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Ing-Haw Cheng
Andrei Kirilenko
Wei Xiong

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ABSTRACT

This paper analyzes the joint responses of commodity futures prices and traders' futures positions to changes in the VIX before and after the recent financial crisis. We find that while financial traders accommodate the needs of commercial hedgers in normal times, in times of distress, financial traders reduce their net long positions in response to an increase in the VIX causing the risk to flow to commercial hedgers. By exploiting a cross-section of traders, we provide micro-level evidence for a convective flow of risk from distressed financial traders to the ultimate producers of commodities in the real economy.

Ing-Haw Cheng
701 Tappan St
Ross School of Business
University of Michigan
Ann Arbor, MI 48109
ingcheng@umich.edu

Andrei Kirilenko
Office of the Chief Economist
1155 21st Street, N.W.
Washington, DC 20581
AKirilenko@CFTC.gov

Wei Xiong
Princeton University
Department of Economics
Bendheim Center for Finance
Princeton, NJ 08450
and NBER
wxiong@princeton.edu

During the recent financial crisis, policymakers were severely concerned by the amplification effects of financial intermediaries. A growing body of theoretical work (e.g., Kyle and Xiong 2001; Brunnermeier and Pedersen 2009; He and Krishnamurthy 2009; and Danielsson, Shin, and Zigrand 2010) highlights that, in the presence of frictions that constrain capital from flowing freely, financial intermediaries have to unwind positions across their holdings when suffering large capital losses or facing severe funding risk during a crisis. The liquidation of their holdings can exacerbate the crisis and cause synchronized price fluctuations across different asset markets. Policymakers, who were especially worried about systemic risk and the financial distress of financial intermediaries affecting the real economy, took efforts to bail out financial institutions following the failure of Lehman Brothers and again during the Greek debt crisis.

However, whether the distress of financial intermediaries matters to the dynamics of asset prices and the health of the economy is far from clear. In his recent Presidential Address to the American Finance Association, Cochrane (2011) made a compelling argument that a coordinated rise in the premium for systematic risk can explain the synchronized price fluctuations across different asset markets during the recent financial crisis without the need to resort to the stress of financial intermediaries. This crisis was accompanied by the worst economic recession in the United States since the Great Depression. Investors suffered large investment losses and, as a result, their appetite for financial market risk was greatly reduced just when they were confronted with deteriorating economic fundamentals and elevated economic uncertainty. These fundamental factors affected the discount rates that the standard asset pricing theories use to discount assets' future cash flows, and clearly had first-order effects on the synchronized asset price fluctuations during the crisis.

However, the success of the standard asset pricing models does not preclude potential roles played by distressed financial institutions and investors. Cochrane (2011, page 1071) acknowledges that "arguing over puzzling patterns of prices is weak." Instead, he urged the literature to provide micro-level evidence to resolve the debate: "Ideally, one should tie price or discount-rate variation to central items in the models, such as the balance sheets of leveraged intermediaries, data on who is actually active in segmented markets, and so forth."

In this paper, we use account-level position data in the commodity futures markets to analyze whether distressed financial institutions exacerbated the effects of outside shocks in commodity futures markets during the recent financial crisis. We examine commodity futures markets for three reasons. First, commodity futures markets lie outside the epicenter of the financial crisis, which largely originated in markets for securitized mortgage-backed securities, and thus offer a setting to evaluate the potential spillover effects of distressed financial institutions.

Second, we are able to identify account-level data on each trader's positions in commodity futures markets by making use of the Commodity Futures Trading Commission's (CFTC's) Large Trader Reporting System (LTRS) database. By regulation, when a trader's position in a commodity futures contract becomes larger than a certain threshold, clearing members are obligated to report the trader's end-of-day positions in the commodity to the CFTC. The reportable traders in the LTRS account for 70%-90% of open interest in any given commodity futures contract. This detailed coverage of traders' positions is not currently available in other markets.

Third, we analyze commodity futures markets because these markets allow real economy participants such as producers and users of physical commodities to hedge commodity price risk embedded in their commercial activity. The long-standing hedging-pressure theory, which was initially proposed by Keynes (1930) and Hicks (1939) and further developed by Hirshleifer (1988), emphasizes that commercial hedgers, who are typically net short in the commodity futures market, offer premia to attract non-commercial participants to take the long side. However, during the recent financial crisis, open interest in many agricultural commodities collapsed by as much as 50% just as the overall economic uncertainty, as represented by the VIX Volatility Index, was rising. As shown in Figure 1, these drops in open interest are striking—just when the uncertainty in the economy was spiking, the number of futures contracts used by commercial hedgers to hedge their risks was going down. Furthermore, after September 2008, open interest in commodity futures fluctuated like the reverse image of the VIX. A full account of this phenomenon requires not only understanding hedging behavior, but also the behavior of financial investors, who take the other (long) side.

Two types of financial traders, hedge funds and commodity index traders (CITs), typically take the long side. Hedge funds typically exploit price divergences caused by the unbalanced arrival of commercial hedgers across different futures contracts for the same commodity or among multiple commodities. CITs, a new class of traders that emerged during the mid-2000s, tend to be long-only portfolio investors who treat commodity futures as a new asset class among more traditional asset classes, such as stocks and bonds, and take long positions in the market. Based on each trader's registration with the CFTC and its positions in the LTRS database, we classify the trader as a commercial hedger, a hedge fund, a CIT, or another category.

Our analysis examines whether risk was systematically re-allocated among market participants as uncertainty spiked during the crisis. We focus on the joint dynamics of commodity futures prices and the traders' positions in response to changes in the VIX. The VIX, a commonly used measure of the implied volatility of S&P 500 index options, is widely recognized as an important forward-looking indicator of uncertainty faced by financial market investors. Although fluctuations in the VIX affect the representative agent's discount rate for assets and thus commodity prices, the representative agent theory treat agents as homogeneous and, thus, does not predict any one trader group's positions systematically reacting more strongly to outside market shocks than any other group.

We focus on the VIX as it allows us to contrast theories of risk allocation and exploit differential predictions of how different traders should respond to increases in the VIX. The first hypothesis we examine is what we term the "distressed financials hypothesis." The VIX affects the financial health of financial traders and commercial hedgers. During the recent financial crisis, many financial traders such as CITs and hedge funds reportedly suffered large losses. As a result, an increase in the VIX would add to their stress and likely cause them to reduce their net holdings of commodity futures. On the other hand, the "hedging pressure theory" implies that increases in the VIX would first and foremost expose commercial hedgers to a greater wedge between costs of external and internal financing and greater default risk, and thus provide greater incentives to hedge their commodity price risks. As a result, the hedging pressure hypothesis predicts that an increase in the VIX would lead commercial hedgers to increase their net short positions. In order for the market to clear, financial investors, who take the other side, would have to increase their net long positions as well.

The key difference between the two hypotheses is the direction in which the risk is flowing. Like the convection of a current of air that flows from a high-pressure area to a low-pressure area, a "risk convection" makes the risk flow from the more distressed groups to the less distressed groups. The distressed financials theory predicts that the risk flows from financial investors towards commercial hedgers, while the hedging-pressure theory predicts that the risk flows in the opposite direction. Another way to phrase this is in terms of liquidity: the distressed financials theory predicts that financial institutions were consuming, rather than providing liquidity, which is opposite the prediction of the hedging pressure theory.

Our baseline analysis examines the aggregated position response of CITs, hedge funds, and commercial hedgers to changes in the VIX. We find that after September 2008, both CITs and hedge funds displayed immediate significant and negative position responses to increases in the VIX in a large number of commodity futures markets. Commercial hedgers took the other side and displayed a positive position response to increases in the VIX, meaning they tended to reduce their net short positions just as uncertainty was rising. The increases in the VIX were also accompanied by significant price drops in almost all commodity futures. While the price drops are consistent with the discount rate theory, the pattern of position changes indicates unbalanced stress across trader groups and a convective flow of risk from financial institutions towards commercial hedgers, and, in particular, favors the distressed financials hypothesis. In contrast, prior to September 2008, neither financial traders nor commercial hedgers exhibited significant responses to the VIX.

By exploiting the cross-section of traders within different trader groups, we also provide additional empirical evidence in support of the distressed financials hypothesis. First, we find that CITs with larger CDS spreads were more sensitive to changes in the VIX. We interpret this finding as further direct support of the link between the financial distress of CITs and reductions in their risk exposures. Second, we find that net short hedgers bought commodity futures, while net long hedgers did not reduce their positions or even bought commodity futures in response to an increase in the VIX. We interpret this evidence as contradictory to the hedging pressure theory as greater hedging incentives should have caused both net long hedgers and net short hedgers to increase their exposures in opposite directions. Instead, it suggests that commercial hedgers were induced to fulfill the more severe trading needs of financial traders despite their own needs to hedge. Taken together, the empirical evidence shows that during the financial crisis, in response to a spike in the VIX, financial traders consumed liquidity from commercial hedgers instead of providing liquidity to facilitate the hedging needs of commercial hedgers.

To the extent that financial traders might be faster than commercial hedgers to absorb information contained in VIX changes, there is yet a third possibility: that financial investors have an informational advantage over commercial hedgers. We provide two pieces of evidence to evaluate whether the behavior we see is consistent with this "informational advantage" hypothesis. First, we use the account-level data to classify a set of hedgers who trade actively, defined as the top 10% most active commercial hedgers in the previous year. We find that these traders were more likely to take the other side of financial traders' trades than passive commercial hedgers, even though the active hedgers are more likely to be attentive to information contained in VIX changes. Second, the position responses of financial traders and especially those of CITs are persistent even after a 13-week window, suggesting that they represent permanent position changes as opposed to transitory trading driven by informational advantages. Taken as a whole, there is little evidence to corroborate the informational advantage hypothesis.

Finally, we analyze how commercial hedgers adjust their cash positions (physical stocks, and purchase and sales commitments) in response to changes in the VIX. We make use of a CFTC dataset on the cash positions of bona fide commercial hedgers in a subset of agricultural commodities subject to federal position limits. We find that bona fide hedgers reduced their net short positions in commodity futures in response to changes in the VIX as well as their long positions in cash commodities. Large traders who have been granted bona fide hedger designations by the CFTC are typically agribusiness middlemen rather than farmers. Thus, the fact that they reduced their long position in cash agricultural commodities in response to an increase in the VIX suggests that they reduced purchase commitments to farmers, which, in turn, led risk to flow towards the ultimate producers of these commodities.

The literature offers limited micro-level evidence of the market impact of distressed financial institutions. Mitchell, Pedersen, and Pulvino (2007) describe two episodes in which specialized arbitrageurs lost significant amounts of capital in convertible bond markets and, as a result, turned from liquidity providers to liquidity consumers. Adrian and Shin (2009) document cyclical leverage and balance sheets of financial brokers and dealers. He, Khang, and Krishnamurthy (2010) document the reallocation of mortgage-backed securities during the recent financial crisis from institutions dependent on repo financing, such as hedge funds and brokerdealers, to institutions with more secured financing, such as commercial banks. Equipped with detailed end-of-day position data for almost all participants in the commodities futures markets, we not only examine the position changes of financial institutions, but simultaneously examine position changes of commercial hedgers, who, we find, facilitated the reduction in positions of financial institutions. The latter establishes a channel for distressed financial institutions to impact the real economy.

Our analysis also adds to the ongoing debate on the financialization of commodity futures markets. The growing presence of financial traders in these markets together with episodes of large price volatility raises concerns that their trading may distort commodity prices. However, the evidence regarding an even more elementary question of whether these traders impact commodity prices remains elusive and controversial among researchers (e.g., Tang and Xiong 2010; Buyuksahin and Robe 2010; Stoll and Whaley 2010; Hamilton and Wu 2011; Irwin and Sanders 2011; and Singleton 2011). Our analysis shows that while the positions of CITs and hedge funds complements the hedging needs of commercial hedgers in normal times, their own financial distress rendered them liquidity consumers rather than providers during the financial crisis.

The paper is organized as follows. In Section 1, we describe both the data and the market participants in commodity futures markets. In Section 2, we introduce the hypotheses. Next we examine the joint responses of futures prices and traders' positions to VIX changes across a set of commodity futures markets in Section 3. In Section 4, we examine the cash positions of commercial hedgers using a subset of commodities. Section 5 concludes the paper.

1. The Data and Market Participants

The CFTC publishes weekly reports on long and short positions of trader groups: the Commitments of Traders (COT) and the Supplemental COT on Commodity Index Traders. The data underlying these public reports comes from the CFTC's proprietary LTRS database. As described in detail below, the LTRS data, which we use in this study, includes disaggregated end-of-day positions for each large trader in all commodity futures and options market subject to the jurisdiction of the CFTC.

Our data spans January 1, 2000 to June 1, 2011. We first apply a sequence of data-cleansing steps, described in detail in the Data Appendix. We focus on large traders with positions in the 19 U.S. commodity futures included in the Standard & Poor's-Goldman Sachs Commodity Index (SP-GSCI Index) and the Dow Jones-UBS Commodity Index (DJ-UBSCI). Table 1 lists these commodities and their respective index membership.

1.1 The LTRS data

The CFTC's Large Trader Reporting System (LTRS) compiles daily data of traders' long and short end-of-day positions in individual commodity futures contracts [e.g., a Chicago Board of Trade (CBOT) corn futures contract expiring in December 2001], as well as futures equivalents of commodity options contracts subject to the jurisdiction of the CFTC. Every day, positions in excess of a specified reporting threshold, which varies by commodity, are reported to the CFTC by exchange clearing members, futures commission merchants, and foreign brokers for market oversight purposes. Aggregate positions in LTRS account for 70%-90% of open interest in any given market.

Based on the LTRS data, we construct a weekly time series from 2001 to 2011 that matches the timing of the Tuesday-to-Tuesday COT reports. As a matter of convention, for a weekly time series, when we refer to a time period as September 15, 2008 to June 1, 2011, we are referring to the week ending in the first Tuesday after September 15, 2008 through the week ending the first Tuesday before June 1, 2011.[1] We focus on a weekly frequency, as it allows us to examine position responses at an intermediate frequency and facilitates comparison with existing COT reports.

Although we have data on positions for each individual futures contract expiration, we aggregate the number of contracts across commodities to gain a total picture of a trader's exposure to that commodity. To facilitate interpretation, we normalize positions to a notional dollar value using fixed-index contract prices as of December 15, 2006. As our empirical tests focus on each individual commodity separately, this ad hoc choice of date is innocuous as it is simply a scaling factor on the number of contracts.

[1] Thus, two periods of September 15, 2008 to January 1, 2009 and January 1, 2009 to January 1, 2010 are non-overlapping.

We define excess returns in a commodity as the returns from holding a generic futures contract that tracks the currently indexed contract. This is the return to a position that is always invested in the currently indexed contract. It accounts for a roll return where the position in the currently indexed contract is liquidated and reinvested in the next indexed contract at the end of the day before the generic contract begins tracking the next indexed contract. During a month in which the index calls for the generic contract to switch underlying contracts, we roll contracts on the fifth business day of that month.[2] We roll contracts according to the S&P GSCI roll schedule, which generally rolls out of shorter-dated contracts in the month before expiration (when delivery is close and liquidity drops) and into the next liquid longer-dated contract.[3] Tracking the indexed contract also ensures that our generic contract is always liquid. To facilitate outside replication, we construct this rolling return from the settlement price data of underlying futures contracts in Bloomberg.

In addition to end-of-day exposure information, each trader in the LTRS database has a number of specific attributes that identify its registration, designation or reporting status (e.g., a commodity pool operator or a commercial distributor). In our analysis, we make use of both the disaggregated positions and the registration/designation/reporting status of large traders. We use this information, as well as the prior year's position patterns, to classify each trader in any given year. We give a rough outline of our classification below; full details are in the Appendix.

1.2 Major groups of market participants

Commercial hedgers such as farmers and producers regularly trade commodity futures to hedge commodity price risk inherent in their commercial activities. For example, farmers enter into short positions in grains futures contracts to lock in prices on crops that are yet to be harvested. That way, if cash prices for grains go down, the farmers make less by selling their crop to a local elevator, but gain on their short futures positions on, for example, the Chicago Board of Trade.

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[2] The GSCI rolls smoothly over the fifth through ninth business days; for simplicity we switch contracts on the fifth day. The monthly roll schedule for the GSCI is provided in the Data Appendix. We define the fifth business day as the fifth trading day of the month, where a trading day is a day in which all 19 commodities have positions.

[3] The DJ-UBSCI switches contracts on a more infrequent schedule. We use the S&P GSCI schedule for most commodities as it rolls more frequently. When switching to the longer-dated contract, the GSCI will occasionally skip certain expirations for liquidity reasons (e.g., October gold is skipped). For soybean oil and copper, we use the DJ-UBSCI roll schedule, since soybean oil is not in the GSCI and the GSCI tracks copper contracts traded in London (for which we have no data) rather than the CME.

On the other hand, bakers and feed producers who need to buy grain from elevators enter into long grain futures positions. For them, if cash prices for grains go up, they need to pay more to buy from a local elevator, but gain on their long grain futures positions at the exchange. Despite the diversity of the commercial hedgers, in the aggregate they tend to be net short in commodity futures. The long-standing hedging-pressure theory posits that commercial hedgers need to offer premia to attract non-commercial buyers to absorb their net short positions due to a limited commercial buyer interest on the long side.[4] In our analysis, we classify commercial hedgers as traders in the LTRS system with registration, reporting and designation codes that clearly indicate commercial use in all the commodities in which they trade. We use a conservative classification compared to the Commitment of Traders (COT) reports in that we require commercial usage in all commodities in which a trader trades, as well as an explicitly stated purpose for commercial usage (e.g., a "Livestock Feeder").

Hedge funds who trade in commodity derivatives must register with the CFTC as Commodity Pool Operators (CPOs). If they do not trade commodity derivatives, but provide advice to their clients, they must register as Commodity Trading Advisors (CTAs). These funds invest others' money on a discretionary basis in commodities, commodity futures, and options on futures. They make use of leverage as only a fraction of money that must be paid to enter into a position. Moreover, they face far fewer trading restrictions than traditional money managers, such as mutual funds and pension funds. For example, they may enter into both long and short positions, trade spreads, and construct complex trading strategies, which include both commodity derivatives and cash positions. The use of leverage makes funding risk an important part of their business. In several historical episodes, inability to secure funding caused some hedge funds to bail out of positions during market stress, such as the crisis of the Long-Term Capital Management in 1998. In our analysis, we classify hedge funds as traders who are registered with the CFTC as commodity pool operators and commodity trading advisors or designated in the LTRS as managed money.

A new breed of commodity market participants—commodity index traders—emerged

[4] This theory was initially proposed by Keynes (1930) and Hicks (1939) and further developed by Hirshleifer (1988). Consistent with this theory, Bessembinder (1992), de Roon, Nijman and Veld (2000), and Acharya, Lochstoer, and Ramadorai (2010) find that returns of commodity futures increase with commercial hedgers' hedging needs after controlling for systematic risk.

during the mid-2000s. After the U.S. equity market collapsed in 2001, attractive historical returns from investing in commodity futures together with their slightly negative correlations with equity returns, as summarized by Erb and Harvey (2006) and Gorton and Rouwenhorst (2006), motivated many prudent buy-side financial institutions, such as university endowments, insurance companies, and pension funds, to incorporate commodities as a new asset class in their portfolios. These institutions tend to focus on strategic asset allocation between commodities and other asset classes, including stocks and bonds, and designate assets among specific commodities to a commodity investment index that tracks performance of a basket of commodity futures contracts.[5] Thus, they are often referred to as commodity index traders.[6] As CITs are exposed to stock market fluctuations through their stock positions, they may need to tighten up their risk exposures in commodities after suffering large losses in stocks. Unlike CPOs and CTAs, CITs are not a registered category with the CFTC. We identify CITs based on the CIT classification of the CFTC's Supplemental COT report and two additional criteria motivated by the trading patterns of broad-based portfolio investors in commodity indices: 1) they should be invested in many commodities (greater than eight in our sample); and 2) they should be mostly net long in those commodities over the previous year (more than 70% net long in our sample).

1.3 The netting problem and conflicting groups

The CFTC's LTRS database is designed for market oversight and enforcement purposes over markets subject to the jurisdiction of the CFTC. Until the adoption of the Dodd-Frank Wall Street Reform and Consumer Protection Act, the CFTC did not have jurisdiction of commodity swaps. As a result, the LTRS includes only a subset of positions of market participants in commodity derivatives. At a practical level, CITs often establish commodity index positions by

[5] A commodity index functions like an equity index, such as the S&P 500, in that its value is derived from the total value of a specified basket of commodity futures contracts with specified weights. These contracts are typically nearby contracts with delivery times longer than one month. When a first-month contract matures and the second-month contract becomes the first-month contract, a commodity index specifies the so-called "roll" (i.e., replacing the current contract in the index with a following contract). In this way, commodity indices provide returns comparable to passive long positions in listed commodity futures contracts. By far the largest two indices by market share are the SP-GSCI and the Dow-Jones UBS Commodity Index (DJ-UBS). These indices differ in terms of index composition, commodity selection criteria, rolling mechanism, rebalancing strategy, and weighting scheme. Instead of entering positions on individual futures contracts, CITs typically purchase financial instruments that give them exposures to returns of a commodity index. There are three types of such instruments: commodity index swaps, exchange-traded funds, and exchange-traded notes.

[6] See Tang and Xiong (2010) for an analysis of the growth of CITs and their potential impact on commodity prices.

acquiring index swap contracts from swap dealers, rather than taking long positions in individual commodity futures. Swap dealers then hedge themselves by taking long positions in individual commodity futures and report their futures positions to the CFTC. For this reason, CITs classified in our analysis are mostly swap dealers. As swap dealers are likely to hold positions of their own, their positions reported to the CFTC contain commodity exposures both of the clients and their own. Although this is a limitation of the LTRS data, we have an ex ante expectation of which commodities are more susceptible to these problems. In particular, this problem is quite severe in energies and metals, which have deep commodity swaps markets, but not in agricultural commodities, where swaps are quite rare.[7]

This netting problem of comingling different lines of business activity in the exposures reported to the CFTC goes beyond the CITs. Traders may be engaged in multiple lines of business, including, for example, both CIT business and managed money. As a result, a trader in the LTRS data may have multiple self-reported trader registrations. Therefore, it is possible for a trader to have designations of both a CIT and a commodity trading advisor (hedge fund). Thus, even the disaggregated LTRS data faces the netting problem across each trader's multiple business lines. We classify traders as CITs, hedge funds, and commercial hedgers while separately tracking groups of traders who have multiple designations (Figure 2), and use the LTRS data to resolve the problem of position overlap. It is important to note that our goal is not to measure the levels of positions in each trader group, but rather to capture the trading pattern of certain types of traders. There are eight total trader group categorizations: three conflict-free categories (CIT, Hedge Fund, Hedger); four conflict categories (CIT-HFs, Hedger-HFs, CIT-Hedgers, Triple), and other unclassified traders. The difference of the sum of these positions and zero are positions that are not reported to the CFTC.

1.4 Market participation of different trader groups

Commodities futures markets have grown dramatically over the past decade, and the nature of market participation has changed dramatically as well. Figure 3 is a map of market participation in commodities futures markets in 2010, the last full year in which we have position data. Each bubble represents a trader, with the color indicating the type of trader according to our

[7] This is noted in the CFTC's accompanying note to the Supplemental COT report. The note is available online at http://www.cftc.gov/ucm/groups/public/@commitmentsoftraders/documents/file/noticeonsupplementalcotrept.pdf.

classification, and with the area of the bubble proportional to the average dollar notional net position taken on by traders across the commodities they invested in during 2010. The vertical axis displays the average daily number of commodities in which a trader was invested during 2010, while the horizontal axis is our measure of whether a trader was long or short on average in these commodities, with a value of 50% indicating that the trader was on average net zero through most of the year.[8] Traders towards the bottom-left of the figure tend to be net short in a few commodities, while traders in the upper right tend to be long in many commodities. Recall that for a large trader to be designated as a CIT, we require this trader to have held positions in at least eight out of our designated 19 commodities and to have been at least 70% long during the year.

Several salient features about the market can be seen in Figure 3. First, there are relatively few commodity index traders, yet their net positions are typically very large. This is visible in Figure 3 with the clustering of a relatively few number of CIT and CIT-HFs bubbles in the upper right-hand corner. Table 2 reports summary statistics by trader types through time. Panel A reports the number of traders while Panel B reports the median dollar notional net position across traders within each category. In 2010, the median CIT had an average notional position size well in excess of $2 billion net long, and the median CIT-had an average position size of $700 million net long, even though there are only 32 traders between the two categories in 2010.[9] In contrast, the median commercial hedger was net short $7 million while the median hedge fund was net long $1.3 million.

Second, hedge funds tend to have slightly net long exposure, with 60% of their contracts long, as indicated in Figure 3 and in Panel D of Table 2. However, as Figure 3 suggests, there is substantial heterogeneity among hedge funds. Although hedge funds typically invest in only 2.6 commodities on average, far fewer than CITs (16.7 on average, as reported in Panel C), there are a number of hedge funds in our sample which have significant net positions in many commodities.

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[8] Specifically, we compute the double average (first equal-weight commodity average and then time average) of the number of long contracts by the total number of contracts in which a trader is invested.

[9] The number of traders is low compared to those reported in the public COT reports. In this sense, our classification scheme is conservative and likely an underestimate of the size of the CIT sector. For our purposes, we are more interested in the time series properties of changes in true CIT behavior.

Third, commercial hedgers are mostly invested in one or two commodities (on average, 1.2 commodities, as indicated in Panel D of Table 2), consistent with the nature of their specific hedging needs. While hedgers' positions are typically net short (25% long as indicated in Panel D of Table 2), there is a subset of hedgers taking net long positions. These net long hedgers are clustered in the lower right corner of Figure 3.

As indicated in Table 2, Panel A, there are a number of other unclassified traders. Although, as indicated in Panels B-D, most of these traders are small, some of them have a significant net short exposure. These traders might be commercial hedgers who were not registered with, reported to or designated by the CFTC as such. There are also a few CIT-HF traders; for confidentiality reasons, their exact count in not reported. The behavior of these traders, however, appears to be fairly similar to the 18 traders who had the CIT designation, but not a hedge fund designation. There are very few traders who have designations as both a Commercial Hedger and a Hedge Fund. Lastly, there were no traders who were classified as CIT-Hedger or who had all three designations.

Figure 4 presents market participation of different categories of traders for every year between 2000 and 2011. During this period, the landscape of commodity investing has fundamentally changed. Prior to 2004, there were fewer traders and fewer traders invested in multiple commodities. Since 2004, however, there has been an explosion in index investing, as evidenced by the growing number of bubbles and the growing size of bubbles in the upper right-hand corner marked by commodity indexers. In Table 2, Panel A shows that the number of traders has been increasing through time in the CIT, Hedge Fund, and Commercial Hedger categories, and Panel B shows that the average net notional position of the median CIT trader has exploded since 2004.

Figure 5 plots the aggregate net notional position of each trader category, where positions have been aggregated across all 19 commodities.[10] Although our categorizations are meant to conservatively capture the trading pattern of different groups in the market rather than the pure

[10] Figures 5 and 6 may exhibit jumps in positions on January 1 of each year, as positions are re-shuffled due to the re-categorization of traders on an annual basis. In this sense, the change in the aggregate level here is not the same as the flow on the first trading day of each year (or any week/time unit that spans multiple years), as the categorization changes. In subsequent calculations involving flows, flows are always computed using a constant sample composition. For example, the flow on the first trading day of the year for the CIT grouping is the change in position for the new group.

level of positions, the plots are useful in describing the pattern of investing through time. Panel A plots notional positions computed using contemporaneous prices and thus are a measure of actual value (in real December 2006 dollars), while Panel B computes notional positions using a fixed price throughout (December 15, 2006 prices). Evidently, the long side of the commodities futures markets has become increasingly dominated by commodity index traders and hedge funds, with commercial hedgers and other unclassified traders forming the bulk of the short side.

Figure 6 plots the aggregate net notional positions (using fixed prices) for each of the five sectors of commodities, and these observations seem to hold within each sector. However, it is evident that the netting problem is severe in the energy and metal sectors, with CITs "appearing" to take even a net short position in metals. This is consistent with the CFTC's acknowledgement in the Supplemental COT report that CIT positions are difficult to measure in the energy and metals markets due to the heavy use of commodity swaps in these markets.

To summarize the differences across trader groups, we compare second moments of trader flows rather than the first moments of levels. In contrast to other trader groups, commodity index traders should be relatively passive, and this is borne out in the data. Figure 6 shows that the volatility of position changes in grains, livestock, and softs is strikingly lower for CIT traders. Table 3 formalizes this by providing summary statistics on the flows for each trader category during the post-financial crisis sample period. The volatility of flows for CITs is substantially lower than other groups in nearly every commodity. Hedge funds have extremely high volatility of flows, with commercial hedgers and other unclassified traders in between. The magnitudes are striking: across the 12 agricultural commodities, the volatility of hedge fund flows is 2.6 times the volatility of CIT flow. However, although CITs are passive, their positions are not constant, as demonstrated by Figures 5 and 6, which show sharp decreases in CIT positions during the financial crisis.

1.5 Other data

Our data on the VIX, S&P 500 Total Return, and GSCI come from Bloomberg. We use the following weekly macroeconomic indicators as control variables: the Baltic Dry Index (from Bloomberg), the Moody's Baa credit spread (from the Federal Reserve Board), and the 10-year inflation compensation (Gürkaynak, Sack, and Wright 2010; data from their paper).[11] Our choice of macroeconomic indicators is constrained by our desire to focus on a weekly frequency. The Baltic Dry Index (BDI) tracks worldwide international shipping rates and is a measure of global demand for commodities; higher values represent higher shipping rates and greater expected demand. Higher Baa credit spreads indicate worsening credit conditions in the economy, and higher inflation compensation generally indicates higher inflation expectations.

2. Empirical Hypotheses

We analyze how movements in the VIX are statistically related to the joint dynamics of prices and traders' positions in the commodity futures markets to understand the direction in which risk flows in these markets. Focusing on movements in the VIX allows us to separate which trader groups are under greater distress and consuming liquidity from those who are absorbing risks and providing liquidity during the crisis.

As noted in the introduction and in Figure 1, open interest in many commodities markets collapsed around the time of the financial crisis just as the VIX was rising. During this time, the observed correlation of commodity prices with the VIX also increased dramatically. Figure 7 plots the return correlations of the GSCI and the GSCI Agriculture Index with the VIX Index, with a vertical line marking Monday, September 15, 2008, the day Lehman Brothers collapsed. Evidently, during the post-Lehman period, both the GSCI and the GSCI Agriculture Index were more synchronized with the VIX Index than during historical periods. The highly synchronized price movements were commonly observed during the financial crisis in other asset markets.[12]

A natural explanation for the increased correlation between commodity futures returns and the fluctuations of the VIX is the elevated uncertainty about economic fundamentals and the heightened risk aversion of a representative agent. Cochrane (2011) used these factors as a common explanation of the synchronized price movements across a broad set of asset classes through the discount rate channel, which aggregates the effects of the increased risk and risk

[11] The Bloomberg codes for VIX, S&P 500, and BDI are VIX Index, SPTR Index, and BDIY Index, respectively.

[12] It is also possible that the observed rolling correlation rises because the volatility in both markets rise even though the underlying correlation remains the same. For our purposes, this poses isomorphic research questions: Why does volatility rise in both markets simultaneously, and which, if any, groups of traders were driving this market volatility?

premium during the crisis. These effects are clearly important and serve as the baseline for our analysis. However, the representative agent theory treats agents as homogenous and does not give any prediction about who was buying and selling as open interest collapsed. We thus consider the following three hypotheses to explain the joint pattern of prices and position changes before and during the recent financial crisis.

2.1. The distressed financial institution hypothesis

A quickly growing body of theoretical studies, such as those cited in the introduction, emphasizes that financial institutions may become consumers rather than providers of liquidity when they suffer large losses or when they face severe funding risk. This theory is applicable to both CITs and hedge funds in the commodity futures markets during the financial crisis. Recall from our earlier discussion that in our data, positions of the CITs' reflect demands of both portfolio investors who choose to invest in commodity indices and those of swap dealers who intermediate on behalf of clients. As commonly recognized by the extant literature, the VIX directly affects the funding liquidity of both of these financial institutions. As the VIX spikes, these institutions may face more stringent funding requirements from their lenders and thus have to reduce the leverage of their risky holdings. This effect was particularly strong during the financial crisis because the financial institutions suffered large losses and were vulnerable to any additional funding shock. As a result, during the crisis they could have responded to increases in the VIX by reducing their commodity exposures.

Taken together, the distressed financial institution hypothesis posits that during the crisis both CITs and hedge funds are expected to reduce their commodity futures positions in response to an increase in the VIX, and that commercial hedgers are expected to buy commodity futures in response to an increase in the VIX in order for the markets to clear. Among financial traders, this hypothesis also implies that we should see more distressed traders, for example, those with higher CDS spreads, to be more responsive to changes in the VIX.

2.2 The hedging pressure hypothesis

The hedging pressure theory emphasizes the needs of commercial hedgers to short commodity futures to hedge the price risk of the commodities they produce. As futures positions expose hedgers to potential margin risk, it is common for them to partially hedge their commodity price risk. Depending on the reasons that drive hedging, their hedging incentives may also vary during a financial crisis. Froot, Scharfstein, and Stein (1993) developed a model for corporate hedging under the premise that external sources of capital are more costly than internally-generated funds. This funding wedge motivates firms to hedge their cash flow risk so that they have sufficient cash to finance future profitable investment opportunities. As an increase in the VIX raises the funding wedge, they should have greater incentives to hedge. Acharya, Lochstoer, and Ramadorai (2010) argue that hedging commodity price risk allows a commercial hedger with leverage to reduce default risk and thus the subsequent default cost. An increase in the VIX exposes all leveraged firms to greater default risk, which, in turn, also gives commercial hedgers greater incentives to hedge their commodity price risk. Thus, regardless of the reasons for hedging, an increase in the VIX gives commercial hedgers greater incentives to hedge, and more specifically, for short hedgers to take greater short positions in commodity futures and long hedgers to take greater long positions. As commercial hedgers are mostly on the short side, the hedging pressure hypothesis implies that, during the financial crisis, commercial hedgers are expected to increase their net short positions in commodity futures in response to an increase in the VIX. To clear the markets, this hypothesis also requires that financial traders such as CITs and hedge funds take larger net long positions in response to an increase in the VIX.

Taken together, the distressed financial institution hypothesis and the hedging pressure hypothesis both build on the premise that during the financial crisis, an increase in the VIX could have added financial stress to certain trader groups, but emphasize the distress of different groups. The distressed financial institution hypothesis highlights the stress of CITs and hedge funds, while the hedging pressure hypothesis focuses on that of commercial hedgers. Under the distressed financials hypothesis, risk flows from financial institutions towards real economy players such as commercial hedgers, while under the hedging pressure hypothesis, risk flows in the opposite direction.

2.3 The informational advantage hypothesis

Traders might also trade against each other in order to exploit an informational advantage rather than to reallocate risk. It is plausible that an increase in the VIX contains negative information about the fundamentals of commodities, although this argument does not explain the low correlation between commodity returns and VIX changes before September 2008. If financial traders such as CITs and hedge funds are faster in absorbing the information contained in VIX changes than commercial hedgers, then we could expect that in response to an increase in VIX, commodity prices would co-move negatively with the VIX and financial traders would sell commodity futures to commercial hedgers. These joint dynamics of prices and traders' positions are similar to those implied by the distressed financial institution hypothesis.

To isolate the effects of the informational advantage hypothesis and the distressed financial institution hypothesis, we explore the cross-section of traders within each trader group, as well as the long-term dynamics of traders' positions. The premise of the informational advantage hypothesis is that commercial hedgers were less attentive to VIX changes than financial traders during the crisis and thus willing to trade at unfavorable prices. The large number of commercial hedgers in our data allows us to compare the responses of commercial hedgers who are very active traders to those who are not. To the extent that "passive" hedgers are more likely to be inattentive to VIX changes, the informational advantage hypothesis implies that passive hedgers in aggregate are more likely to be on the other side of financial institutions' trades than active hedgers. Furthermore, if financial traders trade to exploit their informational advantages, we expect them to take profits by unwinding their positions in the future. In contrast, the distressed financial institution hypothesis implies that the responses of financial traders to VIX changes are persistent and represent a reallocation of risk.

3. Empirical Results

3.1 VIX changes and commodity returns

Table 4 reports the results from estimating a linear regression where the left-hand side variable is the weekly commodity return and the right-hand side variables are weekly VIX changes. We allow for VIX changes to affect commodity prices with a delay, and thus use the contemporaneous, as well as one lag of weekly VIX changes on the right-hand side. We also control for one lag of commodity returns to allow for persistence in commodity price movements, as well as our weekly macroeconomic indicators, which are the contemporaneous percentage change in the BDI index, change in inflation compensation, and change in Baa credit spread. We use the Newey and West (1987) construction for the covariance matrix of the estimators with four lags.

The results indicate a strong effect of VIX changes on commodity markets in the post-crisis period (September 15, 2008 to June 1, 2011). The first major column reports the coefficient on the contemporaneous VIX changes during this period. With the exception of lean hogs and gold, all commodities display a negative price relationship with the VIX, with almost all coefficients statistically significant at the 5% level. The second major column shows that this relationship also holds in the second half of the post-crisis period (January 1, 2010 to June 1, 2011) for most of the commodities. For most commodities, the negative correlation persisted over a year after the collapse of Lehman Brothers.

This relationship does not hold during the pre-crisis period. The third major column of Table 4 reports the coefficient on the contemporaneous VIX change for the period January 1, 2006 to September 15, 2008, a pre-crisis period of nearly equal length with our post-crisis period. The coefficients during this period are mostly insignificant with the exception of coffee and copper having significantly negative coefficients at the 5% level. The fourth major column goes back even further and analyzes the period January 1, 2001 to January 1, 2006 and similarly finds little systematic relationship between VIX changes and commodity returns.

3.2 VIX changes and trader positions

We now estimate the effect of changes in the VIX on the changes of aggregate positions of different groups of traders. We focus on the aggregate positions of different trader groups as we are interested in identifying which groups have been driving the price, and do not want small individual traders who may behave in a nonsystematic way to change our analysis. We estimate the same specification in Table 4 but with position changes on the left-hand side. As discussed above, the netting problem in the LTRS position data is particularly severe for commodities in the energy and metal sectors. This problem contaminates our analysis of the relationship between traders' positions and VIX changes for these commodities. Below, we report results only for commodities in the grains, livestock, and softs sectors.

Our running null hypothesis is that the VIX did not systematically affect a given trader group's position changes. This would be consistent with the discount rate hypothesis. One alternative is that increases in the VIX positively affected CIT and hedge fund positions and negatively affected commercial hedger's positions. This would be consistent with the hedging pressure hypothesis. Another alternative, the distressed financials hypothesis, predicts that increases in the VIX negatively affected CIT and hedge fund positions, while positively affecting commercial hedger positions. Given the negative correlation between VIX changes and commodity returns in the post-crisis period, the economic content of this prediction is that both CITs and hedge funds were willing to sell at such deep discounts that commercial hedgers were willing to reduce their net short positions as the VIX rose.

Table 5 reports the results where the left-hand side variable is the weekly change in position (flows) and the right-hand side variables are weekly VIX changes. We again allow for VIX changes to affect commodity prices with a delay by including the contemporaneous, as well as one lag of weekly VIX changes on the right-hand side, control for one lag of commodity returns as well as our weekly macroeconomic indicators, and use the Newey and West (1987) covariance matrix with four lags. Panel A reports the estimated coefficients during the post-crisis September 15, 2008 to June 1, 2011 period, while Panel B reports the estimated coefficients during the period immediately before the crisis, January 1, 2006 to September 15, 2008. The results in Panel A strongly indicate asymmetric responses of market participants to VIX changes in the post-crisis period. When the VIX increases, both CITs and hedge funds tend to reduce their net long exposures, while commercial hedgers and other unclassified traders tend to buy, in virtually all commodities. For CITs, the association between position changes and the contemporaneous VIX change is negative and statistically significant at the 10% level or better among 8 of the 12 agricultural commodities (grains, livestock, and softs), with an average economic significance of -0.21-standard deviations. Hedge funds display a positive and statistically significant relationship (at the 10% level or better) between positions and contemporaneous VIX change in 6 of the 12 commodities, with an average economic significance of -0.12-standard deviations; only one commodity has a positive point estimate.

In contrast, Table 5 shows that commercial hedgers tend to display a positive relationship between VIX changes and position changes. The relationship is positive and statistically significant for 8 of the 12 commodities, with only one negative point estimate. The average economic significance among all 12 commodities is +0.16-standard deviations. Interestingly, the other unclassified traders are similar to commercial hedgers: the relationship is negative and statistically significant for 8 of the 12 commodities, with an average economic significance of

+0.15 standard deviations. This is perhaps not surprising given the CFTC's designation of commercial hedgers.

Panel B of Table 5 shows weak evidence of VIX changes affecting traders' positions during the pre-crisis period from January 1, 2006 to September 15, 2008, a period nearly equal in length to our post-crisis period of September 15, 2008 to June 1, 2011. In sharp contrast to the post-crisis period, across all of the trader groups and all 12 commodities, the coefficients of the contemporaneous VIX changes in the pre-crisis period are virtually insignificant with the exception of one or two commodities for each group.

The patterns in Table 5 show that changes in the VIX had asymmetric impacts on commodity futures markets participants after September 2008. An increase in the VIX led both CITs and hedge funds to sell commodity futures, which commercial hedgers bought. This pattern is consistent with the distressed financial institution hypothesis, which predicts that CITs and hedge funds became more sensitive to changes in the VIX during the financial crisis due either to changes in risk appetite or funding concerns. In contrast, this pattern suggests that the discount rate hypothesis is not a complete explanation for the synchronized price movements, as it posits that VIX shocks could affect commodity prices without systematic changes in traders' positions.

The finding that commercial hedgers were buying, rather than selling, as the VIX increased is inconsistent with the hedging pressure hypothesis. The hedging pressure hypothesis posits that during the financial crisis, an increase in the VIX incentivized commercial hedgers to hedge (i.e., to increase their aggregate short positions in commodity futures). Instead, they reduced, rather than increased, their short positions. This buying behavior on the part of hedgers is remarkable in light of the observation that hedgers who were short stood to make extreme profits from the steep price fall during the financial crisis. That is, they provided liquidity to financial traders, while financial traders consumed liquidity.

3.3 Cross-sectional evidence

We examine the responses of different traders within the same group to further isolate our competing hypotheses.

3.3.1 Evidence on distressed financials. The distressed financial institution hypothesis implies that the more distressed financial traders are more sensitive to VIX changes during the financial crisis. We provide direct evidence that the trading responses of CITs to the VIX are heterogeneous across firms with different CDS spreads. The hypothesis implies that CIT trading accounts with high CDS spreads have a higher position change-sensitivity to changes in the VIX through two possible channels. First, the CIT institutions (large financial intermediaries) may need to sell their own proprietary positions when volatility rises in order to contain risk exposures. Second, investors who entered into swap contracts with CITs may potentially withdraw their investment when the institution is distressed.

We manually matched large traders identified as CITs to the names of their respective firms and collected their CDS spreads from Bloomberg.[13] For each week, we split the group of CIT accounts into accounts with high CDS spreads (above the median) and low CDS spreads (below the median). We regress the account-level position change as the left-hand side variable on the change in the VIX, an indicator for whether the trader has a high CDS spread, and the interaction of these two terms, and again control for the same set of weekly macroeconomic indicators.[14] Table 6 reports the results from this regression. Consistent with the distressed financial institution hypothesis, high CDS spread firms sell more, and, furthermore, are more sensitive to changes in the VIX in 5 of the 12 agricultural commodities: Chicago wheat, corn, coffee, cotton, and sugar. This regression exploits the relative ranking of firms with high and low CDS spreads. Alternatively, one may expect that the absolute level of CDS spreads is what matters. A regression that substitutes the raw log CDS spread in place of high/low indicator reveals nearly identical results, which are available from the authors upon request.

3.3.2 Evidence on hedging pressure. For the hedging pressure hypothesis to explain the commercial hedgers' responses to changes in the VIX, their incentives to hedge would have to vary with the fluctuations of VIX. Table 5 suggests that commercial hedgers actually bought when the VIX was rising, contrary to most theories of hedging, which predict that commercial hedgers, who are typically short, would actually increase their hedges and short more. However, one might argue that the specific reasons discussed in the previous section may be incomplete

[13] For this portion of the analysis, we aggregate CITs and CIT-HFs due to the small number of CITs.

[14] We cluster standard errors at the weekly level because position changes across traders may be correlated within a week given aggregate shocks. Clustering standard errors at the account-level generates nearly identical results, which are available from the authors.

and that an unspecified reason might cause commercial hedgers to have reduced incentives to hedge after the VIX increases. Comparing the responses of long hedgers and short hedgers provides a channel to address this concern. While commercial hedgers are mostly on the short side, there are a number of long hedgers in our sample. As the greater hedging incentives motivate long hedgers and short hedgers to trade in opposite directions, we expect them to have opposite responses to VIX shocks if their trading was driven by fluctuations in their hedging incentives.

To explore this hypothesis, we classify a hedger as a “long hedger” in a commodity if the hedger maintained an average net long position in the previous calendar year. Specifically, for each day, we compute the fraction of long contracts in which a hedger is invested, and compute the time average over the year. If the average fraction is greater than 50%, we classify the hedger as long, while a fraction less than 50% corresponds to short. We then separately regress the aggregate position change of long hedgers on changes in the VIX, including both contemporaneous and lagged changes as usual and including one lag of commodity returns as a control, along with our weekly macroeconomic indicators. Table 7 reports the results and shows that, consistent with Table 5, short hedgers drive the positive relationship between hedgers’ position changes and changes in the VIX. However, there is no clear pattern of the opposite reaction for long hedgers. For example, it appears that although long hedgers were selling in sugar, in fact they were buying in Chicago wheat and coffee. This suggests that the long hedgers of coffee and Chicago wheat were trading in the same direction as the short hedgers, inconsistent with the hedging pressure hypothesis.

3.3.3 Evidence on informational advantages. The above tests distinguish between the hedging pressure hypothesis and the distressed financials hypothesis. Here, we consider whether informational advantages can explain our results so far. The informational advantage hypothesis posits that financial traders’ trade on the VIX to exploit an informational advantage rather than to reduce risk. The premise of this hypothesis is that by absorbing the information contained in VIX movements at a faster pace, financial traders can profit from the other party, presumably commercial hedgers and other unclassified traders. As the more active hedgers tend to be more attentive to VIX movements than passive hedgers, this hypothesis naturally implies that passive hedgers are more likely than active hedgers to be on the other side of financial traders’ trades in response to VIX changes.

We explore this informational advantage hypothesis by classifying a group of "active" hedgers who have a record of trading both frequently and in large amounts. Specifically, we compute the median daily absolute position change for every hedger every year, and classify a hedger as active if it was in the top decile of all hedgers in that commodity in the previous year. We use the median rather than the mean as we want to capture hedgers who consistently and frequently trade large amounts as opposed to those who trade extraordinarily large amounts infrequently. By the same reasoning, we use the absolute position changes as opposed to a measure of portfolio turnover.[15] We then aggregate active and passive hedgers and test whether the aggregate positions of active hedgers display a significantly more positive sensitivity to the VIX than passive hedgers in a panel of these two time series.[16]

In Table 8, we regress weekly position changes on changes in the VIX, an indicator for the active group of hedgers, and an interaction between these two terms, along with one lag of commodity returns and our weekly macroeconomic controls and during the post-crisis period. The active hedgers tended to be on the other side of the financial traders' trades in that they typically display a more pronounced positive sensitivity to the VIX, meaning that as the VIX rose, they were buying. This evidence is inconsistent with the informational advantage hypothesis.

We can further examine the informational advantage hypothesis by examining the persistence of their position responses. If financial traders trade to exploit informational advantages, their VIX-induced position changes should be temporary, as they will eventually unwind their positions after the information is fully incorporated into prices in order to profit from the trade. In contrast, distressed-induced position changes are likely to be persistent over time.

To test whether responses are persistent, we extend our previous analysis and regress the position change on the contemporaneous plus 13 lags of changes in the VIX, as well as 13 lags

[15] Ranking on portfolio turnover yields qualitatively results that hedgers with higher portfolio turnover in the previous year tend to display a significantly more positive sensitivity to the VIX than passive hedgers.

[16] For our panel regression, we report standard errors clustered by time. FGLS estimates corrected for serial correlation yield nearly identical results.

of commodity returns:

$$positionchange_t = \alpha + \lambda\Delta VIX_t + \sum_{s=1}^{13}\beta_s\Delta VIX_{t-s} + \sum_{s=1}^{13}\gamma_s r_{t-s},$$

where r_{t-s} is the lagged commodity return. By iterating this equation forward, it is clear that the cumulative response to an initial shock to the VIX over the next s periods, subsequent to initial effect, is the sum of β_s from 1 through lag s. If the initial response to an increase in the VIX reverted, this sum would be positive for CITs and financials (since they sell initially) and the subsequent response would be negative for hedgers (since they buy initially).

Table 9 reports the 13-week cumulative subsequent response to changes in the VIX for each trader group and each commodity. For CITs, we see that if anything, there is a continuation of the initial response to the VIX. An increase in the VIX today predicts that CITs sell even more positions over the next 13 weeks, particularly in grain. Hedge funds display mild reversion in their positions. Aggregating the CITs and hedge funds shows little evidence of strong reversion; in fact, continuation is the dominant effect among cotton and sugar. Similarly, hedgers show no sign of reversing their initial buying behavior in response to a change in the VIX.

Figure 8 plots the cumulative subsequent response of a change in VIX over 13 weeks for CITs. Although standard error bands necessarily widen over the forecast horizon, no commodities show significant reversal, and in fact grains show continuation. We thus conclude that our results are not driven by any informational advantages of CITs and that their selling in response to movements in VIX was a response to distress. Furthermore, the commercial hedgers also show little sign of reversals to movements in the VIX, suggesting the risk convection was a re-allocation of risk that does not reverse over a 13-week horizon.

3.4 Comparability and further robustness

Table 10 reports results from our baseline analysis, which regresses position changes on movements in the VIX for the trader categories from the disaggregated COT reports, as well as the Supplemental CIT report. The results are consistent with those in Table 5, which shows that producers' positions react positively to the VIX and that managed money traders react negatively to the VIX. Other financial traders are roughly neutral.

Although CIT traders are not separately classified within the disaggregated COT reports, much of the CIT business is conducted through swaps. Consistent with this, swap dealers react negatively to the VIX in the disaggregated COT reports, although the statistical significance is limited. This is interesting as swap dealer positions are usually aggregated with commercial positions in the historical COT reports, which only break down commercial and non-commercial positions. Table 10 also examines how position changes of CITs respond to changes in the VIX, and confirm our earlier result that CITs react negatively. Notably, these positions are not simply a subset of any single category in the disaggregated COT reports, but instead are a mix of the swap dealer positions and managed money positions due to the netting problem described in Section 1. Therefore, our effects are not driven by our classification scheme.

We also check whether our results may be explained by observable shifts in expected demand. One alternative explanation is that our results are fully explained by movements in demand not captured in our macroeconomic controls. To examine this issue more closely, we collect monthly projections of world usage for the upcoming harvest issued by the U.S. Department of Agriculture (USDA) for wheat, corn, soybeans, soybean oil, and cotton in its *World Agricultural Supply and Demand Estimates* reports. In the middle of each month, the USDA projects the usage of the coming year's harvest for these crops. We repeat our exercise at a monthly frequency and include the year-on-year percentage change in forecasted world usage as a control. Table 11 reports the results, which are very similar to our previous weekly results. We choose the year-on-year percentage change in forecast because each month's forecast is a forecast for that year's harvest, with the forecasted harvest year typically changing to the subsequent harvest year in May.[17]

Finally, we note that the link between equity markets and commodity futures markets is not only manifested in the responses of prices and traders' responses in the commodity futures markets to the VIX changes. We focus on the VIX because of its intuitive appeal as a proxy both for the distress of financial institutions and its relation to hedging demands of commercial hedgers. We are also motivated to explain the observed link between the two markets. We have re-run our analysis using total returns to the S&P 500 as the source of shocks and obtain

[17] For example from May 2006 through April 2007, the USDA forecasts the harvest and usage for the 2006-2007 harvest year; in May 2007, it begins forecasting the 2007-2008 harvest. The April 2007 projection is typically very accurate for the actual realized 2006-2007 harvest. The estimated actual 2006-2007 harvest is reported from May 2007 through April 2007, with the finalized actual 2006-2007 harvest numbers reported starting May 2008, subject to subsequent revision.

qualitatively identical results. This exercise more directly measures shocks to equity markets and how CITs and hedge funds link the two markets.

4. Risk, Commercial Hedging, and the Real Economy

Commercial hedgers take positions in futures markets to hedge positions in the cash market. If distressed financials were unable to provide liquidity or consumed liquidity around the recent financial crisis, the flow of risk back to commercial hedgers would represent an inefficient allocation relative to a world where financials were not distressed, all else equal. In this section, we take a closer look at commercial hedgers and examine how such risk convection affects risk sharing in the cash market.

In practice, many commercial hedgers who participate in agricultural futures markets are distributors acting essentially as middlemen on behalf of farmers. For example, grain elevators are representative commercial hedgers in the grain futures markets. A grain elevator may commit to purchase grains from local farmers and store it while waiting for distribution. (The purchase commitments are essentially forward contracts.) To hedge this long exposure in the cash market, the grain elevator would take a short position in the corresponding futures market. All else equal, if distressed financials reduce their demand for long futures positions, the downward price pressure induces the grain elevator to reduce its short futures positions, which, in turn, tips the balance between its futures and cash positions. Limited risk-bearing capacity on the part of the grain elevator may further induce it to cut its cash positions by either offloading its physical stocks or reducing its purchase commitments to farmers. Through this chain of position reductions, farmers end up with greater exposure to the price risk, unless they reduce their production of the crop or hedge directly through the futures markets themselves.

The CFTC requires futures market participants in wheat, corn, soybeans, soybean oil, and cotton who have a “bona fide hedging exemption” to hold a futures position larger than federally-mandated speculative limits to report their cash positions as of the close of business on the last Friday of each month. Cash positions represent physical stocks, as well as sales and purchase commitments. For the grain commodities, participants report the thousands of bushels owned in stocks and committed to in purchase agreements and sales agreements. The sum of stocks owned and purchase agreements represent the total long cash position, while the sales commitments represent the total short cash position. Cotton is reported similarly in hundreds of bales weekly, every Friday.[18] To compare cash positions with futures positions, we convert cash positions into futures contract-equivalents using data on the size of futures contracts.[19] We then match the cash position with the futures position of the account reported in LTRS. We focus on changes in net cash (long cash minus short cash) and changes in net futures.[20]

Table 12, Panel A reports summary statistics for commercial hedger accounts that report both cash and futures data for the period January 2006 through May 2011.[21] For each commodity, the number of accounts reporting cash and futures is reported, as is how many futures positions are reported by accounts that report both cash and futures, as a percentage of total futures positions reported in the LTRS data. For wheat and soybeans, this is roughly 50%, corn is lower at 30%, and cotton is higher at 70%. The table also reports the time series average of the aggregate cash futures, and cash plus futures (C+F), expressed as the notional value of contracts (and contract-equivalents, for cash) using fixed prices as of December 15, 2006. For all commodities except soybean oil, our accounts are long cash and short futures, giving us confidence in the classification. Soybean oil exhibits near slightly short cash on average, as well as larger short futures positions. Given that soybean oil is a refined product, it is not surprising that this market operates differently than grains and cotton. Wheat, corn, soybeans, and cotton all exhibit "under-

[18] For comparability with other commodities, we standardize this monthly frequency by taking the last Friday of each month. However, we have replicated the analysis on a weekly basis and results are identical.

[19] For soybean oil and cotton, contracts are specified in pounds, while cash positions in soybean oil are reported in bushel equivalents, and cotton positions are reported in bales. We use approximate conversion factors of 500 pounds/bale for cotton and 11 pounds of oil per soybean bushel of soybean oil. The former is based on the conversion factor suggested on the CFTC reporting form for cotton while the latter is based the CME soybean crush guidelines.

[20] To our knowledge, this is the first study to utilize this data to examine the joint cash and futures behavior of hedgers. However, the reporting process for cash positions is different than that for futures positions and a few caveats are required. First, cash positions are self-reported by the account holder on paper (which is then keyed into a database by CFTC), as opposed to futures positions, which are reported electronically on behalf of account holders by clearing members. We hand-correct a number of obvious clerical data errors. However, the data from some accounts may be more or less reliable depending on how well each account tracks its daily positions. Second, given that only firms are only required to report if they have a bona fide hedging exemption and exceed federal speculative position limits, we observe gaps in coverage that do not represent a position close to zero, as in the LTRS data. Finally, although reporting is supposed to be as of the last Friday of the month, in practice reporting can sometimes occur around that day rather than on that day. We are careful to match an account's cash positions with its futures positions on the reporting day indicated by the account on the cash reporting form. Given these caveats, we examine the panel of changes in positions for individual accounts rather than changes in aggregate positions. We winsorize changes in the cash and futures at the 1% and 99% percent levels to remove the effect of extreme outliers.

[21] A handful of financial accounts report cash positions, which we do not include in our analysis. A number of other unclassified traders also appear in our analysis. As in the futures data, they tend to be much smaller in aggregate than commercial hedgers in the commodities we examine, although their behavior is similar. For consistency, we focus on the group of accounts classified as commercial hedgers.

hedging," where aggregate futures positions tend to be smaller than cash positions in absolute value.[22]

Futures positions and cash positions tend to co-move negatively. For example, the panel correlation of the change in net cash and change in net futures in soybeans is -0.32. This suggests that many accounts in our sample are indeed distributors who make the spread between futures contracts and cash purchase agreements. Indeed, an inspection of these accounts reveals that some of the largest accounts are involved in distribution or merchandising.

Table 12, Panel B examines how movements in the VIX correlate with changes in futures, cash, and total cash plus futures positions of these accounts during the post-Lehman period. We regress the change in futures (cash, cash plus futures) position as the left-hand side variable on the contemporaneous plus one lag monthly change in the VIX, and the previous calendar month's futures return, as right-hand side variables. When computing changes in the VIX, we are careful to compute the change in VIX from the reporting day of the previous month to the reporting day of this month for each account so that all information is available at time *t*. The coefficient on the contemporaneous change in VIX is positive for all commodities, indicating that increases in the VIX tend to reduce positions in hedgers' futures. For example, in cotton, a one-standard deviation increase in the VIX (675 basis points in the sample) is associated with a +0.14-standard deviation change in futures position, and is statistically significant at the 1% level. The coefficients in other commodities are also positive, although the statistical significance is limited given the limited number of months and accounts.[23]

Table 12 shows that increases in the VIX also tend to reduce commercial hedgers' cash positions as well, with negative coefficients in all commodities (with the exception of soybean oil). For example, in cotton, a one-standard deviation increase in the VIX is associated with a cash position reduction of 0.08-standard deviations during this period, statistically significant at the 1% level. Coefficients in other commodities (with the exception of soybean oil) are also negative, but statistically insignificant. Overall, the data suggest that commercial hedgers in commodities futures markets adjust their cash positions in the opposite direction as adjustments

[22] However, our data does not include option positions, which mitigate this observed difference.
[23] We cluster standard errors at the monthly level because position changes across traders may be correlated within a month given aggregate shocks. As with the account-level CIT analysis, clustering standard errors at the account-level has a negative statistically significant coefficient for corn at the 5% level and for cotton at the 1% level.

in futures positions. This chain of adjustments implies that producers such as farmers may end up with increased exposures to commodity price risk.

One might argue that producers may hedge directly through the futures markets themselves or reduce their production. According to our analysis, the reduced aggregate short futures positions by commercial hedgers give no evidence for producers directly taking short positions in futures. As production in grains and cotton move according to an annual harvest schedule, it is also difficult for them to reduce production in response to weekly or monthly fluctuations in the VIX. To examine this issue more closely, we turn to the USDA monthly projections of the next year's harvest for wheat, corn, soybeans, soybean oil, and cotton. We analyze whether the monthly 12-month percentage change in expected production covaries with changes in the VIX. Table 13 confirms that expected production did not co-move in any significant way with changes in the VIX.

Our analysis of commercial hedgers' cash positions in a set of commodities suggests that as distressed financials liquidated long futures positions in response to increases in the VIX, commodity price risk flowed from financial traders back towards the ultimate producers of these commodities.

5. Conclusion

We analyze the joint responses of prices and positions of all trader groups in the commodity futures markets to movements in the VIX. Although the price movements are naturally related to VIX movements as a fundamental, jointly analyzing positions and prices allows us to examine whether amplification effects due to distressed financial institutions or hedging pressure are also at work. We find that CITs and hedge fund positions reacted negatively to the VIX during the recent financial crisis, with commercial hedgers taking the other side. Consistent with theories suggesting this is related to the distress of financial institutions, we find that CITs with high CDS spreads are more sensitive to movements in the VIX. Contrary to the hedging pressure hypothesis, we do not find that hedgers increased their hedges as the VIX rose. Finally, the findings show that the reactions of all trader groups were persistent over time.

This evidence suggests that during times of distress, there was a flow of risk away from financial institutions back towards commercial hedgers. Much like the convection of a current of air that flows from a high pressured area to low pressured one, this “risk convection” reallocates risk from the more distressed groups to the less distressed groups.

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Appendix: Trader Classification

The CFTC publishes the weekly Tuesday-to-Tuesday Commitment of Traders reports on long and short positions by aggregate trader groups based on the LTRS data. There are three sets of reports. The standard report breaks down positions in each commodity by commercial use and non-commercial-use positions. Beginning in June 2006, the CFTC began publishing a COT report that was further disaggregated into four trader groups: Producer/Merchant/Processor/Users (“Producers”), Swap Dealers, Managed Money, and Other Non-Commercials. These classifications are based on information that must be reported to the CFTC. Beginning in January 2007, the CFTC began publishing an additional weekly “Supplemental CIT” report providing a breakdown of commercial-use, non-commercial-use, and index positions for 12 agricultural commodities (with data going back to January 2006).[24]

[24] Beginning in December 2007, the CFTC began publishing quarterly “Special Call” reports on CIT activity, which increased to monthly beginning in June 2010. Detailed data on index activity was solicited from pre-selected traders, so the data is separate from the LTRS data. The reports provide detailed data on more commodities, for example in energies, including both gross notional and net values, provided by the traders. The Special Call CIT Report is more precise than the Supplemental CIT report with regards to the netting problem. However, it is available only at an

The position breakdown in the Supplemental CIT report is distinct from the position breakdowns in the existing COT report; indeed, this was the express purpose of creating a supplemental report. This means that positions counted as CIT positions in the Supplemental report overlap with positions counted in multiple different categories in the main COT report, such as Managed Money or Swap Dealers. The overlap makes positions across the two reports incomparable for the purposes of assessing the behavior of disjoint trader categories.

This issue goes more deeply beyond simply how trader positions in public COT reports are aggregated. At a fundamental level, traders may be engaged in multiple lines of business, including, for example, both CIT business and managed money. As a result, a trader in the LTRS data may have multiple self-reported trader registrations. In addition, the CFTC's staff assign the CIT designation to some traders. As a result, it is possible for a trader to have designations of both CIT and commodity trading advisor (hedge fund). Thus, even the disaggregated LTRS data face the netting problem across each trader's multiple business lines.

We classify traders as CITs, hedge funds, and commercial hedgers while separately tracking groups of traders who have multiple designations (see Figure 2), using the LTRS data, resolving the position overlap problem. This also ensures that groups with multiple codes are allocated properly; however, as we show, it does not completely resolve the netting issue, as even traders who only have one trader designation net out positions before they are reported to the CFTC. Constructing our own classification scheme also has other benefits, including the ability to look at positions before 2006 when the disaggregated COT and Supplemental CIT reports began, the ability to focus on futures-only positions of CITs, as the Supplemental CIT only reports futures plus options, as well as the ability to examine the behavior of positions in other commodities not covered by the Supplemental CIT report.

We classify traders into four major groups: commercial hedgers, hedge funds, commodity index traders (CITs), and other unclassified traders.

Commercial hedgers. The CFTC requires traders to report whether traders have commercial use for commodities in which they are invested. We classify traders as commercial hedgers if they indicated a commercial use in all commodities in which they have positions, among the following reported commercial use types in the data: "Dealer/Merchant" (AD), "Agricultural"

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interval longer than appropriate for our analysis. It also faces the concern that positions are self-reported rather than recorded through clearing members.

(AM), “Manufacturer” (AO), “Producer” (AP), and “Livestock Feeder,” “Slaughterer,” or “Other Livestock” (LF, LO, LS, respectively). Given the agricultural tilt of the hedger classification codes, we expect this categorization to be conservative in non-agricultural commodities.

Hedge funds. The CFTC also requires traders to report their trader registrations. These registrations are supplemented by internal CFTC staff. We classify as a hedge fund any trader registered as a commodity pool operator (CPO), commodity trading advisor (CTA), an associated person of such an account (AP), or who has been otherwise marked as a financial leveraged speculator (FLS), financial asset manager (FAM), or managed money (MM) in their trader registrations. We also include traders who have the “FH” hedge fund commercial use code.

Commodity index traders (CITs). CITs in the Supplemental CIT report are identified by CFTC staff based on confidential interviews with traders, as well as analysis of trading patterns, but have been updated only on an irregular basis since the inception of the Supplemental report. Given the changing nature of the commodity index investing business, we construct a transparent time-varying classification of our own based on two important characteristics of trading patterns of broad-based portfolio investors in commodity indices: one is that they should be invested in many commodities, and the other is that they should be mostly long in those commodities.

We compute two variables that measure these two dimensions. First, we construct the average number of commodities for which a trader has net exposure by adding the total number of commodities every day for which a trader has any non-zero net position, and then taking a time-average over the year. We define this variable to be the *Number of Commodities with Exposure*. We then measure whether or not a trader tends to be short or long on average across these commodities. For each commodity and every day, we divide the total number contracts in which a trader is long by the total number of long plus short contracts, both totaled over all contract expirations. A number of 50% indicates that a trader is net zero for that commodity that day (perhaps spread over different contract expirations). We then take an equally-weighted average over all commodities in which a trader is invested in each day, followed by a time-average over every year.[25] We define this variable to be the *Percentage of Contracts Long Across Commodities.*

We classify a trader as a potential CIT if the average number of commodities for which it

[25] We use an equal weight to avoid contaminating our trader characteristics with price information even though the trader may, on a dollar basis, be more long or more short.

has exposure to within year *t* is greater than 8 and the average percentage of contracts long is greater than 70%. The rationale is that due to the netting problem across lines of businesses, CITs may not appear to be 100% long. Because we are still concerned with potential contamination from non-CIT traders, we intersect this group of traders with the list of traders who have been tagged as CIT for the Supplemental CIT report.[26] Finally, to obtain a yearly list of CITs, we hand-check the list of names associated with each trader to ensure that they are in fact CITs. When aggregating positions, we count positions in year *t* as CIT if the trader was classified as a CIT in year *t*-1 to avoid any forward-looking bias. Our classification scheme should be viewed as conservative relative to the true number of CIT traders in the market.

Although our classification more clearly separates CIT traders from CIT traders who are also designated as managed money, we cannot resolve the netting problem completely. CIT traders are often dealers who are hedging swap positions sold to clients by going long in futures. However, since dealers themselves are likely to have many types of positions, this will still contaminate the positions associated with the selected CIT traders. Although this is a limitation of the LTRS data, we have an ex ante expectation of which commodities are more susceptible to these problems. In particular, such problems are quite severe in energies and metals, as noted in the CFTC's accompanying note to the release of the Supplemental CIT report, while measurement in agricultural commodities is likely to be much more precise.[27]

Other unclassified traders. There may be traders who do not fit neatly into the other three categories. For example, there may be commercial hedgers who do not match the above criterion, particularly in non-agricultural commodities. Non-CIT swap dealers who do not have managed money businesses may also fit into this category. Traders who are not yet CITs may also be in this categorization.

Separating conflicting categories. As Figure 2 illustrates, the CIT, hedge fund, and commercial hedger classifications may overlap since each trader may carry multiple designations. We separate traders with multiple overlapping designations into respective categories. We track traders that have both a CIT categorization and hedge fund trader registration as "CIT-Hedge funds" (CIT-HFs); these traders are active in both business lines. We track traders that have both

[26] In the LTRS data, trader registrations are not time-varying, and hence our classification produces a time-varying classification CIT based on the actual annual behavior of each trader.

[27] The CFTC's accompanying note to the Supplemental CIT report is available online at http://www.cftc.gov/ucm/groups/public/@commitmentsoftraders/documents/file/noticeonsupplementalcotrept.pdf.

a Hedge Fund and Commercial Hedger categorization as “Hedger-Hedge Funds” (Hedger-HFs), and may be traders who do physical hedging business but also have businesses speculating on behalf of others (in practice, this group is small). Theoretically, there may be “CIT-Hedgers” and traders that are all three (“Triple”) as well; in practice, no traders fall in these two categories in any year.

The final result is that there are eight possible categories: three conflict-free categories (CIT, hedge fund, and commercial hedger); four conflict categories (CIT-HFs, Hedger-HFs, CIT-Hedgers, and Triple), and other unclassified Traders. The difference of the sum of these positions and zero are positions, which are not reported to the CFTC.

Figure 5 shows that other unclassified traders form a significant part of the short side of the market. There is a concern that we may have missed a significant portion of traders in the market. Indeed, in contrast to the construction of the producers category in the disaggregated COT reports, which includes all commercial positions not associated with swap dealers and is thus a “residual,” our classification of commercial hedgers is conservative in that we only include positions if they are associated with traders whose dealings in all commodities are classified into the specific commercial uses of Dealer/Merchant, Agricultural, Manufacturer, Producer, Livestock Feeder, Slaughterer, or Other Livestock. These categories are relatively focused on activities in agriculture and livestock.

Figure 6 shows that aggregate net positions of other unclassified traders are relatively small in the grains sector, on par with commercial hedger net positions in livestock and softs, and form the largest segment of the short side in energies and metals. In energy and metals in particular, our commercial hedger group forms only a small part of the market. This could be due to two possibilities. First, true commercial hedgers could be more neutral in energies and metals; for example, there may be both producers and customers who are hedging in these markets. Second, our commercial hedger group may only be capturing a slice of hedging activity in energies and metals. The fact that other unclassified traders dominate the short side in these markets lends support to this second hypothesis. Under this hypothesis, our commercial hedger group conservatively captures a range of hedging activities most associated with grains, livestock and softs, and less so in energy and metal commodities, with other unclassified traders capturing this wider group of commercial hedgers. In subsequent analysis, we empirically check whether the behavior of these unclassified traders is consistently different from other groups.

Figure 1: Open Interest and the VIX

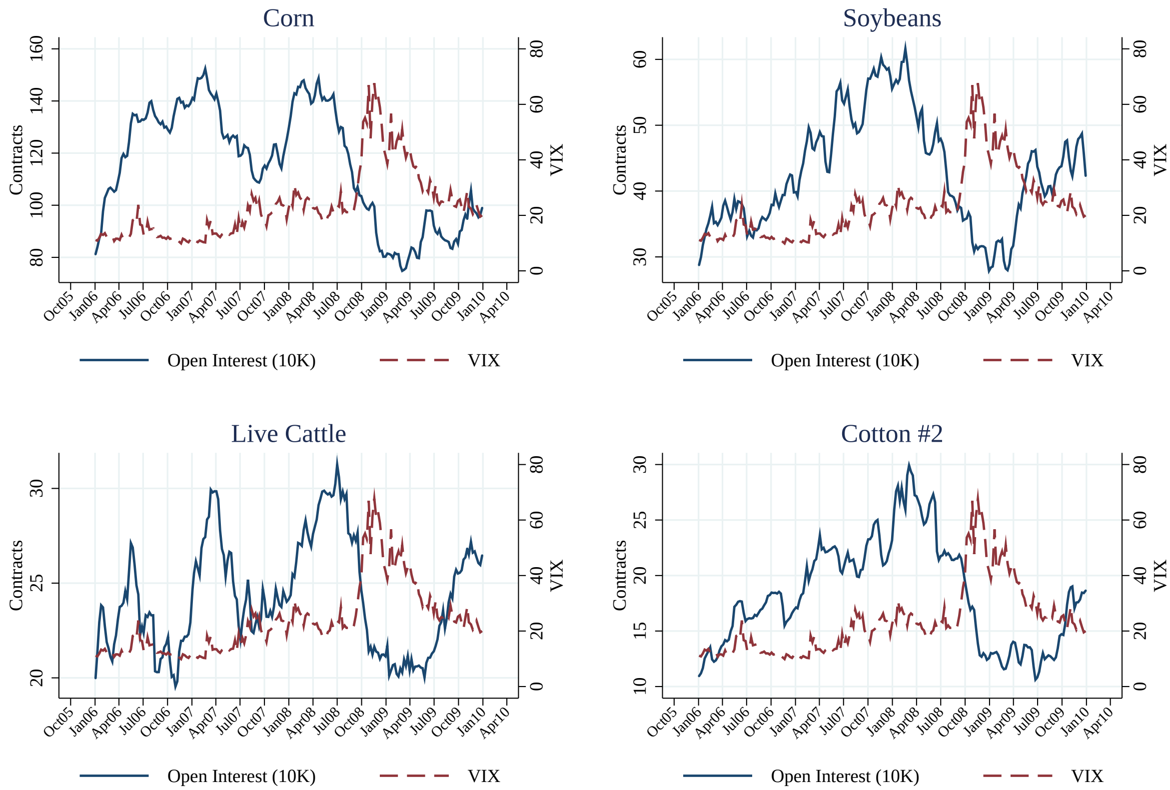


Figure 2: Classification of Traders

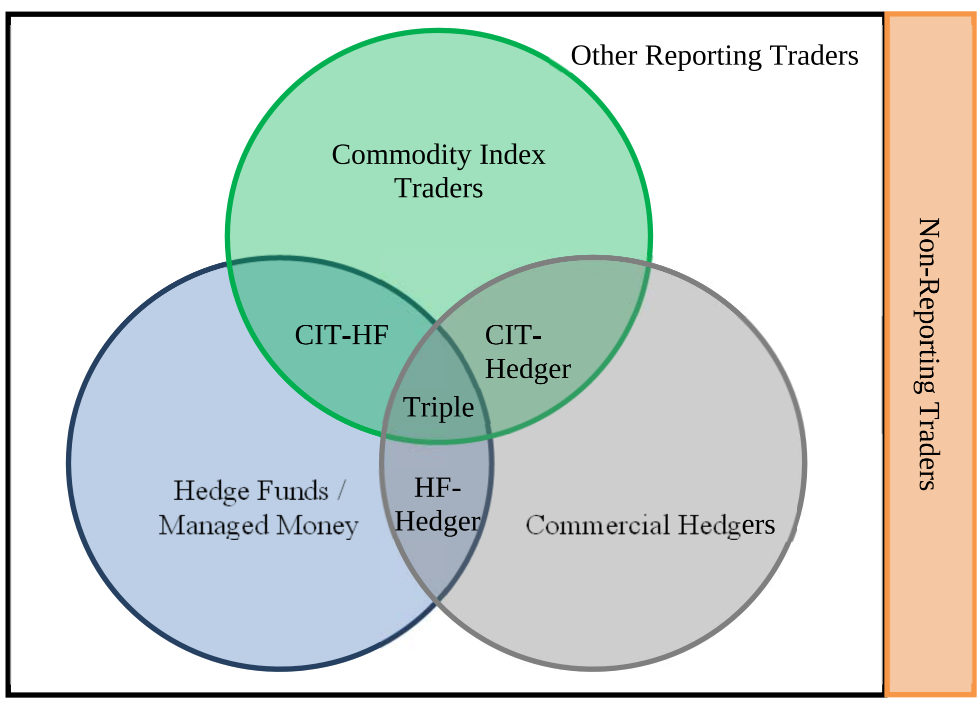


Figure 3: Commodity Futures Market Participation in 2010

Each dot represents a trader, with areas proportional to the average notional net position size over the year. Colors indicate to which group the trader belongs. The vertical axis is the average number of commodities with any exposure a trader had exposure to over the course of the year. The horizontal axis is the equal-weight commodity average of the time-average of the percentage of total contracts held by the trader which were long.

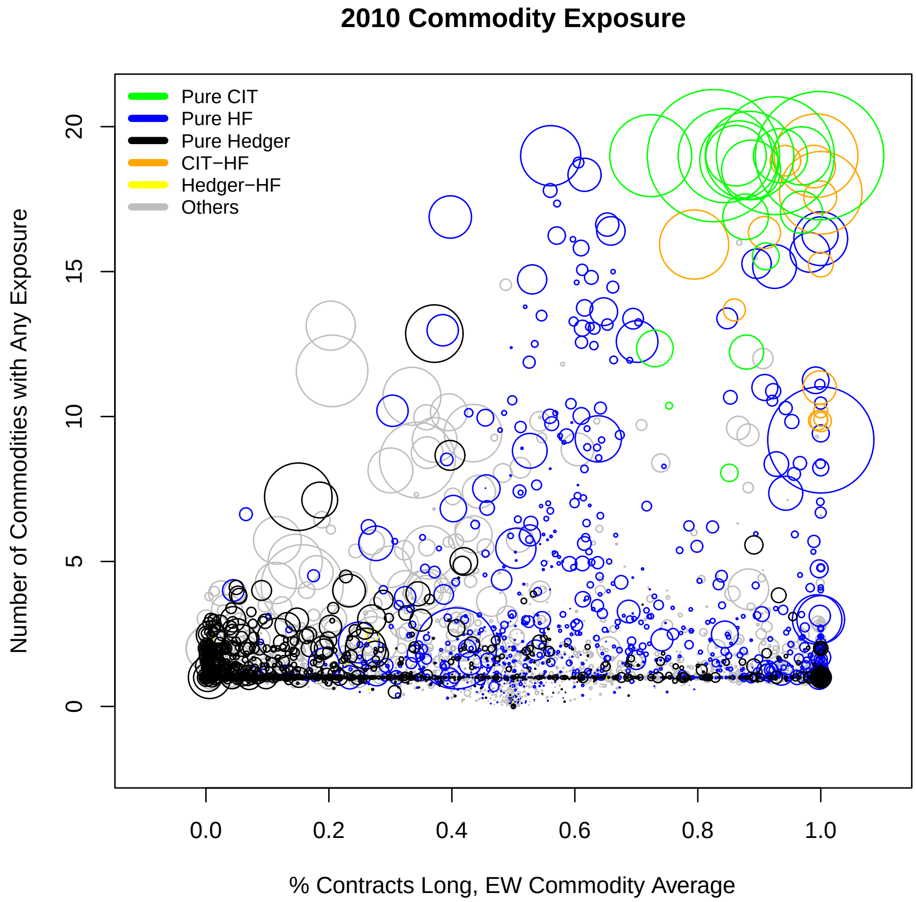


Figure 4: Commodity Futures Market Participation

Each dot in represents a trader, with areas proportional to the average notional net position size over the year. Areas are comparable across years, and colors indicate to which group the trader belongs. The vertical axis is the average number of commodities with any exposure a trader had exposure to over the course of the year. The horizontal axis is the equal-weight commodity average of the time-average of the percentage of total contracts held by the trader that were long.

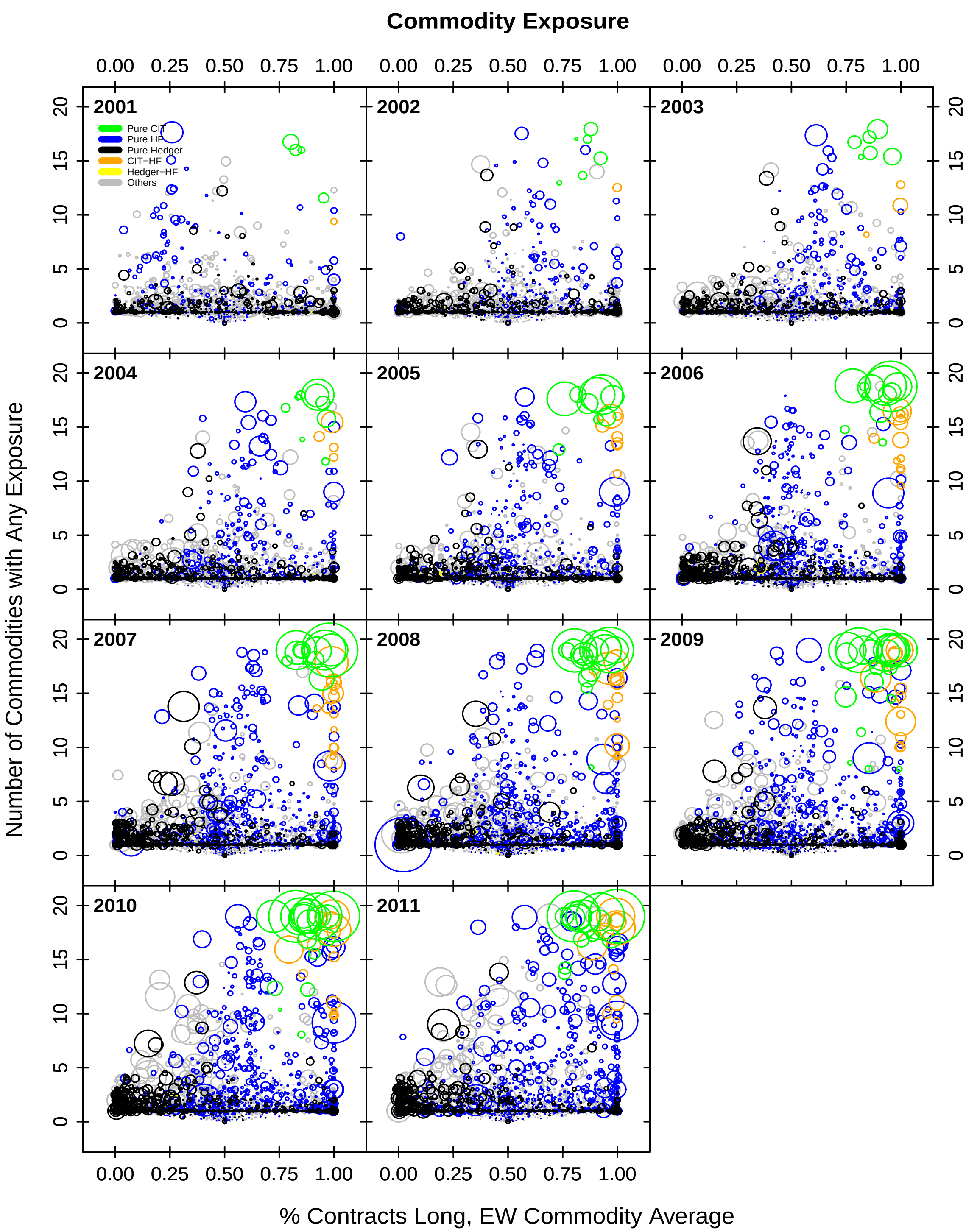
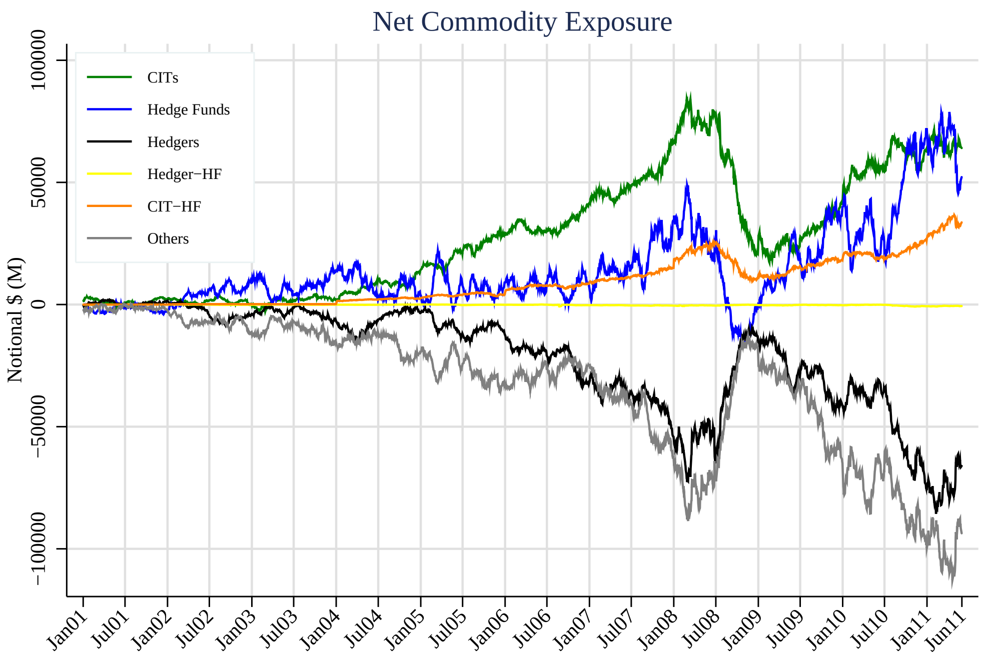


Figure 5: Net Commodity Exposures

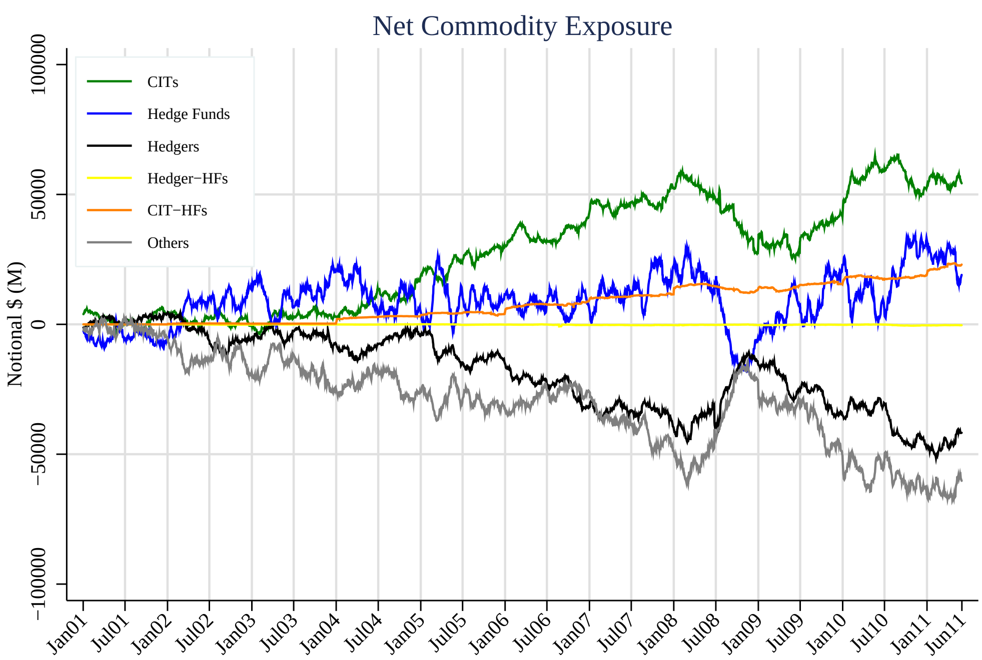
This figure plots the daily net notional value of positions held by the different trader groups. Panel A computes notional values using contemporaneous nearby prices adjusted for inflation to real 2006 prices. Panel B computes notional values using fixed nearby prices as of December 15, 2006.

Panel A



Exposure defined as Net Position(t) x Front Month Price(t), Real Dec2006 $

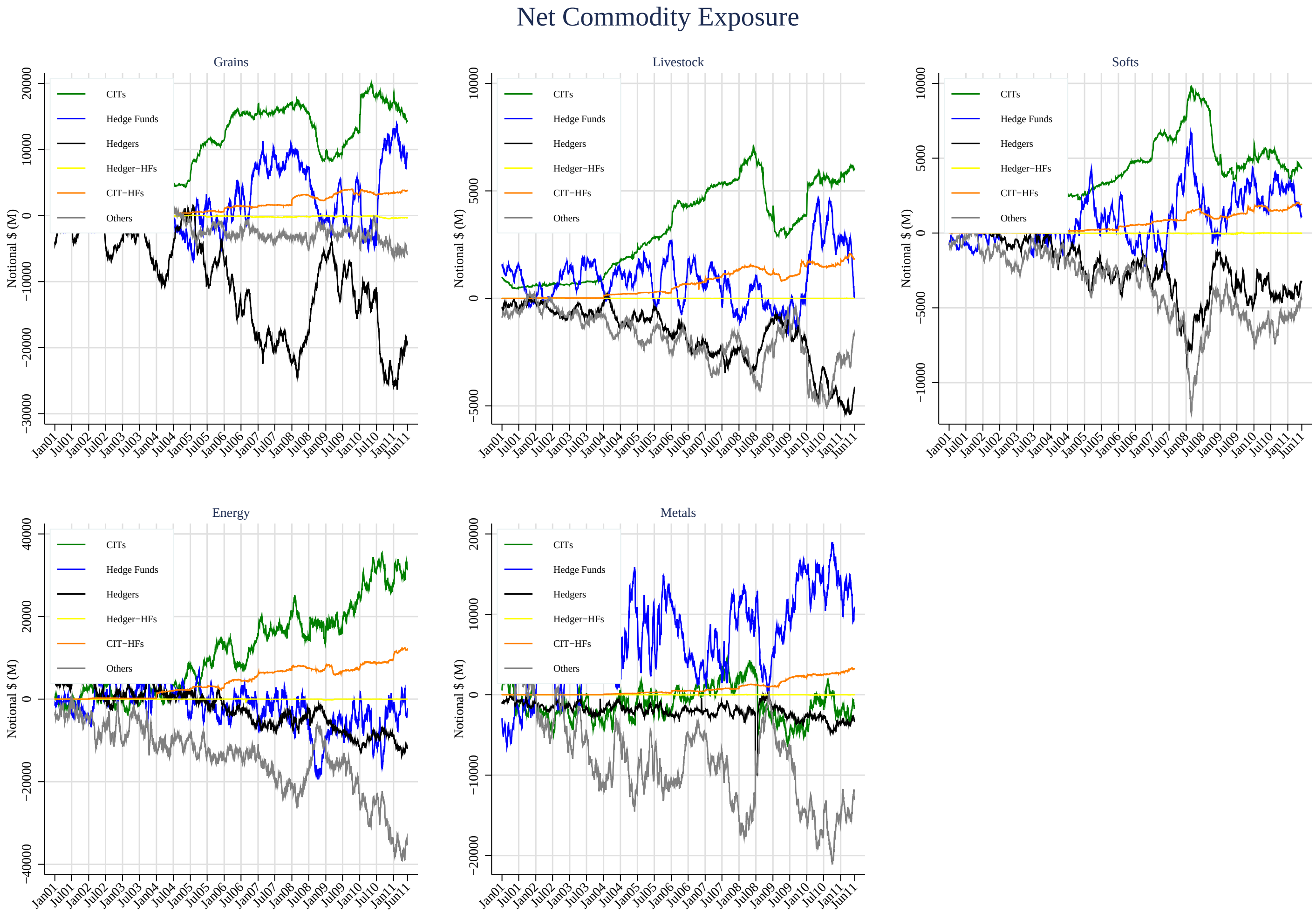
Panel B



Exposure defined as Net Position(t) x Front Month Price(15Dec2006)

Figure 6: Net Commodity Exposure by Sector

This figure plots the daily net notional value of positions held by the different trader groups across each commodity sector. Notional values were computed using fixed nearby prices as of December 15, 2006.



Exposure defined as Net Position(t) x Front Month Price(15Dec2006)

Figure 7: Correlations between Changes in VIX and SP-GSCI Indices

The correlations are estimated from one-year rolling correlations of daily changes to the VIX and returns of SP-GSCI commodity index in different commodity sectors.

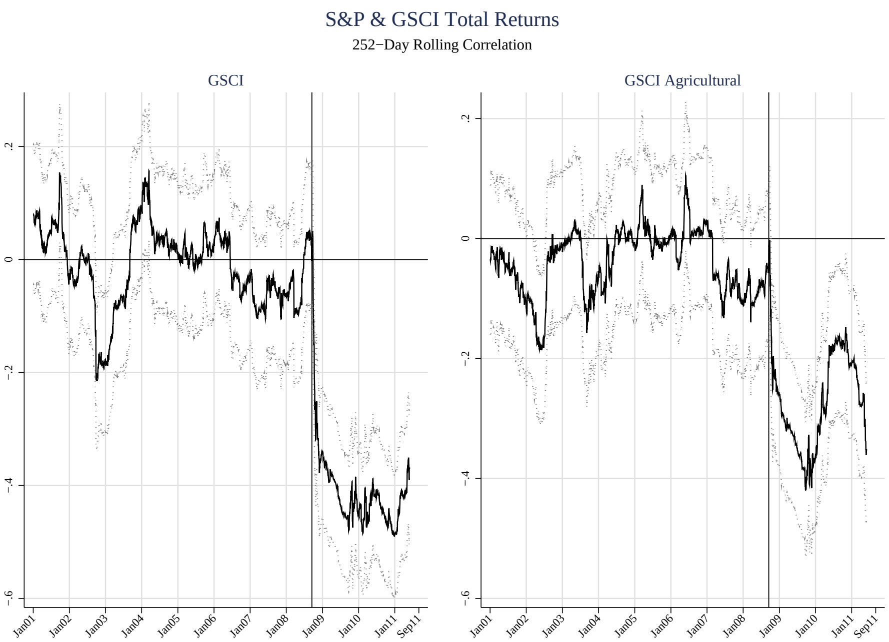


Figure 8: Long-Run Position Responses of CITs

This figure plots the cumulative response of CITs to a unit basis point movement in the VIX during the period from September 15, 2008 to June 1, 2011. The vertical axis indicates the position response, where positions are the number of contracts normalized to a dollar value (in millions) by multiplying the quantity of contracts by fixed prices on December 15, 2006. 95% confidence bands are reported by grey dashed lines.

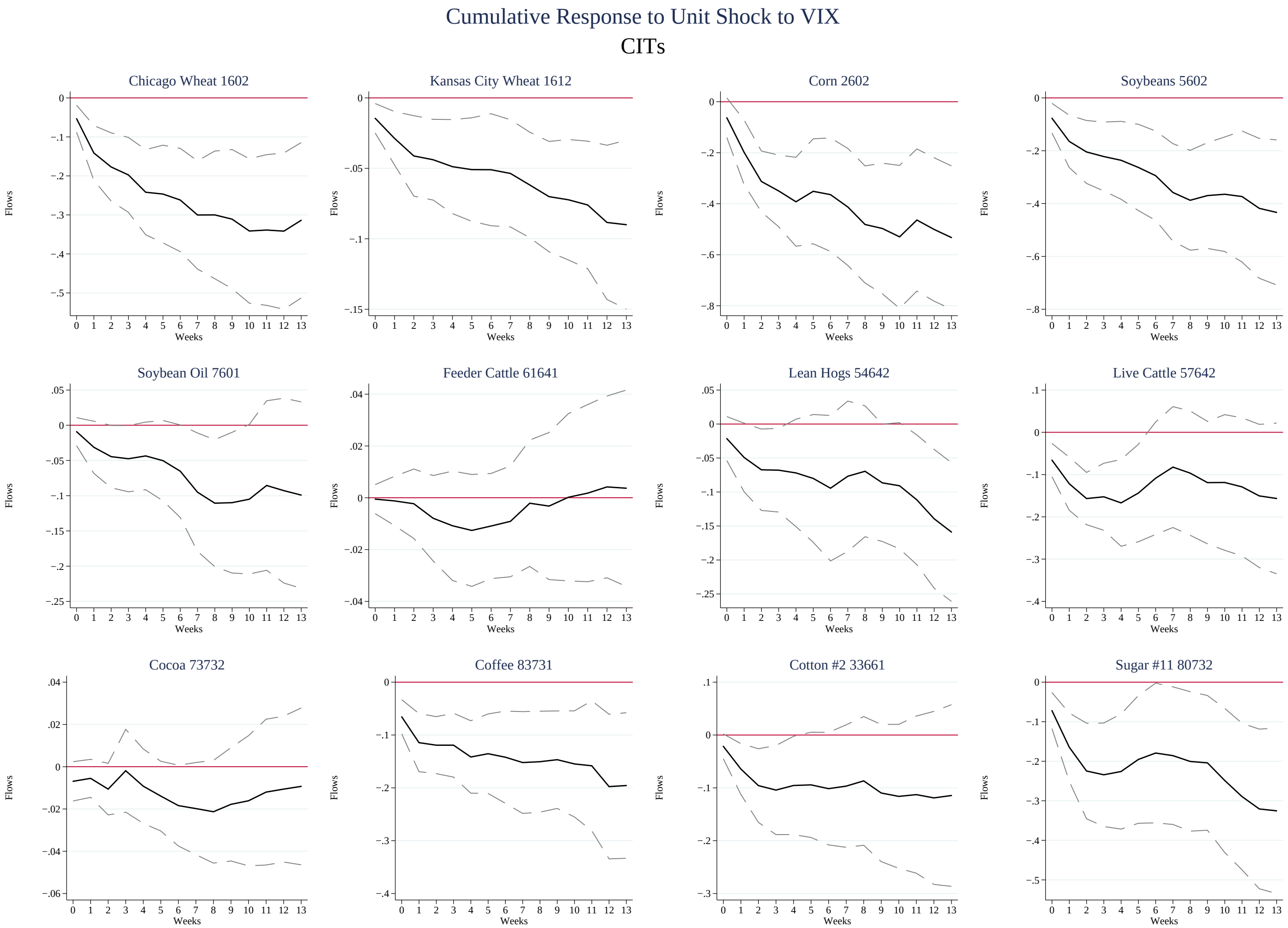


Table 1: Commodities

We list the 19 U.S. indexed commodities compromising the S&P GSCI and Dow Jones-UBS Commodity Indices in 2011. Aluminum, brent crude oil, lead, gasoil, nickel, and zinc are not included as they are not traded on U.S. exchanges. For a given commodity, each index tracks the same contract (e.g., Sugar #11 traded on ICE), except for Copper, noted below.

Sector	**Commodity Name**	**Exchange**	**GSCI**	**DJ-UBS**
Grains	Chicago Wheat	CME/CBT	X	X
	Corn	CME/CBT	X	X
	Kansas City Wheat	KBCT	X	
	Soybeans	CME/CBT	X	X
	Soybean Oil	CME/CBT		X
Livestock	Feeder Cattle	CME	X	
	Lean Hogs	CME	X	X
	Live Cattle	CME	X	X
Softs	Cocoa	ICE	X	
	Coffee	ICE	X	X
	Cotton #2	ICE	X	X
	Sugar #11	ICE	X	X
Energy	Crude Oil	CME/NYMEX	X	X
	Heating Oil	CME/NYMEX	X	X
	Natural Gas	CME/NYMEX	X	X
	RBOB Gasoline	CME/NYMEX	X	X
Metals	Copper	CME/COMEX	X	X
	Gold	CME/COMEX	X	X
	Silver	CME/COMEX	X	X

Table 2: Trader Characteristics

We report the number of traders and trader characteristics by year and trader category. Panel A gives the counts of traders, while Panel B gives the median notional value of each traders' positions during the year. Panel C reports the average number of commodities with any exposure. Panel D reports the average percentage of contracts long. For security reasons, the number of traders for CIT-HF and Hedger-HFs are concealed as they are very small.

Panel A: Number of Traders

Ranking Year	Population	CIT	C.Hedger	Hedge Fund	CIT-HF	Hedger-HF	Others
2000	4822	4	810	324			3672
2001	4576	4	857	334			3369
2002	4729	6	953	391			3363
2003	4990	6	1075	466			3424
2004	5376	9	1169	567			3610
2005	5197	9	1208	688			3267
2006	5664	12	1453	874			3293
2007	5629	12	1483	974			3123
2008	5667	15	1503	1089			3027
2009	5148	20	1332	1082			2686
2010	5699	18	1465	1116			3072

Panel B: Median Notional Net Position, 15Dec2006 Indexed Contract Prices $M

Ranking Year	Population	CIT	C. Hedger	Hedge Fund	CIT-HF	Hedger-HF	Others
2000	0.026	549.758	-2.434	0.806	.	-3.936	0.070
2001	0.014	527.124	-1.056	-0.039	181.463	-2.463	0.055
2002	0.005	315.939	-2.970	1.712	314.100	-4.127	0.046
2003	0.023	482.972	-2.482	2.394	278.254	-4.814	0.056
2004	-0.008	352.938	-3.265	0.720	388.174	-5.765	0.000
2005	-0.181	1893.471	-3.626	0.110	487.965	-5.048	-0.041
2006	-0.103	1737.572	-4.760	0.192	297.596	-7.797	0.000
2007	-0.191	2678.250	-5.569	0.368	403.775	-6.402	-0.024
2008	-0.291	2335.372	-5.301	0.200	483.518	-6.139	-0.014
2009	-0.261	1746.668	-5.084	0.438	546.638	-4.362	-0.054
2010	-0.242	2332.411	-7.128	1.362	725.793	-6.736	-0.013

Panel C: Average Number of Commodities with Any Exposure

Ranking Year	Population	CIT	C. Hedger	Hedge Fund	CIT-HF	Hedger-HF	Others
2000	1.257	14.925	1.246	2.364	.	1.011	1.147
2001	1.268	15.070	1.215	2.427	9.382	1.166	1.148
2002	1.263	15.629	1.210	2.442	12.516	1.106	1.113
2003	1.289	16.383	1.210	2.387	10.616	1.053	1.131
2004	1.328	16.345	1.204	2.543	13.727	1.160	1.128
2005	1.373	16.795	1.194	2.593	14.099	1.164	1.113
2006	1.415	17.626	1.200	2.571	13.637	1.337	1.101
2007	1.480	18.493	1.243	2.634	13.380	1.233	1.111
2008	1.502	17.627	1.239	2.410	13.894	1.164	1.174
2009	1.549	16.227	1.208	2.506	14.686	1.154	1.161
2010	1.574	16.713	1.242	2.594	14.553	1.221	1.216

Table 2, Continued

Panel D: Average Percentage of Contracts Long

Ranking Year	Population	CIT	C. Hedger	Hedge Fund	CIT-HF	Hedger-HF	Others
2000	0.522	0.860	0.394	0.599	.	0.212	0.545
2001	0.528	0.858	0.449	0.512	1.000	0.413	0.550
2002	0.521	0.842	0.400	0.609	0.999	0.206	0.546
2003	0.520	0.863	0.392	0.646	0.947	0.331	0.542
2004	0.495	0.894	0.367	0.587	0.981	0.207	0.522
2005	0.465	0.873	0.352	0.545	0.986	0.193	0.489
2006	0.469	0.887	0.323	0.563	0.987	0.221	0.506
2007	0.452	0.893	0.295	0.581	0.991	0.190	0.484
2008	0.448	0.873	0.299	0.549	0.984	0.248	0.483
2009	0.452	0.880	0.301	0.575	0.979	0.235	0.473
2010	0.445	0.872	0.250	0.604	0.963	0.229	0.477

Table 3: Time Series Summary Statistics for Flows and Returns

We report summary statistics for 19 indexed commodities at a weekly frequency. Indexed contract returns are expressed in basis points, while flows are expressed as notional dollar values ($M) normalized using indexed contract prices on December 15, 2006. Panel A reports summary statistics for the period September 15, 2008 onwards. Panel B reports the ratio of trader flow volatilities for September 15, 2008 onwards, as well as for the periods January 1, 2006 to September 15, 2008 and January 1, 2001 to January 1, 2006.

Panel A: Summary Statistics, 15Sep2008-01Jun2011

Sector	Commodity	Mean Indexed Contract Return	SD Indexed Contract Return	SD Flow: CIT	SD Flow: HF	SD Flow: C. Hedger	SD Flow: Other Unclass.	T
Grains	Chicago Wheat	-14.5	547.3	103.7	194.6	141.7	132.4	142
	Corn	13.5	566.7	177.6	457.1	391.1	204.3	142
	Kansas City Wheat	4.8	509.3	28.8	78.7	92.8	44.3	142
	Soybeans	23.9	422.3	121.6	429.7	386.7	254.9	142
	Soybean Oil	10.1	441.3	49.2	150.6	139.7	104.9	142
Livestock	Feeder Cattle	-1.3	222.4	16.8	55.5	28.4	35.5	142
	Lean Hogs	-28.2	370.8	50.2	105.7	52.6	113.2	142
	Live Cattle	-14.1	209.9	81.9	194.0	118.3	141.5	142
Softs	Cocoa	12.6	447.2	17.3	53.1	38.8	41.5	142
	Coffee	40.3	454.9	68.8	204.5	171.7	108.5	142
	Cotton #2	68.4	532.2	62.9	125.4	67.3	145.6	142
	Sugar #11	50.6	615.4	98.0	136.5	160.3	158.2	142
Energy	Crude Oil	-27.7	619.5	851.8	1173.7	388.5	755.3	142
	Heating Oil	-6.4	566.1	288.1	567.0	264.2	526.9	142
	Natural Gas	-99.3	655.3	512.5	834.1	244.8	637.2	142
	RBOB Gasoline	16.7	616.7	156.8	519.3	279.4	479.9	142
Metals	Copper	29.0	486.0	121.7	267.8	78.8	253.0	142
	Silver	98.0	573.4	123.7	216.6	63.1	143.4	142
	Gold	49.4	295.9	493.4	741.5	182.9	627.0	142

Panel B: Ratio of Flow Volatilities, Grain/Livestock/Softs Average

Period:	HF/CIT	C. Hedger /CIT	Other/CIT	HF /C. Hedger
15Sep2008-01Jun2011	2.6	2.0	1.8	1.4
01Jan2006-15Sep2008	3.5	2.6	2.4	1.5
01Jan2001-01Jan2006	6.3	4.2	4.2	1.6

Table 4: Commodity Returns and the VIX

We report coefficients from a weekly regression of commodity returns as the left-hand side variable on contemporaneous and one lag of changes in the VIX as right hand side variables, controlling for lagged commodity returns, percentage changes in the BDI, changes in the Baa credit spread, and changes in inflation compensation. Each row reports coefficients for a different commodity and each set of columns reports coefficients for different sample periods. For brevity, only the coefficients on the contemporaneous change in VIX are reported. Coefficients are reported where both returns and the VIX are in basis points. We use the Newey and West (1987) construction for standard errors with four lags. */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively.

Coefficient on Contemporaneous ΔVIX

		Post-Crisis				**Pre-Crisis**			
		15Sep2008-01Jun2011 *T*=142 Weeks		**01Jan2010-01Jun2011 *T*=74 Weeks**		**01Jan2006-15Sep2008 *T*=141 Weeks**		**01Jan2001-01Jan2006 *T*=262 Weeks**	
		Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic
Grains	Chi W	-0.6174	[-6.8105]***	-0.9345	[-3.8257]***	0.0068	[0.0303]	0.0747	[0.8290]
	Corn	-0.4551	[-3.8024]***	-0.7121	[-4.8204]***	-0.1429	[-0.8316]	-0.0166	[-0.1937]
	KC W	-0.5688	[-6.9442]***	-0.8676	[-3.9568]***	-0.0354	[-0.1510]	0.113	[1.2397]
	Soybeans	-0.3718	[-4.6336]***	-0.4896	[-3.4953]***	-0.0344	[-0.2206]	0.0203	[0.2320]
	Soyb Oil	-0.4115	[-4.9881]***	-0.4951	[-4.1131]***	-0.0384	[-0.2652]	-0.0587	[-0.6628]
Livestock	F Cattle	-0.2252	[-3.9118]***	0.0065	[0.1067]	0.0524	[0.5151]	0.0477	[0.9251]
	L Hogs	-0.0919	[-1.1710]	-0.3613	[-2.3938]**	0.0143	[0.1208]	-0.1337	[-1.3270]
	L Cattle	-0.1963	[-4.9440]***	-0.0775	[-1.1357]	-0.042	[-0.4006]	0.0666	[1.3047]
Softs	Cocoa	-0.2134	[-2.3469]**	-0.1228	[-0.7663]	-0.3467	[-1.7125]*	-0.0691	[-0.5049]
	Coffee	-0.2914	[-4.0742]***	-0.4263	[-2.2689]**	-0.2348	[-1.7615]*	0.0336	[0.2606]
	Cotton	-0.371	[-6.4895]***	-0.3929	[-1.9713]*	-0.0891	[-0.5968]	-0.1032	[-0.8861]
	Sugar	-0.2701	[-2.0996]**	-0.5985	[-2.1881]**	-0.0577	[-0.3413]	0.2296	[1.7985]*
Energy	Oil	-0.4674	[-3.7665]***	-0.4941	[-2.6536]***	0.0206	[0.1382]	-0.076	[-0.6132]
	Heat Oil	-0.4134	[-3.7817]***	-0.3638	[-2.5819]**	0.0719	[0.4626]	-0.1516	[-1.1289]
	Nat Gas	-0.3597	[-2.5277]**	-0.3229	[-1.1624]	-0.0572	[-0.2505]	-0.2669	[-1.5913]
	Gas	-0.3531	[-2.4924]**	-0.4439	[-2.9168]***	0.1	[0.5812]		
Metals	Copper	-0.3648	[-3.9503]***	-0.6387	[-5.1094]***	-0.4338	[-1.8313]*	-0.1942	[-2.8210]***
	Gold	-0.1199	[-1.1664]	-0.0917	[-0.7926]	-0.1203	[-0.6312]	-0.0175	[-0.3034]
	Silver	-0.332	[-2.3913]**	-0.431	[-1.5223]	-0.4193	[-1.5138]	-0.0854	[-0.9789]

Table 5: Position Changes and the VIX

We report coefficients from a weekly regression of position changes as the left-hand side variable on contemporaneous and one lag of changes in the VIX as right hand side variables, controlling for lagged commodity returns, percentage changes in the BDI index, changes in the Baa credit spread, and changes in inflation compensation. Each row reports coefficients for a different commodity, and each column reports coefficients for different trader groups. The sample period is September 15, 2008 through June 1, 2011. Changes in the VIX are measured in basis points and flows are the number of contracts normalized to a dollar value (in millions) by multiplying the quantity of contracts by fixed prices on December 15, 2006. For brevity, only the term on the contemporaneous change in VIX is reported. We use the Newey and West (1987) construction for standard errors with four lags. */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively.

Panel A: Post-Crisis, 15Sep2008-01Jun2011 (*T*=142 Weeks)

		Post-Crisis, 15Sep2008-01Jun2011 (T=142 Weeks)							
		CITs		**Hedge Funds**		**C.Hedgers**		**Other Unclassified**	
		Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic
Grains	Chi W	-0.0406	[-2.0679]**	-0.0992	[-2.6972]***	0.0983	[3.9693]***	0.0537	[1.6003]
	Corn	-0.0718	[-1.8418]*	-0.1729	[-1.7389]*	0.1217	[1.6063]	0.0901	[2.5066]**
	KC W	-0.0127	[-2.3353]**	-0.0242	[-1.6728]*	0.0477	[2.7001]***	0.0004	[0.0600]
	Soybeans	-0.0613	[-2.2734]**	-0.1772	[-1.8907]*	0.1703	[2.3964]**	0.1277	[2.5582]**
	Soyb Oil	-0.0115	[-1.0703]	-0.0437	[-1.3787]	0.05	[1.5339]	0.0368	[2.3800]**
Livestock	F Cattle	-0.0034	[-1.3905]	-0.0089	[-0.8355]	0.0119	[2.3098]**	-0.003	[-0.5542]
	L Hogs	-0.0208	[-1.0839]	-0.0144	[-1.0220]	-0.0004	[-0.0404]	0.0546	[2.2974]**
	L Cattle	-0.0705	[-2.7050]***	-0.026	[-0.6738]	0.0481	[2.4147]**	0.0519	[2.3585]**
Softs	Cocoa	-0.0045	[-1.0804]	0.0004	[0.0404]	0.0036	[0.7471]	0.006	[0.5533]
	Coffee	-0.0609	[-3.6880]***	-0.0647	[-1.6287]	0.0834	[2.7330]***	0.0506	[2.4617]**
	Cotton	-0.0299	[-2.0970]**	-0.0544	[-2.3864]**	0.0352	[2.7333]***	0.0818	[2.7030]***
	Sugar	-0.0644	[-2.3465]**	-0.0477	[-1.7686]*	0.0533	[2.2771]**	0.089	[2.7478]***
Average R-Squared		9.45%		15.99%		15.76%		9.77%	

Table 5, continued

Panel B: Pre-Crisis, 01Jan2006-15Sep2008 (*T*=141 Weeks)

		Coefficient on Contemporaneous ΔVIX							
		CITs		Hedge Funds		C.Hedgers		Other Unclassified	
		Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic
Grains	Chi W	0.0489	[1.4619]	0.1694	[2.3234]**	-0.0813	[-1.4291]	-0.128	[-2.7704]***
	Corn	0.0242	[0.3914]	-0.0223	[-0.1528]	0.104	[0.7782]	-0.0722	[-1.0279]
	KC W	0.0114	[1.6206]	0.0254	[0.6491]	-0.0397	[-0.8581]	0.0015	[0.0640]
	Soybeans	0.0481	[1.0047]	0.0375	[0.2697]	-0.0594	[-0.5393]	-0.1231	[-1.2378]
	Soyb Oil	0.0143	[1.1623]	-0.0233	[-0.4291]	0.0316	[0.7071]	-0.0158	[-0.4083]
Livestock	F Cattle	0.0102	[1.1226]	-0.0245	[-1.6905]*	0.001	[0.1283]	0.0106	[0.7442]
	L Hogs	-0.0429	[-1.7085]*	-0.0459	[-1.4848]	-0.0206	[-1.0118]	0.1103	[2.2984]**
	L Cattle	-0.0031	[-0.1626]	-0.0044	[-0.0608]	0.0444	[1.2345]	-0.021	[-0.4048]
Softs	Cocoa	0.0045	[0.7035]	-0.0737	[-2.0659]**	0.0362	[1.3269]	0.0273	[1.3053]
	Coffee	-0.0116	[-0.6407]	0.0006	[0.0076]	0.0177	[0.3468]	0.0064	[0.1122]
	Cotton	-0.0014	[-0.0431]	0.026	[0.3804]	-0.0216	[-0.7584]	0.0185	[0.2223]
	Sugar	-0.0647	[-1.7767]*	-0.0454	[-0.6309]	0.0735	[0.5311]	0.0798	[0.7674]

Panel C: 01Jan2001-01Jan2006 (T=262 Weeks)

		CITs		Hedge Funds		C.Hedgers		Other Unclassified	
		Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic
Grains	Chi W	0.0002	[0.0182]	-0.0005	[-0.0151]	-0.0113	[-0.4594]	0.0189	[0.7776]
	Corn	0.0265	[1.7070]*	-0.015	[-0.2191]	0.0014	[0.0199]	0.0025	[0.0879]
	KC W	-0.0059	[-1.5424]	0.0314	[1.7672]*	-0.0288	[-1.7969]*	-0.0054	[-0.3117]
	Soybeans	0.0383	[2.8007]***	-0.012	[-0.2053]	-0.0168	[-0.2548]	-0.0023	[-0.0629]
	Soyb Oil	0.0009	[0.3881]	-0.0119	[-0.5025]	0.0165	[0.5717]	0.0104	[0.7378]
Livestock	F Cattle	0.0005	[0.7531]	0.0129	[1.1078]	-0.0012	[-0.2722]	-0.0073	[-0.9909]
	L Hogs	0.0012	[0.5510]	-0.0023	[-0.1698]	-0.0054	[-0.8415]	0.0055	[0.4722]
	L Cattle	-0.0027	[-0.6116]	0.0351	[1.1263]	-0.0372	[-2.4287]**	0.0258	[1.3559]
Softs	Cocoa	0.0008	[0.6870]	-0.0313	[-1.8719]*	0.0109	[1.0440]	0.021	[1.5734]
	Coffee	-0.002	[-0.2604]	0.0018	[0.0373]	-0.0116	[-0.4158]	0.0119	[0.3739]
	Cotton	0.0032	[1.3217]	0.0282	[0.8339]	-0.0055	[-0.3269]	-0.0242	[-0.9760]
	Sugar	-0.0025	[-0.6526]	0.0848	[1.8658]*	-0.0719	[-2.1661]**	-0.0343	[-1.2563]

Table 6: Financial Distress and CIT Position Changes

We report coefficients from a weekly account-level panel regression of CIT position changes as the left-hand side variable on changes in the VIX, an indicator for whether the trader has a CDS spread above the median, and an interaction between the two, controlling for lagged commodity returns, percentage changes in the BDI index, changes in the Baa credit spread, and changes in inflation compensation. Each row reports coefficients for a different commodity. The sample period is September 15, 2008 through June 1, 2011. Changes in the VIX are measured in basis points and flows are the number of contracts normalized to a dollar value (in millions) by multiplying the quantity of contracts by fixed prices on December 15, 2006. Standard are clustered at the week level (*T*=142). */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively.

		CDS Hi/Lo		**Change in VIX**		**Interaction**		***N***	**R-Squared**
		Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic		
Grains	Chi W	-2.4707	[-1.4571]	0.0006	[0.3021]	-0.0063	[-2.3222]**	1480	0.0083
	Corn	1.2416	[0.4841]	0.0015	[0.4648]	-0.0124	[-2.3353]**	1480	0.0124
	KC W	0.7686	[1.5370]	-0.0007	[-0.9089]	-0.0012	[-1.3178]	1333	0.0126
	Soybeans	0.1508	[0.0711]	-0.0033	[-1.1243]	0.0003	[0.0611]	1480	0.0099
	Soyb Oil	-0.4106	[-0.4452]	-0.0006	[-0.5533]	0.0001	[0.0752]	1421	0.0074
Livestock	F Cattle	-0.2099	[-0.5660]	0	[-0.0119]	-0.0006	[-0.7565]	1227	0.0069
	L Hogs	-1.1912	[-1.3219]	-0.0007	[-0.7136]	-0.0008	[-0.3948]	1422	0.0189
	L Cattle	-1.4333	[-1.0355]	-0.0049	[-2.4045]**	-0.002	[-0.5185]	1422	0.0202
Softs	Cocoa	-0.3576	[-0.7369]	0.0001	[0.1206]	-0.0009	[-0.4630]	1244	0.0034
	Coffee	-1.5446	[-1.6353]	-0.0007	[-0.4404]	-0.0066	[-3.0605]***	1422	0.0316
	Cotton	-0.7968	[-0.8265]	0.001	[0.7768]	-0.0053	[-1.9560]*	1420	0.0234
	Sugar	-1.6204	[-1.1252]	0.0006	[0.2197]	-0.0079	[-2.0602]**	1480	0.0155

Table 7: Commercial Hedgers and Hedge Fund Sub-Groups

We report coefficients from a weekly regression of position changes as the left-hand side variable on contemporaneous and one lag of changes in the VIX as right hand side variables, controlling for lagged commodity returns, percentage changes in the BDI index, changes in the Baa credit spread, and changes in inflation compensation. Each row reports coefficients for a different commodity, and each column reports coefficients for different trader groups. The sample period is September 15, 2008 through June 1, 2011 (*T*=142 weeks). Changes in the VIX are measured in basis points and flows are the number of contracts normalized to a dollar value (in millions) by multiplying the quantity of contracts by fixed prices on December 15, 2006. For brevity, only the term on the contemporaneous change in VIX is reported. We use the Newey and West (1987) construction for standard errors with four lags. */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively.

		C.Hedgers, Long		**C.Hedgers, Short**	
CIT Position Changes		Coef.	t-statistic	Coef.	t-statistic
Grains	Chi W	0.0065	[1.9214]*	0.0918	[3.9348]***
	Corn	-0.0011	[-0.0612]	0.1168	[1.7359]*
	KC W	0.0008	[0.1143]	0.0445	[3.2131]***
	Soybeans	0.0007	[0.0456]	0.1507	[2.2548]**
	Soyb Oil	0.0193	[1.3809]	0.0338	[1.4093]
Livestock	F Cattle	0.0019	[1.0432]	0.0068	[2.0401]**
	L Hogs	0.0031	[1.3733]	0.0011	[0.1688]
	L Cattle	-0.0051	[-1.4066]	0.0578	[3.0390]***
Softs	Cocoa	0.0006	[0.2442]	0.0032	[0.7040]
	Coffee	0.0121	[1.7131]*	0.0787	[2.7089]***
	Cotton	-0.003	[-1.8002]*	0.0346	[2.7801]***
	Sugar	-0.0088	[-2.2474]**	0.0551	[2.4479]**
Average R-Squared		7.85%		13.51%	

Table 8: Active and Passive Commercial Hedgers

We test whether active commercial hedgers behave differently than passive commercial hedgers in aggregate by constructing a weekly panel of aggregate position changes for these two groups. This table reports the coefficients from regressing these weekly changes as the left-hand side variable on changes in the VIX, an indicator for the active group, and an interaction between the two, controlling for lagged commodity returns, percentage changes in the BDI, changes to the Baa credit spread, and changes to break-even inflation compensation. The sample period is September 15, 2008 through June 1, 2011. Changes in the VIX are measured in basis points and flows are the number of contracts normalized to a dollar value (in millions) by multiplying the quantity of contracts by fixed prices on December 15, 2006. For brevity, the term on the lagged commodity return is omitted. Standard are clustered at the week level (T=142). */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively.

		Active Trader Flag		**Change in VIX**		**Interaction**		**R-Squared**
		Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic	
Grains	Chi W	-2.2906	[-0.2827]	0.0157	[1.7490]*	0.0681	[4.3833]***	0.1281
	Corn	4.1253	[0.2057]	0.0491	[1.6723]*	0.0026	[0.0777]	0.0757
	KC W	-2.7796	[-0.4950]	0.013	[1.4698]	0.014	[1.1340]	0.0867
	Soybeans	-7.0281	[-0.2957]	0.0036	[0.2496]	0.13	[2.5159]**	0.0728
	Soyb Oil	-4.0109	[-0.4364]	0.0121	[1.2002]	0.0286	[1.7098]*	0.0694
Livestock	F Cattle	0.3638	[0.2653]	0.0031	[1.2106]	0.0023	[0.9191]	0.1408
	L Hogs	-0.0625	[-0.0156]	0.0032	[0.8702]	-0.0075	[-1.0000]	0.0209
	L Cattle	1.5305	[0.2612]	0.0099	[1.2379]	0.0172	[1.0942]	0.0853
Softs	Cocoa	-3.9815	[-1.6633]*	0.0074	[1.6289]	-0.0101	[-1.9346]*	0.165
	Coffee	1.8139	[0.2954]	0.0477	[2.6561]***	-0.0118	[-0.8943]	0.269
	Cotton	0.3193	[0.0850]	-0.0003	[-0.0483]	0.0246	[2.7797]***	0.0719
	Sugar	4.5892	[0.3875]	-0.0019	[-0.1909]	0.049	[1.9074]*	0.0329

Table 9: Persistence of Equity Market Shocks on Trader Positions

We report the sum of coefficients from a weekly regression of position changes as the left-hand side variable on contemporaneous and thirteen lags of changes in VIX as right hand side variables, controlling for 13 lags of commodity returns, during the post-crisis period September 1, 2008 - June 1, 2011. Each row reports the sum of coefficients on the thirteen lags of changes in the VIX results for a different commodity, while each column reports a different trader group. Changes in the VIX are measured in basis points and flows are the number of contracts normalized to a dollar value (in millions) by multiplying the quantity of contracts by fixed prices on December 15, 2006. We use the Newey and West (1987a) construction for standard errors with four lags. */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively.

		CITs		**Hedge Fund**		**All Financials**		**C. Hedger**	
		Sum of Lags	t-statistic	Sum of Lags	t-statistic	Sum of Lags	t-statistic	Sum of Lags	t-statistic
Grains	Chi W	-0.2605***	2.662	0.0962	0.396	-0.1624	0.838	0.0696	0.525
	Corn	-0.4698***	3.287	0.3475	0.837	-0.2131	0.452	0.2317	0.57
	KC W	-0.0755***	2.681	0.1808*	1.793	0.0766	0.688	-0.0918	0.675
	Soybeans	-0.3568***	2.721	0.0299	0.0545	-0.3906	0.641	0.4597	0.88
	Soyb Oil	-0.0899	1.465	-0.0638	0.396	-0.1685	0.964	0.2035	0.947
Livestock	F Cattle	0.0042	0.227	0.0449	0.926	0.0512	0.956	-0.0182	0.522
	L Hogs	-0.1375***	2.705	-0.0745	1.044	-0.2045**	2.558	0.0547*	1.728
	L Cattle	-0.0905	0.964	0.0590	0.278	-0.0528	0.224	0.1036	0.865
Softs	Cocoa	-0.0024	0.137	0.0671	1.275	0.0656	1.265	0.0074	0.198
	Coffee	-0.1300**	2.029	-0.1082	0.57	-0.2471	1.369	0.3233**	2.054
	Cotton	-0.0930	1.147	-0.2249**	2.056	-0.3033**	2.473	0.0913	1.522
	Sugar	-0.2534**	2.48	-0.1479	1.164	-0.4363***	3.583	0.2682**	2.262

Table 10: Analysis of Commitment of Traders Data

We report coefficients from a weekly regression of position changes as the left-hand side variable on contemporaneous and one lag of changes in the VIX as right hand side variables, controlling for lagged commodity returns, percentage changes in the BDI index, changes in the Baa credit spread, and changes in inflation compensation. Each row reports coefficients for a different commodity, and each column reports coefficients for different trader groups from the Commitment of Traders reports. The sample period is September 15, 2008 through June 1, 2011 (T=142 weeks). Changes in the VIX are measured in basis points and flows are the number of contracts normalized to a dollar value (in millions) by multiplying the quantity of contracts by fixed prices on December 15, 2006. For brevity, only the term on the contemporaneous change in VIX is reported. We use the Newey and West (1987) construction for standard errors with four lags. */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively.

		Disaggregated COT Report								CIT Supplemental	
		Producers		Swap Dealers		Managed Money		Other Non-Comm.		CITs	
		Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic	Coef.	t-statistic
Grains	Chi W	0.1459	[3.5170]***	-0.02	[-1.1457]	-0.0864	[-2.0865]**	-0.0005	[-0.0200]	-0.0228	[-1.6602]*
	Corn	0.2167	[2.1785]**	-0.0378	[-1.3665]	-0.1776	[-1.8407]*	0.0267	[1.0308]	-0.0993	[-3.5983]***
	KC W	0.0532	[3.0400]***	-0.0085	[-1.4402]	-0.0225	[-1.4432]	-0.0123	[-1.7798]*	-0.015	[-2.4855]**
	Soybeans	0.2734	[2.6283]***	-0.0361	[-1.4866]	-0.1856	[-2.0988]**	0.0712	[2.7371]***	-0.074	[-2.7992]***
	Soyb Oil	0.0697	[1.7575]*	-0.0076	[-0.8161]	-0.0475	[-1.4857]	0.0412	[3.2438]***	-0.0164	[-1.9086]*
Livestock	F Cattle	0.0166	[2.3488]**	-0.003	[-1.0045]	-0.0125	[-1.2046]	0.0058	[1.0483]	-0.0028	[-0.7466]
	L Hogs	0.0172	[0.8837]	-0.0066	[-0.4727]	-0.0217	[-1.5049]	0.0088	[0.8128]	-0.0085	[-0.5590]
	L Cattle	0.079	[2.4195]**	-0.0375	[-2.4722]**	-0.0463	[-1.1485]	-0.0027	[-0.1026]	-0.0575	[-3.0275]***
Softs	Cocoa	0.0099	[0.9047]	-0.002	[-0.5053]	0.0049	[0.4912]	-0.0048	[-2.0938]**	-0.0004	[-0.0712]
	Coffee	0.1112	[2.6026]**	-0.0336	[-2.5334]**	-0.0726	[-1.8089]*	0.0194	[1.4530]	-0.0388	[-2.8539]***
	Cotton	0.1093	[3.4673]***	-0.0231	[-1.4759]	-0.0463	[-1.8947]*	0.0240	[1.4492]	-0.0091	[-0.7493]
	Sugar	0.1128	[3.3121]***	-0.0547	[-1.7460]*	-0.0452	[-1.6949]*	-0.0112	[-1.3279]	-0.0454	[-1.9083]*
Average R-Squared		16.10%		8.54%		15.70%		6.99%		12.39%	

Table 11: Projected World Usage

We report coefficients from a monthly regression of position changes as the left-hand side variable on contemporaneous and one lag of changes in the VIX as right hand side variables, controlling for lagged commodity returns and the 12-month change in projected world usage for the upcoming harvest. The sample period is September 2008 through May 2011. Changes in the VIX are measured in basis points and flows are the number of contracts normalized to a dollar value (in millions) by multiplying the quantity of contracts by fixed prices on December 15, 2006. We use the Newey and West (1987) construction for standard errors with 1 lag. */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively. For brevity, we do not report the constant term.

	CITs					**Hedge Funds**				
	Chi W	**Corn**	**Soybeans**	**Soyb Oil**	**Cotton**	**Chi W**	**Corn**	**Soybeans**	**Soyb Oil**	**Cotton**
ΔVIX (*t*)	-0.1065	-0.267	-0.1712	-0.0545	-0.0878	-0.1996	-0.4828	-0.6099	-0.1266	-0.0567
	[-2.3885]**	[-3.1240]***	[-3.1591]***	[-1.9653]*	[-1.9372]*	[-1.2962]	[-1.9413]*	[-1.8810]*	[-1.3703]	[-0.9586]
ΔVIX (*t*-1)	-0.0546	-0.0659	-0.0697	-0.0367	0.0157	0.061	-0.2776	-0.0717	-0.0523	-0.1715
	[-1.0689]	[-0.6371]	[-1.2017]	[-0.7851]	[0.3918]	[0.4167]	[-0.8140]	[-0.2269]	[-0.6000]	[-1.6444]
Futures Return (*t*-1)	-0.0673	-0.1209	-0.0387	-0.0235	0.0206	-0.0549	-0.1138	-0.1127	-0.1039	-0.0954
	[-1.3714]	[-1.7775]*	[-0.6946]	[-0.3939]	[0.7485]	[-0.4889]	[-0.5301]	[-0.3808]	[-1.1891]	[-1.9323]*
%ΔForecasted Usage (*t*)	-0.3392	-0.1847	-0.122	0.0011	-0.0227	0.0702	0.6058	0.1406	0.0494	-0.0136
	[-3.2590]***	[-0.7302]	[-1.9034]*	[0.0321]	[-0.7324]	[0.2693]	[0.5763]	[0.4487]	[0.4614]	[-0.2221]
Observations	33	33	33	33	33	33	33	33	33	33
R-Squared	0.347	0.272	0.282	0.0958	0.164	0.0861	0.0953	0.161	0.0826	0.158

	Commercial Hedgers					**Other Unclassified**				
	Chi W	**Corn**	**Soybeans**	**Soyb Oil**	**Cotton**	**Chi W**	**Corn**	**Soybeans**	**Soyb Oil**	**Cotton**
ΔVIX (*t*)	0.2473	0.4899	0.4512	0.2273	0.1329	0.1025	0.2325	0.377	0.0219	0.0616
	[3.1369]***	[2.3916]**	[1.8594]*	[2.7114]**	[2.7709]***	[1.5247]	[3.5796]***	[2.4591]**	[0.3608]	[1.0949]
ΔVIX (*t*-1)	-0.0394	0.5544	-0.0791	0.0626	0.0154	0.0366	-0.129	0.1825	0.0273	0.1731
	[-0.5098]	[1.8747]*	[-0.2905]	[0.6138]	[0.3638]	[0.4074]	[-1.4759]	[1.1532]	[0.6476]	[2.0459]*
Futures Return (*t*-1)	0.0611	0.2952	-0.069	0.0749	0.0108	0.058	0.0345	0.3192	0.0779	0.094
	[0.8750]	[1.6183]	[-0.3020]	[0.6938]	[0.3911]	[1.0097]	[0.4525]	[1.8761]*	[1.3700]	[1.8348]*
%ΔForecasted Usage (*t*)	0.0754	-0.6233	-0.0181	-0.008	0.0233	0.0983	-0.0997	-0.077	-0.0465	0.0102
	[0.5243]	[-0.7579]	[-0.0491]	[-0.1005]	[0.7299]	[1.3365]	[-0.4370]	[-0.6206]	[-0.5948]	[0.1571]
Observations	33	33	33	33	33	33	33	33	33	33
R-Squared	0.277	0.194	0.101	0.222	0.274	0.168	0.197	0.288	0.055	0.155

Table 12: Cash Commitments

Panel A presents summary statistics for the accounts providing monthly data on cash commitments for the period January 2006 - May 2011. Panel B presents results from a panel regression of changes in cash and changes in cash plus futures as left-hand side variables, and the contemporaneous plus one lag of changes in the VIX as right-hand side variables, with a control for the lagged futures return. Changes in the VIX are measured in basis points and changes in cash positions are converted to an equivalent number of contracts and normalized to a dollar value (in millions) by multiplying the quantity of contracts by fixed prices on December 15, 2006. We use clustered standard errors in panel regressions where we cluster at the monthly level. */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively.

Panel A: Summary Statistics

	Number of Accounts	% Futures Positions Covered	Panel ρ(ΔC,ΔF)	Time Series Average of Aggregate: Cash ($ MM, Prices as of Dec 15 2006)	Futures	C+F
Wheat	21	51.48	-0.1218	1795.3	-1,046.00	749.3
Corn	31	30.25	-0.1814	3,432.60	-2,519.80	912.8
Soybeans	27	47.95	-0.3162	5,122.60	-2,173.80	2,948.90
Soybean Oil	13	59.96	0.0515	-160.20	-1,027.20	-1,187.40
Cotton	61	71.02	-0.2053	1,510.00	-623.80	886.20

Panel B: Sensitivity to VIX, September 2008 - May 2011

	Change in Futures					**Change in Cash Commitments**				
	Wheat	**Corn**	**Soybeans**	**Soyb Oil**	**Cotton**	**Wheat**	**Corn**	**Soybeans**	**Soyb Oil**	**Cotton**
ΔVIX (*t*)	0.0178	0.0016	0.0108	0.0282	0.0031	-0.0126	-0.0118	-0.0144	0.0011	-0.0057
	[2.6537]**	[0.1801]	[0.9716]	[2.8256]***	[2.3057]**	[-1.4235]	[-0.9272]	[-0.6774]	[0.1314]	[-3.2304]***
ΔVIX (*t*-1)	-0.006	0.0201	-0.0018	0.0034	-0.0005	-0.0164	-0.0076	-0.0044	0.0037	-0.0023
	[-0.4313]	[1.6698]	[-0.1543]	[0.2568]	[-0.4369]	[-0.8238]	[-0.5658]	[-0.1662]	[0.3023]	[-1.1831]
Futures Return (*t*-1)	0.0069	0.0168	0.0071	0.0015	0	0.0051	0.0178	0.0034	0.0013	0.0009
	[1.1516]	[2.2124]**	[0.4793]	[0.1162]	[0.0253]	[0.3759]	[2.1753]**	[0.1214]	[0.1431]	[0.8448]
Constant	1.1279	-7.0638	2.3633	-0.479	0.4337	1.3908	-7.0064	3.2247	7.2337	-1.6757
	[0.2133]	[-0.9100]	[0.2595]	[-0.0654]	[0.3706]	[0.1750]	[-0.8513]	[0.2333]	[1.1670]	[-1.3492]
Observations	137	146	142	126	532	137	146	142	126	532
R-Squared	0.0687	0.046	0.0094	0.0603	0.0189	0.0406	0.0547	0.0072	0.0007	0.04

Table 12, Panel B, Continued

	Change in Cash + Futures				
	Wheat	**Corn**	**Soybeans**	**Soyb Oil**	**Cotton**
ΔVIX (t)	0.0022	-0.0028	-0.0035	0.0296	-0.0026
	[0.2897]	[-0.2360]	[-0.1959]	[1.7945]*	[-1.2045]
ΔVIX (t-1)	-0.0175	0.0071	-0.0096	0.0131	-0.0028
	[-1.1092]	[0.5103]	[-0.4949]	[0.6961]	[-1.4530]
Futures Return (t-1)	0.019	0.035	0.0096	0.0055	0.0008
	[1.4964]	[3.0591]***	[0.4609]	[0.2910]	[0.6199]
Constant	1.1362	-8.2319	-5.138	3.2234	-1.2949
	[0.1655]	[-0.8550]	[-0.3729]	[0.3066]	[-1.0214]
Observations	137	146	142	126	532
R-Squared	0.0688	0.0778	0.008	0.0291	0.0147

Table 13: US Production

We report coefficients from a monthly regression of the 12-month percent change in projected U.S. production for the upcoming harvest as the left-hand side variable on contemporaneous and one lag of changes in the VIX as right-hand side variables, controlling for lagged commodity returns. We use the Newey and West (1987) construction for standard errors with one lag. */**/*** denotes significant at the 10%, 5%, and 1% levels, respectively.

	Forecasted US Production for Upcoming Harvest 12 Month Percent Change									
	Sep 2008 - May 2011					Jan 2006 - Aug 2008				
	Wheat	**Corn**	**Soybeans**	**Soyb Oil**	**Cotton**	**Wheat**	**Corn**	**Soybeans**	**Soyb Oil**	**Cotton**
ΔVIX (*t*)	0.165	-0.0455	-0.0366	0.1251	-0.0305	0.3428	0.1771	0.2039	-0.085	0.0028
	[0.4390]	[-0.1919]	[-0.2861]	[1.4948]	[-0.0503]	[0.3684]	[0.2157]	[0.2336]	[-0.7511]	[0.0058]
ΔVIX (*t*-1)	0.6243	-0.0592	-0.2044	0.1156	1.0067	0.263	0.4268	0.1475	-0.1224	0.1203
	[1.3206]	[-0.2351]	[-1.1429]	[1.1644]	[1.4480]	[0.3191]	[0.5332]	[0.2035]	[-1.6286]	[0.2243]
Futures Return (*t*-1)	0.1221	0	-0.2695	0.1152	1.6459	0.2802	0.0264	-0.2583	0.0008	-0.1177
	[0.6493]	[-0.0003]	[-1.7434]*	[1.2950]	[3.7236]***	[0.9135]	[0.1131]	[-0.9410]	[0.0245]	[-0.6895]
Constant	114.31	48.23	863.48	-342.81	239.16	92.03	562.38	-293.73	374.65	-871.48
	[0.3987]	[0.2733]	[6.1402]***	[-3.4042]***	[0.3975]	[0.2457]	[1.8766]*	[-1.0591]	[6.5783]***	[-4.3851]***
Observations	33	33	33	33	33	32	32	32	32	32
R-Squared	0.0301	0.00423	0.0339	0.0416	0.257	0.041	0.00161	0.031	0.00976	0.00764