The Financialization of Food Commodity Markets

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Abstract

This chapter quantifies the extent of financialization of food commodity markets over the period since 2000 and analyzes impacts of this process. We look specifically at food price bubbles, price volatility and price comovement. We reject the view that financialization has been responsible for high and volatile food commodity prices but also reject the view that financialization has not had any effects on these markets. Trades originated by financial actors, and specifically index investors, can move prices but tend typically to be volatility-reducing. The widely-commented increased comovement, which relates to oil prices but not to equity prices, appears more likely to have resulted from the use of food commodities as biofuels feedstocks than from financialization.

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1. Introduction

There is a widespread perception that financialization may have contributed to the 2008 food price spike. This perception has been stimulated by pronouncements by prominent politicians and leading market commentators. Here we cite three instances:

- French President Sarkozy asked in 2011, "Speculation, panic and lack of transparency have seen prices soaring. Is that the world we want?".[1]
- A 2009 U.S. Senate Subcommittee report examined "excessive speculation" in the wheat market (United States Senate Permanent Subcommittee on Investigations, 2009). The subcommittee report was particularly concerned by the growth of index-based investment which it termed "index speculation".
- Hedge fund manager Michael Masters (2008) argued in evidence before a second Senate subcommittee that index-based investment both raised the levels of commodity prices and, by consuming liquidity, increased volatilities.

In the old days, it was widely believed, commodity futures markets in general and food commodity markets in particular, were populated by commodity market professionals. These professionals comprised three groups.

- Firms with a direct involvement in the physical commodity market ("commercials") who wished to offset their price exposure on the physical market by hedging on the futures market. The principal members of this group were supply chain intermediaries such as grain elevator companies.
- Large ("non-commercial") speculative funds which had no direct involvement in the physical market but nevertheless were habitual participants in the specific markets in which they operated. This group included funds operated by the (then) relatively small Commodity Trade Advisors (CTAs) who specialized in commodity as distinct from financial futures. While very many of these funds were technical traders, i.e. they traded on the basis of some form of trend identification procedure, a smaller proportion traded on the basis of their assessment of the supply and demand balance in the physical market (i.e. on market fundamentals).

[1] The Guardian, 17 June 2011.

- Small (“non-commercial”) speculative funds and individual traders.

From around 1990, commodity futures markets started to witness an influx of financial actors who were new to commodity futures. These included investment banks, hedge funds, pension funds and the entirely new group of index traders. Members of this new group often were motivated by different considerations than were traditional speculators, for example portfolio diversification, and they also adopted different trading strategies, for example taking positions in a commodity, say corn, rather than a specific commodity future, say the Chicago Board of Trade (CBT) December corn contract.

A consequence of this influx is that some traditional market participants found it more difficult to read market developments. In the situation, for example, in which a market was moving towards excess supply and a build-up of stocks implying a likely price fall, financial traders might nevertheless move the market upwards by taking long positions as an inflation hedge. Alternatively, another group of financial actors might see the commodity price as low relative to its long-run value and take long positions in the expectation of eventual reversion towards the mean. Futures markets were seen becoming separate from underlying physical markets. In a discussion of the impact of commodity funds on the London cocoa futures market, Gilbert (1994) wrote “the funds may appear as an outside, non-fundamental and possibly unnecessary intrusion into what is primarily a physical market”.

This gives us a broad characterization of financialization in terms of the influx of speculative and investment money into the commodity futures markets (Mayer, 2011). This definition is less than completely satisfactory since some of these financial institutions will have numbered among the traditional large non-commercial category of traders, and because hedging by commercial traders has generally grown by the same order of magnitude as non-commercial activity. More hedge funds exist now than twenty years ago and it is therefore unsurprising that there is greater hedge fund participation in commodity futures.

A narrower characterization of financialization results from the distinction between investing or speculating in commodities and investing in the “commodity asset class”. Traditional speculators saw themselves as investing in particular commodity futures on the basis that these offered attractive prospective returns. Some of the new financial actors, by contrast, saw themselves in commodities as a class either because commodities in general offered attractive prospective returns, or simply as a means of diversifying a portfolio of equities and bonds and thereby obtaining a higher prospective return for the same risk (or equivalently a lower risk with the same prospective return).

The perspective that commodities form a distinct asset class, similar to equities, fixed interest and real estate asset classes, supposes that the return behaviour of the different commodities is fairly homogeneous in the sense that it may be spanned by a small number of representative positions. Specifically, this requires that the class have a unique risk premium which is not replicable by combining other asset classes – see Scherer and He (2008). Given this premise, then provided that commodities exhibit sufficiently high returns and sufficiently low correlations with other asset classes, it follows that, when added to portfolio, the overall risk-return characteristics of the portfolio improve – see Bodie and Rosansky (1980), Jaffee (1989), Gorton and Rouwenhorst (2006), and for a summary, Woodward (2008).

Two characteristics of this new type of investor differentiate them from traditional speculators. The first is that they take positions in commodities in general rather than in specific commodities. Second, their positions are almost invariably long whereas traditional speculators will take long or short positions according to their perception of the underlying price trends. These differences led Gilbert (2010a,b) to describe the new class of commodity actors as investors as distinct from speculators .

This chapter is structured as follows. Section 2 documents the growth in financialization of food commodity markets since 2000, distinguishing between the broader and narrower concepts introduced above. In section 3, we discuss the evidence for bubbles in food prices. In section 4, we look at the evidence relating to possible impacts of financial traders on food price levels. Section 5 documents the rise in food price volatility and examines whether this may have been caused by financialization. Then, in section 6, we look at the contemporaneous rise in the comovement of food commodity prices and crude oil prices and equity returns. Section 7 concludes.

2. The extent of financialization

We first consider growth of financialization on the broader of the two definitions in section 1. The Bank for International Settlements publishes semiannual statistics on the notional value of outstanding commodity derivative positions. The first column of Table 1 reports these figures for alternate years. The figures relate to futures and swap positions in all commodity futures excluding gold and other precious metals.[2] The figures show rapid growth in the dollar values of these positions from 2004 to 2008 followed by a subsequent fall back to lower levels from the end of 2008. Even after this fall, the outstanding contract value remains three times that of 2004, prior to the big rise.

Table 1
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 for column 1: BIS, *Detailed tables on semiannual OTC derivatives statistics at end-June 2012*, Table DT19. The reported figures are for total forwards and swaps and exclude gold and other precious metals. Column 2 gives these notional values deflated by the average of the IMF non-fuel commodity price and energy price indices (2005 = 100), IMF, *International Financial Statistics*.

In part, of course, this rise in values reflects the rise in prices over the same period. We obtain an approximation to the quantum of positions by deflating by an appropriate commodity price index (here, the average of the IMF non-fuel commodity price index and energy price index) – see Table 1, column 2. The overall picture is unchanged by deflation.

[2] We exclude options positions since many of these will have been offset by futures positions resulting in potential double counting.

The implied total quantity of outstanding positions nearly trebled between 2004 and 2006 and then redoubled between 2006 and 2008. Subsequently, it has fallen back to a level which nevertheless remains substantially higher than that prevailing in 2004.

The figures reported in Table 1 relate to all commodity futures contracts with the exception of precious metals. Energy commodities, in particular crude oil, are the most important commodity contracts by value and the growth in overall positions seen in Table 1 is likely to be driven by growth in positions in energy futures and swaps. Nevertheless, the same pattern is seen in food commodity markets. Irwin and Sanders (2012a) show that the fast growth in trading volume and open interest on the Chicago grains markets commenced in 2004. They attribute this growth to increased market access and greater liquidity arising out of the move from pit to electronic trading. Table 2 reports the growth in open interest (i.e. the number of futures contracts outstanding) in the three important Chicago Board of Trade (CBT) grains and oilseeds markets – those for corn (maize), soybeans and soft wheat. The CBT market is the most important world market for each of these three commodities and these CBT prices are generally taken as reference prices in both domestic U.S. and in international commerce.

The table shows the rapid growth in outstanding positions in both the corn and wheat markets from around 2004 peaking in the three years 2006-08.[3] In both cases open interest fell back in 2009 but recovered to reach new peaks in the (northern hemisphere) winter of 2010-11.[4] Differently from the all commodity pattern seen in Table 1, the rapid growth in outstanding positions in these two grains started somewhat later (around the mid decade) and the high 2007-08 levels were maintained even after the financial crisis and through the subsequent recession.

The growth path of open interest in soybeans, the major oilseed traded on world markets, is different again and shows a broadly steady growth throughout the period under consideration. In the late nineteen nineties, the Chicago soybeans and wheat markets were of comparable size (in terms of contracts traded) while the corn market was significantly

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[3] Corn (Tuesday) open interest peaked at 1,523,926 contracts on 20th February 2007 and again at 1,488,009 contacts on 22nd April 2008. Wheat (Tuesday) open interest peaked at 482,008 contracts on 1st August 2006 and then subsequently at 462,934 contracts on 8th February 2008.
[4] Corn (Tuesday) open interest peaked at 1,719,814 contracts on 15th February 2011. Wheat (Tuesday) open interest reached a new peak of 562,198 contracts on 8th February 2011.

larger. By 2012, the soybean market had grown to become fifty per cent larger than the wheat market.

Table 2 Open Interest, Chicago Grains and Oilseed 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, *Commitments of Traders* reports.

Starting from June 2006, the Commodity Futures Trading Commission (CFTC) which regulates all U.S. futures markets, has published information on the composition of outstanding positions. The CFTC *Commitments of Traders* (COT) reports distinguish positions held by

- producers and merchants
- swap dealers
- money managers (typically hedge funds, pension funds)
- other reporting traders (commodity funds, such as Commodity Trade Advisors, and rich individuals), and
- non-reporting traders (typically, large famers and small speculators).[5]

The producers and merchants category corresponds to the "commercial" category of traders who have a direct interest in the physical commodity industry. While it is not

[5] The COT data is collected under the CFTC's mandate to monitor large positions. The "other reporting" positions are too small to be of interest for this purpose but brokers are nevertheless required to report the aggregate of such small positions. Prior to June 2006, the CFTC used a much coarser classification of commercials, large non-commercials and non-reporting traders. However, this classification had ceased to be very informative given that many financial institutions, in particular swap providers and some money managers, were classified as commercial on the basis that they were hedging positions taken by non-commercial clients – see CFTC (2006).

possible to infer the motivation of particular trades from the nature of a trader's business, it is natural to think that the bulk of the producer and merchants trades are hedges. Instead, the remaining three categories of reporting traders correspond broadly to the non-commercial group in that they have little or no involvement in the physical commodity. It is not the case that all trades undertaken by these three groups of traders are speculative or investment trades – swap providers, for example, will see their futures positions as offsetting price exposure taken on by writing swaps for their clients.[6] However, if these clients are non-commercial, as will usually be the case, the swap dealer's hedge may be taken as proxying a speculative or investment trade by the client. Broadly, therefore, we can regard the producers and merchants category as commercial traders, who will typically be hedgers, and the remaining four categories as non-commercial traders, either directly or indirectly driven predominantly by speculative or investment motives.

It has long been recognized that futures markets require a balance of hedgers and speculators – see, for example, Edwards and Ma (1992, chapter 7). In commodity futures markets, hedgers are almost invariably net long the physical commodity and hence have a net short futures position.[7] In the absence of speculators, they could not all find counterparties. Speculators take positions in the hope of making profits. In the absence of hedgers, net speculative profits would be zero (negative after trading costs). By paying a risk premium, hedgers ensure the profitability (in an average or expected sense) of speculation. A premise of much of the discussion of financialization is that the large increase in futures trading in food commodities witnessed over the past decade has been driven by financial institutions. This view is difficult to sustain since, at least in terms of net positions, hedging and speculation inevitably grow together.

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[6] In a vanilla fixed for floating commodity swap, the client agrees to pay the swap provider a fixed dollar sum and will receive in exchange a sum contingent on the price of a commodity or commodity index at the swap maturity date (or dates). This generates a short exposure for the provider in the sense that, the higher the commodity or index price, the more he is obliged to pay to the client under the swap contract. The provider will therefore have an incentive to hedge out this exposure by taking a long position in the commodity future (or in the basket of futures corresponding to the index).

[7] Stockholders, who typically operate on slender margins, will have short futures positions. Food processing companies, who have a short exposure to the physical and who therefore may be expected to take a long futures position, may remain unhedged on the basis that adverse price changes can be passed through to final consumers.

Table 3 Net Positions (Number of Contracts), CBT Corn Futures					
	Producers and merchants	**Swap dealers**	**Money managers**	**Other reporting**	**Non-reporting**
27-Jun-06	-410966	350607	88171	65612	-93424
26-Jun-07	-500967	335943	138557	87368	-60901
24-Jun-08	-577800	350337	220321	119408	-112266
30-Jun-09	-225853	221106	94106	18944	-108303
29-Jun-10	-263825	383214	-19821	29649	-129217
28-Jun-11	-459248	199850	225301	96114	-62017
26-Jun-12	-316713	266433	104215	23266	-77201
Positions relate to the final Tuesday of June. Source: CFTC, *Commitments of Traders* reports.					

Table 3 illustrates this issue in relation the CBT corn market, the most important of the U.S. agricultural futures market, for the final Tuesday of June from 2006 to 2012. Producers and merchants were invariably net short and swap dealers invariably net long as are the other reporting group on the particular dates considered. Money manager positions show the greatest variability. The non-reporting category of small traders is consistently net short suggesting that their positions may be dominated by farmers' hedge trades. Table 2 shows a rapid growth in outstanding positions between 2006 and 2008. From Table 3, we can see both a large increase in the net producers and merchants short position and in the long positions taken by money managers and the other reporting category. It is not clear from this information whether financialization resulted in an increase in hedging or whether an increase in hedging increased the prospective profitability of commodity speculation and drew in a greater volume of speculative funds.

Granger-causality analysis is a standard technique used by time series econometricians to disentangle causal relationships – see, for example, Stock and Watson (2003, chapter 12). The test asks whether knowledge of the past history of a candidate causal variable *C* helps, in a statistically robust sense, forecast an effect variable *E*. If so, the investigator may conclude that there is a causal relationship (possibly indirect) between *C* and *E* which, given time's arrow, must be from *C* to *E* (since there cannot be causal links from the present to the past). We can use this approach to examine whether commercial hedging behaviour causes or is caused by the activities of financial institutions.

The results of this investigation, using data from July 2006 to December 2012, are summarized in Figure 1 for the three main CBT grain and oilseed contracts. In each case, causation is seen to run from changes in producer and merchant positions to changes in money manager positions implying that changes in hedging drive changes in financialization. The results are more mixed for the two other categories but it remains true that the majority of the causal relationships detected are from producers and merchants and to the financial transactors.[8] These results suggest that, notwithstanding the global character of financialization, the influx of financial actors into the food commodity markets over the past decade has in large measure been driven by the requirements of commercial hedgers to find counterparties.

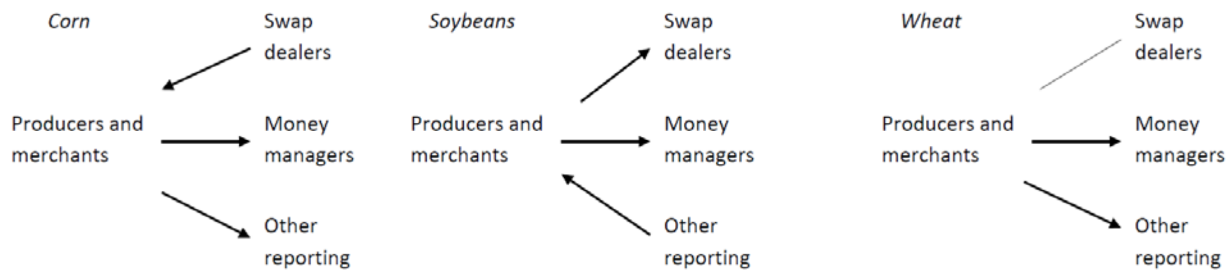

Figure 1: Causal Relationships Between Positions, CBT Grains Markets

Up to now we have focused on the broad definition of financialization as influx of investment money. The narrower definition looks instead at the influx of money into commodity markets from only those, non-traditional, investors who consider commodities as an asset class. These investors take long position across the range of commodities,

[8] Sample: 11 July 2006 to 24 December 2012 (338 weekly observations). Tests are carried out within an ADL(3,3) reducing symmetrically to an ADL(2,2) and ADL(1,1) with selection on the basis of the Akaike Information Criterion (AIC). The results reported in Figure 1 use a 5% critical value. (With a 10% critical value, the relationship between the other reporting and producer and merchants groups becomes bidirectional for wheat). Tests cannot be taken as independent since position changes sum to zero across trading categories and position changes are correlated across the three markets considered.

generally by replicating one of the main tradable commodity futures indices.[9] Regulators only started to compile and disseminate Information on the size of index-related positions once these became controversial. The Commodity Futures Trading Commission (CFTC) started to monitor positions in U.S. markets from 2004 although information in the public domain starts in 2006. Figure 2, which gives estimates of assets under management (AUM) in commodity index products, derives from numbers made available by Barclays Capital and extends back to 2002. Investment in commodity index products has risen rapidly over the last ten years from close to zero to over 400 billion dollars. The only year-on-year fall was recorded between 2007 and 2008. The increase in the following year more than made up for the decrease in index related products the previous year and the rapid increase continued between 2009 and 2010. These figures relate to all index related investment of which food commodities are only a relatively small share, as commodity index products are dominated by energy markets.

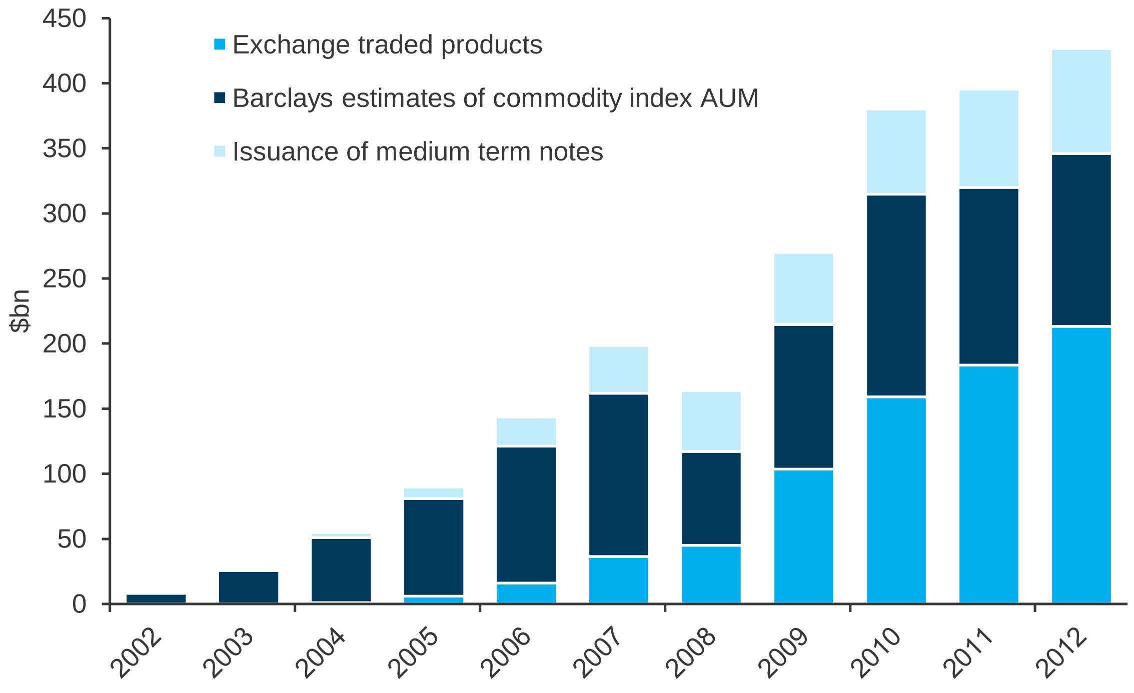

Figure 2: Total Assets Invested in Commodity Products 2002 to 2012 ($bn)[10]

[9] The S&P GSCI and the Dow Jones-UBS indices are the most common commodity futures indices. The former is the more widely tracked. It gives a high weighting to energy commodities and only a low weight to agricultural commodities. The Dow-Jones UBS index caps sectoral shares, including that of energy, at one third and hence gives greater weight to food commodities.

[10] Source: Barclays Capital. We are grateful to Kevin Norrish for making these data available.

The CFTC has published data on positions held by commodity index traders (CIT) at close on Tuesdays on a weekly basis in the twelve most important U.S. agricultural futures markets starting from 2006.[11] Table 4 shows CIT net positions on the last Tuesday of June for CBT corn, wheat and soybeans from 2006 to 2012. Comparing the three markets, net CIT positions are highest in the CBT corn market but the share of long positions held by CITs is highest in the CBT wheat market. In all three markets, the commodity index trader positions represented a sizeable share of total long positions over the period, generally between 20% and 35% in the corn and soybean markets and between just under 40% and 50% in the wheat market.

Table 4
Net CIT Positions (number of contracts) and Shares of Total Long Positions

	CBT Corn		CBT Wheat		CBT Soybeans	
	Net Positions	Share of Total	Net Positions	Share of Total	Net Positions	Share of Total
27-Jun-06	418,882	26.6%	199,467	39.3%	114,050	27.7%
26-Jun-07	362,737	22.6%	174,380	38.1%	144,448	22.4%
24-Jun-08	428,310	22.9%	179,228	48.1%	168,857	28.6%
30-Jun-09	305,167	27.5%	151,964	44.4%	137,088	26.9%
29-Jun-10	469,750	33.6%	215,461	46.7%	170,909	33.4%
28-Jun-11	378,124	26.3%	208,626	45.1%	171,893	27.7%
26-Jun-12	383,854	28.8%	195,655	43.6%	150,193	18.9%

Positions and shares relate to final Tuesday of June. Source: CFTC, *Commitment of Traders* reports.

The data in Table 4 do not show any clear trends or patterns. However, in all three markets, net CIT positions and the shares increased between June 2007 and June 2008 and between June 2009 and June 2010.[12] Both of these years were followed by falls in CIT net positions and falls in the share of CIT positions in two out of the three markets. Between June 2010

[11] Not all positions in the CIT category track the main commodity indices. The CFTC have also published Index Investment Data since end of 2007 initially on a quarterly basis and since June 2010 on a monthly basis. See Irwin and Sanders (2012b) and Sanders and Irwin (2012) for discussion of the index investment data .

[12] Irwin and Sanders (2011) have access to data on CIT positions for 2004 and 2005 that are not publically available. They show that net positions held by commodity index traders grew rapidly in all three of these markets over these two years.

and June 2012, the commodity index traders' share of total long positions in the soybean market fell substantially from 33.4% to 18.9%, which was mainly due to a large increase in total long positions.

3. Food price bubbles[13]

A number of commentators have suggested that the past two decades have come to be dominated by a series of bubbles caused by excessive market exuberance during to so-called Great Moderation, by relatively loose monetary control as central banks moved from money supply rules to inflation targeting and by low interest rates initially after 9/11 and subsequently in the post-Lehman period. Caballero, Fahri and Gourinchas (2008a,b) see recent financial crises as linking global financial asset scarcity and global imbalances to the rise in U.S. real estate prices, the subsequent subprime crisis and the 2007-08 spike in commodity prices. They model bubble creation followed by collapse as money migrates from sector to sector. In line with this story, Gilbert (2010c) argued that world money supply has been a major determinant of changes in food commodity prices over a forty year period.

Bubbles may be generated by "loose money" but we need to ask how this is transmitted into food commodity prices. A possible mechanism is as follows (other possible routes are discussed later in the section). A chance rise in a commodity price, perhaps generated by a large purchase by a financial institution, may lead uninformed traders to believe that market fundamentals have become more positive. Not having detailed market information themselves, they attempt to infer the information that others may have by working backwards from observed price changes. The result may be that the initial purchase attracts a further influx of money leading to a further rise taking the price further away from its equilibrium value. Informed traders will know that the price is now out of line with fundamentals but may be wary of taking a contrarian position, either because there is now too much money on the buy side or because they have short reporting horizons and cannot afford to carry a loss until the market comes right (De Long *et al.*, 1990). It is often remarked that the easiest way to go bankrupt in a financial market is to be right but to be right too early.

[13] We are grateful to Rod McCrorie for comments on the initial draft of this section.

It is frequently objected that food commodity prices cannot move significantly away from the level implied by supply and demand equilibrium since that would imply accumulation or disaccumulation of stocks and consequential price correction. The argument is correct in the sense that no bubble can persist indefinitely. However, for annual crop commodities, production responses to higher prices can only come with a new harvest and consumption responses to price rises take time as price changes feed through the food processing and distribution chain. The stock correction mechanism will therefore do little to prevent a bubble over a period of weeks or even months. Since the first major documented price bubble was in an agricultural market (tulips in seventeenth century Holland,[14] it would be unwise to dismiss the possibility of food price bubbles in the more recent past.

The key feature of any bubble is that price follows an explosive path. Explosions can easily be heard even at a distance and explosive price behaviour is therefore in principle easy to detect although it is difficult to do this in a statistically robust manner. However, since bubbles can only persist for a limited period of time, any bubble-affected time series must exhibit discontinuities in its behaviour. Standard tests, for example those based on the Augmented Dickey-Fuller (ADF) non-stationarity test,[15] may therefore fail to detect even visually evident periodically collapsing bubbles (Evans, 1991). Bubble tests are therefore tests for such discontinuities.

There are two strands to the empirical bubble literature. The first, initiated by Hall, Psaradakis and Sola (1999), Psaradakis, Sola and Spagnolo (2001) and Schaller and van Noorden (2002), adopts a Markov-switching approach to identify periods associated with bubble-type behaviour. Brooks and Katsaris (BK, 2005) extend the Schaller and van Noorden (2002) model to allow for three regimes – a dormant regime where the price follows a stationary trend, an explosive regime and a collapse regime. These models were all developed in relation to macroeconomic (money, exchange rates, price) and stock market variables. Shi and Arora (2012) apply the BK model to the West Texas Intermediate (WTI) crude oil price and find evidence for a bubble in crude oil prices in 2008. However, to the best of our knowledge this approach has yet to be applied to agricultural commodity prices.

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[14] Krelage (1942), Dash (1999).

[15] See, for example, Stock and Watson (2003, chapter 12).

The Markov-switching approach to bubble identification estimates a probability associated with each state (dormant, explosive and, in the BK model, collapsing) for each date in the sample. Bubble periods are therefore identified only in a probabilistic sense. The alternative approach to bubble modelling, developed by Phillips, Wu and Yu (PWY, 2011), adopts a classical approach with the result that, at any level of significance, a given period is either a bubble or a normal period. Gilbert (2010b) reports the results of application of the PWY procedure to the Chicago corn, soybeans and wheat markets using both monthly average data and daily data over the sample January 2000 to June 2009 and January 2006 to December 2008. There is no evidence of bubbles in the three food commodities using monthly data but the daily tests yield evidence for a bubble in soybean prices in the first three months of 2008.

There are (at least) two reasons why bubbles apparent at a high data sampling frequency (e.g. daily) may fail to be detected at a more coarse frequency (e.g. monthly). First, Figuerola-Ferretti, Gilbert and McCrorie (2012a) show that if the tests at different sampling frequencies are to be mutually significant, it will be necessary to use different critical values in the two cases. Second, PWY impose a condition that to qualify as a bubble, the sequence of explosive observations must satisfy a minimum duration condition. The length of this duration is somewhat arbitrary but the criterion used by PWY (the rounded natural log of the sample length) implies a minimum length which, on monthly data, will typically be between four and seven months while on daily data this may be between ten and twenty days. It is evidently possible that a bubble which is sufficiently long to be identified as a bubble on daily data may fail to be so identified on monthly data. Consequently, short duration bubbles (froth?) may not be apparent using low frequency data.

Figuerola-Ferretti, Gilbert and McCrorie (FGM, 2012b) revisit the issue of food price bubbles and employ the PWY procedure using daily, weekly and monthly data from January 2000 to December 2011 with critical values adjusted for sample length and frequency. They consider five grains (corn, oats, rough rice and both hard and soft wheat), two oilseed contracts (soybeans and soybean oil), three meat contracts (feeder cattle, live cattle and lean hogs) and three ”soft” commodities (cocoa, coffee and sugar).[16] They find that the clearest bubble definition is obtained with weekly data.[17] Table 5, which is adapted from Table 3 in FGM, summarizes bubble identification results for these 13 food commodities in relation to three periods: 2000-06, 2007-08 and 2009-11. Looking at the 2007-08 “food price spike” period, bubbles are identified for four of the five grains (oats being the exception) and for both the soybean and soybean oil contracts but for none of the meat or “soft” contracts.[18]

Table 5
Food Price Bubble Periods

		Pre-2007	2007-08	Post-2008
Grains	Corn	No bubble	Daily, weekly & monthly	Test unavailable
	Soft wheat	No bubble	Daily & monthly	No bubble
	Hard wheat	Daily & weekly (2002)	* Daily, weekly & monthly	Test unavailable
	Oats	Weekly (2001)	No bubble	No bubble
	Rough rice	No bubble	Daily, weekly & monthly	Test unavailable
Oils and oilseeds	Soybeans	Daily & weekly (2004)	* Daily	No bubble
	Soybean oil	Daily & weekly (2004)	* Daily & weekly	No bubble
Livestock	Feeder cattle	No bubble	No bubble	No bubble
	Live cattle	No bubble	No bubble	No bubble
	Lean hogs	No bubble	No bubble	No bubble
Softs	Cocoa	Daily & weekly (2002)	No bubble	No bubble
	Coffee	Daily (2001)	No bubble	No bubble
	Sugar	Daily & weekly (2000)	No bubble	No bubble

The table lists bubbles identified by the PWY procedure at the 90% critical value distinguishing three time periods: 2000-06, 2007-08 and 2009-11. The test procedure terminates once a bubble has been identified and any subsequent bubbles are only identified if the bubble identified by the PWY procedure is classified as non-robust. In those cases, indicated by an asterisk (*), a subsequent bubble may be identified using the Phillips and Yu (2011) procedure. In those cases in which a bubble has been classified as robust, the bubble test is subsequently unavailable. The table is adapted from Table 3 in FGM.

[16] Hard wheat is traded on the Kansas City Board of Trade (KCBT). Cocoa, coffee and sugar are traded on the InterContinetal Exchange (ICE). The remaining contracts are traded on either the Chicago Board of Trade (CBT) or Chicago Mercantile Exchange (CME), both part of the CME Group.

[17] Many food price bubbles are too short to be visible on monthly data. With daily data, bubble identification can be imperilled by individual days in which the price corrects within a more extended explosive period. The PY procedure cannot cope with these minor corrections – see Gilbert (2010b).

[18] The PWY procedure terminates once a bubble has been identified and is therefore blind to subsequent bubbles. FGM discuss various ways of circumventing this problem. One approach is to search for bubbles using different levels of significance. A second relies on the Phillips and Yu (PY, 2011)modification of the PWY procedure. PY note that the results obtained by applying the PWY procedure may not be robust to the sample start date. In those cases in which the PY procedure reveals a bubble identified by the PWY procedure to be non-robust, it is possible to proceed to identify a second possible bubble using the PY procedure. Bubbles identified in this way are marked with an asterisk in the table. In the remaining cases in which the PWY test is judged robust, no test is available post-2008.

FGM also estimate the extent of price inflation over bubble periods in 2007-08. Their results are reported in Table 6 (adapted from Table 4 of FGM). Inflation is of the order of 10% to 30% but substantially higher than this for the long bubbles (August 2007 to February 2008) estimated for wheat prices at the monthly data frequency.

Table 6
Estimated Bubble Inflation (2007-08 bubbles)

		Daily	Weekly	Monthly
Grains	Corn	6.7%	19.2%	17.1%
	Soft wheat	12.6%	No bubble	70.3%
	Hard wheat	11.8%	19.7%	86.0%
	Rough rice	25.6%	33.2%	36.4%
Oils and oilseeds	Soybeans	6.0%	No bubble	No bubble
	Soybean oil	12.6%	23.3%	No bubble

The table reports the price change from the period (day, week or month) prior to the estimated bubble start date to the estimated bubble end date. Bubble start and end dates are taken from the basic PWY estimates. The longest bubble period is selected from those estimated at 2½% , 5% and 10% (typically implying 10%). Source: FGM, Table 5.

There are three important points to make about these estimated bubbles. The first is that financialization is only one of several factors which can lead to the emergence of bubbles and there is nothing explicit in these studies which links the emergence of bubbles to the increased trading of commodity derivatives generally or index-based investment in particular.[19] The oats and rough rice contracts are crucial in this regard. These are both thinly traded contracts which have little relevance to world markets and attract only very slight interest from financial institutions. Index-based investment in these two contracts is negligible. If financialization were the only explanation for commodity price bubbles, we should not expect to find bubbles for either of these two grains. Although this negative expectation is confirmed for oats, there is strong evidence for a 2007-08 price bubble in rough rice.[20]

The second important qualification is that price bubbles may derive from sharp and unexpected movements in supply and demand fundamentals, especially during periods of

[19] FGM investigate whether bubble incidence is related to index-based investment. They fail to find any association.
[20] The 2007-08 rice price spike is authoritatively discussed in Christiaensen (2009) and Dawe and Slayton (2010, 2011).

relatively low stocks. Models of competitive storage can explain the general price patterns seen in many commodity markets - long periods of lower prices interrupted by sharp price peaks in periods of stockouts. Cafiero et al. (2011) show that models of competitive storage can explain the order of magnitude of volatility and autocorrelations in many commodity markets. The end-2007 and early 2008 bubbles which FGM identify in the two wheat contracts, soybean oil and rough rice, are susceptible to very straightforward fundamental explanations in terms of supply problems at that time and concerns about the emergence of such problems when global stock were relatively low. While it is possible that speculation and other financial factors may have played some role in these bubbles, it does not seem necessary to go beyond market fundamentals. A tentative conclusion may be that, while financialization may have played a role in determining the apparently explosive character of price movements during the 2007–08 food price spike, there is little evidence that it was the major driver of these changes.

The third qualification refers to the econometric methodology which remains in a state of evolution. The PY procedure, which was employed by FGM in relation to the results reported here in Tables 5 and 6, suffers from the fact that results may not be robust to the choice of sample start date and that the procedure cannot cope with multiple bubbles. Phillips, Shi and Yu (2012) have suggested a modified procedure which appears to overcome both these problems. Figuerola-Ferretti, Gilbert and McCrorie (2012c) have applied this procedure to non-ferrous metals prices but we are not aware of any application to food commodity prices.

4. Financialization and the level of food prices

There is a large literature which asks whether trades initiated by financial transactors with no direct interest in the physical markets may shift prices away from fundamental price levels. A number of possible mechanisms leading to price movements that are unrelated to market fundamentals has been suggested.

If financially-instigated futures market purchases are large in relation to the total size of a market, they may eat into the market order book and push prices upwards (see Scholes, 1972; Shleifer, 1986; and Holthausen, Leftwich and Mayers, 1987). We should therefore not be surprised if we find that CIT trades have an impact on U.S. agricultural futures prices and indirectly also spot prices (see Hernandez and Torero, 2010; Acharya, Lochstoer and Ramadorai, 2012; and Sockin and Xiong, 2012). However, these weight-of-money or liquidity effects should be transient and hence evaporate fairly quickly. Nevertheless, this may not be true if other, uninformed, market participants interpret the resulting price movement as conveying information about underlying market fundamentals or about the likelihood of future large purchases (see, for example, O'Hara, 1995; Stoll, 2000; and de Jong and Rindi, 2009).

UNCTAD (2009) distinguishes three types of traders. Informed traders base their position taking in commodity markets on information about market fundamentals. Uninformed traders do not collect information about market conditions but base their trading instead on past and current prices. Noise traders base their position taking on strategic considerations unrelated to the specific commodity market conditions. Index investors whose involvement in commodity markets is based on portfolio diversification considerations are one example of noise traders. When the number of noise traders and uninformed traders is large and when informed traders face limits to arbitrage, prices might not revert to fundamental values in the short term. In such a situation it can be even rational for informed traders to follow the trend away from fundamentals (de Long et al., 1990).[21] The concern that financial investors have moved prices away from fundamentals has been examined in the specific context of whether index investment may have impacted food price levels in particular during the 2008 food price spike — the Masters Hypothesis. This relates to the bubbles discussion in section 3.

The now large academic literature has looked at this impact issue mainly in relation to commodity index (CIT) positions. Commodity futures price returns and CIT positions are generally positively correlated.[22] Using the weekly CIT position data from the CTFC, over the period from 2006 to 2011 the contemporaneous correlation for the CBT corn, wheat and soybean markets were 0.145, 0.179 and 0.368 respectively.[23] It is not possible, however, to infer causality from CIT positions to prices since causation could also be from prices to CIT positions – high prices could attract CIT investment – or the positive association could be

[21] See UNCTAD (2009) and Mayer (2011, 2012) for a more detailed discussion.
[22] Gilbert and Pfuderer, 2011; Stoll and Whaley, 2010; Sanders, Irwin and Merrin, 2009
[23] Correlation for corn is significant at the 5% level and those for wheat and soybeans at the 1% level.

indirect through a third variable. As explained in section 2, Granger-causality analysis is a standard technique to investigate causal relationships and has become the most widely employed method used in the academic literature to examine the impact of asset market trades on price and, specifically, the impact of CIT position impacts on agricultural commodity futures prices.

A large number of studies have used Granger-causality analysis to examine the impact of index of CIT trading. The results are predominantly negative although there are important exceptions to this. Among the negative results, Stoll and Whaley (2010), using data from the complete set of twelve agricultural markets included in the Supplemental report CFTC Commitment of Traders reports (the *Supplementals*), only find evidence of Granger-causality from positions to prices over the period from 2006 to 2009 in the cotton market. Similarly, Sanders and Irwin (2011a), who use the same *Supplementals* data but extended back to 2004 and 2005 fail to find Granger-causality for the grains they examine (corn, soybeans, soft and hard wheat). Capelle-Blancard and Coulibaly (2011) use the same data over 2006-10 for the twelve *Supplementals* food commodities within a systems framework. This can increase efficiency and hence test power by exploitation of the cross-equation residual correlations. No evidence is found that commodity index positions Granger-cause prices in the majority of the markets with the exception of the live cattle market before September 2008 and the cocoa market for the period between September 2008 and December 2010. Sanders and Irwin (2011b) also adopt a systems approach using swap provider positions over the 2006 and 2009 period.[24] They do not find Granger-causality in agricultural markets. Hamilton and Wu (2012) take a slightly different approach and examine whether changes in nominal CIT exposure Granger-cause price changes. Their results are negative. Mayer (2012) analyses price effects of index positions together with those of money managers in four agricultural (wheat, maize, soybeans and soybean oil) and four non-agricultural markets over the period June 2006 to June 2009. He finds Granger-causality from index positions to prices in two of the agricultural (soybeans and soybean oil) and two of non-agricultural markets while for money managers Granger-causality is only found in the maize market.

[24] In agricultural markets, there is substantial overlap between CIT and swap provider positions (Sanders, Irwin and Merrin, 2010)

This battery of negative results supports the conclusion that there is indeed no causal impact from CIT trading to futures returns and that the small number of contrary results reflect sampling error. However, these studies fail to explain how the positive contemporaneous correlation between returns and position changes arises. It must be expected that, in a liquid financial market, any price impact of position changes will be immediate. However, in Granger-causality analysis the analyst is limited to looking at lagged reactions. Many of the studies quoted above have focused primarily on the most actively traded markets (corn, soybeans and the two wheat markets). Gilbert and Pfuderer (2012) conjecture that such lagged reactions are more likely to be evident in illiquid markets. They perform Granger-causality tests for eight grains and livestock markets over the period 2006 to 2011 using two different measures of index positions,

Table 7 summarizes the Gilbert and Pfuderer (2012) results. They use both an absolute measure (net long positions) and a normalized measure (share of long positions held by index investors). Among the four most active contracts, there is evidence Granger-causality for corn and (at the 10% significance level) soybeans. Among less active contracts, Granger-causality is found for soybean oil and the two cattle contacts. Similarly, Aulerich, Irwin and Garcia (2012), who have access to the CFTC's daily Large Traders Reporting System database and who use daily position change data within a system framework, establish Granger-causality for the feeder cattle, lean hogs and Kansas City Board of Trade wheat markets.

Contemporaneous position change-return correlations differ little between the markets in which Granger-causality is established and those in which it is not. This suggests that changes in index positions may, after all, drive food price changes but that Granger-causality is not always sufficiently powerful to establish this. Gilbert and Pfuderer (2012) conjecture that it is more likely that Granger-causality will be found in less liquid market. Their results, together with those of Aulerich, Irwin and Garcia (2012), lend support to this hypothesis. If CIT positions impact prices in less liquid markets, they may also do so in more liquid markets. In liquid markets, the impact would happen in a shorter period of time and thus would manifest itself in contemporaneous correlations. As noted before, contemporaneous correlations between measures of prices movement and measures of index investment are generally positive in agricultural futures markets, which is in line with our conjecture.[25]

Table 7 Granger-Causality Test Results (CIT positions) – 2006 to 2011		
CBT corn	Absolute	Yes (5%)
	Normalized	Yes (5%)
CBT wheat	Absolute	No
	Normalized	No
KCBT wheat	Absolute	No
	Normalized	No
CBT soybeans	Absolute	No
	Normalized	Yes (10%)
CBT soybean oil[26]	Absolute	Yes (5%)
	Normalized	Yes (5%)
CME feeder cattle	Absolute	No
	Normalized	No
CME live cattle	Absolute	Yes (10%)
	Normalized	Yes (5%)
CME lean hogs	Absolute	No
	Normalized	Yes (5%)

The table reports the results of Granger-causality tests over the period 6 January 2006 to 27 December 2011 (313 weekly observations). Lag lengths, equal for the causal and effect variables, were chosen on the basis of the Akaike Information Criterion (AIC) and vary across commodities – see Gilbert and Pfuderer (2012) for details. The table states whether or not absence of Granger-causality was rejected and the significance level of the rejection, Source: Gilbert and Pfuderer (2012).

Two final qualifications are in order. First, Granger-causality analysis tests for the presence of a causal relationship but cannot be used to quantify its importance. It is therefore not possible to move directly from a positive Granger-causality finding to an estimate of the size of the causal impact for which purpose one needs a more fully specified model. Gilbert (2010b) estimated the impact of CIT positions on CBT corn, soybean and wheat prices as

[25] CIT position changes tend to be positively autocorrelated. Supposing there is a positive causal link from current position changes to returns, Granger-causality analysis sees this through the indirect link from lagged position changes via the current change. The strength of that relationship will depend on the degree of position change autocorrelation which may be higher is less active markets.
[26]CIT positions in soybean oil are relatively small. However, the soybean oil market is closely linked to the soybean market through the so-called "crush spread". The results reported in Table 7 relate changes in the soybean oil price to changes in both soybean and soybean oil CIT positions.

between 12% and 15% over the first six months of 2008. Second, as emphasized by Gilbert (2010c), index investment may an important channel by which information about market fundamentals becomes impounded in prices. There is thus no necessary reason to regard a financially-driven price change as non-fundamental.

5. Financialization and food price volatility

In popular discussion, it is often stated that a price is volatile when what is intended is that it is high relative to some past value. Instead, in academic discourse, volatility is a measure of the directionless extent of the variability of that price. This can be the price standard deviation, either in levels or in logarithms, and possibly after detrending. In the finance literature volatilities are the return standard deviations which can be approximated by the standard deviation of logarithmic price changes. This definition avoids problematic issues of trend estimation. In periods in which prices are high they are often also volatile since both are symptomatic of tight market conditions. Nevertheless, prices can be high without being volatile, for example when they result from supply restrictions in a cartelized market. The impact on financialization of food price volatility is therefore not necessarily the same as that on price levels.

Gilbert and Morgan (2010, 2011) used monthly data to analyze the volatility of 19 food commodities over the 40 year period 1970-2009. Volatility had only increased in a statistically significant manner over the second half of the period (1990-2009) relative to the first two decades for two of the 19 commodities (bananas and rice) whereas it had decreased significantly for nine of the commodities. This reflects the fact that the food price rises of 1972-74 were in general much larger than those in 2007-08. Figure 3 updates the numbers in Gilbert and Morgan (2010, 2011) with data for two additional years. The figure graphs the standard deviation of monthly logarithmic price changes over the two six year periods 2000-05 and 2006-11.[27] It is arranged in increasing order of the difference between 2000-06 and 2007-11 volatilities. Dark bars indicate cases where the change in volatility is statistically significant (on the basis of a standard *F* test for equality of two variances). There are statistically significant increases for seven of the same 19 food commodities and

[27] Volatilities are reported on an annualized basis by multiplying the standard deviation of monthly logarithmic price changes by $\sqrt{12}$. Source for data: IMF, *International Financial Statistics* except coffee: International Coffee Organization (ICO indicator price).

decreases for only four. The increases are concentrated on the grains. Beef (dependent on maize feed) also shows a volatility increase as does sunflower oil. What we appear to have witnessed is an increase in the volatility of grains prices but not a general increase in that of food prices across the board.

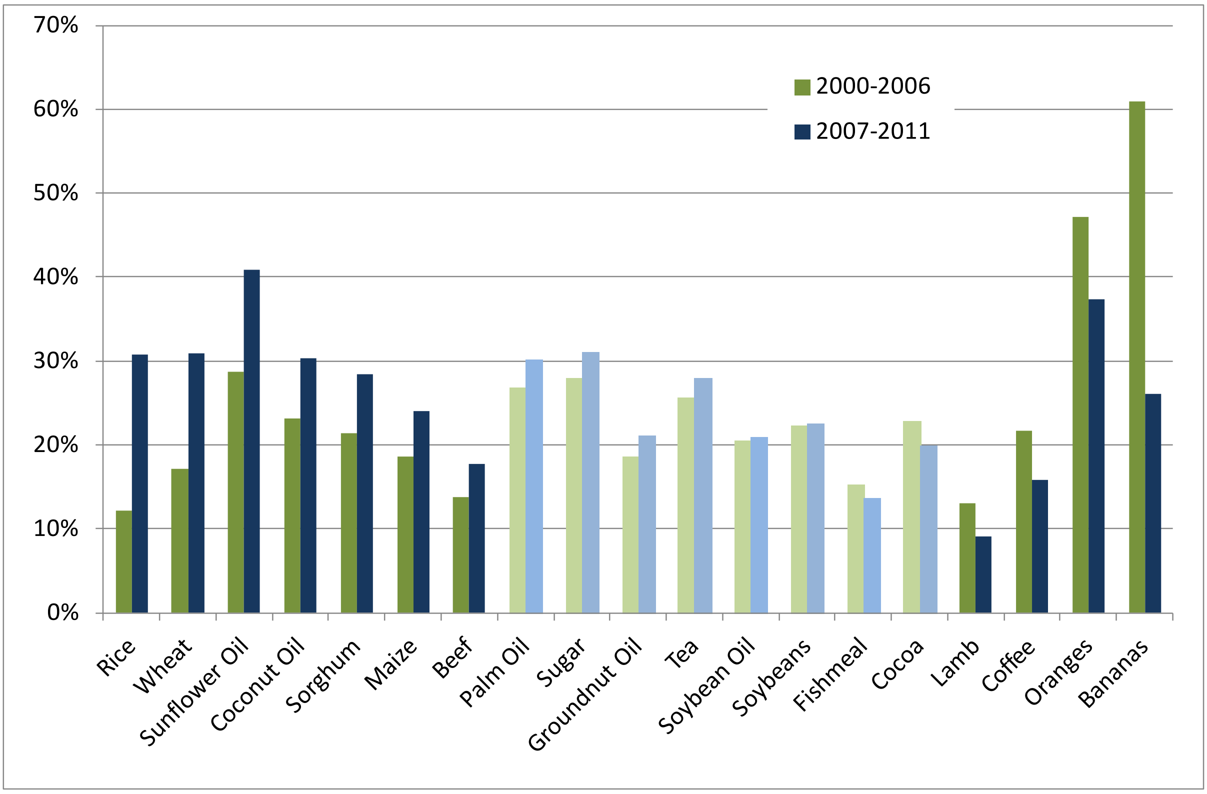

Figure 3: Food Price Volatilities, 2000-06 and 2007-11

It is natural to ask whether these increases in price volatility might be associated with financialization. This inference is problematic on the basis that there are no active futures markets in rice, sunflower oil or coconut oil, all of which have seen volatility increases, but there are active markets in palm oil, sugar, soybeans, soybean oil and cocoa, where the change in volatility is seen as not statistically significant, and in coffee, where volatility has declined.[28] The concentration of volatility increases among the grains and oilseed commodities suggests an explanation which differentiates between this group of food commodities and the remainder.

[28] There are futures markets for rice in Bangkok and Chicago. Trading volume on the Bangkok market is low and it tends to follow rather than lead commercial transactions (Gilbert, 2011). The Chicago (CBT) rough rice market also trades relatively small volumes and is relevant only in the U.S. domestic rice trade. Palm oil futures are traded in Kuala Lumpur.

Masters (2008) argued that index investment both raised the levels of commodity prices, and by consuming liquidity, increased volatilities. We have already discussed the Masters Hypothesis in terms of level effects in section 5. Gilbert (2012) refers to possible volatility impacts of index investment as the Masters Volatility Hypothesis. From a theoretical standpoint, the impact of financialized trading might either be volatility-increasing, as Masters maintained, or volatility-reducing. Large trades will be volatility-increasing if they eat into the order book leading to (possibly transient) price movements. They will be volatility-reducing if transactors trade in such a way as to accommodate commercial counterparties thereby reducing the price movement resulting from large hedge trades. In the former case, these transactions reduce market liquidity while in the latter case, they increase it.

A number of authors have employed Granger-causality analysis to examine the impact of changes in the positions taken by financial transactors, and specifically index investors, on the volatility of food commodity prices. Brunetti and Büyükşahin (2009) find a negative association between changes in swap dealer positions and changes in volatility in energy markets but not in the corn market. Sanders and Irwin (2011b) report that rises in CIT positions tend to lead falls in price volatility across a range of agricultural futures markets but hesitate to state that the former cause the latter. Gilbert (2012), who embeds the Granger-causality methodology within a Generalized AutoRegressive Conditional Heteroscedasticity (GARCH – see Bollerslev, 1986) framework, finds that swap dealer, money manager and other reporting position changes do not have any discernible volatility impact. Nevertheless, CIT position changes do Granger-cause either or both cash and futures volatility changes in all five markets examined (corn, soybeans, soybean oil, soft and hard wheat). These effects are volatility-reducing. The Masters Volatility Hypothesis is therefore emphatically rejected for U.S. grains and vegetable oils markets.

These results imply that index-based trades have generally been accommodating and that their impact has been volatility-reducing. The Masters (2008) view is that index-based investment is passive. It is possible that this is indeed true of the pension funds and other large institutional investors which initiate these trades. However, both index providers and direct index investors may trade on the basis of their index positions, for example by trading calendar spreads or writing options, and this would be sufficient to explain the negative volatility impact.

Overall, we can conclude that food price volatility has risen but this does not appear to be directly linked with the increased presence of financial actors in food commodity futures markets. To the extent that financialized trading does have an impact on food price volatility, it is volatility-reducing.

6. Price comovement

A number of authors have emphasized the increased comovement of food prices (and indeed of commodity prices generally) with crude oil prices, stock market returns and exchange rate changes over the recent past. There is little dispute in relation to the facts. Büyükşahin, Haigh and Robe (2010) document that the correlation between equity and commodity returns increased sharply in the latter part of 2008 following the Lehman collapse. UNCTAD (2011) reports that the rolling correlation between crude oil returns and returns on the S&P 500 equity index has grown steadily since 2004. Tang and Xiong (2012) find similar rises in the rolling correlations between crude oil returns and both agricultural and non-agricultural commodity futures 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. Gilbert and Mugera (2012) show that the conditional correlations, generated from a multivariate Dynamic Conditional Correlation (DCC) GARCH model (see Engle, 2002), between daily returns on WTI crude oil and respectively CBT corn, soybeans and wheat rose sharply from around 2006.

Here, we illustrate these rising correlations using the same monthly data employed in relation to the volatility changes charted in Figure 3. Figure 4 charts the correlations in the logs of the monthly averages of the same set of food commodity prices and log changes in the Brent crude oil price.[29] The commodities are organized in descending order of 2007-11

[29] The WTI price has traditionally been taken as the reference price for crude oil. The NYMECX WTI contract prices crude oil at Cushing (OK). Limitations of storage capacity at Cushing resulted in WTI moving to a substantial discount to the Brent seaborne crude oil price during 2010-12. It is this seaborne price which is of greater relevance in international oil commerce. With two exceptions

crude oil correlation. Dark colours indicate statistically significant increases in correlation (at the 5% significance level).

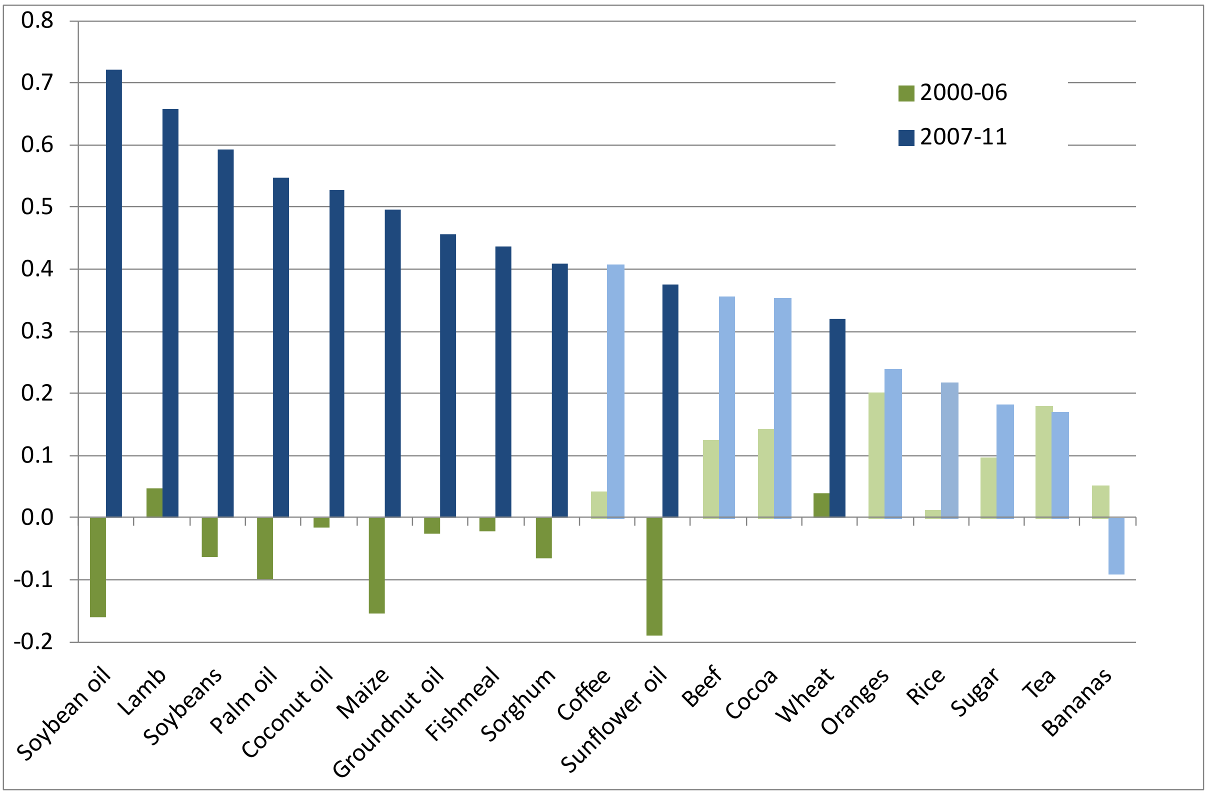

Figure 4: Correlations, Changes in Food and Crude Oil (Brent) Prices, 2000-06 and 2007-11

The comparison is dramatic. With the single exception of bananas, price changes are all positively correlated with changes in the price of crude oil in the later period while in the earlier period they are small and so not exhibit any consistent sign. The correlation increases are statistically significant for all the grains except rice, all the oilseeds and additionally for lamb. This is the same broad group of food commodities for which the volatility increases were seen as significant (see Figure 3).

Figure 5 repeats the same exercise substituting S&P industrial returns for crude oil price changes. The same pattern of increased correlations emerges but in this case, the 2007-11 correlations are generally lower (except for coconut oil) and fewer of the correlation increases are statistically significant.

(bananas and groundnut oil) the 2007-11 correlations charted in Figure 3 would be lower if WTI were substituted for Brent.

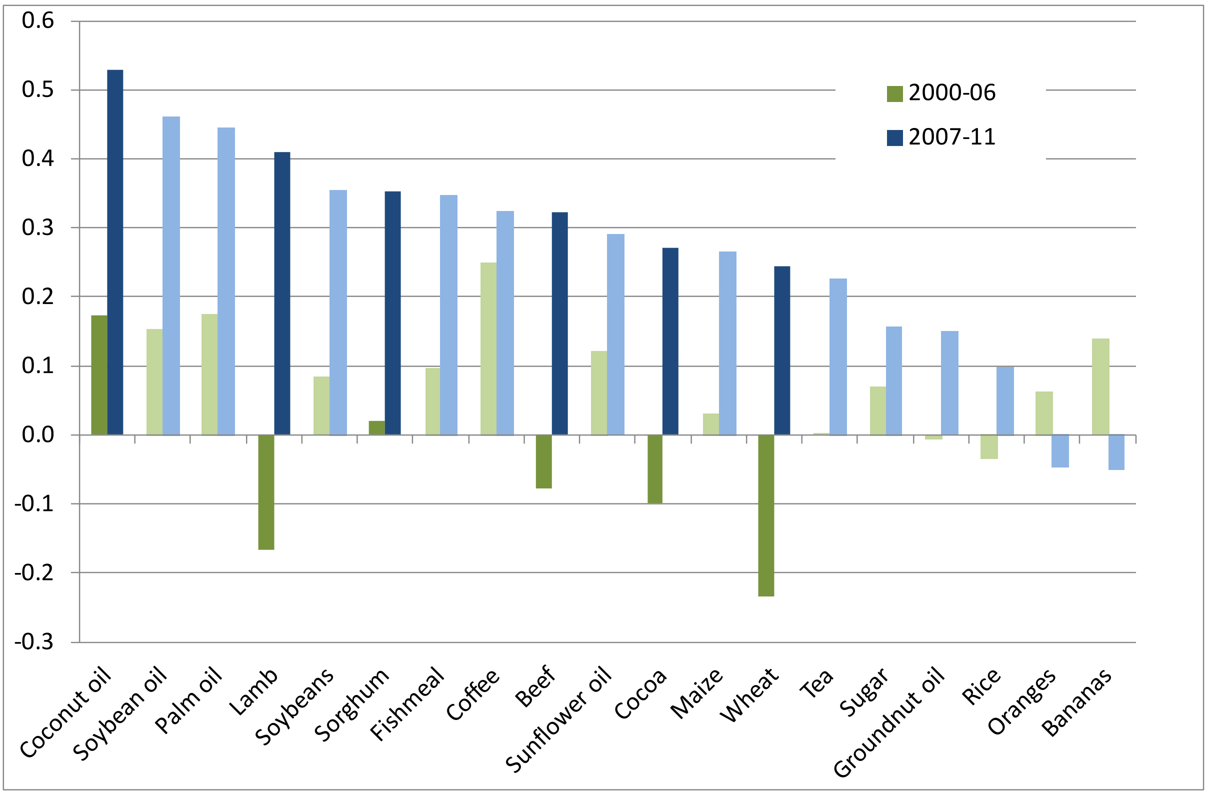

Figure 5: Correlations, Changes in Food Prices and S&P Returns, 2000-06 and 2007-11

The correlations reported in Figures 4 and 5 demonstrate that the increase in comovement with crude oil price has been more dramatic than that with share prices. Since changes in crude oil prices are themselves correlated with equity returns, it seems possible that comovement of food commodity prices with equity prices, stressed by Büyükşahin, Haigh and Robe (2010) and Bicchetti and Maystre (2012) may be largely accounted for as an indirect impact of changes in crude oil prices. Table 8, which reports the partial correlations of food commodity prices and respectively crude oil prices and equity returns demonstrates that this is indeed correct. The partial correlations of food commodity prices and equity returns, holding crude oil prices constant, showed only a modest increase between 2000-06 and 2007-11 (Table 8, columns 3 and 4) while that between food commodity and crude oil prices, holding share prices constant, rose sharply (Table 8, columns 1 and 2).

Table 8 **Partial Correlations**				
	Brent crude		S&P Industrials	
	2000-06	2007-11	2000-06	2007-11
Cocoa	0.1277	0.2615	-0.0762	0.2615
Coffee	0.0883	**0.3007**	**0.2604**	0.1428
Tea	0.1833	0.0686	0.1058	0.1673
Sugar	0.1105	0.1204	0.0889	0.0794
Oranges	**0.2163**	**0.3013**	0.1068	-0.1934
Bananas	0.0768	-0.0755	0.0500	0.0000
Beef	0.1131	0.2387	0.0566	0.1808
Lamb	0.0200	**0.5739**	-0.1616	0.1304
Wheat	0.0000	0.2360	**-0.2313**	0.1058
Rice	0.0624	0.1944	0.0100	-0.0100
Maize	-0.1513	**0.4343**	0.0000	0.0283
Sorghum	-0.0624	**0.2879**	0.0100	0.1903
Soybeans	0.0500	**0.5138**	0.0742	0.0900
Coconut oil	0.0141	**0.3604**	0.1726	**0.3633**
Soybean oil	-0.1378	**0.6392**	0.1288	0.1764
Groundnut oil	-0.0283	**0.4441**	-0.0100	-0.0964
Palm oil	-0.0707	**0.4199**	0.1606	0.2410
Sunflower oil	-0.1720	**0.2782**	0.0933	0.1304
Fishmeal	0.0000	**0.3245**	0.0943	0.1694
Average	0.0232	0.3117	0.0491	0.1135
Columns 1 and 2 give the partial correlations of the change in the row price and Brent crude, holding the S&P Industrials index constant. Columns 3 and 4 give the partial correlations of the change in the row price and the S&P Industrials index, holding the Brent crude price constant. Bold face indicates statistical significance at the 95% level.				

It is therefore the increased comovement of food commodity crude oil prices which requires explanation, as emphasized by UNCTAD (2011), Tang and Xiong (2012) and Gilbert and Mugera (2012).Two rival explanations are available. Tang and Xiong (2012) see this as a financialization effect. According to their view, the increased correlation arises as index investors buy or sell "on block" the entire range of commodity futures included in the two major commodity indices of which crude oil is the single most important by index weight. They claim that the comovement is greater for commodities included in indices than for those less liquidly contracts outside the indices. Figure 5 fails to bear out this contention with respect to the comovement of food commodity and crude oil prices. The alternative view, stressed by Gilbert and Mugera (2012), is that the comovement arises instead from the biofuels link whereby the profitability of diverting grains (essentially corn) into ethanol production and vegetable oils (largely oil seed rape and palm oil) into the production of biodiesel. This explanation, which has nothing to do with financialization, can explain why the volatility rises documented in section 5 and the rises in oil price comovement documented here are concentrated on grains and vegetable oils. It is also consistent with the finding that index investment tends to be volatility-reducing.

7. Conclusions

The food commodity financialization literature is characterized by two opposing views. On the one hand, much popular opinion sees financialization, and in particular speculation, as the major driver of recent high food prices and the rise in food price volatility. This view has been shared by some important politicians and legislators who point the finger specifically at index-based investment which, they suggest, should be limited or tightly regulated. At the other extreme, a major strand of the academic literature minimizes the impact of financialization on food commodity markets. The food commodity markets have absorbed the large inflows from financial transactors without any problem. According to this view there is no abuse to be regulated. The truth lies somewhere between these two positions.

Bubbles are seen as emblematic of financialization. The academic literature characterized bubbles in terms of episodes of explosive price movements. We have reported evidence of explosive price behaviour in some food commodity markets (mainly in grains and oilseeds) in 2007 and 2008 Nevertheless, financialization is only one explanation of explosive behaviour which could also be generated by sharp changes in market fundamentals. That may have been the case in the 2007-08 grains and oilseeds markets as supply problems and concerns about the emergence of such problems existed at the time in which case financialization may have been no more than a facilitating factor.

The extensive literature which examines the impact of index investment on food commodity futures prices relies on Granger-causality analysis. In general, few causal impacts have been found although we argue that these impacts are clearer on less actively traded markets, particularly meats. Nevertheless changes in index investor positions are strongly correlated with contemporaneous changes in food prices. We suggest that the failure of much of the academic literature to see price impacts is because the Granger causality methodology lacks sufficient power to detect these, in particular if used, as is standard, with data at the weekly frequency. However, even if there are impacts, there is no implication that these are quantitatively important.

A smaller literature looks at possible impacts of financialization on food price volatility. The volatility of grains and vegetable oils prices has increased over recent years, but this is not true of food price volatility more generally. There is no evidence that links this increase to financialization and indeed index investment in food commodity futures markets appears to be volatility-reducing.

Finally, we have examined the increased comovement of food commodity prices with the crude oil price and with equity returns. The increased comovement with oil prices is robust and general while the increased comovement with equity prices, which is in any case less clearly defined, disappears once one controls for the oil price. We argue that this phenomenon may be better explained by the biofuels link between oil prices and grains and oilseed prices than by financialization.

In summary, financialization has been an important element in the recent evolution of food commodity markets and may have impacted prices over recent years including during the price rises in 2007 and 2008. Grains and oilseeds markets, in particular, have experienced bubbles and volatility increases, and though financialization is one possible explanation, other explanations seem more likely as main explanations for these phenomena. Speculation, in particular index investment, has tended to reduce food price volatility and is probably not responsible for the increased comovement of food and crude oil prices.

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