

The Financialization of Commodity Futures Markets

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1. Introduction

Futures Markets

There are active and liquid futures markets for most major internationally traded agricultural, energy and metals commodities . Important exceptions are iron ore, steel and rice.

Futures markets serve three important functions:

1. The futures price (generally a nearby more than the delivery contract) provides a reference price for commercial transactions worldwide. Price discovery therefore takes place on the futures markets which can be seen as information aggregators.
2. The “actors” on commodity futures markets have traditionally been seen as “commercials”, generally identified as hedgers, and “non-commercials”, identified as speculators. The markets transfer risk from the commercials to the non-commercials.
3. Non-commercials act as counterparties to commercials. This liquidity provision function allows hedging at low cost.

Financialization

- The commercial/non-commercial distinction is based on type of economic activity while the hedger-speculator distinction is based on the motivation of the transaction. As financial institutions have become more sophisticated and less specialized, it is no longer possible to infer trading motivation from institutional type. Commercials may speculate and non-commercials may sometimes hedge.
- Over the past two decades, the commodity industries (producers, stockholders, processors) have complained that futures markets have come to be dominated by non-commercial players (sometimes loosely referred to as “the funds”) with no knowledge or interest of the industries in question. The fundamentals of stocks and production are dominated by the “fund”-amentals of momentum and trends. Many of the funds are classed as commercial by the regulators since they use futures to hedge options, swap and other OTC positions.
- This is associated with the emergence of commodities as a distinct asset class, competing with equities, bonds and real estate for a place in investor portfolios. Investors add commodity futures to equity and bond portfolios.

Total commodity futures and swap positions (\$bn)

	Nominal	2005 values
1998	137.8	246.6
2000	159.3	234.1
2002	271.5	438.4
2004	480.7	580.5
2006	2153.4	1709.7
2008	7474.2	3626.4
2010	1470.1	1015.6
2012	1595.9	942.1
Figures relate to the end of June.		
Source BIS and IMF.		

Open interest, Chicago grains and oilseeds markets (# contracts)

	Corn	Soybeans	Wheat
1998	301399	133659	118612
2000	431659	156455	131555
2002	424811	191074	97871
2004	577335	183456	144525
2006	1329400	351200	461737
2008	1366107	476188	349615
2010	1133201	440453	455011
2012	1057772	767737	412616
Contracts of 5,000 bushels. Figures relate to the final trading day of June of the respective years. Source: CFTC, <i>Commitments of Traders</i> reports.			

What are the issues?

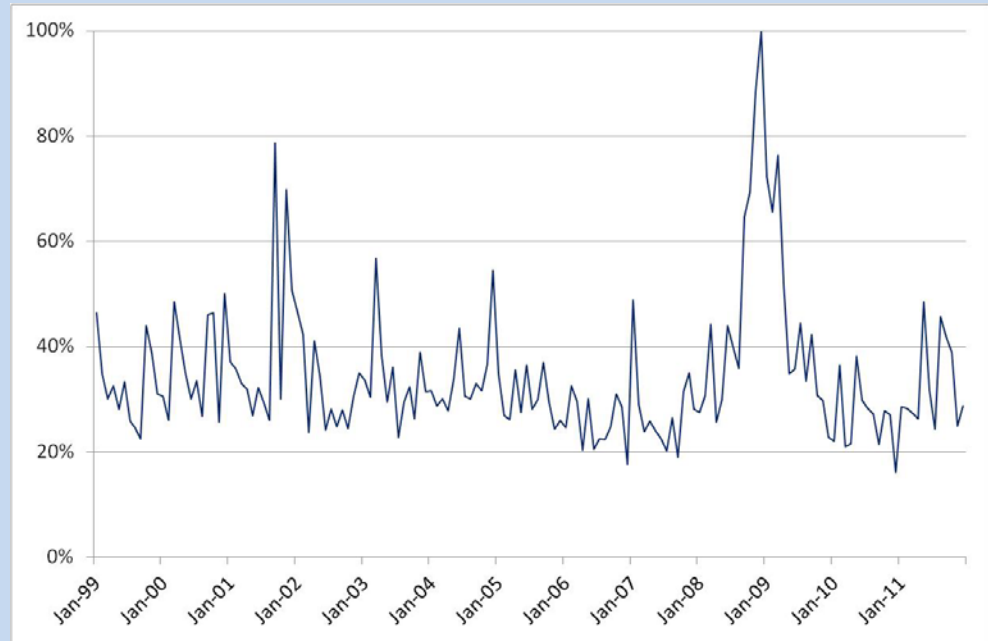
Can markets distort? Are prices the result (sometimes?, always?) of the way prices are formed as well as the information that goes into their formation?

1. Volatility: It is widely supposed that price volatility has increased over recent years. Is this true? If so, why?
2. High prices and volatility: Some commentators have argued that index-based commodity investment, which has become increasingly important over the past decade, adds to demand and so raises prices and/or reduces market liquidity and hence increases hedging costs and market volatility.
3. Bubbles: Many commodity funds follow declared non-discretionary “technical” strategies. These are typically based on trend identification algorithms. There is a concern that this may result in herd following behaviour leading to bubbles.
4. Cross-commodity correlations: The correlation of price movements across commodities has increased substantially over the past five years. Have fundamental drivers become more correlated or is this evidence that prices have moved away from fundamentals?

2. Volatility

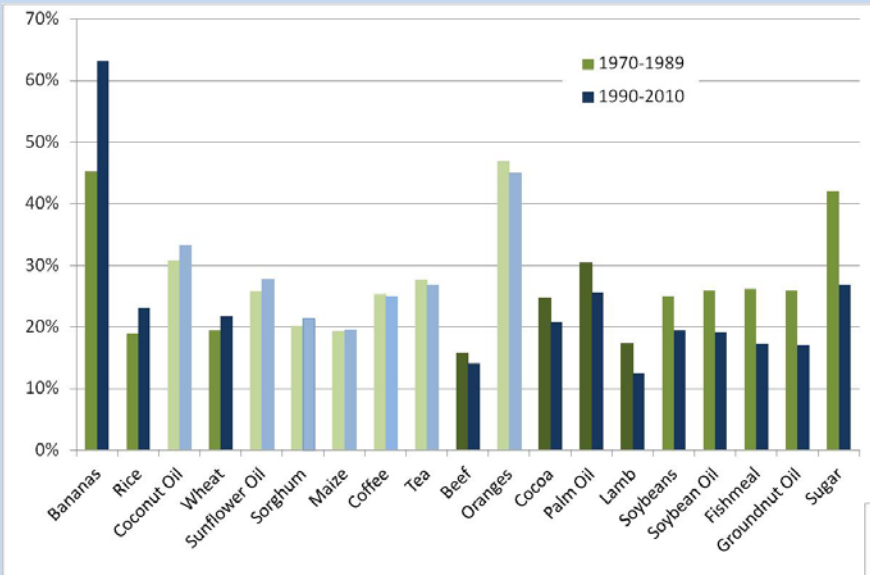
Crude oil volatility

WTI volatility (left, intra-month return standard deviation, front future) has been broadly constant over the 13 years 1999-2011, ranging between 20% and 45% at an annual rate.



The two large spikes are associated with 9/11 and the aftermath of the Lehman collapse.

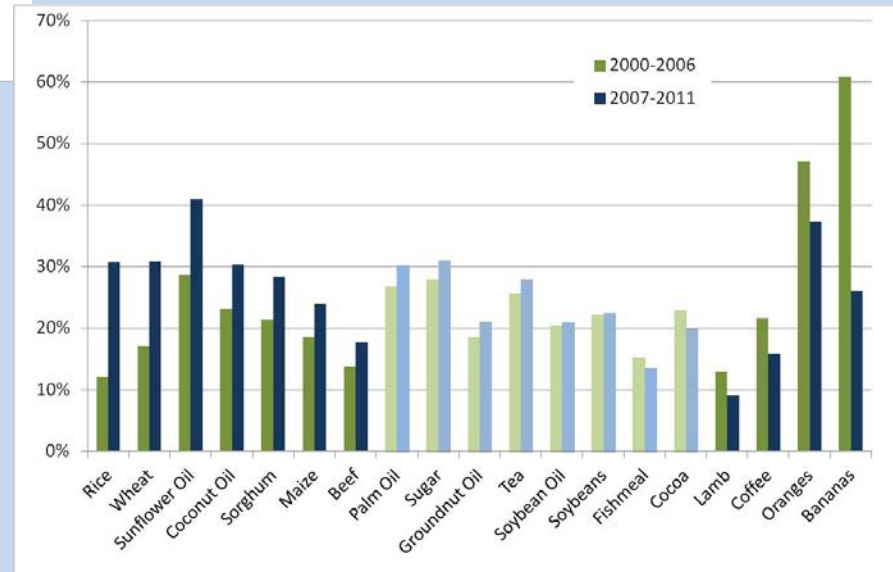
Agricultural price volatility



Gilbert and Morgan (2010, 2011) and I compared food price volatility over 1990-2010 with 1970-1989 (left). There was a significant increase for only 2 commodities (bananas and rice) with falls for 9 commodities.

Comparing 2000-06 with 2007-11, we find increases for 8 commodities, including all the important grains, and declines for only 4.

Grains price volatility has increased relative to the recent but not relative to the distant past.



Volatility conclusion

- There does appear to have been a rise in the volatility of grains and vegetable oils prices over the past five years extending to some extent to livestock prices.
- There is no evidence of a more general rise in agricultural price volatility.
- Volatility increases do not correspond with financialization – there are volatility rises for oars and rice, which are not actively traded on futures markets, but not for coffee, cocoa and sugar, which are actively traded.
- Instead, we should look for an explanation of volatility increases which relates specifically to grains and vegetable oils.

3. Index-based investment

Index-based commodity investment

- The past two decades have seen the emergence of commodity investors as an important group of market participants. Index investors set out to replicate an index – usually the S&P GSCI or the Dow Jones UBS index – or a sub-index of one of these. The declared objective is portfolio diversification into the “commodity asset class”.
- Many investors take these positions through purchase of floating-for-fixed swaps - the investor swaps the invested sum for the value of the index. Some institutions, particularly pension funds, replicate the indices directly.
- The investor is long the index so the index provider (typically an investment bank) is short. The index provider will invest in commodity futures to offset his risk exposure.
- Net index positions can be large – up to 40% of total open interest.
- George Soros accused these funds of having driven up oil prices in 2008. Another hedge fund manager, Michael Masters, accused them of “eating liquidity” and hence increasing price volatility.

Why add commodities to an investment portfolio?

Following Markowitz (1952), standard investment theory looks at financial assets in terms of how they impact the risk-returns profile of an overall investment portfolio, not the individual risk-returns characteristics. Through asset diversification, an investor can increase the expected return holding risk constant, or equivalently reduce risk holding expected return constant.

	Equities	Bonds	Commodity Futures
Average	5.6%	2.2%	5.2%
s.d.	14.9%	8.5%	12.1%
Sharpe ratio	0.38	0.26	0.43

Annualized monthly excess returns , July 1957 – December 2004

Gorton and Rouwenhorst (2004) argued that total commodity returns on the S&P-GSCI compare favourably with equity returns, although they are slightly more risky. The Sharpe ratio is comparable with that on equities and better than the Sharpe ratio for bonds.

Index funds can account for a large share of total market open interest

Index fund shares, June 2008, (CFTC)					
	\$bn	Share		\$bn	Share
Crude oil	51.0	26.6%	Cocoa	0.8	14.1%
Gasoline	8.0	23.9%	Coffee	3.1	25.6%
Heating oil	10.0	34.5%	Cotton	2.9	21.5%
Natural gas	17.0	14.7%	Sugar	4.9	31.1%
Copper	4.4	41.7%	Feeder cattle	0.6	30.7%
Gold	9.0	22.7%	Live cattle	6.5	41.8%
Silver	2.3	20.1%	Lean hogs	3.2	40.6%
Corn	13.1	27.4%	Other U.S. markets	1.4	
Soybeans	10.9	20.8%	Total (U.S. markets)	161.5	25.8%
Soybean oil	2.6	21.7%	Non-U.S. markets	38.4	
Wheat	9.7	41.9%	Overall total	199.9	

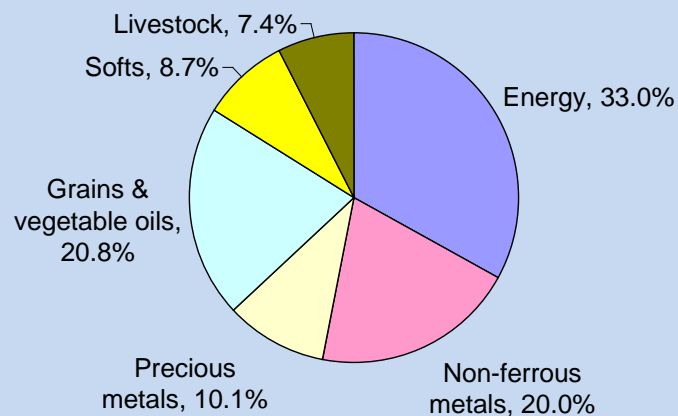
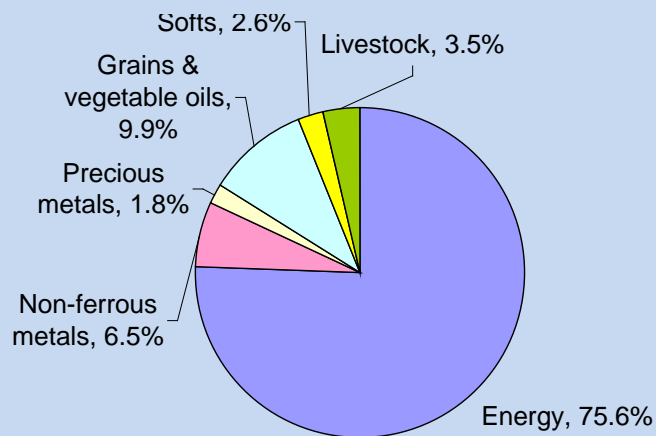
Index composition

The two major tradable indices are the S&P GSCI and the Dow Jones UBS indices.

The S&P GSCI (top) has a very high energy weighting. The DJ-UBS index (bottom) caps sector weights at one third and gives a larger weight to agriculturals.

Overall agricultural weights are small relative to energy and metals so any effects should be comparably small.

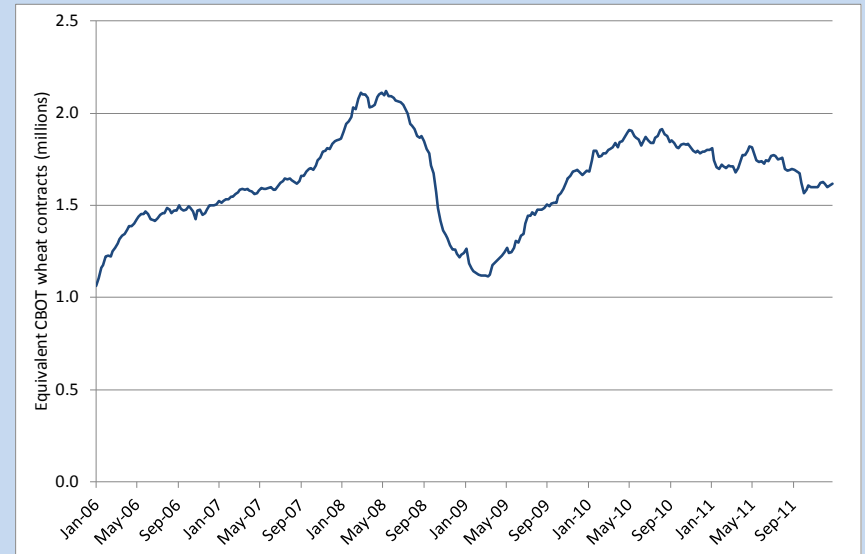
Figures are for September 2008.



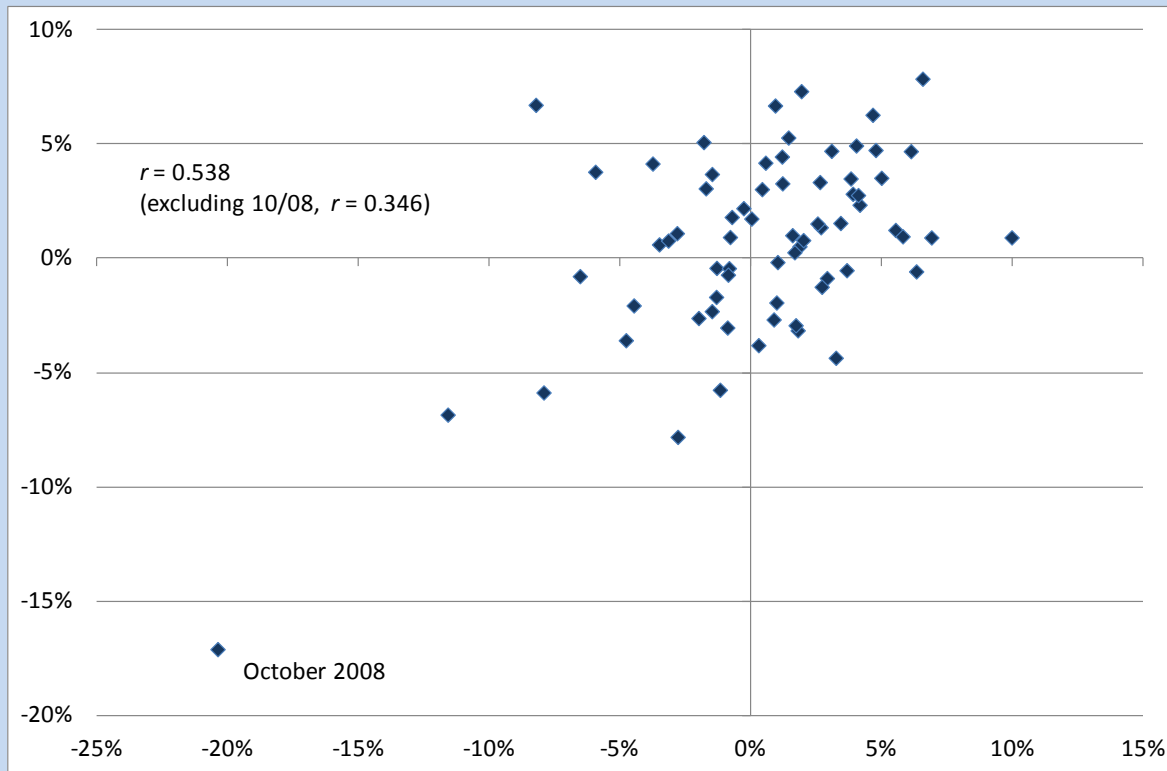
An index investment quantum index

We can use the index investment figures from the CFTC's *Supplemental Commitment of Traders* reports to construct an index of total (net) index investment in US agricultural markets. I use base period (January 2006) prices to weight positions figures to give an index in terms of equivalent CBOT wheat contracts.

Positions rise steeply in the first half of 2006 and again in late 2007 and early 2008. They fall in the summer of 2008 to a low in spring 2009, then rise back and have been broadly stable with a slight negative trend since 2010.



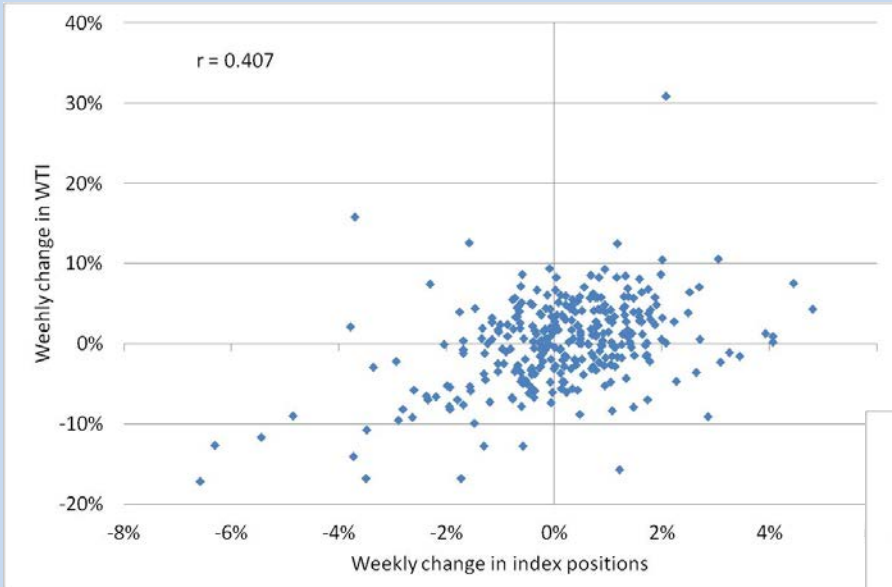
These movements correlate well with price developments.



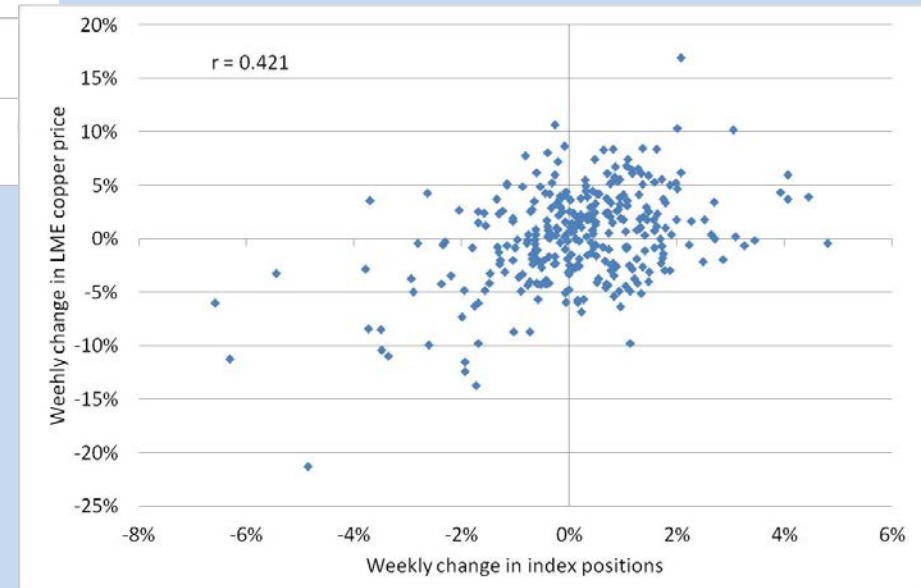
The chart plots monthly changes in the IMF's food price index against changes in the index investment index (February 2006 – October 2011).

The correlation is heavily influenced by the post-Lehman October 2008 observation. Excluding this, $r = 0.346$

Index investment correlations



Weekly changes in the index investment quantum correlate well with contemporaneous changes in WTI (left) and LME copper (below)



Correlations are around 0.4 and stable over time. Granger causality tests show that lagged changes in index positions predict changes in WTI and metals prices.

This is strong evidence that index investment does impact prices.

Granger-causality analysis

Granger-causality analysis is widely used to investigate links between position changes and futures returns. Here I report the test result for WTI crude oil returns using the index investment quantum:

$$\Delta \ln WTI_t = \text{intercept} - \frac{0.121}{(1.40)} \Delta \ln WTI_{t-1} - \frac{0.136}{(1.42)} \Delta \ln WTI_{t-1} + \frac{21.84}{(2.35)} \Delta \text{Index}_{t-1} + \frac{12.37}{(1.19)} \Delta \text{Index}_{t-2}$$

Sample: 309 weekly observations, January 2006 – December 2011.

The Granger causality test statistic is $F_{2,304} = 5.98$ with tail probability 0.003.

Smaller volumes of index investment go into agricultural products so results are less clear. Here is a marginal result for soybeans

$$\Delta \ln psb_t = \text{intercept} - \frac{0.044}{(0.54)} \Delta \ln psb_{t-1} + \frac{1.525}{(1.95)} \Delta \text{index}_{sb_{t-1}}$$

Sample: 259 weekly observations, January 2006 – December 2010. The t statistic marginally fails to reject Granger-non-causality at the 5% level.

Index investment and volatility

- The fact that index investment impacts prices does not imply that it is volatility-increasing.
- Masters (2008) stated that index investors “eat liquidity” but they might equally be liquidity providers by acting as counterparties to commercials.
- In research reported at a Dublin EAAE workshop in February 2012, I suggested that the evidence favours this latter view. Using an extended GARCH framework, I showed that where index investment does impact grains price volatility, it is volatility reducing.
- Index investment does impact commodity prices but not obviously in an adverse manner. It can be seen as a form of macroeconomic-based speculation. It does not raise public policy concerns.
- Implication for public policy: There is no evidence that index investment is problematic and requires additional regulation.

Index investment - summary

Index-based investment has become an important component of commodity futures markets accounting for up to 40% of long side open interest. There are two questions:

1. Does index-based investment impact agricultural futures prices and volatility? Based on Granger causality tests, Sanders and Irwin, and also Stoll, have argued not. These tests have low power, in particular since any such impacts should be contemporaneous. Simone Pfuderer and I do find impacts but not for all commodities. I find that the effects have generally been to reduce volatility implying that index trading is accommodating.
2. Supposing an affirmative answer to the first question: Has index-based investment contributed to the higher and more volatile food prices? I argued that it was an important factor in 2008 but I don't believe it has been so important subsequently.

4. Bubbles

The Dutch tulip bubble, 1636-37

This is the first recorded commodity price bubble.

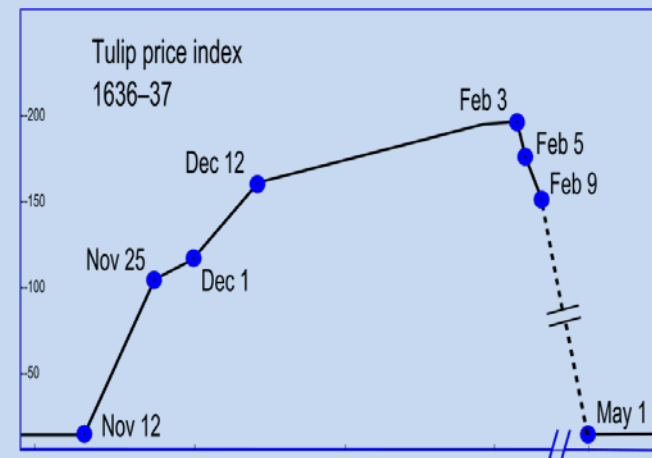
Tulips were a phenomenon in C17 Netherlands, already a rich country. Importantly, bulbs take a long time (7-10 years) to grow from seed so a rise in demand can lead to a sharp rise in prices before new supplies become available.



The Dutch placed particular value on tulips with streaky petals – resulting from the presence of a virus and impossible to predict until the plant flowers.

A large but informal paper market in bulbs grew up over the winter months in anticipation of the next spring's bulbs.

The bubble occurred in the winter of 1636 – prices rose sharply to collapse in spring 1637.



The Economics of Price Bubbles

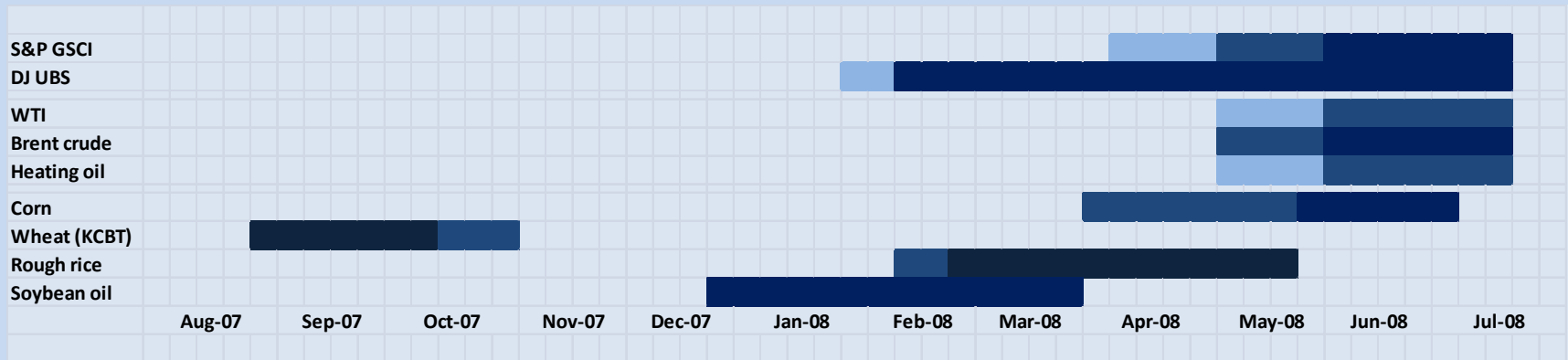
There are two stories: behavioural bubbles and “rational” bubbles. I offer a hybrid account:

- Behavioural economists emphasize non-rational explanations of bubbles. These explanations run in terms of return chasing, extrapolation, herding, and over-optimism.
- The discussions are generally at the level of the individual retail investor. Investment in commodity futures is dominated by institutions who are less likely to exhibit these features. Instead, financial institutions suffer from “short termism” – they, and individual managers, are under pressure to produce high returns every year, and if possible, every quarter.
- Institutional investors will aim to beat common “benchmark” portfolios but will not deviate far from the implied allocations for fear of underperforming. Even if they are aware that particular price developments are without fundamental support, they lack the freedom to take a contrarian view.

Rational bubbles

- This is the mainstream account of bubbles.
- It rests on the view that finance theory gives a good account of the relationship between asset returns, but only a weak account of asset values. So long as an asset is earning the appropriate (risk adjusted) return, its price can be away from equilibrium. With a positive return, an asset price which is too high will become increasingly out of line with the fundamental but will nevertheless generate the required return.
- In the end, reality catches up through supply-demand adjustment. In commodities, inventories become unsustainably high. The bubble bursts and price falls back to the fundamental. In the interim, the knowledge that the bubble will eventually burst leads investors to look for ever increasing returns, so the bubble growth typically accelerates before it bursts.
- Trend spotting algorithms home in on bubbles. Because institutional investors are short term, they will typically ride with the bubble.

Bubbles in grains and vegetable oils markets, 2007-08



- Figuerola-Ferretti, Gilbert and McCrorie (2012) used the Phillips and Yu (2011) methodology to look for possible bubbles in energy and oil markets over the period 2000-11. The darkness of the bars indicates critical values (10%, 5%, 1%). (These results may not be robust to the sample start date).
- Using weekly data, bubbles were found in 2007-08 for the energy products, corn, hard (but not soft) wheat, rough rice and soybean oil (but not soybeans).
- These bubbles do not relate in any clear way to index investment or other financialization variables. It is more plausible that they were generated by sharp changes in fundamentals (or perceptions about fundamentals).

Bubbles summary

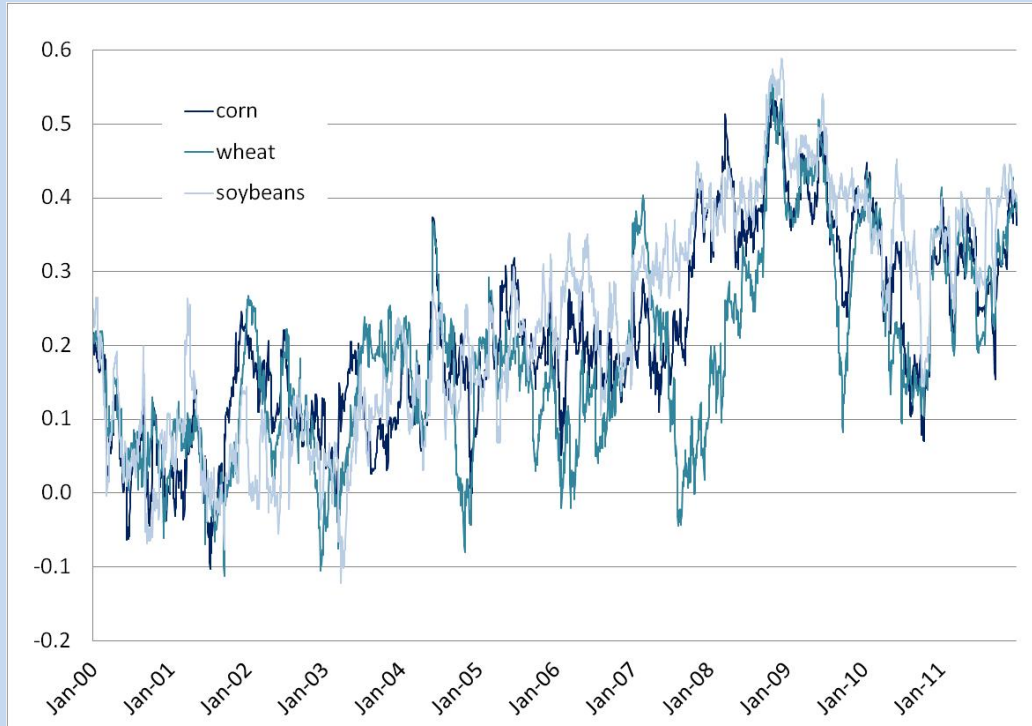
- Price movements in the grains and vegetable oils markets in 2007-08 appear to conform to the rational bubble story.
- Despite this, there is no evidence directly linking these bubble phenomena to financialization. It seems more likely that their genesis was in movements in fundamentals. More work is required on the methodology to clarify this channel.

5. Commodity return correlations

Increased price comovement

- The increased comovement of food prices (and indeed commodity prices generally) with crude oil prices, stock market returns and exchange rate changes over the recent past has been widely noted (Büyükkşahin, Haigh and Robe, 2010; UNCTAD, 2011).
- Tang and Xiong (2012) find rises in the rolling correlations between crude oil returns and both agricultural and non-agricultural commodity prices.
- Bicchetti and Maystre (2012) use high frequency data to document a jump in the moving correlation in the returns on various commodity futures (including CBT corn, soybeans and wheat, CME live cattle and ICE sugar) and S&P 500 futures returns.
- Two competing explanations are available – financialization, and in particular index based investment, which implies transmission of financial market shocks into food prices, or biofuels, which do the same with oil price shocks.

DCC MGARCH conditional correlations



Gilbert and Mugeru (2013) use the DCC Multivariate GARCH model to extract conditional correlations of grains price returns with crude oil returns (here Brent crude). Correlations with crude oil returns have increased for all three grains and do not show any sign of declining.

Average correlation with crude oil			
	Corn	Wheat	Soybeans
2000-06	0.125	0.130	0.114
2007-11	0.378	0.313	0.278

Possible explanations

1. Financialization: This does not appear right because we see the same increased correlations for oats and rough rice, markets which are too small to attract index investment or money managers.
2. Common demand side shocks: supply shocks tend to be commodity-specific while demand shocks are more general. The post-2008 financial crisis may have led to a dominance of demand side shocks. This may be part of the explanation, but the rise in the inter-commodity correlation starts in 2006-07 predating the financial crisis. Once we control for oil price movements, the correlation of grains prices with equity returns declines substantially.
3. Biofuels: the increase in correlations coincides with the rise in oil prices and the installation of ethanol refining capacity in the US. However, the biofuels story cannot explain why we get a similar rise in correlations of metals and crude oil prices.

Comovement summary

- For food commodities, the biofuels appear to dominate financialization as the explanation for comovement.
- This can also explain the earlier finding that, over the same period, volatility has risen for grains and vegetable oil prices, irrespective of whether or not traded on futures markets, but not for other agricultural prices.
- Biofuels cannot explain the increased comovement of metals prices with oil prices and equity returns. Again, increased comovement is independent of futures trading. Here, common demand shocks appear to be the stronger explanation.

6. Summary conclusions

Summary conclusions

1. Although there has not been any general rise in commodity price volatility, there has been a rise in the volatility of grains prices. Furthermore, oil price volatility is now transmitted to grains prices to a greater extent than previously.
2. Financialization, and in particular index-based investment, does not seem a strong contender to explain these phenomena. Index investment does impact food commodity prices, but probably less than it does energy and metals prices. It appears to be volatility-reducing.
3. Price movements in 2007-08 exhibited bubble features. These were not clearly related to financialization.
4. The use of food commodities as biofuels feedstocks may provide the common explanation for the rise in food price volatility and increased comovement with oil and equities.

The Trader's Song ("Supply and Demand"), updated

Weiß ich was ein Reis ist?

Weiß, ich, wer das weiß?

Ich weiß nicht was ein Reis ist.

Ich kenne nur seinen Preis.

By the way, what is rice?

Don't ask me what rice is.

Don't ask advice.

I've no idea what rice is.

All I know is price.

Wheat, beans, oats and maize!

These things leave me in a daze.

Delta, gamma, vega, rho:

that's the sort of thing I know!

Contangos, backs, whatever
tracks.

In the end, the trend's your friend.

Ag' research never pays.

Bertolt Brecht, *Die Maßnahme* (1930)

Thank you for your attention