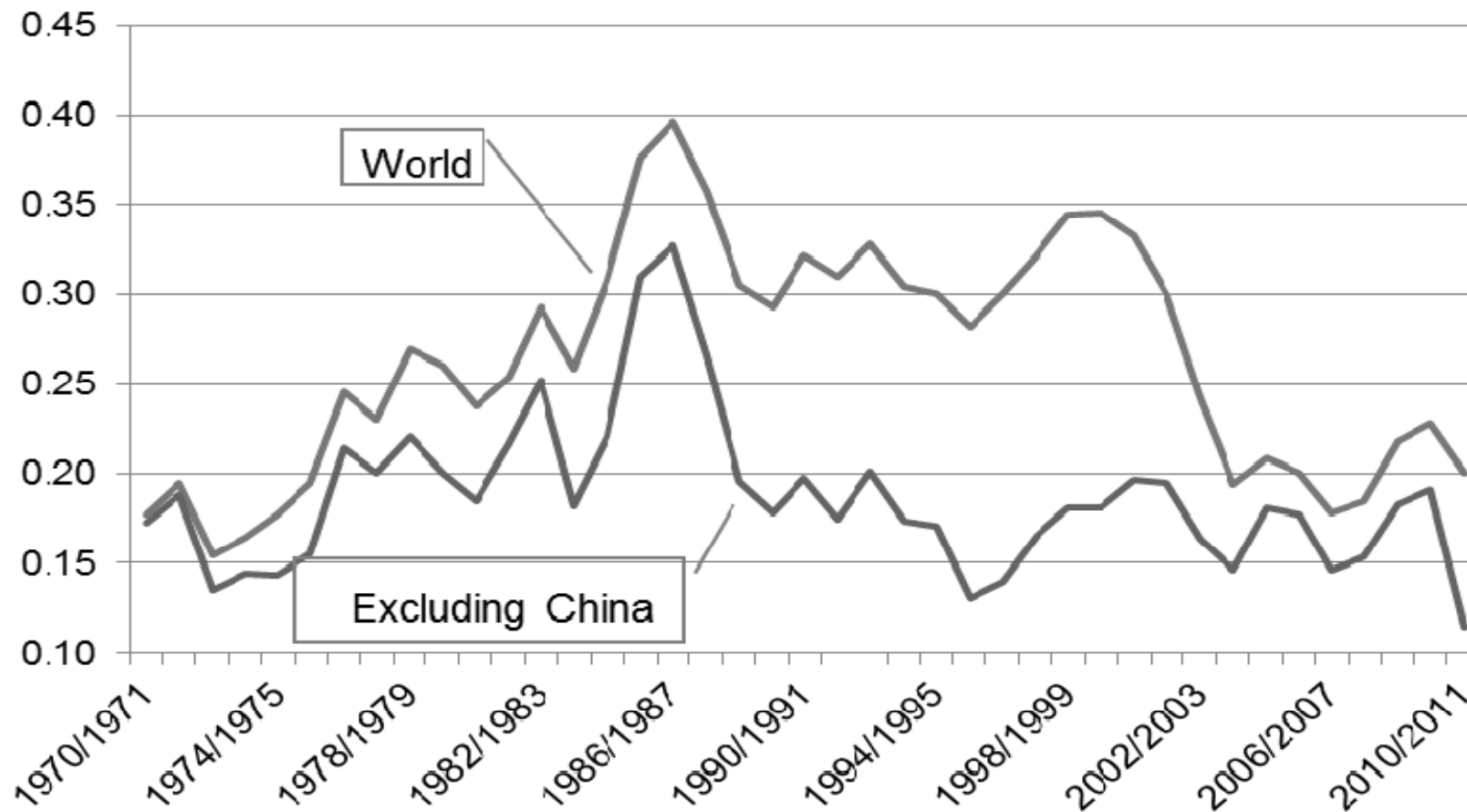


Source. Calculated using data from USDA.

Note. World grains (wheat + maize + milled rice) ending stocks to use ratio with and without China (all quantities converted into Calories assuming, for wheat 3338Kcal per Kg, for maize 3650 Kcal per Kg, and for milled rice 3656 Kcal per Kg).

2010/2011 is projection.

Calories from major grains: Stocks-to-use ratio predicts spikes



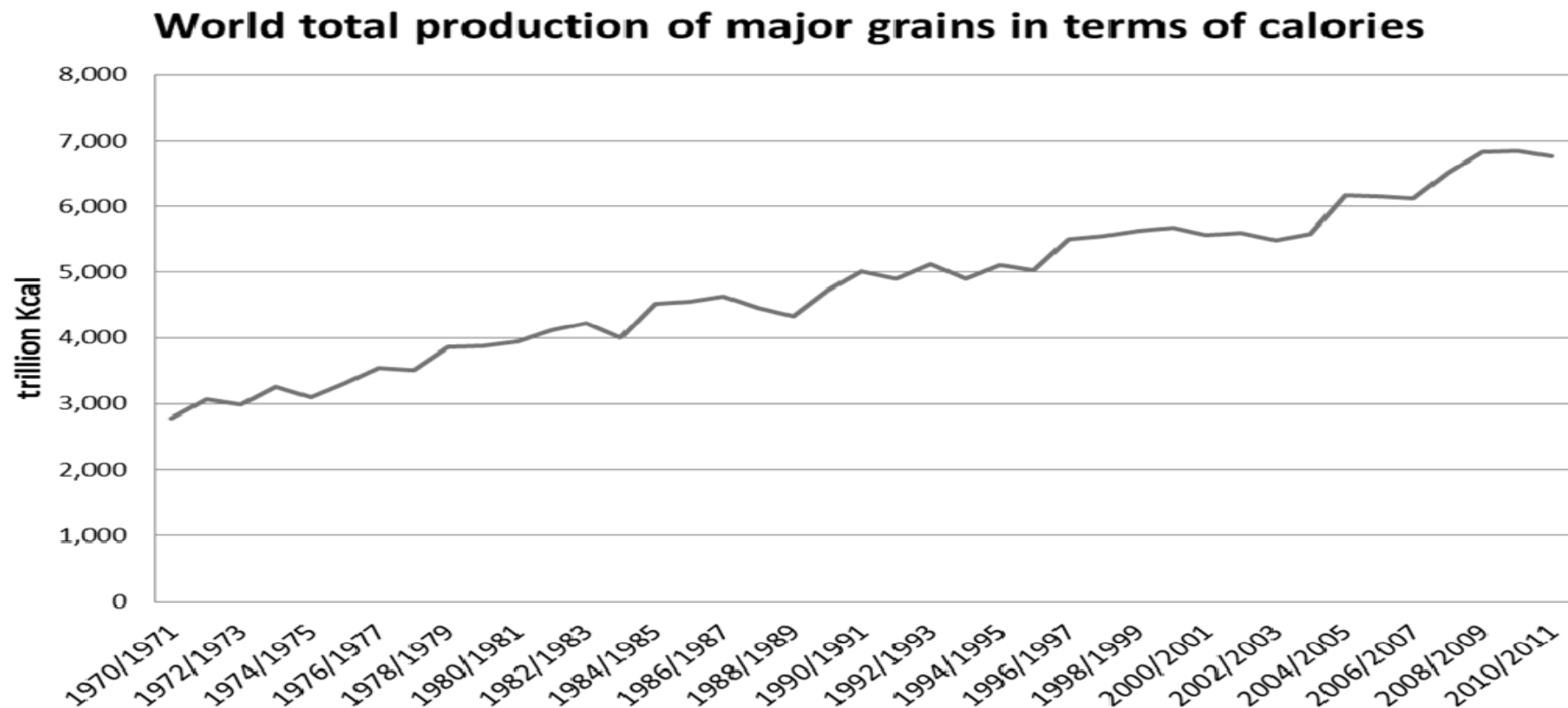
Source. Calculated using data from USDA.

Note. World grains (wheat + maize + milled rice) ending stocks to use ratio with and without China (all quantities converted into Calories assuming, for wheat 3338Kcal per Kg, for maize 3650 Kcal per Kg, and for milled rice 3656 Kcal per Kg).

2010/2011 is projection.

(from previous slide)

In contrast, price spikes ***do not*** reliably reflect low harvests:

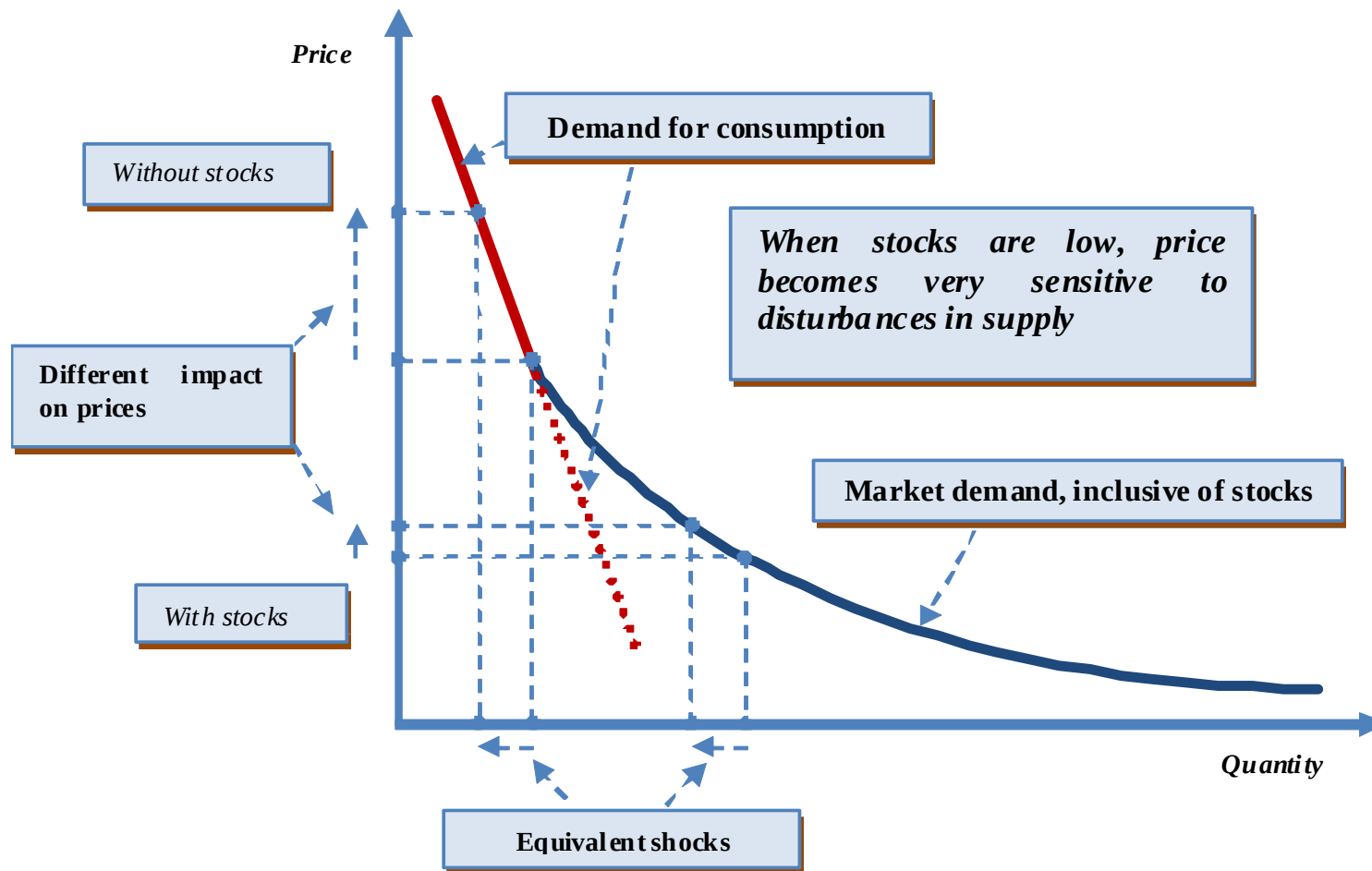


Source: Calculated using data from PSD Online, USDA.

Note. World grains = wheat + maize + milled rice. All quantities converted into calories assuming, for wheat 3338Kcal per Kg, for maize 3650 Kcal per Kg, and for milled rice 3656 Kcal per Kg).

2010/2011 is projection.

Why price is much more sensitive to shocks when stocks are minimal



The problem with allocating the blame:

- The response is ***very nonlinear***
- ***What does nonlinearity mean for allocating the “blame” for recent price spikes?***

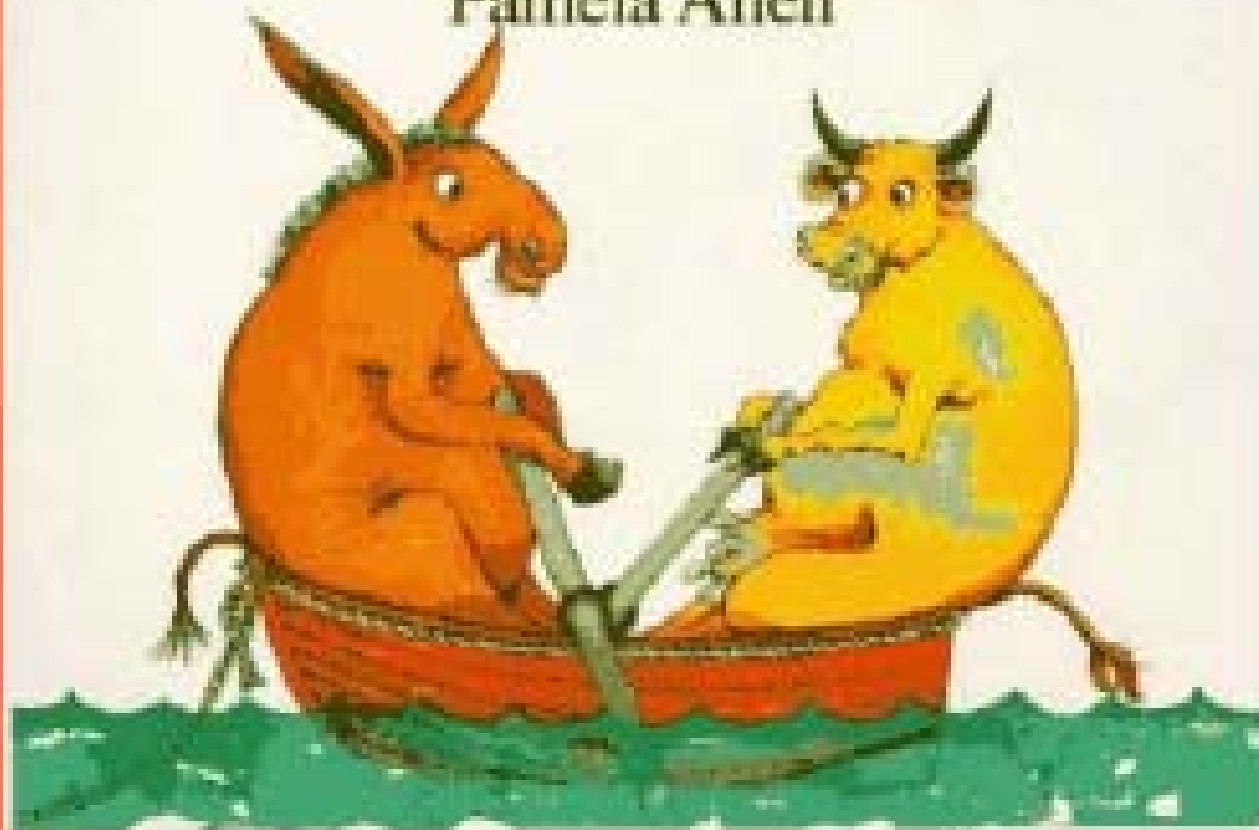
The 2008 *Blame Game*:

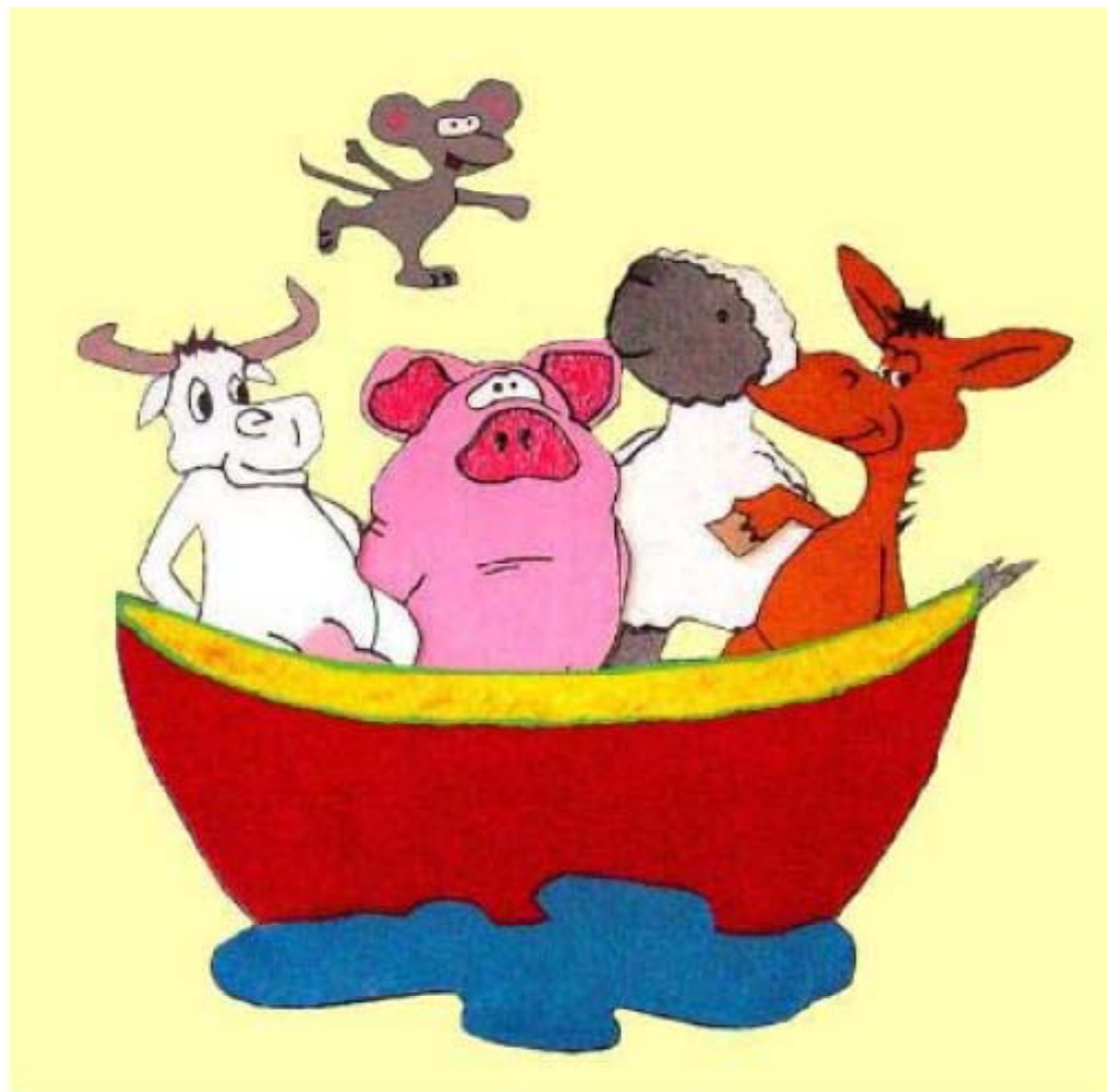
What caused the recent food price crisis?

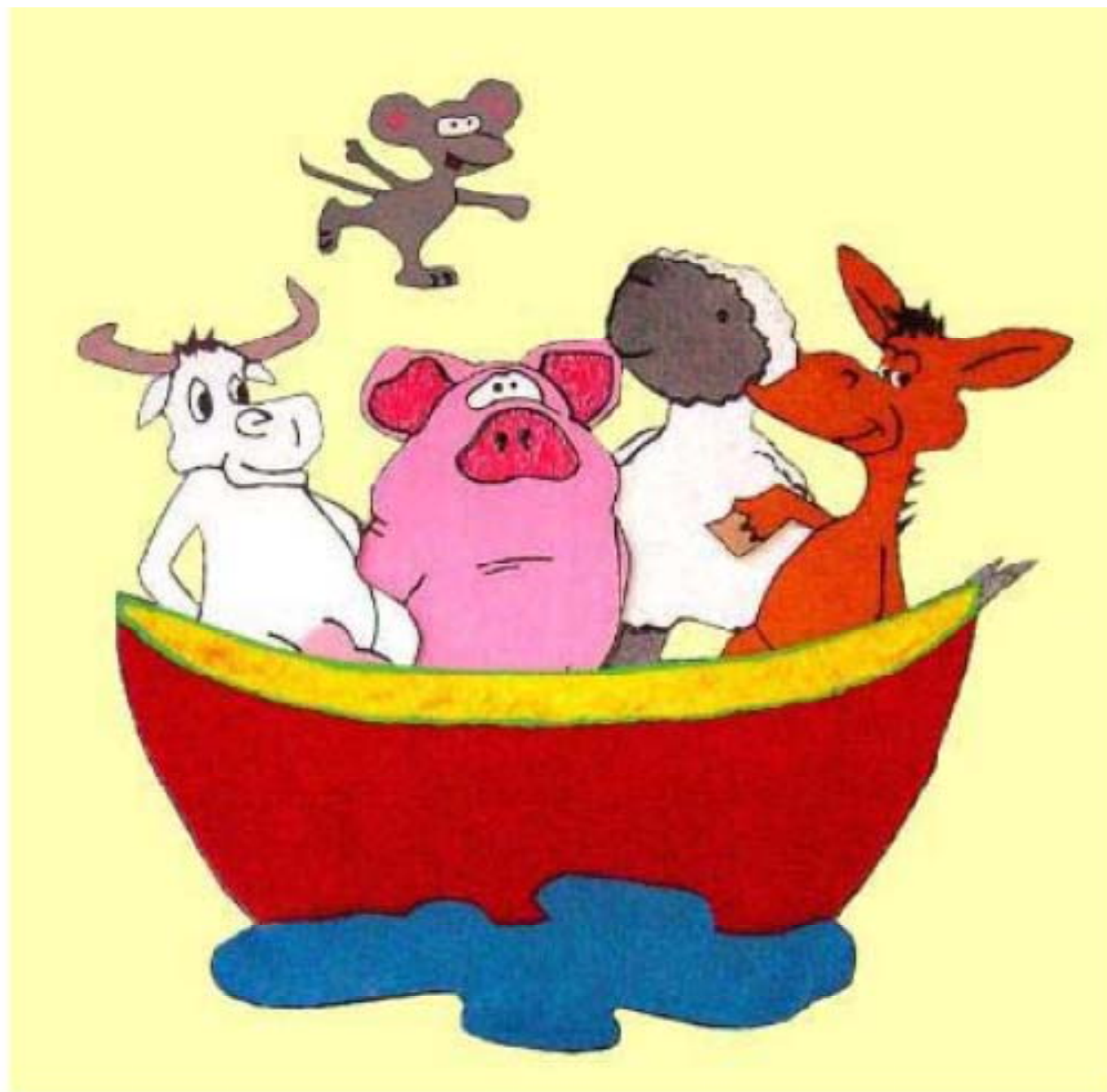
- Was it the price of crude oil ?%
- Was it the Australian drought? ?%
- Was it China's consumption? ?%
- Was it US and EU biofuels policy? ?%
- A bubble: greedy speculators? ?%

Who Sank the Boat?

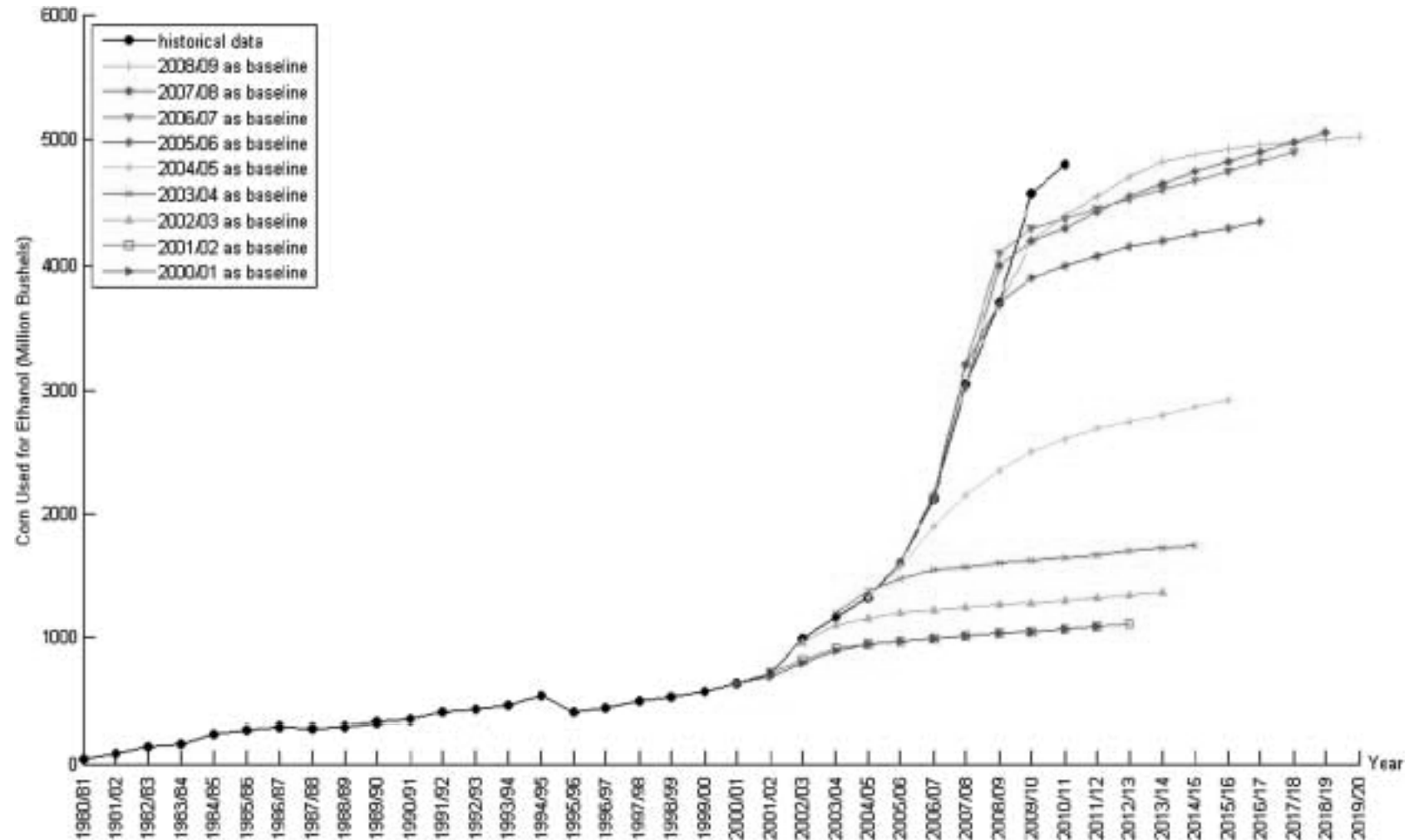
Pamela Allen





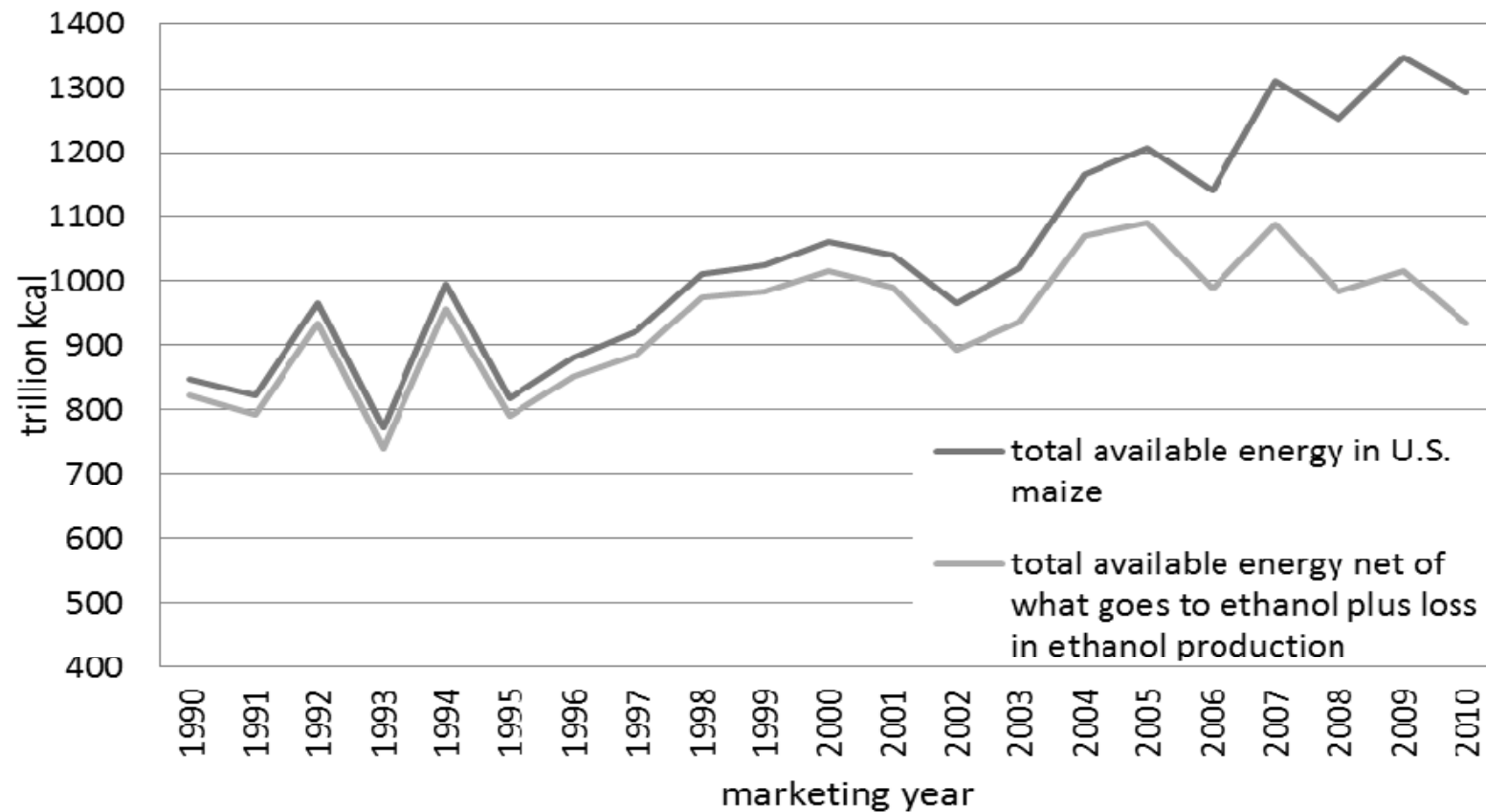


US Corn Ethanol Expectations Soared 2005-09



Source: USDA Agricultural Baseline Projections (2002–2010)

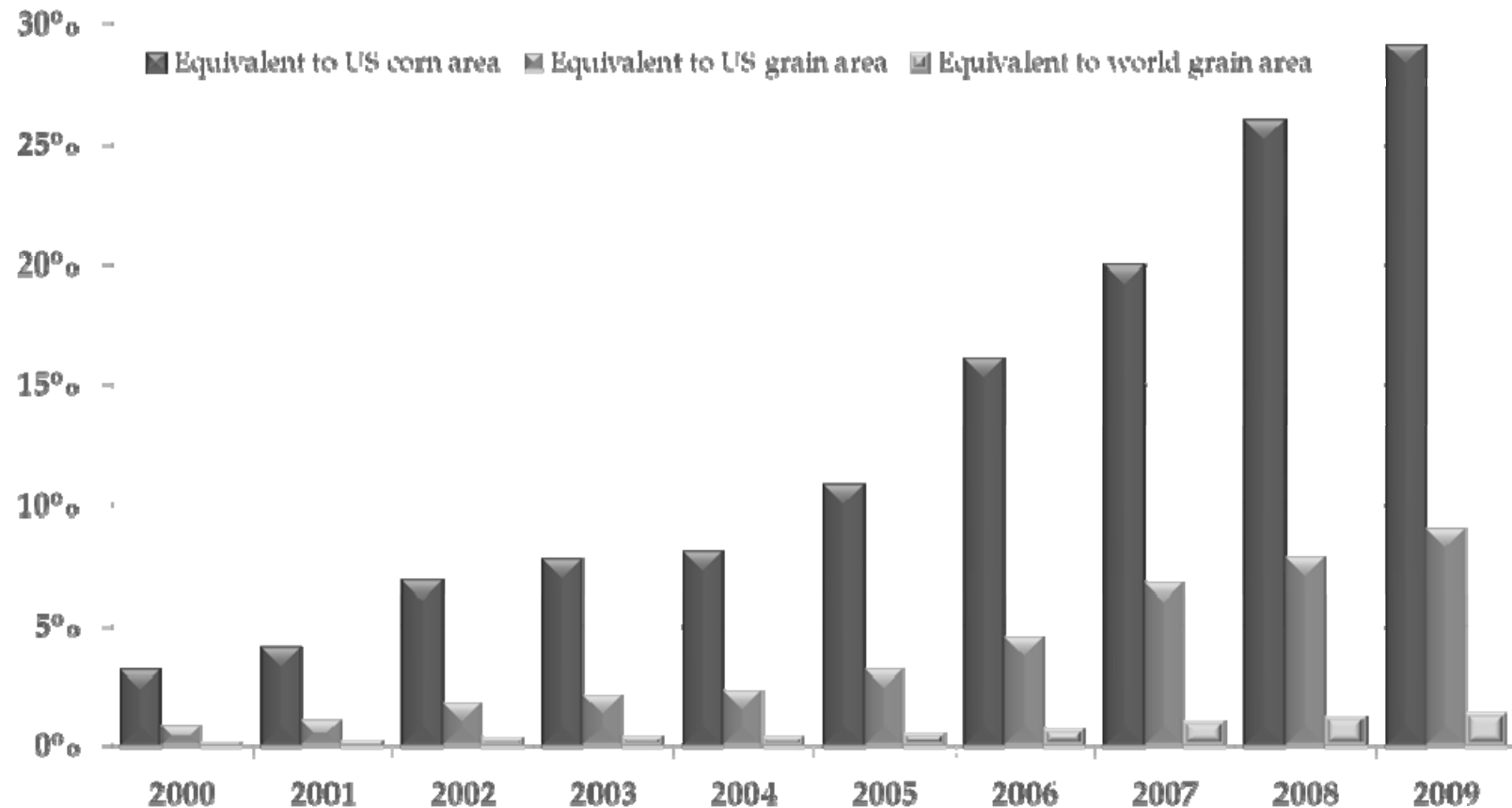
U.S. maize energy for food/feed fell below 1994 level



Source: Calculated using supply and use data from Feed Grain Database, USDA.

Note. Annual supply-use statistics provided by USDA are on a marketing-year basis.

Land used for US ethanol from corn

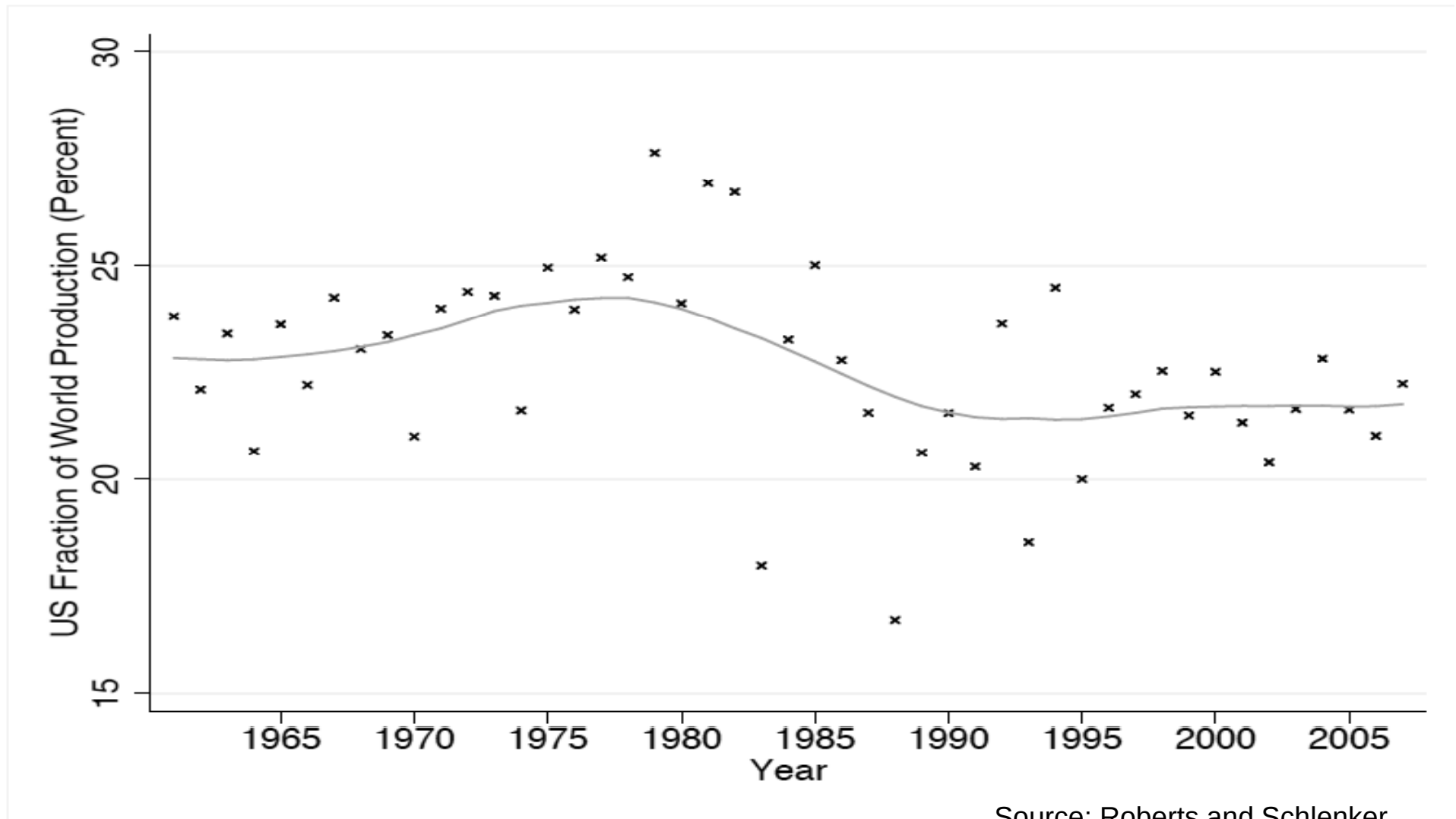


Source: Baffes 2010

Maize and oilseed energy demand shocks depleted stocks, led to spikes

- Soy availability also fell, as did canola in Europe
- Substitution of grains in use and of grain lands spread the shortage to all major grains
- Stocks fell as supply could not match the burst in corn and oilseed fuel demands
- At low stocks, prices were highly sensitive to otherwise “normal” disturbances

US has large shares of global caloric production of maize, wheat, rice and soy



Source: Roberts and Schlenker

Beyond Price Spikes:
***Corn Ethanol Policy as Classic Price
Discrimination***

- Shift supply from price inelastic market (food consumers) to transport fuel market (where demand for biofuel is elastic due to biofuel's small market share)
- Food price rises but consumption falls less, so food/feed grain revenue rises
- Grain for biofuel rises but price falls little, so fuel grain revenue also rises
- Farmers gain, food consumers lose

Are speculators causing spikes?

Arithmetic of Speculation

- Available supply – Stocks = Consumption
- In short run supply is fixed (in agriculture, not minerals incl. oil).
- *Price is a function of consumption of food and feed*
- If speculators affect price, *they must affect consumption*, so they *must change stocks*
- *Where are the extra stocks?*

Grain Biofuels Policy: Regime Change?

- *Farmers are politically powerful now, not just in USA or OECD*
- If they can, they will make the current price the floor
- ***↑ In developing countries, grains, sugar, oil palm or cassava are included in biofuel plans in at least a dozen countries***

Grain Biofuels Policy: The Danger

- **Corn ethanol, soy for diesel, and sugar ethanol can be expanded faster than yields can rise, *in response to mandate expansion or high oil price*, keeping stock ratios low and food prices high and volatile for many years**
- **Can aid make up for such a transfer?**
- **Can productivity growth make fill the gap?**

Farm-friendly economists do not emphasize the price-raising role of biofuels, but:

“If the ethanol industry were to shrink in the absence of the subsidies up for renewal this year, corn prices could end up somewhere south of the loan rate.”

Policy Pennings, by Daryll E. Ray, Ag Policy Analysis Center, University of Tennessee©2011 May 11, 2011
<http://agpolicy.org/weekcol/536.html>

Second Generation biofuels

- Cellulosic ethanol has interesting possibilities.

But:

- A decade away at least
- Where will it be grown? (research question)
- If it is perennial, and competes with food production, worse than annual crops, because inflexible
- Otherwise, a promising alternative for the long run

- Algae?

Conclusions

1. No evidence of climate change in harvest volatility.
2. Price spikes:
 - ✓ occur only when stocks/use ratios are minimal and market is fragile
 - ✓ do not match market shocks due to storage
 - ✓ match times of ***low stocks***, not ***low production***

Conclusions (contd.)

3. Food-competing biofuels expansion can:

- ✓ maintain a **medium term regime change in price levels**
- ✓ keep farmers/landowners rich, ***in countries at all development levels***
- ✓ Import petroleum market disturbances into agriculture

4. Biofuel options can counter volatility effects, not higher price levels
(see my IPC proposal)



IPC Policy Focus

February 2011

Biofuels and Food Security: Time to Consider Safety Valves? by Brian Wright

Alarm bells over rising food prices are sounding once more. In the summer of 2010, drought and fires in Russia's wheat growing regions, and subsequent announcements of a Russian export ban and quotas on exports from Ukraine, sent wheat prices gyrating again. In early October, a United States Department of Agriculture corn stocks report sent corn prices plunging one week, but a week later an unexpectedly low harvest report caused jumps in the prices of corn, wheat and soybeans. Despite one of the highest aggregate grain harvest achieved in 2010, carry-over stocks—especially of corn—for 2011 are at precariously low levels and there is no sign of decreasing demand on the horizon. The market expects sustained upward pressure on grain prices in the global marketplace, and the FAO's price for a basket

pressure of energy demands on food supplies continues to increase, there will be a serious threat to the food security of the world's poor. We believe, therefore, that serious consideration needs to be given to the establishment of "safety valves"—measures that allow the diversion of agricultural feedstocks from biofuel production into the food chain in times of acute need.

Safety Valves to Protect the Poor

Such safety valves are of greatest importance in those countries pursuing or contemplating ambitious biofuels programs that have large populations vulnerable to food shortages. They may also be important for developing countries with export-oriented animal feeding industries to facilitate the diversion of animal feed supplies to food uses in emergencies. It should be possible, for

Conclusions (contd.)

5. Food-competing Biofuels can ***do more harm to the welfare of poor and landless***, globally, than ***the greatest conceivable aid efforts or productivity increases could compensate.***

Thanks to my colleagues:

- Carlo Cafiero, FAO
- Eugenio Bobenrieth, Universidad de Concepcion, Chile
- Juan Bobenrieth, Universidad del Bio-Bio, Chile
- Di Zeng, ARE, University of California, Berkeley
- Ann Harrison, World Bank
- Julian Lampietti, World Bank
- Don Larsen, World Bank
- Yongdong Liu, ARE, University of California, Berkeley
- Olivier Mahul, World Bank
- Will Martin, World Bank
- Wallace Tyner
- Yang Xie, ARE, University of California, Berkeley
- Marc Sadler, World Bank
- Josef Schmidhuber, FAO
- Stefan Tangerman
- Phil Verleger
- Nicole Wright

