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The Price Impact of Index Funds in Commodity Futures Markets: Evidence from the CFTC's Daily Large Trader Reporting System

This paper analyzes the price impact of long-only index funds in commodity futures markets for the January 2004 through July 2008 period. Daily positions of index traders in 12 markets are drawn from the internal large trader reporting system used by the CFTC. Granger causality test results provide negligible evidence that index traders impact commodity future returns regardless of the measure of market participation considered. The signs of the relatively few significant coefficients are as likely to be negative as positive and the magnitudes of the economic effects are very small. Some evidence is found that volatility has been influenced by the presence of index traders in several markets, but only using one of the measures of index position changes. These effects appear to be small in economic magnitude, except in several traditionally less liquid markets. While the overall balance between significant positive and negative signs is nearly equal, index positions appear to have had a dampening effect on volatility during 2004-2005 particularly in the soft commodity contracts, followed by a heightening effect during 2006-2008 in deferred contracts.

Keywords: commodities, futures markets, index funds, large trader reporting system, returns, speculator, volatility

Introduction

The idea of a long-only investment that tracks an index of commodity futures prices is not new (Greer 1978; Bodie and Rosansky 1980); however, actual investment in such instruments was small until recently. The Commodity Futures Trading Commission (CFTC) estimates that index fund investment was only $12 billion in 2002 but increased to over $200 billion by 2008.[1] Index fund investors are attracted to commodity futures markets in search of risk premiums and portfolio diversification benefits (e.g., Gorton and Rouwenhorst 2006).

A world-wide debate has erupted about the price impact of these new 'index fund' speculators in commodity futures markets.[2] A number of observers (e.g., Masters and White 2008) assert that buying pressure from index funds created a bubble in commodity prices during 2007-2008, which resulted in market prices far exceeding fundamental values. Petzel (2009) argues that unleveraged futures positions of index funds are effectively synthetic long positions in physical commodities, and hence represent new demand. If the magnitude of index fund demand is large enough relative to physically-constrained supplies in the short-run, prices and price volatility can increase sharply. The bottom-line of this argument is that the size of index fund investment is "too big" for the current size of commodity futures markets.

Based on these concerns, a number of bills have been introduced in the U.S. Congress to prohibit or limit speculation in commodity futures markets. The U.S. Senate Permanent Subcommittee on Investigations stated that "…there is significant and persuasive evidence to conclude that these commodity index traders, in the aggregate, were one of the major causes of "unwarranted changes"—here, increases—in the price of wheat futures contracts relative to the price of wheat in the cash market…Accordingly, the Report finds that the activities of

commodity index traders, in the aggregate, constituted "excessive speculation" in the wheat market under the Commodity Exchange Act." (USS/PSI 2009, p. 2) Some also argue that the wave of speculation increased food prices, which "…harm the poor and result in long-term, irreversible nutritional damage, especially among children." (Robles, Torero, and von Braun 2009, p.7) This is seen as justification for a new scheme of public intervention in commodity futures markets to prevent reoccurrence of damaging food price spikes (von Braun and Torero 2009).

Several studies examine the relationship between large trader positions and subsequent commodity futures returns (e.g., Petzel 1981; Bryant, Bessler, and Haigh 2006; Buyuksahin and Harris 2009; Sanders, Irwin, and Merrin 2009). While these studies generally indicate that speculators (as a group) do not systematically influence price changes, they do not specifically investigate the price impact of index funds. Tiang and Xiong (2009) conclude that index fund investing has an impact on commodity prices based on a trend towards increasing co-movement of futures prices for commodities included in popular investment indexes, such as the S&P GSCI Index™. Stoll and Whaley (2009), Robles, Torero, and von Braun (2009), and Sanders and Irwin (2009 2010) use data from the CFTC's *Supplemental Commodity Index Trader* (CIT) report to conduct a variety of tests of the null hypothesis that index fund trading does not cause commodity futures price changes. None of these studies provides compelling evidence contrary to the null hypothesis of no causality.[3]

Research to date on the price impact of index funds is subject to important data limitations. First, indirect tests such as those used by Tiang and Xiong (2009) do not incorporate data on market supply and demand fundamentals. Failure to condition on market fundamentals can lead to incorrect inferences regarding the degree of 'excess co-movement' in commodity futures returns (Ai, Chatrath, and Song 2006). Second, direct tests in other studies such as Stoll and Whaley (2009) are based on index trader data from the CFTC that is aggregated across all contracts and available only on a weekly basis. This limits the power of the tests because changes in prices and positions cannot be matched precisely to contract maturity months and positions cannot be tracked over daily intervals. If speculator positions do impact returns, they may be more likely to do so over time horizons shorter than a week (Streeter and Tomek 1992). Third, public data from the CFTC on index trader positions are not available prior to 2006. Previous research suggests that the buildup in index positions was most rapid during 2004 and 2005, and therefore the period most probable to show the impact of index traders (Sanders, Irwin, and Merrin 2008; Sanders and Irwin 2009).

The purpose of this paper is to analyze the price impact of long-only index funds in commodity futures markets for the January 2004 through July 2008 period. Daily positions of index traders in 12 markets are drawn from the internal large trader reporting system used by the CFTC. The commodity futures markets include corn, soybeans, soybean oil, CBOT wheat, KCBOT wheat, feeder cattle, lean hogs, live cattle, cocoa, cotton, coffee, and sugar. Since index positions are available on a daily basis and disaggregated by contract the analysis is not subject to data limitations previously identified. The non-public and disaggregated CFTC large trader database has been used in only a few previous studies of the relationship between trader positions and futures returns (e.g., Haigh, Hranaiova, and Overdahl 2007; Buyuksahin and Harris 2009) and none have focused on index funds.

Granger causality tests are used to investigate whether a significant relationship exists between index trader position changes and commodity futures returns and volatility. The analysis is performed on nearby and first deferred contracts and separately for the 2004-2005 and 2006-2008 periods. The use of nearby and first deferred contracts allows for the influence of the index funds to emerge as they roll their positions. The use of an early and later period allows for possible differential effects that might exist as index traders initiated and built up their positions in commodity markets. Finally, to allow for the possibility that the effect of index traders on commodity markets is more accurately reflected as their positions accumulate, we also assess the relationship between longer-term moving-average position changes and daily returns and their volatility.

Our findings identify very limited evidence to support the argument that index fund trading affects the direction and magnitude of commodity futures returns, regardless of how positions are measured. Some evidence emerges that volatility has been influenced by the presence of index traders in several markets, but only using one of the measures of index fund position changes. These effects appear to be small in economic magnitude, except in several traditionally less liquid markets. While the overall balance between significant positive and negative signs is nearly equal, index positions appear to have had a dampening effect on volatility during 2004-2005 particularly in the soft commodity contracts, followed by a heightening effect during 2006-2008 in deferred contracts.

CFTC Large Trader Reporting System

The CFTC Large Trader Reporting System (LTRS) is designed for surveillance purposes to detect and deter futures and options market manipulation (Fenton and Martinaitas 2005). Positions must be reported to the CFTC on a daily basis if they meet or exceed reporting levels. For example, the current reporting level in the corn futures contract is 250 contracts, or 1.25 million bushels. The LTRS database contains end-of-day reportable positions for long futures, short futures, long delta-adjusted options, and short delta-adjusted options for each trader ID and contract maturity.[4,5] In recent years about 80% to 90% of open interest in commodity futures markets has been reported to the CFTC and included in the LTRS (Sanders, Irwin, and Merrin 2008).

A weekly snapshot of the LTRS data is compiled in aggregate form and released to the general public as the *Commitment of Traders* report (COT). The COT pools traders into two broad categories (commercial and non-commercial), all contract maturities are aggregated into one open interest figure, and the report is released each Friday with the data as of the end-of-day on the preceding Tuesday. The COT report covers over 90 U.S. commodity markets and two versions are published: i) the *Futures-Only Commitments of Traders* report that includes futures market open interest only; and ii) the *Futures-and-Options-Combined Commitments of Traders* report that includes futures market open interest and delta-weighted options market open interest.

In response to industry concerns regarding commodity index fund positions, the CFTC changed the reporting system in 2007 by creating the *Supplemental Commodity Index Trader* (CIT) report that separates commodity index traders from the original commercial and

noncommercial COT categories. CFTC staff engaged in a detailed process to identify index traders in the LTRS for inclusion in the new category. The process included screening all traders with large long positions in commodity futures contracts, analyzing futures positions to determine a pattern consistent with index trading, reviewing line of business forms (Form 40) to obtain more detailed information on their use of the market, and conducting an expansive series of phone and in-person interviews with traders. The CFTC acknowledges that the classification procedure was imperfect and that "…some traders assigned to the Index Traders category are engaged in other futures activity that could not be disaggregated….Likewise, the Index Traders category will not include some traders who are engaged in index trading, but for whom it does not represent a substantial part of their overall trading activity" (CFTC 2008a). While recognizing these potential problems, the CIT data are nevertheless widely regarded as providing valuable information about index trader activity in commodity futures markets.

The first weekly *Supplemental* report was published in January 2007 and provided aggregate futures and delta-adjusted options positions of CITs in 12 commodity futures markets: corn, soybeans, soybean oil, CBOT wheat, KCBOT wheat, feeder cattle, lean hogs, live cattle, cocoa, cotton, coffee, and sugar. The CIT category was computed retroactively for 2006 to provide context for the initial release of the data in 2007.

As noted above, CITs are drawn from the original commercial and noncommercial categories in the LTRS. CITs from the commercial category are traders whose positions predominately reflect hedging of OTC transactions associated with commodity index investors seeking exposure to commodity prices in an unleveraged and passive manner using a standardized commodity index. CITs from the noncommercial category are mostly managed funds, pension funds and other institutional investors also seeking exposure to commodity price movements. Sanders, Irwin and Merrin (2008) show that approximately 85% of index trader positions are drawn from the long commercial category with the other 15% from the long non-commercial category. This implies that the bulk of CIT positions are initially established in the OTC market and the underlying position is then transmitted to the futures market by swap dealers (including both commercial and investment banks) hedging OTC exposure.

Commodity Index Trader Positions

Aggregate data on the positions of CITs are collected from the LTRS for the same 12 markets included in the weekly *Supplemental* report. In contrast to the public and weekly data on CIT positions available in the *Supplemental* report, CIT positions collected directly from the LTRS are on a daily basis and disaggregated by contract maturity month and whether the position is in futures or options. Descriptive examination of the daily CIT positions covers the January 2000 through July 2008 period. The CIT classifications are applied retroactively from 2000 through 2005 to approximate CIT positions before the official CFTC CIT classifications began in 2006. This assumes that traders classified as CITs over 2006-2008 also were CITs previous to this period. Discussions with CFTC staff indicate that CIT designations have changed little since the classification scheme was first constructed in 2006, which provides support for its retroactive application.[6]

The growth in CIT positions in commodity futures markets is pronounced during the 2000 to 2008 period. Table 1 provides a breakdown by year of the average daily net long open interest (long minus short contracts) held by CITs in the 12 markets. Note that these CIT futures positions are aggregated across all contract maturities and options positions are excluded. The general pattern is a small base of positions in 2000-2003, rapid growth during 2004-2005, and then a leveling off or more modest growth during 2006-2008. For example, the net long position of CITs in CBOT wheat increased from an average of 25,702 contracts in 2003 to 134,408 contracts in 2005, over a fivefold increase. The rapid growth in CIT positions is also apparent in CBOT wheat as a percentage of total open interest (long), which increased from 24% to 55% over the same time frame. There were some exceptions to this pattern. Growth in CIT positions in feeder cattle, live cattle, coffee, and cocoa was more linear over 2000-2008.

While there is some variation in the pattern across markets, the averages in table 1 clearly reveal that CITs became large participants in commodity futures markets during a relatively short period of time. By 2008, the lowest CIT percentage of total market open interest was 17% in cocoa and the highest was 48% in live cattle. The average across all 12 markets in 2008 was 35%. Concerns about the price impact of index funds are understandable in light of the historic magnitude of this structural change in market participation. Some have termed this process the 'financialisation' of commodity futures markets (Domanski and Heath 2007).

Figure 1 provides daily detail on the growth of CIT positions for one of the most actively traded markets, the corn futures market.[7] Panel A displays the daily net long open interest in terms of number of contracts held by CIT traders for two categories: i) nearby and first deferred corn contracts combined, and ii) all other deferred corn contracts combined. Panel B displays the percent of total CIT open interest in all other corn deferred contracts. Separating positions into these two categories highlights any changes in the maturity of futures contracts held by CITs.

Total CIT open interest in corn was at a moderate level, between 25,000 and 50,000 contracts through the end of 2003, and then increased rapidly starting in early 2004, with a peak of more than 425,000 contracts in July 2006. CIT open interest leveled off and declined slightly thereafter. There was a large increase in the importance of other deferred contracts towards the end of the period, as reflected by the dark portion of panel A and the line in panel B. For example, about a quarter of CIT positions were held in longer maturity corn futures contracts in 2008. This is consistent with the much discussed trend of CITs spreading positions across more contracts in an effort to reduce trade execution costs (e.g., Meyer and Cui 2009). However, the magnitude of the increase in CIT activity for more distant contracts was less pronounced in several markets (soybean oil, feeder cattle, cocoa, coffee, and sugar).

Based on inspection of the data, other characteristics of CIT positions were identified. CIT traders bypass certain cotton, lean hogs, soybeans, and soybean oil contracts, presumably due to trading or liquidity costs considerations. These contracts are excluded in the later statistical analysis of price impacts.[8] It was also determined that CITs do not trade actively in options markets. The proportion of combined futures and delta-adjusted options positions represented by options has increased modestly over time, but it is unusual for options to make up

more than 5% of the total. As a result only futures positions are used in the later statistical analysis

A defining characteristic of CIT trading patterns is the "roll." Since commodity futures contracts have a limited life, CITs develop strategies to transfer (roll) long positions from an expiring contract to a later contract. The S&P GSCI Index™ is one of the most widely tracked indexes and the roll process for this index is described as follows:

> "The rolling forward of the underlying futures contracts in the excess return index portfolio occurs once each month, on the fifth through ninth business days (the roll period). As explained above, some of the underlying commodity contracts expire in the next month and thus need to be rolled forward. The simplest way to think of the process is as rolling from one basket of nearby futures (the first nearby basket) to a basket of futures contracts that are further from expiration (the second nearby basket). The S&P GSCI™ is calculated as though these rolls occur at the end of each day during the roll period at the daily settlement prices."[9]

The implication is that CIT trading ebbs and flows in specific contracts, as positions shift from one maturity to another. The nearby contract carries the majority of the open interest and the deferred contracts constitute the remaining positions.

Figure 2 presents an example of this "ebbing and flowing" for the 2007 calendar year in the March, May, July, September, and December corn futures contracts. Each contract expires roughly in the third week of the expiration month. The top solid black line in panel A represents the net long open interest aggregated across all contracts each business day. Total position size of CITs in corn was about 400,000 contracts at the start of the year, quickly declined to about 350,000 contracts, and then varied little from that level over the remainder of 2007. The "hills" below the total line show the composition of CIT positions on each day and clearly illustrate the pattern of rolling positions from contract-to-contract. Positions build up rapidly during the period when a contract is the nearest-to-maturity (nearby) and decline equally rapidly as the contract approaches expiration and positions are moved the next contract (first deferred). Note that the pattern is somewhat different for the December 2007 "new crop" contract, with positions being held at some level in this contract for almost the entire year.

In order to conduct statistical analysis of the price impact of CITs a continuous series of CIT positions is needed.[10] The aggregate position is continuous (top line in panel A of figure 2), but as noted above does not reflect the movement of positions in and out of specific contracts. Panel B of figure 2 demonstrates the construction of two alternative continuous series of CIT positions during 2007. The switch between contracts in both series is assumed to occur on the last business day of the calendar month before expiration. In essence, the nearby series strings together the right-half of the hills while the first deferred series strings together the left-half of the hills. As shown in panel C, changes in the two series are nearly mirror images.[11] Position changes tend to be negative (positive) in the nearby (first deferred) series since CITs generally are exiting (entering) long positions during this period of a nearby (first deferred) contract's life. The position change graphs also highlight the potential importance of examining price impact on a disaggregated basis. Changes in aggregate CIT positions mask very large changes in positions for specific contracts.[12]

Price Impact Tests

Hamilton (1994) recommends Granger tests to assess causal relationships between two time series using lead-lag variables. Granger causality tests reflect the basic idea that if event *X* causes event *Y* then event *X* should precede event *Y* in time. Previous studies of large trader impacts in commodity futures markets (e.g., Buyuksahin and Harris 2009; Sanders, Irwin, and Merrin 2009) generally assume futures returns are stationary, and therefore specify returns as a function of lagged returns and lagged measures of trader participation. Here, since the focus is CIT participation in commodity futures markets, equations (1) and (2) are specified using market returns, market volatility, and CIT positions,

$$R_t = \alpha + \sum_{i=1}^{m} \gamma_i R_{t-i} + \sum_{j=1}^{n} \beta_j X_{t-j} + \varepsilon_t \quad (1)$$

$$V_t = \alpha + \sum_{i=1}^{m} \gamma_i V_{t-i} + \sum_{j=1}^{n} \beta_j X_{t-j} + Monthly\ Effects + \nu_t \quad (2)$$

where R_t is the daily return $[R_t = (\ln P_t - \ln P_{t-1})*100]$, X_t is a measure of CIT participation in the market, V_t is the Parkinson measure of daily price volatility (annualized standard deviation) based on the difference between the daily high and low price (Parkinson 1980), and *Monthly Effects* is a set of monthly dummy variables to allow for changing seasonal volatility (Egelkraut, Garcia, and Sherrick 2007). Estimation of (1) and (2), testing for statistical significance of $\sum_{j=1}^{n} \beta_j$, and the development of cumulative percentage response measures permit an assessment of the effect of CIT participation on returns and volatility. As is well-known, these tests require careful interpretation if the null hypothesis of no causality is rejected. A statistical correlation may be observed between *X* and *Y* when in reality an omitted variable *Z* is the true cause of both *X* and *Y*. Hamilton (1994, p. 308) suggests it is better to describe "Granger causality" tests between *X* and *Y* as tests of whether *X* helps forecast *Y* rather than whether *X* causes *Y*.

Returns, volatilities, and positions correspond to the nearby and first deferred futures contracts traded by CITs, which were identified in the previous section as representing the largest portion of their trading activity. The use of both nearby and first deferred contracts allows for the possibility of a divergent impact of CITs across contract maturities, particularly as they roll positions. As also noted in the previous section, delta-adjusted option positions are not considered due to their small size.

Following the convention in numerous studies, nearby price and position series for most futures markets are computed by rolling from the nearby contract to the first deferred contract on the last day of the month prior to the expiration month of the nearby contract. For instance, in February the nearest contract for corn is March. On the last business day in February the price series is rolled to May, the next nearest contract. The first deferred price and position series are arranged in a similar manner, but the series rolls from the first deferred to the second deferred on the last trading day prior to the expiration month of the first deferred contract. Price and position

changes are not calculated across contracts, so that price and position changes on a switching date correspond to the contract entering the series. Due to the nature of their contract expiration rules, cocoa, coffee, cotton, and sugar are rolled on the day following the 15th day of the month prior to the delivery month.

CIT participation in markets can be measured in a number of ways. Two primary measures are used in the analysis: the daily change in CIT open interest measured in contracts, and the daily percent of total open interest held by CIT traders. The change in open interest permits a direct assessment of how the net flow of CIT market activity in a specific contract influences corresponding price behavior. The percent of open interest held by CIT permits an assessment of how the magnitude of the CIT positions relative to the total open interest in the specific contract affects price behavior.

While providing a good indication of CIT daily market activity, the previous two measures may not be reflective of longer-term influence of CIT activity on prices. Daily and weekly observations may result in low power to detect speculative relationships over longer horizons (Summers 1986). For instance, trader activities may flow in "waves" that build slowly—pushing prices higher—and fading slowly. In this context, horizons longer than a day may be necessary to identify the relationship between prices and CIT trader positions. A long-horizon analysis is implemented using a version of the "fads" model by modifying (1) and (2) as follows,

$$R_t = \alpha + \sum_{i=1}^{m} \gamma_i R_{t-i} + \beta \frac{\sum_{j=1}^{n} X_{t-j}}{n} + \varepsilon_t \tag{3}$$

$$V_t = \alpha + \sum_{i=1}^{m} \gamma_i V_{t-i} + \beta \frac{\sum_{j=1}^{n} X_{t-j}}{n} + Monthly\ Effects + v_t. \tag{4}$$

In this formulation CIT positions enter as a moving average calculated over recent observations. Jegadeesh (1991) shows that letting an independent variable enter as a moving average of recent *n* observations provides the highest power against a fads-type alternative hypothesis using standard OLS estimation and testing procedures. In the context of our analysis, if the estimated β_t is positive (negative) returns tend to increase (decrease) slowly over a relatively long period after widespread CIT buying. This framework is consistent with the notion of "waves" of speculative pressure building up a "bubble" in commodity futures prices. Examination of volatility in this context also permits an assessment of the longer-term CIT behavior on market uncertainty.

To assess the effect of CIT behavior on market behavior, several steps are performed. Prior to estimating (1) – (4), all daily series are examined for stationarity using the augmented Dickey-Fuller test for which the optimal lag length is chosen using BIC. In all cases, the test includes a constant and trend and the null hypothesis of non-stationarity is rejected.[13] For equations (1) and (2), lags lengths of one to five days are examined for both variables and the dynamic structure that minimizes BIC is selected. For equations (3) and (4), the dynamic structure for the lagged dependent variable established in (1) and (2) is used and then a moving

average length of 5, 10, 15, or 20 days is selected that minimizes BIC. This procedure is used to minimize data mining tendencies associated with the selection procedure for moving average models. Once lag structures are determined, tests for autocorrelation and heteroskedasticity are applied to the resulting residuals, and if necessary, a Newey-West correction procedure is used to obtain robust standard errors. *F*-tests are then performed to identify statistical significance of the CIT position variable.

Cumulative response measures are calculated to assess the magnitude of estimated price impacts. For example, the cumulative response to a change in the CIT position for equation (1) can be provided as follows,

$$\text{CI} = \left[\frac{\sum_{j}^{n} \beta_j}{1 - \sum_{i}^{m} \gamma_i} \right]. \tag{5}$$

CI is the long-run solution of the dynamic relationship (Hendry 1996, pp.213). When the CIT position is expressed as a percent of open interest, CI provides a direct elasticity measure of the effect on returns and volatility. When the position is expressed as the change number of contracts of open interest held by CITs, multiplying CI by the average change in number of contracts provides an elasticity measure.[14] A positive sign for CI is consistent with a "bubble-type" impact of CIT trading on commodity futures prices, while a negative sign is consistent with a "dampening-type" impact.

Results

The statistical analysis is focused on 2004-2008, when CIT traders were most active. This sample is further subdivided into two periods: 2004-2005 and 2006-2008. The use of an early and later period allows for possible differential effects that might exist as index funds initiated and built up their positions in commodity futures markets. Breaking the sample this way also corresponds to differences in the application of CIT classifications. As noted earlier, CIT classifications for 2006-2008 were applied retroactively to 2004-2005.

As an example of price behavior over 2004 through 2008, daily nearby prices, returns, and volatility for the corn futures market are presented in figure 3. The dominant trend in nearby corn future prices is the rise from about $2.20 per bushel in late August 2006 to a peak above $7.50 in early July 2008, over a three-fold increase. Volatility (annualized) increased even more on a proportional basis during the same time frame, from about 10% to a peak of nearly 80%.

Returns

Panel A of table 2 presents Granger causality estimation results for the impact of CIT position changes on futures returns using nearby and first deferred contracts for the 12 commodities and two periods (2004-2005 and 2006-2008). The *p*-values refer to the test of the null hypothesis that CIT position changes have no effect on returns (i.e., in equation (1) H_0: $\sum_{j=1}^{n} \beta_j = 0$). The

cumulative impact is given in equation (5) and reflects the dynamic response in percentage terms. Panel B of table 2 presents similar information for CIT impacts on futures returns when their market activity is measured in terms of percent of open interest. All of the estimated models presented in table 2 have lag structures of (1,1), (1,2), or (2,1). Table 3 presents results when a moving average position change and a moving average percent of open interest, respectively, (i.e., equation (3)) are used in the Granger causality tests for returns. Moving average lengths for the estimated models presented in table 3 vary between 5, 10, 15, and 20 days.

Results from table 2, which reflect the effect of daily position changes and daily percent of open interest, provide limited evidence that CIT positions affect commodity futures market returns. For daily position changes, six statistically significant CIT effects emerged on returns in five markets, three of which were negative. An inverse relationship suggests that as CIT traders increased positions market prices decreased, just the opposite of that expected under the bubble hypothesis.[15] The magnitude of the CIT effect in those markets with statistically significant coefficients is small. For instance, the largest cumulative impact during 2004-2005 is in soybeans, where a one percent change in CIT positions increases returns 0.105 percent and the average price of soybeans ($6.72/bushel) by 0.673 cents/bushel. There appears to be little difference in the findings between the periods and between nearby and deferred contracts, and the only weak pattern that emerges is the significance of the CIT effect in the soybean and soybean oil markets in the 2004-2005 period. Overall, only 6 of the 48 cumulative impacts shown in panel A of table 2 are statistically significant.

For the percent of open interest (panel B, table 2), results are slightly more pronounced with nine significant CIT effects, four of which are negative. The size of the coefficients again are small, but in the 2006-2008 nearby contracts exhibited slightly more significant CIT effects appear, but these are predominantly negative in sign. Again, a pattern emerges with significant CIT effects in the soybean and soybean oil markets both with negative signs in the nearby but positive signs in the first deferred contracts. Only 7 of the 48 cumulative impacts shown in panel B of table 2 are statistically significant.

Results from table 3, which reflect the longer-horizon moving average effects on daily returns, provide somewhat more evidence CIT market activity influenced returns. Seventeen significant CIT effects are encountered using a moving average of position changes (panel A), and nine significant CIT effects using a moving average percent of open interest (panel B). The signs continue to be somewhat mixed (12 of 17 and 3 of 9 are positive). Magnitudes of the coefficients for the significant moving average position changes are about twice as large as those for the average position changes in table 2, but the overall effects are still rather small. Here, the evidence of a CIT effect continues to emerge in soybeans and soybean oil, with some modest evidence in the "soft commodities" (coffee, cotton, sugar). The patterns of responses in the soybean and soybean oil markets are rather similar, particularly for the percent of total open interest measure, to those found using the short horizon (table 2). Only 18 of the 96 cumulative impacts shown in panels A and B of table 3 are statistically significant.

In sum, the CIT impact on commodity future returns is quite limited regardless of the measure of market participation considered. There also is no evidence that CIT positions had a

greater impact on returns during 2004-2005 when their positions were growing most rapidly. A total of 31 out of 192 estimated cumulative impacts (16%) are statistically significant, barely more than what one would expect based on randomness. The signs of the relatively few significant coefficients are as likely to be negative as positive and the magnitudes of the economic effects are very small. Finally, we also estimated models allowing for a structural break in the coefficients on lagged CIT activity variables. Breaks were associated with the month before contract expiration, when the bulk of CIT positions are rolled (see panel C in figure 2), and position changes greater than the 80th percentile. Standard Chow tests provide little evidence that the impact of CITs on returns differed between "small" and "large" position changes.[16]

Volatility

The results of the CIT effect on volatility are presented in a similar manner to the return findings. Table 4 provides the effect of daily CIT position changes and daily percent of open interest on the annualized future price volatility. Table 5 provides the effect of a moving average of CIT position changes and percent of open interest on price volatility. Not surprisingly, lag structures for the volatility models in tables 4 and 5 varied more than for the return models. Structures ranged from (1,1) to (5,4).

The importance of the CIT impact on price volatility varies to some degree by whether market activity is measured by position change or the percent of open interest and by whether a longer-term moving average measure of market activity is used. Using position change as a measure of market activity in a short-term context (panel A, table 4), the CIT effect on volatility is least pronounced with four of six significant coefficients negative in sign. Using the percent of open interest as a measure of CIT market activity, the number of significant effects increases compared to the position change findings but estimated magnitudes do not (panel B, table 4). There are 16 significant CIT effects, with 6 negative and 10 positive. Negative CIT effects emerge in the 2004-2005 nearby "soft" contracts and suggest that CITs provide market liquidity and dampen volatility in these markets. In most cases, the magnitudes of the CIT effect on volatility are small, but several larger effects emerge in the traditionally less liquid markets including cocoa, coffee, sugar, and live cattle and feeder cattle markets. Somewhat surprisingly, a large negative effect of CIT activity on volatility emerges in the CBOT wheat market.

Similar but less pronounced findings emerge using the long-horizon moving-average percent of open interest (table 5). Sixteen significant CIT effects appear with their signs split evenly between positive and negative. The pattern identified with the daily percent of open interest continues—a negative CIT effect in 2004-2005, particularly evidenced in the "soft" contracts, and a positive effect in the 2006-2008 deferred contracts where three markets exhibited a positive effect.

Overall, the evidence is stronger that CIT market positions influenceprice volatility, particularly when measured using percent of open interest in a longer-term context. While a nearly overall balance between significant positive and negative signs emerged (27 negative and 22 positive), signs across the measures suggest that CIT market activity had a dampening effect on volatility during the 2004-2005 period, particularly in the soft contracts, followed by a

heightening volatility effect during the 2006-2008, particularly in the first deferred contracts. The findings suggest during the 2004-2005 period that increasing CIT market activity served to provide liquidity to market. The heightening effect during 2006-2008 is somewhat surprising in light of CIT participation in the markets that tended to stabilize or even decrease modestly in the later period.

Contemporaneous Correlations

In table 6, bivariate contemporaneous correlations are presented for the daily measures of CIT position changes and the returns and volatility measures for 2004-2005 and 2006-2008.[17] Care must be taken interpreting the correlations. For instance, CIT positions may change in response to within the day changes in returns or CIT positions may cause returns to change. Both interpretations are possible. Nevertheless, the correlations provide an indication of the degree to which the measures are related.

The results are supportive of findings in the Granger causality analysis. Overall, very limited correlation exists between CIT position measures and daily returns. During 2004-2005, significant correlations are nonexistent except for the sugar and soybean markets, which exhibited negative and positive signs. During 2006-2008, modest statistically significant correlations $(\rho < |0.13|)$ emerge in five markets, with four of six significant CIT correlations negative in sign. More correlation exists between the CIT position measures and annualized volatility. During 2004-2005, correlations emerged in 7 markets and 12 cases. Most statistically significant correlations had a limited range $(|0.09| < \rho < |0.23|)$, and 8 of 12 significant relationships were positive in sign. Significant correlations were most prevalent in the cocoa market and when measured in terms of percent of open interest. During 2006-2008, significant correlations between CIT position measures and volatility emerged in 10 of the 12 markets, with 14 of the 18 significant correlations positive in sign. In general, the significant correlations were larger than in other periods, with many of the stronger positive relationships emerging in the deferred contracts using the percent of open interest as a measure of CIT market activity (e.g., cocoa).

Summary and Conclusions

A world-wide debate has erupted about the price impact of long-only 'index fund' speculators in commodity futures markets. A number of observers assert that buying pressure from index funds created a bubble in commodity prices during 2007-2008, which resulted in market prices far exceeding fundamental values. The purpose of this paper is to analyze the price impact of long-only index funds in commodity futures markets for the January 2004 through July 2008 period. Daily positions of index traders in 12 markets are drawn from the internal large trader reporting system used by the Commodity Futures Trading Commission (CFTC). The commodity futures markets include corn, soybeans, soybean oil, CBOT wheat, KCBOT wheat, feeder cattle, lean hogs, live cattle, cocoa, cotton, coffee, and sugar. Since index positions are available on a daily basis and disaggregated by contract the analysis is not be subject to data limitations of previous studies.

Granger causality tests are used to investigate whether a significant relationship exists between index trader position changes and commodity futures returns and volatility. The analysis is performed on nearby and first deferred contracts and separately for the 2004-2005 and 2006-2008 periods. The use of nearby and first deferred contracts allows for the influence of the index traders to emerge as they roll their positions. The use of an early and later period allows for possible differential effects that might exist as index traders initiated and built up their positions in commodity futures markets. Finally, to allow for the possibility that the effect of index traders in commodity futures markets is more accurately reflected as their positions accumulate, we also assess the relationship between longer-term moving-average position changes and daily returns and their volatility.

Results provide very limited evidence to support the argument that index fund trading affects the direction and magnitude of commodity futures returns, regardless of how positions are measured. There is no evidence that index positions had a greater impact on returns during 2004-2005, when their positions were growing most rapidly. A total of 31 out of 192 estimated cumulative impacts (16%) are statistically significant, barely more than what one would expect based on randomness. The signs of the relatively few significant coefficients are as likely to be negative as positive and the magnitudes of the economic effects are very small. These findings are consistent with other research that uses a higher level of aggregation for index trader positions (e.g., Stoll and Whaley 2009) and most research on the effects of large trader positions on commodity market returns (e.g., Sanders, Irwin, and Merrin 2009).

Some evidence is found that volatility has been influenced by the presence of index traders in several markets, but only using one of the measures of index position changes. These effects appear to be small in economic magnitude, except in several traditionally less liquid markets. While the overall balance between significant positive and negative signs is nearly equal, index trader positions appear to have had a dampening effect on volatility during 2004-2005 particularly in the soft commodity contracts, followed by a heightening effect during 2006-2008 in deferred contracts. The mixed volatility results may simply reflect divergent effects over time and markets and/or highlight the difficulty in explaining price variability. They may also be reflective of the dramatic increase in price volatility that occurred during this period that may have confounded analysis. Further research to develop a more comprehensive understanding of volatility dynamics in the presence of index trader activity certainly seems warranted.

The results of this study provide the strongest evidence to date that ‘long-only’ index funds have a minimal impact on commodity futures price movements. This has important implications for the ongoing policy debate surrounding index fund participation in commodity futures markets. In particular, the results provide no justification for limiting the participation of index fund investors. Since there is some evidence that index funds provide liquidity and dampen price volatility, limiting index fund positions may be harmful in that an important source of liquidity and risk-bearing capacity may be removed at a time when both are in high demand.

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Endnotes

[1] The source is the CFTC *Quarterly Index Investment Data* report found at: http://cftc.gov/marketreports/IndexInvestment/index.htm.

[2] In reality, a variety of investment instruments are typically lumped under the heading 'commodity index fund.' Large institutional investors, such as pension funds, may enter directly into over-the-counter (OTC) contracts with swap dealers to gain the desired long exposure to returns from a particular index of commodity prices. Some firms also offer investment funds whose returns are tied to a commodity index. Exchange-traded funds (ETFs) and structured notes (ETNs) have also been developed to make it easier for smaller investors to obtain commodity exposure in their portfolios. ETFs and ETNs trade on securities exchanges in the same manner as stocks on individual companies. See Engelke and Yuen (2008) and CFTC (2008b) for additional details.

[3] Despite the overwhelmingly negative results of their statistical analysis, Robles, Torero, and von Braun (2009) nonetheless assert there is sufficient evidence of the damaging role of speculation to warrant the creation of a new international organization to counteract this market failure. See Wright (2009) for further discussion.

[4] Delta is the change in option price for a one percent change in the price of the underlying futures contract. Adjusting options positions by delta makes options positions comparable to futures positions in terms of price changes.

[5] The data do not include positions of day traders or scalpers since these participants seldom carry positions overnight.

[6] This assumption does not imply that the number of CIT traders is constant across the sample period. In fact, the number of CIT traders rises over time in parallel with the rise in aggregate CIT positions. For example, the number of CIT traders in corn increases from 7 in 2000 to 31 in 2008. Retroactive application of CIT classifications prior to 2006 could induce two types of misclassification error. First, CITs that traded between 2000 and 2005 but ceased operation sometime before 2006 would be excluded from the CIT category over 2000-2005. Second, traders classified as CITs over 2006-2008 would be incorrectly categorized as CITs over 2000-2006 if they changed their line of business at some point before 2006. Given the stability in CIT classifications over 2006-2008 the likelihood of either type of error is minimal.

[7] The patterns in the corn market are representative of those identified in other markets except where identified in the text. Similar figures for the other commodities are available from the authors.

[8] CITs did not trade in the August and September soybean contracts, August, September, and October soybean oil contract, May lean hog contract, or October cotton contract.

[9] This material can be found at the following website: http://www2.goldmansachs.com/services/securities/products/sp-gsci-commodity-index/roll-period.html.

[10] An alternate methodology would be to test each contract maturity separately, but this would create many small data sets that would limit the power of each individual test. In addition, the numerous test results would have to be aggregated in some manner to reach overall conclusions.

[11] The simple correlation coefficient between the two series is -0.94.

[12] There is evidence in the data that CITs lengthen the roll period over time in an effort to reduce trade execution costs. We computed the proportion of nearby position changes that occur during the so-called "Goldman roll window." Specifically, the numerator is the change in positions that occur over the 5th through 9th business days in the month prior to expiration and the denominator is the change from the 15th of the month two months prior to expiration to the last business day in the month prior to expiration. On average, this proportion dropped from about two-thirds of position changes to about half between 2004 and 2008. Complete results of this analysis are available from the authors.

[13] Since non-stationarity tests have low power, Enders (1995) argues that rejection of the null with a constant and trend provides strong evidence that a series is stationary. Detailed results are available from the authors.

[14] The long-run solution is informative when the sum of coefficients of the lagged dependent variable is positive, but negative signs can be a reflection of autocorrelation rather than an adjustment process. When the sum was negative (which occurred in several cases), we use only the numerator in CI to measure the distributed effect of the CIT position.

[15] Negative signs are not implausible due to the rebalancing of index fund positions over time. For a fixed dollar investment and to maintain fixed investment weightings, index funds must reduce (increase) the number of contracts for commodities that rise (fall) in price.

[16] These results are available from the authors.

[17] Moving average measures were not included as their meaning is longer-term in nature.

Table 1. Average Daily Net Long Open Interest of Commodity Index Traders (CITs) in 12 Commodity Futures Markets, All Contracts, 2000-2008

	Year								
Market	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Panel A: Number of Contracts									
Corn	28,618	30,217	48,209	53,656	117,364	233,142	394,008	357,482	409,542
Soybeans	6,483	4,920	9,563	28,279	36,692	76,884	114,627	147,449	166,709
Soybean oil	-147	-41	949	1,377	10,773	38,030	65,806	72,351	72,043
Wheat CBOT	20,098	18,704	21,439	25,702	56,682	134,408	195,180	185,341	178,940
Wheat KCBOT	5,569	5,777	7,921	9,543	14,971	18,210	25,480	31,372	30,411
Feeder Cattle	-15	-14	1,551	1,933	2,838	4,362	6,562	8,315	9,716
Lean Hogs	7,827	6,479	8,654	10,546	26,801	43,871	76,923	80,275	108,593
Live Cattle	22,271	12,779	12,067	13,941	33,118	52,931	86,152	112,310	135,777
Cocoa	2,201	1,451	1,893	2,614	11,556	7,483	13,272	17,534	27,143
Coffee	2,703	1,495	2,868	6,914	21,677	23,114	33,862	42,716	60,144
Cotton	4,948	4,015	5,559	7,864	16,043	38,696	71,430	87,229	105,433
Sugar	12,851	10,093	17,669	23,496	61,972	98,672	136,135	230,434	349,034
Panel B: Percent of Total Open Interest									
Corn	7	7	10	13	19	33	32	28	29
Soybeans	4	3	5	13	17	28	31	29	33
Soybean oil	0	0	1	1	7	25	28	25	26
Wheat CBOT	15	14	20	24	37	55	46	46	47
Wheat KCBOT	8	8	11	16	23	21	18	24	28
Feeder Cattle	0	0	12	11	17	17	23	30	28
Lean Hogs	17	16	26	25	34	43	48	44	47
Live Cattle	18	11	12	13	29	35	38	45	48
Cocoa	2	1	2	3	11	6	10	12	17
Coffee	6	3	4	9	23	25	31	28	37
Cotton	8	6	8	10	20	38	46	41	41
Sugar	7	7	10	12	21	24	28	33	38

Notes: Data for 2008 end on August 1, 2008. Positions of commodity index traders (CITs) are aggregated across all contract maturity months on a given day and exclude options positions.

Table 2. Granger Causality Test Results for the Null Hypothesis that Commodity Index Traders (CITs) do not Cause Daily Returns in 12 Commodity Futures Markets, 2004-2008

	2004-2005				2006-2008			
	Nearby Contract		First Deferred Contract		Nearby Contract		First Deferred Contract	
Market	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier
Panel A: Change in CIT Net Long Open Interest								
Corn	0.91	-0.002	0.33	-0.036	0.23	0.050	0.95	-0.003
Soybeans	**0.01**	**0.105**	0.18	0.061	0.05	0.077	0.18	0.055
Soybean oil	**0.02**	**0.044**	**0.05**	**-0.005**	0.07	0.062	0.23	0.030
Wheat CBOT	0.16	-0.030	0.08	-0.055	0.49	0.042	**0.03**	**-0.008**
Wheat KCBOT	0.27	-0.063	**0.04**	**-0.087**	0.14	0.052	0.05	-0.021
Feeder Cattle	0.28	-0.040	0.54	-0.023	0.81	-0.006	0.45	-0.015
Lean Hogs	0.75	0.011	0.17	-0.049	0.60	0.019	0.19	-0.039
Live Cattle	0.27	0.029	0.83	-0.002	0.35	-0.021	0.12	-0.032
Cocoa	0.89	0.005	0.75	0.015	0.93	0.003	0.77	0.010
Coffee	0.29	-0.045	0.13	-0.087	0.71	0.013	0.37	0.036
Cotton	0.72	0.010	0.97	-0.001	0.09	0.047	0.84	-0.006
Sugar	0.44	-0.016	0.09	-0.043	**0.01**	**0.066**	0.25	0.045
Panel B: CIT Net Long Open Interest as a Percent of Total Open Interest								
Corn	0.56	-0.004	0.67	-0.002	0.29	-0.002	0.84	-0.001
Soybeans	**0.01**	**-0.013**	**0.03**	**0.009**	**0.05**	**-0.007**	**0.01**	**0.008**
Soybean oil	0.11	-0.009	0.93	0.000	**0.00**	**-0.012**	**0.00**	**0.011**
Wheat CBOT	0.85	-0.001	0.36	-0.002	0.19	-0.005	0.42	0.003
Wheat KCBOT	0.22	-0.009	0.76	-0.001	0.06	-0.013	0.06	0.001
Feeder Cattle	0.63	0.001	0.64	-0.001	0.83	0.000	0.25	-0.002
Lean Hogs	0.17	-0.004	0.39	0.000	0.96	0.000	0.72	-0.001
Live Cattle	0.21	-0.002	0.70	-0.001	**0.03**	**0.001**	0.05	-0.002
Cocoa	0.72	-0.004	0.99	0.001	0.83	-0.003	0.95	-0.001
Coffee	0.34	0.010	0.10	-0.012	0.61	0.004	0.69	-0.002
Cotton	0.62	0.005	0.59	-0.003	0.52	-0.006	0.46	-0.002
Sugar	**0.03**	**0.024**	0.29	-0.007	**0.00**	**-0.027**	0.22	0.005

Notes: Data for 2008 end on August 1, 2008. The *p* -values are used to test the null hypothesis that daily commodity index trader (CIT) positions do not impact daily futures returns. Bold values indicate statistical significance at the five percent level. Impact multipliers provide an estimate of the percent change in return for a one-percent increase in CIT market participation (change in position or percent of open interest).

Table 3. Long-Horizon Granger Causality Test Results for the Null Hypothesis that Commodity Index Traders (CITs) do not Cause Returns in 12 Commodity Futures Markets, 2004-2008

	2004-2005				2006-2008			
	Nearby Contract		First Deferred Contract		Nearby Contract		First Deferred Contract	
Market	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier
Panel A: Change in CIT Net Long Open Interest								
Corn	0.65	-0.032	0.66	-0.033	0.58	-0.057	0.27	-0.102
Soybeans	**0.00**	**0.180**	**0.00**	**0.178**	**0.00**	**0.152**	**0.02**	**0.121**
Soybean oil	**0.00**	**0.117**	0.12	0.064	**0.00**	**0.201**	**0.00**	**0.204**
Wheat CBOT	0.69	0.020	0.32	-0.046	0.08	0.203	0.15	0.138
Wheat KCBOT	0.70	0.028	0.88	-0.012	**0.04**	**0.239**	0.15	0.128
Feeder Cattle	0.22	-0.042	0.64	-0.039	0.12	-0.079	**0.03**	**-0.117**
Lean Hogs	0.22	-0.093	**0.04**	**-0.107**	0.15	0.133	0.10	-0.079
Live Cattle	0.51	0.026	0.13	-0.046	0.38	-0.023	**0.04**	**-0.049**
Cocoa	0.51	0.043	0.70	0.023	**0.01**	**0.163**	0.08	0.131
Coffee	**0.04**	**-0.112**	**0.04**	**-0.145**	0.34	0.039	0.36	0.044
Cotton	**0.02**	**0.059**	0.17	0.054	0.32	0.032	0.80	-0.008
Sugar	0.27	-0.027	0.17	-0.040	**0.00**	**0.111**	**0.02**	**0.110**
Panel B: CIT Net Long Open Interest as a Percent of Total Open Interest								
Corn	0.31	-0.004	0.26	-0.005	0.23	0.008	0.10	-0.011
Soybeans	0.67	-0.002	0.73	0.001	**0.00**	**-0.012**	**0.00**	**0.011**
Soybean oil	**0.03**	**-0.012**	0.07	0.009	**0.04**	**-0.007**	**0.01**	**0.007**
Wheat CBOT	0.57	-0.003	0.54	0.002	0.16	-0.006	0.30	0.004
Wheat KCBOT	0.05	-0.015	1.00	0.000	0.10	-0.012	0.52	-0.005
Feeder Cattle	0.84	-0.001	0.19	0.005	0.07	0.004	**0.02**	**-0.004**
Lean Hogs	**0.05**	**0.008**	**0.02**	**-0.006**	0.08	-0.006	0.12	0.004
Live Cattle	0.54	-0.001	0.20	-0.003	0.46	-0.002	0.09	-0.002
Cocoa	0.65	-0.006	0.36	0.012	0.50	0.010	0.70	-0.003
Coffee	0.47	0.008	0.21	-0.011	0.35	0.014	0.42	-0.005
Cotton	0.26	0.008	0.10	0.012	0.42	-0.005	0.46	-0.004
Sugar	0.05	0.025	0.29	-0.007	**0.00**	**-0.029**	0.25	0.005

Notes: Data for 2008 end on August 1, 2008. The *p* -values are used to test the null hypothesis that daily commodity index trader (CIT) positions do not impact daily futures returns. Bold values indicate statistical significance at the five percent level. Impact multipliers provide an estimate of the percent change in return for a one-percent increase in CIT market participation (change in position or percent of open interest).

Table 4. Granger Causality Test Results for the Null Hypothesis that Commodity Index Traders (CITs) do not Cause Daily Volatility in 12 Commodity Futures Markets, 2004-2008

	2004-2005				2006-2008			
	Nearby Contract		First Deferred Contract		Nearby Contract		First Deferred Contract	
Market	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier
Panel A: Change in CIT Net Long Open Interest								
Corn	0.59	0.391	0.44	0.289	0.29	0.662	0.88	-0.090
Soybeans	0.40	0.312	0.24	0.196	0.87	-0.110	**0.00**	**-0.895**
Soybean oil	0.68	-0.218	**0.00**	**-0.603**	0.88	-0.083	0.50	-0.316
Wheat CBOT	0.07	-0.492	0.06	-0.508	0.52	-0.799	**0.00**	**-1.811**
Wheat KCBOT	0.39	-0.219	0.25	-0.318	0.23	0.801	0.65	0.289
Feeder Cattle	0.07	-0.211	0.80	0.064	0.24	0.243	0.87	-0.023
Lean Hogs	0.30	0.184	0.48	-0.132	0.07	0.399	0.81	0.045
Live Cattle	0.31	-0.312	0.43	-0.299	**0.04**	**0.368**	0.32	0.175
Cocoa	0.39	0.198	**0.03**	**1.193**	0.20	0.584	0.11	0.820
Coffee	0.50	-0.183	0.76	0.116	0.99	0.008	0.71	-0.250
Cotton	0.30	-0.168	0.24	-0.283	0.70	-0.220	0.98	-0.016
Sugar	0.18	-0.278	0.79	-0.063	**0.01**	**-0.264**	0.34	0.728
Panel B: CIT Net Long Open Interest as a Percent of Total Open Interest								
Corn	0.68	-0.044	0.77	0.015	0.81	0.013	0.89	0.012
Soybeans	0.29	-0.060	0.23	0.019	0.06	-0.141	**0.00**	**0.203**
Soybean oil	**0.04**	**-0.116**	0.06	-0.032	0.42	-0.060	**0.00**	**0.194**
Wheat CBOT	0.12	-0.043	0.86	0.006	0.15	-0.138	**0.00**	**0.172**
Wheat KCBOT	0.09	-0.079	0.84	0.009	0.65	-0.046	0.31	0.118
Feeder Cattle	0.34	0.044	0.67	-0.010	0.13	0.027	0.17	-0.025
Lean Hogs	0.52	0.009	0.16	0.020	0.19	0.017	**0.03**	**0.033**
Live Cattle	0.83	-0.006	0.53	-0.025	0.15	0.007	**0.04**	**-0.024**
Cocoa	**0.01**	**0.204**	0.11	0.179	0.24	0.231	**0.00**	**0.527**
Coffee	**0.00**	**-0.259**	0.45	-0.041	0.34	-0.120	**0.00**	**0.218**
Cotton	**0.00**	**-0.157**	0.97	-0.002	**0.00**	**-0.376**	**0.01**	**0.251**
Sugar	**0.00**	**-0.288**	0.71	**0.022**	0.89	-0.021	**0.02**	**0.180**

Notes: Data for 2008 end on August 1, 2008. The *p* -values are used to test the null hypothesis that daily commodity index trader (CIT) positions do not impact daily futures volatility. Bold values indicate statistical significance at the five percent level. Impact multipliers provide an estimate of the percent change in return for a one-percent increase in CIT market participation (change in position or percent of open interest).

Table 5. Long-Horizon Granger Causality Test Results for the Null Hypothesis that Commodity Index Traders (CITs) do not Cause Volatility in 12 Commodity Futures Markets, 2004-2008

	2004-2005				2006-2008			
	Nearby Contract		First Deferred Contract		Nearby Contract		First Deferred Contract	
Market	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier	*p* -value	Impact Multiplier
Panel A: Change in CIT Net Long Open Interest								
Corn	0.41	0.486	0.41	0.567	0.53	-0.771	0.15	-2.028
Soybeans	0.48	-0.286	0.77	0.141	0.37	-0.856	0.10	-1.355
Soybean oil	0.75	-0.109	0.27	0.559	0.46	-0.779	0.64	-0.581
Wheat CBOT	0.16	-0.434	0.09	-0.587	0.10	-2.964	**0.04**	**-3.557**
Wheat KCBOT	0.57	0.267	0.58	-0.199	0.59	-0.702	0.38	-0.831
Feeder Cattle	0.77	-0.075	**0.01**	**-1.368**	0.19	-0.554	0.12	-0.550
Lean Hogs	**0.02**	**-0.868**	0.25	0.481	0.07	0.578	0.16	0.541
Live Cattle	**0.00**	**-1.377**	**0.00**	**-0.928**	**0.02**	**0.505**	0.07	0.366
Cocoa	0.30	-0.444	0.84	0.106	**0.01**	**4.275**	0.27	1.158
Coffee	0.05	1.713	**0.03**	**1.979**	0.32	1.070	0.58	-0.957
Cotton	**0.03**	**-0.612**	**0.02**	**-0.911**	0.37	0.683	0.48	0.691
Sugar	**0.01**	**-0.897**	**0.03**	**-1.156**	0.21	2.024	0.70	0.578
Panel B: CIT Net Long Open Interest as a Percent of Total Open Interest								
Corn	0.07	-0.084	0.39	0.037	0.28	-0.046	0.27	0.044
Soybeans	**0.02**	**-0.132**	0.62	0.019	**0.00**	**-0.197**	**0.00**	**0.159**
Soybean oil	**0.01**	**-0.136**	0.23	-0.049	0.70	-0.026	0.68	0.085
Wheat CBOT	0.13	-0.035	0.76	-0.007	0.13	-0.112	0.13	0.109
Wheat KCBOT	0.09	-0.094	0.83	-0.007	0.72	-0.036	0.72	0.177
Feeder Cattle	**0.00**	**0.067**	0.44	0.019	0.07	0.026	0.07	0.033
Lean Hogs	0.22	-0.026	0.62	0.006	**0.05**	**0.027**	0.06	0.033
Live Cattle	0.34	-0.024	**0.02**	**-0.041**	0.32	0.008	0.35	-0.020
Cocoa	**0.00**	**0.229**	0.99	0.002	**0.00**	**0.696**	**0.00**	**0.890**
Coffee	**0.00**	**-0.505**	0.20	-0.089	0.07	-0.230	0.07	0.310
Cotton	**0.00**	**-0.253**	0.26	-0.064	**0.00**	**-0.607**	**0.00**	**0.347**
Sugar	**0.00**	**-0.813**	**0.02**	**-0.272**	0.71	-0.047	0.71	0.314

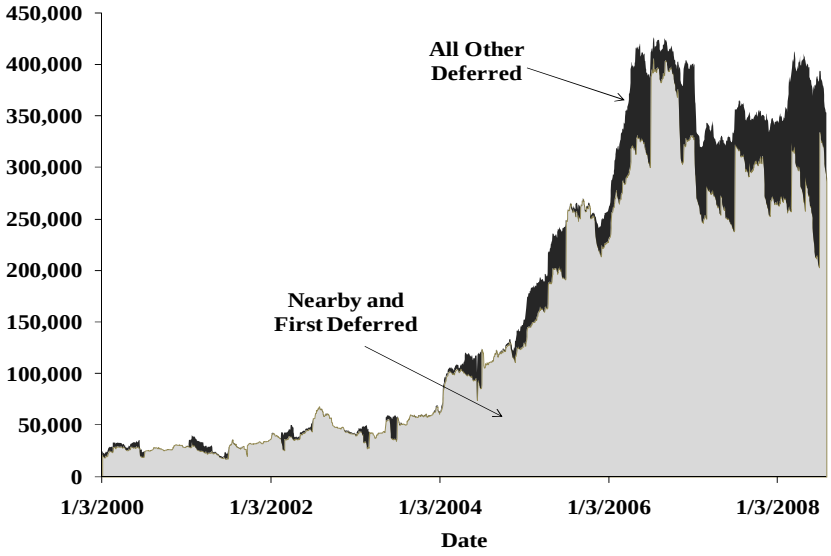
Notes: Data for 2008 end on August 1, 2008. The *p* -values are used to test the null hypothesis that daily commodity index trader (CIT) positions do not impact daily futures volatility. Bold values indicate statistical significance at the five percent level. Impact multipliers provide an estimate of the percent change in return for a one-percent increase in CIT market participation (change in position or percent of open interest).

Table 6. Contemporaneous Correlation Coefficients between Commodity Index Trader (CITs) Positions and Returns or Volatility in 12 Commodity Futures Markets, 2004-2008

	2004-2005				2006-2008			
	Nearby Contract		First Deferred Contract		Nearby Contract		First Deferred Contract	
Market	Change in Position	% of Open Interest	Change in Position	% of Open Interest	Change in Position	% of Open Interest	Change in Position	% of Open Interest
Panel A: CIT Positions and Returns								
Corn	0.007	-0.029	-0.011	-0.034	0.016	-0.011	0.013	-0.016
Soybeans	-0.076	**-0.112**	0.051	0.071	-0.047	**-0.091**	0.047	**0.086**
Soybean oil	0.033	-0.049	0.013	0.004	0.033	-0.049	0.013	0.004
Wheat CBOT	-0.044	0.001	-0.030	-0.035	**0.091**	-0.074	-0.052	0.022
Wheat KCBOT	0.017	-0.062	-0.063	-0.012	0.037	**-0.081**	0.024	0.019
Feeder Cattle	0.050	0.040	-0.017	-0.079	0.058	-0.009	-0.050	-0.052
Lean Hogs	0.026	-0.048	-0.004	-0.047	-0.016	-0.027	0.055	-0.024
Live Cattle	-0.040	-0.066	0.054	-0.007	0.057	0.019	-0.048	**-0.084**
Cocoa	0.005	-0.035	-0.017	0.032	0.007	-0.022	0.042	0.002
Coffee	-0.054	0.014	-0.015	-0.080	-0.030	-0.017	0.043	0.018
Cotton	-0.015	0.018	0.007	-0.019	0.016	-0.051	-0.023	-0.020
Sugar	0.050	**0.106**	-0.057	**-0.096**	-0.024	**-0.134**	0.056	0.037
Panel B: CIT Positions and Volatility								
Corn	-0.039	**0.090**	0.014	**0.190**	-0.060	0.001	0.004	0.073
Soybeans	0.019	0.074	0.031	0.028	-0.024	-0.031	-0.014	**0.134**
Soybean oil	0.031	0.010	-0.038	0.039	0.031	0.010	-0.038	0.039
Wheat CBOT	0.031	-0.016	-0.065	0.047	-0.038	-0.071	-0.024	**0.125**
Wheat KCBOT	0.013	0.038	-0.052	-0.014	**-0.122**	-0.062	**0.102**	**0.238**
Feeder Cattle	0.025	**0.225**	-0.023	-0.014	0.008	**0.175**	0.039	**-0.105**
Lean Hogs	0.012	**0.130**	-0.056	0.056	-0.047	**0.104**	0.017	**0.127**
Live Cattle	0.058	-0.011	-0.001	0.017	-0.075	-0.015	**0.079**	0.047
Cocoa	**-0.099**	**0.160**	**0.201**	**0.185**	-0.010	**0.163**	0.020	**0.286**
Coffee	0.042	**-0.108**	-0.014	-0.086	0.017	0.020	-0.016	**0.216**
Cotton	0.075	**-0.128**	-0.071	-0.036	-0.002	**-0.228**	0.004	**0.214**
Sugar	-0.003	**-0.120**	**0.095**	0.057	**-0.092**	-0.025	**0.092**	**0.266**

Notes: Data for 2008 end on August 1, 2008. Bold values indicate statistical significance at the five percent level.

Panel A: Number of Contracts



Panel B: Percent of Position in All Other Deferred Contracts

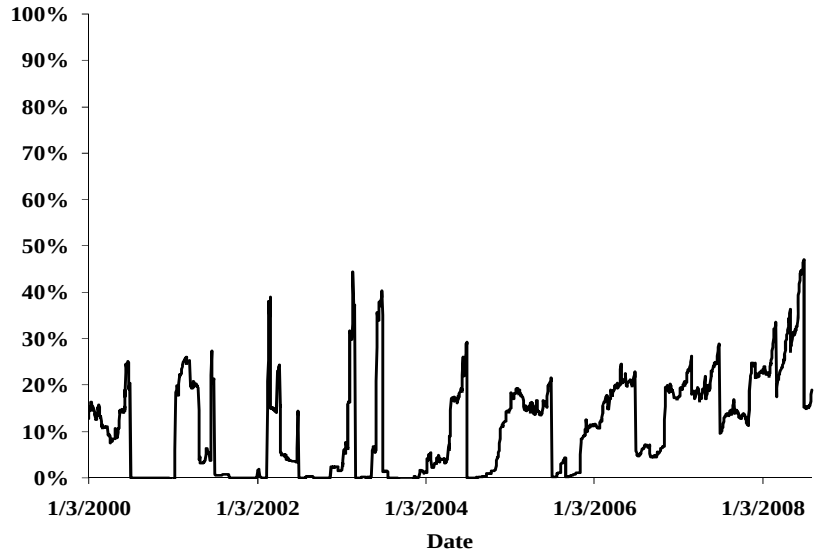
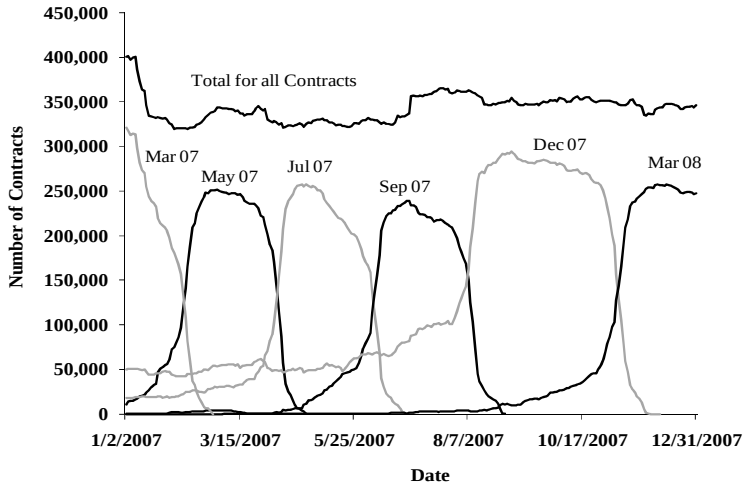
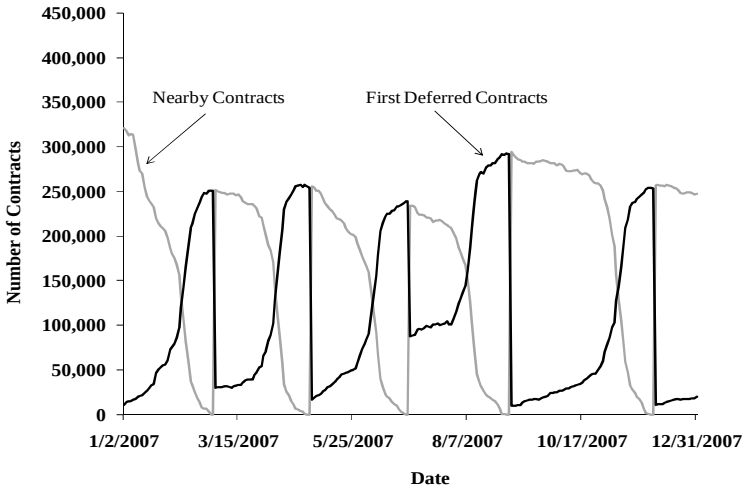


Figure 1. Composition of Daily Net Long Open Interest of Commodity Index Traders (CITs) in the Corn Futures Market, January 3, 2000 - August 1, 2008

Panel A: Total and Contract-by-Contract Net Long Open Interest



Panel B: Nearby and First Deferred Contract Net Long Open Interest



Panel C: Change in Nearby and First Deferred Net Long Open Interest

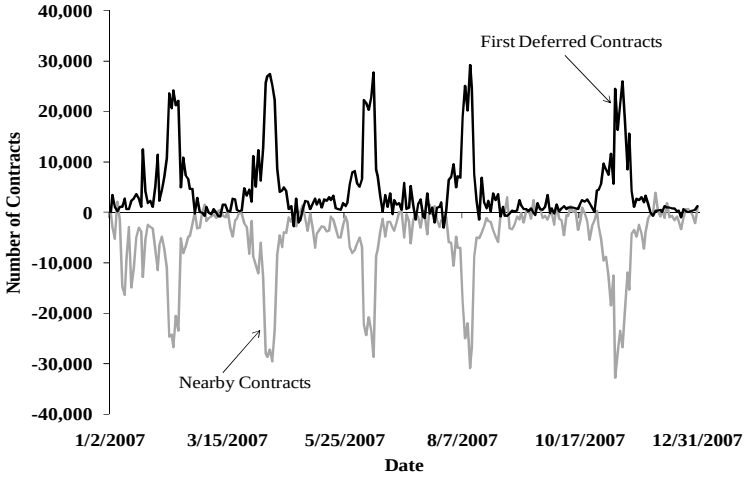
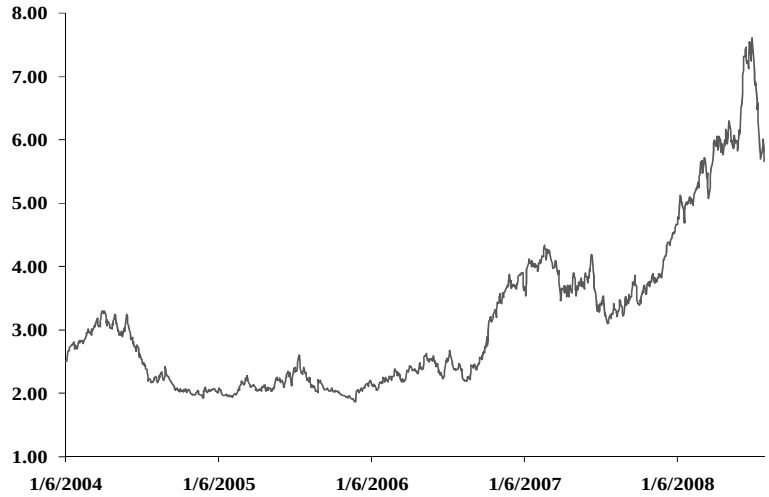
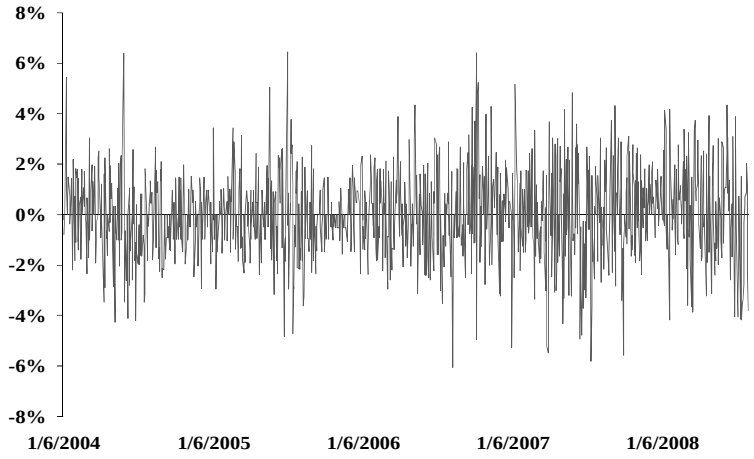


Figure 2. Level and Change in Daily Net Long Open Interest of Commodity Index Traders (CITs) in Corn, January 2, 2007 - December 31, 2007

Panel A: Price Level ($/bushel)



Panel B: Returns



Panel C: Volatility (annualized)

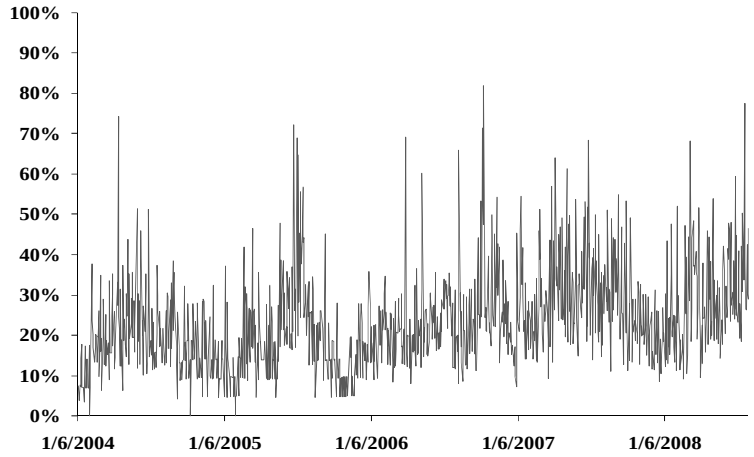


Figure 3. Daily Price Level, Return, and Volatility for Nearby Corn Futures Contracts, January 3, 2000 - August 1, 2008