# Does Financial Stress Affect Commodity Futures Traders' Positions?

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**Abstract**

Financial stress can impact trading behavior in the U.S. commodity futures markets. To clarify the impact, we study absolute changes and relative exposure dynamics in traders' positions during two recent crises: the 2008 Global Financial Crisis (GFC) and the COVID-19 pandemic. The nature of these two crises are very distinct, and we find that traders behaved quite differently. The commodity market collapse during the 2008 GFC followed the classic pattern of a speculative bubble; speculators, including financial institutions and money managers, rushed to close their long positions in commodity futures while commodity producers or hedgers actively facilitated these trades. Consequently, the risk in commodity futures flowed from speculators back to producers. In sharp contrast, no evidence is found to support this type of risk flow during the COVID-19 crisis. Stress in the financial system was relatively mild compared with the 2008 GFC, and the commodity market experienced a strong rally early in the crisis. Both speculators and hedgers traded in an orderly fashion. In terms of traders' relative exposures, we find that the impact from financial stress was immaterial. We also find that speculators generally reacted to changing financial conditions more strongly than hedgers, during the period.

Keywords: Commodities, Futures, Financial Stability, Market Volatility, COVID-19, 2008 GFC
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# 1 Introduction

We study how risk is transferred between different participants within commodities futures markets in response to a financial system shock. Understanding risk transfer in these markets is important, because commodity futures play a critical role in the global economy. Commodities are essential to the real economy and futures provide essential hedging instruments for producers and consumers alike. The trading of commodity futures also facilitates price discovery, can help manage market volatility, and offers opportunities for speculation and investment. Consequently, the futures market represents an important intersection between the real and financial sides of the economy and understanding how risk is transferred through those markets is valuable.

Commodity futures markets are highly integrated with the global financial system. The interconnectedness between commodity futures markets and the financial system can cause significant repercussions during times of market stress. Commodity price shocks can create a ripple effect through financial institutions, particularly those heavily exposed to commodity-related assets. On the other hand, the financial system's health—including interest rates, market liquidity, and investor sentiment—could attenuate stress in the commodity futures market.

Hedgers and speculators are two major type of participants in commodity futures markets. Typically, hedgers either produce the commodity or use the actual commodity. Futures enable them to manage their risks by "locking-in" prices, so that they are protected against unfavorable price fluctuations. Speculators, on the other hand, are the risk-takers of the futures market. They aim to profit from price movements, for example, by buying or selling a futures contract if they anticipate rising or falling prices respectively, or constructing more complicated exposures to take advantage of perceived opportunities. The behavior of both these types of participants and their interaction can determine whether commodity futures serve as a stabilizing or destabilizing channel for market stress.

This paper, therefore, studies risk transfer between these two groups under stress. In particular, we look at aggregate changes in the positions of commodity futures traders during two recent periods of severe financial stress: the 2008 Global Financial Crisis (GFC) and the 2020 COVID-19 crisis (including the 2022 Russian invasion of Ukraine). We are particularly interested in whether and how traders reacted differently to global financial system shocks during those two crises, and what differences in the reactions might imply about how commodity futures markets can amplify or mitigate financial stress. This objective contrasts with prior research has focused on the potential impact of commodity market shocks on financial-sector stability, specifically on banking-sector stability (Alodayni, 2016, Kinda et al., 2018, Eberhardt and Presbitero, 2021).

Both the 2008 GFC and the 2020 COVID-19 crises severely stressed the financial system as well as the broader economy. However, the causes and consequences of those two crises are quite different. The 2008 GFC, which was started by the mortgage meltdown, represented an inflection point within the financial system caused by excess leverage and poor-quality mortgage loans; the 2020 COVID-19 crisis, on the other hand, represented a substantial global economic shock from the viral outbreak of COVID-19 that was somewhat exogenous to the financial system itself. At the beginning of the COVID-19 crisis, global financial markets experienced unprecedented upheaval in volatility. The magnitude of stress on financial stability and the global economy was more severe than during the 2008 GFC. With supports from the government and central bank, the financial market also stabilized and recovered much faster compared with the 2008 GFC.

The Russian invasion of Ukraine during 2022 caused a tremendous shock to some specific commodity markets, but the overall impact on financial stability was contained.

We use the Financial Stress Index (FSI) provided by the Office of Financial Research (OFR) to measure the stability conditions of the global financial system. The OFR FSI provides a daily market-based measurement of stress level in global financial markets. According to the OFR's white paper (OFR, 2023), the OFR FSI performs well in identifying systemic financial stress as a coincidental indicator. In addition, the OFR FSI leads the Chicago Fed National Activity Index in a Granger causality analysis, suggesting that this index might be predictive of decreases in global economic activity.

To measure traders' position changes, we use Commodity Futures Trading Commission (CFTC) weekly Disaggregated Commitments of Traders (DCOT) data. The CFTC collects data on the daily positions (expressed through open interest) of large participants in individual commodity markets. The CFTC aggregates these data and groups individual trading entities into several classes of traders, and releases the positions of the aggregate groups in its weekly DCOT report. Some research using these reports has focused mainly on finding whether certain groups of traders' positions lead or lag returns, and how hedging pressure affects prices. The purpose is to discern whether open interest as an indicator contains any information that can be used to anticipate price movements; see Dedi and Mandilaras (2022) for example. The focus of this paper is broader as we look at the relationship between traders' position changes and the general condition of the financial system.

Our research is mainly motivated by a theory of a convective risk flow proposed by Cheng et al. (2015).[1] They show empirically that during the 2008 GFC, risk flowed from the financial institutions to commodities producers. Before the crisis, financial institutions actively facilitated hedging trades for commodity producers using their balance sheet. However, during the crisis, as those financial institutions encountered significant stress on their balance sheet, they were forced to reduce their commodity market exposures. Without those financial institutions taking the hedging positions, commodity hedgers either had to close their positions or find other trading counterparties to replace the financial institutions. Cheng et al. (2015) argues that during the 2008 GFC, some commodity producers actually took the role of large financial institutions. The aggregated exposures for producers as a group became larger, thus market risk flowed from financial institutions to commodity producers. Kang et al. (2020) further developed this theory by showing that speculators need to pay a risk premium to producers for closing their positions because of external financial conditions. Bonnier (2021) also found that short-term fluctuations in open interest might primarily be driven by speculators' demand for liquidity.

This study makes four unique contributions to the literature. First, our analysis extends the previous literature by considering a broader metric for financial stress by using the OFR FSI. This index is not only a better indicator of broad financial system conditions, but also decomposes "financial stress" into five specific categories: (1) credit, (2) equity valuation, (3) funding, (4) safe assets, and (5) volatility. This approach allows us to assess the type of financial stress market participants to which are reacting. For instance, if funding constraints are the main drivers for financial institutions liquidating their positions, we would expect there to be high correlation between the FSI funding sub-index and speculators' positions. Second, our analysis considers how the COVID-19 financial shock affected commodity futures traders' position. There are many differences as well as similarities between the COVID-19 shock and the 2008 financial

[1]Another paper that is closer to this one is Tokic (2012), which studies the behavior of different traders during the 2008 oil bubble.

crisis, allowing us to test the convective risk flow hypothesis in different financial stress conditions. Third, we investigate both absolute and relative position changes for hedgers and speculators. Previous research only studied the position changes for individual commodities. We extend the analysis to relative exposure between hedgers and speculators at the aggregate market level. Lastly, we study the positions of both active investors like money managers and passive investors like commodity index traders (CIT) in commodity futures market. We test whether those two type of investors, both categorized as speculators, respond to financial system stress differently during the two crises.

The remainder of the paper is organized as follows. In the following section, we provide a brief introduction to the DCOT data and the FSI. Section 3 provides an overview of market dynamics and trader positions during the 2008 GFC and the COVID-19 crisis. Section 4 studies the relationship between financial stability and commodity market. Section 5 presents the regression results for the absolute changes in traders' positions. Section 6 provides a study on the relative exposure of different traders, and section 7 concludes.

## 2 DCOT Data and the FSI

This study focuses on four groups of commodity futures actively traded on the Chicago Mercantile Exchange (CME): (1) energy, (2) agriculture, (3) base metals, and (4) precious metals. For traders' positions, we use the DCOT report published by the CFTC. The report is released as a snapshot of the aggregated positions of four categories of traders on Tuesday each week. The categories are: (a) Producer/Merchant/Processor/User, (b) Swap Dealers, (c) Money Managers, and (d) Other Reportables. The CFTC defines these categories as follows:

**Producer/Merchant/Processor/User** Entity that trades predominately for the purpose of hedging risk that is tied to their non-financial business;

**Swap Dealer** Entity that primarily deals in swaps for a commodity and uses the futures markets to manage or hedge the risk associated with those swap transactions. The swap dealer's counterparties may be speculative traders, like hedge funds, or traditional commercial clients that are managing risk arising from their dealings in the physical commodity;

**Money Manager** Entity that trades speculatively, such as a commodity trading advisor (CTA), a registered commodity pool operator (CPO), or an unregistered fund identified by the CFTC; and

**Other** Entities that the CFTC cannot reliably place into any of the other categories.

We identify the first group as producers or hedgers and aggregate the second and third groups as speculators. We exclude the other category from our analysis.

We use the OFR FSI to measure the level of stress in the financial markets. According to OFR (2023), the FSI measures systemic financial stress –disruptions in the normal functioning of financial markets. The OFR FSI incorporates five categories of indicators and is constructed from 33 financial market variables, such as yield spreads, valuation measures, and interest rates. Each variable in the index measures a feature of financial stress. Financial stress can be captured by how the variables move together through time. A statistical algorithm captures the co- movement and produces a set of weights for the variables. The value

of the OFR FSI on a given day is the weighted average level of each variable observed in the market on that day, relative to its history. The OFR FSI is positive when stress levels are above average, and negative when stress levels are below average. The magnitude of the index indicates how far the index deviates from the average at zero. The index is calculated after each U.S. trading day and is a concurrent indicator. The OFR FSI incorporates five categories of indicators:

**Credit** Tracks credit spreads, which indicate the cost difference for borrowing between firms with varying creditworthiness. Wider spreads suggest investors are more hesitant to hold debt, raising borrowing costs;

**Equity valuation** Monitors stock valuations across multiple market indexes, reflecting investor sentiment and risk tolerance;

**Funding** Assesses the ease with which financial institutions can secure funding. Stress in financial markets can lead to funding freezes if market participants perceive heightened counterparty credit or liquidity risks;

**Safe assets** Evaluates the valuation of assets considered stable stores of value or those with predictable cash flows. During periods of stress, higher valuations of safe assets may indicate a "flight to quality" as investors shift from riskier or less liquid assets to safer options; and

**Volatility** Measures both implied and realized volatility across equity, credit, currency, and commodity markets. Increased uncertainty about asset values or investor behavior during stressed periods often manifests as higher volatility.

Our DCOT data sample extends from June 2006 through December 2022, covering three major commodity market shocks: the 2008 GFC, the 2020 COVID-19 crisis, and the 2022 Russian invasion of Ukraine. Table 1 presents the statistics of traders' net positions over the entire sample period for selected commodity futures contracts. Generally, producers have net short positions as they are selling futures contracts to hedge against the price risk. Swap dealers and money managers are usually on the other side of producers' hedge positions, and therefore tend to have net long positions.

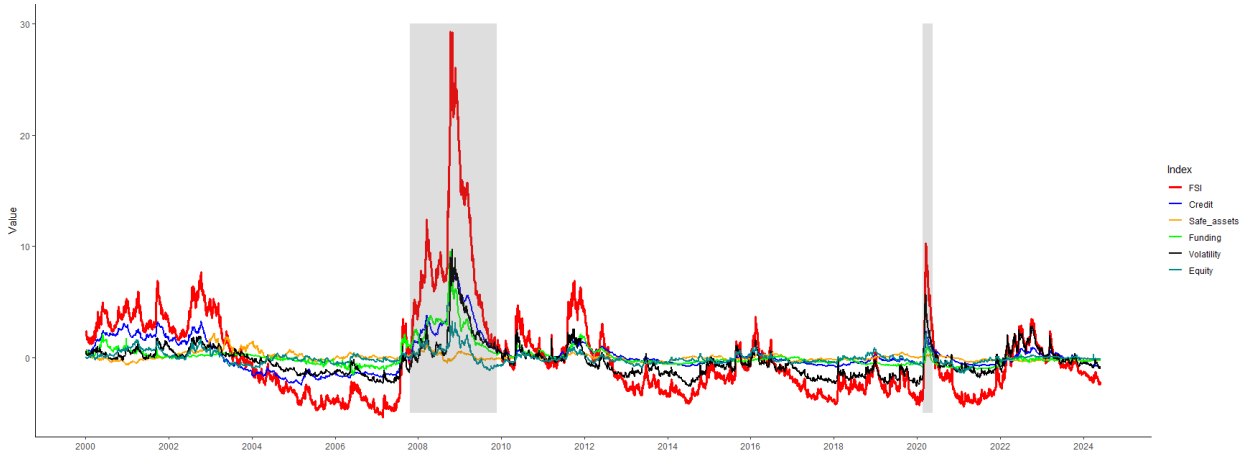
Figure 1 on the following page shows the daily history of the OFR FSI and its sub-index from 2000 through 2024. The FSI peaked in 2008 and remained in positive territory for an extended period. The 2008 GFC was a banking crisis, and the global financial system was under persistent severe stress for several years. The FSI did not return to its neutral baseline until February 2010. The COVID-19 crisis, on the other hand, was triggered by economic lockdowns aimed at preventing the virus's spread. It was not a banking crisis, and the impact on the global financial system was temporary and relatively contained, particularly compared to the GFC. The FSI jumped in 2020, but too less than 50 percent of its peak level during 2009. This level was similar to the initial (local) peak in the FSI observed in 2008 that was subsequently dwarfed by the later (global) peak. Following the initial jump in 2020, the FSI quickly fell back into negative territory relatively quickly, indicating that financial stability conditions reverted to normal after a short- lived market turmoil. In 2022, the Russian invasion of Ukraine created some stress on the global financial system, but the impact was muted in terms of magnitude, although the index did remain positive for several months.

Table 1: Summary Statistics for Net Positions of Traders' Open Interest

| Commodities | Producers | | Swap Dealers | | Money Managers | |
|---|---|---|---|---|---|---|
| | Mean | Std Dev | Mean | Std Dev | Mean | Std Dev |
| Crude Oil | −100,860 | 96,304 | −184,264 | 235,129 | 185,870 | 105,634 |
| Wheat | −85,531 | 47,528 | 109,924 | 37,931 | −15,692 | 46,838 |
| Natural Gas | −32,518 | 36,424 | 111,588 | 72,190 | −26,872 | 108,789 |
| Copper | −40,177 | 26,234 | 37,474 | 26,234 | 10,944 | 32,684 |
| Gold | −105,193 | 55,524 | −76,222 | 61,237 | 103,905 | 70,480 |
| Soybean | −161,845 | 103,365 | 100,421 | 24,782 | 69,596 | 18,780 |

*Unit is in futures contracts

Figure 1: History of the OFR FSI and its Sub-indexes




## 3 Commodity Market and Trader Position Overview

Commodity futures markets had distinct price movements between the 2008 GFC and the COVID-19 crisis. In the 2000s, commodity markets experienced a price boom, driven by the growth of the global economy and the inflow of investors' money. Commodity prices rose steadily through the 2000s until the beginning of the 2008 GFC, when the market collapsed. What caused this boom and bust cycle in commodity markets has been extensively studied (Dominguez and Reinhart, 2008, Carter et al., 2011, Irwin and Sanders, 2011, Hamilton, 2009, etc.). Researchers found strong interconnectedness between financial system, speculative trading, and commodity market movements. Some have argued that excessive speculation was a major cause of the dramatic price movement in commodity prices. In contrast, the commodity markets were relative stable before the COVID-19 crisis and gained momentum for the upward movement after the COVID-19, partially driven by the imbalance of supply and the strong demand from the economy recovering (Monge and Lazcano, 2022, Zhang and Wang, 2022).

Figure 2: Daily History of Normalized and Inflation-Adjusted Commodity Futures Prices

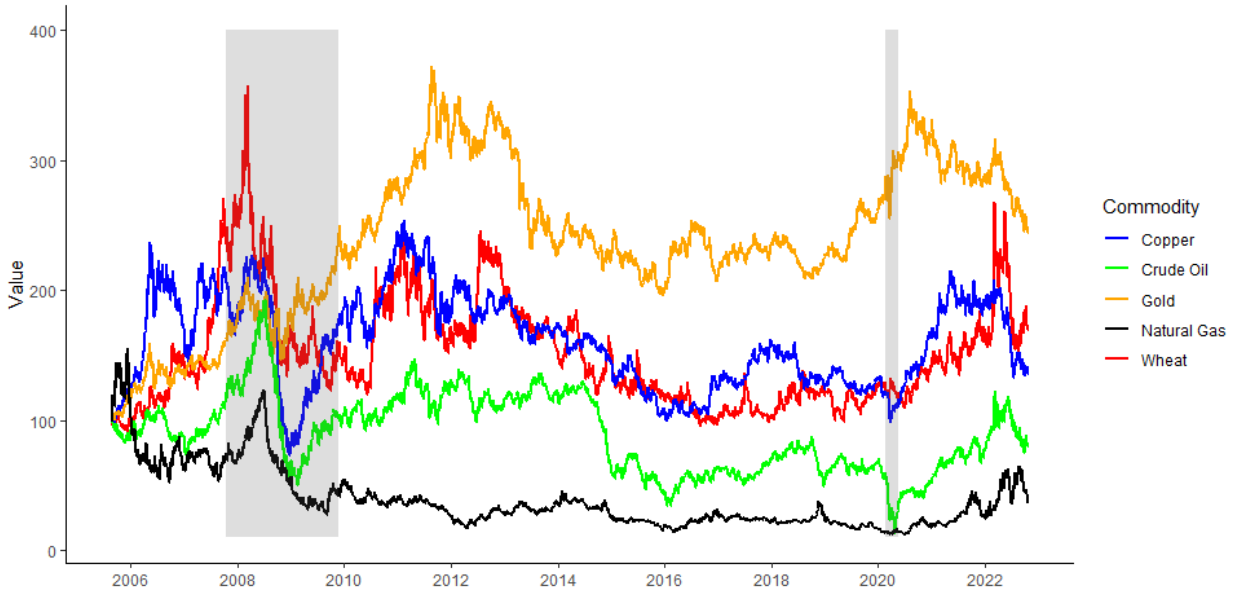
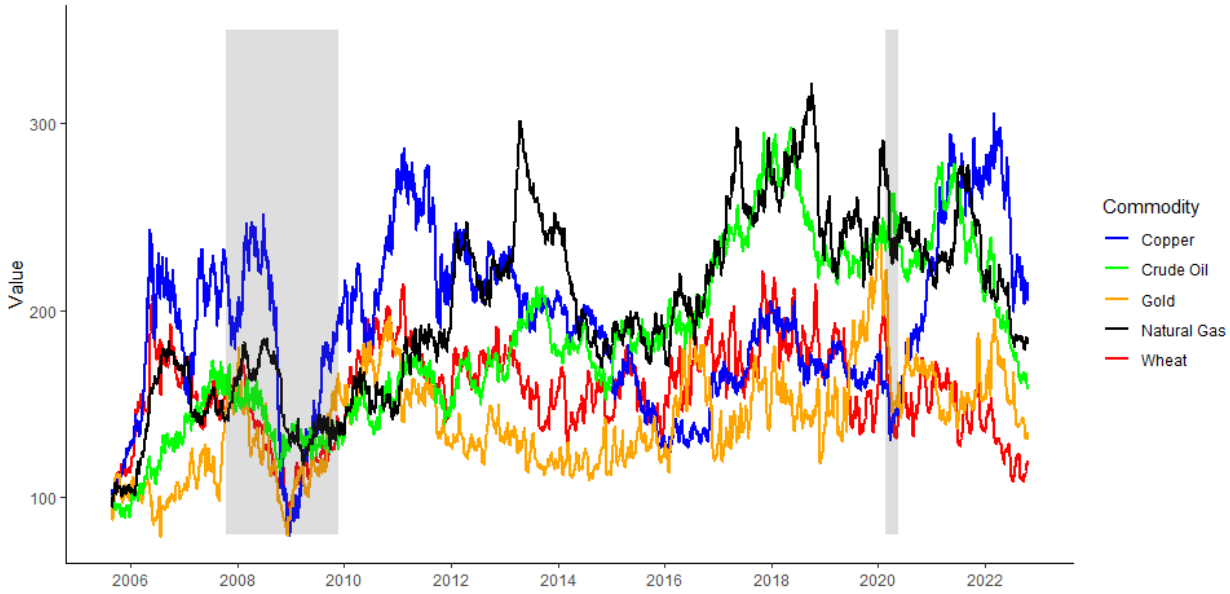



Figure 2 shows the price movement for five commodity futures. The price is normalized to the level of Aug 25th, 2005, and it is also adjusted for inflation using the consumer price inflation index. Except for gold futures, the inflation adjusted price for commodity futures dropped dramatically after reaching the historical high in early 2008. It recovered most of the loss from 2009 through 2012. Since then, the commodity markets were in a multi-year downward movement. In the beginning of the COVID-19 crisis, the commodity markets were weakened by the economic shutdowns and lack of demand. Then, the economic recovery and supply chain shortages caused an imbalance between supply and demand for commodities, resulting in commodity prices sharply increasing since 2020.

Traders' positions, as measured by the total open interest of futures contracts, have shown similar movement with the price changes. Figure 3 on the following page presents the normalized total open interest for selected commodities. Following the price movement, total open interest for commodity futures steadily increased in the 2000s and reached a peak level in early 2008. When the market collapsed, traders dramatically reduced their commodity futures exposures. Total open interest quickly dropped below 2005 levels. When markets started to recover after the GFC, open interest increased as well. It remained relatively stable before the COVID-19 crisis. After the COVID-19, open interest increased with the futures prices.

Figure 4 on page 9 shows the long and short positions of producers (hedgers) and speculators (swap dealers and money managers) for wheat futures. Hedgers' and speculators' positions have displayed similar historical patterns as the commodity price movements. Since the beginning of the GFC, producers have been reducing their short hedging positions, while speculators have been actively closing their long exposures. The change in total open interest was mainly driven by the cross-trading between producers and speculators. When the market recovered from the sell-off, speculators started to build their long exposure and hedgers

Figure 3: History of Normalized Open Interest




increased their short positions. Other commodity futures displayed a similar trading pattern during the 2008 GFC period. In contrast, during the COVID-19 crisis, hedgers' and speculators' positions remained relatively stable comparing with the 2008 GFC period.

Figure 5 on the following page shows the aggregate long and short positions for speculators and hedgers cross all major commodity futures, along with the S&P GSCI (formerly the Goldman Sachs Commodity Index). All the data are normalized to August 25th, 2005. It shows a sizable drop on speculators' long positions and hedgers' short positions during the 2008 GFC. The S&P GSCI declined sharply as all the commodities experienced a serious market selloff. During the COVID-19 crisis, the aggregate positions increased when the commodity index rebounded sharply from the bottom in 2020 and gradually decreased after reaching the peak in 2022. This result is consistent with the findings of Bonnier (2021) and Kang et al. (2020), who showed that the commodity price movement is the main driver of traders' positions change for both speculators and hedgers.

## 4 Financial Stability and Commodity Markets

To study the relationship between financial stability and traders' positions, we first need to understand the factors driving the trading behaviors of hedgers and speculators. Lehecka (2015) provided a systematic empirical investigation of lead-lag relationships among trading positions and prices in commodity futures markets. They employed Granger-causality tests applied to a variety of measurements of trading activities and futures prices. Their results indicated little evidence to support that trading activities lead commodity

Figure 4: Daily History of Open Interest for Wheat Futures

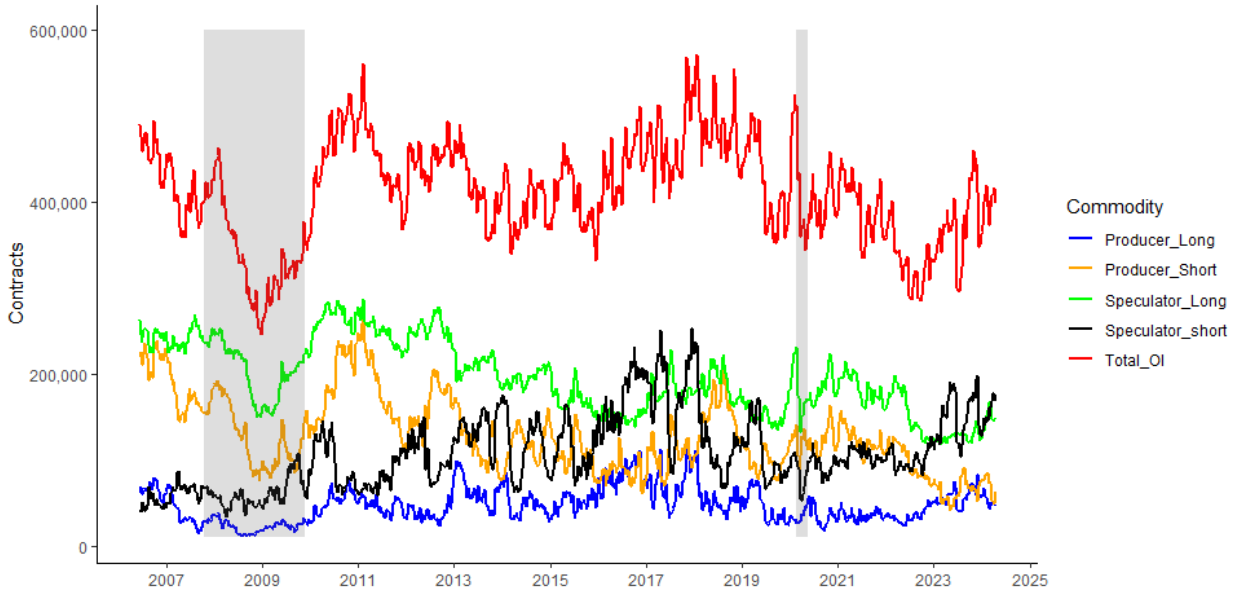
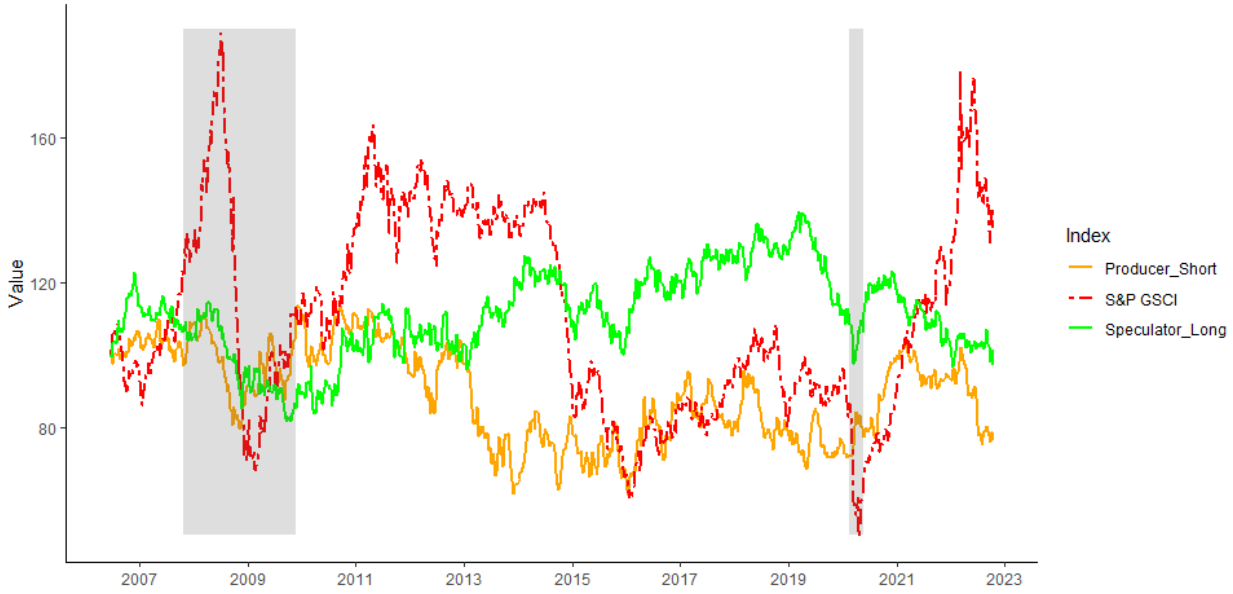



Figure 5: Normalized Aggregate Traders' Positions and the S&P GSCI



prices movement. In contrast, there are strong evidences that prices tend to lead traders' hedging and speculation activity. These results appear to be generally persistent over commodities, measurements of hedging and speculation, and periods. Bosch and Smimou (2022) showed that pricing in commodity markets can be predominantly attributed to hedgers and influential speculators (money managers). Ekeland et al. (2019) studied hedging pressure and speculation in commodity markets. Their study also attributes price action to traders' position changes. Boos and Grob (2023) showed that trend signals largely explain position changes of speculators in commodity markets. Price action is one of the main factors causing traders to change their positions. This result is consistent with what we showed in the previous section.

The other two main factors driving trader position changes are market volatility and initial margin level. Market volatility will impact both variation margin and initial margin, the cost of opening and maintaining a futures position. Hartzmark (1986) studied the relationship between margins and the degree of excessive speculator participation in futures markets. They found that margin changes will result in significant changes in the composition of traders in the market. Daskalaki and Skiadopoulos (2016) found that margin increases make hedgers exit from grain and metal markets, and the effect of margin changes is more pronounced in commodity futures markets than in equity and interest rate futures markets.

## 4.1 Financial Stability and Commodity Prices

Given price movement is the key driver for traders' position changes, we run a regression analysis between the FSI and the S&P GSCI to study the relationship between financial stability and commodity prices. The S&P GSCI currently comprises 24 commodities from all commodity sectors - energy products, industrial metals, agricultural products, livestock products, and precious metals. It serves as a benchmark for investment in the commodity markets. We run the regression using four different historical data samples: the 2008 GFC (from 2007 through 2009), the COVID-19 crisis (from 2020 through 2022), the full sample (from 2007 through 2022), and the data sample between two crises (from 2009 through 2020). The dependent variable is the weekly return of the S&P GSCI, and the independent variables are the lagged weekly return of the S&P GSCI, the volatility of the S&P GSCI weekly return, the weekly change in the FSI, and the lagged weekly change in the FSI.

Table 2 on the next page shows the regression results. The coefficients for the FSI weekly change are negative and statistically significant for all four sample periods. This finding implies that increasing financial stress can add pressure to commodity futures prices. A one-point increase in the FSI results in a 1.3 percent drop in the S&P GSCI during the 2008 GFC period and 2.7 percent for the COVID-19 period. The commodity futures market was more reactive to the change of financial stability conditions during the COVID-19 crisis than the GFC, this could be due to the fact that the change of FSI during the COVID-19 crisis is relative small. The lagged change of the FSI does not show any statistically significant impact on the S&P GSCI, meaning that the commodity futures market mainly responds to the most recent changes in financial stability conditions.

Figure 6 on page 12 shows the scatter plot of the weekly changes in the S&P GSCI and the FSI. The left-hand panel is for the 2008 GFC, and the right-hand panel is for the COVID-19 period. The upper panel plots the weekly change of both indices, and the bottom panel plots the weekly change in the S&P GSCI with the level of FSI. During the 2008 GFC, the weekly return of S&P GSCI was mostly negative, and the FSI stayed in positive territory. Commodity futures prices declined when the financial system was under stress. In contrast, during the COVID-19 period, the weekly return of S&P GSCI was mostly positive and the FSI

Table 2: GSCI Weekly Return Regression Results with FSI

| | Sample | | | |
|---|---|---|---|---|
| | GFC | COVID-19 | All | Between |
| | (1) | (2) | (3) | (4) |
| GSCI Lag Weekly Return | −0.091 | −0.086 | −0.038 | 0.001 |
| | (0.084) | (0.083) | (0.035) | (0.046) |
| Lag FSI | −0.001 | 0.0003 | −0.0003 | 0.001 |
| | (0.003) | (0.004) | (0.001) | (0.002) |
| GSCI Vol | −0.519*** | −0.136 | −0.153** | 0.036 |
| | (0.198) | (0.165) | (0.074) | (0.130) |
| FSI | −0.013*** | −0.027*** | −0.017*** | −0.020*** |
| | (0.002) | (0.004) | (0.001) | (0.002) |
| Observations | 151 | 151 | 830 | 480 |
| $R^2$ | 0.185 | 0.267 | 0.179 | 0.206 |
| Adjusted $R^2$ | 0.163 | 0.247 | 0.175 | 0.199 |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ( )

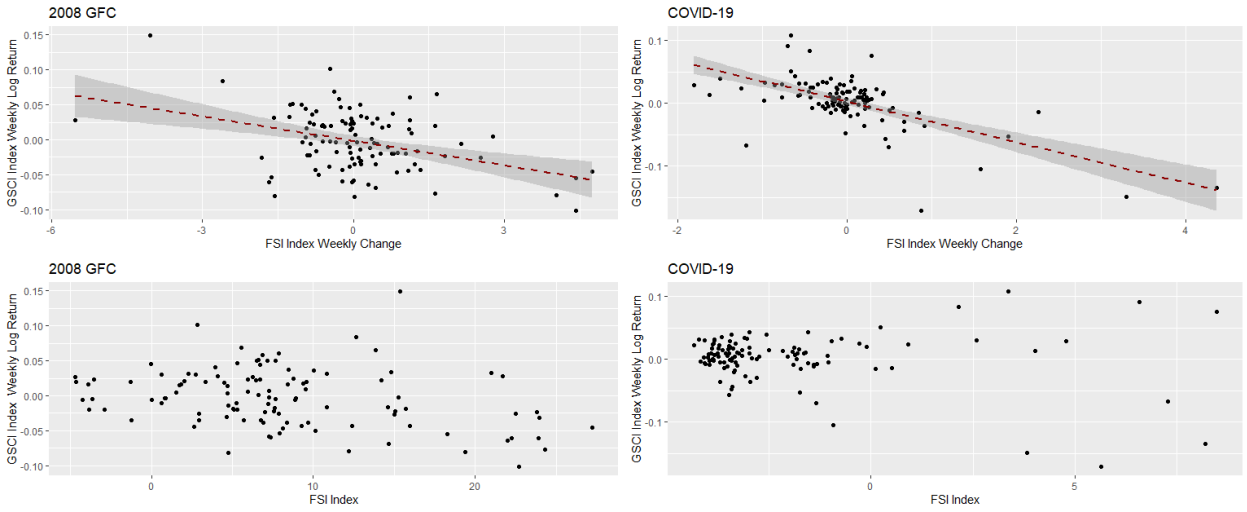
stayed in negative territory most of the time. Commodity futures prices surged when financial stability conditions normalized after the COVID-19 lockdowns.

### 4.2 Financial Stability and Volatility/Margin

Increasing market volatility raises the variation margin for a futures portfolio. Clearing houses will also increase the initial margin requirement to address high market volatility. Both changes raise the costs to open and maintain futures positions for hedgers and speculators, and the high trading costs could force traders to liquidate their positions, triggering a fire-sell event, especially when the financial system is under stress.

We use wheat futures as an example to illustrate the impact of initial margin on traders' positions. Figure 7 on page 13 presents the scatter plot between initial margin and speculators' long and producers' short positions, while figure 8 on page 14 shows the same chart for speculators' short and producers' long positions. The left-hand panel presents for the 2008 GFC, and the right-hand panel is for the COVID-19 period. During the 2008 GFC (left panels), both speculators' long positions and producers' short positions exhibit a strong negative correlation with initial margin levels, especially when initial margins increased significantly; when initial margin was up over 50%, traders' positions have decreased substantially, indicating a significant impact on market participation. The elevated initial margin significantly increased the trading cost during the GFC, which could explain why traders were dramatically reducing their futures positions. In contrast, the COVID-19 period (right panels) shows a much weaker relationship, with only a slight negative trend visible. Notably, the range of normalized initial margin values is smaller for the COVID-19

Figure 6: Relationship between the S&P GSCI and the FSI

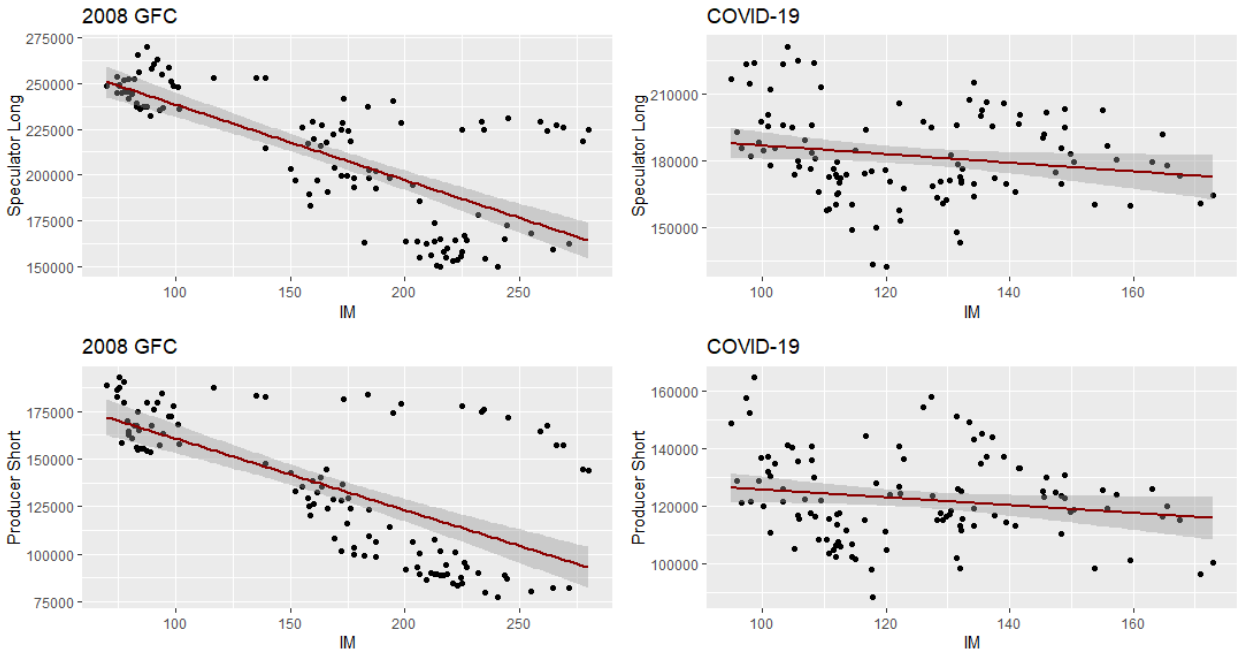



period compared to the GFC, meaning there was also a very limited change on the initial margin during the period. For speculators' short positions and hedgers' long positions, the impact from the change of initial margin was relatively muted during both crises.

The level of initial margin generally follows the market volatility. Figure 9 on page 14 shows the annualized volatility for the S&P GSCI and normalized initial margin level for wheat and corn futures from 2025 to 2024. The initial margin level is measured as the ratio of initial margin to the value for one futures contract, normalized to the level of August 25th, 2005. The chart reveals distinct market behaviors during the two major crises: 2008 GFC and COVID-19 pandemic. During the GFC, commodity market volatility spiked dramatically, accompanied by a near tripling of normalized initial margins for both wheat and corn futures. This elevation in margins persisted throughout the crisis period, indicating prolonged market uncertainty and risk. In contrast, the COVID-19 crisis in 2020 exhibited a different pattern. While the S&P GSCI volatility surged briefly, it quickly subsided. Interestingly, the initial margins for wheat and corn futures have not showed significant increases during this period, suggesting that agricultural futures were relatively insulated from the broader commodity market volatility. The S&P GSCI index has over 20 different commodities in the basket; its volatility level is a measure for the broad commodity market condition, not for a specific commodity futures. During the GFC, Commodity markets were more inter-correlated during the 2008 GFC. There was a market sell-off across all the commodity futures. In contrast, during the COVID-19 crisis, commodity futures markets were less correlated and volatility level varied across different commodities. This explains why the S&P GSCI volatility can diverge from the margin requirements of individual agricultural futures.

To further illustrate the divergence between initial margin and general market volatility during COVID-19 crisis, we calculate the one-year moving window correlation among the FSI, the S&P GSCI, and initial margin for wheat futures. Figure 10 on page 15 presents the history from 2008 to 2022. Notably, those three variables were highly correlated during 2008 GFC. Initial margin for a specific commodity futures is

Figure 7: Normalized Initial Margin versus Traders' Positions - Panel A




usually determined by its own volatility, not by the broad market volatility. Given the commodity markets were highly connected during the 2008 GFC, correlation between initial margin for a specific commodity futures and the broad market volatility was high. This result is consistent with Abricha et al. (2024), who found that interconnectedness increases at all quantiles during periods of high market stress. Elevated initial margin cross all commodity futures during the GFC caused by persistent financial system stress significantly increased transaction cost for traders and could force them to close their futures position. In contrast, during the COVID-19 crisis, correlation among different commodities was relatively low and initial margin for individual commodity futures did not closely follow with the broad market volatility. Financial system stress and general market volatility did not cause a spike in the initial margin for wheat futures. As a result, traders can maintain their positions without the economic pressure from the increasing of transaction cost.

To better understand the statistical relationship between the FSI and S&P GSCI volatility, we applied a vector autoregressive (VAR) model on the weekly change of those two variables. VAR models describe the joint generation process over time and can be used for investigating relationships between two time series variables. Our models are specified as:

$$\Delta\text{GSCI Volatility}_t = \alpha + \Delta\text{GSCI Volatility}_{t-1} + \Delta\text{FSI}_{t-1} + \Delta\text{GSCI Volatility}_{t-2} + \Delta\text{FSI}_{t-2} + \epsilon_{1t} \quad (1)$$

and

$$\Delta\text{FSI}_t = \alpha + \Delta\text{GSCI Volatility}_{t-1} + \Delta\text{FSI}_{t-1} + \Delta\text{GSCI Volatility}_{t-2} + \Delta\text{FSI}_{t-2} + \epsilon_{2t} \quad (2)$$

Figure 8: Normalized Initial Margin versus Traders' Positions - Panel B

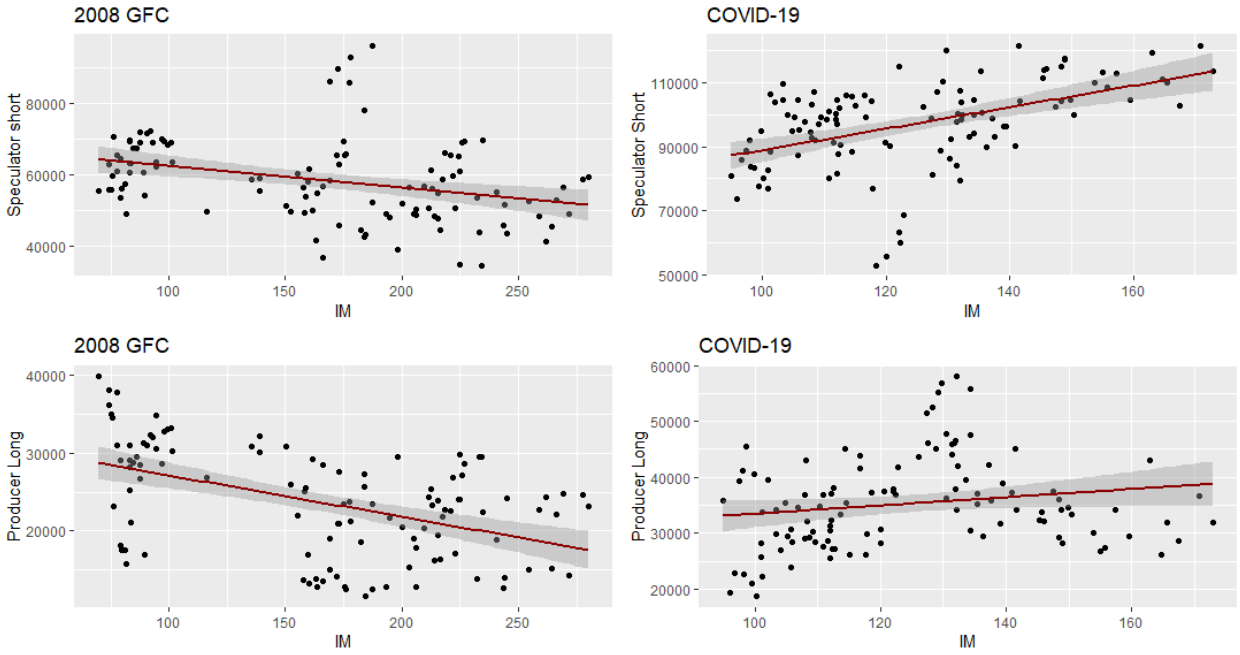



Figure 9: S&P GSCI Volatility and Normalized Initial Margin for Wheat and Corn

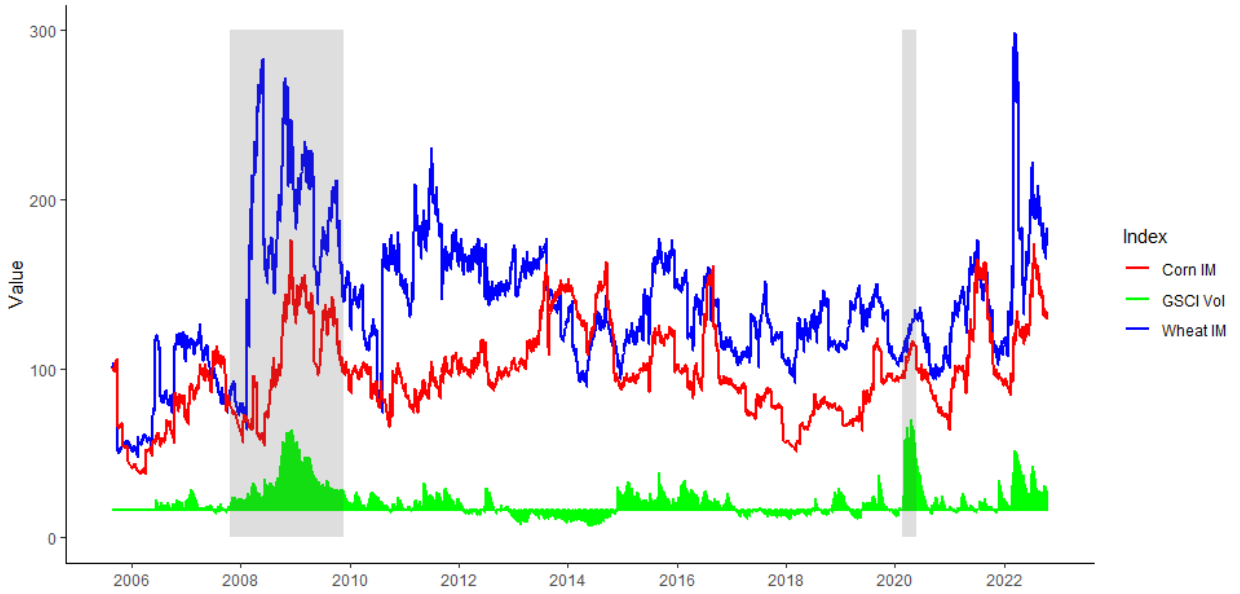
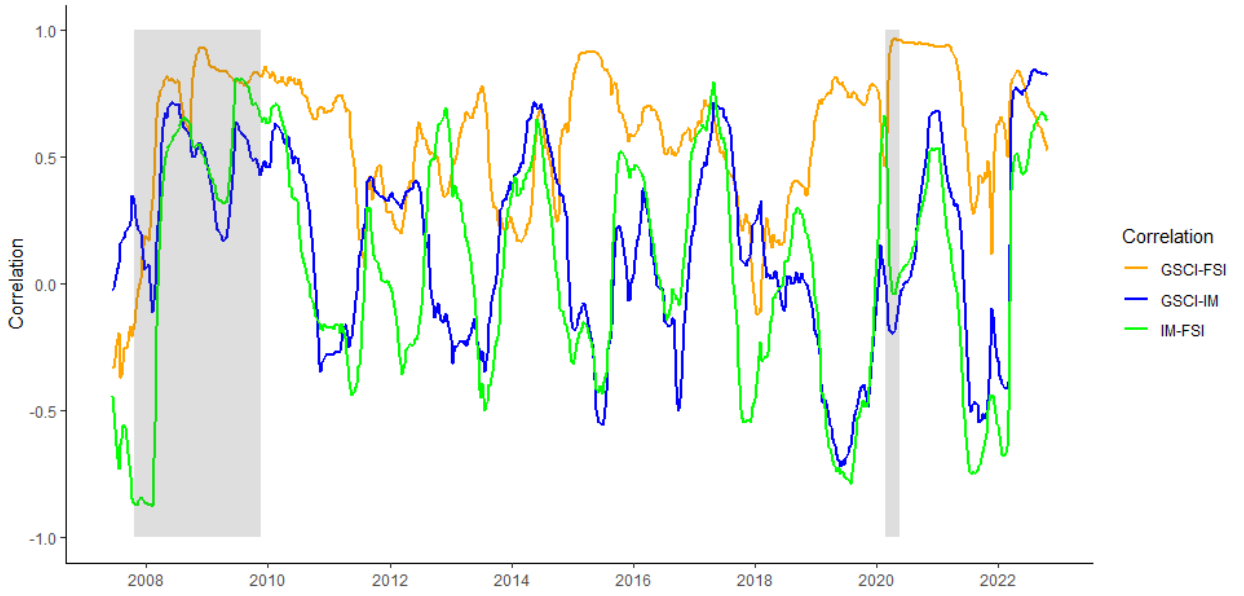


Figure 10: Moving Window Correlation among S&P GSCI Volatility, the FSI, and Initial Margin of Wheat Futures




We also perform standard Granger-causality tests (Granger, 1969) to study the temporal influence of financial (in)stability on S&P GSCI volatility. Granger-causality (GC) tests whether the prediction of one time series can be improved by incorporating the knowledge of a second time series. If it does, then the latter is said to have a causal influence on the first.

We run the VAR models and Granger-causality tests using three different sample periods: the 2008 GFC (from 2007 through 2009), the COVID-19 (from 2020 through 2022), and the full sample period (from 2007 through 2022). Table 3 presents the VAR model estimations as well as the GC test results. Both the VAR and GC test accept the hypothesis that the changes of the FSI can improve the prediction of S&P GSCI volatility, implying that systemic financial stress can increase the volatility in commodity futures markets. This result holds for all three sample periods. Interestingly, we don't find that the S&P GSCI volatility shows any meaningful impact on the FSI as all the coefficients are not statistically significant.

### 4.3 Financial Stability and Traders' Positions

After a brief studying on the connection between FSI and the factors driving the changes of trading position in futures market, we examine the direct relationship between FSI and trader positions. The literature on how financial stress can affect hedgers and speculators is well-developed. Chen and Yang (2021) found that during a period when market volatility was especially elevated, dealers and leveraged fund managers would alter their trading strategies. Röthig (2011) provided some empirical results that speculators lead hedgers in currency futures markets and attract hedgers to open/close positions in currency

Table 3: VAR Results – FSI and S&P GSCI Volatility

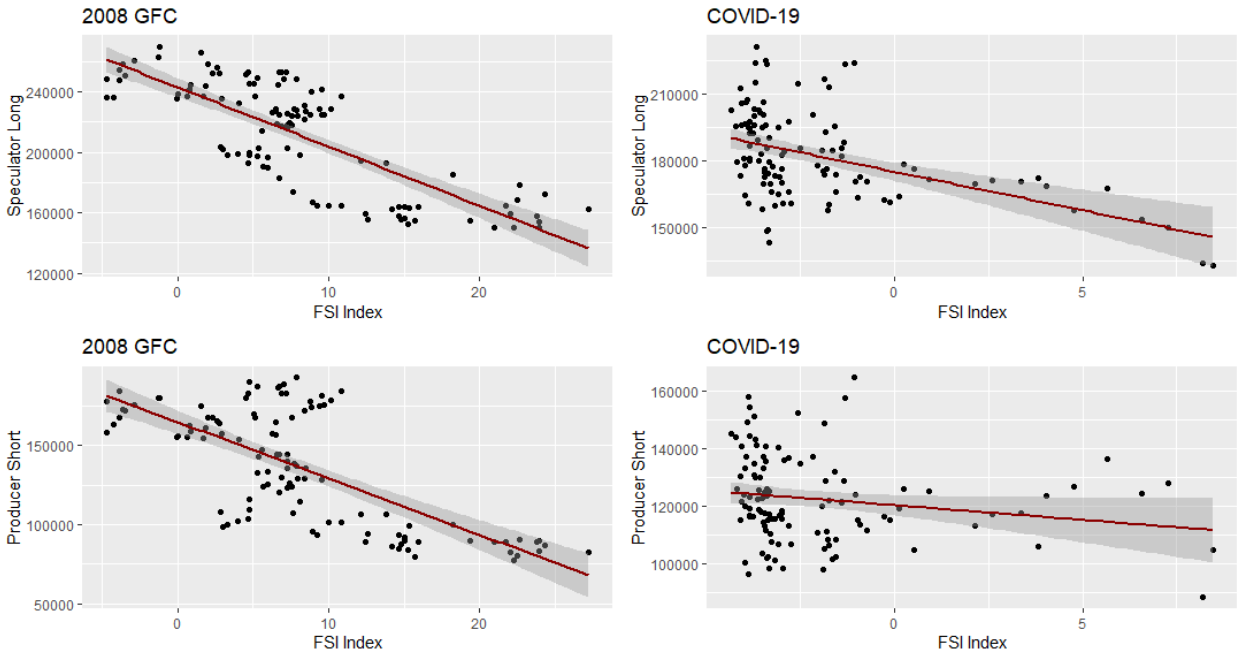
| | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 2008 GFC | | COVID-19 | | Full Sample | |
| *Dependent variable* ⇒ | GSCI Vol | FSI | GSCI Vol | FSI | GSCI Vol | FSI |
| GSCI Vol Lag1 | 1.020*** | 8.671 | 1.094*** | −3.457 | 1.048*** | −0.081 |
| | (0.082) | (24.229) | (0.093) | (13.644) | (0.036) | (7.009) |
| FSI Lag1 | 0.001** | 0.081 | 0.002*** | 0.248*** | 0.001*** | 0.076** |
| | (0.0003) | (0.081) | (0.001) | (0.094) | (0.0002) | (0.036) |
| GSCI Vol Lag2 | −0.047 | −19.423 | −0.165* | −5.772 | −0.100*** | −6.492 |
| | (0.083) | (24.461) | (0.093) | (13.669) | (0.036) | (7.033) |
| FSI Lag2 | 0.001* | 0.216*** | 0.001 | 0.123 | 0.0005*** | 0.154*** |
| | (0.0003) | (0.082) | (0.001) | (0.089) | (0.0002) | (0.036) |
| const. | 0.001 | 0.417 | 0.002*** | 0.327** | 0.001*** | 0.185*** |
| | (0.001) | (0.257) | (0.001) | (0.130) | (0.0003) | (0.061) |
| Observations | 149 | 149 | 149 | 149 | 799 | 799 |
| $R^2$ | 0.933 | 0.092 | 0.921 | 0.145 | 0.915 | 0.047 |
| Adjusted $R^2$ | 0.931 | 0.067 | 0.919 | 0.121 | 0.915 | 0.042 |
| GC F-Test | 4.4637 | | 8.8882 | | 22.463 | |
| GC p-value | 0.01233 | | 0.0002 | | 0.0000 | |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

futures markets. Cheng et al. (2015) argued that during the 2008 GFC, some commodity producers played the role of large financial institutions by taking the other end of trades of distressed banks and money managers. The aggregated exposures in the futures market for commodity producers as a group grew during the crisis, thus market risk flowed from financial institutions to commodity producers. Kang et al. (2020) further developed this theory by testing the existence of a liquidity premium paid by speculators to hedgers. All these studies support the idea that financial stability conditions can change traders' positions in the commodity futures market, especially for the speculators who are more reactive to the financial system stress.

Figure 11 on the next page presents the scatter plot between traders' positions and the FSI in wheat futures market. The left-hand panel is for the 2008 GFC and the right-hand panel is for the COVID-19 crisis. Speculators' long positions and hedgers' short positions displayed a strong negative correlation with the FSI during the 2008 GFC. The higher the FSI level, the lower the open interests. During the 2008 GFC, financial stress put pressures on commodity prices and increased market volatility. As a result, speculators aggressively closed the long positions and producers also quickly reduced their short positions. During the COVID-19 crisis, the correlation between the FSI and traders' positions was not as significant as it was

Figure 11: The FSI and Traders' Position




during the 2008 GFC; financial stress had relatively limited impact on traders' positions.

Using wheat futures as an example, we conduct a regression study to show how traders' position changes respond to the change of financial stability conditions. We run separate regressions for hedgers and speculators. We use the Baltic Dry Index (BDRY) as the independent variable to control the impact from the macroeconomic conditions.[2] The regression model is specified as the following:

$$\Delta \text{Position}_t = \alpha + \Delta \text{FSI}_t + \Delta \text{GSCI}_t + \Delta \text{GSCI Volatility}_t + \Delta \text{Margin}_t + \text{Controls}_t + \epsilon_t \tag{3}$$

Table 4 on the following page shows the regression results, covering three different sample periods: the 2008 GFC (from 2007 through 2009), the COVID-19 crisis (from 2020 through 2022), and the full sample period (from 2007 through 2022). We focused on hedgers' short positions and speculators' long positions. In general, the coefficients of the FSI are not statistically significant for hedgers' short positions, implying that financial stress has less impact on hedgers. For speculators' long positions, the coefficients are statistically significant. Increases in financial stress can reduce speculators' long positions. To address the multicollinearity problem in the regression model, we run a stepwise regression analysis to select the most significant variables driving the change of traders' positions. For hedgers' short positions, the regression selects price return and initial margin level; For speculators' long positions, the model adds the FSI. This finding confirms that speculators react to the financial system stability conditions more substantially than

[2]The BDRY is reported daily by the Baltic Exchange in London to measure the cost of moving the major raw materials globally.

Table 4: Traders' Position Change Regression with the FSI

| | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 2008 GFC | | COVID-19 | | Full Sample | |
| *Positions* ⇒ | Hedge | Speculate | Hedge | Speculate | Hedge | Speculate |
| GSCI Return | 0.425*** | 0.134** | 0.153 | 0.074 | 0.306*** | 0.135*** |
| | (0.137) | (0.063) | (0.199) | (0.132) | (0.089) | (0.045) |
| BDRY | 0.021 | 0.045* | −0.016 | −0.023 | −0.023 | −0.016 |
| | (0.051) | (0.023) | (0.064) | (0.043) | (0.029) | (0.014) |
| GSCI Vol | 0.667* | 0.149 | −0.084 | −0.253 | 0.279 | −0.075 |
| | (0.385) | (0.176) | (0.382) | (0.253) | (0.212) | (0.106) |
| FSI | −0.004 | −0.003* | −0.011 | −0.023*** | −0.004 | −0.006*** |
| | (0.004) | (0.002) | (0.010) | (0.006) | (0.004) | (0.002) |
| Margin | −0.0002** | −0.0001* | −0.0005 | −0.0001 | −0.0003*** | −0.0001** |
| | (0.0001) | (0.00005) | (0.0003) | (0.0002) | (0.0001) | (0.00004) |
| Observations | 111 | 111 | 111 | 111 | 831 | 831 |
| $R^2$ | 0.199 | 0.225 | 0.056 | 0.186 | 0.041 | 0.053 |
| Adjusted $R^2$ | 0.161 | 0.188 | 0.011 | 0.147 | 0.035 | 0.047 |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

hedgers.

We also run the regression analysis using the FSI sub-index. Table 5 provides the regression coefficients for each sub-index. Again, we find that hedgers are in general not very responsive to the changes in financial stability condition. The coefficients for all FIS sub-indices are not statistically significant for hedgers' short positions. Speculators, on the other hand, are much more reactive to the increase of financial stress, especially to the conditions of credit, funding, and market volatility. This finding implies that speculators are particularly sensitive to widening credit spreads, deteriorating funding markets, and increasing market volatility. These results align well with the literature. Cheng et al. (2015) showed that financial institutions decrease their market exposure in commodities with respect to changes in equity market volatility.

# 5 Absolute Position Change

This section extends our regression analysis to more individual commodities. Following the method of Cheng et al. (2015) and Kang et al. (2020), we employ a standard OLS regression to examine the impact of financial stability on traders' exposures to different commodity futures. The regression model is specified as the following:

$$\Delta \text{Position}_t = \alpha + \Delta \text{FSI}_t + \Delta \text{Price}_{t-1} + \Delta \text{FSI}_{t-1} + \Delta \text{Position}_{t-1} + \text{Controls}_t + \epsilon_t \tag{4}$$

Table 5: Traders' Position Change Regression with FSI Subindex

| | Sample | | | | | |
|---|---|---|---|---|---|---|
| | 2008 GFC | | COVID-19 | | Full Sample | |
| *Positions* ⇒ | Hedge | Speculate | Hedge | Speculate | Hedge | Speculate |
| Credit | −0.023 | −0.021*** | −0.022 | −0.111*** | −0.020 | −0.039*** |
| | (0.017) | (0.008) | (0.042) | (0.027) | (0.017) | (0.009) |
| Funding | −0.003 | −0.006 | 0.017 | −0.150*** | −0.007 | −0.012** |
| | (0.009) | (0.004) | (0.059) | (0.039) | (0.011) | (0.006) |
| Safe Assets | −0.047 | −0.018 | 0.120 | 0.137 | −0.009 | 0.023 |
| | (0.049) | (0.023) | (0.140) | (0.098) | (0.040) | (0.020) |
| Volatility | −0.014 | −0.008* | −0.025 | −0.031*** | −0.005 | −0.009*** |
| | (0.009) | (0.004) | (0.017) | (0.012) | (0.007) | (0.004) |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

We study four different position changes: the change in traders' net position (the long position offset by the short position); the change in net of trade, which is the change in the net position divided by total open interest; the change in hedgers' short positions; and the change in speculators' long positions. To be precise, the position changes are calculated as follows:

$$\begin{aligned}
\Delta \text{Net Position}_t &= \text{Net Position}_t - \text{Net Position}_{t-1} \\
\Delta \text{Net of Trade}_t &= \frac{(\text{Net Position}_t - \text{Net Position}_{t-1})}{\text{Total Open Interest}_{t-1}} \\
\Delta \text{Hedger's Short Position}_t &= \frac{(\text{Hedger's Short Position}_t - \text{Hedger's Short Position}_{t-1})}{\text{Hedger's Short Position}_{t-1}} \\
\Delta \text{Speculator's Long Position}_t &= \frac{(\text{Speculator's Long Position}_t - \text{Speculator's Long Position}_{t-1})}{\text{Speculator's Long Position}_{t-1}}.
\end{aligned}$$

The lagged change in the commodity price is used to control for the impact from price movements. We also introduce other variables like the BDRY and the industrial production index to control for macroeconomic effects.

We conduct the regression analysis on six major commodity futures contracts traded on the CME: wheat, soybeans, copper, gold, natural gas, and crude oil. Those commodity futures contracts are heavily traded. For each of the commodities, we run the regression model using four different sample periods: the pre-GFC period, the GFC period, the pre-COVID period, and the COVID period (including the 2022 Russian invasion of Ukraine). For these regressions, we do not aggregate into speculators, but rather run each regression separately for the three different market types identified in the DCOT data: producers, swap dealers, and money managers. In total, 12 regressions are studied for each commodity future contract.

Table 6: Regression Coefficient of the FSI for Traders' Net Position Change–GFC

| | FSI Coefficients | | | | | |
|---|---|---|---|---|---|---|
| | Producers | | Swap Dealers | | Money Managers | |
| Commodities | Pre-GFC | GFC | Pre-GFC | GFC | Pre-GFC | GFC |
| Crude Oil | −1119.99 | 674.92 | 30.28 | 1645.59 | −1850.29 | −3415.41** |
| | (1612.51) | (832.81) | (1604.51) | (1299.03) | (1756.33) | (1621.53) |
| Wheat | 133.38 | 1784.49** | −92.90 | −826.11** | 420.77 | −772.12 |
| | (834.25) | (690.26) | (512.21) | (346.64) | (887.40) | (610.46) |
| Natural Gas | −443.29 | 766.58** | −833.39 | 611.88 | 179.75 | −2339.93 |
| | (656.18) | (373.30) | (692.33) | (657.56) | (1302.59) | (1420.90) |
| Copper | 159.44 | 586.41** | −125.88 | 10.03 | −43.42 | −363.34 |
| | (221.54) | (248.69) | (132.04) | (192.88) | (247.34) | (286.33) |
| Gold | −231.77 | 830.15 | −2245.11** | 340.93 | 1259.19 | −1035.69 |
| | (1379.31) | (860.39) | (1028.18)‘ | (634.59) | (1776.64) | (904.10) |
| Soybean | −4535.65 | 4831.55 | 1500.50 | −1000.64 | 2803.39 | −4071 |
| | (4317.77) | (3550.48) | (1363.03) | (902.68) | (3321.56) | (3084.28) |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

Table 6 shows the regression coefficient of the FSI for the pre-GFC period and the GFC period. The dependent variable is the weekly change in net position. The regression results show that producers grew their net positions with the increase of the FSI over the GFC sample period. They either closed their short positions or opened more long positions. This change added more exposures to commodity price movements as producers are less hedged. The coefficients for wheat, natural gas, and copper are statistically significant in the GFC sample. For the pre-GFC sample, the coefficients are not statistically significant for all the commodities. For swap dealers, the coefficients of the FSI are mostly not statistically significant, except for Gold in the pre-GFC period and Wheat during the GFC. There is not a clear pattern to show the impacts from financial stability conditions. For money managers, the coefficients are negative for the GFC sample period, although most of them are not statistically significant. Money managers as a group likely reduced their long exposures when the financial system was under stress during the GFC. The reduction in crude oil positions—the contract arguably most strongly connected to global economic conditions—was statistically significant. Overall, the money managers response during the GFC was consistent with the convective risk flow theory.

Table 7 on the following page shows the regression results for the weekly changes in net of trade, which is the change of net position divided by the total open interest. This variable measures traders' position change relatives to the total open interest. If open interest was constant, changes in net of trade for producers implies the hedging demand from commodity producers and changes in net of trade for money managers measures the trading pressure from speculation activity. The imbalance in the net of

Table 7: Regression Coefficient of the FSI for Traders' Net of Trade–GFC

| | FSI Coefficients | | | | | |
|---|---|---|---|---|---|---|
| | Producers | | Swap Dealers | | Money Managers | |
| Commodities | Pre-GFC | GFC | Pre-GFC | GFC | Pre-GFC | GFC |
| Crude Oil | −0.001 | 0.001 | −0.0001 | 0.001 | −0.001 | −0.003** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Wheat | 0.001 | 0.01*** | −0.0004 | −0.002*** | 0.0002 | −0.003* |
| | (0.002) | (0.002) | (0.001) | (0.001) | (0.002) | (0.002) |
| Natural Gas | −0.001 | 0.001** | −0.001 | 0.001 | 0.0002 | −0.003 |
| | (0.001) | (0.0005) | (0.001) | (0.001) | (0.002) | (0.002) |
| Copper | 0.002 | 0.01*** | −0.002 | 0.001 | −0.001 | −0.004** |
| | (0.003) | (0.002) | (0.002) | (0.002) | (0.003) | (0.002) |
| Gold | −0.001 | 0.002 | −0.01** | 0.001 | 0.003 | −0.003 |
| | (0.003) | (0.002) | (0.003) | (0.001) | (0.005) | (0.002) |
| Soybean | 0.0001 | 0.01*** | 0.001 | −0.002** | −0.001 | −0.005** |
| | (0.003) | (0.002) | (0.001) | (0.001) | (0.002) | (0.002) |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

trade between producers and money managers could bring volatility to the futures market.

The regression results for the pre-GFC and GFC sample periods are mostly consistent with those from regression on the changes in net position. When the FSI increases, producers reduce the short hedging positions, while money managers close their long exposures. Swap dealers also reduce their exposure to agricultural contracts. As a result, the total open interest decreases. Normalizing the changes in net position by the decreasing open interest appears to yield more power to our estimates, as more coefficients become statistically significant, especially for the money managers.

Table 8 on the next page shows the regression results for the weekly changes in producers' short positions and swap dealers and money managers' long positions. Again, those results are mostly consistent with the regression on net of trade. This finding highlights the fact that during the 2008 GFC, speculators' net position changes were mainly from the reduction in long positions, while hedgers' net position changes were driven by closing short positions. The two groups reversed their trading patterns. Instead of supplying liquidity to hedgers as they usually do in normal market conditions, speculators demanded liquidity from hedgers to reduce their exposures to the commodity futures market.

Table 9 on page 23, Table 10 on page 24, and Table 11 on page 25 show the same regression results for the pre-COVID and COVID sample periods. In general, the coefficients for the FSI are not statistically significant. The impacts from the changes in financial stability conditions are negligible during both sample periods. The COVID-19 crisis created a large shock to the financial system, but the overall stress level was not comparable with the 2008 GFC. Moreover, financial system conditions quickly stabilized with

Table 8: FSI Coefficient for Producers' Short and Speculators' Long Position–GFC

| | FSI Coefficients | | | | | |
|---|---|---|---|---|---|---|
| | Producers' Short Position | | Swap Dealers' Long Position | | Money Managers' Long Position | |
| Commodities | Pre-GFC | GFC | Pre-GFC | GFC | Pre-GFC | GFC |
| Crude Oil | 0.005 | −0.002 | 0.004 | 0.01 | −0.002 | −0.02*** |
| | (0.01) | (0.004) | (0.01) | (0.004) | (0.01) | (0.01) |
| Wheat | −0.005 | −0.01*** | 0.0002 | −0.005*** | 0.003 | −0.004 |
| | (0.01) | (0.005) | (0.003) | (0.002) | (0.01) | (0.01) |
| Natural Gas | 0.01 | −0.002 | −0.01* | 0.001 | −0.01 | −0.02** |
| | (0.01) | (0.005) | (0.01) | (0.004) | (0.01) | (0.01) |
| Copper | −0.02* | −0.01 | −0.002 | −0.0002 | −0.02 | −0.02** |
| | (0.01) | (0.01) | (0.003) | (0.003) | (0.02) | (0.01) |
| Gold | −0.003 | −0.003 | −0.05*** | −0.001 | 0.01 | −0.01 |
| | (0.01) | (0.004) | (0.01) | (0.01) | (0.01) | (0.005) |
| Soybean | 0.002 | −0.01** | 0.004 | −0.003 | −0.001 | −0.005** |
| | (0.01) | (0.004) | (0.003) | (0.002) | (0.002) | (0.002) |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

government interventions. The stress in the financial system did not transform to a large shock to the commodity futures markets. Commodity markets actually had a very strong upward movement during the COVID-19 crisis, as it is shown in figure 2. Trading activity was growing, and open interest increased, as illustrated by Figure 3 on page 8. The start of the Russian invasion of Ukraine in 2022 created a political shock to the global financial system. The FSI was positive for several months, indicating a stress in the global financial system. However, the stress level was not comparable with the 2008 GFC. The war actually triggered a strong market rally in the commodity futures markets, instead of creating a sell-off. Overall, the financial stress measured by the FSI during the COVID-19 crisis period was not as severe as the 2008 GFC; and the impact of financial stress on traders' positions was relatively limited.

Our regression results provide some supports to the hypothesis of convective risk flow theory: producers increased their net long positions on commodity futures and speculators—particularly money managers who are likely more active in speculating—reduced their commodity exposures when the financial system was severely stressed during the 2008 GFC. However, we should apply caution when interpolating the regression results. First, traders' position changes could be mainly driven by the market price movement (For example, by dynamics like in Jiang et al., 2024). As the commodity market collapsed in 2008, it was normal for speculators to promptly close their risk exposures to avoid further losses from the negative market movement. Hedgers, on the other hand, could take the opportunity to profit from their short hedging positions and reduce their hedging positions. Second, elevated initial margin level and market volatility

Table 9: Regression Coefficient of the FSI for Traders' Net Position Change–COVID-19

| | FSI Coefficients | | | | | |
|---|---|---|---|---|---|---|
| | Producers | | Swap Dealers | | Money Managers | |
| Commodities | Pre-COVID | COVID | Pre-COVID | COVID | Pre-COVID | COVID |
| Crude Oil | 1141.40 | 2839.10 | −382.26 | −4442.99* | 4102.71 | −5657.70* |
| | (2127.29) | (1806.09) | (3964.64) | (2578.42) | (6073.16) | (3035.44) |
| Wheat | 1740.99 | 1615.53 | −1101.83 | 2.73 | −2198.96 | −1889.56 |
| | (1594.58) | (1144.67) | (694.16) | (600.24) | (2006.02) | (1470.11) |
| Natural Gas | −558.91 | 135.73 | −264.12 | −1206.25 | 2316.48 | −2236.72 |
| | (1743.39) | (1121.74) | (2628.67) | (1762.65) | (4896.29) | (3506.02) |
| Copper | 5109.09*** | 2584.53** | −273.94 | 171.91 | −4777.76** | −3323.57** |
| | (1273.36) | (1072.91) | (284.65) | (303.97) | (1822.41) | (1285.22) |
| Gold | 1657.58 | 233.50 | −3423.74 | 1604.95 | 4209.54 | −2052.23 |
| | (1808.85) | (926.90) | (3355.86) | (1961.17) | (4695.30) | (2791.77) |
| Soybean | 2087.00 | 2839.18 | −396.78 | −63.99 | −528.42 | −3162.72 |
| | (4075.40) | (2626.93) | (1027.43) | (1083.79) | (3887.75) | (2582.55) |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

significantly increased trading cost and could force traders to reduce the exposures, as we discussed in the previous sections.

On the other hand, our results could be blunted by limitations in the data, both in terms of the high level classifications and the focus on large traders. For example, Sun et al. (2023) find that Commodity Index Traders (CIT) act as passive traders, which is consistent with Hamilton and Wu (2015). Unfortunately, there is no clear means to remove the impact of CIT activity. Certainly the bulk of CIT activity is included in the swap dealers category, but the precise overlap is not clear, and it may change in the samples (Robe and Roberts, 2024).[3] Sun et al. (2023) also find that 'non-reportable' traders reinforce positive market feedback in their trading. In the appendix, we do analyze small traders' sensitivity to financial conditions; the results suggest that, particularly in the pre-COVID and COVID periods, small traders are even more sensitive than large traders so that their activity would reinforce convective risk flows.

Convective risk flow theory argues that during the 2008 GFC, commodity risk flowed from speculators to hedgers. Our study shows that, at group level, both speculators and hedgers have been unwinding their commodity futures positions and reduced the risk exposures. Further studies are needed to understand the mechanism of this reversed risk flow. More detailed trader position data can shed light who is providing

[3]The CFTC provides separate data on CIT activity for agricultural futures. Recent data shows that CIT activity is larger than that of Swap Dealers. In the appendix, we analyze the position change of CIT and find that it displayed similar trading behaviors to swap dealers. Possibly, CIT activity is primarily responsible for the swap dealer results.

Table 10: Regression Coefficient of the FSI for Traders' Net of Trade–COVID-19

| | FSI Coefficients | | | | | |
|---|---|---|---|---|---|---|
| | Producers | | Swap Dealers | | Money Managers | |
| Commodities | Pre-COVID | COVID | Pre-COVID | COVID | Pre-COVID | COVID |
| Crude Oil | 0.001 | 0.002** | 0.0001 | −0.003* | 0.002 | −0.003 |
| | (0.001) | (0.001) | (0.002) | (0.002) | (0.003) | (0.002) |
| Wheat | 0.003 | 0.01 | −0.003 | −0.001 | −0.005 | −0.01 |
| | (0.004) | (0.004) | (0.002) | (0.002) | (0.004) | (0.01) |
| Natural Gas | −0.001 | −0.0003 | −0.00001 | −0.001 | 0.002 | −0.001 |
| | (0.001) | (0.001) | (0.002) | (0.002) | (0.004) | (0.004) |
| Copper | 0.02*** | 0.01 | −0.001 | −0.0004 | −0.02** | −0.01 |
| | (0.01) | (0.01) | (0.001) | (0.002) | (0.01) | (0.01) |
| Gold | 0.002 | 0.001 | −0.01 | 0.004 | 0.01 | −0.01 |
| | (0.003) | (0.002) | (0.01) | (0.004) | (0.01) | (0.01) |
| Soybean | 0.002 | 0.01 | −0.001 | −0.002 | −0.001 | −0.003 |
| | (0.01) | (0.004) | (0.001) | (0.001) | (0.01) | (0.004) |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

liquidity in the commodity futures markets during the 2008 GFC and what the motivation is for doing so.

# 6 Relative Exposure Dynamics

Previous sections examined six individual commodity futures contracts. This section extends our empirical analysis to study the aggregated positions of different type of traders cross the six commodity futures market. First, we calculate the simple average of the percentage of traders' long and short positions over total open interest, which shows the relative exposures of different traders. Second, we apply the regression analysis to investigate whether the relative exposure of hedgers and speculators changes under financial stress. Studying the aggregated position could highlight the systematic impact of financial stress on the commodity futures market. Lastly, we study the speculation index proposed by Working (1953) to examine whether financial stability conditions change the speculative trading behaviors. This index also reflects the relative exposure between speculators and hedgers.

Figure 12 on page 26 shows the daily history of the speculation index and the relative exposures of producers and speculators. For illustrative purpose, the speculation index is scaled up by a factor of 30. In general, the speculation index has been steadily increasing since the 2000s. No major structural changes were observed during the two crises. This result implies that financial stress has not significantly changed the relative exposure between hedgers and speculators. During the 2008 GFC period, speculators reduced

Table 11: FSI Coefficient for Producers' Short and Speculators' Long Position–COVID-19

| | FSI Coefficients | | | | | |
|---|---|---|---|---|---|---|
| | Producers' Short Position | | Swap Dealers' Long Position | | Money Managers' Long Position | |
| Commodities | Pre-COVID | COVID | Pre-COVID | COVID | Pre-COVID | COVID |
| Crude Oil | 0.001 | −0.01 | 0.004 | −0.02* | 0.01 | −0.03*** |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.02) | (0.01) |
| Wheat | −0.02 | −0.03** | −0.01 | −0.02*** | −0.01 | −0.03* |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.02) |
| Natural Gas | 0.004 | −0.001 | −0.01 | −0.01 | 0.004 | −0.02* |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Copper | −0.05** | −0.01 | −0.01 | −0.003 | −0.06*** | −0.01 |
| | (0.02) | (0.01) | (0.01) | (0.01) | (0.02) | (0.02) |
| Gold | −0.01 | 0.004 | −0.01 | −0.01 | 0.005 | −0.02 |
| | (0.02) | (0.01) | (0.01) | (0.01) | (0.02) | (0.02) |
| Soybean | −0.003 | −0.01 | −0.01 | −0.02*** | −0.004 | −0.002 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.02) | (0.02) |

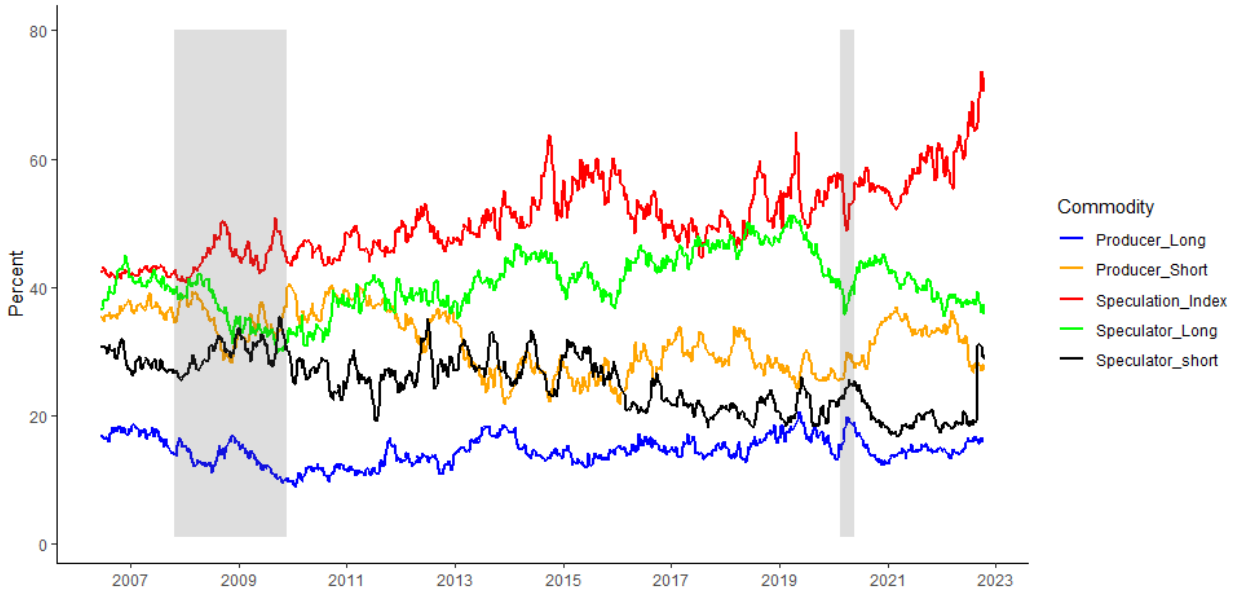
Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

their long exposures while hedgers closed their short positions, the relative exposure between those two groups did not change significantly. After the COVID-19 lockdowns, as commodity futures prices gained a strong momentum to move upward, speculative trading activities outgrew the hedging activities and the speculation index increased.

Following the framework of the previous section, we run a regression analysis on the weekly changes in producers' and speculators' relative exposures, measured by the percentage of long and short positions over total interest. The regression is estimated using two different data samples: the 2008 GFC and the COVID-19 crisis. Table 12 and table 13 on page 27 show the regression results for producers and speculators separately.

For producers, the regression coefficients of the FSI are all positive, and they are more statistically significant during the COVID-19 period. Producers' relative exposures expands when financial stress increases. For speculators, the coefficient is negative during the 2008 GFC, meaning speculators reduced exposures when financial stability conditions deteriorated. The speculation index also shows a negative relationship with the FSI. The coefficients are negative for both GFC and COVID-19 sample periods. Overall, those coefficients are relatively small, indicating that the impact of financial stability on traders' relative exposures is limited in general. For example, one-point increasing in the FSI index only changes producers' short positions by 0.104 percent. In summary, financial stress did slightly change traders' relative exposures during the two crises.

Figure 12: Speculation Index and Average Percentage of Traders' Long and Short Positions




The coefficient of the S&P GSCI are more statistically significant compared with the coefficient for the FSI, implying that traders' relative exposures change more noticeably with the commodity prices. When commodity prices increase, producers increase their short hedging positions and reduces their long exposures. Speculators, on the other hand, tend to add more long exposures. Surprisingly, the coefficients of the S&P GSCI for the speculation index are consistently negative. Rising commodity price actually decreases the speculation index. This result could mean that producers' relative exposures outgrow speculators' positions when commodity prices increase, not necessarily implying a reduction in speculative trading.

To further confirm our results, we run a different set of regressions. We create a dummy variable to represent financial stress based on the value of the FSI. If the FSI is non-positive, the dummy variable is 0, meaning financial stability is normal; if the FSI is positive, the dummy variable is 1, meaning financial stability is under stress. Table 14 on page 28 shows the regression results using this dummy variable. Other than the coefficient of the S&P GSCI, all other coefficients are not statistically significant. This result confirms that financial stability conditions have minimal impacts on the relative exposures for producers and speculators, and price movement plays a key role to determine traders' relative exposures.

This finding is consistent with our prior analysis. During normal market conditions, hedgers open short futures positions to hedge their production risk, while speculators take hedgers' short positions and are compensated with a risk premium. This trading relation was reversed during the 2008 GFC; speculators paid a risk premium to hedgers in order to close their long positions. The total open interest decreased significantly, but the relative exposure between those two groups was relatively stable.

Table 12: Regression Results for Aggregate Producers' Position

| | Producers' Position Type | | | |
|---|---|---|---|---|
| | Long Position | | Short Position | |
| *Sample* ⇒ | GFC | COVID-19 | GFC | COVID-19 |
| FSI | 0.0003 | 0.104* | 0.014 | 0.130* |
| | (0.039) | (0.056) | (0.056) | (0.078) |
| GSCI | −5.480*** | −2.808** | 8.304*** | 3.273** |
| | (1.259) | (1.083) | (1.808) | (1.508) |
| BDRY | −0.604 | −0.322 | 0.562 | −0.217 |
| | (0.467) | (0.345) | (0.671) | (0.480) |
| GSCI Vol. | −0.807 | 4.863** | 6.733 | 0.088 |
| | (2.960) | (2.148) | (4.253) | (2.991) |
| Observations | 151 | 151 | 151 | 151 |
| $R^2$ | 0.166 | 0.154 | 0.166 | 0.035 |
| Adjusted $R^2$ | 0.144 | 0.130 | 0.143 | 0.009 |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

Table 13: Regression Results for Aggregate Speculators' Position and Speculation Index

| | Speculators' Position Type | | | | | |
|---|---|---|---|---|---|---|
| | Long Position | | Short Position | | Speculation Index | |
| *Sample* ⇒ | GFC | COVID-19 | GFC | COVID-19 | GFC | COVID-19 |
| FSI | −0.0110 | 0.092* | 0.029 | 0.076 | −0.004*** | −0.011** |
| | (0.028) | (0.050) | (0.049) | (0.055) | (0.002) | (0.005) |
| GSCI | 1.001 | 2.239** | −3.273** | 1.188 | −0.214*** | −0.265** |
| | (0.899) | (0.966) | (1.599) | (1.073) | (0.053) | (0.103) |
| BDRY | −0.232 | −0.370 | −0.289 | 0.440 | 0.011 | 0.045 |
| | (0.334) | (0.308) | (0.594) | (0.342) | (0.020) | (0.033) |
| GSCI Vol. | −1.923 | 4.162** | −3.378 | −0.643 | −0.342*** | 0.108 |
| | (2.114) | (1.917) | (3.762) | (2.130) | (0.124) | (0.205) |
| Observations | 151 | 151 | 151 | 151 | 151 | 151 |
| $R^2$ | 0.020 | 0.070 | 0.054 | 0.027 | 0.131 | 0.062 |
| Adjusted $R^2$ | −0.007 | 0.045 | 0.028 | 0.0003 | 0.107 | 0.036 |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

Table 14: Regression Results with FSI Dummy Variable for Aggregate Position

| | Position Type | | | | |
|---|---|---|---|---|---|
| | Producers' Long Position | Producers' Short Position | Speculators' Long Position | Speculators' Short Position | Speculation Index |
| GSCI | −4.966*** | 3.740** | 2.434*** | 0.241 | −0.050 |
| | (1.063) | (1.490) | (0.778) | (1.087) | (0.075) |
| BDRY | 0.032 | 0.147 | −0.205 | 0.733** | −0.001 |
| | (0.295) | (0.414) | (0.216) | (0.302) | (0.021) |
| GSCI Vol. | −1.890 | 4.457 | −2.476 | −1.990 | 0.034 |
| | (3.487) | (4.885) | (2.551) | (3.564) | (0.247) |
| FSI Dummy | −0.136 | 0.077 | −0.062 | 0.001 | 0.002 |
| | (0.114) | (0.160) | (0.084) | (0.117) | (0.008) |
| GSCI × Dummy | −0.145 | 2.244 | −0.998 | −1.417 | −0.071 |
| | (1.313) | (1.840) | (0.961) | (1.342) | (0.093) |
| GSCI Vol × Dummy | 4.468 | −1.862 | 3.561 | 1.189 | −0.105 |
| | (4.053) | (5.678) | (2.965) | (4.143) | (0.287) |
| BDRY × Dummy | −0.278 | 0.160 | −0.119 | −0.814* | 0.012 |
| | (0.449) | (0.629) | (0.328) | (0.459) | (0.032) |
| Observations | 831 | 831 | 831 | 831 | 831 |
| $R^2$ | 0.079 | 0.048 | 0.025 | 0.011 | 0.007 |
| Adjusted $R^2$ | 0.071 | 0.039 | 0.016 | 0.002 | −0.002 |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

# 7 Conclusion

The commodity futures market is highly integrated with the global financial system. This paper examines the relationship between traders' positions and the global financial stability during the two most recent crises: the 2008 GFC and the COVID-19 crisis (including the 2022 Russian invasion of Ukraine). We study the dynamic of both absolute position changes and relative exposures for hedgers and speculators.

Our regression results provide evidence in support of the convective risk flows theory proposed by Cheng et al. (2015) during the 2008 GFC. As the global financial system came under severe stress in 2008, speculators aggressively reduced their commodity futures exposure. In contrast, commodity producers, in aggregate, actively took the long position from speculators and closed their short positions. The 2008 GFC was mainly a banking crisis, reflecting the balance sheet constraints and diminished risk tolerance of the investment banks and trading firms. The financial stress limited their capacity to warehouse commodity market risk and forced them to close the long positions on commodity futures to limit their losses from the massive market sell-off.

In contrast, during the COVID-19 crisis, the commodity markets had a strong upward movement; The 2022 Russian invasion of Ukraine created more upward momentum for some commodities. Large investment banks grew their trading business across all asset classes, including commodities. Speculators also increased their commodity futures exposures. The convective risk flow was not observed during the COVID-19 crisis. These results highlighted the complexity of the dynamics between financial stress and traders' behaviors. How traders respond to financial stress is a complicated matter, involving the price movement of the underlying commodity, the type and severity of stress financial institutions experience, as well as the financial health of those institutions.

We also study speculators' long and hedgers' short positions relative to total open interest. We find that financial stability conditions had a limited impact on the relative exposures during both crises. In general, the changes of total open interest for commodity futures are mainly driven by cross-trading between those two groups: one group provides liquidity to the other. Under normal market conditions, speculators provide liquidity to hedgers, taking hedgers short position and accumulating net long exposures; when financial markets are under severe stress, like during the 2008 GFC, the trading flows could reverse. Hedgers start to facilitate the trades for speculators and supply the liquidity to the market. Further study is needed to understand the mechanism of this reverse risk flow during the 2008 GFC. It is important to study what triggers the risk-flow reversal, who are the players inside the producers group providing the liquidity to speculators, and what the motivations are for those producers. More detailed position and trade data are needed for this research.

The other main finding of this paper is that during both crises, the impact of financial stress on traders' positions is relatively limited compared with the impact of price movement. Speculators in general are more reactive to the changes of financial stability conditions than producers, who are more responsive to price movement and economy condition. This result could explain why we do not observe the reverse risk flow during the COVID-19 crisis, when financial stress was not as severe as the 2008 GFC.

Our findings have some strong implications for regulators seeking to address the financial stability issues related to commodity market shocks. A fire sale by financial institutions at a time when the global financial system is under stress increases the probability of a market crash, like what happened to LME nickels futures in 2022. Commodity producers, who are less regulated in general than financial institutions, may not be able to survive a large unexpected market movement when they are overly exposed to commodity market risk by taking the positions from financial institutions. A default event of a large commodity producer could bring more stress to the financial system, triggering a downward spiral in commodity futures markets. Addressing such risks within the current market and regulatory structure where substantial trading occurs between more and less regulated entities is challenging. The asymmetry of regulation implies that increased regulatory standards may have unforeseen results due to the asymmetric effects on institutional soundness versus market functioning.

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# Appendix: Financial System Stress Effects on the Positions of CIT and Small Traders

Commodity index traders (CIT) play a significant role in futures markets, particularly in the agricultural and energy sectors. These institutional investors, often large financial institutions or pension funds, seek exposure to commodity price movements by tracking broad-based commodity indices. Unlike traditional speculators or hedgers, index traders typically maintain long positions across a basket of commodities, rolling their contracts forward as they near expiration. Their approach is generally passive, aiming to replicate the performance of commodity indices rather than actively trading based on market views. CFTC publishes a supplemental report including 13 select agricultural commodity contracts for combined futures and options positions. Supplemental reports break down the reportable open interest positions into three trader classifications: non-commercial, commercial, and index traders. For small traders who do not meet the reportable threshold, their positions will be aggregated together as non-reportable position. We utilize the report to study how the financial system stress can impact the position of passive investors like CIT as well as small traders during the 2008 GFC and COVID-19 crisis. We focus on four agricultural futures: soybean, corn, wheat-SRW, and wheat-HRW[4].

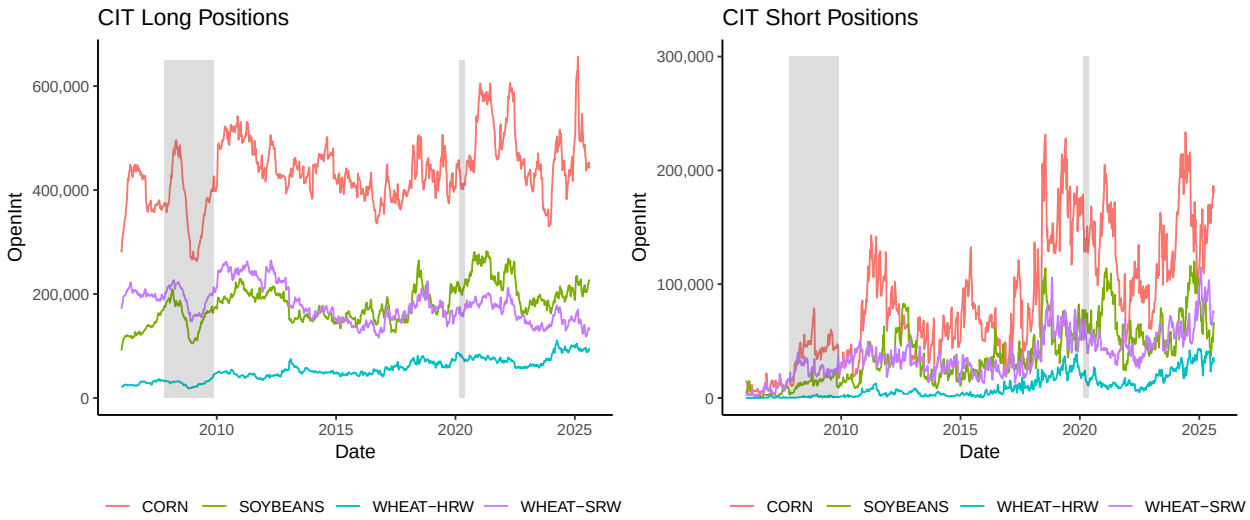
Figure 13 on the next page presents the CIT positions in those four agricultural futures markets over time. The left panel shows CIT long positions, while the right panel displays short positions. A notable feature is the sharp decrease in long positions across all commodities during the 2008 Global Financial Crisis, particularly evident in corn and soybeans. This contrasts starkly with the COVID-19 period, where positions remained relatively stable or even increased, suggesting different market dynamics and trader responses between these two major economic events. CIT's short positions, while generally much lower than long positions, show more volatility and have increased significantly since 2020, particularly for corn and soybeans.

The sharp decrease of CIT's agricultural long positions during the GFC is consistent with the change of active speculators' positions that we identify in section 5. To test whether increasing financial system stress can significantly impact CIT positions, we run a panel regression between the change of CIT positions and the change of FSI for four different sample periods: pre-GFC, GFC, pre-COVID, and COVID. Table 15 on the following page presents the panel regression result for the long positions. The results show a consistent negative relationship between changes in the FSI and changes in CIT long positions across all four sample period, suggesting that as financial stress increases, CIT long positions tend to decrease. This relationship is statistically significant in both GFC and COVID-19 crises. Those results show passive CIT investors displaying similar trading patterns as speculators. However, as it is just for agricultural contracts, the pattern most closely resembles the findings for swap dealers, where the decline was statistically significant for wheat and soy (see Table 7 on page 21).

Figure 14 on page 34 presents the small traders' positions in those four agricultural futures markets over time. The left panel shows their long positions, while the right panel displays short positions. Like the CIT and manage money positions, small traders' positions also show a dramatic decrease during the 2008 Global Financial Crisis, indicating that small traders might be also sensitive to broader financial market stress just

[4]Hard Red Winter (HRW) Wheat futures trade on the Kansas City Board of Trade (now CME Group), reflecting the primary growing region in the central and western plains of the United States. Soft Red Winter (SRW) wheat futures trade on the Chicago Board of Trade (now CME Group), representing production in the Eastern Corn Belt and Great Lakes regions.

Figure 13: CIT Long and Short Positions




like the institutional investors. We run a similar panel regression between FSI and smaller traders' position. Table 16 on the next page show the regression result for their long position. The panel regression results reveal a consistent negative relationship across all sample periods, with increasing statistical significance after the GFC. Give the FSI has been remained relative stable after the GFC, the regression results could imply that small traders are more sensitive to the change of financial system condition than large institution traders.

Table 15: CIT Long Positions Panel Regression

| | Δ of CIT Long Positions | | | |
|---|---|---|---|---|
| | Pre-GFC | GFC | Pre-COVID | COVID |
| Δ of FSI | −210.963 | −600.139*** | −440.177 | −865.058* |
| | (448.997) | (190.398) | (323.984) | (449.007) |
| Observations | 380 | 448 | 2,092 | 588 |
| $R^2$ | 0.001 | 0.022 | 0.001 | 0.006 |
| Adjusted $R^2$ | −0.002 | 0.020 | 0.0004 | 0.005 |
| F Statistic | 0.221 | 9.935*** | 1.846 | 3.712* |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()

Figure 14: Small Traders' Long and Short Positions

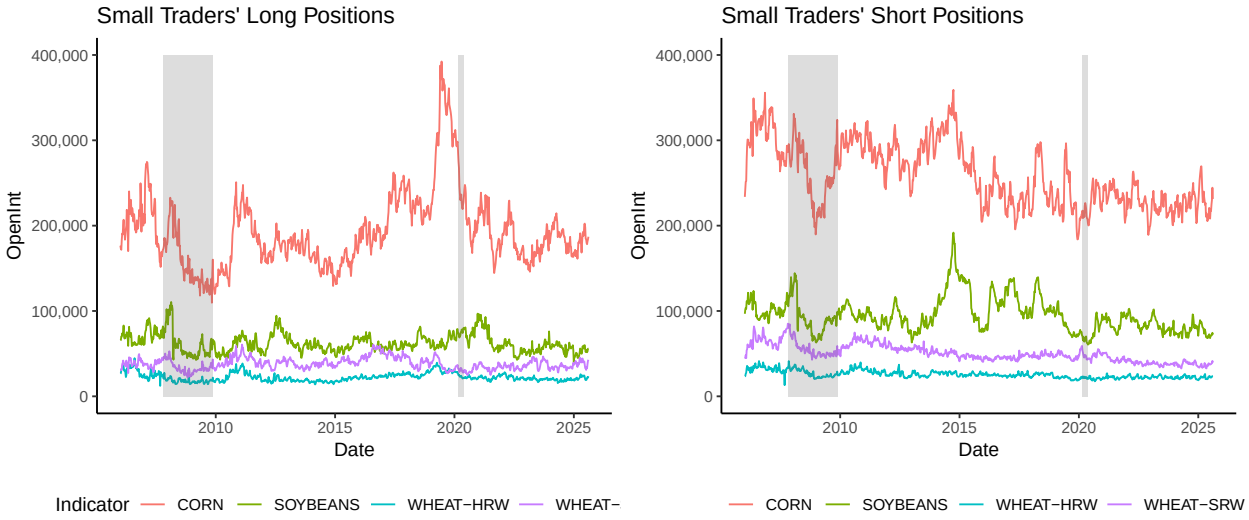



Table 16: Small Traders' Long Positions Panel Regression

| | Δ of Small Trader's Long Positions | | | |
|---|---|---|---|---|
| | Pre-GFC | GFC | Pre-COVID | COVID |
| Δ of FSI | −505.909 | −312.743 | −567.205*** | −1259.571*** |
| | (749.406) | (243.292) | (191.789) | (263.098) |
| Observations | 380 | 448 | 2,092 | 588 |
| $R^2$ | 0.001 | 0.004 | 0.004 | 0.038 |
| Adjusted $R^2$ | −0.001 | 0.001 | 0.004 | 0.036 |
| F Statistic | 0.456 | 1.652 | 8.747*** | 22.920*** |

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; standard errors in ()