Did Long-Short Investors Destabilize Commodity Markets?

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Abstract

This paper contributes to the debate on the effects of the financialization of commodity futures markets by studying the conditional volatility of long-short commodity portfolios and their conditional correlation with traditional assets (stocks and bonds). Using several groups of trading strategies that hedge fund managers are known to implement, we show that long-short speculators do not cause changes in the volatilities of the portfolios they hold or changes in the conditional correlations between these portfolios and traditional assets. Thus calls for increased regulation of commodity money managers might at this stage be premature.

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1. Introduction

The surge in commodity investing and its potential impact on prices (or the so-called "financialization" of commodity markets) has been the subject of an intense debate, both in the political and regulatory arenas and in academic circles. Were investors seeking the equity-like returns, inflation hedging and diversification benefits of commodity futures (Gorton and Rouwenhorst, 2006; Erb and Harvey, 2006) disruptive forces, driving commodity prices away from their fundamentals? The 2009 Staff Report by the U.S. Senate Permanent Subcommittee on Investigation argues in favor of this proposition, suggesting that a rise in the long positions of commodity index traders caused a commodity price bubble.[1] In April 2012, Finance Watch further argues that excessive speculation and its positive impact on prices lead to food riots and social unrest, preventing the risk transfer that naturally takes place in commodity futures markets between hedgers and speculators.[2] In an attempt to curb speculation and volatility in the future, Finance Watch calls for greater transparency in hedgers' and speculators' positions, the definition of stringent position limits for speculators and a ban on commodity index instruments.

This paper adds to the debate on the financialization of commodity futures markets by using a novel approach to testing whether long-short commodity investors had an impact on the volatility of the portfolios they held and on the correlation between their long-short commodity portfolios and traditional assets (S&P500 composite index and Barclays Capital US Aggregate bond index). To mimic the trading behavior of long-short commodity market participants, we use a battery of strategies that they are known to follow (such as momentum and term structure investing) and then test the proposition that their trading Granger-caused a change in volatility or a change in cross-market correlation. A finding that long-short commodity traders increased volatility and cross-market correlation could legitimate claims for increased regulation.

Our results, however, indicate that speculators had no impact on volatility or cross-market correlation. This conclusion holds irrespective of whether speculators are labeled as "non-commercial" in the CFTC (Commodity Futures Trading Commission) Commitment of Traders report or "professional money managers" (i.e., commodity trading advisors (CTAs), commodity

[1] The report entitled "Excessive Speculation in the Wheat Market" is available at http://www.hsgac.senate.gov/subcommittees/investigations/reports

[2] Finance Watch, 2012, Investing not betting, Making financial markets serves society, A position paper on MiFID 2/MiFIR, April.

pool operators (CPOs) and hedge funds) in the CFTC disaggregated Commitment of Traders report. It follows that calls for increased regulation of commodity money managers might be at this stage premature: they are unlikely to prevent the volatility of commodity futures prices from rising again in the future.

The remainder of this paper is structured as follows. Section 2 sets up the debate on the financialization of commodity futures markets from an academic perspective. Section 3 presents the dataset we use. Section 4 introduces the methodologies employed to capture the returns earned by long-short speculators in commodity futures markets, the conditional volatility of their portfolios and the conditional correlation between their returns and traditional assets. Section 4 also highlights the methodology used to test whether changes in speculators' positions Granger cause changes in conditional volatility or changes in conditional correlation. Section 5 discusses our results. Finally section 6 concludes.

2. Where does the debate stand in academic circles?

The academic debate as to whether the financialization of commodity markets is responsible for the observed volatility of commodity prices has been intense and is still on-going. On one hand, some argue that supply and demand imbalances were the drivers of commodity price changes and thus price changes have been fundamentally driven.[3] Tests for excessive speculation support the idea that speculation rose as a response to a rise in hedging demand (Till, 2009; Sanders, Irwin, and Merrin, 2010). Irwin, Sanders and Merrin (2009) and Stoll and Whaley (2010) use a battery of tests to conclude that commodity index traders had no impact on commodity price movements. Finally, Brunetti, Büyükşahin and Harris (2011) test whether change in the net positions of hedge funds in three commodities (corn, crude oil and natural gas) Granger cause volatility and conclude that hedge funds, far from destabilizing markets, actually decreased volatility. All these articles tend to refute the idea that commodity futures traders were a disruptive force. Rather they acted as liquidity and insurance providers.

[3] For example, Hamilton (2009) blames the stagnation in global supply, and the rapid growth in global demand, for the oil price shock of 2007-08. Korniotis (2009) relates the sharp rise in spot metal prices in 2003-04 to economic fundamentals such as rising demand and consumption or falling production and inventories.

On the other hand, there are several noteworthy studies suggesting that commodity investors do have an impact of commodity prices. The first, by Tang and Xiong (2012), blames commodity index traders for the observed increase in the correlations across indexed commodity futures. In comparison, other factors (such as a weakening of the US dollar, an increase in the demand for indexed commodities from emerging countries, the financial crisis that followed Lehman Brothers' demise, a sudden rise in inflation or the widespread use of biofuel) are shown to be less instrumental. Relatedly, Büyükşahin and Robe (2010) hold hedge funds (and especially those that are active in both equity and commodity futures markets) responsible for the rise in conditional correlations between commodity and stock indices observed since 2008. Third, Cheng, Kirilenko and Xiong (2012) argue that in times of distress commodity index traders and hedge funds, by reducing their net long exposure, fail to provide the insurance short hedgers demand. Finally, in arguably the closest study to the present one, Sanders and Irwin (2011) consider the impact of commodity trader position in three futures price contracts on the prices of these commodities. They too employ a Granger causality approach and find that there is no causality from trader positions to prices. However, our analysis differs from theirs in several important respects. First, they examine only corn, soybean and wheat, while we consider a much broader range of commodities. Second, their chosen sample hones in on the period before and during the recent price rises (2004-2009), whereas we consider a considerably longer period comprising almost two decades. Third, they examine causality between index trader positions and returns, whereas we consider the impact of speculation on both price volatilities and the correlation with the returns to other asset classes.

Altogether the empirical evidence on the potentially destabilizing role of commodity investors is therefore mixed. From a theoretical perspective, it is not obvious either whether speculators move prices away from equilibrium. The traditional view, as put forward by Friedman (1953), is that speculators (or rational news traders) stabilize prices: by buying low and selling high, they bring prices closer to fundamentals. Yet, De Long, Shleifer, Summers and Waldmann (1990) bring forward a theoretical model showing that rational news traders, by anticipating the price impact of trend followers (or positive feedback traders), actually end up destabilizing markets. In their model, rational speculators, in anticipation of the forthcoming buy/sell orders of trend followers, increase their long/short positions today in the hope of earning higher returns tomorrow. As a result, far from stabilizing prices, they end up setting price trends and deterring short-term prices away from fundamentals. It is thus not obvious from a theoretical standpoint whether long-short speculators stabilize markets. To test this in the context of commodity speculators, we first model the returns they earned using a battery of long-short strategies that they are supposed to follow and then explicitly test whether their trading had any impact on volatility and cross-market correlation.

3. Data

We obtain data on a sample of 27 commodity futures price series for the period 2 October 1992 to 25 March 2011 from Thomson Datastream. These comprise random length lumber, five metals, five energy, four livestock, and 12 agricultural commodity futures. Our choice of series, as well as their frequency and sample period, is dictated by the existence of information in the CFTC Commitment of Traders report on the positions of speculators and hedgers.

In order to construct a continuous futures pricing series, we assume that in order not to have to physically deliver the commodity, the nearby contract is held until one month prior to maturity and then investors switch into the second nearest. Some summary statistics for the commodity futures returns are given in Table 1. It is evident that, confirming Erb and Harvey's (2006) earlier observation, commodities did not perform well over the sample period when considered as individual investments, with both low average returns and high standard deviations. From 1992-2011, the average excess return across all commodity futures in our sample was almost exactly zero, but with a huge range around this figure. Ten commodities had negative average excess returns, while it was positive for the remaining seventeen. Electricity was by far the worst performer with average annualized excess returns of -25.7%, while the best were copper, crude oil, palladium, platinum, silver, and soybean meal, all of which generated excess returns of 9-11% per annum.

Panel B of the table shows that naturally the commodity indices did not do better than the typical behavior of the individual components with average returns close to zero for an equally weighted long only portfolio and around 4% for the S&P-GSCI. The paper analyzes the evolution in the conditional correlations between long-short commodity portfolios and traditional assets. To represent the later, we choose the S&P-500 Composite Index and Barclays Capital US Aggregate

Bond Index. In terms of their risk-adjusted performances, the Sharpe ratio of the S&P-GCSI (0.2), despite being considerably better than that of the equally weighted portfolio (0.05), is below that of the S&P500 stock index (0.24) and well below that of an aggregate bond index (0.66). The Sharpe ratio of the S&P500 index also exceeds that of 22 (out of 27) individual commodities.

<< Insert Table 1 around here >>

To determine the liquidity of the commodity markets that we consider in this study, the two rightmost columns of Table 1 display the average open interest for each series. For most commodities in the sample the markets appear to have sufficient depth, although this is not the case for electricity, pork bellies, random length lumber and rough rice. Since a lack of liquidity may have an impact upon the abilities of speculators to implement the arbitrage strategies that we consider below, in order to mitigate its effects, we specifically exclude the 25% of series with the lowest average open interest over the R weeks immediately prior to portfolio formation.[4]

The CFTC classifies traders based on the sizes of their positions into those who are "reportable" and those who are "non-reportable." Reportable traders constitute 70% to 90% of the open interest in any given futures markets and are further recorded as "commercial" or "non-commercial." Commercial traders use commodity derivatives to hedge price risk. Non-commercial traders have no position in the underlying asset; they either take a long-only approach or speculate on an upcoming rise or fall in commodity futures prices. Aside from declaring whether they are commercial (hedgers) or non-commercial (speculators), traders also have to report whether they are long or short. The evolution in the long and short positions of speculators (i.e., non-commercial traders) is pictured in Figure 1, where the plot is for the open interest of both long and short speculators averaged across our 27 commodities (on the left-hand side) and for the futures prices of the S&P-GSCI (on the right-hand side). Two points are worth noting. First, the huge changes in the open interest of long speculators seem to parallel the dramatic ups and downs of the S&P-GSCI over the 1992-2011 period. This gives credibility to the claim that the activities of speculators could have increased the volatility of the S&P-GSCI. Second, both the long and short positions of speculators have risen sharply over the period 1992-

[4] The problem is magnified in our case since we adopt equally weighted portfolios in order to ensure that the strategies are well diversified and are not effectively focused on just one or two commodities.

2011, confirming that indeed there was an increase in the financialization of commodity futures markets.

<< Insert Figure 1 around here >>

We construct separate measures of hedging pressure for speculators and for hedgers, both based on the declarations of market participants summarized in the Commitment of Traders report. These measures are constructed by taking for the previous week the number of long positions as a proportion of the total number of long and short positions by non-commercial traders. So, for instance, a hedging pressure value of 0.3 *for hedgers* would imply that only 30% of hedgers were long over the immediately prior week and the remaining 70% were short, suggesting that the market was backwardated.[5] On the other hand, a value of 0.3 *for speculators* would imply that 30% of speculators were long with the remaining 70% being short, indicative of a contangoed market.[6]

The hedging pressure measures thus defined are used in two ways. First, as in Basu and Miffre (2013), we use them as signals for sorting commodity futures into portfolios, where the returns of portfolios that buy backwardated commodities and sell contangoed commodities are deemed to replicate the returns that speculators earned over the period 1992-2011 for taking on price risk. Second, we use the hedging pressure measures to test whether commodity markets have become more volatile - and asset markets more integrated - under the actions of speculators. The idea here is to test whether changes in speculators' hedging pressure Granger-cause changes in the volatility of the portfolios they hold or changes in the conditional return correlation between their portfolios and traditional assets.

[5] Backwardation occurs when commodity producers are more prone to hedge than commodity consumers and processors. The then net short positions of hedgers lead to the intervention of net long speculators and thus to the rising price pattern typically associated with backwardation. In our setting, backwardation translates into low hedging pressure for hedgers and high hedging pressure for speculators.

[6] Contango arises when consumers and processors of a commodity outnumber producers. The then net long positions of hedgers lead to the intervention of net short speculators and to the falling price pattern typically linked to contango. In our setting, contango translates into high hedging pressure for hedgers and low hedging pressure for speculators.

4. Methodology

To mimic the trading behavior of long-short market participants, we implement a battery of long-short strategies that hedge fund managers are known to follow (Bhardwaj, Gorton, and Rouwenhorst, 2008), where these strategies are based on momentum and term structure signals. We also replicate their trading behavior by looking at the positions they took (Basu and Miffre, 2013). In total we have eight strategies that are based on performance, roll-returns, the positions of hedgers or/and the positions of speculators. These rule-based strategies aim at systematically taking long positions in the commodities whose prices are expected to appreciate and short positions in the commodities whose prices are expected to depreciate. We remind the reader that each of the strategies described below are implemented on all commodities but omitting the 25% that have the lowest average open interest at the portfolio formation point. We adopt this filter to ensure liquidity in the instruments such that all of the strategies could have been implemented in a timely fashion and with acceptable transactions costs.

Sections 4.1 and 4.2 briefly summarize the methodologies used to implement these strategies. Section4.3. then presents the techniques employed to model the conditional volatility of commodity portfolios and their conditional return correlations with traditional assets. Finally, Section 4.4 introduces the methodology employed to test whether changes in speculators' positions Granger-cause changes in volatility or changes in correlation.

4.1. Momentum and Term Structure Strategies

Further to the approaches documented in Erb and Harvey (2006) and Miffre and Rallis (2007), we construct momentum portfolios by taking long positions in the quintile of commodity futures having the highest average returns during the ranking period of R weeks ("the winners") and short positions in the quintile of futures having the lowest returns over the same horizon ("the losers"). These positions are then retained for a holding period of H weeks and are then rebalanced and a new set of portfolios are formed following the same procedure.

We construct term structure portfolios by taking long positions in the quintile of commodity futures having the best mean roll returns during the R-week ranking period and short positions in the quintile of futures having the smallest mean roll returns over this horizon (see Erb and Harvey, 2006; Gorton and Rouwenhorst, 2006). We calculate the roll return as the nearby contract's log price less that of the second nearest. These positions are again retained for a holding period of H weeks and are then rebalanced and a new set of portfolios are formed following the same procedure

We also adopt a combined strategy that results from a two-way sort on the momentum and term structure measures, following Fuertes, Miffre and Rallis (2010). For this purpose, our full sample is initially separated using R-week average returns into *Winner* and *Loser* portfolios containing equal numbers of commodities. This first part is thus the momentum part of the strategy, and we second form the term structure part. To achieve, this we purchase the 40% of the *Winner* portfolio's constituents that have the greatest mean R-week roll returns and we short sell the 40% of the *Loser* portfolio's constituents that have the lowest R-week roll returns. These long and short positions are retained for the following H weeks. Since the implicit choice above to first sort on past return performance and then on roll returns was entirely arbitrary, we then repeat the two way sort procedure but now swapping the order of forming the portfolios.

4.2. Hedging Pressure Strategies

The next group of strategies we consider are based on hedging pressure and aim to replicate the reward that speculators may have hoped to gain by assuming the price risk that hedgers wanted to offload – see Basu and Miffre (2013). We construct a portfolio that takes long positions in the quintile of most backwardated commodity futures for which hedgers had the lowest mean hedging pressure (i.e. where they were most net short) over an R-week portfolio formation period. We also construct a portfolio that takes short positions in the quintile of most contangoed commodity futures for which hedgers had the greatest mean hedging pressure (i.e. where they were most net long) over the same formation period. We then hold these long and short positions for the following H weeks before the portfolios are rebalanced and a new set of portfolios is formed.

We also adopt long-short strategies based on speculator hedging pressure. We implement a long portfolio using the quintile of commodity futures for which speculators had the highest mean hedging pressure (i.e. they were most net long) over the R-week portfolio formation period. Similarly, we implement a short portfolio using the quintile of commodity futures for which speculators had the lowest mean hedging pressure (i.e. they were most net short) over the same portfolio formation horizon. We then hold these long and short positions for the following H weeks before the portfolios are rebalanced and a new set of portfolios is formed.

Following Basu and Miffre (2013), we further implement a combined strategy that results from a two-way sort on the positions of hedgers and speculators. The collection of all commodities is split into two equal samples based on the mean hedging pressure of hedgers over the previous R weeks. We thus form a backwardated portfolio (which we term 'Low_{Hedg}') and a contangoed portfolio ('$High_{Hedg}$'). Next, the positions of hedgers are combined with those of speculators by buying the 40% of Low_{Hedg} for which speculators had the highest hedging pressure and selling the 40% of $High_{Hedg}$ for which speculators had the lowest hedging pressure over the R-week horizon. As previously, we then hold these long and short positions for the following H weeks before the portfolios are rebalanced and a new set of portfolios is formed. Finally, since the implicit choice to first sort on the hedging pressure of hedgers and then on the hedging pressure of speculators was entirely arbitrary, we then repeat the two way sort procedure but now swapping the order of forming the portfolios.

The approaches that we design to capture the trading behavior of hedgers and speculators are identical in all respects except for the sorting method used to form the portfolios. The portfolio formation and holding periods, R and H respectively, are set throughout to 4, 13, 26 or 52 weeks. All possible combinations (4×4) of these four ranking and holding periods leads to a total of 16 long-short portfolios for each of the strategies we described above. For simplicity of presentation, we report the results from a portfolio that equally weights these 16 combinations of horizons throughout the rest of this paper. Also, taking our lead from existing research (see, for example, Erb and Harvey (2006) or Miffre and Rallis (2007)), to avoid the strategies being excessively concentrated in a small number of commodities and to ensure reasonable diversification, we also equally weight the constituents of the long and short portfolios. Finally, the long-short portfolios are conservatively assumed to have a leverage of two – i.e. they are 50% collateralized.[7]

[7] Hedge funds typically opt for considerably higher leverage multiples.

4.3. Modeling Conditional Volatility and Conditional Correlation

To model volatility, we use the generalized autoregressive conditional heteroskedasticity GARCH(1,1) model of Bollerslev (1986). The GARCH(1,1) variance, $h_{C,t}$, describes the volatility dynamics of a (long, short or long-short) commodity portfolio C as follows

$$
\begin{aligned}
R_{C,t} &= \mu + \varepsilon_{C,t} \\
h_{C,t} &= \gamma + \alpha\varepsilon^2_{C,t-1} + \beta h_{C,t-1}
\end{aligned} \tag{1}
$$

$R_{C,t}$ is the time t return of the (long, short or long-short) commodity portfolio modeled in Sections 4.1. and 4.2., $\varepsilon_{C,t}$ are residuals distributed as $N(0, h_{C,t})$, μ is the mean return of $R_{C,t}$, α, β and γ are such that $\gamma > 0$, $\alpha \geq 0$, $\beta \geq 0$ and $\alpha + \beta < 1$.

When it comes to modeling the return co-movements between commodities C and traditional assets T, we use the dynamic conditional correlation (DCC) model of Engle (2002)[8]. DCC time-varying correlations are estimated in two steps. The first step estimates time-varying variances as GARCH(1,1) processes and the second step models a time-varying correlation matrix using the standardized residuals from the first-stage estimation. More specifically, the covariance matrix is expressed as $H_t \equiv D_t R_t D_t$, where $D_t = diag\left(\sqrt{h_{C,t}}, \sqrt{h_{T,t}}\right)$ is a diagonal matrix of univariate GARCH(1,1) volatilities and $R_t = Q_t^{*-1} Q_t Q_t^{*-1}$ is the time varying correlation matrix, with:

- $Q_t = \left(q_{C,T,t}\right)$ as described by $Q_t = (1 - a - b)\overline{Q} + a\left(\varepsilon_{C,t-1}\varepsilon_{T,t-1}\right) + bQ_{t-1}$, where $\varepsilon_{C,t} = R_{C,t} / \sqrt{h_{C,t}}$ and $\varepsilon_{T,t} = R_{T,t} / \sqrt{h_{T,t}}$ are standardized residuals modeled from the first stage. $\overline{Q}$ is the $N \times N$ unconditional covariance matrix of standardized residuals, and a and b are non-negative coefficients satisfying $a + b < 1$.
- $Q_t^* = \left(q^*_{ii,t}\right) = \left(\sqrt{q_{ii,t}}\right)$ is a diagonal matrix composed of the square root of the i^{th} diagonal elements of Q_t, where i stands for C or T.

[8] See also Büyükşahin and Robe (2010), Büyükşahin, Haigh and Robe (2010), Chong and Miffre (2010) for an analysis of conditional correlations between traditional assets and long-only commodity futures.

Rewriting $R_t = Q_t^{*-1} Q_t Q_t^{*-1}$, the time t conditional return correlation between a commodity and traditional asset can then be expressed as

$$\rho_{C,T,t} = \frac{q_{C,T,t}}{\sqrt{q_{C,t}}\sqrt{q_{T,t}}} \tag{2}$$

4.4. Testing for Granger Causality

Our analysis focuses on the hedging pressure (*HP*) of speculators, which measures the propensity of speculators to be net long or net short. Essentially, a high *HP* (e.g., 0.8) translates into large speculators being net long (e.g., 80% are long and 20% are short), while a low *HP* (e.g., 0.2) translates into large speculators being net short (e.g., 20% are long and 80% are short). We measure for the commodities included in a given (long, short or long-short) commodity portfolio *C* the average hedging pressure of speculators in each week of the holding period. We denote this quantity $\overline{HP}_{C,t}$ and use $\Delta\overline{HP}_{C,t}$ as a measure of the propensity of speculators to change their commodity exposure. In the case of a long portfolio, a positive use $\Delta\overline{HP}_{C,t}$ means that long speculators increased their long exposure. In the case of a short portfolio, a negative use $\Delta\overline{HP}_{C,t}$ means that short speculators decreased their long exposures and thus increased their short exposures.

To test whether the increased financialization of commodity markets lead to change in volatility, we run tests of the null hypothesis that changes in speculators' hedging pressure did not Granger (1969) cause changes in the volatility of the long, short and long-short commodity portfolio returns. Namely, regression (3) is estimated

$$\Delta\sqrt{h_{C,t}} = \delta_0 + \delta_1 \Delta\overline{HP}_{C,t-1} + \delta_2 \Delta\sqrt{h_{C,t-1}} + v_{C,t} \tag{3}$$

$\Delta\sqrt{h_{C,t}}$ measures the change in the annualized conditional volatility of the long (respectively short, respectively long-short) commodity portfolio, $\Delta\overline{HP}_{C,t-1}$ represents the first lag in the change of the average hedging pressure of speculators for the assets included in long (respectively short, respectively long-short) commodity portfolio C over the holding period, $v_{C,t}$ are residuals, δ_0, δ_1 and δ_2 are parameters to estimate. The null hypothesis that $\delta_1 = 0$ is then tested using a Granger causality test, where a rejection of the null indicates that speculators through their long (respectively short, respectively long-short) positions had an impact on volatility. If δ_1 is positive and significant for a given long portfolio, then increases in the long positions of speculators (namely, $\Delta\overline{HP}_{C,t-1} > 0$) destabilize commodity markets by increasing the volatility of that long portfolio returns. Similarly, if δ_1 is negative and significant for a given short portfolio, then increases in the short positions of speculators (namely, $\Delta\overline{HP}_{C,t-1} < 0$) destabilize commodity markets by increasing the volatility of the returns of that short portfolio.

Granger causality tests are also used to investigate whether the financialization of commodity markets had a bearing on conditional correlation. The following regression is estimated for the conditional return correlations between the long, short and long-short commodity portfolios C and the traditional asset class T

$$\Delta\rho_{C,T,t} = \delta_0 + \delta_1\Delta\overline{HP}_{C,t-1} + \delta_2\Delta\rho_{C,T,t-1} + \nu_{C,P,t} \qquad (4)$$

The null hypothesis is that changes in the speculators' hedging pressure for the constituents of the long (respectively short, respectively long-short) portfolios in (4) did not Granger cause a change in the conditional correlation between the returns of the long (respectively short, respectively long-short) commodity portfolio and the returns of the traditional asset. As in equation (3), a positive and significant δ_1 in (4) indicates increased integration driven by speculators increasing their long positions. A negative and significant δ_1 in (4) indicates increased integration driven by speculators increasing their short positions. Since data are at a weekly frequency, we also test the joint significance of the lags up to order 4 in equations (3) and (4).

Finally, we test the robustness of the results to three different specifications of equations (3) and (4). Following Irwin and Sanders (2011), Brunetti, Büyükşahin and Harris (2011) and Büyükşahin and Robe (2010), the first robustness test uses conditional volatility and conditional correlation as dependent and independent variables in (3) and (4) instead of their changes. As conditional volatilities and correlations do not depend solely on past values and traders' positions, the second robustness test augments equations (3) and (4) with the first lag in two business cycle variables[9] (in a way similar to Büyükşahin and Robe, 2010). Finally, the third robustness test uses the disaggregated (instead of aggregated) Commitment of Traders report to

[9] The business cycle variables considered are default spread (difference in yields between BAA and AAA-rated bonds) and term spread (difference between 10-year constant maturity T-bond yields and 3-month T-bill rate), where the data are downloaded from the Federal Reserve of St Louis.

test the null hypothesis that professional money managers (i.e., CTAs, CPOs and hedge funds) had no destabilizing effect on conditional volatility and correlation.

5. Empirical Results

5.1. Performance of Long-Short Commodity Portfolios

Table 2 presents a summary of the performances of all of the various trading strategies that we outlined above – including their mean excess returns, a *t*-test for the significance of those returns, their standard deviations, and Sharpe ratios. Results for the momentum and term structure strategies are given in Panel A, those based on hedging pressure are given in Panel B, and finally for comparison Table C results comparable results are given for the equally weighted and S&P-GCSI long-only portfolios. As stated above, in order to keep the number of results manageable, only the results for a portfolio that equally weights all possible combinations of the four formation and holding periods is presented.

In summary, Table 2 shows that active long-short strategies are able to significantly outperform a passive, long-only approach. The mean risk-adjusted performance of the active strategies as measured by the Sharpe ratio is 0.46 for the momentum and term structure group and 0.55 for the hedging pressure group, yet it is a mere 0.05 for the equally weighted passive portfolio and 0.20 for the S&P commodity index. These findings serve to further confirm the previously reported need to take on board the degree of backwardation and contango when designing commodity futures trading strategies.

<< Insert Table 2 around here >>

Table 2 also presents slope coefficients of regressions of speculators' hedging pressure on a time trend for each of the commodity strategies presented in Section 3, where hedging pressure is measured as $\overline{HP}_{C,t}$, namely, as the cross-sectional average of the hedging pressure of speculators for the constituents of the long-short portfolios over the holding period for the strategy. The idea is to investigate how the average hedging pressure of speculators for the commodity futures included in the long-short portfolios changes over time. An increased level of financialization of commodity markets would translate into an increase in the hedging pressure of speculators for the long-short portfolios over time. This would be consistent with the idea that speculators took more long-short positions at the end of the sample than they did at the beginning, a sign of increased financialization.

The slope coefficients on the time trend reported in Table 2 are for the most part in line with this viewpoint. They are positive and significant at the 1% level for seven of eight long-short portfolios, confirming the evidence from the perspective of the long-short portfolios of an increased financialization of commodity markets. The question remains: Did this observed increase in the financialization of commodity futures markets by long-short investors lead to an increase in the volatility of commodity markets and to an increase in their conditional correlations with traditional assets? We now turn our attention to these questions.

5.2. Granger Causality Tests using the Aggregated Commitment of Traders Report

Results from tests as to whether speculators increase volatility and cross-market linkages are reported in Table 3 for the long, short and long-short portfolios. We present estimates, associated *t*-statistics (in parentheses) for δ_1 in (3) and (4) and *p*-values for the null hypothesis that changes in speculators' hedging pressure do not Granger cause changes in either conditional volatility (Panel A) or conditional correlation (Panels B and C). As the data frequency is weekly, we report *p*-values from Granger causality tests with four lags as well as one (under $p(4)$ and $p(1)$ respectively).

<< Insert Table 3 around here >>

Regardless of the panel or portfolio, δ_1 is never significant at the 5% level. This indicates that speculators neither increased, nor decreased conditional volatility and conditional correlation. The *p*-values indicate a failure to reject the null hypothesis of no-causality for all the long portfolios, all but one of the short portfolios, and all the long-short portfolios. This shows that the increased participation of speculators did not increase either the volatility of the portfolios they held or the level of integration of these portfolios with traditional assets. These results go against the idea that speculators destabilized commodity markets or increased asset correlations by treating commodities as part of their strategic and tactical asset allocations.

Two robustness checks are implemented. Following Brunetti, Büyükşahin and Harris (2011) and Büyükşahin and Robe (2010), we test whether our results on the financialization of commodity markets are any different first, if we use the level (instead of the change) in conditional volatility and in conditional correlation in (3) and (4); and second, if we include as explanatory variables the first lag in two business cycle variables (the default spread and term spread). The p-values from Granger causality tests, reported on the right-hand side of Table 3 (under the headings *Test* 1 and *Test* 2), are all less than 5% and thus the results are consistent with those previously reported.

5.3. Granger Causality Tests using the Disaggregated Commitment of Traders Report

The analysis conducted thus far focuses on the positions of commercial market participants (hedgers) and non-commercial market participants (speculators) as reported in the Commitment of Traders report. According to the CFTC website, the "commercial" category includes 1. Producers, processors, merchants and users of the underlying commodity (who use commodity derivatives to hedge price risk); and 2. Swap dealers (who hedge their short OTC positions by taking long futures positions). The "non-commercial" category includes 1. Professional money managers (CTAs, CPOs and hedge funds); and 2. A wide array of other non-commercial traders not classified as professional money managers (e.g., pension funds with long-only positions). Strictly, swap dealers are not pure hedgers in the sense of Keynes (1930) since they do not have a position in the underlying commodity. Similarly, pension funds and long-only indexers are not pure Keynesian speculators since they merely seek passive exposure to commodity markets as part of their strategic asset allocation.

Bearing these distinctions in mind, the disaggregated Commitment of Traders report (also available from the CFTC website) splits the positions of market participants explicitly into four categories: 1. Pure hedgers (producers, processors, merchants and users of the physical commodity); 2. Swap dealers; 3. Pure speculators (professional money managers such as CTAs, CPOs and hedge funds); and 4. Other non-commercial traders. It is hoped that by omitting other non-commercial traders from the non-commercial category, we will get a better idea of the trades implemented by pure speculators (professional money managers). Similarly, by omitting swap dealers from the commercial category, we hope to get a better picture of pure hedging demand from those who have a commercial interest in the physical commodity. Disaggregated data on the positions of pure hedgers and pure speculators are only available since Tuesday June, 13 2006, which restricts the ensuing analysis to the period June 2006 – March 2011.

Figure 2 plots the evolution in the S&P-GSCI (on the right-hand scale) and the evolution in the long and short open interests of professional money managers averaged across our 27 commodities (on the left-hand scale). The long positions have risen sharply and seem to follow the ups and downs of the S&P-GSCI, legitimating the concern that changes in the former could have increased volatility. On the other hand, the short positions look as if they remained constant, hovering around 25,000 over the period 2006-2011. As the short positions of professional money managers pretty much remained constant, their change is unlikely to have increased volatility.

<< Insert Figure 2 around here>>

Table 4 presents summary statistics for the performances of long-short and long-only commodity portfolios over the period June 2006 – March 2011. Unlike in Table 2, the asset allocation of the portfolios based on the positions of hedgers or/and speculators is based on the *disaggregated* hedging pressure of pure hedgers and pure speculators as opposed to the *aggregated* hedging pressure of commercial and non commercial traders. As in Table 2 however, the results of Table 4 highlight the importance of taking long, as well as short, positions in commodity futures markets. Over this shorter sample too, the Sharpe ratios of the long-short portfolios systematically and substantially exceed those of the long-only portfolios (which happen to be negative and as low as -0.15 in the case of the S&P-GSCI). The best performance is achieved within the double-sort portfolio based on the positions of, first, hedgers and, second, speculators, whose equally-weighted portfolio of 16 permutations of ranking and holding periods achieves a Sharpe ratio of 1.19. Table 4 also presents slope coefficients of regressions of the hedging pressure of pure speculators on a time trend for each of the long-short strategies, where the hedging pressure of pure speculators is measured as $\overline{HP}_{C,t}$, namely, as the cross-sectional average of the *HP* of pure speculators for the constituents of the long-short portfolios over the holding period of the strategy. With only one exception, these slope coefficients are positive and significant at the 5% level, indicating (as in Table 2 for the longer sample) an increase in the financialization of commodity markets over this shorter period.

<< Insert Table 4 around here >>

Instead of using the aggregated speculators' positions as in Table 3, the positions of pure speculators (i.e., hedge funds) as disclosed in the CFTC disaggregated Commitment of Traders report are tracked in the holding periods of the long-short strategies and the cross-sectional average of these hedging pressures are measured for the constituents of the long-short portfolios. The first lag in the change of these average hedging pressures is then used as a regressor in (3) and (4) to test whether changes in the positions of pure speculators Granger-cause a change in the conditional volatility of the long-short portfolios they hold or a change in the conditional correlation between their portfolios and traditional assets. Table 5 reports tests of these hypotheses for conditional volatilities in Panel A and for conditional correlations in Panels B and C. None of the δ_1 coefficients in (3) and (4) are significant even at the 10% level. With only one exception, the *p*-values for the null hypothesis of no Granger causality are more than 10%, suggesting an almost systematic failure to reject the null hypothesis of no Granger causality. Altogether, these conclusions are robust to the definition of the non-commercial category: whether it focuses exclusively on professional money managers or not, we find very little to no evidence suggesting that speculators destabilized commodity markets by increasing the volatility of the portfolios they held or the integration of these portfolios with traditional assets.

<< Insert Table 5 around here >>

6. Conclusions

This paper mimics the trading behavior of long-short commodity market participants using a battery of strategies that they are known to follow and then tests whether their trading activities had an impact on the volatility of the commodity portfolios they held or on cross-market correlations. If long-short commodity speculators are a disruptive force, their trading should Granger cause a change in the volatility of their portfolios and/or a change in the conditional correlation between their commodity portfolios and traditional assets.

Our results find no support for the hypothesis that speculators destabilized commodity prices by increasing volatility or co-movements with traditional assets. Interestingly, this conclusion holds irrespective of whether speculators are labeled as "non-commercial" in the CFTC Commitment of Traders report or as "professional money managers" (i.e., CTAs, CPOs and hedge funds) in the CFTC disaggregated Commitment of Traders report. Thus the analysis presented here does not call for a change in regulation relating to the participation of professional money managers in commodity futures markets. If we are looking for the causes of changes in commodity price instability, it seems that we must look elsewhere, although indeed there is even doubt about whether prices have become more volatile at all. Calvo-Gonzales et al. (2010), examining a very long panel of commodity prices back to the end of the eighteenth century, argue that while price volatility has risen and fallen enormously over the past century or so, in general it has not had an upward trend. Gilbert and Morgen (2010) further argue that there is evidence to suggest that the prices of foodstuffs were actually more stable during the 1990s and 2000s than they had been previously. Instead, it seems important to devote more resources to collecting and analyzing inventory data worldwide as this information might be crucial in supporting an understanding of the drivers of price volatility in commodity markets which seem to be fundamental and well rooted in the forces of supply and demand.

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Table 1: Summary Statistics

The table presents summary statistics for the excess returns of individual commodity futures (Panel A), long-only commodity indices (Panel B) and traditional assets (Panel C). When it comes to excess returns, Mean is the annualized mean excess returns, t(Mean) stands for the associated t-statistic in parentheses, SD is the annualized standard deviation of excess returns, Sharpe is the ratio of the annualized mean to the annualized SD.

	Excess Returns				Open interest	
	Mean	t(Mean)	SD	Sharpe	Mean	SD
Panel A: Individual Commodity Futures						
Cocoa	0.0158	(0.22)	0.3053	0.0519	29,233	22,647
Coffee C	0.0101	(0.11)	0.3825	0.0264	33,633	28,018
Copper grade # 1	0.0878	(1.39)	0.2712	0.3238	13,319	16,594
Corn	-0.0577	(-0.91)	0.2714	-0.2125	217,261	167,378
Cotton # 2	-0.0137	(-0.22)	0.2705	-0.0508	33,191	35,958
Crude oil (light sweet)	0.0918	(1.18)	0.3343	0.2746	161,460	91,763
Electricity	-0.2569	(-1.52)	0.4477	-0.5738	2,235	888
Feeder cattle	0.0298	(0.88)	0.1447	0.2058	7,898	4,446
Frozen concentrated orange juice	-0.0621	(-0.84)	0.3191	-0.1946	12,823	6,479
Gasoline (Blendstock RBOB)	0.0452	(0.27)	0.3847	0.1175	54,401	28,559
Gold	0.0427	(1.13)	0.1631	0.2617	108,846	91,539
Heating oil # 2	0.0744	(1.00)	0.3207	0.2321	43,491	18,784
Lean hogs	-0.0602	(-0.99)	0.2615	-0.2302	27,765	24,873
Live cattle	0.0066	(0.19)	0.1517	0.0433	56,973	36,524
Natural gas	-0.1618	(-1.48)	0.4686	-0.3452	59,756	43,832
Oats	-0.0199	(-0.27)	0.3187	-0.0624	5,955	3,090
Palladium	0.0986	(1.22)	0.3483	0.2830	7,007	6,140
Platinum	0.0940	(1.88)	0.2149	0.4373	11,821	7,484
Pork bellies	0.0279	(0.35)	0.3439	0.0812	2,555	1,956
Random length lumber	-0.1255	(-1.67)	0.3232	-0.3884	2,709	1,664
Rough rice	-0.0918	(-1.13)	0.2723	-0.3372	4,618	3,211
Silver	0.0855	(1.27)	0.2894	0.2954	51,021	23,392
Soybean meal	0.1087	(1.71)	0.2731	0.3979	38,963	21,858
Soybean oil	0.0065	(0.12)	0.2367	0.0275	48,655	38,297
Soybeans	0.0550	(0.98)	0.2407	0.2287	86,780	67,679
Sugar # 11	0.0539	(0.74)	0.3151	0.1711	142,656	108,928
Wheat	-0.0789	(-1.19)	0.2850	-0.2767	81,120	67,494
Average	0.0002		0.2948	0.0292		
Panel B: Long-Only Commodity Indices						
Equally-weighted long-only portfolio	0.0064	(0.23)	0.1208	0.0529	50,552	25,281
S&P-GSCI	0.0428	(0.84)	0.2178	0.1965	12,587	9,738
Panel C: Traditional Asset Classes						
S&P-500 composite index	0.0421	(1.03)	0.1755	0.2401		
Barclays Capital US aggregate bond index	0.0295	(2.85)	0.0444	0.6631		

Table 2: The Performance of Long-Short and Long-Only Commodity Portfolios

The table presents summary statistics for long-short and long-only commodity portfolios. Strategies based on momentum and/or term structure signals are presented in Panel A; strategies based on hedging pressure in Panel B where the signals are modeled over four ranking periods, R, of 4, 13, 26 and 52 weeks. The long-short portfolios are then held over four holding periods, H, of 4, 13, 26 and 52 weeks. Instead of reporting summary statistics for each of the 16 portfolios that results from combinations of these R and H, a portfolio that equally weights all 16 combinations is formed for each strategy. The table presents summary statistics for the excess returns of these equally-weighted portfolios. The Mean has been annualized, SD is the annualized standard deviation of the portfolio excess returns, Sharpe is the ratio of Mean to SD, Trend (×100) is 100 × the slope coefficient of a regression of the portfolio hedging pressure on a time trend. t(.) in parentheses stands for the associated t-statistic. EW represents an equally-weighted portfolio that includes all 27 commodities.

	Mean	t(Mean)	SD	Sharpe ratio	Trend (×100)	t(Trend)
Panel A: Long-Short Portfolios Based on Momentum and/or Term Structure						
Momentum	0.0416	(1.17)	0.1536	0.2711	-0.0001	(-0.09)
Term structure	0.0803	(2.02)	0.1712	0.4693	0.0170	(14.87)
Momentum-TS	0.0843	(2.39)	0.1518	0.5556	0.0094	(9.87)
TS-Momentum	0.0898	(2.44)	0.1584	0.5666	0.0079	(7.72)
Average	0.0740		0.1588	0.4656		
Panel B: Long-Short Portfolios Based on Hedging Pressure						
Hedgers	0.1140	(2.71)	0.1809	0.6302	0.0134	(11.13)
Speculators	0.0835	(2.09)	0.1717	0.4863	0.0141	(12.54)
Hedgers-Speculators	0.0784	(2.05)	0.1647	0.4759	0.0130	(11.44)
Speculators-Hedgers	0.1086	(2.66)	0.1753	0.6197	0.0141	(11.99)
Average	0.0961		0.1731	0.5530		
Panel C: Long-Only Portfolios						
EW	0.0064	(0.23)	0.1208	0.0529		
S&P-GSCI	0.0428	(0.84)	0.2178	0.1965		

Table 3: Granger Causality Tests

The table tests whether changes in the positions of speculators Granger-cause changes in the volatility of commodity portfolios (Panel A) or changes in the conditional correlation between commodities and traditional asset returns (Panels B and C). δ_1 is the slope coefficient of a regression of the change in these conditional volatilities (correlations) on the first lag of the change in speculators' hedging pressure for the constituents of that specific commodity portfolio. *t*-statistics are in parentheses. $p(n)$ is the p-value associated with test of the hypothesis that change in the positions of speculators do not Granger-cause change in volatility (correlation), n is the number of lags. The last two columns present p-values from two Granger causality tests with four lags as robustness tests; the first test uses the levels of, instead of the changes in, conditional volatility and conditional correlation as dependent and independent variables in (3) and (4). The second test augments (3) and (4) with the first lag of two business cycle variables: default spread and term spread.

	Long portfolios				Short portfolios				Long-short portfolios				Test 1	Test 2
	δ_1		$p(1)$	$p(4)$	δ_1		$p(1)$	$p(4)$	δ_1		$p(1)$	$p(4)$		
Panel A: Conditional volatility														
Momentum	0.0036	(0.21)	0.83	0.58	-0.0087	(-0.78)	0.44	0.90	0.0074	(1.55)	0.12	0.43	0.54	0.43
Term structure (TS)	-0.0132	(-0.78)	0.43	0.94	-0.0054	(-0.72)	0.47	0.43	0.0005	(0.07)	0.95	0.82	0.87	0.78
Momentum-TS	-0.0066	(-0.62)	0.54	0.62	0.0036	(0.58)	0.56	0.76	-0.0004	(-0.04)	0.97	0.97	0.87	0.79
TS-Momentum	-0.0097	(-0.65)	0.52	0.68	0.0033	(0.39)	0.70	0.65	-0.0030	(-0.40)	0.69	0.80	0.65	0.47
Hedgers	-0.0125	(-0.77)	0.44	0.71	-0.0077	(-0.99)	0.32	0.79	0.0079	(0.93)	0.35	0.79	0.98	0.97
Speculators	0.0055	(0.35)	0.72	0.81	-0.0003	(-0.03)	0.98	1.00	0.0115	(1.25)	0.21	0.46	0.79	0.79
Hedgers-Speculators	-0.0074	(-0.59)	0.55	0.60	0.0059	(0.70)	0.48	0.84	-0.0014	(-0.19)	0.85	0.99	0.98	0.99
Speculators-Hedgers	-0.0117	(-0.87)	0.39	0.64	0.0071	(1.16)	0.25	0.66	-0.0032	(-0.50)	0.61	0.93	0.94	0.94
Panel B: Conditional correlation with S&P500 index														
Momentum	-0.0270	(-0.64)	0.52	0.52	0.0071	(0.40)	0.69	0.04	-0.0188	(-0.79)	0.43	0.59	0.60	0.59
TS	-0.0043	(-0.19)	0.85	0.06	0.0248	(0.80)	0.43	0.88	0.0183	(1.68)	0.09	0.09	0.16	0.09
Momentum-TS	0.0437	(1.25)	0.21	0.60	0.0290	(1.17)	0.24	0.51	-0.0137	(-0.63)	0.53	0.32	0.60	0.59
TS-Momentum	0.0180	(0.57)	0.57	0.81	0.0059	(0.21)	0.83	0.23	0.0063	(1.07)	0.28	0.70	0.46	0.46
Hedgers	-0.0144	(-0.32)	0.75	0.06	0.0352	(1.41)	0.16	0.09	0.0053	(0.26)	0.80	0.59	0.31	0.32
Speculators	-0.0187	(-0.42)	0.67	0.26	0.0195	(0.85)	0.40	0.08	0.0014	(0.05)	0.96	0.46	0.75	0.70
Hedgers-Speculators	0.0331	(0.96)	0.34	0.58	0.0118	(0.43)	0.67	0.42	0.0135	(1.58)	0.11	0.42	0.44	0.42
Speculators-Hedgers	0.0688	(1.62)	0.11	0.49	0.0149	(0.60)	0.55	0.12	-0.0001	(-0.01)	0.99	0.78	0.82	0.78
Panel C: Conditional correlation with Barclays bond index														
Momentum	0.0033	(0.26)	0.79	0.26	-0.0043	(-0.45)	0.65	0.89	-0.0034	(-0.37)	0.71	0.95	0.86	0.95
TS	-0.0094	(-0.20)	0.84	0.61	-0.0034	(-0.35)	0.72	0.92	0.0162	(0.44)	0.66	0.95	1.00	0.94
Momentum-TS	0.0116	(0.60)	0.55	0.89	0.0055	(0.70)	0.48	0.84	-0.0034	(-0.74)	0.46	0.71	0.87	0.87
TS-Momentum	0.0040	(0.20)	0.85	0.99	0.0071	(0.62)	0.54	0.97	-0.0361	(-0.76)	0.45	0.83	0.61	0.74
Hedgers	-0.0077	(-0.18)	0.86	0.86	-0.0001	(-0.02)	0.98	0.93	0.0046	(0.21)	0.83	0.87	0.68	0.72
Speculators	-0.0055	(-0.24)	0.81	0.76	-0.0033	(-0.75)	0.45	0.84	-0.0060	(-0.53)	0.60	0.74	0.93	0.83
Hedgers-Speculators	0.0040	(0.18)	0.86	0.87	0.0060	(0.23)	0.82	0.94	-0.0070	(-0.96)	0.33	0.55	0.67	0.55
Speculators-Hedgers	0.0212	(0.82)	0.41	0.80	0.0042	(0.57)	0.57	0.97	-0.0023	(-0.39)	0.69	0.54	0.41	0.56

Table 4: Performance of Long-Short Commodity Portfolios: Evidence from the Disaggregated Commitment of Traders Report

The positions of pure hedgers (i.e., producers, processors, merchants and users of the underlying commodity) and of pure speculators (i.e., CTAs, CPOs, and hedge funds) as disclosed in the CFTC disaggregated Commitment of Traders report are used to model the performance of the hedgers and speculators-based portfolios. The table presents summary statistics for long-short and long-only commodity portfolios over the period for which the disaggregated Commitment of Traders report data are available: July, 14 2006 – March, 25 2011. Strategies are based on momentum and/or term structure in Panel A and on hedging pressure in Panel B, where the signals are modeled over ranking periods, *R*, of 4, 13, 26 and 52 weeks. The long-short portfolios are then held over four holding periods, *H*, of 4, 13, 26 and 52 weeks. Instead of reporting summary statistics for each of the 16 portfolios that results from combinations of these *R* and *H*, a portfolio that equally weights all 16 combinations is formed for each strategy. The table presents summary statistics for the excess returns of these equally-weighted portfolios. The Mean has been annualized, SD is the annualized standard deviation of the portfolio excess returns, Sharpe is the ratio of Mean to SD, Trend (×100) is 100 × the slope coefficient of a regression of the portfolio hedging pressure on a time trend. *t*(.) in parentheses stands for the associated *t*-statistic. EW represents an equally-weighted portfolio that includes all 27 commodities.

	Mean	*t*-stat	SD	Sharpe ratio	Trend (×100)	*t*(Trend)
Panel A: Long-Short Momentum and/or Term Structure Portfolios						
Momentum	0.0529	(0.69)	0.1659	0.3190	0.0281	(5.00)
Term structure (TS)	0.0488	(0.56)	0.1908	0.2556	0.0912	(16.02)
Momentum-TS	0.0910	(1.19)	0.1660	0.5483	0.0598	(10.72)
TS-Momentum	0.0931	(1.19)	0.1707	0.5457	0.0558	(8.96)
Average	0.0715		0.1734	0.4171		
Panel B: Long-Short Hedging Pressure Portfolios						
Hedgers	0.1129	(1.11)	0.2212	0.5104	0.0186	(2.25)
Speculators	0.1856	(2.23)	0.1813	1.0235	0.0229	(2.78)
Hedgers-Speculators	0.2210	(2.59)	0.1857	1.1903	-0.0065	(-1.00)
Speculators-Hedgers	0.2131	(2.45)	0.1888	1.1285	0.0122	(2.32)
Average	0.1832		0.1943	0.9632		
Panel C: Long-Only Portfolios						
EW	-0.0050	(-0.06)	0.1781	-0.0282		
S&P-GSCI	-0.0427	(-0.33)	0.2841	-0.1502		

Table 5: Granger Causality Tests: Evidence from the Disaggregated Commitment of Traders Report

The positions of pure hedgers (i.e., producers, processors, merchants and users of the underlying commodity) and of pure speculators (i.e., CTAs, CPOs, and hedge funds) as disclosed in the CFTC disaggregated Commitment of Traders report are used to model the performance of the hedger- and speculator-based portfolios and subsequently to test for Granger causality between changes in conditional volatility (correlation) and changes in the positions of pure speculators. δ_1 is the slope coefficient of regressions of the change in conditional volatility (correlation) on the first lag of the change in the hedging pressure of the pure speculators for the constituents of that specific commodity portfolio. $p(n)$ is the associated p-value when n lags are considered in the Granger causality tests. The sample covers the period: July, 14 2006 – March, 25 2011, for which data from the disaggregated Commitment of Traders report are available.

	δ_1		$p(1)$	$p(4)$
Panel A: Conditional Volatility of Commodity Portfolios				
Momentum	-0.0344	(-1.59)	0.11	0.26
Term structure (TS)	-0.0011	(-0.03)	0.98	0.19
Momentum-TS	0.0117	(0.53)	0.60	0.74
TS-Momentum	-0.0056	(-0.16)	0.87	1.00
Hedgers	0.0032	(0.20)	0.84	0.42
Speculators	0.0057	(0.28)	0.78	0.30
Hedgers-Speculators	-0.0269	(-0.24)	0.81	0.45
Speculators-Hedgers	-0.0040	(-0.25)	0.80	0.01
Panel B: Conditional Correlation with the S&P-500 Index				
Momentum	-0.1508	(-1.15)	0.25	0.79
TS	0.0941	(1.17)	0.24	0.81
Momentum-TS	-0.0176	(-0.20)	0.84	0.85
TS-Momentum	-0.0445	(-0.42)	0.68	0.99
Hedgers	-0.0435	(-0.31)	0.75	0.50
Speculators	-0.0759	(-0.89)	0.37	0.65
Hedgers-Speculators	-0.1560	(-1.28)	0.20	0.41
Speculators-Hedgers	-0.1240	(-1.15)	0.25	0.73
Panel C: Conditional Correlation with Barclays Aggregate Bond Index				
Momentum	0.0025	(0.94)	0.35	0.64
TS	-0.1823	(-1.06)	0.29	0.69
Momentum-TS	0.0739	(0.70)	0.48	0.91
TS-Momentum	0.0052	(0.34)	0.74	0.99
Hedgers	0.0111	(0.56)	0.58	0.88
Speculators	0.0002	(0.57)	0.57	0.89
Hedgers-Speculators	-0.1212	(-0.60)	0.55	0.30
Speculators-Hedgers	-0.1223	(-0.77)	0.44	0.73

Figure 1: Open Interest of Non-Commercial Traders (Speculators)

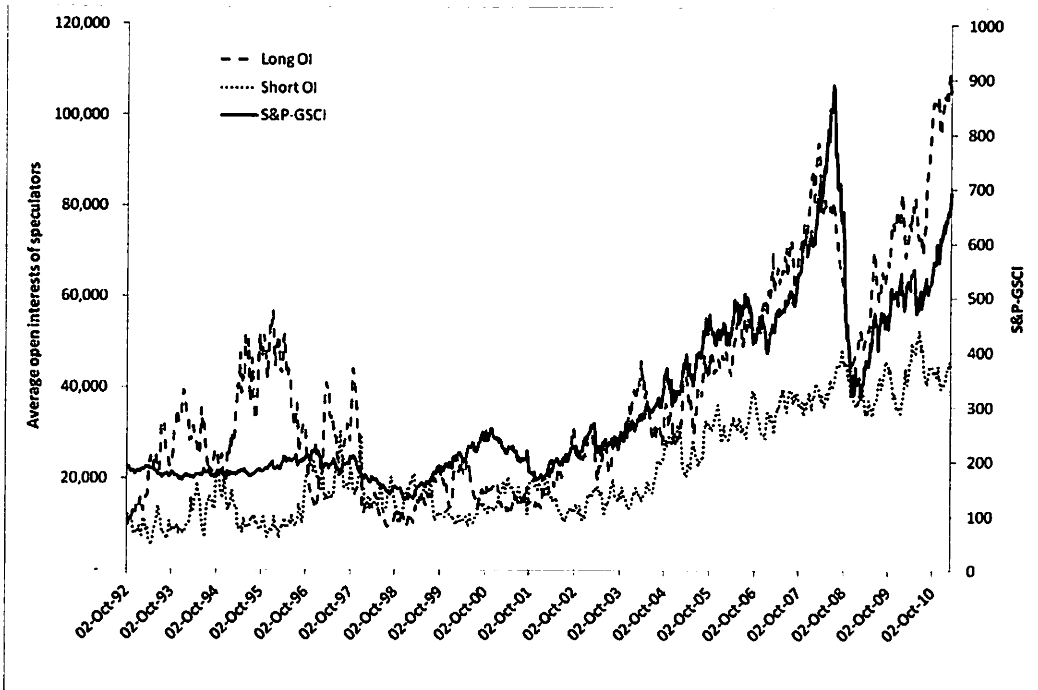

Figure 2: Open Interest of Professional Money Managers (CTAs, CPOs and hedge funds)