School of Economics and Finance

The Effects of Margin Changes on Commodity Futures Markets

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Working Paper No. 736 December 2014 ISSN 1473-0278

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First Draft: 5 August 2012 **- This Draft**: 24 October 2014

Abstract

In light of the recently passed 2010 Dodd–Frank Act, we assess the effect of margin changes on prices, the risk-sharing between speculators and hedgers, and the price stability of 20 commodity futures markets. We find that margin increases decrease the rate at which prices change, yet they impair the risk sharing function and they decrease market liquidity in certain markets. The regulator should set margins by taking the heterogeneity of commodity futures markets into account. Certain effects of margin changes diffuse across related markets though. Our results are robust to endogenously set margins by the exchanges.

Keywords: Commodities, Hedging, Market liquidity, Margins, Speculators.

JEL codes: G10, G14, G18, G28.

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* We would like to thank Viral Acharya, Angelos Antzoulatos, Evangelos Benos, Gikas Hardouvelis, Esben Hedegaard, Eirini Konstantinidi, Dimitris Malliaropoulos, Michael Neumann, Tarun Ramadorai, Theodoros Stamatiou, Dimitris Thomakos, Efthymios Tsionas, Christos Tsoumas, and Dimitris Vayanos for useful comments and discussions. Any remaining errors are our responsibility alone.

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"*…Government data confirm that oil speculators are driving the price increase …In the Dodd-Frank Wall Street Reform and Consumer Protection Act, we empowered your Commission with a number of new tools to rein in excessive speculation and prevent market failures … Now is the time to exercise that authority…. Higher margin levels would reduce incentives for excessive speculation by requiring investors to back their bets with real capital…"*

U.S. Senators letter sent to Gary Gensler, chairman of the Commodity Futures Trading Commission (CFTC), March 2011.

1. INTRODUCTION

Traditionally, futures exchanges use margins as a risk management tool; they are a payment that serves as a collateral deposit to eliminate credit risk (e.g., Telser 1981, Figlewski, 1984, Kahl et al., 1985, Gay et al., 1986, Fenn and Kupiec, 1993, Gemmill, 1994). Till recently, futures exchanges had the discretion to set and change margin rules. However, the 2003-2008 commodity boom (Arezki et al., 2014) has revived the discussion about whether commodity futures margin requirements should be regulated so that they can also be used as a policy tool to restrict speculation and drive commodity prices down. The recently passed 2010 *Dodd–Frank Wall Street Reform and Consumer Protection Act* gives the authority to the U.S. Commodity Futures Trading Commission (CFTC) to establish margin requirements so as to protect the financial integrity of futures markets, including the commodity futures ones. So far, CFTC has not exercised this authority, yet the view that it should do so gains popularity.[1]

We investigate comprehensively the effect of margin changes on (1) commodity futures prices/returns, (2) the sharing of risk between speculators and hedgers, (3) commodity futures price stability and (4) the interaction between commodity markets characteristics. The study of the effect of margin changes on the above features of commodity markets is of interest to academics, investors and regulators for at least three reasons. First, it stands in the core of the historically ongoing debate

[1] "*...Mr. President, if CFTC Chairman Gary Gensler doesn't act soon to implement rules that will cut down on speculation in the oil futures markets, then you should consider not reappointing him*.", Senator Nelson, in his letter to President Obama, April 2012.

about whether margins should be regulated (for a review, see Kupiec, 1998). Second, it tests empirically the predictions of the theoretical literature on the effect of funding constraints on financial markets (Aiyagari and Gertler, 1999, Gromb and Vayanos, 2002, Brunnermeier and Pedersen, 2009, Adrian and Shin, 2010, Geanakoplos, 2010, Gârleanu and Pedersen, 2011, Acharya et al., 2013, Gibson and Murawski, 2013). In the case where investors face funding constraints, changes in margins make these constraints tighter forcing investors to close their positions. Hence, margin changes may affect market liquidity leading to price, volatility and risk sharing effects. Third, the commodity futures market is a natural setting to explore the effects of margin changes because historical data on margins are available; this is not the case for other futures markets.

We make four contributions. First, we examine the effect of margin changes on commodity futures prices and returns. Aiyagari and Gertler (1999), Gromb and Vayanos (2002), Brunnermeier and Pedersen (2009), Gârleanu and Pedersen (2011) and Acharya et al. (2013) models assume that speculators are more capital constrained than hedgers. Hence, they predict that in the case where speculators are net long (short), increases in margins decrease (increase) futures prices. The intuition is that an increase in margins make capital constraints binding and thus the long (short) speculators liquidate their positions by selling (buying) the futures and thus decreasing (increasing) its price. Our analysis tests these theoretical predictions.

Second, we study the effect of margin changes on the risk transfer between hedgers and speculators; this is one of the main roles of futures markets. Gârleanu and Pedersen (2011) and Acharya et al. (2013) assume that speculators are more sensitive than hedgers to changes in margin requirements. However, it is not clear à priori whether margin requirements impose significant costs on futures traders, and hence whether they undermine the risk transfer mechanism of futures markets. Anderson (1981) argues that futures margin requirements are costless and margin changes do not affect the behaviour of traders. On the other hand, Telser (1981) argues that margins impose significant opportunity and transaction costs on futures traders. However, the investigation of our

question is not equivalent to addressing whether margin changes affect the *total* trading volume or open interest (for such an effect, see e.g., Gibson and Murawski, 2013, Phylaktis and Aristidou, 2013). Instead, we investigate the impact of margin changes on speculative and hedging open interest, separately. In the case where we find that a margin increase coincides with a greater decrease in the speculators' than the hedgers' open interest, this will imply that the risk sharing role of futures markets is at risk; hedgers will have to exit futures markets not only because they cannot bear the increased costs but also because they cannot find speculators to share their risk.

Third, we investigate the effect of margin changes on the price stability of commodity futures markets because price stabilization yields welfare gains (Massell, 1969). There is an extensive long standing literature which addresses the issue of the stability of commodity prices (for a review, see Schmitz, 1984). However, most attempts to stabilize the commodity prices were not successful (Salant, 1983) just as was the case with the attempts to stabilize other market variables (see e.g., Obstfeld and Rogoff, 1995, for the case of fixing exchange rates). From a theoretical perspective, it is not clear what the effect of margins on the price stability would be. There are three competing hypotheses. The first hypothesis states that increases in margins decrease volatility (i.e. they increase price stability) because they drive the destabilizing speculators who increase the volatility out of the market. The second hypothesis argues that increases in margins increase volatility because they drive the speculators who provide liquidity out of the market (Brunnermeier and Pedersen, 2009). The last hypothesis states that there is no relation between changes in margins and volatility because the two effects described in the first two respective hypotheses cancel out. The empirical evidence is also mixed (for a review, see Kupiec, 1998). The previous literature though investigates these hypotheses by measuring price stability by the exhibited volatility. Instead, we use both volatility and market liquidity of the respective markets as alternative measures of price stability.[2]

[2] The International Organization of Securities Commission (IOSCO, 2003, 2011) sets transparency and market efficiency as two objectives that the regulator should be after. This is because the more transparent the market is, the easier it is for

This is because volatility and market liquidity are closely inversely related concepts (Gromb and Vayanos, 2002, Brunnermeier and Pedersen, 2009). The impact of margin changes on market liquidity is also of interest to the regulator. Increases in market liquidity improve social welfare (Huang and Wang, 2010), they reduce systemic risk (Allen and Carletti, 2008) and promote economic growth (Florackis et al., 2014). In addition, a highly liquid market promotes market transparency by obstructing market manipulation (Pashigian, 1986) and it engenders a greater degree of informational efficiency (Chordia et al., 2008). In line with Florackis et al. (2014), we measure market liquidity by using Amihud's (2002) illiquidity ratio.

Fourth, we examine for the first time whether the margin changes for an individual futures contract (target contract) affect the previously examined market features of the other contracts that belong in the same commodity group and which have not experienced a margin change (cross-contract margin effects). Margin increases in the target contract may make investors move to other related markets or drive them out of that group entirely in the fear that these increases will be extended to all related contracts (e.g., Hardouvelis and Kim, 1995, Xiong, 2001, Gromb and Vayanos, 2002, Brunnermeier and Pedersen, 2009).

To assess the impact of margin changes on the variables of interest, we employ 20 individual commodity futures; most of the previous empirical studies use considerably smaller cross-sections. We use an event study methodology. We identify the days where margin changes have occurred for each individual futures contract and we examine their effect on the variables of interest around these days. We repeat the analysis by classifying individual commodities in five distinct commodity groups. The analysis on individual futures takes into account the heterogeneity of the different commodity contracts (Erb and Harvey, 2006, Daskalaki et al., 2014) whereas the analysis on groups gains statistical power (for a similar approach, see also Hardouvelis and Kim, 1995).

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hedgers and speculators to access it (Cuny, 1993, and references therein). Informational efficiency also helps the risk sharing role of futures markets (Kahl et al, 1985, Chowdhury, 1991).

To ensure the robustness of the obtained results, we also conduct an instrumental variable estimation to address the case that margins changes may be set endogenously by the exchange. This is because margins in futures markets are set based on market conditions (Figlewski, 1984, Fenn and Kupiec, 1993, Brunnermeier and Pedersen, 2009). In addition, to gain further insight on the effect of margin changes, we classify margin changes into (a) positive and negative margin changes, and (b) large and small margin changes, and we analyze their effect separately. This further analysis is also of importance to regulators. First, policy makers are in favour of imposing higher margin levels and therefore understanding the effect of positive margin changes is of particular interest to them. Second, the exact magnitude of margin changes to be imposed by the regulator under the *Dodd–Frank Act* is yet to be decided and thus the effect of large margin changes on the commodity futures market should be studied.[3]

Our empirical analysis yields five main results. First, changes in margin requirements have a positive (negative) relation with commodity futures prices (returns). This implies that an increase in margin requirements constrains the rate at which commodity futures prices increase. A 10% margin increase, increases commodity prices by 1.51%, on average, over the 20-day horizon. Second, increases in margins impair the risk transfer mechanism in grains and metal markets because they make hedgers decrease their positions This occurs because hedgers cannot find speculators to share their risk. On average, a 10% increase in margin requirements drives out of the market 1.75% more speculators than hedgers. Third, there is a positive relation between margin changes and volatility. However, margin changes do not affect the individual contracts' market liquidity. Instead, we document that margin changes affect excessive speculation measured by Working's (1960) *T*-index. Fourth, cross-contract margin effects exist in some cases, i.e. when a margin change occurs for a target contract, other related contracts that belong in the same group are also affected. The results

[3] After the 1987 stock market crash, the Brady report recommended that significant increases in futures margin requirements should be imposed in line with the magnitude of margins in the stock markets. Even though this appeal has not been met, this issue is frequently raised.

are robust even when an instrumental variable estimation is performed. Finally, in the case where we examine the impact of positive and negative as well as the impact of large and small margin changes separately, we find that the previously examined market features are more sensitive to margin increases and large margin changes. In these cases, market liquidity decreases in certain markets. A 10% increase in margin requirements in softs and energy markets decreases liquidity by 7.39% (5.24%) when the positive (large) margin changes are considered.

We conclude this introduction by discussing the related empirical literature on commodity futures markets. Previous studies address some of the questions we pose in this paper, too. However, they consider them in a stand-alone setting. Instead, we consider them within a unified setting dictated by the predictions of the recent literature on the effect of funding constraints on financial markets. Adrangi and Chatrath (1999) and Chatrath et al. (2001) find that margin changes affect the risk sharing mechanism in three markets (gold, corn and silver). However, their analysis is limited only to four contracts and to a relatively short period (10 years). Regarding the effect on price stability, the evidence is mixed. The earlier literature uses only volatility to measure price stability. Hartzmark (1986) does not find a stable relation between margin changes and volatility whereas Fishe et al. (1990) find mixed results depending on their specifications. Ma et al. (1993) examine the silver market and they find a strong negative impact of margin changes on volatility across various subperiods. On the other hand, Hardouvelis and Kim (1995, 1996) and Chatrath et al. (2001) report a significant positive association between margins and volatility for metal futures, whereas Adrangi and Chatrath (1999) find a similar association for soybean and corn. Hedegaard (2011) uses market liquidity to measure price stability and he finds that margin changes affect liquidity. He also finds that margin changes do not affect futures prices. However, he focuses on a time series analysis setting which may be prone to the omission of factors other than margin changes which may affect liquidity and prices, too. On the contrary, our event study setting allows us to

focus on the dates where a margin change has occurred (for a similar rationale, see also Hardouvelis and Peristiani, 1992, and Hardouvelis and Kim, 1995).

The rest of the paper is structured as follows. Section 2 describes the dataset. Section 3 describes the event study methodology and it studies the margin effects. Section 4 examines whether cross-contract margin effects exist. Section 5 discusses the results of the robustness tests and the evidence from further analysis. The final section concludes and it discusses the implications of our findings.

2. THE DATASET

We collect data on maintenance margins for 20 individual commodity futures contracts. The employed contracts represent the five main commodity categories (energy, metals, grains, softs, and livestock) and they provide a lengthy sample of margin changes that enable us to conduct our subsequent analysis. We obtain the data on margins, quoted in dollar values, from the Chicago Mercantile Exchange (CME) group and the Intercontinental Exchange (ICE) where the employed commodity futures trade. We use maintenance rather than initial margins because the former are the same for hedgers and speculators and they are publicly available for a greater number of contracts. The sample is unbalanced, i.e. the starting date and the number of margin changes vary across commodities. In particular, margin data cover the period 2000-2011 for livestock, 2003-2011 for grains and oilseeds, 2004-2011 for energy, copper and platinum contracts, 2008-2011 for gold and silver contracts, whereas the data on soft contracts start in mid 1990s.[4] The sample interval is rich because it incorporates bull and bear regimes in commodity prices as well as the 2003-2008 commodity boom period and the recent 2007-2009 financial crisis.

[4] The CME group provides data on energy (crude oil, heating oil, natural gas), copper and platinum contracts over the period 2009-2011. The margin data on these futures over 2004-2008 were kindly provided by Esben Hedegaard as obtained from CFTC.

Table 1 reports the first date where the margin change occurs, the average, minimum and maximum maintenance margin level (quoted in % with respect to the contract value), the average number of days between margin changes, the total number of margin changes and the number of increases and decreases for each one individual futures contract as well as for each distinct commodity group. In addition, the average percentage increases and decreases in the quoted dollar amount margin requirements are analysed separately. The dataset consists of 784 margin changes; 457 are increases and 327 are decreases. The average maintenance margin requirement varies across individual commodities from 2.03% (feedercattle) to 9.29% (natural gas). Regarding the minimum and maximum maintenance margins within any given commodity group, we can see that the average sectoral minimum and maximum margins are given respectively by [2.17%, 10.18%] for grains, [2.56%, 14.79%] for softs, [1.30%, 6.69%] for livestock, [3.90%, 17.29%] for energy, and [2.99%, 13.89%] for metals. Regarding the statistics of margin changes, we can see that the average increase in margins ranges from 13.26% (silver) to 34.44% (cotton) whereas the average decrease ranges from 11.90% (lean hogs) to 27.48% (cotton); margin changes are quoted in percentage changes of a dollar amount. The results indicate that the magnitude of margin changes differ significantly among commodities. Finally, margin changes do not occur on a regular basis (the average time between margin changes ranges from 38 to 156 days), yet the number of margin changes occurred is considered to be large enough compared to the frequency of margin changes in other markets. For instance, the Federal Reserve Board has changed margin requirements in the stock markets only 23 times over the period 1934-1974, and margin requirements remain constant since then.

We also obtain data on the daily closing, opening, high, and low futures prices for individual commodity futures contracts from Bloomberg. To create continuous series of commodity futures daily returns, we hold the first nearby contract until the beginning of the delivery month and then we roll over our position to the contract with the following delivery month which then becomes the nearest-to-maturity contract**.** Notice that we are careful to compute daily futures returns using the

successive daily prices of a contract for a given delivery date, i.e. we do not compute returns by using prices across contracts with different delivery dates. Hence, the returns correspond to the returns of a strategy of closing the position in the near contract and opening a position in the second nearest contract at the beginning of the delivery month (for a similar approach, see Gorton et al., 2012, Daskalaki et al., 2014, Szymanowska et al., 2014).

Finally, we use the data on the reportable (large) traders' positions reported by CFTC on a weekly basis. For each distinct commodity futures contract, the Commitments of Traders (COT) reports provide a breakdown of the total open interest across all traded maturities into reportable and non-reportable positions. The reportable positions in a given futures contract are those held by large traders, who own or control positions above a specific threshold specified by CFTC. They are further categorized either as commercial (hedgers) if they are engaged in business activities hedged by the use of futures contracts or non-commercial (speculators) if they are engaged in speculative activities. The rest of the open interest in a futures contract is defined as non-reportable positions that correspond to small traders whose positions do not exceed the reporting levels, and no distinction is made regarding their motives.

3. THE IMPACT OF MARGIN CHANGES

3.1. The event study setting

To assess the impact of margin changes on the variables of interest, we apply the event study methodology. We isolate the days where a margin change for each individual futures contract has occurred and we examine their impact on a number of features of the commodity futures market around these days. We consider a short and a long pre-event and post-event period. We examine the variables of interest over a pre-event period comprising the last five (or twenty) trading days immediately before the margin change and a post-event period comprising the five (or twenty)

trading days immediately after the margin change. Note that margin changes may be announced by futures exchanges 24 hours in advance of the actual margin change. Hence, the event study is not subject to an early announcement effect to the considered variables because the pre-event window spans a longer interval of time. Finally, we investigate the impact of margin changes both on individual commodity futures contracts as well as on distinct groups including contracts that belong in the same sector.

3.2. The effect on commodity futures prices and returns

First, we investigate whether margin changes affect the prices and returns of commodity futures. Gârleanu and Pedersen (2011) and Acharya et al. (2013) models predict that in the case where speculators are net long (short), there would be a negative (positive) relation between margin changes and futures prices. Let NSP_i denote the net speculative positions for commodity *i* measured on the day just prior to the day where the margin change occurred. NSP_i is defined as the number of long speculators minus the number of short speculators divided by the total open interest in the respective commodity market prevailing on the day just prior to the margin change, i.e.

$$NSP_i = \frac{Long\ SP_i - Short\ SP_i}{Total\ OI_i} \tag{1}$$

We calculate the average NSP for each one of the assumed commodity futures contracts. Unreported results show that the average NSP is positive for almost all contracts. The only exceptions are natural gas and copper futures. Hence, for almost all individual futures contracts, Gârleanu and Pedersen (2011) and Acharya et al. (2013) models would predict that margin changes will have a negative effect on commodity futures prices.

To assess the price impact of margin changes, we examine the effect both on the price level as well as on the price growth (i.e. the returns) for each commodity futures contract by taking into

account the net speculative positions at the time of the margin change. We run the following regression:

$$\Delta Y_i = a_0 + a_1 \Delta \ln M_i + \beta NSP_i + u_i \quad (2)$$

where $\Delta Y_i = \Delta \ln P_i \ (\Delta R_i)$ is the change in the average price level (change in the average return) and $\Delta \ln M_i$ is the change in the average margin level before and after the margin change *i*. $\Delta \ln P_i \equiv \ln P_{A,i} - \ln P_{B,i}$, $P_{B,i}$ is the average price level before the margin change *i*, from business day -5 (or -20) to business day -1 (pre-event period), $P_{A,i}$ is the average price level after the margin change *i*, from business day 0 to business day 5 (or 20, post event period), with day 0 being the day that the *i*th margin change occurs for a given commodity futures contract. Similarly, $\Delta R_i \equiv R_{A,i} - R_{B,i}$, $R_{B,i}$, $(R_{A,i})$ is the geometric average daily futures return over the pre-event (post-event) period and $\Delta \ln M_i \equiv \ln(M_{A,i} / M_{B,i})$, $M_{B,i}$, $(M_{A,i})$ is the average daily level of the maintenance margin over the pre-event (post-event) period.

Note that we calculate the average daily prices and returns by using the same expiry contracts in both the pre-event and post-event period to avoid incurring noise in our analysis due to the contracts rollover. We estimate the regression models first for the individual commodity futures contracts and then for each distinct commodity group. Table 2 reports the results in the case where we assess the margin effect both on the price level as well as on the futures returns. Panels A and B report the results for the individual commodity futures contracts and for the distinct commodity groups, respectively. We can see that there is a positive (negative) association between margin changes and average futures prices (returns). In addition, the effect of net speculative positions is insignificant. The only exception is the livestock futures contracts; there is a negative association between margin changes and futures prices and the effect of the NSP is statistically significant. Overall, our results imply that margin increases decrease the rate at which futures prices increase. This finding is more evident for the distinct commodity groups rather than the individual futures

contracts and in general it is stronger over the longer rather than the shorter horizon. In particular, when the margin increases 10%, commodity prices increase 1.47%, on average, over the 20-day horizon. The effect is more pronounced for energy contracts; their prices increase 3.31%.

Our results are in contrast to the predictions of Aiyagari and Gertler (1999), Gromb and Vayanos (2002), Brunnermeier and Pedersen (2009), Gârleanu and Pedersen (2011) and Acharya et al. (2013) models where margin increases lead to price drops. Yet, we find that margin increases lead to a decrease in the *rate* at which the price increases. Hedegaard (2011) does not confirm the predictions of the previously mentioned models either; he finds that changes in maintenance margins do not affect the returns of 16 individual commodity futures contracts using a time series rather than an event study setting though.

3.3. The effect on the risk transfer mechanism

Next, we investigate whether margin changes affect the risk transfer mechanism of the commodity futures markets. We perform our analysis in two steps by employing data from the COT reports provided by CFTC. First, we regress the change in reportable hedgers' (HP) open interest positions before and after the margin change on the change in margins. In the case where we find that hedgers positions are negatively affected by margin changes, this would imply that a margin increase would make hedgers exit the market. This would undermine the risk transferring role of futures markets. It can be attributed to either that the hedgers cannot afford hedging costs incurred by the margin change or that they cannot find speculators to hedge their risk.

Furthermore, we regress the change in reportable speculators' (SP) open interest positions (sum of long and short speculative positions) and the change in the ratio (SP/HP) positions on the change in margins, separately (notice that the ratio does not equal one because the small traders positions are not taken into account). The reason for doing so is the following. Assume we find that both speculative and hedging positions are negatively affected by the margin increases. In this case, a negative (positive) effect on the (SP/HP) ratio would imply that speculative positions are more

(less) sensitive than hedging positions. Evidence that hedgers are more sensitive than speculators would indicate that hedgers leave the market because they cannot afford hedging costs. On the other hand, evidence that speculators are more sensitive may indicate that hedgers leave the market either because they cannot find speculators to hedge their risk and/or they cannot afford hedging costs. Interestingly, Gârleanu and Pedersen (2011) and Acharya et al. (2013) models assume that speculators are more sensitive than hedgers to changes in margin requirements.

We estimate the following regression model:

$$\Delta \ln Pos_i = a_0 + a_1 \Delta \ln M_i + u_i, \quad for\ Pos_i = SP_i, HP_i, SP_i / HP_i \tag{3}$$

where $\Delta \ln Pos_i \equiv \ln(Pos_{A,i} / Pos_{B,i})$, $Pos_{B,i}$ $(Pos_{A,i})$ is the average traders' positions over the pre-event (post-event) period for a given commodity futures contract. Note that CFTC data are available on a weekly basis, recorded every Tuesday. This may not coincide with the date where a margin change occurs. To match the timing of a margin change with the corresponding change in traders' positions, we assign the Tuesday value provided by CFTC to each day falling in the interval from Tuesday to Monday (for a similar approach with weekly data, see also Hardouvelis and Peristiani, 1992).

Table 3 reports the results from the regression described in equation (3) for the individual commodity futures returns and for the distinct commodity groups (panels A and B, respectively). We can see that margin changes are negatively associated with hedging positions in grains and metals markets and they have no association with the hedging positions in the other markets. In the grains and metal markets, we can also see that there is a negative association of margin changes with speculative positions as well as with the SP/HP ratio. The evidence on the statistical significance is stronger in the case where the analysis is applied to groups rather than individual commodities. The evidence indicates that speculators are more sensitive to margin changes than hedgers. A 10% increase in margin requirements drives out on average 1.75% more speculators than hedgers from the grains and metals markets. This implies that margin increases impair the risk sharing function in

these markets which traditionally are used for hedging. Hedgers exit these two markets because they cannot afford increased costs as well as because they cannot find a counterparty to share their price risk. The significance in results is mostly documented for the commodity groups rather than for the individual futures contracts. Adrangi and Chatrath (1999) and Chatrath et al. (2001) also find that margin changes affect speculators more than hedgers.

Interestingly, the heterogeneity across individual contracts and groups regarding the margin effect on the hedging positions indicates that each futures contract/group should be examined on a stand-alone basis by the regulatory agencies. This also extends the findings of the previous literature on the heterogeneity of commodity futures in terms of their risk risk-returns profile (Erb and Harvey, 2006, Daskalaki et al., 2014) to a heterogeneity structure in terms of their response to margin changes.

3.4. The effect on price stability

We investigate the effect of margin changes on the price stability of the commodity futures market. First, we use volatility as a measure of the price stability in line with Ma et al. (1993) and Hardouvelis and Kim (1995, 1996). We also examine the effect of margin changes on the market liquidity of the individual contracts. The recent literature and the 2007-2009 subprime credit crisis have revealed that market liquidity is an alternative way of signalling price stability because it is inversely related with volatility (Brunnermeier and Pedersen, 2009, Huang and Wang, 2010).

A. The effect on futures returns volatility

We regress the change in the average volatility on the change in the average margin requirement (Hardouvelis and Kim, 1995), i.e.

$$\Delta \ln Vol_i = a_0 + a_1 \Delta \ln M_i + u_i \qquad (4)$$

where $\Delta \ln Vol_i \equiv \ln(Vol_{A,i} / Vol_{B,i})$, $Vol_{B,i}$, $(Vol_{A,i})$ is the average daily returns volatility of commodity futures returns over the pre-event (post-event) period.

We measure the daily futures returns volatility by using three alternative volatility estimators to ensure the robustness of the obtained results. First, we employ two traditional variance measures which combine high, low, opening, and closing prices, namely the Garman and Klass (1980) and Rogers and Satchell (1991) estimators, $V_{GK,t}$ and $V_{RS,t}$, respectively. Let O_t, C_t, H_t and L_t denote the opening, closing, high and low futures prices at day t, respectively. Then,

$$V_{GK,t} = 0.5\left(\ln H_t - \ln L_t\right)^2 - \left(2\ln 2 - 1\right)\left(\ln C_t - \ln O_t\right)^2 \tag{5}$$

$$V_{RS,t} = \left(\ln H_t - \ln O_t\right)\left(\ln H_t - \ln C_t\right) + \left(\ln L_t - \ln O_t\right)\left(\ln L_t - \ln C_t\right) \tag{6}$$

In addition, we use the log range defined as the difference between the asset's highest and lowest log prices at day t, i.e.

$$V_{R,t} = \left(\ln H_t - \ln L_t\right) \tag{7}$$

Alizadeah et al. (2002) propose the log range as a superior volatility proxy since it is indicative of the intraday price fluctuations. In addition, they argue against the inclusion of the opening and closing prices on the grounds that these prices are highly influenced by microstructure effects (see also Brown, 1990).

Table 4 reports the results from the regression in equation (4) for the individual commodity futures returns and for the distinct commodity groups (panels A and B, respectively). In the case of the individual commodity futures contracts, we can see a statistically significant positive association between margin changes and changes in volatility in more than half of the cases, mostly over the long event window; over the short event window, the reported results are not statistically significant in almost all cases. This implies that margin changes for most commodity futures coincide with changes of similar direction in volatility over longer intervals of time. In the case of the grouped commodities, again we find a positive association between margin changes and volatility, especially when we consider the long horizon. Results hold regardless of the employed volatility estimator. Notice that margin changes are not clustered over time and hence the stronger evidence reported over

the long horizons cannot be attributed to a spiral effect where an increase in margin leads to an increase in volatility and next the volatility increase leads to an increase in margin again.

The evidence on the margin effect on volatility is in line with Hardouvelis and Kim (1995) findings in the metal futures market. This could be attributed to the fact that an increase in margin drives the liquidity-providers speculators out of the market, thus causing an increase in the volatility of the futures contract. We shed further light on this issue by analyzing the margin effect on the futures contracts' liquidity in the next subsection.

B. The effect on futures market liquidity

We examine the effect of margin changes on futures market liquidity. To this end, we use Amihud's (2002) liquidity measure. Marshall et al. (2012) conduct a horse race among various liquidity proxies by focusing on commodity futures markets. They conclude that Amihud's ratio has the largest correlation with liquidity measures constructed by high-frequency data that represent actual commodity transaction costs. Amihud's illiquidity measure $ILL_{j,t}$ at day t of a given commodity j is defined as:

$$ILL_{j,t} = \frac{\left| r_{j,t} \right|}{DolVol_{j,t}} \tag{8}$$

where $r_{i,t}$ is the daily return of the commodity j on day t, $\left| \, . \, \right|$ denotes the absolute value; $DolVol_{j,t}$ is the dollar volume for commodity j on day t, i.e. the closing price on day t multiplied by the number of futures contracts traded during that date. Amihud's ratio gives the absolute (percentage) price change per dollar of daily trading volume; the greater Amihud's ratio is, the greater the response of prices will be and hence the more illiquid the futures contract is considered to be.

To assess the impact of margin changes on contract's liquidity, we examine the change in the individual contract's illiquidity measure over two intervals, before and after the margin change. To this end, we regress the change in the average illiquidity on the change in the average margin requirement:

$$\Delta \ln ILL_i = a_0 + a_1 \Delta \ln M_i + u_i \quad (9)$$

where $\Delta \ln ILL_i \equiv \ln\left(ILL_{A,i} / ILL_{B,i} \right)$, $ILL_{B,i}$ $(ILL_{A,i})$ is the average illiquidity over the pre-event (post-event) period for a given commodity futures contract.

Table 5 reports the results from the regression described in equation (9) for the individual commodity futures returns and for the distinct commodity groups (panels A and B, respectively). We can see that margin changes do not affect the liquidity of futures contracts in almost all cases. This holds both for the individual contracts as well as for the distinct commodity groups, regardless of the employed size of the event window.

C. The effect on excessive speculation

The evidence that margin changes do not affect market liquidity in conjunction with the previous finding that a margin change is negatively associated with speculative positions (Section 3.3), implies that the affected speculative positions can be viewed as *excessive* speculation, i.e. speculation in excess of the speculation required to provide market liquidity. This would imply that an increase in margins decreases excessive speculation. To explore this statement further, we examine the effect of margin changes on excessive speculation measured by Working's *T* Index. Based on the COT reports provided by CFTC, Working (1960) defines speculation to be excessive if the speculative positions are greater than those required to match the hedging positions. Working's *T* Speculative index (SPI) is defined as

$$SPI = \begin{cases} 1 + \dfrac{SS}{HL + HS} & if \;\; HS \geq HL \\ 1 + \dfrac{SL}{HL + HS} & if \; HL \geq HS \end{cases} \quad (10)$$

where *SS*, *SL* denote the open interest held by short and long speculators and *HL*, *HS* denote the open interest held by long and short hedgers. The denominator is the total amount of futures hedging positions. Assume that the short hedging positions are greater than the long hedging positions. This

implies that a greater number of long speculative positions is needed to balance the market whereas short speculative positions are not required by the hedgers. Therefore, the short speculative positions can be interpreted as "excessive". A number of studies (see e.g. Leuthold 1983,Sanders et al., 2010) uses Working's *T* Index to measure excessive speculation in various futures markets.

To assess the impact of margin changes on the excessive speculation, we regress the change in the average excessive speculation on the change in the average margin requirement

$$\Delta \boldsymbol{lnSPI}_i = a_0 + a_1 \Delta \boldsymbol{ln}\, M_i + u_i \qquad (11)$$

where $\Delta \boldsymbol{lnSPI}_i \equiv \boldsymbol{ln}\left(SPI_{A,i} / SPI_{B,i}\right)$, $SPI_{B,i}$ $(SPI_{A,i})$ is the average excessive speculation over the pre-event (post-event) period for a given commodity futures contract.

Table 6 reports the results from the regression in equation (11) for the individual commodity futures returns and for the distinct commodity groups (panels A and B, respectively). In the case of the individual commodity futures contracts, we can see that there is a statistically significant negative association between margin changes and changes in excessive speculation in more than half of the cases. This implies that margin changes for most commodity futures are negatively correlated with changes in excessive speculation. In the case of the grouped commodities, again we find a negative association between margin changes and volatility, especially when we consider the 20-days horizon. This evidence explains our previous findings that an increase in margins decreases speculative positions whereas it does not affect market liquidity. This is because the affected speculative positions constitute *excessive* speculation.

In sum, we find that margin changes increase volatility yet they do not affect market liquidity. The latter result is explained by the fact that we find that a margin increase decreases excessive speculation. The former result has also been documented by Hardouvelis and Kim (1995). They conjecture that this may be due to the fact that futures exchanges raise (decrease) margins in anticipation of higher (lower) volatility for individual futures contracts.

4. CROSS-CONTRACT MARGIN EFFECTS

Next, we examine whether margin changes for an individual futures contract (target contract) affect the rest of the contracts that belong in the same commodity group (cross-contract margin effect). For each target contract and each margin change *i*, we create a benchmark set that includes the contracts that belong in the same commodity group and they do not undergo a margin change during the event period (-20, 20) of the *i*th margin change of the target contract (for the concept of benchmark groups, see also Hardouvelis and Kim, 1995). Then, we estimate again the previous regression equations where the independent variable is the margin change for the target contract and the dependent variables are the previously examined characteristics of the benchmark group around this change.[5]

Table 7 reports the results when the effect of margin changes for the target contract on the other related contracts is examined. We evaluate the change on the benchmark groups' prices (column 1), returns (column 2), hedging positions (column 3), speculative positions (column 4), volatility (column 5), and liquidity (column 6). Due to space limitations, the results are reported only for the long event window. We can see that cross-contract margin effects appear only in some cases. However, their magnitude and sign depend on the commodity group under scrutiny. This implies that policymakers should take into account that margin changes in a futures contract may affect other related contracts. In addition, the direction of the effect varies across groups.

In particular, we can see that a margin change in the target contract does not affect the prices and returns of the contracts that belong in the same group in most of the cases. Regarding the effect on hedging positions, this depends on the commodity contract under scrutiny. In the case of softs, the change in margin for half of the target contracts coincides with positive changes in the hedging positions of the other related contracts, indicating that hedgers turn to the other softs contracts when they face a margin increase. On the other hand, in the case of metals, the respective negative relation

[5] For the case where we examine the effect of margin changes on futures price/returns, we also control for the Net Speculative Positions as in equation (2).

for half of the contracts indicates that when the margin of the target contract increases, hedgers leave the metals market. For the other target contracts, margin changes have no effect on the hedging positions of the related futures.

Regarding the effect on the speculative positions, the margin changes of the target contract are negatively associated with the speculative positions for half of the target contracts that belong in grains, livestock and metal markets; for the other groups, the results are insignificant. This finding, in conjunction with the finding in Section 3.3 on the effect of margin changes on risk transfer, implies that a margin increase for these target contracts decreases the speculative positions both for the target contract as well as for contracts that belong in the same group. It may well be the case that this happens because many of the speculative positions in futures markets have to do with spread trading. In a futures spread strategy, a speculator takes simultaneously a position in two futures contracts (two legs) that have different but highly correlated underlying assets and the same expiry date. Hence, when the spread trader is forced to liquidate her position in one of the two legs of the strategy due to a margin increase, she will also liquidate the other leg even if this leg is not affected by the margin change (see Xiong, 2001). Finally, we can see that in most cases, the margin change of the target contract does not affect the volatility and the liquidity of the other related contracts. Unreported results show that in these cases margin changes affect excessive speculation measured by Working's *T*-index.

5. ROBUSTNESS TESTS & FURTHER ANALYSIS

In this section, first we revisit the margin effect on the selected market variables by performing an instrumental variable estimation to deal with concerns stemming from the potential endogeneity of margins. Then, we classify margin changes into (a) positive and negative changes and (b) large and small changes, and we analyze their effect separately. Finally, we examine the price impact of margin changes during the recent 2007-2009 liquidity crisis. In the last three cases, we conduct the

analysis only for the distinct commodity groups. This is because the classification of margin changes in categories yields a limited number of observations for individual commodity futures.

5.1. Instrumental Variable (IV) estimation and Two Stages Least Squares (TSLS)

We should acknowledge that an endogeneity issue may arise regarding the effect of margin changes on market's features. This is because margins in futures markets are set based on market conditions (e.g., volatility, see Figlewski, 1984, Goldberg and Harvey, 1992, Fenn and Kupiec, 1993, Brunnermeier and Pedersen, 2009, Hedegaard, 2011). Therefore, changes in market conditions may have forced futures exchanges to change margin requirements rather than the reverse. To address the potential presence of endogeneity, we employ the instrumental variables (IV) technique and the two stages least squares (TSLS) estimators.

We choose the lagged once margin change (whenever this has occurred) as an instrument; the choice of the lagged endogenous variable as an instrument is common in the IV approach. The argument is that even though the current values of margin changes might be endogenous, it is unlikely that its past values are subject to the same problem. This is because margin changes occur sporadically and they are uncorrelated over time. Next, we perform a TSLS estimation. In the first stage, we regress the potentially endogenous variables (margin changes) on the chosen exogenous instruments (lagged margin changes). In the second stage, we regress the dependent variable under scrutiny (price/return, liquidity, etc) on the predicted values from the first stage regressions in place of the potentially endogenous variables. By using the predicted values based on exogenous variables only, we obtain the exogenous part of their variation. Thus, the second stage uses a variable that is now exogenous and so any bias due to endogeneity disappears.

Table 8 reports the results from TSLS for the individual commodity contracts as well as for the distinct commodity groups. First, we examine whether the instrument we have chosen is a relevant one (instrument relevance condition) i.e. the covariance between margin changes and lagged margin changes differs from zero. Column 1 reports the results from the first stage of TSLS. We

can see that the chosen instrument (lagged margin changes) is correlated with the potential endogenous variable (margin changes); in most cases, the reported coefficients are statistically different from zero.

Columns (2)-(8) report the results from the second stage TSLS. In particular, we assess the effect of IV margin changes separately on futures prices (column 2), futures returns (column 3), hedging positions (column 4), speculative positions (column 5), speculative/hedging positions (column 6), volatility (column 7), and liquidity (column 8). The results of TSLS remain qualitatively similar to those reported in Sections 3.2-3.4.[6] We can see that changes in margin requirements coincide with positive (negative) changes in prices (returns) in most cases; livestock futures is again the only exception. In addition, we find that the margin effect on the hedgers' open interest is either negative (grains and metals) or insignificant (other commodity groups). In the former case, the margin impact on speculators open interest is also negative and greater than that of the hedgers' one in all commodity markets. Therefore, hedgers exit these two markets because they cannot afford the increased costs as well as because they cannot find a counterparty to share their price risk. Moreover, there is a positive association between margin changes and volatility with the evidence being stronger for commodity groups, whereas the market liquidity of the individual contracts/groups is not affected by margin changes. In most cases, the reported evidence is stronger over the longer rather than the shorter horizon.

5.2. The impact of positive and negative margin changes

We repeat the event study analysis described in the previous sections by examining separately the impact of margin increases and decreases on the corresponding values of the dependent variables. This differentiation is of importance for regulatory purposes because policy circles argue in favour of

[6] In the case where we examine the impact of margin changes on the futures price/ return, we also employ the instrumental variables (IV) technique and the two stages least squares (TSLS) estimators for the regression shown in equation (2) to control for the net speculative positions. The results remain qualitatively similar.

imposing higher margin requirements on commodity futures. Table 9 reports the results for the distinct commodity groups. We can see that there is an asymmetric reaction of each dependent variable to positive and negative margin changes; for most groups and market variables, the effect of margin increases is statistically significant whereas there is no effect caused by margin decreases. The direction of the effect of margin increases on most dependent variable is the same with the one documented in Sections 3.2-3.4, i.e. a margin increase coincides with increases (decreases) in futures prices (returns), decreases in hedging positions (only for grains and metals) and speculative positions with the speculative positions being more sensitive than the hedging ones, and with increases in volatility. The results confirm the evidence reported over the full sample of margin changes that the risk sharing function of grains and metals futures markets is impaired when faced a margin increase.

On the other hand, regarding the effect of margin changes on market liquidity, the results now are in contrast to the findings reported in Section 3.4 where we documented that margin changes do not affect the liquidity of softs and energy markets. Now, margin increases decrease liquidity (only) in the case of softs and energy markets. In particular, a 10% increase in margin requirements in these markets decrease liquidity on average by 7.39% over the 20-days horizon. This implies that a margin increase in softs and energy markets could harm their liquidity, i.e. the liquidity-providers speculators leave the market when faced a margin change that restricts their trading activities. The contrast in results when the sign of the margin change is considered, indicates that there is an asymmetric margin effect on these markets' market liquidity which is masked if one does not consider the effect of margin increases and decreases separately. The fact that liquidity-providers speculators do not return to the market when margins decrease may be due to the fact that as soon as the margin was raised, they moved to another asset class or to commodity futures contracts that belong to a different sector; the latter is documented by the findings in the cross-contract margin effects analysis (Section 4). Then, they stay there even if subsequently margins decrease. They do

so possibly in order to avoid transaction costs, other frictions, or simply because they are content with the risk/return profile of their new investments.

5.3. The impact of large and small margin changes

We partition the margin sample for each commodity group into two groups of large and small margin changes and we assess separately their impact on the various dependent variables. The motivation for undertaking this analysis stems from examining whether the results reported in the previous sections are sensitive to the magnitude of margin changes (for a similar approach, see also Hardouvelis and Kim, 1995). This is important for regulatory purposes because it will help deciding whether a large or a small margin change should be imposed.

First, for each commodity group, we rank margin changes across all futures contracts belonging in the group based on their absolute changes and we calculate their average value. Then, we assign the set of changes above (below) the average margin change to the large (small) margin changes group. Next, we assess the impact of large and small margin changes on the corresponding values of each dependent variable, separately.

Table 10 reports the results from these regressions. We can see that there is an asymmetric reaction of the dependent variables to large and small margin changes. For most groups and dependent variables, the effect of large margin changes is statistically significant whereas there is no significant effect caused by the small margin changes. This supports the view of a number of policymakers that large changes in margins should be adopted for these to be effective as a policy tool. The direction of the effect of large margin changes on prices, volatility and traders' positions is the same with the one obtained over the full sample of margin changes. Again the risk sharing function of grains and metal markets is impaired when facing large margin changes. On the other hand, regarding the effect on liquidity, large margin changes decrease liquidity in the case of grains, softs, and energy markets. A 10% increase in margin requirements decrease liquidity on average by 5.24% in these markets over the 20-days horizon; for the other two groups, there is no effect on their

liquidity regardless of the magnitude of the margin change. This evidence implies that speculators who provide liquidity in these markets decrease their positions when faced with a large margin change. This is in contrast to the results reported in Section 3.4 where margin changes do not affect the liquidity of the grains, softs and energy markets. This indicates again that examining the full sample of margin changes masks the asymmetric effect of small and large changes on the market liquidity just as it was the case with the effect of positive and negative margin changes.

5.4. The 2007-2009 liquidity crisis and the price impact of margin changes

The results reported in Section 3.2 do not confirm the predictions of Gârleanu and Pedersen (2011) and Acharya et al. (2013) models with regard to the effect of margin changes on futures prices. A possible explanation may be that margin increases may not make speculators' capital-constraints binding over the full sample period. It may well be the case that speculators' capital is abundant so that there is no risk of breaching the capital constraints. We investigate this further by conducting a subsample analysis. We examine the impact of margin changes on prices and returns during the recent liquidity crisis period 2007-2009. This subsample choice is motivated by Gromb and Vayanos (2002), Brunnermeier and Pedersen's (2009) and Gârleanu and Pedersen's (2011) who predict that the role of funding constraints becomes salient during liquidity crisis periods compared to calmer periods.

Table 11 reports the results. We can see that the positive association between margin changes and prices, previously reported for all groups but livestock over the full sample, holds now for the grains, energy and the soft futures mostly over the long event window; there is not a statistically significant relation for metals. However, the effect on futures returns remains negative just as it was over the full sample period, i.e. margin increases coincide with negative changes in futures returns. Livestock futures is again the only exception where margin increases coincide with decreases in prices. The results indicate that the predictions of the theoretical models cannot be

verified even during the liquidity crisis period where the speculators' capital constraints are expected to be binding.

6. CONCLUSIONS

The recent spectacular increase in commodity prices and the 2010 Dodd-Frank reform have revived the debate about whether margin requirements should be regulated in commodity futures markets. We contribute to this discussion being guided by the recent theoretical literature on the effect of funding constraints on financial markets. We investigate the impact of margin changes on commodity futures prices/returns, the risk sharing mechanism, and the price stability of 20 commodity futures markets. In addition, we examine whether margin changes in one futures affect the characteristics of all other futures that belong in the same commodity group and they do not undergo a margin change (cross-contract margin effects).

We find that changes in margin requirements are positively (negatively) correlated with changes in prices (returns) and we document that increases in margins impair the risk transfer mechanism in grains and metal markets. We also find that the market liquidity of the individual contracts/groups is not affected by margin changes. This is because margin changes affect excessive speculation. Our results are robust even if the margin changes are set endogenously by the exchanges. Interestingly, in the case where we examine the margin impact of positive/negative and large/small margin changes separately, we find that the market liquidity in some markets (grains, softs, and energy) decreases when large margin increases are considered. Finally, we document cross-contract margin effects for hedging and speculative positions only in some cases.

Our findings have three implications for academics, market participants and policy makers. First, margin increases harm the risk sharing function and they have an asymmetric effect compared

to margin decreases on the liquidity of certain markets.[7] Second, policymakers should also take into account the fact that the effect of margin changes varies across commodity groups. Interestingly, changes in the margins of one commodity futures may affect the hedging and speculative positions for other related commodity futures that belong in the same commodity group. Finally, only the large and positive (i.e. increases) margin changes affect the characteristics of the commodity futures market; the small and negative changes do not. Hence, the regulator should be cautious before implementing any margin changes because the consequences may be irreversible. Our study motivates the investigation of whether margins are priced in the cross-section of commodity futures returns. This will add to the literature on asset pricing for commodity futures (e.g., Daskalaki et al., 2014, Szymanowska et al., 2014, and for a review, Skiadopoulos, 2013) and it is best left for future research.

Acknowledgements

We are grateful to one anonymous refree for thorough, constructive and stimulating comments. We would also like to thank Viral Acharya, Angelos Antzoulatos, Evangelos Benos, Gikas Hardouvelis, Esben Hedegaard, Eirini Konstantinidi, Dimitris Malliaropoulos, Michael Neumann, Tarun Ramadorai, Theodoros Stamatiou, Dimitris Thomakos, Efthymios Tsionas, Christos Tsoumas, and Dimitris Vayanos for useful comments and discussions. Any remaining errors are our responsibility alone.

[7] This evidence is in line with the opinion expressed by Alan Greenspan, former Chairman of the Federal Reserve, during a Fed Policy Meeting in September 1996: *"I guarantee you that if you want to get rid of the bubble, whatever it is, that [raising margin requirements] will do it. My concern is that I am not sure what else it will do*."

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Table 1: Commodity futures contracts and margin changes

The table describes the commodity futures contracts employed in this study and it provides information regarding the margin changes for each one individual futures contract and for the distinct commodity groups. Entries report the first date of margin change, the average, minimum and maximum maintenance margin, the average number of days between margin changes, the total number of margin changes and the number of margin increases and decreases for each individual futures contract and for each commodity group. The average percentage margin increases and decreases are also reported.

Futures Contract	Exchange	Inception date	Average % Maint.Margin	Minimum % Maint.Margin	Maximum % Maint.Margin	Average # of days btw changes	Frequency of Margin changes			Average margin change in %	
							Increases	Decreases	Total	Increases	Decreases
Grains & Oilseeds											
Corn	Chicago Board of Trade/ CME Group	24/11/2003	4.69%	2.09%	9.70%	69	25	16	41	21.27%	-17.88%
Wheat	Chicago Board of Trade/ CME Group	24/11/2003	5.60%	2.10%	12.10%	73	25	15	40	21.84%	-20.53%
Soybeans	Chicago Board of Trade/ CME Group	24/11/2003	4.48%	2.09%	8.93%	71	23	18	41	19.46%	-15.31%
Soybean Meal	Chicago Board of Trade/ CME Group	24/11/2003	4.79%	2.48%	10.52%	91	21	15	36	22.65%	-20.68%
Soybean Oil	Chicago Board of Trade/ CME Group	24/11/2003	3.80%	2.03%	7.94%	99	17	12	29	21.75%	-19.48%
Oats	Chicago Board of Trade/ CME Group	24/11/2003	5.24%	2.23%	11.87%	110	14	10	24	27.99%	-21.09%
Sectoral average			4.77%	2.17%	10.18%	86	125	86	211	22.49%	-19.16%
Softs											
Cocoa	New York Board of Trade/ ICE Futures US	14/1/1998	5.57%	2.86%	10.64%	120	24	18	42	25.89%	-23.11%
Coffee	New York Board of Trade/ ICE Futures US	18/12/1996	6.27%	3.27%	15.65%	68	44	34	78	24.34%	-20.10%
Cotton	New York Board of Trade/ ICE Futures US	3/1/1995	6.76%	1.92%	17.11%	104	37	23	60	34.44%	-27.48%
Sugar	New York Board of Trade/ ICE Futures US	1/5/1997	6.43%	2.18%	15.75%	117	29	16	45	26.22%	-19.93%
Sectoral average			6.26%	2.56%	14.79%	102	134	91	225	27.72%	-22.65%
Livestock											
Live Cattle	Chicago Mercantile Exchange/CME group	1/1/2000	2.34%	1.10%	7.01%	98	25	18	43	19.74%	-17.23%
Lean Hogs	Chicago Mercantile Exchange/CME group	1/1/2000	3.41%	1.93%	6.66%	156	14	13	27	16.71%	-11.90%
Feeder Cattle	Chicago Mercantile Exchange/CME group	1/1/2000	2.03%	0.88%	6.41%	89	25	22	47	24.14%	-17.01%
Sectoral average			2.59%	1.30%	6.69%	114	64	53	117	20.20%	-15.38%
Energy											
Crude Oil	New York Mercantile Exchange/CME Group	1/9/2004	6.30%	3.51%	19.09%	85	18	14	32	15.01%	-13.29%
Heating Oil	New York Mercantile Exchange/CME Group	1/9/2004	6.26%	2.91%	16.24%	59	25	21	46	14.62%	-12.92%
Natural Gas	New York Mercantile Exchange/CME Group	1/9/2004	9.29%	5.30%	16.53%	38	35	35	70	17.62%	-15.07%
Sectoral average			7.28%	3.90%	17.29%	61	78	70	148	15.75%	-13.76%
Metals											
Gold	Commodity Exchange, Inc./CME group	7/9/2008	4.00%	2.52%	7.70%	93	8	5	13	29.58%	-14.09%
Silver	Commodity Exchange, Inc./CME group	7/9/2008	7.46%	3.46%	14.56%	56	17	4	21	13.26%	-17.22%
Copper	Commodity Exchange, Inc./CME group	1/9/2004	6.46%	3.67%	18.05%	83	18	9	27	16.13%	-15.91%
Platinum	New York Mercantile Exchange/CME Group	1/9/2004	5.58%	2.31%	15.24%	94	13	9	22	26.34%	-21.31%
Sectoral average			5.88%	2.99%	13.89%	82	56	27	83	21.33%	-17.13%

Table 2: Margin requirements and commodity futures prices/returns

Entries report the results when the price and return impact of margin changes is examined. First, we consider the effect of margin changes on commodity futures prices and we estimate the following regression model: $\Delta \ln P_i = a_0 + a_1 \Delta \ln M_i + \beta NSP_i + u_i$,where $\Delta \ln P_i \equiv P_{A,i} - P_{B,i}$ $P_{B,i}\left(P_{A,i}\right)$ is the average price level in the pre (post)-event period, $\Delta \ln M_i \equiv \ln(M_{A,i} / M_{B,i})$, $M_{B,i}\left(M_{A,i}\right)$ is the average daily level of margin in the pre (post)-event period and NSP_i is the net speculative positions prior to the margin change. Second, we consider the effect of margin changes on the commodity futures returns and we estimate the following regression model: $\Delta R_i = a_0 + a_1 \Delta \ln M_i + \beta NSP_i + u_i$ where $\Delta R_i \equiv R_{A,i} - R_{B,i}$, $R_{B,i}\left(R_{A,i}\right)$ is the average geometric daily return in the pre-event (post-event) period. The coefficient estimates α_1, β and the respective *t*-statistics in parentheses are reported for the individual commodity futures returns and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel A: Individual Commodity Futures Contracts

	$\Delta \ln P_i = \alpha_0 + \alpha_1 \Delta \ln M_i + \beta NSP + u_i$				$\Delta R_i = \alpha_0 + \alpha_1 \Delta \ln M_i + \beta NSP + u_i$			
	5-day horizon		*20-day horizon*		*5-day horizon*		*20-day horizon*	
	α_1	β	α_1	β	α_1	β	α_1	β
Grains Futures								
Corn	0.082**	0.023	0.214***	0.047	0.001	-0.013	0.004	-0.017**
	(2.371)	*(0.359)*	*(4.608)*	*(0.485)*	*(0.119)*	*(-0.782)*	*(1.104)*	*(-2.303)*
Wheat	0.025	-0.061	0.124***	-0.219	-0.030***	-0.024	-0.010***	-0.013
	(0.788)	*(-0.524)*	*(2.856)*	*(-1.077)*	*(-3.552)*	*(-0.796)*	*(-3.148)*	*(-0.881)*
Oats	-0.002	-0.024	-0.017	-0.075	-0.015	0.005	-0.015***	-0.003
	(-0.051)	*(-0.358)*	*(-0.354)*	*(-0.789)*	*(-1.042)*	*(0.209)*	*(-2.937)*	*(-0.281)*
Soybeans	0.014	0.002	0.015	0.019	-0.002	0.008	-0.002	-0.003
	(0.440)	*(0.037)*	*(0.309)*	*(0.231)*	*(-0.234)*	*(0.628)*	*(-0.378)*	*(-0.365)*
Soybean Meal	0.059*	-0.097	0.091**	-0.147	0.008	0.004	0.002	-0.013
	(1.942)	*(-1.614)*	*(1.971)*	*(-1.390)*	*(0.835)*	*(0.205)*	*(0.374)*	*(-1.288)*
Soybean Oil	0.038	-0.053	0.144***	-0.082	-0.022	0.007	0.000	-0.017
	(1.102)	*(-0.891)*	*(2.943)*	*(-0.823)*	*(-1.625)*	*(0.277)*	*(0.036)*	*(-1.223)*
Soft Futures								
Cocoa	-0.024	-0.104**	-0.010	-0.078	0.009	-0.006	-0.004	-0.004
	(-0.853)	*(-2.023)*	*(-0.238)*	*(-0.874)*	*(0.861)*	*(-0.312)*	*(-1.092)*	*(-0.528)*
Coffee	0.020	0.019	0.083*	0.145	-0.037***	0.019	-0.021***	-0.002
	(0.850)	*(0.457)*	*(1.847)*	*(1.589)*	*(-4.186)*	*(1.164)*	*(-5.065)*	*(-0.249)*
Cotton	0.013	0.006	0.073***	-0.011	-0.007	-0.011	-0.003	-0.011
	(0.945)	*(0.213)*	*(3.167)*	*(-0.197)*	*(-1.609)*	*(-1.089)*	*(-1.448)*	*(-1.644)*
Sugar	-0.058	0.018	0.013	0.294	-0.007	-0.038	-0.010***	-0.013
	(-1.509)	*(0.186)*	*(0.224)*	*(1.816)*	*(-0.700)*	*(-1.493)*	*(-2.656)*	*(-1.280)*
Livestock Futures								
Live Cattle	-0.039*	0.058	-0.021	0.170**	-0.017***	-0.006	-0.002	-0.005
	(-1.862)	*(1.031)*	*(-0.829)*	*(2.294)*	*(-3.952)*	*(-0.503)*	*(-1.476)*	*(-1.596)*
Lean Hogs	0.004	-0.009	-0.077	0.125*	-0.002	-0.027**	-0.002	-0.013**
	(0.113)	*(-0.266)*	*(-1.267)*	*(1.878)*	*(-0.143)*	*(-2.156)*	*(-0.359)*	*(-2.205)*
Feeder Cattle	-0.042***	0.006	-0.037*	0.037	-0.004	-0.002	-0.001	-0.009***
	(-2.722)	*(0.228)*	*(-1.954)*	*(1.104)*	*(-0.982)*	*(-0.300)*	*(-0.729)*	*(-3.530)*
Energy Futures								
Crude Oil	0.069	0.123	0.239***	0.050	-0.029**	0.052	-0.015***	0.030
	(1.221)	*(0.665)*	*(2.970)*	*(0.159)*	*(-2.147)*	*(1.148)*	*(-2.812)*	*(1.410)*
Heating Oil	0.077*	0.124	0.226***	0.292	-0.028**	0.011	-0.009*	-0.032*
	(1.947)	*(0.988)*	*(3.514)*	*(1.214)*	*(-2.071)*	*(0.260)*	*(-1.715)*	*(-1.658)*
Natural Gas	0.167***	-0.071	0.383***	0.077	-0.028***	-0.031	-0.006	-0.014
	(4.014)	*(-0.667)*	*(8.416)*	*(0.482)*	*(-2.650)*	*(-1.153)*	*(-1.396)*	*(-0.925)*
Metal Futures								
Gold	0.083	0.019	0.036	0.058	-0.006	0.019	-0.014***	-0.019
	(1.397)	*(0.108)*	*(0.564)*	*(0.288)*	*(-0.462)*	*(0.496)*	*(-3.782)*	*(-1.606)*
Silver	-0.118	0.683	0.002	0.004	-0.037	-0.077	-0.037***	-0.098*
	(-0.924)	*(1.467)*	*(0.091)*	*(0.057)*	*(-0.901)*	*(-0.508)*	(-3.641)	*(-1.909)*
Copper	0.089*	-0.045	-0.004	0.020	-0.011	0.007	-0.004	0.020
	(1.868)	*(-0.400)*	*(-0.584)*	*(0.919)*	*(-0.718)*	*(0.199)*	*(-0.584)*	*(0.919)*
Platinum	0.024	0.025	0.169***	0.091	-0.004	0.027	-0.008	0.011
	(0.639)	*(0.313)*	*(3.090)*	*(0.614)*	*(-0.527)*	*(1.561)*	*(-1.453)*	*(0.767)*

Table 2 : Margin requirements and commodity futures prices/ returns (cont'd)

Entries report the results when the price and return impact of margin changes is examined. First, we consider the effect of margin changes on commodity futures prices and we estimate the following regression model: $\Delta \ln P_i = a_0 + a_1 \Delta \ln M_i + \beta NSP_i + u_i$,where $\Delta \ln P_i \equiv P_{A,i} - P_{B,i}$ $P_{B,i}\left(P_{A,i}\right)$ is the average price level in the pre (post)-event period, $\Delta \ln M_i \equiv \ln(M_{A,i} / M_{B,i})$, $M_{B,i}\left(M_{A,i}\right)$ is the average daily level of margin in the pre (post)-event period and NSP_i is the net speculative positions prior to the margin change. Second, we consider the effect of margin changes on the commodity futures returns and we estimate the following regression model: $\Delta R_i = a_0 + a_1 \Delta \ln M_i + \beta NSP_i + u_i$ where $\Delta R_i \equiv R_{A,i} - R_{B,i}$, $R_{B,i}\left(R_{A,i}\right)$ is the average geometric daily return in the pre-event (post-event) period. The coefficient estimates α_1, β and the respective *t*-statistics in parentheses are reported for the individual commodity futures returns and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel B: Distinct Commodity Futures Groups

	$\Delta \ln P_i=\alpha_0+\alpha_1\Delta \ln M_i+\beta NSP+u_i$				$\Delta R_i=\alpha_0+\alpha_1\Delta \ln M_i+\beta NSP+u_i$			
	5-day horizon		***20-day horizon***		***5-day horizon***		***20-day horizon***	
	α_1	β	α_1	β	α_1	β	α_1	***B***
Grains Futures	0.039***	-0.034	0.099***	-0.058	-0.0138***	0.008	-0.006***	-0.003
	(2.904)	*(-1.466)*	*(5.384)*	*(-1.491)*	*(-3.305)*	*(1.112)*	*(-3.710)*	*(-0.980)*
Soft Futures	0.000	-0.004	0.056***	0.055	-0.0112***	-0.007	-0.008***	-0.009
	(-0.042)	*(-0.157)*	*(2.853)*	*(1.264)*	*(-2.797)*	*(-0.866)*	*(-4.848)*	*(-1.633)*
Livestock Futures	-0.035***	0.013	-0.020	0.103***	-0.010***	-0.013**	-0.001	-0.009***
	(-3.119)	*(0.606)*	*(-1.335)*	*(3.433)*	*(-3.723)*	*(-2.398)*	*(-1.060)*	*(-4.474)*
Energy Futures	0.127***	0.017	0.331***	0.132	-0.028***	-0.010	-0.008***	-0.006
	(4.914)	*(0.334)*	*(10.396)*	*(1.616)*	*(-4.118)*	*(-0.700)*	*(-3.033)*	*(-0.810)*
Metal Futures	0.008	0.005	0.102**	-0.015	-0.011	-0.005	-0.011***	0.001
	(0.228)	*(0.132)*	*(2.411)*	*(-0.252)*	*(-1.269)*	*(-0.560)*	*(-3.071)*	*(0.228)*

Table 3: Margin requirements and different traders positions

Entries report the results from the following regression model: $\Delta \ln Pos_i = a_0 + a_1 \Delta \ln M_i + u_i$ where $\Delta \ln M_i \equiv \ln(M_{A,i} / M_{B,i})$, $M_{B,i}$ $\left(M_{A,i}\right)$ is the average daily level of margin in the pre-event (post-event) period , $\Delta \ln Pos_i \equiv \ln(Pos_{A,i} / Pos_{B,i})$, $Pos_{B,i}$ $\left(Pos_{A,i}\right)$ is the average positions in the pre-event (post –event) period. We consider the change in hedging positions (HP), speculative positions(SP) and the ratio (SP/HP). The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported for the individual commodity futures and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel A: Individual Commodity Futures Contracts

	$\Delta \ln HP_i = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$		$\Delta \ln SP_i = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$		$\Delta \ln(SP_i/HP_i) = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$	
	5day horizon	***20day horizon***	***5day horizon***	***20day horizon***	***5day horizon***	***20day horizon***
Grains Futures						
Corn	0.005	0.032	-0.034	-0.101**	-0.039	-0.132**
	(0.264)	*(0.902)*	*(-1.381)*	*(-2.319)*	*(-1.403)*	*(-2.525)*
Wheat	0.002	0.013	0.016	0.044	0.013	0.029
	(0.087)	*(0.427)*	*(0.419)*	*(0.933)*	*(0.466)*	*(0.900)*
Oats	-0.11	-0.164	-0.174**	-0.342**	-0.062	-0.161
	(-1.636)	*(-1.456)*	*(-1.962)*	*(-2.295)*	*(-0.633)*	*(-1.500)*
Soybeans	-0.038	-0.100*	-0.048	-0.173***	-0.011	-0.076
	(-1.177)	*(-1.951)*	*(-0.771)*	*(-2.653)*	*(-0.227)*	*(-1.385)*
Soybean Meal	-0.013	-0.067*	-0.176***	-0.382***	-0.162***	-0.314***
	(-0.491)	*(-1.862)*	*(-2.579)*	*(-3.871)*	*(-2.800)*	*(-3.513)*
Soybean Oil	-0.044*	-0.085*	-0.052	-0.268**	-0.011	-0.182*
	(-1.706)	*(-1.886)*	*(-0.649)*	*(-2.444)*	*(-0.137)*	*(-1.713)*
Soft Futures						
Cocoa	0.011	-0.047	-0.190***	-0.372***	-0.685	-0.623
	(0.167)	*(-1.347)*	*(-3.121)*	*(-4.219)*	*(-0.679)*	*(-0.762)*
Coffee	0.044*	0.058	-0.068	-0.124	-0.113**	-0.612
	(1.804)	*(1.375)*	*(-1.372)*	*(-1.524)*	*(-2.444)*	*(-1.422)*
Cotton	-0.002	0.011	0.031	-0.036	0.034	-0.048
	(-0.139)	*(0.421)*	*(0.925)*	*(-0.824)*	*(1.163)*	*(-1.207)*
Sugar	0.007	0.015	0.029	0.077	0.022	0.065
	(0.275)	*(0.324)*	*(0.400)*	*(0.985)*	*(0.320)*	*(0.841)*
Livestock Futures						
Live Cattle	0.003	-0.084***	-0.134***	-0.295***	-0.136***	-0.211***
	(0.197)	*(-2.743)*	*(-4.973)*	*(-7.350)*	*(-5.193)*	*(-5.144)*
Lean Hogs	-0.009	0.032	0.001	-0.153	0.013	-0.181
	(-0.134)	*(0.230)*	*(0.010)*	*(-0.591)*	*(0.111)*	*(-0.773)*
Feeder Cattle	0.005	0.010	-0.041	-0.230***	-0.046	-0.243**
	(0.110)	*(0.136)*	*(-0.904)*	*(-2.694)*	*(-0.741)*	*(-2.156)*
Energy Futures						
Crude Oil	0.027	-0.016	0.062	0.001	0.034	0.017
	(1.300)	*(-0.481)*	*(1.292)*	*(0.020)*	*(0.652)*	*(0.217)*
Heating Oil	-0.018	-0.029	-0.196***	-0.449***	-0.177**	-0.420***
	(-0.523)	*(-0.732)*	*(-3.178)*	*(-4.535)*	*(-2.565)*	*(-4.390)*
Natural Gas	0.006	0.052*	-0.091*	-0.072	-0.097**	-0.124**
	(0.441)	*(1.672)*	*(-1.875)*	*(-1.328)*	*(-2.255)*	*(-2.333)*
Metal Futures						
Gold	-0.069*	-0.188*	-0.046	-0.229**	0.022	-0.041
	(-1.679)	*(-1.919)*	*(-0.639)*	*(-2.089)*	*(0.303)*	*(-0.434)*
Silver	-0.084*	-0.201***	-0.171*	-0.458***	-0.085	-0.256***
	(-1.837)	*(-4.398)*	*(-1.790)*	*(-5.922)*	*(-0.792)*	*(-3.842)*
Copper	-0.012	0.016	-0.140**	-0.319***	-0.128*	-0.337***
	(-0.319)	*(0.379)*	*(-1.970)*	*(-3.349)*	*(-1.905)*	*(-4.645)*
Platinum	-0.001	-0.113	-0.049	-0.262***	-0.048	-0.149
	(-0.018)	*(-1.484)*	*(-0.623)*	*(-2.625)*	*(-0.664)*	*(-1.577)*

Table 3: Margin requirements and different traders positions (cont'd)

Entries report the results from the following regression model: $\Delta \ln Pos_i = a_0 + a_1 \Delta \ln M_i + u_i$ where $\Delta \ln M_i \equiv \ln(M_{A,i} / M_{B,i})$, $M_{B,i}$ $\left(M_{A,i}\right)$ is the average daily level of margin in the pre-event (post-event) period , $\Delta \ln Pos_i \equiv \ln(Pos_{A,i} / Pos_{B,i})$, $Pos_{B,i}$ $\left(Pos_{A,i}\right)$ is the average positions in the pre-event (post – event) period. We consider the change in hedging positions (HP), speculative positions(SP) and the ratio (SP/HP). The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported for the individual commodity futures and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel B: Distinct Commodity Futures Groups

	Regression model: $\Delta \ln HP_i = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$		**Regression model: $\Delta \ln SP_i = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$**		**Regression model: $\Delta \ln(SP_i/HP_i) = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$**	
	5day horizon	***20day horizon***	***5day horizon***	***20day horizon***	***5day horizon***	***20day horizon***
Grains Futures	-0.025*	-0.043**	-0.068***	-0.167***	-0.042*	-0.122***
	(-1.951)	*(-2.062)*	*(-2.797)*	*(-4.769)*	*(-1.925)*	*(-4.094)*
Soft Futures	0.012	0.015	-0.027	-0.092***	-0.104	-0.246*
	(0.819)	*(0.830)*	*(-1.081)*	*(-2.620)*	*(-0.617)*	*(-1.934)*
Livestock Futures	0.003	-0.033	-0.088***	-0.265***	-0.091***	-0.233***
	(0.155)	*(-0.876)*	*(-3.006)*	*(-5.208)*	*(-2.767)*	*(-4.092)*
Energy Futures	0.003	0.027*	-0.094***	-0.137***	-0.097***	-0.164***
	(0.234)	*(1.708)*	*(-2.882)*	*(-3.199)*	*(-3.072)*	*(-3.926)*
Metal Futures	-0.033	-0.089***	-0.099**	-0.316***	-0.065*	-0.227***
	(-1.366)	*(-2.707)*	*(-2.506)*	*(-6.423)*	*(-1.680)*	*(-5.345)*

Table 4: Margin requirements and volatility of daily futures returns

Entries report the results from the regression model: $\Delta \ln Vol_i = a_0 + a_1 \Delta \ln M_i + u_i$ where $\Delta \ln Vol_i \equiv \ln(Vol_{A,i} / Vol_{B,i})$, $Vol_{B,i}$ $\left(Vol_{A,i}\right)$ is the average daily volatility in the pre-event (post-event) period, $\Delta \ln M_i \equiv \ln(M_{A,i} / M_{B,i})$, $M_{B,i}$ $\left(M_{A,i}\right)$ is the average daily level of margin in the pre-event (post-event) period. The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported for the individual commodity futures and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. Three different volatility proxies are employed: the Garman-Klass (*GK*, 1980) estimator, the Rogers-Satchell (*RS*,1991) estimator and the log-range. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel A: Individual Commodity Futures Contracts

Regression model: $\Delta \ln Vol_i = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$

	GK estimator		*RS estimator*		*Log-range*	
	5-day horizon	*20-day horizon*	*5-day horizon*	*20-day horizon*	*5-day horizon*	*20-day horizon*
Grains Futures						
Corn	-0.147	0.265**	-0.049	0.344**	-0.252	0.158
	(-0.706)	*(1.980)*	*(-0.220)*	*(2.479)*	*(-1.208)*	*(1.149)*
Wheat	0.184	0.293**	0.228	0.326***	0.066	0.227***
	(1.152)	*(3.568)*	*(1.317)*	*(3.957)*	*(0.424)*	*(2.659)*
Oats	-0.068	0.082	0.175	0.168	-0.256	0.018
	(-0.365)	*(0.494)*	*(0.816)*	*(0.920)*	*(-1.382)*	*(0.116)*
Soybeans	-0.23	0.226**	-0.159	0.276**	-0.209	0.169
	(-1.379)	*(1.971)*	*(-0.819)*	*(2.326)*	*(-1.222)*	*(1.429)*
Soybean Meal	-0.24	0.134	-0.16	0.162	-0.434**	0.09
	(-1.306)	*(1.116)*	*(-0.870)*	*(1.260)*	*(-2.192)*	*(0.715)*
Soybean Oil	-0.246	0.026	-0.21	0.005	-0.25	0.027
	(-1.395)	*(0.177)*	*(-0.963)*	*(0.032)*	*(-1.370)*	*(0.183)*
Soft Futures						
Cocoa	0.106	0.191*	0.228	0.244**	-0.072	0.158
	(0.699)	*(1.862)*	*(1.562)*	*(2.365)*	*(-0.411)*	*(1.347)*
Coffee	0.059	0.241***	0.143	0.261***	-0.028	0.227**
	(0.542)	*(2.706)*	*(1.250)*	*(2.940)*	*(-0.253)*	*(2.542)*
Cotton	0.101	0.127**	0.205	0.133**	0.053	0.113*
	(0.974)	*(2.092)*	*(1.439)*	*(2.115)*	*(0.494)*	*(1.756)*
Sugar	0.126	0.351***	0.188	0.426***	0.028	0.281**
	(0.757)	*(2.948)*	*(1.114)*	*(3.279)*	*(0.149)*	*(2.386)*
Livestock Futures						
Live Cattle	0.542***	0.240**	0.619***	0.210**	0.422***	0.270***
	(3.795)	*(2.353)*	*(3.780)*	*(1.961)*	*(3.125)*	*(2.593)*
Lean Hogs	0.192	-0.083	0.308	-0.009	0.069	-0.154
	(0.682)	*(-0.500)*	*(0.869)*	*(-0.047)*	*(0.262)*	*(-0.944)*
Feeder Cattle	0.498***	0.114	0.583***	0.174	0.541***	0.096
	(3.143)	*(0.972)*	*(3.520)*	*(1.373)*	*(3.191)*	*(0.818)*
Energy Futures						
Crude Oil	-0.220	0.417**	-0.088	0.440**	-0.410	0.388*
	(-0.751)	*(2.043)*	*(-0.259)*	*(2.068)*	*(-1.484)*	*(1.938)*
Heating Oil	0.231	0.609***	0.335	0.668***	0.038	0.464***
	(1.018)	*(3.957)*	*(1.311)*	*(4.245)*	*(0.160)*	*(3.002)*
Natural Gas	-0.042	0.306***	-0.030	0.323***	-0.047	0.266***
	(-0.329)	*(3.465)*	*(-0.217)*	*(3.468)*	*(-0.353)*	*(3.107)*
Metal Futures						
Gold	0.130	0.496*	0.159	0.471*	-0.003	0.497*
	(0.589)	*(1.800)*	*(0.640)*	*(1.664)*	*(-0.013)*	*(1.763)*
Silver	-0.198	0.389	-0.198	0.389	0.032	0.537*
	(-0.442)	*(1.345)*	*(-0.442)*	*(1.345)*	*(0.073)*	*(1.934)*
Copper	0.388	0.781***	0.398	0.813***	0.319	0.725***
	(1.349)	*(4.734)*	*(1.221)*	*(4.698)*	*(1.130)*	*(4.518)*
Platinum	-0.447*	0.135	-0.359	0.192	-0.649**	0.043
	(-1.804)	*(0.609)*	*(-1.277)*	*(0.852)*	*(-2.266)*	*(0.189)*

Table 4: Margin requirements and volatility of daily futures returns (cont'd)

Entries report the results from the regression model: $\Delta \ln Vol_i = a_0 + a_1 \Delta \ln M_i + u_i$ where $\Delta \ln Vol_i \equiv \ln(Vol_{A,i} / Vol_{B,i})$, $Vol_{B,i}$ $\left(Vol_{A,i}\right)$ is the average daily volatility in the pre-event (post-event) period, $\Delta \ln M_i \equiv \ln(M_{A,i} / M_{B,i})$, $M_{B,i}$ $\left(M_{A,i}\right)$ is the average daily level of margin in the pre-event (post-event) period. The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported for the individual commodity futures and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. Three different volatility proxies are employed: the Garman-Klass (*GK*, 1980) estimator, the Rogers-Satchell (*RS*, 1991) estimator and the log-range One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel B: Distinct Commodity Futures Groups

Regression model: $\Delta \ln Vol_i = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$

	GK estimator		***RS estimator***		***Log-range***	
	5-day horizon	***20-day horizon***	***5-day horizon***	***20-day horizon***	***5-day horizon***	***20-day horizon***
Grains Futures	-0.073	0.219***	0.016	0.261***	-0.176**	0.161***
	(-0.975)	*(4.304)*	*(0.195)*	*(4.907)*	*(-2.308)*	*(3.112)*
Soft Futures	0.100*	0.200***	0.196***	0.227***	0.016	0.177***
	(1.647)	*(4.697)*	*(2.778)*	*(5.135)*	*(0.246)*	*(3.992)*
Livestock Futures	0.513***	0.160**	0.597***	0.172**	0.458***	0.161**
	(5.270)	*(2.368)*	*(5.490)*	*(2.383)*	*(4.715)*	*(2.363)*
Energy Futures	0.001	0.383***	0.052	0.408***	-0.077	0.323***
	(0.006)	*(5.377)*	*(0.440)*	*(5.482)*	*(-0.705)*	*(4.648)*
Metal Futures	-0.049	0.461***	-0.013	0.489***	-0.133	0.436***
	(-0.322)	*(4.034)*	*(-0.082)*	*(4.195)*	*(-0.851)*	*(3.804)*

Table 5: Margin requirements and Illiquidity

Entries report the results from the regression model: $\Delta \ln ILL_i = a_0 + a_1 \Delta \ln M_i + u_i$ where $\Delta \ln ILL_i \equiv \ln(ILL_{A,i} / ILL_{B,i})$, $ILL_{B,i}\left(ILL_{A,i}\right)$ is the average value of Amihud (2002) illiquidity measure in the pre-event period (post –event) period, $\Delta \ln M_i \equiv \ln(M_{A,i} / M_{B,i})$, $M_{B,i}\left(M_{A,i}\right)$ is the average daily level of margin in the pre-event (post-event) period. The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported for the individual commodity futures and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel A: Individual Commodity Futures Contracts		
Regression model: $\Delta \ln ILL_i = \alpha_0 + \alpha_1 \Delta M_i + u_i$		
	5-day horizon	***20-day horizon***
Grains Futures		
Corn	-0.245	0.222
	(-0.652)	*(0.977)*
Wheat	0.101	0.524*
	-0.229	*(1.646)*
Oats	-0.05	0.756
	(-0.125)	*(1.395)*
Soybeans	-0.485	1.152
	(-0.526)	*(1.402)*
Soybean Meal	-1.615	-0.352
	(-1.503)	*(-0.372)*
Soybean Oil	-0.682	-0.263
	(-1.030)	*(-0.486)*
Soft Futures		
Cocoa	-0.476	0.148
	(-0.596)	*(0.153)*
Coffee	0.034	0.132
	(0.187)	*(0.687)*
Cotton	0.094	0.074
	(0.401)	*(0.208)*
Sugar	0.189	0.726**
	(0.661)	*(2.122)*
Livestock Futures		
Live Cattle	-0.038	1.414
	(-0.028)	*(0.954)*
Lean Hogs	-0.654	0.001
	(-0.597)	*(0.001)*
Feeder Cattle	0.403	0.313
	(1.257)	*(1.317)*
Energy Futures		
Crude Oil	-0.568	0.294
	(-0.611)	*(1.016)*
Heating Oil	-0.319	0.163
	(-0.471)	*(0.664)*
Natural Gas	-0.026	0.138
	(-0.050)	*(0.374)*
Metal Futures		
Gold	-0.189	-0.628
	(-0.733)	*(-1.297)*
Silver	-1.251	1.232
	(-1.137)	*(1.274)*
Copper	0.397	0.642***
	-0.777	*(2.699)*
Platinum	-0.691	-0.161
	(-1.611)	*(-0.619)*

Table 5 : Margin requirements and Illiquidity (cont'd)

Entries report the results from the regression model: $\Delta \ln ILL_i = a_0 + a_1 \Delta \ln M_i + u_i$ where $\Delta \ln ILL_i \equiv \ln(ILL_{A,i} / ILL_{B,i})$, $ILL_{B,i}\left(ILL_{A,i}\right)$ is the average value of Amihud (2002) illiquidity measure in the pre-event period (post –event) period, $\Delta \ln M_i \equiv \ln(M_{A,i} / M_{B,i})$, $M_{B,i}\left(M_{A,i}\right)$ is the average daily level of margin in the pre-event (post-event) period. The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported for the individual commodity futures and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel B: Distinct Commodity Futures Groups

Regression model: $\Delta \ln ILL_i = \alpha_0 + \alpha_1 \Delta M_i + u_i$

	5-day horizon	***20-day horizon***
Grains Futures	-0.481*	0.361
	(-1.680)	*(1.490)*
Soft Futures	-0.002	0.199
	(-0.013)	*(0.957)*
Livestock Futures	-0.086	0.761
	(-0.140)	*(1.185)*
Energy Futures	-0.160	0.205
	(-0.405)	*(0.857)*
Metal Futures	-0.367	0.522
	(-1.202)	*(1.296)*

Table 6: Margin requirements and Excessive Speculation

Entries report the results from the following regression model: $\Delta \boldsymbol{lnSPI}_i = a_0 + a_1 \Delta \boldsymbol{ln}\, M_i + u_i$ where $\Delta lnSPI_i \equiv ln(SPI_{A,i} / SPI_{B,i})$, $SPI_{B,i}$ $\left(SPI_{A,i}\right)$ is the average value of Working's T (1960) excessice speculative index in the pre-event period (post –event) period, $\Delta \boldsymbol{ln}\, M_i \equiv \boldsymbol{ln}(M_{A,i} / M_{B,i})$, $M_{B,i}$ $\left(M_{A,i}\right)$ is the average daily level of margin in the pre-event (post-event) period. The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported for the individual commodity futures and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel A: Individual Commodity Futures Contracts		
Regression model: $\Delta lnSPI_i=\alpha_0+\alpha_1\Delta lnM_i+u_i$		
	5-day horizon	***20-day horizon***
Grains Futures		
Corn	-0.035**	-0.044**
	(-2.353)	*(-2.562)*
Wheat	-0.024**	-0.020**
	(-2.408)	*(-2.467)*
Oats	-0.007	-0.016
	(-0.597)	*(-1.034)*
Soybeans	-0.017**	-0.026*
	(-1.992)	*(-1.925)*
Soybean Meal	0.000	-0.004
	(-0.001)	*(-0.271)*
Soybean Oil	-0.028***	-0.051***
	(-3.317)	*(-3.784)*
Soft Futures		
Cocoa	-0.021**	-0.038***
	(-2.539)	*(-2.934)*
Coffee	-0.035***	-0.0583***
	(-3.864)	*(-4.983)*
Cotton	-0.007*	-0.013
	(-1.686)	*(-1.473)*
Sugar	0.001	0.012
	(0.243)	*(1.019)*
Livestock Futures		
Live Cattle	-0.008	-0.0311**
	(-0.628)	*(-2.021)*
Lean Hogs	-0.064	-0.087
	(-1.559)	*(-1.421)*
Feeder Cattle	-0.047	-0.121**
	(-1.316)	*(-2.128)*
Energy Futures		
Crude Oil	-0.005	0.003
	(-0.725)	*(0.353)*
Heating Oil	-0.013*	-0.020**
	(-1.883)	*(-2.122)*
Natural Gas	-0.007	-0.019
	(-0.669)	*(-1.609)*
Metal Futures		
Gold	-0.020**	-0.042**
	(-2.114)	*(-2.356)*
Silver	-0.049**	-0.041***
	(-2.495)	*(-4.460)*
Copper	-0.021	-0.044**
	(-1.278)	*(-2.529)*
Platinum	-0.033	-0.048
	(-1.640)	*(-1.642)*

Table 6: Margin requirements and Excessive Speculation (cont'd)

Entries report the results from the following regression model: $\Delta \boldsymbol{lnSPI}_i = a_0 + a_1 \Delta \boldsymbol{ln}\, M_i + u_i$ where $\Delta lnSPI_i \equiv ln(SPI_{A,i} / SPI_{B,i})$, $SPI_{B,i}$ $\left(SPI_{A,i}\right)$ is the average value of Working's T (1960) excessice speculative index in the pre-event period (post –event) period, $\Delta \boldsymbol{ln}\, M_i \equiv \boldsymbol{ln}(M_{A,i} / M_{B,i})$, $M_{B,i}$ $\left(M_{A,i}\right)$ is the average daily level of margin in the pre-event (post-event) period. The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported for the individual commodity futures and for the distinct commodity groups (panels A and B, respectively). A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

Panel B: Distinct Commodity Futures Groups

Regression model: $\Delta lnSPI_i=\alpha_0+\alpha_1\Delta lnM_i+u_i$

	5-day horizon	***20-day horizon***
Grains Futures	-0.019***	-0.025***
	(-4.390)	*(-4.801)*
Soft Futures	-0.014***	-0.038***
	(-3.963)	*(-5.002)*
Livestock Futures	-0.028***	-0.068***
	(-1.708)	*(-2.656)*
Energy Futures	-0.008	-0.015**
	(-1.263)	*(-2.043)*
Metal Futures	-0.019**	-0.151**
	(-2.226)	*(-2.336)*

Table 7: Cross-contract margin effects

Entries report the results when the effect of margin changes on benchmark groups is examined. For each target contract and each margin change *i*, we create a benchmark group that includes the remaining contracts in the same commodity group that do not undergo a margin change during the event period (-20,20) of the ith margin change of the target contract. We examine the effect of the margin changes of the target contract on the benchmark groups's prices (Column 1), returns (Column 2), hedging positions (Column 3), speculative positions (Column 4), volatility (Column 5), and liquidity (Column 6). Due to space limitations, the results are reported only for the longer event window, i.e. (-20,20). One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
	$\Delta P_i=\alpha_0+\alpha_1\Delta lnM_i+u_i$	$\Delta R_i=\alpha_0+\alpha_1\Delta lnM_i+u_i$	$\Delta lnHP_i=\alpha_0+\alpha_1\Delta lnM_i+u_i$	$\Delta lnSP_i=\alpha_0+\alpha_1\Delta lnM_i+u_i$	$\Delta lnVol_i=\alpha_0+\alpha_1\Delta lnM_i+u_i$	$\Delta lnILL_i=\alpha_0+\alpha_1\Delta lnM_i+u_i$
Grains Futures						
Corn	0.095***	0.004*	0.018	-0.189***	0.155**	-0.309
	(3.032)	*(1.767)*	*(0.468)*	*(-2.796)*	*(1.974)*	*(-0.664)*
Wheat	0.092***	-0.002	0.03	-0.035	0.132**	0.053
	(4.466)	*(-1.348)*	*(1.075)*	*(-0.725)*	*(2.024)*	*(0.205)*
Oats	-0.011	-0.002	-0.04	-0.105**	0.092	0.656*
	(-0.478)	*(-0.628)*	*(-1.392)*	*(-2.091)*	*(1.018)*	*(1.764)*
Soybeans	-0.042	0.003	-0.048	-0.187**	-0.060	0.834*
	(-1.088)	*(1.095)*	*(-1.007)*	*(-2.552)*	*(-0.600)*	*(1.765)*
SoybeanMeal	0.013	0.001	-0.004	-0.082	0.011	-0.244
	(0.420)	*(0.319)*	*(-0.093)*	*(-1.307)*	*(0.115)*	*(-0.515)*
Soybean Oil	0.092**	-0.001	0.04	0.009	-0.097	0.030
	(2.043)	*(-0.401)*	*(0.836)*	*(0.114)*	*(-0.930)*	*(0.078)*
Soft Futures						
Cocoa	0.068*	0.004*	0.073**	0.049	0.154*	-0.857**
	(1.722)	*(1.811)*	*(2.450)*	*(1.009)*	*(1.843)*	*(-2.340)*
Coffee	0.000	-0.001	0.019	-0.028	-0.005	-0.729*
	(-0.008)	*(-0.447)*	*(0.769)*	*(-0.509)*	*(-0.083)*	*(-1.750)*
Cotton	-0.025	0.005**	0.000	-0.061	-0.023	0.445
	(-1.199)	*(2.500)*	*(-0.017)*	*(-1.046)*	*(-0.361)*	*(0.533)*
Sugar	0.039	-0.001	0.065**	-0.051	-0.061	0.259
	(1.223)	*(-0.637)*	*(2.322)*	*(-1.019)*	*(-0.676)*	*(0.186)*
Livestock Futures						
Live Cattle	-0.067***	-0.006**	-0.091*	-0.418***	-0.052	-0.192
	(-2.635)	*(-2.452)*	*(-1.705)*	*(-5.985)*	*(-0.606)*	*(-0.416)*
Lean Hogs	0.005	-0.001	0.022	0.095	0.335	-0.501
	(0.167)	*(-0.411)*	*(0.103)*	*(0.442)*	*(1.515)*	*(-0.634)*
Feeder Cattle	0.016	0.000	0.036	-0.285***	-0.170*	0.400
	(0.568)	*(0.190)*	*(0.678)*	*(-3.769)*	*(-1.724)*	*(0.695)*
Energy Futures						
Crude Oil	0.103	0.002	0.011	0.017	0.272	-0.302
	(0.866)	*(0.143)*	*(0.218)*	*(0.148)*	*(1.174)*	*(-0.592)*
Heating Oil	0.038	-0.02***	0.000	0.083	0.096	0.040
	(0.429)	*(-2.885)*	*(-0.013)*	*(0.957)*	*(0.516)*	*(0.115)*
Natural Gas	0.043	-0.006*	0.034	-0.008	0.249**	0.380
	(1.476)	*(-1.762)*	*(1.193)*	*(-0.140)*	*(2.200)*	*(1.453)*
Metal Futures						
Gold	-0.115*	-0.009**	-0.008	-0.119	0.668***	0.429
	(-1.795)	*(-2.408)*	*(-0.097)*	*(-1.273)*	*(4.395)*	*(1.610)*
Silver	-0.013	-0.004*	-0.147***	-0.174***	0.420***	0.010
	(-0.215)	*(-1.658)*	*(-2.929)*	*(-3.021)*	*(3.128)*	*(0.185)*
Copper	-0.206**	0.002	-0.233	-0.396*	0.119	0.534
	(-2.356)	*(0.449)*	*(-1.307)*	*(-1.844)*	*(0.315)*	*(0.260)*
Platinum	-0.072	-0.003	-0.139*	-0.136	0.263	0.437
	(-1.420)	*(-0.839)*	*(-1.947)*	*(-0.907)*	*(1.214)*	*(0.503)*

Table 8: Instrumental Variable (IV) estimation and Two-stages Least Squares (TSLS)

Entries report results from the first and two stage TSLS (column 1 and columns 2-8, respectively). m_i denotes the predicted values from the first stage of TSLS for each commodity *i*. We examine the effect of margin changes on futures prices (column 2), futures returns (column 3), hedging positions (column 4), speculative positions (column 5), speculative/hedging positions (column 6), volatility (log-range, column 7), and liquidity (column 8). Coefficient estimates and respective *t*-statistics in parentheses are reported. A pre- and post- event study window of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

	(1): 1st Stage of TSLS		*(2)*		*(3)*		*(4)*		*(5)*		*(6)*		*(7)*		*(8)*	
	$\Delta lnM_i=b_0+b_1\Delta lnM_{i,t-1}+e_i$		$\Delta lnP_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta R_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta lnHP_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta lnSP_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta ln(SP_i/HP_i)=\alpha_0+\alpha_1 m_i+u_i$		$\Delta lnVol_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta lnILL_i=\alpha_0+\alpha_1 m_i+u_i$	
	5day horizon	*20day horizon*	*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5dayhorizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5dayhorizon*	*20day horizon*
Grains Futures																
Corn	0.134	0.253*	0.263	0.378*	-0.029	-0.005	0.115	0.068	-0.151	-0.104	-0.263	-0.172	-1.655	0.473	0.540	0.131
	(0.829)	*(1.924)*	*(0.812)*	*(1.932)*	*(-0.388)*	*(-0.322)*	*(0.589)*	*(0.471)*	*(-0.650)*	*(-0.612)*	*(-0.762)*	*(-0.835)*	*(-0.644)*	*(0.698)*	*(0.183)*	*(0.154)*
Wheat	0.360**	0.461***	0.094	0.058**	-0.081***	-0.025***	-0.066*	-0.132	-0.036	-0.057	0.03	0.075	0.308	0.235**	-0.417	0.748
	(2.296)	*(3.085)*	*(1.018)*	*(1.957)*	*(-2.691)*	*(-3.152)*	*(-1.876)*	*(-1.526)*	*(-0.325)*	*(-0.057)*	*(0.370)*	*(1.008)*	*(0.679)*	*(1.969)*	*(-0.423)*	*(1.259)*
Oats	0.01	0.207*	-0.671	-0.270	0.085	-0.031	-6.464	-0.589	1.153	-1.520	7.627	-0.928	-21.074	-0.595	-0.614	0.404
	(0.047)	*(1.915)*	*(-0.047)*	*(-0.795)*	*(0.034)*	*(-1.070)*	*(-0.047)*	*(-0.827)*	*(0.039)*	*(-1.071)*	*(0.046)*	*(-1.014)*	*(-0.048)*	*(-0.593)*	*(-0.047)*	*(0.150)*
Soybeans	0.191	0.375**	-0.314	-0.159	-0.004	-0.011	-0.094	-0.242	0.094	-0.222*	0.189	-0.02	-0.556	0.309	-0.691	-0.327
	(1.212)	*(2.495)*	*(-1.000)*	*(-1.136)*	*(-0.087)*	*(-1.044)*	*(-1.549)*	*(-1.382)*	*(0.272)*	*(-1.738)*	*(0.625)*	*(-0.137)*	*(-0.595)*	*(0.810)*	*(-0.955)*	*(-1.113)*
Soybean Meal	0.097	0.308**	-0.332	-0.126	0.002	-0.007	-0.437	-0.127	-0.928	-0.753**	-0.500	-0.627**	-3.157	-0.214	0.155	0.474
	(0.561)	*(1.957)*	*(-0.466)*	*(-0.767)*	*(0.021)*	*(-0.550)*	*(-0.544)*	*(-1.032)*	*(-0.623)*	*(-2.041)*	*(-0.600)*	*(-1.998)*	*(-0,591)*	*(-0.473)*	*(0.470)*	*(1.111)*
Soybean Oil	0.315*	0.395**	0.15	0.154**	-0.001	0.003	-0.04	-0.189	0.017	-0.368	0.057	-0.181	-0.087	-0.031	-0.404	-0.132
	(1.664)	*(2.169)*	*(1.032)*	*(1.972)*	*(-0.030)*	*(0.193)*	*(-0.481)*	*(-1.459)*	*(0.064)*	*(-1.273)*	*(0.224)*	*(-0.653)*	*(-0.142)*	*(-0.080)*	*(-1.327)*	*(-0.098)*
Soft Futures																
Cocoa	-0.209	0.043	0.070	-0.679	-0.073	0.158	0.331	-1.808	0.232	-4.602	-4.194	15.22	0.446	0.61	0.349	-0.125
	(-1.342)	*(0.266)*	*(0.443)*	*(-0.254)*	*(-0.916)*	*(0.255)*	*(0.801)*	*(-0.271)*	*(0.532)*	*(-0.289)*	*(-0.751)*	*(0.243)*	*(0.475)*	*(0.186)*	*(0.711)*	*(-0.237)*
Coffee	-0.155	0.093	0.091	0.117*	0.019	-0.025**	-0.037	-0.561	0.212	-2.036	0.256	-7.108	0.501	0.266**	0.24	0.554
	(-1.360)	*(0.808)*	*(0.628)*	*(1.939)*	*(0.283)*	*(-1.980)*	*(-0.248)*	*(-0.634)*	*(0.552)*	*(-0.814)*	*(0.628)*	*(-0.763)*	*(0.629)*	*(1.968)*	*(1.044)*	*(0.710)*
Cotton	-0.136	0.148*	-0.141	0.294	0.006	-0.02	0.078	-0.110	0.026	-0.083	-0.049	0.013	-0.868	0.579	-0.148	0.183
	(-1.026)	*(1.936)*	*(-0.795)*	*(1.194)*	*(0.163)*	*(-1.053)*	*(0.553)*	*(-0.510)*	*(0.105)*	*(-0.271)*	*(-0.213)*	*(0.049)*	*(-0.717)*	*(0.952)*	*(-0.737)*	*(0.917)*
Sugar	0.003	0.201*	-0.181	0.214	3.942	-0.017**	-0.167	-0.203	-0.376	-0.775	-20.736	-0.582	-0.254	-0.038	1.203	0.257
	(0.022)	*(1.934)*	*(-0.022)*	*(0.608)*	*(0.022)*	*(-1.973)*	*(-0.022)*	*(-0.706)*	*(-0.022)*	*(-1.012)*	*(-0.022)*	*(-0.917)*	*(-0.022)*	*(-0.059)*	*(0.022)*	*(0.146)*
Livestock Futures																
Live Cattle	0.489***	0.597***	-0.029	0.040	-0.028***	-0.004**	-0.031	-0.119**	-0.235***	-0.311***	-0.202***	-0.192***	0.549**	0.209	-0.379	-0.265
	(3.566)	*(4.755)*	*(-0.700)*	*(0.876)*	*(-3.127)*	*(-2.261)*	*(-0.981)*	*(-2.312)*	*(-3.721)*	*(-4.682)*	*(-3.514)*	*(-2.767)*	*(2.028)*	*(1.177)*	*(-1.236)*	*(-0.969)*
Lean Hogs	-0.287	-0.274	0.030	0.303	-0.033	-0.024	0.312	0.830	-0.485	-0.434	-0.795	-1.282	1.140	-0.049	1.486	0.26
	(-1.460)	*(-1.389)*	*(0.265)*	*(0.800)*	*(-0.661)*	*(-0.866)*	*(0.934)*	*(1.056)*	*(-0.838)*	*(-0.436)*	*(-1.115)*	*(-1.062)*	*(0.943)*	*(-0.081)*	*(0.352)*	*(0.638)*
Feeder Cattle	0.066	0.162*	-0.458	-0.209	-0.066	-0.011	0.106	-0.03	-0.520	-1.090	-0.636	-1.055	10.476	1.196	-0.322	-0.053
	(0.452)	*(1.916)*	*(-0.488)*	*(-1.149)*	*(-0.445)*	*(-0.761)*	*(0.150)*	*(-0.064)*	*(-0.410)*	*(-1.176)*	*(-0.392)*	*(-1.045)*	*(0.471)*	*(0.961)*	*(-0.342)*	*(-0.035)*
Energy Futures																
Crude Oil	0.215	0.398**	0.311	0.280**	-0.047	-0.015*	0.114	-0.243*	0.183	0.027	0.067	0.27	-2.081	0.621	0.017	0.668
	(1.193)	*(2.333)*	*(0.975)*	*(1.968)*	*(-0.720)*	*(-1.924)*	*(0.946)*	*(-1.834)*	*(0.743)*	*(0.163)*	*(0.267)*	*(1.254)*	*(-1.109)*	*(0.918)*	*(0.003)*	*(0.853)*
Heating Oil	0.264*	0.548***	0.065	0.165*	-0.029*	-0.027***	-0.270	-0.161**	-0.731*	-0.930***	-0.461	-0.767***	0.829	0.438	0.231	0.906*
	(1.799)	*(4.271)*	*(0.442)*	*(1.911)*	*(-1.939)*	*(-2.589)*	*(-1.377)*	*(-1.990)*	*(-1.890)*	*(-4.081)*	*(-1.483)*	*(-3.805)*	*(0.813)*	*(1.567)*	*(0.758)*	*(1.842)*
Natural Gas	0.370***	0.707***	0.096	0.348***	0.018	-0.011**	0.026	0.069**	-0.053	-0.037	-0.078	-0.106	-0.273	0.241**	0.326	0.182
	(3.239)	*(8.209)*	*(0.876)*	*(5.719)*	*(0.555)*	*(-1.964)*	*(0.658)*	*(2.498)*	*(-0.397)*	*(-0.491)*	*(-0.658)*	*(-1.437)*	*(-0.746)*	*(1.980)*	*(0.233)*	*(0.348)*
Metal Futures																
Gold	-0.193	-0.129	0.268	0.42	0.021	-0.024*	0.35	-0.116	0.122	1.152	-0.229	-0.01	-0.221	0.786	0.826	0.235
	(-0.935)	*(-0.564)*	*(0.644)*	*(0.458)*	*(0.403)*	*(-1.982)*	*(0.712)*	*(-1.469)*	*(0.255)*	*(0.412)*	*(-0.692)*	*(-0.013)*	*(-0.207)*	*(0.327)*	*(0.409)*	*(0.398)*
Silver	0.402*	0.578***	-0.671*	-0.444**	0.017	-0.014**	-0.056	-0.263****	-0.400	-0.633***	-0.341	-0.369***	0.039	0.615	-0.368	0.170
	(1.869)	*(3.007)*	*(-1.928)*	*(-2.200)*	*(0.183)*	*(-1.967)*	*(-0.502)*	*(-3.196)*	*(-1.437)*	*(-4.153)*	*(-1.103)*	*(-2.906)*	*(0.036)*	*(1.267)*	*(-1.166)*	*(0.546)*
Copper	0.389**	0.691***	0.266*	0.370***	-0.065	-0.012	0.016	0.003	-0.190	-0.479***	-0.210	-0.484***	-0.117	0.610***	0.389	0.696***
	(2.088)	*(4.697)*	*(1.721)*	*(3.255)*	*(-1.371)*	*(-1.319)*	*(0.165)*	*(0.055)*	*(-1.004)*	*(-3.234)*	*(-1.166)*	*(-4.278)*	*(-0.151)*	*(2.582)*	*(0.291)*	*(2.280)*
Platinum	-0.174	0.303**	-0.335	0.432	0.015	-0.034	-0.437	-0.093	-0.352	-0.238	0.068	-0.334	-1.359	0.323	0.460	-0.639
	(-0.768)	*(1.981)*	*(-0.644)*	*(1.635)*	*(0.267)*	*(-1.311)*	*(-0.635)*	*(-0.825)*	*(-0.589)*	*(-0.702)*	*-0.153*	*(-1.026)*	*(-0,714)*	*(0.398)*	*(0.615)*	*(-0.715)*

Table 8: Instrumental Variable (IV) estimation and Two-stages Least Squares (TSLS) (cont'd)

Entries report results from the first and two stage TSLS (column 1 and columns 2-8, respectively). m_i denotes the predicted values from the first stage of TSLS for each commodity group *i*. We examine the effect of margin changes on futures prices (column 2), futures returns (column 3), hedging positions (column 4), speculative positions (column 5), speculative/hedging positions (column 6), volatility (log-range, column 7), and liquidity (column 8). Coefficient estimates and respective *t*-statistics in parentheses are reported. A pre- and post- event study window of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

	(1): 1st Stage of the TSLS		***(2)***		***(3)***		***(4)***		***(5)***		***(6)***		***(7)***		***(8)***	
	$\Delta lnM_i=b_0+b_1\Delta lnM_{i,t-1}+e_i$		$\Delta lnP_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta R_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta lnHP_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta lnSP_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta ln(SP_i/HP_i)=\alpha_0+\alpha_1 m_i+u_i$		$\Delta lnVol_i=\alpha_0+\alpha_1 m_i+u_i$		$\Delta lnILL_i=\alpha_0+\alpha_1 m_i+u_i$	
	5day horizon	***20day horizon***	***5day horizon***	***20day horizon***	***5day horizon***	***20day horizon***	***5day horizon***	***20day horizon***	***5day horizon***	***20day horizon***	***5day horizon***	***20day horizon***	***5day horizon***	***20day horizon***	***5day horizon***	***20day horizon***
Grains Futures	0.228***	0.362***	0.021*	0.091**	-0.051***	-0.016***	-0.117*	-0.148**	-0.105	-0.343***	0.012	-0.195**	-0.341	0.184*	-0.886	0.414
	(3.574)	*(5.508)*	*(1.856)*	*(1.957)*	*(-2.729)*	*(-3.330)*	*(-1.935)*	*(-2.414)*	*(-1.016)*	*(-3.322)*	*(0.123)*	*(-2.346)*	*(-1.106)*	*(1.948)*	*(-0.782)*	*(0.623)*
Soft Futures	-0.109	0.130*	0.037	0.102*	-0.014**	-0.011*	0.170	-0.279	0.272	-0.789*	-0.946	-0.600	-0.129	0.217*	0.744	1.421
	(-1.223)	*(1.946)*	*(0.418)*	*(1.919)*	*(-1.987)*	*(-1.945)*	*(1.205)*	*(-1.350)*	*(1.077)*	*(-1.772)*	*(-0.677)*	*(-0.414)*	*(-0.253)*	*(1.924)*	*(0.542)*	*(0.815)*
Livestock Futures	0.253***	0.370***	-0.087*	-0.013	-0.032**	-0.004	-0.043	-0.141	-0.255*	-0.458***	-0.212	-0.315**	1.660***	0.388**	-0.468	-0.24
	(2.808)	*(4.277)*	*(-1.810)*	*(-0.303)*	*(-2.298)*	*(-1.288)*	*(-0.498)*	*(-1.332)*	*(-1.939)*	*(-3.136)*	*(-1.528)*	*(-2.004)*	*(2.808)*	*(1.988)*	*(-1.577)*	*(-1.238)*
Energy Futures	0.321***	0.636***	0.111**	0.309***	-0.006	-0.014***	-0.026	0.005	-0.165	-0.184***	-0.139	-0.188***	-0.222	0.137*	0.863	0.377
	(4.051)	*(9.877)*	*(1.985)*	*(6.183)*	*(-0.270)*	*(-3.313)*	*(-0.618)*	*(0.200)*	*(-1.577)*	*(-2.704)*	*(-1.384)*	*(-2.862)*	*(-0.647)*	*(1.949)*	*(0.679)*	*(0.988)*
Metal Futures	0.089	0.449***	-0.160	0.174*	-0.076	-0.017**	0.104	-0.078**	-0.404	-0.516***	-0.499	-0.439***	0.943	0.538**	-0.56	0.558
	(0.830)	*(4.545)*	*(-0.410)*	*(1.923)*	*(-0.582)*	*(-2.241)*	*(0.327)*	*(-2.091)*	*(-0.723)*	*(-4.293)*	*(-0.776)*	*(-4.314)*	*(0.418)*	*(2.048)*	*(-0.781)*	*(0.613)*

Table 9: The impact of margin increases and decreases

Entries report the results on the effect of margin changes when these are classified as increases and decreases. For each commodity group, we examine the effect of margin changes on futures prices (column 1), futures returns (column 2), hedging positions (column 3), speculative positions (column 4), speculative/hedging positions (column 5), volatility (logrange, column 6), and liquidity (column 7). The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported. A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and 1% significance level, respectively.

	(1)				*(2)*				*(3)*		*(4)*		*(5)*		*(6)*		*(7)*	
	$\Delta \ln P_i = \alpha_0 + \alpha_1 \Delta \ln M_i + \beta NSP + u_i$				$\Delta R_i = \alpha_0 + \alpha_1 \Delta \ln M_i + \beta NSP + u_i$				$\Delta \ln HP_i = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$		$\Delta \ln SP_i = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$		$\Delta \ln (SP_i/HP_i) = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$		$\Delta \ln Vol_i = \alpha_0 + \alpha_1 \Delta \ln M_i + u_i$		$\Delta \ln ILL_i = \alpha_0 + \alpha_1 \Delta M_i + u_i$	
	5-day horizon		*20-day horizon*		*5-day horizon*		*20-day horizon*		*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*
	α_1	β	α_1	β	α_1	β	α_1	β	α_1	α_1	α_1	α_1	α_1	α_1	α_1	α_1	α_1	α_1
Grains Futures																		
Margin Increases	0.037**	-0.002	0.095***	-0.035	-0.016**	0.014	-0.008***	0.005	-0.047	-0.065**	-0.108*	-0.244**	-0.007	-0.110**	0.096	0.469***	0.638	0.721
	(2.149)	*(-0.058)*	*(4.117)*	*(-0.560)*	*(-2.878)*	*(1.066)*	*(-4.032)*	*(0.921)*	*(-1.243)*	*(-1.985)*	*(-1.879)*	*(-2.493)*	*(-0.117)*	*(-2.184)*	*(0.431)*	*(4.012)*	*(0.791)*	*(1.419)*
Margin Decreases	0.004	-0.041	0.089***	-0.055	-0.006	0.003	-0.001	-0.010	-0.015	-0.017	-0.055	-0.168**	-0.093*	-0.141	-0.361**	0.180	-0.510	0.114
	(0.139)	*(-1.476)*	*(2.265)*	*(-1.086)*	*(-0.677)*	*(0.411)*	*(-0.229)*	*(-1.627)*	*(-0.461)*	*(-0.346)*	*(-0.770)*	*(-2.004)*	*(-1.676)*	*(-1.584)*	*(-1.973)*	*(1.178)*	*(-0.682)*	*(1.375)*
Soft Futures																		
Margin Increases	0.003	-0.026	0.043*	0.052	-0.014**	-0.007	-0.007***	-0.006	-0.01	-0.006	-0.011	-0.089**	0.165	0.107	0.432***	0.437***	0.199	0.780*
	(0.174)	*(-0.555)*	*(1.810)*	*(0.697)*	*(-2.546)*	*(-0.451)*	*(-3.199)*	*(-0.826)*	*(-0.252)*	*(-0.168)*	*(-0.234)*	*(-2.121)*	*(0.338)*	*(0.304)*	*(2.974)*	*(4.779)*	*(0.463)*	*(1.922)*
Margin Decreases	-0.013	0.015	0.111**	0.030	0.005	-0.014	-0.0139***	-0.008	0.003	0.022	0.048	0.041	0.046	0.010	-0.147	-0.072	-0.113	-0.155
	(-0.457)	*(0.511)*	*(2.663)*	*(0.515)*	*(0.535)*	*(-1.490)*	*(-4.108)*	*(-1.635)*	*(0.133)*	*(0.487)*	*(0.975)*	*(0.511)*	*(0.872)*	*(0.023)*	*(-1.032)*	*(-0.744)*	*(-0.397)*	*(-0.322)*
Livestock Futures																		
Margin Increases	-0.037*	0.056	-0.008	0.186**	-0.013***	-0.034***	-0.003**	-0.012***	-0.060*	-0.075	-0.181***	-0.385***	-0.120**	-0.312***	0.923***	0.491***	-0.860	0.549
	(-1.848)	*(0.969)*	*(-0.319)*	*(2.419)*	*(-3.222)*	*(-3.026)*	*(-2.230)*	*(-3.693)*	*(-1.737)*	*(-1.121)*	*(-3.737)*	*(-4.307)*	*(-2.032)*	*(-3.063)*	*(5.324)*	*(4.942)*	*(-0.835)*	*(1.542)*
Margin Decreases	0.019	-0.014	-0.028	0.063**	-0.006	-0.003	0.002	-0.007***	0.073	-0.001	0.095	-0.137	0.021	-0.139	-0.475	-0.177	0.427*	0.887
	(1.218)	*(-0.911)*	*(-1.129)*	*(2.320)*	*(-1.038)*	*(-0.553)*	*(0.894)*	*(-3.006)*	*(0.807)*	*(-0.012)*	*(0.777)*	*(-0.836)*	*(0.157)*	*(-0.765)*	*(-1.418)*	*(-0.734)*	*(1.667)*	*(1.550)*
Energy Futures																		
Margin Increases	0.138***	-0.028	0.324***	0.068	-0.022**	-0.017	-0.007*	-0.010	-0.035	0.064	-0.214***	-0.168*	-0.179***	-0.205**	0.231	0.469***	0.856	0.698*
	(4.027)	*(-0.260)*	*(7.524)*	*(0.403)*	*(-2.210)*	*(-0.537)*	*(-1.820)*	*(-0.674)*	*(-1.146)*	*(1.629)*	*(-3.076)*	*(-1.923)*	*(-2.618)*	*(-2.498)*	*(0.888)*	*(3.319)*	*(1.080)*	*(1.927)*
Margin Decreases	0.100**	0.037	0.363***	0.149	-0.045***	-0.005	-0.012**	-0.003	-0.057	0.048	-0.151	-0.122	-0.092	-0.216*	-1.331***	0.241	-0.327	-0.857
	(2.078)	*(0.648)*	*(6.595)*	*(1.625)*	*(-3.914)*	*(-0.386)*	*(-2.468)*	*(-0.416)*	*(-0.954)*	*(1.006)*	*(-0.898)*	*(-1.298)*	*(-0.567)*	*(-1.659)*	*(-2.726)*	*(1.169)*	*(-0.680)*	*(-1.026)*
Metal Futures																		
Margin Increases	0.020	0.003	0.102*	-0.049	-0.013	-0.005	-0.008**	0.003	-0.045	-0.077**	-0.134	-0.410***	-0.092	-0.326***	0.275	1.262***	0.748	0.811
	(0.484)	*(0.057)*	*(1.931)*	*(-0.579)*	*(-1.292)*	*(-0.356)*	*(-2.225)*	*(0.524)*	*(-0.712)*	*(-1.941)*	*(-1.464)*	*(-4.555)*	*(-0.967)*	*(-4.369)*	*(0.774)*	*(6.983)*	*(1.134)*	*(1.101)*
Margin Decreases	-0.069	0.006	0.003	-0.008	0.010	-0.002	-0.013	0.001	0.105	0.071	0.057	-0.220	-0.047	-0.388**	0.248	0.525	-0.335	-0.398
	(-0.922)	*(0.115)*	*(0.029)*	*(-0.102)*	*(0.463)*	*(-0.135)*	*(-1.530)*	*(0.193)*	*(1.395)*	*(0.479)*	*(0.341)*	*(-0.794)*	*(-0.335)*	*(-2.129)*	*(0.361)*	*(0.929)*	*(-0.213)*	*(-1.502)*

Table 10: The impact of large and small margin changes

Entries report the results on the effect of margin changes when these are classified into two groups of large and small according to the absolute size of the percentage change. For each commodity group, we examine the effect of margin changes on futures prices (column 1), futures returns (column 2), hedging positions (column 3), speculative positions (column 4), speculative/hedging positions (column 5), volatility (log-range volatility measure, column 6), and liquidity (column 7). The coefficient estimates α_1 and the respective *t*-statistics in parentheses are reported. A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and 1% significance level, respectively.

	(1)				*(2)*				*(3)*		*(4)*		*(5)*		*(6)*		*(7)*	
	$\Delta \ln P_i=\alpha_0+\alpha_1\Delta \ln M_i+\beta NSP+u_i$				$\Delta R_i=\alpha_0+\alpha_1\Delta \ln M_i+\beta NSP+u_i$				$\Delta \ln HP_i=\alpha_0+\alpha_1\Delta \ln M_i+u_i$		$\Delta \ln SP_i=\alpha_0+\alpha_1\Delta \ln M_i+u_i$		$\Delta \ln(SP_i/HP_i)=\alpha_0+\alpha_1\Delta \ln M_i+u_i$		$\Delta \ln Vol_i=\alpha_0+\alpha_1\Delta \ln M_i+u_i$		$\Delta \ln ILL_i=\alpha_0+\alpha_1\Delta M_i+u_i$	
	5-day horizon		*20-day horizon*		*5-day horizon*		*20-day horizon*		*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*	*5day horizon*	*20day horizon*
	α_1	β	α_1	β	α_1	β	α_1	β	α_1	α_1	α_1	α_1	α_1	α_1	α_1	α_1	α_1	α_1
Grains Futures																		
Large changes	0.103***	-0.071**	0.143	-0.158***	-0.031**	0.013	-0.012***	-0.003	-0.027*	-0.056**	-0.067**	-0.163***	-0.040	-0.105***	-0.166*	0.150**	-0.176	0.477*
	(2.668)	*(-2.171)*	*(3.437)*	*(-3.019)*	*(-2.538)*	*(1.259)*	*(-3.377)*	*(-0.704)*	*(-1.703)*	*(-2.087)*	*(-2.329)*	*(-3.650)*	*(-1.474)*	*(-2.858)*	*(-1.797)*	*(2.431)*	*(-1.107)*	*(1.953)*
Small changes	0.004	-0.043**	0.101	-0.087**	-0.011	-0.002	0.000	-0.012**	-0.021	-0.010	-0.081	-0.200**	-0.061	-0.167***	-0.216	0.221**	-0.895	-0.015
	(0.176)	*(-2.081)*	*(2.119)*	*(-2.085)*	*(-1.350)*	*(-0.284)*	*(0.047)*	*(-2.489)*	*(-0.716)*	*(-0.250)*	*(-1.457)*	*(-2.847)*	*(-1.259)*	*(-3.032)*	*(-1.257)*	*(1.963)*	*(-1.204)*	*(-0.026)*
Soft Futures																		
Large changes	-0.004	-0.033	0.089	0.060	-0.028***	-0.024	-0.008**	-0.009	0.031	0.040	-0.089	-0.172***	-0.025	-0.075*	0.050	0.146***	0.269	0.648**
	(-0.138)	*(-0.709)*	*(2.151)*	*(0.758)*	*(-2.829)*	*(-1.539)*	*(-2.430)*	*(-1.380)*	*(0.735)*	*(1.081)*	*(-1.389)*	*(-2.647)*	*(-0.941)*	*(-1.903)*	*(0.669)*	*(2.814)*	*(0.710)*	*(2.036)*
Small changes	-0.022	0.009	0.020	0.063	-0.008	-0.005	-0.003	-0.007	0.008	0.007	-0.016	-0.068	-0.521	-0.788*	-0.144	0.297***	-0.050	-0.125
	(-1.319)	*(0.408)*	*(0.645)*	*(1.370)*	*(-1.405)*	*(-0.620)*	*(-1.061)*	*(-1.644)*	*(0.767)*	*(0.321)*	*(-0.591)*	*(-1.474)*	*(-0.981)*	*(-1.715)*	*(-0.916)*	*(3.383)*	*(-0.228)*	*(-0.518)*
Livestock Futures																		
Large changes	-0.077***	0.043	-0.015	0.168***	-0.014**	-0.014*	-0.002	-0.008***	0.017	-0.011	-0.084***	-0.257***	-0.102**	-0.248***	0.448***	0.134*	-0.243	0.669
	(-3.251)	*(1.261)*	*(-0.502)*	*(3.742)*	*(-2.543)*	*(-1.757)*	*(-1.512)*	*(-3.421)*	*(0.801)*	*(-0.298)*	*(-2.637)*	*(-4.532)*	*(-2.586)*	*(-3.987)*	*(3.231)*	*(1.685)*	*(-0.283)*	*(1.328)*
Small changes	-0.005	-0.023	0.023	0.004	-0.006	-0.010	-0.005	-0.009**	0.035	-0.001	-0.008	-0.114	-0.041	-0.112	0.175	-0.087	0.493	0.152
	(-0.203)	*(-1.169)*	*(0.623)*	*(0.110)*	*(-0.673)*	*(-1.585)*	*(-1.405)*	*(-2.540)*	*(0.710)*	*(-0.006)*	*(-0.122)*	*(-0.979)*	*(-0.531)*	*(-0.831)*	*(0.903)*	*(-0.588)*	*(1.174)*	*(0.105)*
Energy Futures																		
Large changes	0.191***	0.109	0.392***	0.202*	-0.004	0.002	0.004	-0.009	-0.012	0.034*	-0.130***	-0.112**	-0.118**	-0.146***	-0.140	0.326***	0.284	0.447**
	(3.377)	*(1.421)*	*(7.271)*	*(1.873)*	*(-0.282)*	*(0.107)*	*(0.751)*	*(-0.779)*	*(-0.844)*	*(1.837)*	*(-3.497)*	*(-2.335)*	*(-3.321)*	*(-3.160)*	*(-1.062)*	*(3.914)*	*(0.691)*	*(2.017)*
Small changes	0.060	-0.043	0.399***	0.087	-0.029	-0.016	-0.004	-0.001	0.047*	0.004	0.002	-0.201**	-0.044	-0.204**	0.045	0.323**	-0.383*	-0.411
	(0.473)	*(-0.619)*	*(3.727)*	*(0.711)*	*(-0.864)*	*(-0.851)*	*(-0.546)*	*(-0.115)*	*(1.794)*	*(0.128)*	*(0.036)*	*(-2.440)*	*(-0.691)*	*(-2.527)*	*(0.209)*	*(2.497)*	*(-1.679)*	*(-0.845)*
Metal Futures																		
Large changes	-0.060*	0.000	0.297***	-0.044	-0.038*	0.003	-0.020***	0.002	-0.027	-0.065*	-0.085*	-0.298***	-0.068	-0.233***	-0.041	0.406***	-0.148	0.267
	(-1.718)	*(0.026)*	*(3.578)*	*(-0.532)*	*(-1.673)*	*(0.188)*	*(-2.939)*	*(0.282)*	*(-1.575)*	*(-1.934)*	*(-1.877)*	*(-4.178)*	*(-1.338)*	*(-4.287)*	*(-0.213)*	*(2.968)*	*(-0.414)*	*(0.774)*
Small changes	0.063	0.023	0.071	0.020	-0.007	-0.012	0.011	-0.001	-0.086	-0.105*	-0.135	-0.290**	-0.028	-0.165*	-0.585*	0.414	-0.303*	0.980
	(0.794)	*(0.906)*	*(0.490)*	*(0.369)*	*(-0.275)*	*(-1.355)*	*(0.934)*	*(-0.177)*	*(-1.229)*	*(-1.673)*	*(-1.450)*	*(-2.274)*	*(-0.369)*	*(-1.881)*	*(-1.727)*	*(1.598)*	*(-1.870)*	*(0.873)*

Table 11: Margin requirements and futures prices during the liquidity crisis period (2007-2009)

Entries report the results when the price impact of margin changes is examined. First, we consider the effect on the commodiy futures prices and estimate the following regression model: $\Delta \boldsymbol{ln} P_i = a_0 + a_1 \Delta \boldsymbol{ln} M_i + \beta NSP_i + u_i$,where $\Delta \boldsymbol{ln} P_i \equiv P_{A,i} - P_{B,i}$ $P_{B,i}$ $\left(P_{A,i}\right)$ is the average price level in the pre (post)-event period, $\Delta \boldsymbol{ln} M_i \equiv \boldsymbol{ln}(M_{A,i} / M_{B,i})$, $M_{B,i}$ $\left(M_{A,i}\right)$ is the average daily level of margin in the pre (post)-event period, NSP_i is the net speculative positions prior to the margin change. Second, we consider the effect of margin changes on the commodity futures returns and estimate the following regression model: $\Delta R_i = a_0 + a_1 \Delta \boldsymbol{ln} M_i + \beta NSP_i + u_i$ where $\Delta R_i \equiv R_{A,i} - R_{B,i}$, $R_{B,i}$ $\left(R_{A,i}\right)$ is the average geometric daily return in the pre-event (post-event) period. The coefficient estimates α_1 , β and the respective *t*-statistics in parentheses are reported for the for the distinct commodity groups. A pre-event and post-event period of five and twenty days is used. One, two and three asterisks indicate that the estimated figures are statistically significant at 10%, 5% and1% significance level, respectively.

	$\Delta \ln P_i = \alpha_0 + \alpha_1 \Delta \ln M_i + \beta NSP + u_i$				$\Delta R_i = \alpha_0 + \alpha_1 \Delta \ln M_i + \beta NSP + u_i$			
	5-day horizon		***20-day horizon***		***5-day horizon***		***20-day horizon***	
	α_1	β	α_1	β	α_1	β	α_1	**B**
Grains Futures	0.025	-0.053*	0.111***	-0.136***	-0.025***	0.007	-0.006**	-0.007
	(1.416)	*(-1.777)*	*(3.841)*	*(-2.787)*	*(-3.215)*	*(0.711)*	*(-2.082)*	*(-1.516)*
Soft Futures	0.009	-0.163**	0.077**	-0.247*	-0.002	-0.023	-0.007***	-0.018*
	(0.401)	*(-2.154)*	*(2.344)*	*(-1.941)*	*(-0.233)*	*(-1.031)*	*(-2.778)*	*(-1.812)*
Livestock Futures	-0.021	0.018	-0.087**	0.123**	-0.001	0.001	-0.001	0.001
	(-0.777)	*(0.442)*	*(-2.371)*	*(2.123)*	*(-0.230)*	*(0.100)*	*(-0.188)*	*(0.198)*
Energy Futures	0.003	0.077	0.216***	0.215***	-0.032***	-0.007	-0.012***	-0.002
	(0.079)	*(1.535)*	*(3.710)*	*(2.601)*	*(-2.971)*	*(-0.564)*	*(-2.880)*	*(-0.290)*
Metal Futures	-0.031	0.071	0.000	0.116	-0.009	-0.014	-0.013***	-0.006
	(-0.748)	*(1.399)*	*(-0.002)*	*(1.556)*	*(-0.758)*	*(-1.043)*	*(-3.316)*	*(-0.907)*

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