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The purpose of the Temi di discussione *series is to promote the circulation of working papers prepared within the Bank of Italy or presented in Bank seminars by outside economists with the aim of stimulating comments and suggestions.*

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THE ROLE OF FINANCIAL INVESTMENTS IN AGRICULTURAL COMMODITY DERIVATIVES MARKETS

by Alessandro Borin* and Virginia Di Nino*

Abstract

This paper investigates the relationship between futures prices and financial investments in derivatives of the main agricultural commodities. We first provide a broad picture of how these markets function and how they have evolved, showing that traders who deal mostly in commodity index investments (swap dealers) have gained importance since the mid-2000s. However, traditional financial market participants (money managers) still show the stronger (simultaneous) correlation with price movements. Our main empirical analysis aims to gauge the influence of financial investors' positions on both the level and the volatility of futures prices. The Granger-causality tests suggest that speculative investments usually follow – rather than precede - variations in futures returns. Employing a GARCH model, we find that the activity of money managers tends to be associated with lower volatility of futures returns, while that of swap dealers is sometimes followed by higher price variations.

JEL Classification: D84, G12, G13, G14, Q13
Keywords: .futures markets, commodities, speculation, GARCH, volatility

Contents

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1. Introduction

The volume of outstanding gross positions on commodity derivatives markets has increased almost fourfold in the last ten years, while the composition of market participants has changed considerably. During the last commodity cycle (from 2004 to the beginning of 2009) the level and volatility of many commodity prices, including agricultural staples, reached unprecedented values, giving support to conjectures that financial investment in commodity futures markets had led to price spikes and misalignment with fundamentals. There has recently been revived interest in these questions, as the prices of major agricultural commodities have experienced a strong rebound since mid-2010, even exceeding the previous peaks. Agricultural price spikes may cause economic and social instability, especially in developing economies, which are important producers but also important consumers of food staples. In the advanced countries, this implies that it is more difficult to manage price stability and undesirable redistribution effects.

Within the international policy debate on the reform of financial systems following the global crisis, there has been discussion over the advisability of more restrictive regulations on financial commodity markets. The need for more transparency and information on activities carried out especially in the OTC markets has been widely recognized. In the USA, the Commodity Futures Trading Commission (CFTC hereafter) is implementing a series of measures approved under the Dodd Frank Act,[1] aiming at improving transparency in the derivatives markets and limiting the activity of pure financial traders. In particular, the new legislation extends the limits on the number of positions held by a single financial trader in each market and, by the second quarter of 2012, it will impose central clearing for current OTC transactions. Debates on the introduction of similar measures are currently under way within the European Union, as well as in other countries.[2]

Nonetheless, as reported by the G20 study group created to investigate the effects of commodity market financialization, the available empirical evidence fails to support the existence of a systematic, significant impact of financialization on the level and volatility of commodities prices.[3]

We are grateful to Valeria Rolli for encouraging us to write this work, for spending long time discussing results and the empirical approach; we would like to thank also Giuseppe Parigi, Pietro Catte, Riccardo Cristadoro and Antonio Di Cesare for very useful comments and suggestions on earlier version of this paper. Any eventual error is our own.

[1] The Dodd–Frank Act (Wall Street Reform and Consumer Protection Act) of July 21, 2010, is a US federal statute that implements a large financial regulatory reform affecting all federal financial regulatory agencies and almost every aspect of the nation's financial services industry. The views expressed in this paper are those of the authors and do not necessarily reflect the position of the Bank of Italy.

[2] EU Commission (2010), "Proposal for a Regulation of the European Parliament and of the Council on OTC derivatives, central counterparties and trade repositories".

[3] For earlier research see IMF-WEO (September 2006); Ahn (2008); Gilbert (2010a); IMF-GFSR (October 2008).

Concerning the effect of finanzialization on commodity price developments, Tang and Xiong (2010) show that variables reflecting commodity market financialization remain significant even after controlling for changes in fundamental factors. Gilbert (2010b) claims that changes in trading commodities may have contributed to inflating oil prices in the first half of 2008, and similar evidence is found for aluminum, copper, and maize, while no such impact is detected for soybeans and wheat. For a contrarian view, Irwin and Sanders (2010) find no statistically significant relationships between index-fund positions and agricultural commodity prices, reaching the conclusion that the changes in commodity prices over the past few years should be attributed to fundamental factors. According to Kilian and Hicks (2009), large upward revisions of growth expectations in emerging economies largely explain the surge in oil prices during the mid-2003 to mid-2008 period. This point of view is also shared by Turner et al. (2011), who ascribe the oil price upswing of the first half of 2008 to strong expectations of future developments in energy demand, with the activity of trading participants just as important as that of pure financial investors.

As regards volatility, empirical studies suggest that, in general, the introduction of derivatives trading in a commodity market leads to a reduction in the price volatility of the underlying product.[4] Derivatives markets allow investors to bring in their private information about the evolution of fundamentals; financial investors, although less informed, can improve market liquidity by acting as counterparts for hedgers. Both these channels should contribute to the price discovery process and reduce price volatility. However, an excessive level of financial trading could be sub-optimal for market efficiency. As shown by anecdotal evidence and in survey studies (Shiller, 1990; Gehrig and Menkhoff, 2004), a significant and growing proportion of financial traders may take their investment decisions irrespective of the physical market conditions - behaviour that may add noise to the market and amplify price fluctuations. Holt and Irwin (2000), using private data provided by the CFTC, find a positive relationship between trading volumes of financial investors (large hedge funds and commodity trading advisors) and price volatility in the commodity derivatives markets. Nevertheless their analysis also confirms that speculative investors operate according to their private information on fundamentals, thus improving market efficiency (Clark 1973), while no support is found for the hypothesis of trend-following or noise-trading behaviour (De Long et al. 1990). A study by the IMF (WEO, October 2009) identifies among the major determinants of the persistent component of food price volatility: the strength of real activity; the volatility of US inflation and exchange rate; and, with a much smaller effect, the total volumes

[4] Powers (1970), Taylor and Leuthold (1974), Turnovsky (1979), Brorsen et al (1989), Gilbert (1989) and Netz (1995) find that the variance of cash prices decreased substantially when futures markets began to function.

of transactions in derivatives markets. Finally, Irwin and Sanders (2010) find a negative relationship between index and swap fund positions and market volatility.[5]

These divergent results are at least partially due to the lack of comprehensive and timely information on financial investments flows and market fundamentals. Indeed, data on commodity investments are normally available only for organized US derivatives markets at weekly intervals (despite derivatives contracts being traded continually), and fail to differentiate positions according to their expiration date and by type of investor. However, even the analyses conducted by the CFTC on the basis of their private information do not reach conclusive results (we can only say that they do not find any clear evidence in favour of an effect of financial investments on commodity futures prices).[6] As a matter of fact, the economic relationship is hard to identify since a number of factors may simultaneously affect both investment decisions and prices and, furthermore, it is difficult to define a precise timing in the information flow (for instance, the statistics on market fundamentals are usually available less frequently than those relating to the financial data). In the case of agricultural markets, controlling for new information and changes in fundamentals is further complicated by crops seasonality and a wide range of potential demand shifters.

The present paper contributes to the literature by investigating the impact of investment positions held by different classes of investors on the level and volatility of commodity prices. We track markets for eleven agricultural commodities traded in the US regulated exchanges[7] over the period June 2006-September 2011. We employ both the old and the new CFTC classification of major investors, released in October 2009 to enhance market transparency. This allows us to assess whether the new method for classifying positions, according to the scope of the investors, reveals

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[5] More recently part of the empirical literature tackled the issue from a different perspective, focusing on a precise aspect of financialization. For instance, Phillips and Yu (2010) examine the migration of price bubbles across equity, bond, currency and commodity markets, and tend to confirm the presence of a price bubble in crude oil in mid-2008 (while no bubbles are detected for agricultural commodities). Buyuksahin and Robe (2010), using CFTC proprietary data, investigate the determinants of the conditional correlation between commodities and equity prices and conclude that commodity index traders (CIT hereafter) did not influence this measure of co-movement across markets at all, while hedge funds, operating simultaneously on equity and commodity derivative markets, have a sizeable and persistent impact. Nonetheless they fail to explain why the conditional correlation goes up in 2009, when hedge fund activity slowly declined, leaving the task of finding an explanation for future research. Mou (2010) instead finds that CIT rolling activity - Commodity index traders often roll contracts forward a few days before the expiration, on to the next nearby contract - has a significant and sizeable effect on rolling yields. Finally on the same point Singleton (2011) shows that quarterly changes in the spread position held by money managers positively affects the average price return.

[6] Haigh, Hranaiova and Overdahl (2005); CFTC (2008); Interagency Task Force on Commodity Markets (2008), Boyd et. al. (2009), Brunetti and Buyuksahin (2009), Buyuksahin and Harris (2009), Buyuksahin and Robe (2009), Stoll and Whaley (2009), Buyuksahin and Robe (2010), and Boyd et al. (2010).

[7] We track the following derivative markets: cocoa (NYBOT), coffee (NYBOT), corn (CBOT), cotton (NYBOT), feeder cattle (CBOT), live cattle (CBOT), soybeans (CBOT), soybean oil (CBOT), sugar (NYBOT), wheat (CBOT), and wheat (Kansas City BOT).

new empirical patterns. We move from three major stylized facts: *i*) the weight of financial investors has increased over time, well beyond the hedging needs of commercial traders (i.e. the "financialization" of commodity derivatives markets); *ii*) futures price fluctuations widened significantly during the last cycle (from 2004 to beginning 2009); and *iii*) similarly, price volatility also increased.

The paper is organized as follows: in Section 2 we provide a comprehensive description of how the commodity derivatives markets function and recent changes; in particular, we identify three broad categories of players, each with different strategies and instruments. , In Section 3 we proceed to peforming a preliminary empirical analysis in order to describe some statistical properties of futures price returns and investment positions, which inform the subsequent analysis. In Section 4, following the approach of Gilbert (2010a), we employ Granger causality tests, within a VAR framework, to investigate the direction of the statistical relationship between futures quotations and investments. Finally, in Section 5 we jointly model mean and volatility of futures returns, in a GARCH framework, in order to gauge the possible impact of financial investments on short-term price volatility. Section 6 concludes.

Our analysis reaches two main conclusions: *i*) the evidence supports the idea that financial investors on derivatives markets tend to react to price movements rather than driving them; *ii*) the activity of different types of financial traders differently affects the volatility of futures returns: while the investments of "traditional speculators" (money managers) tend to reduce volatility, in some specific markets swap dealers' activity leads to an amplification of short-term price fluctuations.

2. The evolution of commodity derivatives markets

In the last ten years commodity derivatives markets underwent major changes in at least two areas: A) the amount of money invested; B) the types of investors. An important source of information is provided by the CFTC, which releases weekly data on the investment positions held by the different types of traders on the US commodity derivatives markets.[8]

2.1 Size of the derivatives markets

The size of the commodity derivatives markets has grown dramatically during the decade (Fig.1.a), with a brisk acceleration at the beginning of 2006, when the number of outstanding positions in regulated commodity futures markets almost doubled in only six months (Bank of

[8] The Commitment of Traders is published each Friday and reports the outstanding positions of different categories of traders as of Tuesday of the same week.

International Settlements, 2009). This is part of a broader pattern, common to other derivatives markets (interest rates, equity indices, exchange rates); nevertheless, also the relative weight of commodity contracts on total financial derivatives has increased from 1.5 to 2.3 per cent between 2004 and 2010. Moreover, the increase in commodity derivatives trading accompanied a widespread rise in prices (Fig.1.b), that contributed to bringing the value of outstanding positions in the main commodity markets from about $100 billion in 2002, to almost $700 billion in mid-2008 (Masters, 2009).

Figure 1.a
Open Interest[1]
(index 200=100, 3-month moving average, futures-and-options combined)

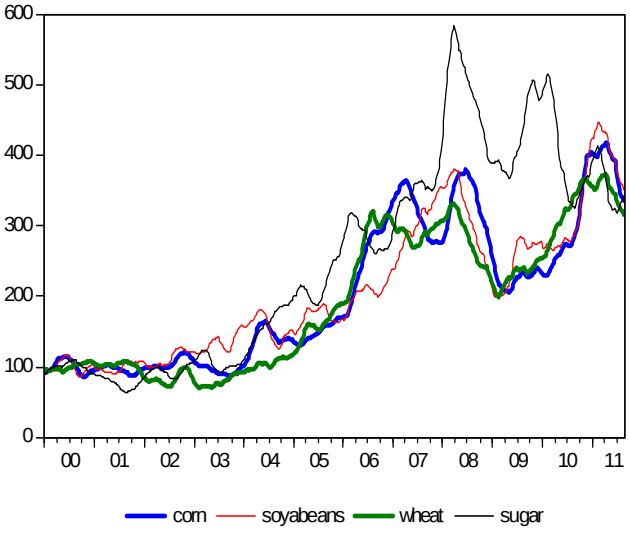
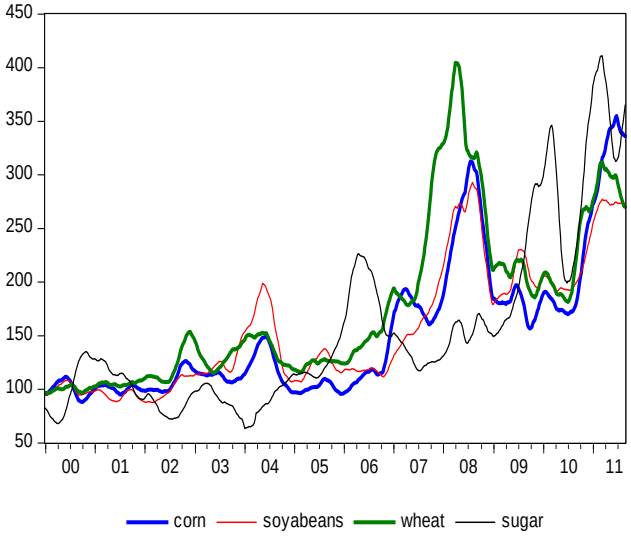


Figure 1.b
Nearby[2] futures prices
(index 2000=100, 3-month moving average)



Source: Commodity Futures Trading Commission (CFTC). Source: Thomson Financial Datastream.
(1) Total number of derivative contracts that have not yet been exercised, expired, or fulfilled by delivery – (2) Prices of the contracts with the closest delivery date.

Another way to gauge the evolution of these investments is to relate them to developments in the physical commodity markets: since 2005 wheat consumption has grown by 7.7 per cent; instead, the total number of contracts in US-regulated markets has more than doubled during the same period.

Investments in commodity derivatives are often made via over the counter (OTC) financial instruments, which have developed remarkably in the past few years. According to data provided by the BIS, the notional amounts of outstanding forward and swap contracts on OTC markets reached about $7 trillion dollars in June 2008 before dropping during the crisis. Afterwards, the number of contracts on regulated markets resumed its upward trend, exceeding the previous mid-2008 peak by 50 per cent in the first quarter of 2011 (Bank of International Settlements, 2011). On the contrary, the notional amounts of OTC contracts have remained subdued. This may reflect an enduring

exacerbation of counterparty risks, which favour a shift of investors away from OTC instruments towards the regulated markets, and it is also due to the development of new instruments – such as exchange traded products (ETPs) – which allow more flexible investment strategies.

This evolution is confirmed by the estimates made by Barclays Capital of the overall assets under management by financial institutions in commodity-related instruments. Since mid-2010 invested resources have increased even more rapidly than before the financial crisis; commodity-related financial assets recorded a historic peak in July 2011 ($431 billion, 65 per cent above the pre-crisis level of 2008). Before falling abruptly as a result of the crisis, investments linked to commodity indices gained weight, rising from $75 billion in 2006 to $170 billion in June 2008. From mid-2009 they resumed growth at a slower pace than other instruments, never exceeding the previous peak. The post-crisis dynamic of investments in commodity indices is another possible cause of the slackness of the OCT markets, as they are usually carried out through OTC swap agreements.

Although the proportion of contracts traded in organized exchanges varies over time, all the commodity-related financial products are interconnected via arbitrage opportunities (for instance, financial intermediaries active in the OTC markets normally hedge their net exposures on the regulated exchanges).

2.2 Type of investors on commodity derivatives markets

In principle, three broad types of participants can be identified on futures commodity markets, depending on their investment scope and time horizon i.e. “hedgers”, “speculators” and “commodity index investors”. While the first two types of investors were present from the beginning of the derivatives markets, index investors have come to play an important role only more recently.

- Hedgers use derivatives markets to hedge business risks. Supposedly, they have an exposure on the physical commodity market, for example, in relation to mining companies, agricultural producers, refiners of oil and metals, or airline companies (whose costs are heavily affected by fuel prices).
- Speculators enter the commodity derivatives market to make profits taking positions according to their expectations of future price movements. Their investment horizon is usually relatively short (from minutes up to a few weeks or months), and they are supposed to revert to

their positions before the delivery date.[9] In general, they should play a stabilizing role by injecting liquidity, acting also as counterparts for hedging transactions and by improving market efficiency, aiding price discovery through their efforts to gather information on fundamental price drivers. However, in a world with asymmetric information, they may adopt procedures to predict price movements that are not necessarily based on market fundamentals, such as trend extraction techniques (in this case they are named "trend followers") and thus their actions may amplify misalignments and feed speculative bubbles.

- Commodity index investors (also named "CIT investors") use commodity derivatives as alternative investment assets as part of a portfolio diversification strategy and are less concerned with the evolution of fundamentals. Most of these investments are made through OTC intermediaries (the swap dealers) by institutional investors, such as pension funds or sovereign wealth funds. Commodity yields have historically shown a positive correlation with inflation and low correlation with equity returns (although since 2009 the latter has increased noticeably), so that they are a natural choice in a long-term portfolio optimization strategy. Exposures by these investors tend to reproduce indices that compound different commodities. The two indices most tracked are the Dow Jones-AIG[10] and the S&P-GSCI. In 2011 around a fifth of investments on commodity indices involves agricultural products (wheat, corn, sugar, and live cattle).[11] Commodity index investor strategies are characterized by a relatively long time horizon, and investors would always acquire long positions in futures markets (directly, or through intermediaries or other financial instruments); thus, commodity index investors may represent a natural counterpart to commercial hedgers, who more often hold net short positions.

The role of CIT investors on futures markets is quite controversial. Masters (2009) likens the entry of CIT investors to a demand shock; as their primary objective is to allocate a given amount of money to commodities, the demand for which is considered rather price-inelastic.[12] In general, there are concerns that commodity index investors may affect price quotations through investment strategies which ignore expectations for fundamentals. Soros (2008) has pointed out that during the last commodity price boom CIT investors in search for higher returns, intensified the trend generated by market fundamentals. Their distorting influence was thus similar to a speculative

[9] For instance "scalpers", who often trade in and out of a position within a few seconds, exploit small differentials to earn. They guarantee the immediacy of execution for a trade.

[10] This index has recently changed its name to Dow Jones UBS (after UBS Securities LLC acquired AIG Financial Product Corp.).

[11] Based on weights in dollars (published in October 2009), 18.3 per cent of all positions are held in agricultural commodities; 3.8 per cent in wheat, 3.3 in corn; 2.5 in sugar, 2.5 in live cattle, and 2.4 in soybeans.

[12] In his own words: "There is a crucial distinction between Traditional Speculators and Index Speculators: Traditional Speculators provide liquidity by both buying and selling futures. Index Speculators buy futures and then roll their positions by buying calendar spreads. They never sell. Therefore, they consume liquidity and provide zero benefit to the futures markets."

bubble, with quite large and long-lasting consequences.[13] Moreover, one could also argue that CIT investors, having set a trend, may induce "traditional speculators" to follow it, in the belief that it will be long-lasting. Thus, even informed speculators may be induced to de-link themselves from market fundamentals, exacerbating a bubble spiral or increasing price volatility. This view is however challenged by other experts. According to Radetzki (2008) and Greely and Currie (2008) the "passive" investment strategy of index investors prevents them from having an effect on price quotations; since they are instead seen as a natural counterpart to commercial hedgers, they may actually improve market liquidity and reduce price volatility.

2.3 CFTC (old and new) classification of investor types

The CFTC publishes weekly data on the positions held by each type of investor on US futures markets. Until 2007 it used to classify them into two broad groups "commercials" and "non-commercials" - according to their main *economic* activity.. Nevertheless, the association between "commercials" and hedging behaviour has indeed weakened over time. By now, this category includes non-traditional hedgers, such as "swap dealers", who operate as counterparts of various types of clients (both commercial and non-commercials, including CIT investors) in the OTC markets and hedge the net exposure on the regulated markets. For this reason, non-traditional hedgers were associated with commercial traders and granted a special exemption from the position limits imposed on other kinds of non-commercial traders. However this privilege has been challenged by the most recent regulation (stemming from the Dodd-Frank Act) which maintained it only for investors operating in the physical market.[14]

As early as 2007, the CFTC responded to the need for more transparency by publishing (for a limited number of agricultural products) a supplement to the standard weekly report on futures positions, with a categorization of investors as either "Commodity Index Traders" (CIT), "non-CIT commercials", "non-CIT non-commercials" (also called "other speculators"), and lastly "non-reportables".[15]

Subsequently in October 2009, the CFTC released a new Commitment of Traders Report aiming at reconciling investors' *trading* activity with the filing classification. It distinguishes major

[13] Quoting from the Soros report to the U.S. Senate Commerce Committee: "I shall focus on financial institutions investing in commodity indexes as an asset class because this is a relatively recent phenomenon and it has become the "elephant in the room in the futures market".

[14] CFTC October 2011, 17 CFR Chapter 1, Effective Date for Swap Regulation.

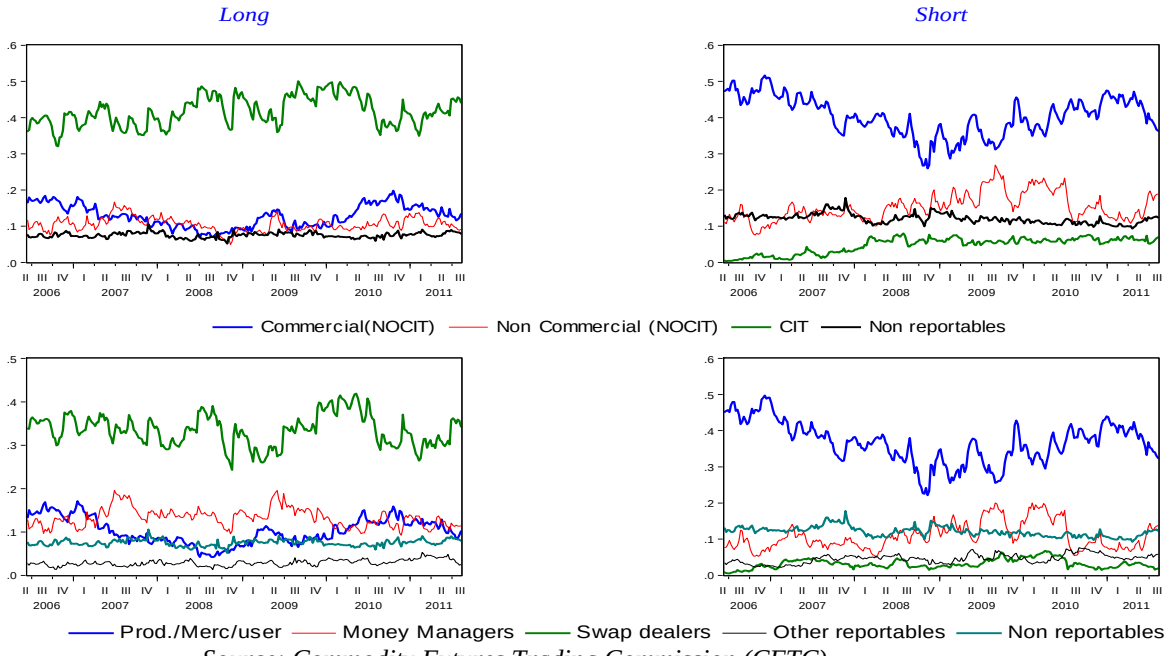
[15] Quoting from CFTC (2006): "These so-called Index Traders will be drawn from both previous non-commercial and commercial categories. Coming from the former, there will be managed funds, pension funds and other institutional investors that generally seek exposure to commodity prices as an asset class in an un-leveraged and passively-managed manner using a standardized commodity index. Coming from the second category there will be entities whose positions predominantly reflect hedging of OTC transactions (swap dealers, holding long futures positions to hedge short OTC commodity index exposure, opposite institutional traders such as pension funds)."

categories of investors into: "producers, merchants, processors and users", "swap dealers", "money managers" (encompassing commodity trading advisors, commodity pool operators, hedge or pension funds) and "other reportables".[16]

Figure 2 shows the evolution of long and short positions by type of investor in the wheat market, according to the 2007 (top panels) and 2009 (bottom panels) classifications. CITs are the most important buyers, while they rarely hold any short positions; commercials are constantly net short, while non-commercials are basically net long; non-reportables (small investors not subject to position reporting) are a non-negligible fraction of the market.

The patterns of CIT and swap dealers' positions resemble each other quite a lot, indicating a large degree of overlapping; the same is true as regards positions of commercials (not CITs) and the group of producers/merchants/users. Similar evidence also emerges for the other main agricultural commodity markets (plots for corn and sugar are shown in Appendix A). At a first glance we might draw the conclusion that, apart from the different denomination tags, the 2007 and 2009 classifications do not differ significantly. Thus in our empirical analysis we mainly present results based on the most recent (2009) classification of investment positions, using the 2007 classification to conduct robustness checks.

Figure 2: Outstanding positions, futures-and-options combined, by type of investors
Wheat *(Chicago Board of Trade)*



Source: Commodity Futures Trading Commission (CFTC).

[16] Nonetheless, a warning issued by the CFTC clarifies that there are still significant limitations to the new data, for instance to the extent that traders may engage in different types of activity: producers may decide to engage in swaps activities, and investors classified among swap dealers may also be involved in commercial activities.

3. Preliminary analyses

Some preliminary statistical analyses are carried out in order to uncover whether changes in agricultural commodity derivatives markets have possibly influenced the mechanism of price formation. First we show that, depending on the classification employed, the proportion of activity on derivatives markets which could be considered as "purely financial" varies noticeably. Then, we show the existence of statistically-significant simultaneous correlations between futures returns and positions held by certain types of investors. Finally, we identify clustering of high and low-volatility of weekly futures returns. This shapes the subsequent analysis in which the link between price volatility and investment positions is investigated.

3.1 Data properties and treatment

Our dataset consists of futures prices and weekly positions (short and long) held by each type of investor for eleven agricultural commodities;[17] it covers the period from mid-2006 to September 2011, for which we have data on positions classified according to the latest classification. Investment positions are taken on Tuesdays; futures prices are (average) daily prices on Tuesdays, accordingly. We follow the standard practice of rolling on the first day of the delivery-month in order to obtain a continuous time series of futures prices.

We started by investigating the stationarity properties of the variables, finding that futures prices and financial investment positions are both I(1)[18] but they are not co-integrated. Hence, we computed logarithmic first differences of futures prices. As expected, the resulting variable, which measures futures returns, shows no significant autocorrelation.[19]

Investment decisions are measured by changes in positions held by each type of financial investor, normalized by market size (i.e. open interest).[20] Long and short positions were considered separately in order to allow for the presence of asymmetric effects on prices.

3.2 An indicator of financial activity on commodity derivatives markets

We compute the Working T-index (1960) as a means of gauging the increasing importance of purely financial activity on the derivatives markets. It measures the share of contracts on the total

[17] The complete list of markets includes: cocoa ICE, cocoa NYBOT, coffee NYBOT, corn CBOT, cotton ICE, cotton NYBOT, feeder cattle CBOT, live cattle CBOT, soybean CBOT, soybean oil CBOT, sugar NYBOT, wheat CBOT, and wheat Kansas City.

[18] This is confirmed by values of the AR(1) coefficients in a VAR model in levels, and by unit root tests. There is no evidence of a co-integration relationship between futures prices and positions; however this could still emerge once data for a longer time span becomes available.

[19] Autocorrelation in returns is a sign of market inefficiency since it can be exploited to earn money; when the AR coefficient is larger than 1, it indicates explosive behaviour.

[20] A log transformation was judged inappropriate as changes in positions would have been assigned the same weight irrespective of their absolute size. Instead, we obtained shares of positions held by each type of investor in the market, and then computed their first differences.

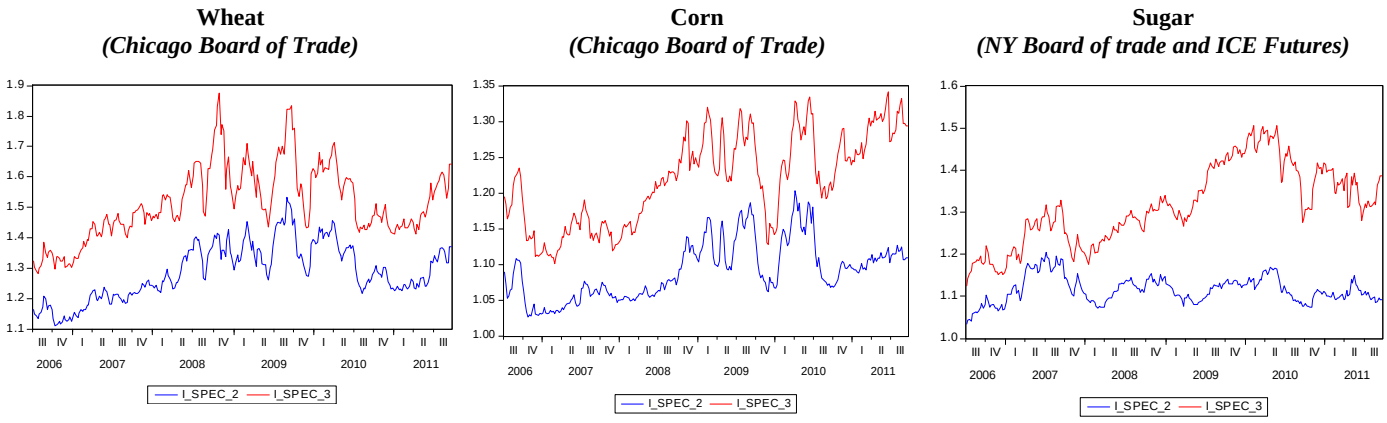
outstanding positions in which both the counterparties are pure financial investors. This indicator is obtained as follows:

$$T = \begin{cases} 1 + ncs/(cl + cs) & if\ (cs \geq cl) \\ 1 + ncl/(cl + cs) & if\ (cs < cl) \end{cases}$$

where *ncs* and *ncl* represent the number of short and long pure financial positions, respectively; *cl* and *cs* the number of long and short "commercial" (non-financial) positions. The index is lower bounded to 1 and it grows with the amount of purely speculative positions in the market, irrespective of the direction mainly assumed by the financial traders (i.e. altogether they may be both net-long or net-short).

The T-index is computed using both data from the 2007 and the 2009 CFTC classifications. Therefore the commercial positions are given by "non-CIT commercial" positions in the 2007 classification and "producers, merchants, processors and users" in that for 2009; all the remaining positions are considered pure financial ones. Figure 3 plots these indices for wheat, corn and sugar which are among the most important agricultural staples (the lines based on the 2007 classification are indicated as I_SPEC_2, those corresponding to the 2009 classification as I_SPEC_3).

Figure 3: The T-index of purely speculative activity



Source:CFTC, COT reports.

The share of contracts which does not involve commercial traders is significant despite a certain degree of heterogeneity across markets; moreover it is clearly higher when the 2009 classification is employed (being the predominant part of the market for wheat). The indices based on the two classifications have a similar evolution most of the time but sometimes they decouple for some sub-periods (see the sugar market in 2011 or the corn market in the second half of 2010). This is explained by the fact that the 2007 classification lists as commercials, investors which are neither

producers, nor processors, nor merchants. Plots for the remaining eight agricultural commodity markets are illustrated in Appendix B.[21]

3.3 Simultaneous correlations between futures returns and positions by type of investors

In Table 1 we report values for simultaneous correlations between futures returns and changes in investment positions for the eleven markets considered.[22] Any statistically significant correlation between futures returns and financial investor positions may be due to endogeneity issues (in particular simultaneity and omitted variables); however, its absence would weigh against a relationship linking the two variables.

Indeed the correlation between futures returns and money managers long (short) positions is positive (negative) and generally statistically significant; this normally holds true even if we condition on other investors' positions and lag by one-period futures returns. Instead, correlations between futures returns and swap dealers positions tend to be statistically insignificant and unstable in sign.

Table 1: Indices of (simultaneous) correlations between futures returns and changes in investment positions (1)

Market	Money managers LONG	Money managers SHORT	SWAP LONG	SWAP SHORT
cocoa	**0.47**	-0.03	0.08	**-0.21**
coffee	**0.54**	**-0.51**	**-0.21**	-0.04
corn	**0.43**	**-0.46**	-0.02	-0.08
cotton	0.19	**-0.48**	**-0.31**	-0.15
feeder cattle	**0.24**	**-0.27**	0.07	-0.01
live cattle	**0.29**	**-0.30**	0.02	0.07
soyabeans	**0.49**	**-0.41**	0.04	-0.11
soyabeans oil	**0.47**	**-0.35**	0.11	**-0.21**
sugar	**0.31**	**-0.34**	-0.08	**0.21**
wheat chicago	0.17	-0.10	0.14	0.10
wheat kansas	**0.37**	**-0.38**	0.03	-0.12

(1) Correlation values > |0.2| are shown in bold.

[21] For most commodity markets, the indices corresponding to the 2007 and 2009 classifications have broadly similar trends; however, cocoa (like sugar) are notable exceptions, as the I_FIN_3 indices point to much larger increases in speculation pressures. For a number of commodities, indices fell dramatically at the end of 2008-beginning of 2009, although they subsequently tended to recoup.

[22] Examination of cross correlograms indicates that correlations for leads and lags were always lower; thus, they were not reported.

3.4 Volatility clustering of futures returns

Daily returns of futures derivatives, as for other financial assets, usually show a certain degree of autocorrelation in volatility (Tomek and Myers, 1993); relatively large (negative or positive) returns are often concentrated in some time periods, while other phases are characterized by low volatility. This phenomenon, known as *volatility clustering*, is usually captured in financial research through models of autoregressive conditional heteroskedasticity (ARCH and GARCH; see: Engle, 1982; Bollerslev, 1986).

The arch tests which we performed on the daily return of each market (log-differences of the nearby futures prices) provide overwhelming evidence of the presence of conditional heteroskedasticity in our data (Table 2 panel A). Nonetheless, since we use weekly data, we also performed the same test on the conditional weekly return. Thus in a first step we estimate an autoregressive model of the weekly return on positions held by various types of investors, then test for the presence of conditional heteroskedasticity of the residuals. We still get a significant ARCH test for the majority of the markets. In Table 2 we report the outcome of ARCH tests and, to give a graphical overview as well, in Appendix C we include a plot of returns and their squares, from January 2000 to September 2011.

Table 2: Testing for the presence of autoregressive conditional heteroskedasticity

	A: daily return		B: conditional weekly return	
	ARCH TEST	p-value	ARCH LM statistic	p-value
cocoa	4.56	0.47	16.22	0.01
coffee	70.82	0.00	0.64	0.99
corn	26.09	0.00	5.97	0.31
cotton	22.53	0.00	9.24	0.10
feeder_cattle	11.77	0.04	24.37	0.00
live_cattle	9.34	0.10	5.35	0.38
soyabeans	24.25	0.00	7.58	0.18
soyabean_oil	63.39	0.00	48.68	0.00
wheat_cbot	40.15	0.00	16.78	0.00
wheat_kansas	45.54	0.00	21.46	0.00
sugar	182.83	0.00	7.22	0.20

We also check whether the observed autocorrelation stemmed from the presence of structural breaks in volatility. For each of the eleven markets analysed we apply the Incan and Tiao (1994) methodology to detect the changes in the unconditional variance. It employs the iterated cumulated sums of squares (ICSS) algorithm, which has been proved particularly powerful with respect to other tools developed for the same purpose (see Malik 2000; Smith 2008). The procedure identifies the presence of a structural break in only three markets out of eleven but, once we control for outliers, these structural breaks in volatility disappear. Therefore they are not an issue in our sample and we conclude that a GARCH model is a suitable framework to investigate the relationship between changes in positions of financial investors and the volatility of futures returns.

On the basis of this evidence, we model futures' return volatility, jointly with return means, through a basic GARCH (1,1) model:

$$r_t = \mu + \alpha r_{t-1} + \varepsilon_t$$
$$\text{where } \varepsilon_t = u_t \sqrt{h_t} \quad \text{with} \quad u_t \approx \mathbf{N}(0,1)$$
$$\text{and} \quad h_t = c + a\varepsilon_{t-1}^2 + bh_{t-1}$$

Results (reported in Appendix E: Table 1, under columns "(1)" for each market) confirm the existence of GARCH effects in futures returns; coefficients for the variance equations are always positive and statistically significant ranging between 0.6 and 0.9.

4. Futures returns and investment decisions: the VAR model and Granger-causality tests

The existence of simultaneous correlation between futures returns and changes in investment positions held by financial investors does not prove any causality relationship. No clear conclusion can be drawn without an underlying structural model. Nonetheless detecting whether positions tend to lead price movements or instead follow them surely helps to identify the underlying economic mechanism. For instance, trend-following strategies (i.e. the investors buy when the price rises and sell when it declines) signal some degree of market inefficiency, as future investments are decided on the basis of past information; on the other hand, futures returns (which are obtained through market clearing prices, for which long positions are the same as short positions) could follow investments made by a certain group of investors, because they may have private information and other investors tend to follow their actions. Based on preliminary analysis, we see no evidence that position changes by financial traders may have triggered large price swings, as we found futures returns to be uncorrelated with their lagged values (if a self-reinforcing mechanism going from prices to positions then back to prices was in place, we would have found returns to be autocorrelated).

We now look at an empirical framework able to accommodate our conjectures and test them. Lacking theoretical restrictions, we explore the relationship between prices and investments by means of a vector autoregressive (VAR) model, containing futures returns and changes in positions held by money managers and swap dealers.[23] We include long and short positions separately.[24] The optimal number of lags has been determined according to selection criteria (Akaike Information

[23] We have estimated a similar VAR model employing investor positions based on the 2007 CFTC classification. Results are reported in the upper panel of the Table in Appendix D. We do not comment on them, as they are similar to those obtained using the latest (October 2009) classification.

[24] Investments by "non reportables" are not included because these are atomistic agents who have little influence on markets. Note that the sum of all short and long positions outstanding in the market is always equal to zero; hence, including positions by all groups of traders (including commercials) would have entailed perfect collinearity in the data.

Criterion and Schwarz Criterion), on the basis of which we have included only one-period (1-week) lagged explanatory variables, for all commodity markets. Thus the model is:

$$y_t = \gamma_0 + \Gamma y_{t-1} + e_t$$

With the vector of endogenous variables: $y_t = \begin{bmatrix} r_t \\ MMlong_t \\ MMshort_t \\ Swaplong_t \\ Swapshort_t \end{bmatrix}$

where: $MMlong_t$ ($MMshort_t$) represent changes in the shares of money managers' long (short) positions (relative to the open interest) at time t and $swaplong_t$ ($swapshort_t$) are similarly defined for swap dealers' long (short) positions; r_t is for futures returns; e_t is the reduced-form error term.

Results from VAR estimates are reported in Appendix D (lower panel of the table), with each column showing regression results associated to the equation for each of the five endogenous variables in the VAR model.[25]

As in other previous empirical works,[26] we have performed a battery of Granger causality tests in the attempt to identify the temporal direction of the relationship. Results are reported in Table 3 (for the direction of causality going from investor positions to futures prices) and Table 4 (for effects in the opposite direction). Since the Granger causality exists when we fail to reject the null hypothesis;[27] for rapid visual inspection, we have filled in results only when this was indeed the case.

At first glance, Table 3 shows quite sparse evidence of causation going from investor positions to futures prices, with no systematic pattern emerging across the various markets. Changes in long positions held by money managers tend to reduce future returns in the market of feeder cattle and live cattle, but they tend to raise them in the corn and wheat markets (see Appendix D). A rise of swap dealers' share on total long positions leads the increase of futures returns in three markets (cocoa, soybeans and soybean oil). Overall our results confirm previous findings[28] of no systematic influence of financial investments on agricultural commodity futures prices.

[25] As we include only one-lag for the regressors, the Granger-causality tests yield the same results as those for simple significance tests applied to single regressors. Thus, in Appendix D we show regression coefficients and their standard errors, in order to gauge sign, size and significance of the coefficients.

[26] Gilbert (2010a), Gilbert (2010b), IMF-GFSR (October 2008) and Irwin and Sanders (2010).

[27] The Granger causality test, which is based on Wald statistics, investigates whether the estimated coefficients on the lagged values of a particular regressor are jointly statistically different from zero. The null hypothesis is that the considered coefficients are all equal to zero.

[28] See Gilbert (2010a), Gilbert (2010b) and IMF (GFSR, October 2008). For instance Gilbert (2010a) finds a significant impact of CIT investors on prices only in the soybean market.

Table 3. Results from Granger tests: do changes in financial investor positions "cause" futures returns? (1)

ENDOGENOUS VARIABLE: FUTURES RETURNS	cocoa		coffee		corn		cotton		feedercattle		livecattle		soybeans		soybeanoil		sugar		wheatc		wheatk	
EXCLUDING REGRESSORS:	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P
Money managers Long					**3.23** +	**0.07**			**5.05** -	**0.02**	**7.27** -	**0.01**							**2.72** +	**0.10**		
Money managers Short	**3.58** +	**0.06**											**2.90** -	**0.09**								
Swap Long	**4.87** +	**0.03**											**7.49** +	**0.01**	**3.68** +	**0.06**						
Swap short																						
All (*)	**10.19**	**0.04**									**11.42**	**0.02**	**9.01**	**0.06**								

(1) "Chi sq" is the value of the Wald test; ; "Coef. Sign" is the sign of the coefficient in the VAR estimation; "P" is the probability value that the null hypothesis is rejected.

With respect to the possibility of reverse causality (Table 4), Granger tests identify many more markets where future returns tend to anticipate changes of financial investors' positions; especially those of money managers. In six markets (cocoa, coffee, feeder cattle, soybean oil, sugar and wheat-Kansas), the group of money managers increases its long exposure along with future return improvements. Swap dealers instead appear less influenced by returns evolution, just in the market of live cattle, following a future returns improvement, they increase their net exposure. These results seem in line with the conclusions reached by the IMF (WEO, September 2006), according to which speculative investments tend to follow price variations in a number of agricultural and industrial commodity markets.

Table 4: Results from Granger tests: do futures returns "drive" changes in financial investor positions? (1)

EXCLUDING REGRESSOR: FUTURES RETURNS	cocoa		coffee		corn		cotton		feedercattle		livecattle		soybeans		soybeanoil		sugar		wheatc		wheatk	
ENDOGENOUS VARIABLES:	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P	Chi-sq Coef. Sign	P
Money managers Long	**9.72** +	**0.00**	**7.75** +	**0.01**					**5.82** +	**0.02**					**3.29** +	**0.07**						
Money managers Short	**5.49** -	**0.02**	**3.70** -	**0.05**					**45.19** -	**0.00**					**3.82** -	**0.05**	**4.38** -	**0.04**			**8.88** -	**0.00**
Swap Long	**4.30** -	**0.04**							**0.01** -	**0.90**	**8.27** +	**0.00**										
Swap short																						

(1) "Chi sq" is the value of the Wald test; "Coef. Sign" is the sign of the coefficient in the VAR estimation; "P" is the probability value that the null hypothesis is rejected.

Results from Granger tests may also suggest the existence of reciprocal causality: the existence of a self-reinforcing mechanism which goes from returns to investments and then back from the latter to the former, with this feedback effect triggering possible price spirals. Based on the above evidence, this seems to occur very rarely: only between positions of money managers and futures returns in the cocoa market.

Our empirical analysis is limited by the impossibility of going beyond statistical causality without theoretically based structural restrictions. Nonetheless, overall the evidence seems to support the idea that financial investors, by following price trends, could implement possibly noisy investment strategies, with their behaviour revealing the existence of some degree of market inefficiency.

5. Investment decisions and the volatility of futures returns: a GARCH analysis

For a given level of uncertainty about fundamentals, we expect smaller price variability in more efficient markets, as all the available information will be promptly incorporated in equilibrium prices. This is why a vast stream of literature[29] has considered price volatility as the main benchmark for evaluating the efficiency performance of trading in the derivatives market.

If investments by financial investors contribute to a prompt inclusion of new information in the market, we should expect a stabilizing effect on futures price dynamics. However, trend following behaviour, of which we found some evidence in Section 4, might induce price overshooting (or undershooting) following an unexpected shock, before prices adjust towards the new fundamental equilibrium. In a recent theoretical contribution Basak and Pavlova (2011) show that index investors, by taking higher exposure to risky assets, increase the volatility of the assets included in the indices. We try to exploit information contained in our dataset in order to shed some light on these alternative hypotheses.

In our preliminary analysis (carried out in Section 3.4) we found some evidence of *volatility clustering* in futures returns; we now employ an extended specification of the GARCH model, in order to make heteroskedasticity in returns conditional on investment positions held by the different types of investors. We will test two different specifications of the following GARCH setting:

$$r_t = \mu + \alpha r_{t-1} + \sum_i \beta_i Z_{i,t-1} + \varepsilon_t$$
$$\text{where } \varepsilon_t = u_t \sqrt{h_t} \quad \text{with} \quad u_t \approx \mathbf{N}(0,1)$$
$$\text{and} \quad h_t = c + a\varepsilon_{t-1}^2 + bh_{t-1} + \sum_i \gamma_i X_{i,t-1}$$

where the term $Z_{i,t-1}$ (included in the *mean* equation) represents the one-period-lagged changes in investment positions of the different types of financial investors; $X_{i,t-1}$ represents the group of regressors included in the conditional *variance* equation, in addition to the one-period-lag squared residuals and the GARCH component ($\varepsilon_{t-1}^2, h_{t-1}$). The formulation of $X_{i,t-1}$ takes two

[29] Powers (1970), Taylor and Leuthold (1974), Turnovsky (1979), Brorsen et al (1989), Gilbert (1989), Netz (1995), Hardouvelis and Dongcheol (1995), and Irwin and Holt (2004).

alternative forms: in one specification $X_{i,t-1} = Z_{i,t-1}$ (same regressors as in the mean equation; linear specification); in the other one, $X_{i,t-1}$ consists of the squared terms of the $Z_{i,t-1}$ regressors (quadratic specification). The latter specification tests how larger position changes are related to returns' volatility, irrespective of the investment direction, providing a gauge of the overall impact of investors' activity.

As in the previous analysis carried out in Section 4, we have to deal with a potentially serious simultaneity issue: investors may change their positions more frequently when new information becomes available or during periods of higher uncertainty on fundamentals (as it may imply higher potential profitability); this could increase the observed correlation between financial investments and returns volatility, due to the discontinuity of the shocks to the information set.

5.A Empirical results

The complete results of GARCH estimations, for the eleven commodity derivatives markets, are reported in Appendix E.[30] Table E2 of the Appendix reads as follows: the upper panel shows regression results for the *mean* equation, while the bottom panel those for the *variance* equation; under column (1) there are results for the basic GARCH (1,1) model (discussed in Section 3.4); under column (2) there are results for the linear specification ($X_{i,t-1} = Z_{i,t-1}$) of the extended GARCH; under column (3) there are results for the non-linear (quadratic) specification.

In order to have a rapid look at the results for the linear specification, Table 5 reports the signs of the (statistically significant) coefficients for the group of $X_{i,t-1}$ regressors in the variance equation. Most cells are empty, indicating no systematic "leading" effect of financial investment positions on futures return volatility. The few significant estimates mostly point out a negative relationship between volatility and the positions of swap dealers, broadly in line with Irwin and Sanders (2010), despite the different estimation methodology. It is worth recalling that this finding does not reveal the overall effect of swap dealers' investment activity on volatility. Indeed it implies that volatility shrinks when their weight increases while the opposite is true when their market share decreases.

[30] Table E1 in Appendix E presents results based on the CFTC 2007 classification of investor positions; Table E2 reports those based on the latest classification (October 2009). We choose to comment on the latter results, taking into account that those based on the older classification are qualitatively quite similar

Table 5: Results for GARCH estimates: the leading effect of financial investment positions on futures return volatility, "linear specification" (1)

MARKET	MONEY MANAGER LONG	MONEY MANAGER SHORT	SWAP DEALER LONG	SWAP SHORT
Cocoa				
Coffee			(-)	
Corn				-
Cotton			+	
Feeder Cattle				
Live Cattle			-	-
Soybeans				
Soybean Oil				
Sugar		(+)		
Wheat-Cbot				-
Wheat-Kansas			-	

(1) Only the signs of 5 per cent statistically significant coefficients are reported (in brackets those significant at the 10 per cent level).

The outcome of the non linear specification (where we include the square of position changes; Table 6), uncovers a rather robust negative driving effect of money managers' activity on returns volatility (confirmed in 9 out of 11 markets); on the contrary, in a few markets, volatility rises with swap dealers' activity, even if in this case the evidence is more mixed. This finding on the different role of traditional speculators with respect to swap dealers empirically confirms the theoretical predictions of Basak and Pavlova (2011).

Table 6: Results for GARCH estimates: the leading effect of financial investment positions on futures return volatility, quadratic specification (1)

MARKET	MONEY MANAGER LONG	MONEY MANAGER SHORT	SWAP LONG	SWAP SHORT
Cocoa		-		
Coffee		(-)	-	
Corn	-			
Cotton		-		(+)
Feeder Cattle			(+)	
Live Cattle		(-)	-	
Soybeans		-		
Soybean Oil	(-)	-		
Sugar		-	+	
Wheat-Cbot	-			
Wheat-Kansas			+	

(1) Only signs of 5 per cent statistically significant coefficients are reported (in brackets those significant at the 10 per cent level).

6. Concluding remarks

The hypothesis that financial investors on commodity derivatives markets provide liquidity and contribute, through their private information, to the price formation process has been challenged by the view that an excessive presence of financial investors may lead to market inefficiency, as it may increase the level of noisy trading and drive prices away from fundamentals.

Traditionally, players in the commodity derivatives markets were divided into "hedgers" (producers/processors/merchants), who enter the derivatives market in order to cover their exposures on the physical market), and "financial speculators" (such as money managers). However, in the last ten years a new type of trader has entered the financial commodity markets: the "commodity index investor". They tend to be "passive investors", replicating an index of the main traded commodities and following portfolio diversification strategies; commodity index investors usually enter the regulated markets only indirectly, through the intermediation of a "swap dealer"; while traditional speculators are subject to position limits on the US derivatives markets for agricultural commodities, swap dealers so far have been granted special exemptions, similarly to commercial traders. This latter regulatory feature has repeatedly attracted attention, due to concerns about the excessive expansion of financial investments on commodity markets, and, according to the most recent CFTC regulation, this exemption is going to be removed in 2012.

This paper aims to contribute to this debate, considering that previous economic research on the topic has been quite inconclusive. Our analysis relies on a dataset on futures positions in agricultural commodity derivatives markets, made available by the US CFTC at the end of 2009. In particular, using a more detailed classification method of weekly investment positions, we are able to distinguish between the activity of two different types of financial trader, the swap dealers and the money managers.

We first show that for all of the eleven agricultural commodity derivatives markets investigated (over the period June 2006-September 2011), futures *price returns* appear to be simultaneously correlated with money manager investments; for swap dealers positions, instead, evidence of such correlation is much weaker. Then, as in previous studies, we examine this relationship more closely by means of Granger causality tests in a VAR model. We find that higher future returns lead to additional money manager investments in around half of the eleven markets while evidence of the opposite effect, going from higher positions to futures returns, is rather scant. This result seems to indicate that "traditional speculators" react to price changes rather than cause them; it could also imply some trend-following behaviour by money managers, which in turn may uncover a certain degree of market inefficiency.

Finally, concerning the possible relationship between investment positions held by financial traders and futures *price volatility*, we employ a GARCH model where the lagged values of investment positions enter both the mean and the variance equations. This analysis confirms that money managers and swap dealers may play different roles: while the positions held by money managers tend to reduce price volatility in a large number of markets, the evidence on swap dealers is more mixed and their investments seem to amplify price volatility in some markets. Although our analysis suffers from severe problems of data limitations and the above evidence is not overwhelming, nonetheless this result gives some support to the idea that swap dealers, whose growing weight in the regulated exchanges tends to reflect the large exposures of "commodity index investors" in the OTC markets, may have a destabilizing impact on futures prices, at least in the short run. On the contrary, the activity of more traditional speculators seems to favour price stability, probably enhancing market liquidity.

Even assuming that an excess of financial investments in commodity markets might be harmful, one still needs to devise policy responses which could be effective in curbing its undesirable effects, while preserving market efficiency. Effective regulation may be developed only by improving our knowledge of market mechanisms that is now limited by the lack of appropriate statistics. As agreed by policy makers in international fora, this can only be achieved by increasing transparency and making available more detailed information both on regulated and OTC financial markets, as well as on physical fundamentals.

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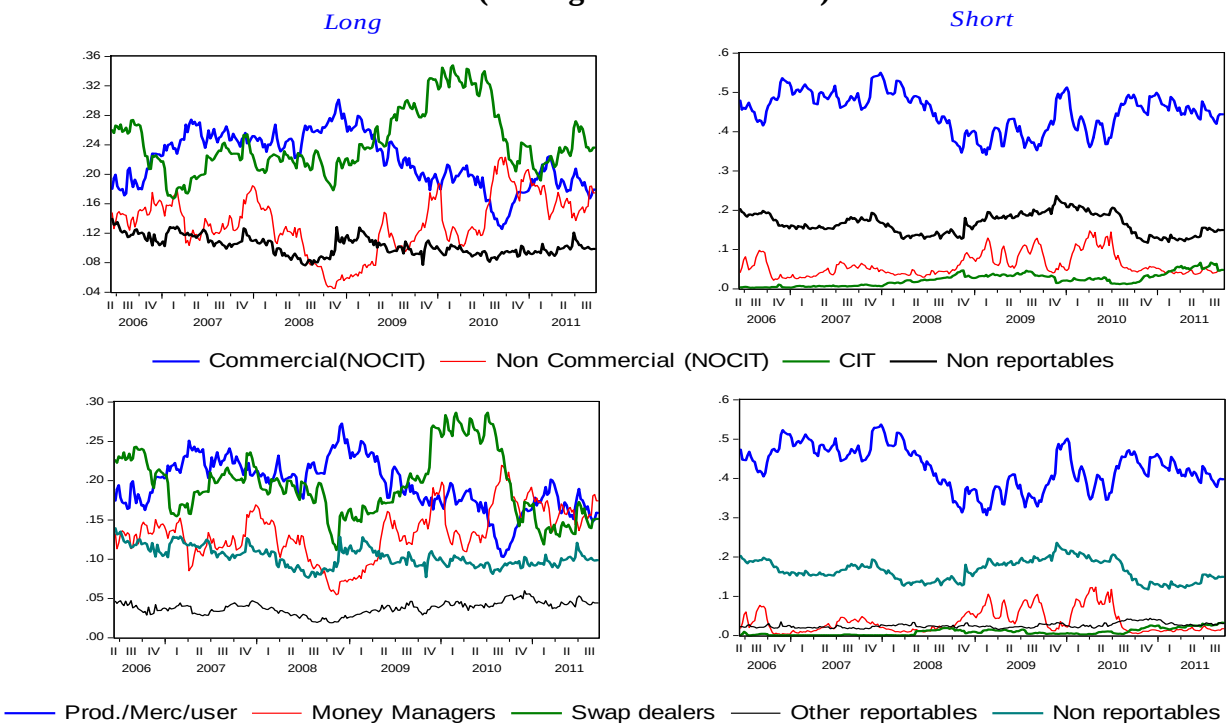
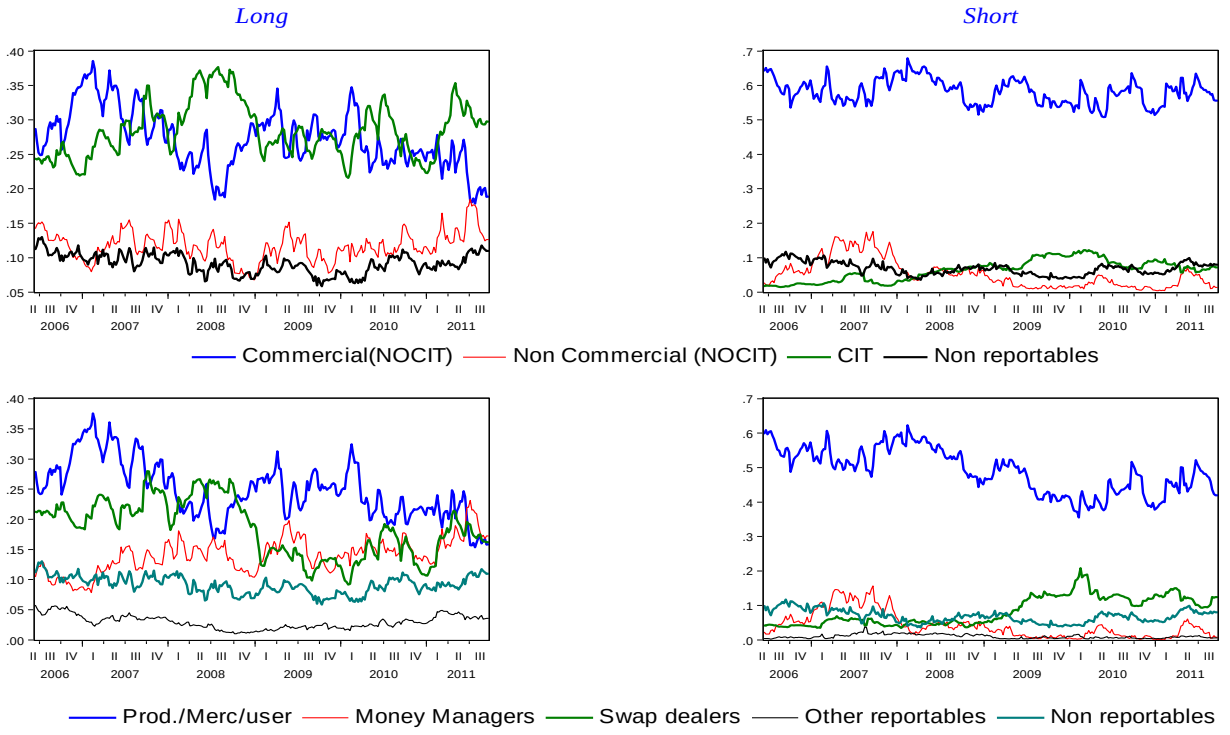
Appendix A

Share of outstanding contracts by type of investor, futures-and-options combined

Corn (Chicago Board of Trade)



Sugar *(NY Board of Trade and ICE Futures)*

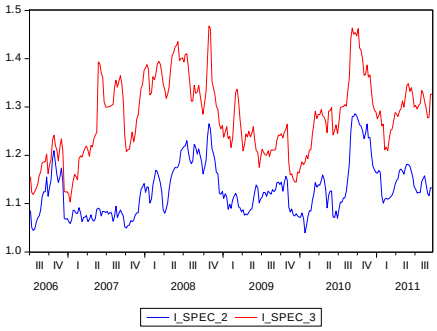


Source: Commodity Futures Trading Commission (CFTC).

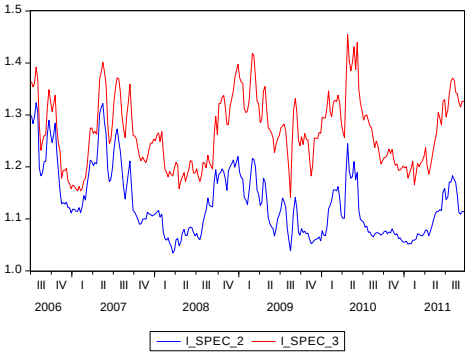
Appendix B

The T index of speculative activity[(1)]

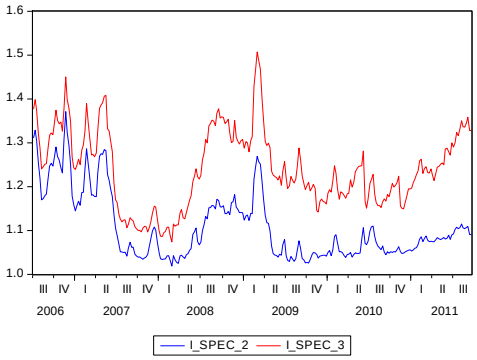
COCOA



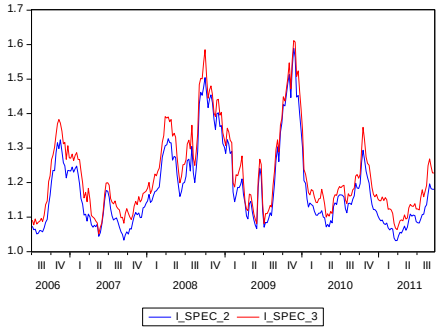
COFFEE



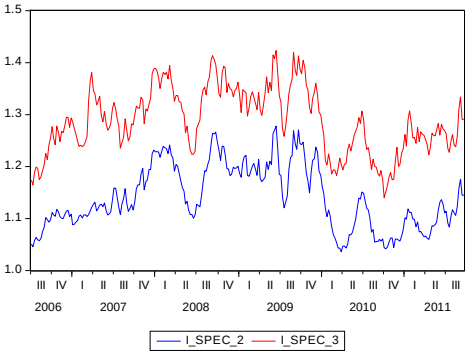
COTTON



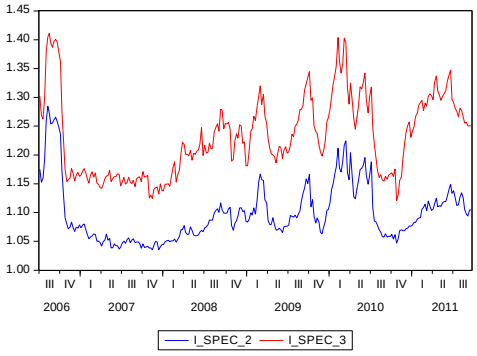
FEEDER CATTLE



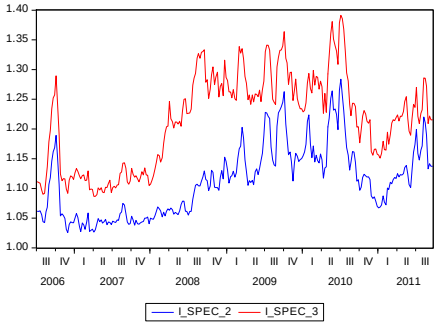
LIVE CATTLE



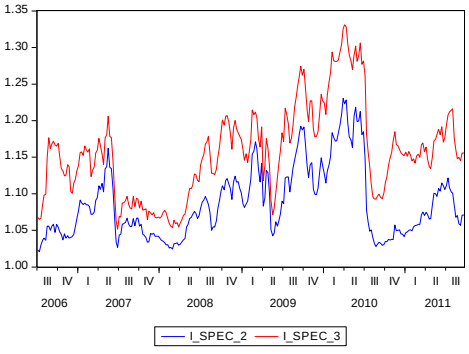
SOYBEANS



SOYBEAN OIL



WHEAT KANSAS

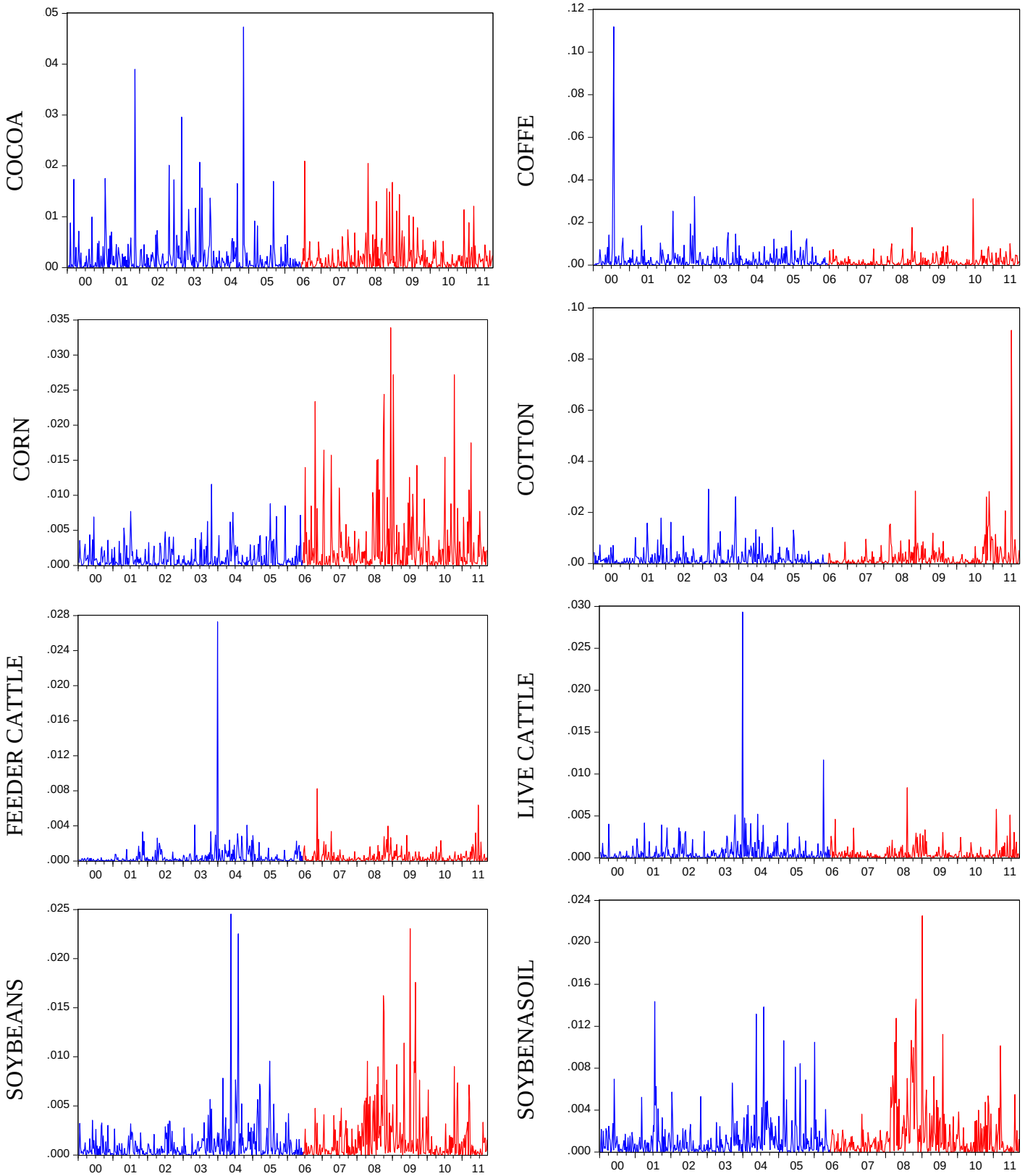


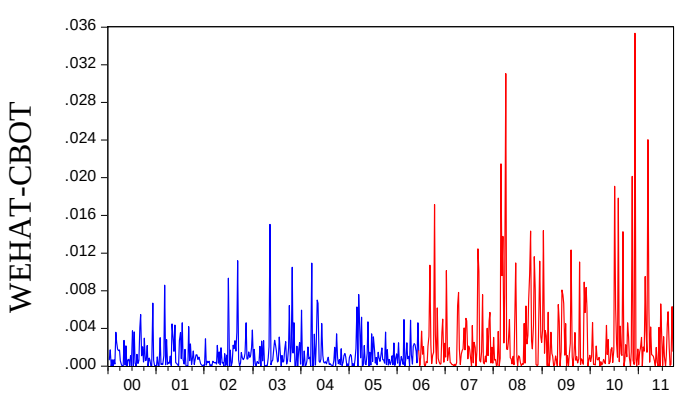
(1) The T-index measures the share of contracts on the total outstanding positions in which both the counterparts are pure financial investors and it is lower bounded to 1. The non-financial positions are given by "non-CIT commercial" positions for 2007 classification (see I_SPEC_2, blue line) and "producers, merchants, processors and users" in the 2009 classification (see I_SPEC_3, red line); all the remaining positions are considered pure financial ones.
Source: Commodity Futures Trading Commission (CFTC).

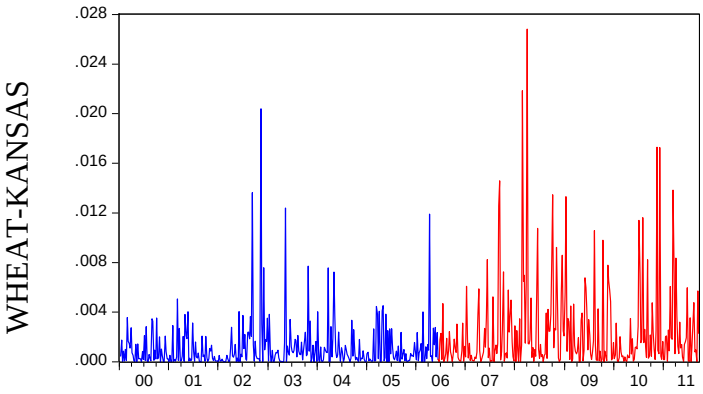
Appendix C

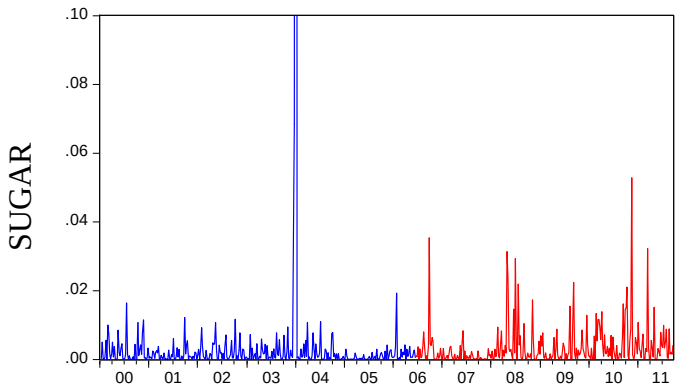
Evidence of volatility clustering for futures prices of selected agricultural commodities

(squares of log differences)









Source: Thomson Financial Datastream.

Appendix D

Table D1: VAR estimates – Top (bottom) panel results based on 2007 (October 2009) CFTC classification of financial investors on derivatives markets[(1)]

	Cocoa				Coffee				Corn			
2007 CFTC Classification	**Futures returns**	**CIT LONG**	**Non commercial LONG**	**Non commercial SHORT**	**Futures returns**	**CIT LONG**	**Non commercial LONG**	**Non commercial SHORT**	**Futures returns**	**CIT LONG**	**Non commercial LONG**	**Non commercial SHORT**
Futures returns (t-1)	0.111	**0.112**	**-0.063**	**-0.037**	-0.005	**0.061**	*-0.055*	-0.042	**-0.16**	-0.004	-0.003	0.005
	(0.069)	(0.032)	(0.026)	(0.013)	(0.079)	(0.030)	(0.030)	(0.027)	(0.074)	(0.013)	(0.012)	(0.013)
Non commercial pos. LONG (t-1)	-0.138	**0.182**	-0.027	0.011	0.040	*0.127*	-0.064	0.009	*0.741*	0.107	**-0.186**	-0.06
	(0.144)	(0.067)	(0.055)	(0.027)	(0.192)	(0.071)	(0.072)	(0.066)	(0.392)	(0.069)	(0.063)	(0.068)
Non commercial pos. SHORT (t-1)	**0.359**	0.010	**0.251**	0.000	**0.338**	0.021	**0.217**	-0.084	0.073	*-0.126*	**0.169**	0.097
	(0.149)	(0.069)	(0.057)	(0.028)	(0.170)	(0.063)	(0.063)	(0.058)	(0.425)	(0.075)	(0.068)	(0.074)
CIT pos. LONG (t-1)	0.319	0.093	0.101	0.058	0.060	-0.097	0.096	0.087	-0.358	0.004	0.010	**0.159**
	(0.334)	(0.155)	(0.128)	(0.062)	(0.181)	(0.067)	(0.068)	(0.062)	(0.376)	(0.066)	(0.060)	(0.065)
constant	0.001	-0.001	0.000	0.000	0.004	0.000	0.000	0.000	0.004	0.000	0.000	0.000
	(0.003)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
R-squared	0.036	0.124	0.102	0.037	0.019	0.074	0.135	0.023	0.023	0.028	0.094	0.042
F-statistic	2.509	9.455	7.586	2.585	1.322	5.361	10.397	1.544	1.605	1.921	6.890	2.932

2009 CFTC Classification	**Futures returns**	**Money Manager LONG**	**Money Manager SHORT**	**Swap Dealer LONG**	**Swap Dealer SHORT**	**Futures returns**	**Money Manager LONG**	**Money Manager SHORT**	**Swap Dealer LONG**	**Swap Dealer SHORT**	**Futures returns**	**Money Manager LONG**	**Money Manager SHORT**	**Swap Dealer LONG**	**Swap Dealer SHORT**
Futures returns (t-1)	0.101	**0.102**	**-0.062**	**-0.021**	-0.002	-0.016	**0.076**	**-0.055**	-0.035	-0.009	**-0.138**	0.001	-0.012	0.011	-0.001
	(0.070)	(0.033)	(0.027)	(0.010)	(0.009)	(0.078)	(0.027)	(0.029)	(0.023)	(0.008)	(0.072)	(0.012)	(0.011)	(0.013)	(0.002)
Money Manager pos. LONG (t-1)	-0.08	**0.181**	-0.031	0.021	-0.016	0.032	*0.131*	-0.052	0.005	0.025	0.797	0.130	**-0.17**	-0.014	0.003
	(0.142)	(0.066)	(0.054)	(0.020)	(0.019)	(0.197)	(0.070)	(0.073)	(0.059)	(0.021)	(0.443)	(0.074)	(0.071)	(0.078)	(0.014)
Money Manager pos. SHORT (t-1)	0.283	-0.012	**0.241**	-0.032	-0.005	0.244	0.038	**0.262**	-0.074	-0.012	0.283	-0.02	*0.125*	0.082	0.011
	(0.149)	(0.070)	(0.057)	(0.022)	(0.020)	(0.173)	(0.061)	(0.064)	(0.052)	(0.018)	(0.435)	(0.073)	(0.069)	(0.076)	(0.013)
Swap Dealer pos. LONG (t-1)	**0.932**	0.022	0.205	**0.165**	-0.004	0.075	**-0.146**	0.085	**0.155**	**0.063**	-0.348	0.005	-0.02	**0.179**	-0.011
	(0.423)	(0.198)	(0.161)	(0.061)	(0.057)	(0.211)	(0.075)	(0.078)	(0.064)	(0.022)	(0.388)	(0.065)	(0.062)	(0.068)	(0.012)
Swap Dealer pos. SHORT (t-1)	0.186	*0.383*	0.229	-0.096	-0.009	-0.076	0.062	*0.368*	0.036	0.016	-3.091	-0.442	**0.612**	-0.24	0.036
	(0.466)	(0.218)	(0.177)	(0.067)	(0.063)	(0.581)	(0.206)	(0.215)	(0.175)	(0.061)	(2.002)	(0.336)	(0.318)	(0.352)	(0.062)
constant	0.002	-0.001	0.000	0.000	0.000	0.004	0	0	0	0.000	0.004	0.000	0	0	0.000
	(0.003)	(0.001)	(0.001)	(0.000)	(0.000)	(0.003)	(0.001)	(0.001)	(0.001)	(0.000)	(0.003)	(0.001)	(0.001)	(0.001)	(0.000)
R-squared	0.043	0.119	0.116	0.044	0.005	0.013	0.099	0.167	0.038	0.046	0.030	0.028	0.104	0.036	0.009
F-statistic	2.375	7.202	6.964	2.429	0.259	0.675	5.832	10.685	2.110	2.586	1.658	1.549	6.181	2.004	0.481

(1) Futures returns are *log*-differences of prices, investment positions are expressed as first differences of gross positions over the open interest; column headings report the endogenous variables; 5% significant estimates in bold scripts, 10% in italics; White heteroskedastic robust standard errors in brackets.

Table D1: *continued*

2007 CFTC Classification	Cotton				Feeder Cattle				Live Cattle			
	Futures returns	**CIT LONG**	**Non commercial LONG**	**Non commercial SHORT**	**Futures returns**	**CIT LONG**	**Non commercial LONG**	**Non commercial SHORT**	**Futures returns**	**CIT LONG**	**Non commercial LONG**	**Non commercial SHORT**
Futures returns (t-1)	0.073	-0.009	-0.012	-0.014	0.065	**0.130**	**-0.402**	-0.028	-0.035	0.021	-0.032	**0.107**
	(0.067)	(0.017)	(0.016)	(0.020)	(0.064)	(0.060)	(0.057)	(0.047)	(0.065)	(0.031)	(0.035)	(0.035)
Non commercial pos. LONG (t-1)	-0.274	0.095	0.023	**-0.159**	-0.082	0.042	-0.024	0.023	**-0.277**	**0.131**	0.002	-0.044
	(0.264)	(0.068)	(0.061)	(0.078)	(0.068)	(0.063)	(0.060)	(0.050)	(0.134)	(0.064)	(0.071)	(0.073)
Non commercial pos. SHORT (t-1)	-0.333	-0.067	**0.471**	0.107	-0.068	**-0.125**	**0.266**	**0.090**	0.154	0.057	**0.234**	0.103
	(0.276)	(0.071)	(0.064)	(0.082)	(0.061)	(0.057)	(0.054)	(0.045)	(0.117)	(0.055)	(0.062)	(0.063)
CIT pos. LONG (t-1)	0.118	0.040	-0.044	**0.238**	-0.103	**-0.198**	-0.004	0.074	0.096	0.033	-0.054	0.098
	(0.233)	(0.060)	(0.054)	(0.069)	(0.087)	(0.081)	(0.077)	(0.064)	(0.113)	(0.054)	(0.060)	(0.061)
constant	0.002	0.000	0.000	0.000	0.001	-0.001	0.000	0.000	0.001	0.000	0.000	0.000
	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
R-squared	0.014	0.018	0.216	0.101	0.018	0.083	0.273	0.026	0.038	0.027	0.061	0.048
F-statistic	0.954	1.194	18.425	7.477	1.217	6.060	25.045	1.810	2.605	1.818	4.315	3.385

2009 CFTC Classification															
	Futures returns	**Money Manager LONG**	**Money Manager SHORT**	**Swap Dealer LONG**	**Swap Dealer SHORT**	**Futures returns**	**Money Manager LONG**	**Money Manager SHORT**	**Swap Dealer LONG**	**Swap Dealer SHORT**	**Futures returns**	**Money Manager LONG**	**Money Manager SHORT**	**Swap Dealer LONG**	**Swap Dealer SHORT**
Futures returns (t-1)	0.069	-0.007	-0.008	-0.003	0.005	0.090	**0.137**	**-0.352**	-0.004	-0.001	-0.033	0.039	-0.015	**0.085**	-0.002
	(0.067)	(0.017)	(0.015)	(0.019)	(0.006)	(0.064)	(0.057)	(0.052)	(0.032)	(0.015)	(0.064)	(0.030)	(0.033)	(0.030)	(0.005)
Money Manager pos. LONG (t-1)	-0.261	0.095	-0.013	-0.094	-0.002	**-0.154**	**0.165**	-0.025	-0.052	-0.011	**-0.385**	0.089	-0.087	-0.069	0.003
	(0.306)	(0.076)	(0.067)	(0.088)	(0.025)	(0.068)	(0.060)	(0.056)	(0.034)	(0.015)	(0.143)	(0.067)	(0.074)	(0.066)	(0.010)
Money Manager pos. SHORT (t-1)	-0.276	-0.069	**0.461**	0.115	**0.063**	-0.032	-0.026	**0.283**	-0.001	-0.016	0.052	0.084	**0.247**	0.043	**0.021**
	(0.295)	(0.073)	(0.064)	(0.085)	(0.024)	(0.068)	(0.060)	(0.056)	(0.034)	(0.015)	(0.122)	(0.057)	(0.063)	(0.056)	(0.009)
Swap Dealer pos. LONG (t-1)	0.106	0.058	0.033	**0.235**	0.022	-0.081	**-0.373**	0.064	**0.213**	**-0.052**	0.217	-0.032	0.003	**0.146**	0.005
	(0.273)	(0.068)	(0.060)	(0.079)	(0.023)	(0.121)	(0.107)	(0.098)	(0.060)	(0.027)	(0.141)	(0.066)	(0.073)	(0.065)	(0.010)
Swap Dealer pos. SHORT (t-1)	-0.539	-0.168	-0.186	-0.184	-0.071	0.050	-0.001	-0.141	0.090	0.072	-1.236	0.096	0.498	-0.103	0.039
	(0.776)	(0.192)	(0.170)	(0.223)	(0.064)	(0.272)	(0.241)	(0.221)	(0.136)	(0.062)	(0.868)	(0.407)	(0.448)	(0.400)	(0.061)
constant	0.002	0.000	0	0	0.000	0.001	0	0.000	0.000	0	0.001	0.000	0.000	0	0.000
	(0.003)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
R-squared	0.014	0.027	0.230	0.068	0.039	0.023	0.106	0.274	0.058	0.023	0.051	0.021	0.085	0.047	0.034
F-statistic	0.729	1.480	15.904	3.877	2.172	1.264	6.329	20.042	3.285	1.259	2.864	1.165	4.939	2.633	1.856

Table D1: *continued*

	Soybeans				Soybean Oil				Sugar			
2007 CFTC Classification	**Futures returns**	**CIT LONG**	**Non commercial LONG**	**Non commercial SHORT**	**Futures returns**	**CIT LONG**	**Non commercial LONG**	**Non commercial SHORT**	**Futures returns**	**CIT LONG**	**Non commercial LONG**	**Non commercial SHORT**
Futures returns (t-1)	-0.038	0.015	-0.009	0.023	-0.008	0.041	-0.035	-0.017	**-0.179**	0.001	*-0.019*	-0.002
	(0.075)	(0.026)	(0.021)	(0.021)	(0.073)	(0.032)	(0.028)	(0.021)	(0.068)	(0.011)	(0.010)	(0.012)
Non commercial pos. LONG (t-1)	-0.22	-0.014	0.067	**-0.149**	-0.063	0.091	0.025	**-0.088**	*0.783*	0.080	-0.067	-0.078
	(0.216)	(0.075)	(0.061)	(0.060)	(0.162)	(0.071)	(0.062)	(0.045)	(0.425)	(0.068)	(0.064)	(0.076)
Non commercial pos. SHORT (t-1)	*-0.39*	**-0.266**	**0.219**	-0.016	-0.203	-0.074	**0.239**	-0.056	-0.187	-0.065	0.044	-0.01
	(0.237)	(0.082)	(0.067)	(0.066)	(0.172)	(0.075)	(0.066)	(0.048)	(0.438)	(0.070)	(0.066)	(0.078)
CIT pos. LONG (t-1)	**0.509**	**0.183**	0.048	*0.115*	*0.407*	-0.044	0.129	**0.168**	-0.025	0.005	*-0.098*	**0.176**
	(0.225)	(0.078)	(0.064)	(0.062)	(0.216)	(0.095)	(0.083)	(0.061)	(0.376)	(0.060)	(0.057)	(0.067)
constant	0.003	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.002	0.000	0.000	0.000
	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.001)
R-squared	0.027	0.063	0.053	0.033	0.017	0.042	0.093	0.058	0.032	0.012	0.041	0.030
F-statistic	1.841	4.455	3.739	2.302	1.140	2.935	6.839	4.137	2.179	0.814	2.855	2.049

2009 CFTC Classification	**Futures returns**	**Money Manager LONG**	**Money Manager SHORT**	**Swap Dealer LONG**	**Swap Dealer SHORT**	**Futures returns**	**Money Manager LONG**	**Money Manager SHORT**	**Swap Dealer LONG**	**Swap Dealer SHORT**	**Futures returns**	**Money Manager LONG**	**Money Manager SHORT**	**Swap Dealer LONG**	**Swap Dealer SHORT**
Futures returns (t-1)	-0.052	0.010	-0.005	0.025	-0.003	0.012	*0.054*	**-0.049**	-0.012	0	**-0.151**	0.008	**-0.02**	-0.005	0.007
	(0.074)	(0.025)	(0.020)	(0.019)	(0.003)	(0.072)	(0.030)	(0.025)	(0.020)	(0.009)	(0.067)	(0.011)	(0.010)	(0.011)	(0.007)
Money Manager pos. LONG (t-1)	-0.28	-0.069	0.045	**-0.127**	-0.009	-0.142	0.052	0.017	-0.04	-0.001	0.548	0.093	-0.029	-0.064	**-0.087**
	(0.227)	(0.078)	(0.060)	(0.058)	(0.011)	(0.180)	(0.073)	(0.062)	(0.051)	(0.022)	(0.426)	(0.069)	(0.061)	(0.069)	(0.044)
Money Manager pos. SHORT (t-1)	*-0.447*	**-0.312**	**0.235**	-0.037	0.009	-0.114	*-0.135*	**0.272**	-0.053	0.023	-0.39	-0.048	0.065	0.040	-0.04
	(0.262)	(0.090)	(0.070)	(0.067)	(0.012)	(0.196)	(0.080)	(0.068)	(0.055)	(0.024)	(0.467)	(0.075)	(0.067)	(0.076)	(0.048)
Swap Dealer pos. LONG (t-1)	**0.683**	**0.215**	0.010	**0.143**	0	**0.423**	0.037	0.057	**0.136**	-0.025	0.460	0.006	**-0.154**	**0.179**	0.040
	(0.250)	(0.086)	(0.066)	(0.064)	(0.012)	(0.221)	(0.090)	(0.076)	(0.062)	(0.027)	(0.431)	(0.070)	(0.061)	(0.070)	(0.044)
Swap Dealer pos. SHORT (t-1)	-0.257	0.417	**0.747**	0.057	0.034	0.187	-0.295	0.065	0.095	0.049	-0.455	0.102	0.003	-0.044	0.089
	(1.309)	(0.449)	(0.348)	(0.335)	(0.062)	(0.506)	(0.206)	(0.174)	(0.143)	(0.062)	(0.596)	(0.096)	(0.085)	(0.096)	(0.061)
constant	0.003	0.000	0	0	0.000	0.003	0	0.000	0	0.000	0.002	0.000	0	0	0.000
	(0.003)	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.004)	(0.001)	(0.001)	(0.001)	(0.000)
R-squared	0.035	0.069	0.083	0.029	0.023	0.015	0.070	0.119	0.022	0.011	0.037	0.024	0.052	0.039	0.026
F-statistic	1.934	3.952	4.803	1.574	1.279	0.784	4.023	7.167	1.187	0.586	2.023	1.281	2.947	2.138	1.428

Table D1: *continued*

2007 CFTC Classification	Wheat Cbot: Futures returns	CIT LONG	Non commercial LONG	Non commercial SHORT	Wheat Kansas: Futures returns	CIT LONG	Non commercial LONG	Non commercial SHORT
Futures returns (t-1)	-0.058	0.007	*-0.03*	-0.012	-0.04	-0.013	**-0.047**	0.010
	(0.071)	(0.011)	(0.016)	(0.022)	(0.068)	(0.020)	(0.018)	(0.016)
Non commercial pos. LONG (t-1)	**0.864**	0.009	-0.058	-0.019	**0.430**	**0.184**	-0.073	-0.047
	(0.423)	(0.065)	(0.097)	(0.128)	(0.220)	(0.063)	(0.058)	(0.050)
Non commercial pos. SHORT (t-1)	-0.095	*-0.094*	0.024	-0.111	-0.044	**-0.218**	*0.115*	-0.072
	(0.341)	(0.052)	(0.078)	(0.104)	(0.236)	(0.068)	(0.062)	(0.054)
CIT pos. LONG (t-1)	0.287	0.044	0.058	**0.192**	0.056	0.066	**0.180**	**0.132**
	(0.236)	(0.036)	(0.054)	(0.072)	(0.265)	(0.076)	(0.069)	(0.061)
constant	0.002	0.000	0.000	0.000	0.002	0.000	0.000	0.000
	(0.003)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)
R-squared	0.026	0.023	0.035	0.028	0.015	0.080	0.097	0.027
F-statistic	1.782	1.581	2.433	1.909	1.021	5.832	7.149	1.860

2009 CFTC Classification	Futures returns	Money Manager LONG	Money Manager SHORT	Swap Dealer LONG	Swap Dealer SHORT	Futures returns	Money Manager LONG	Money Manager SHORT	Swap Dealer LONG	Swap Dealer SHORT
Futures returns (t-1)	-0.054	0.013	-0.02	-0.012	0.003	-0.01	0.026	**-0.052**	-0.004	-0.003
	(0.074)	(0.012)	(0.016)	(0.021)	(0.005)	(0.069)	(0.018)	(0.018)	(0.013)	(0.004)
Money Manager pos. LONG (t-1)	*0.710*	0.042	-0.1	0.022	0.001	0.179	0.088	-0.079	-0.015	-0.013
	(0.431)	(0.073)	(0.093)	(0.123)	(0.031)	(0.249)	(0.064)	(0.064)	(0.049)	(0.014)
Money Manager pos. SHORT (t-1)	-0.128	-0.077	0.103	-0.085	0.025	-0.052	**-0.138**	**0.129**	*-0.08*	-0.005
	(0.351)	(0.059)	(0.076)	(0.100)	(0.025)	(0.251)	(0.065)	(0.064)	(0.049)	(0.014)
Swap Dealer pos. LONG (t-1)	0.250	-0.01	-0.003	0.121	-0.014	0.406	0.104	0.115	**0.186**	-0.024
	(0.268)	(0.045)	(0.058)	(0.076)	(0.019)	(0.315)	(0.081)	(0.081)	(0.061)	(0.018)
Swap Dealer pos. SHORT (t-1)	0.385	-0.002	0.156	-0.11	0.084	0.856	-0.234	-0.098	0.101	**0.236**
	(0.894)	(0.151)	(0.194)	(0.255)	(0.064)	(1.033)	(0.266)	(0.265)	(0.201)	(0.059)
constant	0.002	0	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
	(0.003)	(0.001)	(0.001)	(0.001)	(0.000)	(0.003)	(0.001)	(0.001)	(0.001)	(0.000)
R-squared	0.027	0.029	0.046	0.014	0.011	0.012	0.072	0.102	0.041	0.073
F-statistic	1.498	1.569	2.571	0.764	0.612	0.650	4.115	6.029	2.276	4.204

Appendix E

Table E1: GARCH estimates – based on 2007 CFTC classification of financial investors on derivatives markets[(1)]

	Cocoa			Coffee			Corn			Cotton			Feeder Cattle			Live Cattle		
MEAN EQUATION	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Dep. variable: Futures returns																		
constant	0.002	0.001	0.002	0.003	0.003	0.003	*0.006*	*0.005*	0.006	0.004	0.003	0.002	0.001	0.001	0.001	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Futures returns (t-1)		0.127	0.094		0.021	-0.031		**-0.197**	-0.140		0.072	0.116		0.091	*0.108*		-0.06	-0.065
		(0.066)	(0.088)		(0.079)	(0.089)		(0.081)	(0.080)		(0.077)	(0.078)		(0.075)	(0.076)		(0.075)	(0.077)
CIT pos. LONG (t-1)		0.367	0.45		0.06	0.022		-0.255	-0.291		0.189	0.128		-0.086	-0.078		0.025	0.017
		(0.338)	(0.365)		(0.142)	(0.179)		(0.392)	(0.355)		(0.213)	(0.259)		(0.087)	(0.089)		(0.110)	(0.113)
Non commercial pos. LONG (t-1)		-0.046	-0.134		0.044	0.047		*0.305*	0.476		-0.069	-0.187		-0.098	*-0.123*		*-0.25*	**-0.292**
		(0.134)	(0.167)		(0.188)	(0.200)		(0.409)	(0.416)		(0.226)	(0.290)		(0.063)	(0.063)		(0.135)	(0.144)
Non commercial pos. SHORT (t-1)		**0.342**	0.200		**0.255**	*0.399*		*-0.068*	0.052		-0.275	-0.128		-0.058	-0.074		0.142	0.138
		(0.151)	(0.149)		(0.121)	(0.205)		(0.502)	(0.443)		(0.235)	(0.167)		(0.063)	(0.065)		(0.122)	(0.113)
VARAINCE EQUATION																		
constant	0.000	0.002	0.000	0.000	0.002	0.001	0.000	**0.003**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ε^2 (t-1)	0.058	-0.092	0.025	0.025	0.064	-0.009	*0.058*	**0.222**	0.021	**0.088**	**0.125**	**0.111**	*0.09*	*0.085*	**0.08**	0.042	0.009	0.01
	(0.045)	(0.039)	(0.039)	(0.049)	(0.091)	(0.073)	(0.035)	(0.077)	(0.018)	(0.026)	(0.051)	(0.046)	(0.047)	(0.051)	(0.041)	(0.036)	(0.025)	(0.015)
GARCH h(t-1)	**0.882**	0.241	**0.922**	**0.809**	*0.045*	0.505	**0.840**	-0.251	**0.915**	**0.913**	**0.826**	**0.845**	**0.842**	**0.855**	**0.857**	**0.908**	**0.939**	**0.956**
	(0.082)	(0.423)	(0.058)	(0.330)	(0.187)	(0.377)	(0.101)	(0.143)	(0.051)	(0.020)	(0.053)	(0.050)	(0.069)	(0.077)	(0.055)	(0.083)	(0.038)	(0.013)
CIT pos. LONG. LONG (t-1)		-0.004			*-0.01*			**0.081**			**0.019**			0.001			**-0.005**	
		(0.018)			(0.006)			(0.029)			(0.005)			(0.001)			(0.001)	
Non commercial pos. LONG (t-1)		0.010			-0.005			**-0.046**			*-0.012*			0.00			**-0.003**	
		(0.006)			(0.010)			(0.020)			(0.006)			(0.001)			(0.001)	
Non commercial pos. SHORT (t-1)		-0.003			**-0.034**			-0.042			*-0.013*			0.00			-0.001	
		(0.009)			(0.009)			(0.027)			(0.007)			(0.001)			(0.001)	
CIT pos. LONG (t-1)^2			0.282			-0.246			-0.360			0.294			*0.097*			**-0.174**
			(0.486)			(0.302)			(0.845)			(0.223)			(0.051)			(0.030)
Non commercial pos. LONG (t-1)^2			0.019			-0.425			**-1.277**			*0.063*			0.026			0.078
			(0.049)			(0.486)			(0.439)			(0.193)			(0.030)			(0.057)
Non commercial pos. SHORT2 (t-1)^2			**-0.089**			**-0.334**			0.109			-0.151			-0.006			**-0.085**
			(0.043)			(0.171)			(0.274)			(0.128)			(0.013)			(0.020)
Schwarz selection criterion	-3.312	-3.218	-3.214	-3.435	-3.354	-3.308	-2.940	-2.855	-2.868	-3.126	-3.054	-3.033	-4.759	-4.650	-4.683	-4.686	-4.633	-4.674
Durbin-Watson statistic	1.834	2.084	1.985	2.110	2.082	1.922	2.170	1.874	1.993	1.826	1.985	2.040	1.879	2.043	2.070	2.201	1.980	1.959

(1) Futures returns are *log*-differences of prices, investment positions are expressed as first differences of gross positions over the open interest; 5% significant estimates in bold scripts, 10% in italics; standard error in brackets. Model (1) is a GARCH (1,1) on futures returns; model (2) extends model (1) to include the changes in positions by type of investor both in the mean and the variance equation; model (3) differs from model (2) in the variance equation, where investment positions enter in quadratic form.

Table E1: ***continued***

	Soybeans			Soybean Oil			Sugar			Wheat-Cbot			Wheat-Kansas		
MEAN EQUATION	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Dep. variable: Futures returns															
constant	*0.004*	*0.004*	0.004	**0.005**	**0.004**	**0.005**	0.002	0.003	-0.001	0.002	0.002	0.001	0.001	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Futures returns (t-1)		-0.056	-0.031		0.004	-0.001		**-0.183**	**-0.204**		-0.038	-0.002		-0.038	-0.028
		(0.086)	(0.079)		(0.070)	(0.073)		(0.074)	(0.082)		(0.074)	(0.078)		(0.067)	(0.068)
CIT pos. LONG (t-1)		**0.500**	**0.613**		0.249	*0.185*		0.279	0.037		0.214	0.227		0.083	0.273
		(0.211)	(0.188)		(0.173)	(0.178)		(0.320)	(0.469)		(0.245)	(0.300)		(0.279)	(0.292)
Non commercial pos. LONG (t-1)		-0.193	**-0.324**		-0.142	-0.176		0.568	0.672		*0.832*	0.631		0.362	0.385
		(0.219)	(0.160)		(0.130)	(0.118)		(0.361)	(0.492)		(0.443)	(0.466)		(0.237)	(0.225)
Non commercial pos. SHORT (t-1)		-0.375	**-0.549**		-0.249	-0.227		-0.307	-0.155		0.057	-0.041		-0.05	0.111
		(0.208)	(0.139)		(0.184)	(0.166)		(0.388)	(0.370)		(0.353)	(0.332)		(0.260)	(0.269)
VARAINCE EQUATION															
constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	**0.001**	*0.002*	0.001	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
ε^2 (t-1)	**0.115**	**0.142**	*0.071*	**0.128**	*0.087*	**0.106**	**0.13**	**0.13**	0.036	0.087	0.087	0.113	0.144	0.005	0.047
	(0.044)	(0.069)	(0.039)	(0.045)	(0.042)	(0.045)	(0.049)	(0.052)	(0.056)	(0.089)	(0.083)	(0.096)	(0.096)	(0.021)	(0.033)
GARCH h(t-1)	**0.851**	**0.804**	**0.874**	**0.831**	**0.893**	**0.867**	**0.838**	**0.845**	**0.841**	*0.617*	**0.598**	0.276	**0.574**	**0.959**	**0.903**
	(0.053)	(0.084)	(0.054)	(0.054)	(0.050)	(0.052)	(0.053)	(0.057)	(0.075)	(0.384)	(0.287)	(0.368)	(0.278)	(0.040)	(0.057)
CIT pos. LONG. LONG (t-1)		0.012			-0.006			0.003			0.025			-0.01	
		(0.007)			(0.006)			(0.012)			(0.016)			(0.008)	
Non commercial pos. LONG (t-1)		0.000			-0.004			0.016			0.008			-0.002	
		(0.007)			(0.004)			(0.016)			(0.028)			(0.006)	
Non commercial pos. SHORT (t-1)		0.001			0.002			-0.005			-0.019			-0.009	
		(0.006)			(0.005)			(0.016)			(0.022)			(0.006)	
CIT pos. LONG (t-1)^2			0.227			0.138			0.961			1.501			*1.218*
			(0.322)			(0.166)			(0.785)			(0.969)			(0.646)
Non commercial pos. LONG (t-1)^2			-0.129			**-0.140**			0.725			-0.887			-0.194
			(0.082)			(0.062)			(1.523)			(1.987)			(0.226)
Non commercial pos. SHORT2 (t-1)^2			**-0.18**			*-0.056*			**-1.728**			**-1.318**			-0.224
			(0.060)			(0.053)			(0.066)			(1.184)			(0.140)
Schwarz selection criterion	-3.561	-3.468	-3.498	-3.674	-3.557	-3.578	-2.754	-2.646	-2.683	-2.870	-2.770	-2.770	-3.102	-2.996	-2.997
Durbin-Watson statistic	2.087	1.943	1.968	1.985	2.010	1.982	2.253	1.914	1.882	2.033	2.028	2.096	1.973	1.983	1.969

Table E2: Results of GARCH estimates - based on 2009 CFTC classification of financial investors on futures markets[(1)]

	Cocoa			Coffee			Corn			Cotton			Feeder Cattle			Live Cattle		
MEAN EQUATION	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Dep. variable: Futures returns																		
constant	0.002	0.003	0.002	0.003	0.004	0.003	0.006	**0.007**	0.005	0.004	0.000	0.001	0.001	0.001	0.001	0.002	**0.002**	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Futures returns (t-1)		0.065	0.093		-0.021	-0.018		*-0.164*	-0.115		0.021	0.084		0.12	*0.129*		-0.031	-0.05
		(0.088)	(0.087)		(0.077)	(0.077)		(0.094)	(0.081)		(0.095)	(0.084)		(0.075)	(0.073)		(0.071)	(0.062)
Swap Dealer pos. LONG (t-1)		1.037	0.99		-0.006	0.026		-0.323	-0.159		-0.001	0.045		-0.051	-0.073		0.195	**0.227**
		(0.465)	(0.456)		(0.226)	(0.228)		(0.453)	(0.358)		(0.336)	(0.314)		(0.106)	(0.125)		(0.157)	(0.116)
Swap Dealer pos. SHORT (t-1)		0.2	0.386		-0.12	-0.146		*-3.662*	-3.504		0.268	0.106		0.084	-0.171		**-2.146**	**-1.545**
		(0.390)	(0.546)		(0.782)	(0.849)		(2.049)	(2.348)		(0.814)	(0.918)		(0.234)	(0.230)		(0.952)	(0.702)
Money Manager pos. LONG (t-1)		-0.025	-0.12		0.106	0.054		*0.795*	0.477		-0.266	-0.235		**-0.179**	-0.179		**-0.431**	-0.51
		(0.159)	(0.158)		(0.221)	(0.232)		(0.489)	(0.441)		(0.277)	(0.397)		(0.061)	(0.063)		(0.139)	(0.117)
Money Manager pos. SHORT (t-1)		0.284	0.172		0.296	0.298		0.342	0.318		-0.36	-0.253		-0.029	-0.015		0.063	0.083
		(0.170)	(0.141)		(0.217)	(0.160)		(0.487)	(0.394)		(0.432)	(0.180)		(0.078)	(0.075)		(0.123)	(0.104)
VARAINCE EQUATION																		
constant	0.000	0.000	0.000	0.000	0.001	0.001	0.000	**0.001**	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ε^2 (t-1)	0.058	0.043	0.03	0.025	0.038	0.059	*0.058*	*0.165*	**0.038**	**0.088**	0.138	0.099	0.090	0.101	*0.088*	0.042	0.027	0.056
	(0.045)	(0.047)	(0.037)	(0.049)	(0.072)	(0.089)	(0.035)	(0.085)	(0.014)	(0.026)	(0.079)	(0.063)	(0.047)	(0.053)	(0.053)	(0.036)	(0.026)	(0.041)
GARCH h (t-1)	**0.882**	**0.883**	**0.929**	**0.809**	*0.387*	0.317	**0.840**	0.338	**0.887**	**0.913**	**0.748**	**0.766**	**0.842**	**0.847**	**0.832**	**0.908**	**0.885**	**0.839**
	(0.082)	(0.077)	(0.052)	(0.330)	(0.214)	(0.459)	(0.101)	(0.248)	(0.062)	(0.020)	(0.081)	(0.067)	(0.069)	(0.072)	(0.062)	(0.083)	(0.079)	(0.076)
Swap Dealer pos. LONG (t-1)		0.014			*-0.013*			0.018			**0.048**			0.001			**-0.005**	
		(0.015)			(0.007)			(0.032)			(0.009)			(0.002)			(0.002)	
Swap Dealer pos. SHORT (t-1)		-0.019			0.033			**-0.229**			0.016			0.004			**-0.024**	
		(0.015)			(0.028)			(0.008)			(0.035)			(0.005)			(0.010)	
Money Manager pos. LONG (t-1)		0.000			0.006			-0.011			-0.016			0.000			-0.002	
		(0.004)			(0.010)			(0.021)			(0.014)			(0.001)			(0.002)	
Money Manager pos. SHORT (t-1)		-0.005			-0.018			0.014			-0.011			0.000			0.000	
		(0.006)			(0.009)			(0.027)			(0.017)			(0.001)			(0.002)	
Swap Dealer pos. LONG2 (t-1)^2			-0.758			**-0.426**			-0.011			0.281			*0.261*			**-0.147**
			(1.274)			(0.135)			(0.609)			(0.276)			(0.137)			(0.055)
Swap Dealer pos.SHORT2 (t-1)^2			0.51			-0.923			16.031			*7.401*			0.113			-1.595
			(0.510)			(0.695)			(13.925)			(4.411)			(0.255)			(1.599)
Money Managers pos. LONG (t-1)^2			-0.005			0.265			**-1.041**			1.115			0.046			0.004
			(0.045)			(0.457)			(0.353)			(0.457)			(0.037)			(0.097)
Money Managers pos. SHORT2 (t-1)^2			**-0.085**			*-0.274*			-0.055			*-0.173*			-0.012			*-0.058*
			(0.034)			(0.153)			(0.265)			(0.098)			(0.013)			(0.030)
Schwarz selection criterion	-3.312	-3.178	-3.189	-3.435	-3.308	-3.334	-2.940	-2.814	-2.841	-3.126	-2.924	-2.943	-4.759	-4.621	-4.653	-4.686	-4.627	-4.580
Durbin-Watson statistic	1.834	1.981	1.987	2.110	1.997	1.977	2.170	1.898	1.960	1.826	1.887	1.998	1.879	2.019	2.032	2.201	1.979	1.914

(1) Futures returns are *log*-differences of prices, investment positions are expressed as first differences of gross positions over the open interest; 5% significant estimates in bold scripts, 10% in italics; standard error in brackets. Model (1) is a GARCH (1,1) on futures returns; model (2) extends model (1) to include the changes in positions by type of investor both in the mean and the variance equation; model (3) differs from model (2) in the variance equation, where investment positions enter in quadratic form.

Table E2: *continued*

	Soybeans			Soybean Oil			Sugar			Wheat-Cbot			Wheat-Kansas		
MEAN EQUATION	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Dep. variable: Futures returns															
constant	*0.004*	0.004	0.004	**0.005**	**0.005**	**0.005**	0.002	0.001	0.000	0.002	0.002	0.001	0.001	0.000	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Futures returns (t-1)		-0.083	-0.075		0.01	0.011		**-0.170**	**-0.160**		-0.028	0.005		-0.009	0.011
		(0.080)	(0.078)		(0.071)	(0.080)		(0.069)	(0.075)		(0.073)	(0.081)		(0.069)	(0.071)
Swap Dealer pos. LONG (t-1)		**0.609**	**0.688**		0.27	*0.252*		0.417	0.635		0.114	0.122		0.473	0.559
		(0.228)	(0.225)		(0.174)	(0.143)		(0.307)	(0.501)		(0.293)	(0.319)		(0.328)	(0.342)
Swap Dealer pos. SHORT (t-1)		-0.392	-0.705		-0.04	-0.232		-0.039	-0.546		0.263	0.543		1.195	0.694
		(1.400)	(1.317)		(0.613)	(0.612)		(0.624)	(0.690)		(0.992)	(0.932)		(1.092)	(1.170)
Money Manager pos. LONG (t-1)		-0.172	**-0.243**		-0.149	-0.136		0.435	0.480		0.738	0.580		0.140	0.192
		(0.225)	(0.167)		(0.154)	(0.124)		(0.319)	(0.444)		(0.457)	(0.454)		(0.249)	(0.268)
Money Manager pos. SHORT (t-1)		-0.412	**-0.481**		-0.120	-0.070		-0.388	-0.394		0.114	0.013		-0.056	0.144
		(0.242)	(0.176)		(0.206)	(0.123)		(0.368)	(0.368)		(0.354)	(0.359)		(0.268)	(0.260)
VARAINCE EQUATION															
constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	**0.001**	0.002	0.001	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
ε^2 (t-1)	**0.115**	**0.087**	*0.078*	**0.128**	*0.073*	**0.186**	**0.130**	**0.155**	0.015	0.087	0.101	0.128	0.144	-0.007	0.045
	(0.044)	(0.044)	(0.041)	(0.045)	(0.039)	(0.035)	(0.049)	(0.066)	(0.047)	(0.089)	(0.071)	(0.108)	(0.096)	(0.020)	(0.029)
GARCH h (t-1)	**0.851**	**0.886**	**0.865**	**0.831**	**0.906**	**0.662**	**0.838**	**0.784**	**0.854**	*0.617*	**0.639**	0.275	**0.574**	**0.973**	**0.922**
	(0.053)	(0.055)	(0.064)	(0.054)	(0.044)	(0.086)	(0.053)	(0.080)	(0.058)	(0.384)	(0.169)	(0.419)	(0.278)	(0.032)	(0.037)
Swap Dealer pos. LONG (t-1)		0.004			-0.005			-0.019			0.024			**-0.015**	
		(0.009)			(0.006)			(0.006)			(0.016)			(0.007)	
Swap Dealer pos. SHORT (t-1)		0.036			0.023			0.044			**-0.129**			-0.002	
		(0.038)			(0.023)			(0.031)			(0.061)			(0.034)	
Money Manager pos. LONG (t-1)		0.000			0.000			0.015			-0.007			-0.005	
		(0.007)			(0.006)			(0.018)			(0.027)			(0.009)	
Money Manager pos. SHORT (t-1)		-0.002			0.005			*0.030*			-0.018			-0.006	
		(0.006)			(0.006)			(0.016)			(0.021)			(0.006)	
Swap Dealer pos. LONG2 (t-1)^2			0.349			-0.326			**1.318**			1.068			**1.447**
			(0.440)			(0.318)			(0.391)			(0.712)			(0.740)
Swap Dealer pos.SHORT2 (t-1)^2			3.236			1.756			0.400			-2.901			0.671
			(8.053)			(2.987)			(1.535)			(9.583)			(2.217)
Money Managers pos. LONG (t-1)^2			-0.122			*-0.206*			0.587			**-2.112**			-0.203
			(0.111)			(0.117)			(1.408)			(0.409)			(0.321)
Money Managers pos. SHORT2 (t-1)^2			**-0.140**			**-0.244**			**-2.310**			-0.667			-0.073
			(0.067)			(0.078)			(0.140)			(1.209)			(0.104)
Schwarz selection criterion	-3.561	-3.425	-3.454	-3.674	-3.513	-3.532	-2.754	-2.635	-2.647	-2.870	-2.746	-2.732	-3.102	-2.960	-2.952
Durbin-Watson statistic	2.087	1.942	1.946	1.985	2.005	1.999	2.253	1.912	1.895	2.033	2.028	2.094	1.973	1.994	1.989

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