THE EFFECT OF MARGIN CHANGES ON FUTURES MARKET VOLUME AND TRADING

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The contents of this thesis do not reflect the official opinion of Borsa Istanbul or Borsa Istanbul Derivatives Market (VIOP). Responsibility for the information and views expressed in this thesis therein lies entirely with the author.

ABSTRACT

THE EFFECT OF MARGIN CHANGES ON FUTURES MARKET VOLUME AND TRADING

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Margins are performance bonds that are designed to protect market participants and the market as a whole against investor default. Academic interest in analyzing margins started in the late 1960s and the number of studies increased parallel to the growth of the derivatives markets. Studies on margins mostly focus on optimal margin rules, regulations on margins and the impact of margin levels on trading activity. The aim of this study is to determine the impact of margin levels and margin changes on trading activity as measured by the open interest and trading volume of the most liquid futures contracts traded on the Turkish derivatives exchange. These contracts are the BIST 30 INDEX, USD/TRY FX, and TRY GOLD futures contracts and the sample period is from January 2009 to October 2014. The impact of margin levels and margin changes are examined separately by using time series regressions and an event study methodology. Since margin levels do not affect all trader types uniformly, their impact on trading activity also is examined by considering the composition of traders in the market as well as the trading activity of the entire market.

Keywords: Margins, Trading volume, Open Interest, Derivatives Market, Borsa Istanbul

ÖZ

TEMİNAT SEVİYESİNİN VADELİ İŞLEM SÖZLEŞMELERİNİN İŞLEM HACMİ VE AÇIK POZİSYON SAYISI ÜZERİNDEKİ ETKİSİ

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İşlem teminatları, türev piyasalarda yatırımcıların pozisyon açabilmesi için yatırılması zorunlu olan ve piyasanın temerrüt riskine karşı korunmasını sağlayan güvenlik mekanizmasıdır. 1960'lı yılların sonuna doğru akademik olarak da incelenmeye başlanan işlem teminatları konusunda yapılan çalışmaların sayısı türev piyasaların gelişmesiyle artmıştır. Araştırmacılar çoğunlukla teminatın piyasa faaliyetleri üzerindeki etkisi, ideal teminat seviyeleri ve düzenleyici kurumun teminat seviyelerinin belirlenmesindeki rolü konularına odaklanmışlardır. Teminatın piyasa faaliyetleri üzerindeki etkisini inceleyen çalışmaların temelinde genellikle teminatın yatırımcılara olan maliyeti üzerinde durulmuştur. Bu çalışmanın amacı, Ocak 2009 ve Ekim 2014 arasındaki dönemde işlem görmüş olan BIST 30 INDEX, USD/TRY FX, TRY GOLD vadeli işlem sözleşmelerinin işlem hacmi ve açık pozisyon sayısı üzerinde, teminat seviyelerinin ve teminat seviyelerinde yapılan değişimlerin etkisinin olup olmadığının tespit edilmesidir. Piyasadaki toplam faaliyetlerin yanı sıra bireysel ve kurumsal yatırımcıların faaliyetleri ayrıştırılarak zaman serisi regresyonu ve olay çalışması yöntemleriyle teminatın piyasa faaliyetlerine olan etkisi incelenmiştir.

Anahtar Kelimeler: Teminat, İşlem Hacmi, Açık Pozisyon Sayısı, Türev Piyasası, Borsa İstanbul

To my beloved mother and father

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Margins are performance bonds that are designed to protect market participants and the market as a whole against investor default. In derivatives markets, traders are required to post margins to ensure the integrity of the market. Generally, minimum margin levels are determined endogenously by the exchanges based on the prevailing market conditions but these levels may be differentiated by brokers and additional margins may be required by brokers to minimize their risk of loss. It is important to quantify the optimal levels of margins. Margin levels may be set sufficiently high to cover all possible volatility moves and thus reduce default risk, but setting the margin level too high may make derivatives markets less attractive for investors and may affect the trading activity in the market. Since a successful market is a liquid market, it is important to keep margins at appropriate levels maintaining both market integrity and market liquidity.

The cost associated with margins required for a futures contract transaction provides a basis to the impact of margin levels on trading activity. There may be different types of costs imposed by margins which can be listed as opportunity cost, transaction cost, liquidity cost, execution cost and cost of default. Since margins cannot be used for other purposes, profitable opportunities may be lost after posting margins. The return of an alternative that must be forgone in order to post margins is the opportunity cost of margins. Transaction costs are the expenses incurred when buying and selling a futures contract and include both transfer fees and bid-ask spreads. Liquidity costs are associated with a trader's desire to liquidate the open positions as quickly as possible instead of waiting for a desirable price. When a new trade is executed, it may affect the price of a futures contract and the execution cost is the difference between the price that occurs after an execution and the price that would have existed in the absence of that execution. Finally, the cost of default is the cost of failing to meet the

requirements regarding margin and marking to market calls.

The impact of margins on trading activity depends on the cost imposed by margins. One important point to remember is that margin costs may not be equal for all types of traders even if margin levels are applied equally for all traders. More specifically, the direction and magnitude of the impact may differ among traders. As a result of this differential impact, margin levels may also affect the composition of traders in the market. As trading activity or composition of traders change in the market with the impact of margin levels, volatility also tends to change. Changes in volatility depend on factors such as the number of bids and offers, profit expectations, risk preferences of traders and the type of traders in market. Ultimately, it is hard to determine the impact of margin levels on volatility since margins are determined as a function of changing volatility. Volatility is also a determinant of trading activity and because of the relationship between margins, volatility and trading activity, it is a complicated endeavor to determine the impact of margin on trading activity.

The purpose of this thesis is to determine the impact of margin levels on trading activity measured by open interest and volume. Since margin levels do not affect all trader types uniformly, impact on trading activity is examined considering the composition of traders in the market as well as the trading activity of the entire market. In addition, this study aims to differentiate between the margin levels that are determined endogenously and exogenously.

The remainder of the thesis is organized as follows. Chapter 2 reviews the arguments and empirical evidence in the literature regarding the impact of margin levels on performance, optimal margin rules and regulations on margins. It should be noted that to the best of our knowledge, this issue has never been examined before in the context of the Turkish derivatives market. Chapter 3 provides brief information about the Turkish derivatives market. Chapter 4 describes the data, the features of trading activity for the contracts used in the study, the results of preliminary analyses conducted before empirical tests and, finally, the empirical methodology. The determinants of trading activity and methods used for measuring volatility are also explained in this section. Chapter 5 presents the empirical results. Chapter 6

summarizes the empirical findings and presents the main policy implications of the thesis.

CHAPTER 2

LITERATURE REVIEW

Academic interest on the analysis of margins started in the late 1960s but most of these studies faced data limitations. After the 1980s with the advance in computing capabilities the number of studies increased in line with the growth of the derivatives markets.[1] Most of the previous studies about margins focus on the impact of margin levels on performance, optimal margin rules and margin regulations. In this chapter, previous studies are reviewed in the following order:

- Impact of Margin Levels on
  - ✓ Cost to Traders
  - ✓ Excessive Speculation
  - ✓ Composition of Traders
  - ✓ Volatility
  - ✓ Trading Activity
- Optimal Margin Rules
- Regulation on margins

2.1 Impact of Margin Levels on Cost to Traders

The costs associated with a futures transaction provides a basis for most of the theoretical studies analyzing the effects of margins and there are various views on this topic. Although some studies argue that margins do not impose costs, most of the studies in the literature (Telser and Yamey [27], Nathan [22], Bear [3], Telser [26], Fishe and Goldberg [12], Figlewski [11], Tomek [28], Kahl et al. [19], Hartzmark [18], Gay et al. [15], Fishe et al. [13], Longin [20], Adrangi and Chatrath [1], Dutt and Wein [9], Phylaktis and Aristidou [24], Chou et al. [7]) suggest that margin requirements impose significant costs on traders. There are also different views on the

[1] Sample data used by previous studies are summarized in the Appendix (Table A1).

type of the costs imposed by margins which may be listed as the opportunity, transaction, liquidity, execution and default costs.

The majority of scholars propose that margins impose significant opportunity costs ([Telser [26], Figlewski [11], Tomek [28], Hartzmark [18], Gay et al. [15], Fishe et al. [13], Chou et al. [7]). Unlike Dusak [8] who argues that the opportunity cost of a futures transaction is the full value of the contract or Black [4] who argues that there is no opportunity costs associated with futures transactions, studies analyzing the impact of margins define the opportunity cost with respect to the level of margins. Telser [26] argues that even if a trader uses interest-bearing Treasury bills to satisfy some or all of the margin requirements, higher margins raise the cost of trading. Profitable opportunities may be lost since Treasury bills posted as margins cannot be used for other purposes. This opportunity cost definition is challenged by Anderson [2]. He argues that the opportunity cost of posting margins is zero since margins requirements may be satisfied by posting in the form of Treasury securities and traders may receive interests payments.

Another type of cost, execution cost, which is considered to be imposed by margins is argued by Kahl et al. [19]. They argue that high levels of margins will increase the execution cost of trading since the difference between bid and ask prices will widen with the effect of high margins. Their work also suggests that margin levels have a substantial impact on the operating costs of hedgers. According to Fishe and Goldberg [12], the most significant cost of margin levels is the cost of default.

Hartzmark [18] argued that the costs and risks are related to the probability that a trader will be caught short of liquid assets and high margins impose opportunity cost, transaction cost, liquidity cost and execution cost on traders. He is of the view that when margin requirement levels change, both costs and risk-return opportunity set faced by traders change. Hartzmark's [18] study was extended by Adrangi and Chatrath [1] to allow for liquidity costs imposed by margins to change across the maturity of contracts. They argued that cost imposed by margins will become evident when the impact of margins on trader behavior across contract maturity is analyzed. Their study concluded that the opportunity costs are not a significant cost and margins

impose important transaction costs rather than opportunity costs. Chou et al. [7] also suggests that higher margins cause higher costs of trading. Inconsistent with Adrangi and Chatrath [1] and Chatrath et al. [6], however, their work concluded that margins impose both significant transaction and opportunity costs on traders.

2.2 Impact of Margin Levels on Excessive Speculation

Impact of margins on excessive speculation is one of the topics that is extensively examined in the literature. Some of the studies on this topic are related with government regulation and investigate the possibility of reducing excessive speculation in the market by using margins.

Some of the scholars (Telser and Yamey [27], Bear [3], Kahl et al. [19], Hardouvelis [16]) argue that increase in margin levels will decrease the speculative trading. One belief underlying this result is the increased cost of trading when the margin requirements increase and the other one is risky assets and less cash in portfolios of speculators. Bear [3] noted that the relationship of margin levels to expected price changes and expected price volatility is directly linked with the demand for and supply of speculative services and when speculative margin requirements set too high the level of speculation decreases. Differently from these scholars, McCain [21] noted that the impact of margin levels differs according to the side of the speculation such that high margin requirements are associated with high levels of long speculation and low levels of short speculation. Hartzmark [18] and Chou et al. [7] do not believe this inverse relationship. Hartzmark [18] noted that it is impossible to predict the extent to which different groups of traders will exit the market when faced with margin changes. Chou et al. [7] suggests that margin increases are not lead to decreases in trading activity of speculators. On the other hand, Figlewski [11] suggests that low margins on futures can lead to excessive speculation.

2.3 Impact of Margin Levels on Composition of Traders

Previous studies of margins have also focused on the impact of margins on the composition of traders. Underlying this analysis is the notion that even if the margin

levels are determined equal to all traders, the margin costs are not equal. Figlewski [11], Hartzmark [18], Adrangi and Chatrath [1] and Chou et al. [7] argue that changes in margin levels change the composition of traders in the market. Even though all these studies deduced the existence of a margin impact on composition of traders, they have different views about the direction and magnitude of the impact. Figlewski [11] suggests that the margin requirement determines which investors will trade and high transactions costs eliminate the investors having lowest profit expectations. Hartzmark [18] is of the view that it is impossible to predict the direction and magnitude of the impact of margin changes on the composition of traders without knowing liquidity costs and risk preferences. Hartzmark's [18], however, argued that individual traders are more sensitive to the changes in margins than institutional traders as Chatrath et al. [6]. Contrary to the studies of Hartzmark [18] and Chatrath et al. [6], Chou et al. [7] concluded that institutional traders are more sensitive to margin increases than individual traders and their trading activity decreases more than the others.

2.4 Impact of Margin Levels on Volatility

Previous empirical studies on margins have intensively focused on the impact of margin levels on volatility.[2] Early studies examined this issue in the scope of excessive speculation related with government regulation. Those studies provide different results. While Nathan [22] concluded that small and moderate-sized margin increases stimulate price fluctuations; McCain [21] noted that margin decreases are more effective than increases in reducing price fluctuations. On the contrary; Bear [3], Telser [26], Figlewski [11], Kahl et al. [19], Dutt and Wein [9], Chou et al. [7] noted that volatility will increase as margin levels increase. Also there exists studies (Anderson [2], Tomek [28], Hartzmark [18], Fishe et al. [13], Hardouvelis and Kim [17], Adrangi and Chatrath [1], Phylaktis and Aristidou [24]) noting the hardness of determining the impact of margins on volatility.

Studies have different reasoning for the notion that as margin increases volatility

[2] Details of methods and results of empirical studies analyzing the impact of margins on volatility can be found in Appendix section (Table A2)

increases also. In his study, Bear [3] interpreted price behavior according to efficient market model. According to him, prices do not adjust quickly to new information in case of speculation shortage in the market. As margin levels increase, speculation will decrease and that will cause an increase in volatility. Telser [26] noted a negative impact of high margins on trading activity. He claimed that as trading activity fall, the number of bids and offers will tend to decrease on average and as a result volatility tend to increase. Figlewski [11] and Kahl et al. [19] are of the view that margins increase the cost of trading which means high margin levels eliminate the investors having low profit expectations. As a result, traders having relatively extreme opinions will determine the prices and that will cause the depth of the market to decrease and volatility to increase. Dutt and Wein [9] noted a potential that an increase in margin levels would increase price volatility of the futures contracts. Chou et al. [7] suggested that high levels of margin cause all types of traders to exit the market which decrease the liquidity and as a result increase the volatility of the market.

Studies claiming the hardness of determining the impact of margins on volatility have also different reasoning for this claim. Anderson [2] claimed that since a change in price reflect not only a variation of bid and asks but also new information, it is hard to determine the impact of margins on price volatility without knowing exact causes of price changes. Hartzmark [18] and Fishe et al. [13] analyzed the margin impact on volatility in scope of the margin impact on composition of traders considering that price variability depend on the types of the traders in the market. Hartzmark [18] suggests that margin change may affect the composition of traders without any significant price effects. Underlying his claim is the view that it is impossible to predict the direction and magnitude of the impact of margin changes on composition of traders considering only the margin levels without an information on costs and risk preferences of traders. He used a large data sample compared to the early studies while examining this relationship between margin changes and price volatility and found that there is no significant relationship between margins and price fluctuations. Fishe et al. [13] argue that the impact of margins on volatility depends on the type of traders removed from the market with the effect of margin levels. They are of the view that the reaction of the traders may differ by contract and by the size of margin changes. Tomek [28] and Hardouvelis and Kim [17] noted the hardness of determining the

impact of margins on volatility by considering the notion that margins are a function of the changing volatility of prices. They are of the view that the exact relationship between margins and volatility may be swamped while determining margins according to a correct forecasted trend in volatility. According to Tomek [28], only in extreme cases, impact of margins on price behavior may be clear. Studies of Adrangi and Chatrath [1] and Phylaktis and Aristidou [24] also noted that margin requirements change in response to changes in price volatility and their studies concluded that because of the interactive relation between margins, volumes and volatility; it is difficult to determine the naked impact of margins on volatility.

2.5 Impact of Margin Levels on Trading Activity

Impact of margins on trading activity which is measured by trading volume and open interest is the topic most interest to our examination. Previous studies on margins have produced both theoretical and empirical results[3] on this topic. Although theoretical studies suggest that margin requirements reduce trading activity because of the cost of margins imposed on traders, empirical studies generally failed to conclude this negative relationship. The early empirical studies used limited data samples in their examinations (Nathan [22], McCain [21]) and could not find any significant impact of margin on trading activity. In his theoretical study, Telser [26] argued that higher margin levels are set during volatile periods and increasing margin requirements tends to decrease the size of open interest and volume. He noted that the negative relationship between margins and open interest and volume results from that margin changes impose considerable costs to traders. Since Anderson [2] disagree with Telser [26] on cost impact of margins, he is of the view that margin changes may reduce trading activity on other markets and leave futures markets unaffected. Anderson also noted that volume may not be affected because of the low effect of margins on intraday trading. Fishe and Goldberg [12] studied using more contracts and data belong to a long time period compared to the previous studies and they found that trading activity varies inversely with margin requirements. They concluded that the impact is

[3] Details of methods and results of empirical studies analyzing the impact of margins on trading activity can be found in Appendix section (Table A3)

significant for only nearby delivery months and not for more distant delivery months. Hartzmark [18] analyzed the impacts of margins on open interest and trading volume separately. He concluded that for contracts with more distant expiration dates, margin changes appear to have no effect on open interest. For the nearby contracts, increase in margin requirements has relatively very small negative effect on open interest. His results for trading volume are generally inconclusive. As Telser [26], Tomek [28] also used portfolio theory while analyzing the effect of a change in margins on a customer's open position. He noted that since margins and price volatility have opposite effects on trading activity, margins impact on open position and volume is obvious when the change in margin is large relative to the change in price variability. Kahl et al. [19] argued that trading volumes and margins levels are inversely related because of the negative impact of margins on volume of speculation. Fishe et al. [13] noted that increases in margins will reduce open interest since margins increase the cost of trading contracts by increasing the cost of default. They also predict margin increases to result in more day trading activity. The basis of this conclusion is the notion that day traders do not carry overnight positions and because of that they experience less cost due to margin increases. Adrangi and Chatrath [1] found a negative impact of margins on both trading volume and open interest of all trader types. They also concluded that trading activity becomes more sensitive to margin changes as one gets closer to contract maturity. Dutt and Wein [9] argued that the theory of the previous studies claiming a negative relation between high margin levels and trading activity was correct. According to them the reason of those studies not finding a significant negative relation in their analysis is that they did not control for the volatility effects when examining impacts of margin requirements. Since margins are cost to the traders, the increase in margins has negative impact on trading activity. Higher margins are set in response to the increased market risk as volatility increases. Volatility has also effect on trading volumes as high margins. The increase in price volatility, increases trading volume. Since the margin and volatility effects on volume are of opposite sign, the predicted impact of a margin increase is ambiguous. Because of this fact in their empirical analysis they adjust margins for underlying price risk. After adjusting for risk, they found that margin requirement has economically and statistically significant negative effects on trading volume as predicted by theory. The main rationale of their studies is making a differentiation between exogenous and endogenous changes in the

market. Endogenous changes result from changing market conditions and trading volume is posited to be inversely related to exogenous changes in margins not to endogenous changes. As Dutt and Wein [9], Phylaktis and Aristidou [24] also adjusted margin by underlying price risk while analyzing their data. Even though this adjustment, they could not found a negative relationship between margin changes and trading volume. Chou et al. [7] found that both open interest and trading volume are significantly negatively related to margin increases. They concluded that margin increases reduce trading activity for all traders. Their results also showed that day trading activity reduce with the effect of margin increases.

2.6 Optimal Margin Rules

Margins are designed to protect the brokers and exchanges against investor default. Thus margin levels should be high enough to reduce default risk. On the other hand high margin levels may make derivatives market less attractive for investors. Studies on margins investigated the factors affecting margin determination and optimal margin levels. Telser [26] is of the view that optimal margins in the market are determined by competition among brokers for customers. He noted that margin depends on the risk to the broker and risk depends on the financial strength of customers, the nature of the transactions, maximum price change that may occur during position holding period. As Telser [26], Gay et al. [15] examined margins as determined endogenously and noted that optimal margin depends on the relationship between expected profitability and the default risk.

Figlewski's [11] study is one of the first studies of optimal margin determination with the risk of margin exceedance as the primary concern and analyzed the degree of protection provided by different margin levels. He found that the optimal margin level is the function of the underlying's volatility and the length of the grace period. He also noted that margin requirements should be adjusted as market conditions change. According to Figlewski [11], level of requirements should be set taking into consideration the overall risk of the portfolio of an investor and reflect different investor ability to bear risk. Findings of him also showed that if the portfolio of a trader includes different contracts which have a relation in extreme prices, the optimal margin

requirement for each contract changes. Kahl et al. [19] noted in their study that futures performance margins must be set at a level high enough to maintain the financial integrity of the futures markets, and low enough to maintain low hedging and trading costs and high levels of market liquidity. Tomek [28] and Edwards and Neftci [10] compute margin exposure by using actual movements in futures prices. As Telser [26], Tomek [28] is also of the view that there exists no single equilibrium margin. According to him, margins are determined by the interaction of customers and brokers. According to his study margins should be high enough to ensure contract integrity and should not be changed too frequently. Edwards and Neftci [10] are also argued that optimal margin levels depend on the volatility of the price series. Differently from previous studies they put down to the fact that correlation among extreme movements in different contract prices are important and should be taken into consideration while setting margins. After Edwards and Neftci [10], Longin [20] is also analyzed margin violation by focusing to the distribution of extreme price changes. Longin [20] concluded that margins in futures markets should be set using a parametric method, which gives an analytical equation linking the margin level to the desired probability of margin violation. The important feature of the method is to take into account the occurrence of extreme price movements explicitly.

2.7 Regulation on Margins

Most of the early studies about margins are focused on whether margins on derivatives contracts should be set by the government or by exchanges. Those studies also investigated the possibility of using margins regulated by government to deal with the excessive speculation or high volatilities in the market. Almost all studies argued against government intervention in margin setting. While the reasoning of some studies (Telser and Yamey [27], McCain [21], Hartzmark [18], Fishe et al. [13]) is the conclusions of the analyses indicating that margins have no significant effect on excessive speculation or volatility, the reasoning of the rest is the notion that government regulation of margins have a negative effect on futures market trading (Fishe and Goldberg [12]) or there is no need in the market for an intervention by government and margins should be determined by exchanges themselves (Figlewski [11], Tomek [28], Kahl et al. [19], Gay et al. [15]). There are only a few studies

supporting the government intervention. Anderson [2] justify some governmental regulations on establishing minimum margins but according to him, that does not mean government will set the exact minimum margin levels. Hartzmark [18] argued that margins should only be used as a mechanism to prevent trader default.

CHAPTER 3

DERIVATIVES MARKET IN TURKEY

Turkey's first derivatives exchange, Turkish Derivatives Exchange (Turkdex), was established on February 4th, 2005 after the legislation on "The Establishment and Operation on Futures and Option Exchanges" was published and became the first and only derivatives exchange authorized by the Capital Markets Board (regulatory agency in Turkey) to operate in Turkey. Turkdex quickly became an important player in Turkish capital markets along with the Borsa Istanbul (BIST), Istanbul Settlement and Custody Bank (Takasbank) and Central Securities Depository Institution (MKK).

Turkdex was established as a for-profit-company dedicated to expanding the trading volume and the range of products. This vision produced results in a very short time and starting from 2007 the Turkdex trading volume made tremendous strides. By 2010, 5 years following its establishment, Turkdex had nearly 100 members and over 70,000 trading accounts. The range of products also increased, and in addition to its flagship product equity index futures, currency futures, interest rate futures, energy futures and commodity futures were also traded. In that same year, The Commodity Futures Trading Commission (CFTC), the authority that regulates commodity futures and option markets in the U.S., gave a "No-Action Letter" to Turkdex which enabled American individual investors and investment funds to trade on the equity index futures contract.

On December 21st, 2012 the Borsa Istanbul Futures and Options Market (VIOP) was established. Differently from Turkdex, single stock futures and option contracts and index option contracts were tradable in this market. The single stock options were the first option contracts traded on an organized exchange in Turkey.

Finally, on August 5th, 2013 Borsa Istanbul merged with Turkdex under VIOP. After that date all derivatives contracts started to be traded on a single platform and the contracts transferred from Turkdex were added to the contracts that were already traded on the VIOP.

During the five-year period between 2010 and 2014, the average yearly trading volume of the Turkish derivatives market was 63 million contracts and 425,560 million TRY, an amount equal to 30% of the average GDP for the same period. For the same period, the average yearly trading volume of the equity market[4] was 650,954 million TRY (equal to 46% of the average GDP). Table 1 presents the annual values for each market.

Table 1: Ratio of Derivatives Market and Equity Market Trading Volumes to GDP

Year	Gross Domestic Product (Value, Million TRY)	Derivatives Market Trading Volume/ GDP (%)	Equity Market Trading Volume/ GDP (%)
2010	1,098,800	39.29	52.59
2011	1,297,714	33.89	46.40
2012	1,416,799	28.51	38.69
2013	1,567,290	26.58	46.74
2014	1,749,783	24.90	45.38

For the period between 2010 and 2014, the average yearly trading volumes of equity index, currency and precious metals contracts are 49, 13 and 1 million contracts respectively. Compared to the global derivatives volume[5], these amounts represent 0.74%, 0.51% and 0.32% of trading in their categories.

The market risk and collateral management of the VIOP transactions are carried out by Takasbank. All buyers and sellers in the market are required to post margins through their brokers in order to secure their contract obligations. Until the merger in 2013, a

[4] Companies that fulfill Borsa İstanbul's listing criteria are traded on the National Market under the Equity Market.
[5] Number of contracts traded and/or cleared at exchanges worldwide and announced by the Futures Industry Association (FIA).

contract-based margining method was used for each trading account at the Turkdex. The Exchange determined the required margins for each contract type based on the market conditions. Following the merger, a portfolio-based margining started to be used for each account instead of the contract-based margins and the parameters constituting the basis for this portfolio-based margining approach started to be determined by Takasbank. The regulatory body (CMB) establishes the minimum levels for margins in line with the conditions that exist in the market. For the contract-based margining of Turkdex, CMB used a lower limit[6] for the margin requirements that were calculated as a percentage of the contract value. These percentage levels are no longer used since the adoption of portfolio-based margining.

In order to calculate the portfolio-based margin requirements for each trader, Takasbank uses the Standard Portfolio Analysis of Risk (SPAN) algorithm. After each session's closing, settlement prices for the futures and option contracts are determined and collaterals of all accounts are updated according to their final open interest by using the latest SPAN parameter file. For the accounts whose total collateral amount fall below the maintenance level, a margin call is issued. The maintenance margin is the minimum level that the margin balance of a trader is allowed to decrease as a result of losses incurred in the market or depreciation in the value of non-cash collateral. The maintenance level equals to a percent of the margin requirement. Statistical parameters used by the SPAN algorithm are calculated based on data from at least a 12-month horizon and by using 99 to 99.75 percent confidence levels and assuming a two business-day holding period for each underlying asset. Parameters are adjusted in line with the prevailing market conditions when necessary [25].

As of March 2014, Takasbank started providing central counterparty services[7] (CCP) for the VIOP. In its role as a clearing house, Takasbank guarantees the fulfillment of settlement by acting as the central counterparty for all trades executed on the VIOP.

[6] The lower limits were 7.5% for the ISE30 Index Futures, 5% for the USDTRY Futures and 6,25% for the Gold Futures.

[7] Central Counterparty Clearing is the management of a transaction after a buy or sell transaction and prior to the legal fulfillment of the respective obligation. A CCP is the counterparty of the original buyer and seller.

CHAPTER 4

DATA AND METHODOLOGY

4.1 Data

The data used in this thesis are the daily observations of settlement prices, open interest[8] and trading volumes[9] for the BIST 30 INDEX, USD/TRY FX, TRY GOLD futures contracts. These contracts were traded on the Turkdex until the merger on August 5th, 2013 and on the VIOP following the merger. The sample period is from January 2009 to October 2014 for the BIST 30 INDEX and USD/TRY FX futures contracts and from January 2009 to May 2014 for the TRY GOLD futures contracts. A different sample period is chosen for TRY GOLD futures contracts due to the contract size change in June, 2014. Data on margin changes and daily settlement prices are publicly available on the Borsa Istanbul web site. Data on trading activity are obtained directly from Borsa Istanbul in two separate data sets. The first data set contains account identification numbers and the second data set contains investor-type information[10]. Both data sets contain open interest and trading volume information for all accounts and investors categorized by contracts, boards[11] and maturity months.

The data set used in this thesis makes it possible to trace the trading activity of each instrument type, each maturity month and each account separately. Investor type identification allows categorization of institutional and individual traders and trace their trading activity separately. Account identification further allows tracing the trading activity of each account and determining day trading[12] volumes.

[8] Number of outstanding derivatives contracts that have not been closed.
[9] Number of contracts traded.
[10] Investors are identified as either individual or institutional.
[11] Trades can be executed on three separate boards: Main Board (regular trades), Negotiated Deals Board (block trades) and Advertising Board (pre-transaction bookbuilding for block trades).
[12] Day trading refers to buying and selling the exact same amount of a particular futures contract on the same day. Day traders do not carry open positions overnight.

4.2 Features of Trading Activity on Selected Contracts

There are several reasons why the BIST 30 INDEX, USD/TRY FX, TRY GOLD futures contracts are chosen for analysis. First, a variety of unrelated instrument types are desired in order to provide a robust description of the impact of margin changes on trading activity. Second, these three contracts are the most actively traded contracts in the Turkish derivatives markets. Finally, during the sample period, these contracts have a reasonable number of margin requirement changes. Most of the studies in the previous literature focus on commodity futures contracts. Commodity contracts are not included in this study's sample due to their low trading volumes.

Before conducting empirical tests, trading volume and open interest data are analyzed for each instrument type in detail. Monthly trading volumes of the Negotiated Deals Board, trading volume and open interest lifecycle patterns of each contract, breakdown of monthly trading volumes and open interest by maturity month and by investor type, monthly ratios of day trading volume in total trading volume and the distribution of day trading volume across maturity months are examined and several significant results are obtained. The results of these analyses are summarized below.

4.2.1 Negotiated Deals Board

The data set contains trading volume information by board identification that makes it possible to examine the negotiated deals board trading volumes for each contract separately. In results not shown, it is seen that a significant proportion of the block trading volume occurs on the maturity month with the impact of rollovers[13]. This is an obvious impact of maturity on trading volume and, in order to isolate the relationship between margin changes and trading volume and exclude the confounding effect of contract expiration, the negotiated deals board trading volumes are excluded from all analyses.[14] On the other hand, since the open interest data are contract based and not board based, data used in the analyses of open interest still include open interest

[13] Investors transfer their holdings from one maturity date to another.
[14] Trading volumes arising from expiring transactions are also excluded from the analyses because of the same reason.

information arising from the negotiated deals.

4.2.2 Lifecycle Patterns and Maturity Month Breakdown of Trading Activity

Trading volume and open interest lifecycle patterns are examined by considering each tradable day of a contract during its whole life. Contract months of BIST 30, USD/TRY and TRY GOLD futures contracts are February, April, June, August, October and December. At any given point in time, three different expiration months nearest to the current month are available for trading.[15] BIST 30 and USD/TRY futures contracts with maturities other than December[16] and all TRY GOLD futures contracts are available for trading for six months. Each contract becomes the "nearby" contract during the last two months of its life. When an existing nearby contract expires, the "next nearest" contract becomes the new nearby contract and the "distant" contract becomes the new next nearest contract. The maturity month breakdowns[17] of trading activity are also analyzed to see the distribution of trading activity among the nearby, next nearest and distant contracts. Results of these analyses are summarized below for each instrument type.

4.2.2.1 BIST 30 INDEX Futures Contracts

On average, 95% of the total trading volume of a contract arises from the trades executed during the last two months of the contract's life. The proportion of trading volume arising from the trades executed during first three months[18] is less than 1% of the total trading volume.

[15] If December is not one of those three months for the BIST 30 and USD/TRY futures contracts, it is also launched for trading.
[16] BIST 30 and USD/TRY December contracts are tradable for twelve months.
[17] Analysis results given in this part are the averages of monthly trading volumes. Results in the figures are given separately for odd and even months because even months are maturity months and monthly analyses show a difference in the breakdown of trading activity between contracts with different maturities for odd and even months.
[18] Nine months for December contracts.

Table 2: BIST 30 Futures Contracts Trading Activity Lifecycle Patterns

	Trading Volume (%)			Average Open Interest		
	First 3 Months	4th Month	Last 2 Months	First 3 Months	4th Month	Last 2 Months
Mean	0.4	4.5	95.2	907	29,478	383,372
Min	0.1	2.0	93.7	240	17,670	288,453
Max	0.8	5.9	97.8	1,882	51,397	601,469

As can be seen in Table 2 and Figure 1, for even months, the percentage of the trading volume arising from trades executed on the nearby and next nearest contracts is 90.9% and 9%, respectively. For odd months, the nearby contract's trading volume is 99.3% and next nearest contract's volume is 0.6% of the total monthly trading volume. The percentage of monthly trading volume arising from distant contracts is less than 0.1%.

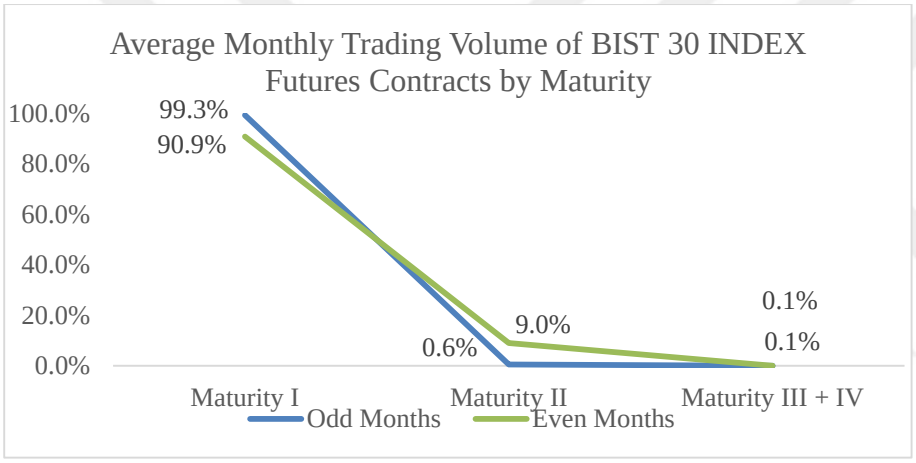

Figure 1: Trading Volume of BIST 30 Futures Contracts by Maturity

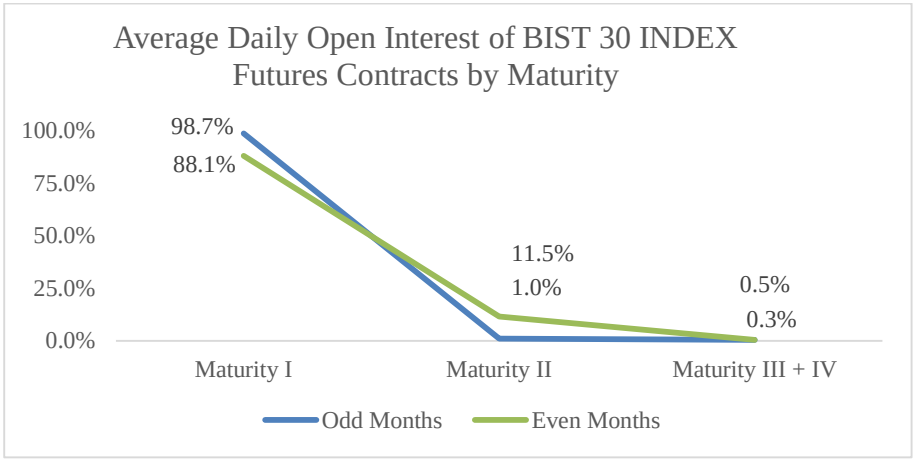

Figure 2: Open Interest of BIST 30 Futures Contracts by Maturity

In Figure 2, it is seen that in comparison to all contracts outstanding, the daily average open interest of the nearby contracts is 98.7% for odd months and 88.0% for even

months. The table and figures indicate that since the majority of trading at any point in time takes place in the nearby contract, the impact of margin changes on the trading activity needs to be analyzed for the nearby contract.

4.2.2.2 USD/TRY FX Futures Contracts

For the dollar contracts, on average, 86% of the total trading volume of a contract arises from the trades executed during the last two months of the contract's life. The proportion of trading volume arising from the trades executed in first three months[19] is on average 3% of the total trading volume.

Table 3: USD/TRY Futures Contracts Trading Activity Lifecycle Patterns

	Trading Volume (%)			Average Open Interest		
	First 3 Months	4th Month	Last 2 Months	First 3 Months	4th Month	Last 2 Months
Mean	3.3	10.4	86.3	3,864	25,426	195,843
Min	0.3	4.7	76.7	773	2,819	109,507
Max	10.8	21.2	93.9	12,469	65,492	321,132

As can be seen in Table 3 and Figure 3, for even months the percentage of the trading volume arising from trades executed in nearby and next nearest contracts is 78.3% and 20.6%, respectively. For odd months, the nearby contract's trading volume is 94.7% and the next nearest contract's volume is 4.5% of the total monthly trading volume. The percentage of monthly trading volume arising from the distant contract is nearly 1%.

[19]Nine months for December contracts.

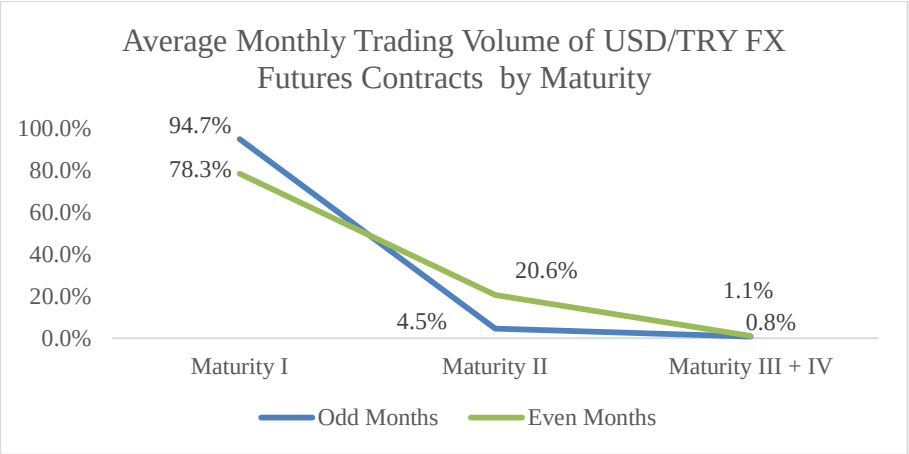

Figure 3: Trading Volume of USD/TRY Futures Contracts by Maturity

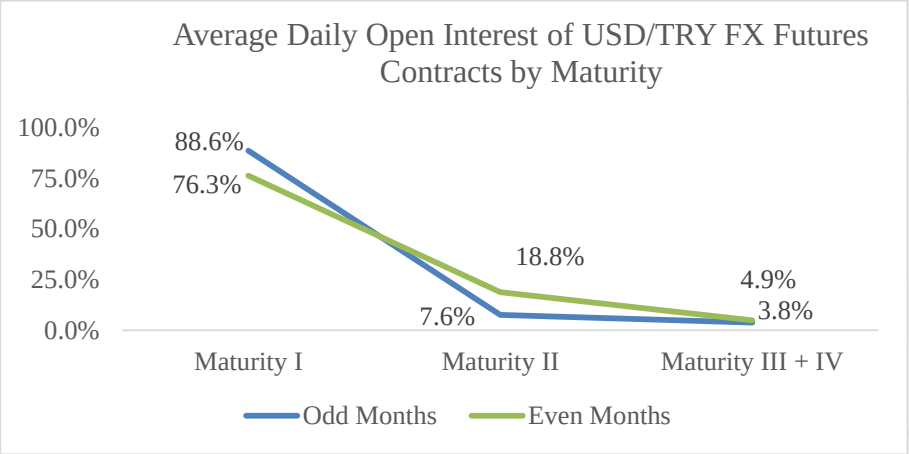

Figure 4: Open Interest of USD/TRY Futures Contracts by Maturity

In Figure 3, it is seen that in comparison to all contracts outstanding, the daily average open interest of the nearby contracts is 88.6% for odd months and 76.3% for even months. Similar to the index futures contracts, since most of the trading takes place in the nearby currency futures contract, the relationship between trading and margin changes needs to be analyzed for the nearby contract.

4.2.2.3 TRY GOLD Futures Contracts

On average 75% of the total trading volume of a gold contract arises from the trades executed during the last two months of the contract's life. The proportion of trading volume arising from the trades executed during first three months is 10% of the total trading volume on average.

Table 4: TRY GOLD Futures Contracts Trading Activity Lifecycle Patterns

	Trading Volume (%)			Average Open Interest		
	First 3 Months	4th Month	Last 2 Months	First 3 Months	4th Month	Last 2 Months
Mean	9.6	15.1	75.3	93	355	1,757
Min	1.2	4.5	46.9	7	28	141
Max	28.0	31.8	91.2	387	1,109	5,592

Table 4 and Figure 5 show that for even months, the proportion of the trading volume in the nearby and next nearest contracts is 66.8% and 29.9%, respectively. For odd months, the nearby contract's trading volume is 86.0% and the next nearest contract's volume is 11.5% of the total monthly trading volume. The percentage of monthly trading volume arising from the distant contracts is nearly 3%.

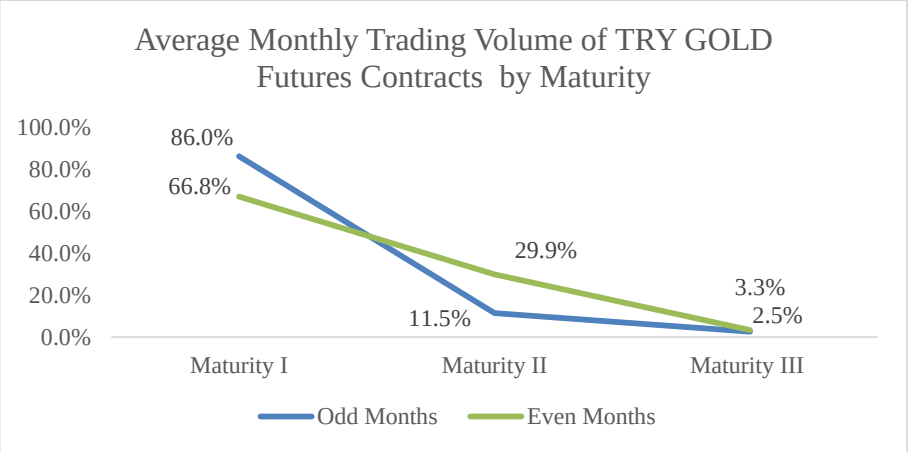

Figure 5: Trading Volume of TRY GOLD Futures Contracts by Maturity

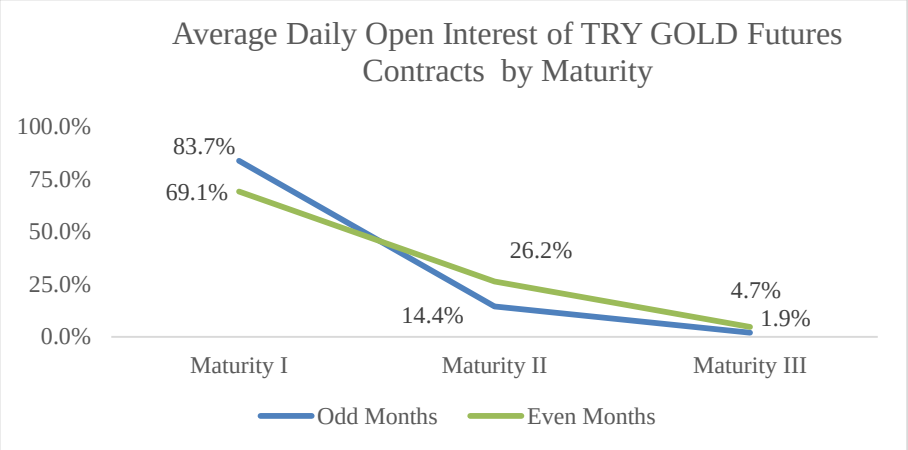

Figure 6: Open Interest of TRY GOLD Futures Contracts by Maturity

Figure 6 shows that in comparison to all contracts outstanding, the daily average open interest of nearby contracts is 83.7% for odd months and 69.1% for even months. The

findings from Table 4 and Figures 5 and 6 suggest that the impact of margin changes on the trading activity of the gold contracts also needs to be analyzed for the nearby contract since the majority of the trading activity takes place in this contract.

4.2.2.4 Summary

Results indicate clearly that the time to maturity is an important determinant of trading activity and the trading volume of distant maturities are too low. As a result, distant contracts are excluded from the sample data used in empirical analyses. Data used in empirical studies are limited to the nearby and next nearest contracts. Figures 7, 8 and 9 below show the pattern of trading activity on the nearby and next nearest contracts between 2009 and 2014 for each instrument type. By providing the maturity month breakdowns, these figures show that the trading activity is heavily concentrated on the nearby contract but there is a drastic increase in both the trading volume and the open interest of the next nearest contract just before the nearby contract reaches maturity. Up until this time, the trading activity on the next nearest contract is negligible. In order to use the most liquid contract data while minimizing expiration effects, the trading activity on the nearby and next nearest contracts are aggregated to form a single series for each instrument type and these single series are used in the empirical analyses.

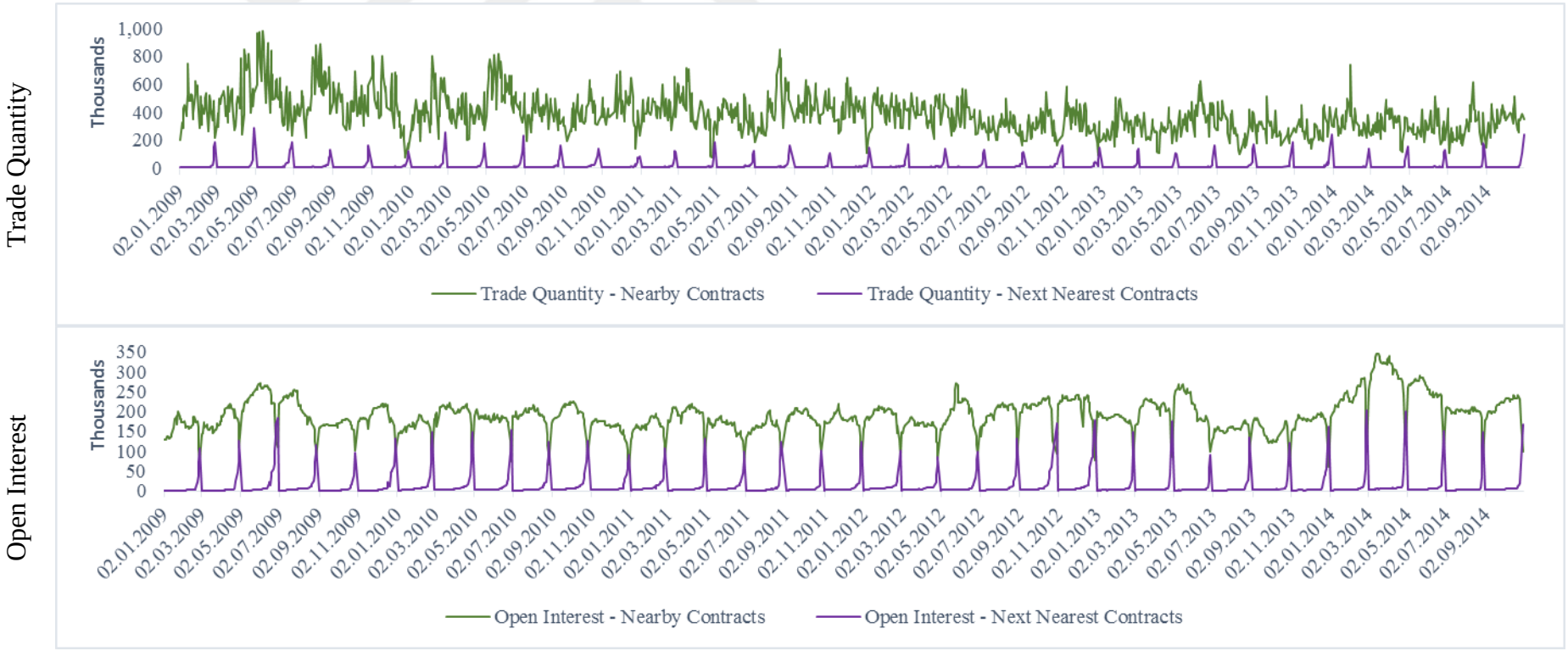

Figure 7: BIST 30 Futures Contracts Daily Trading Activity (2009-2014)

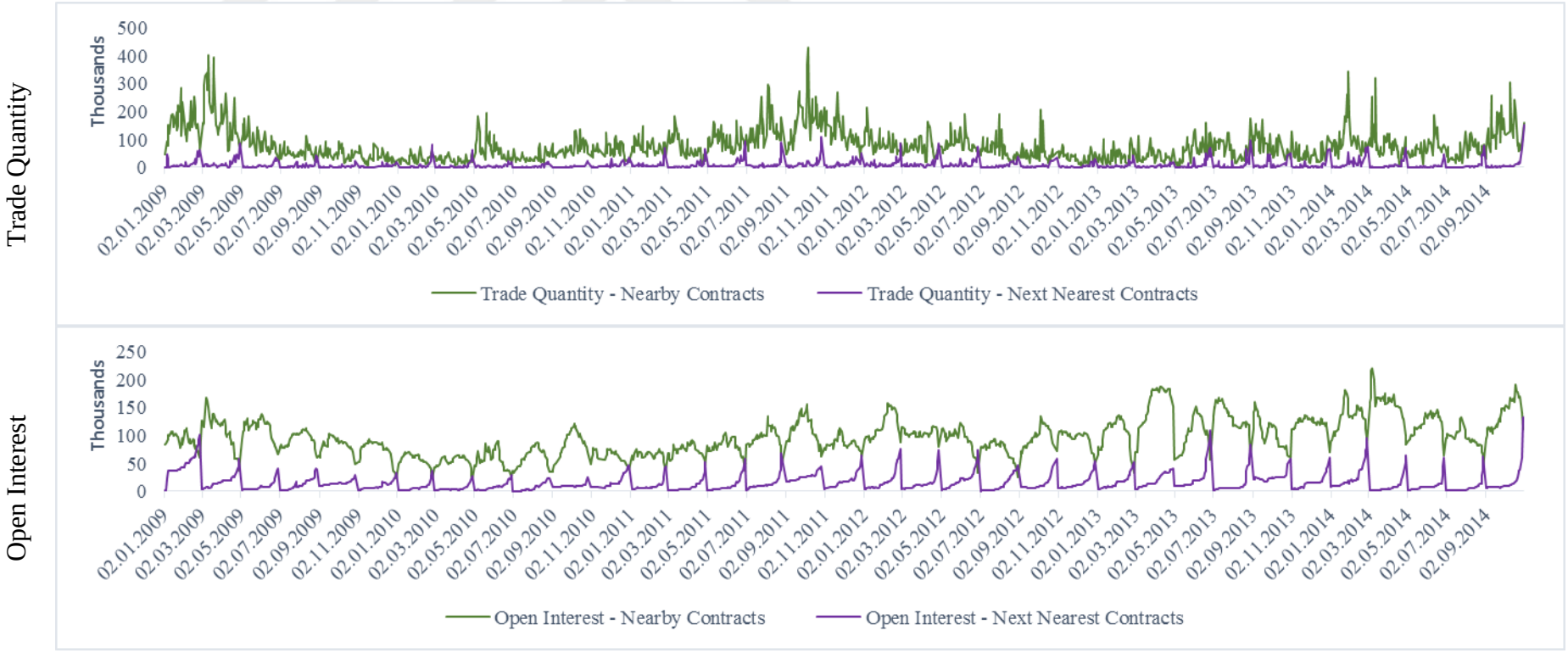

Figure 8: USD/TRY Futures Contracts Daily Trading Activity (2009-2014)

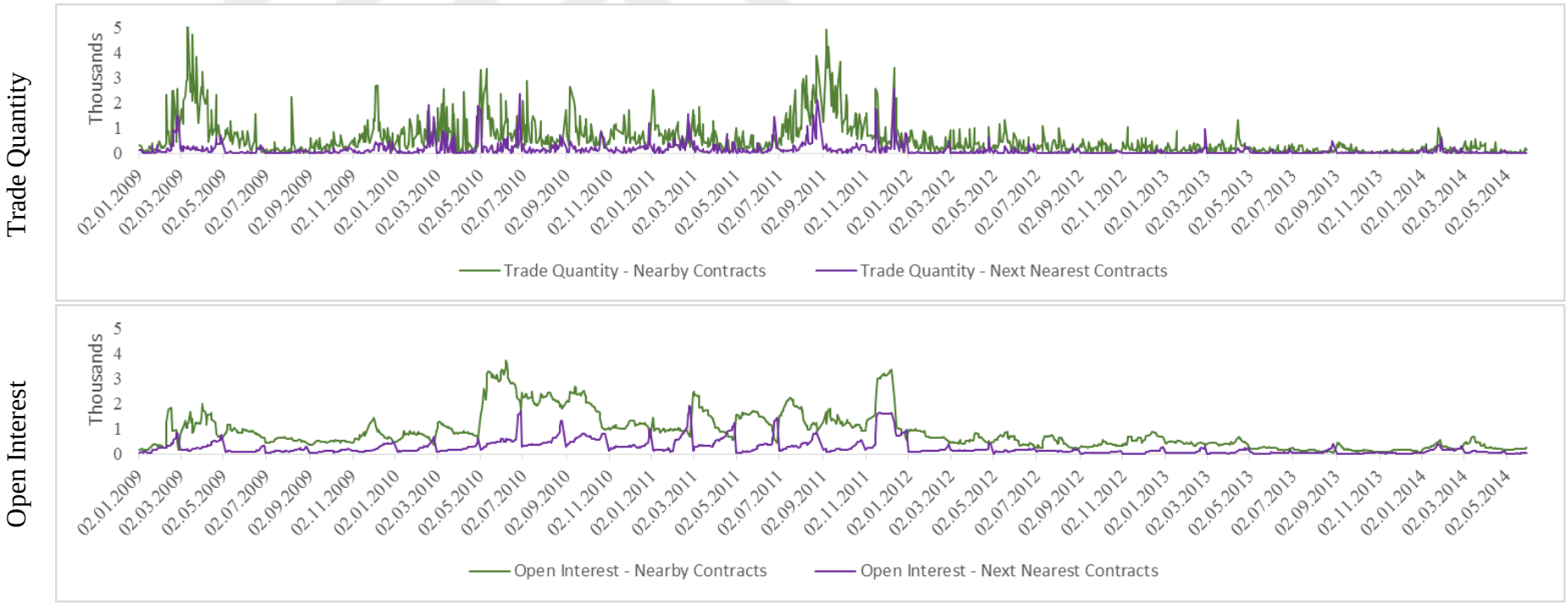

Figure 9: TRY GOLD Futures Contracts Daily Trading Activity (2009-2014)

4.2.3 Investor Type Breakdown of Trading Activity

Investor type breakdowns of monthly total trading volumes are analyzed separately for each instrument type. Results show that, unlike most of the developed derivatives markets, the trading volume of institutional traders is smaller than that of the individual traders for all contracts. For the BIST 30 INDEX contracts, the proportion of individual and institutional traders' trading volume is 70.1% and 29.9%, respectively. For the USD/TRY FX contracts, these proportions are 64.6% for individual and 35.4% for institutional traders. For the TRY GOLD contracts 76.4% of the trading volume belongs to individual traders and 23.6% of the volume belongs to institutional traders.

Investor type breakdowns of daily average open interest also are analyzed separately for each instrument type. The results are interesting since, for the BIST 30 INDEX and USD/TRY FX contracts, the individual traders seem to carry a smaller daily average open interest compared to institutional investors. For the TRY GOLD futures contracts, however, the daily average open interest of institutional traders is smaller than that of the individual traders.

The results of the investor type breakdown of the total trading activity by maturity month are summarized below for each instrument type.

4.2.3.1 BIST 30 INDEX Futures Contracts

Figure 10 shows that for individual traders, the proportion of all trading taking place in the nearby contract is 92.5% for even months and 99.1% for odd months. This ratio is 7.3% for even months when the next nearby contract is considered and less than 0.1% for the distant contracts. Similarly, in the total trading volume for the institutional traders, the nearby contract's proportion is 87.3% for even months and 99.8% for odd months. This ratio is 12.7% for even months when the next nearby contract is considered and nearly 0% for the distant contracts.

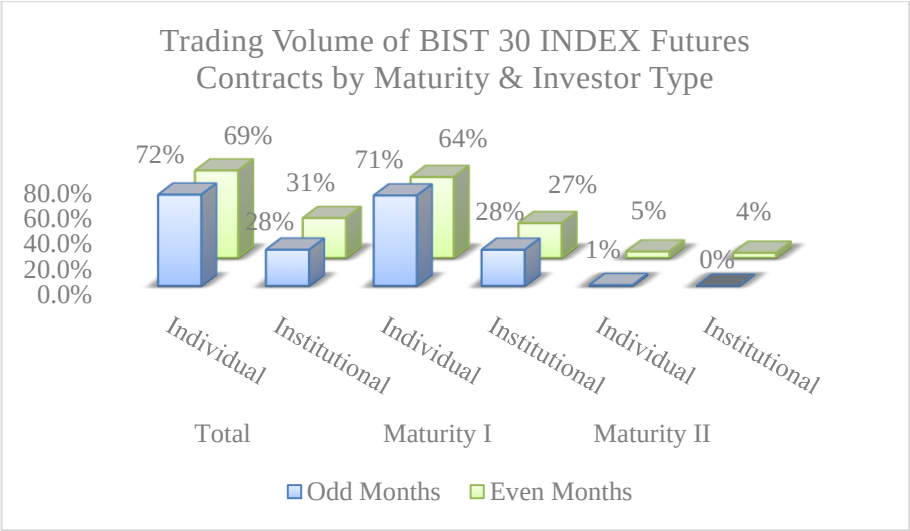

Figure 10: Trading Volume of BIST 30 Futures Contracts by Maturity & Investor Type

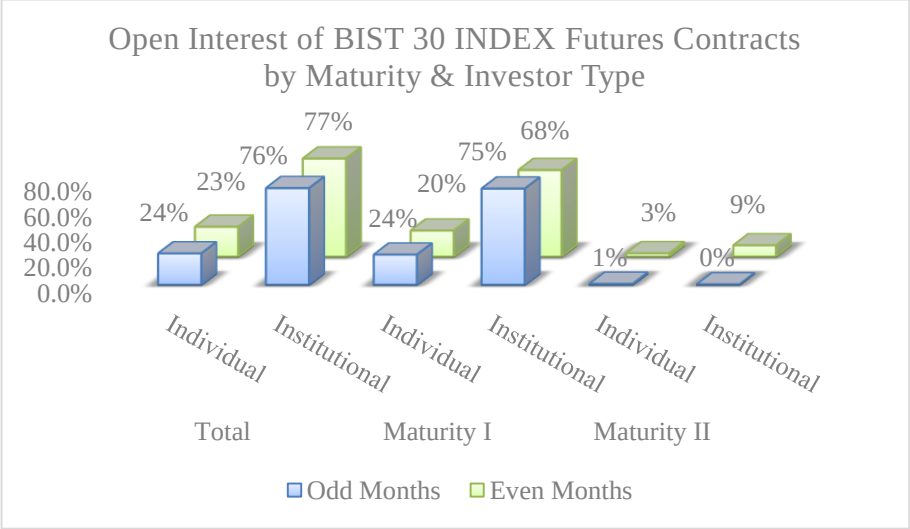

Figure 11: Open Interest of BIST 30 Futures Contracts by Maturity & Investor Type

The breakdown of the daily average open interest for individual and institutional traders is 23.9% and 76.1% respectively when all months and contracts are considered. Figures 10 and 11 indicate that while the individual traders are more active in generating trading volume, the institutional traders hold larger positions in the BIST 30 contracts.

4.2.3.2 USD/TRY FX Futures Contracts

Figure 12 shows that for individual traders, the proportion of all trading taking place in the nearby contract is 78.3% for even months and 94.8% for odd months. When the

next nearby contract is considered, this ratio is 20.3% for even months and 1.1% for distant contracts. For institutional traders, the proportion of the nearby contract in all trading volume is 77.2% for even months and 94.1% for odd months. This ratio is 22.1% for even months when the next nearby contract is considered and nearly 0.7% for the distant contracts.

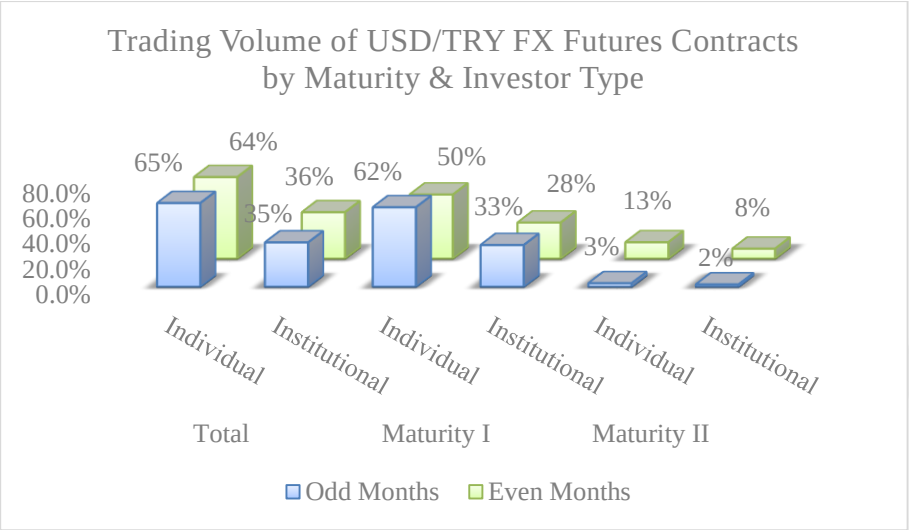

Figure 12: Trading Volume of USD/TRY Futures Contracts by Maturity & Investor Type

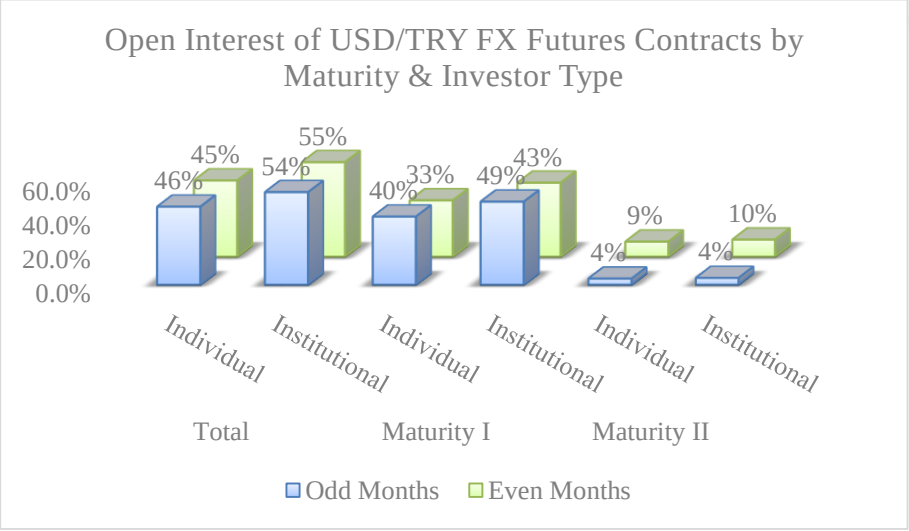

Figure 13: Open Interest of USD/TRY Futures Contracts by Maturity & Investor Type

The breakdown of the daily average open interest for individual and institutional traders is 45% and 55% respectively when all months and contracts are considered. Figures 12 and 13 indicate that, similar to the stock index contracts, while the individual traders are more active in generating trading volume, the institutional

traders hold larger positions in the currency contracts.

4.2.3.3 TRY GOLD Futures Contracts

Figure 14 shows that for individual traders, the proportion of all trading taking place in the nearby contract is 66.4% for even months and 86.9% for odd months. When the next nearby contract is considered, this ratio is 29.7% for even months, 10.6% for odd months and less than 3.2% for distant contracts. For institutional traders, the proportion of the nearby contract in all trading volume is 74.0% for even months and 87.4% for odd months. This ratio is 24.8% for even months and 10.5% for odd months when the next nearby contract is considered and nearly 1.7% for the distant contracts.

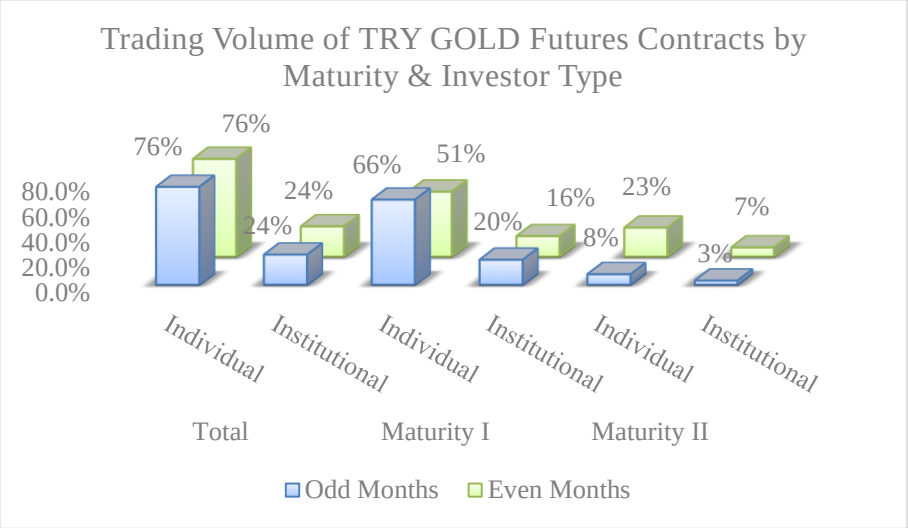

Figure 14: Trading Volume of TRY GOLD Futures Contracts by Maturity & Investor Type

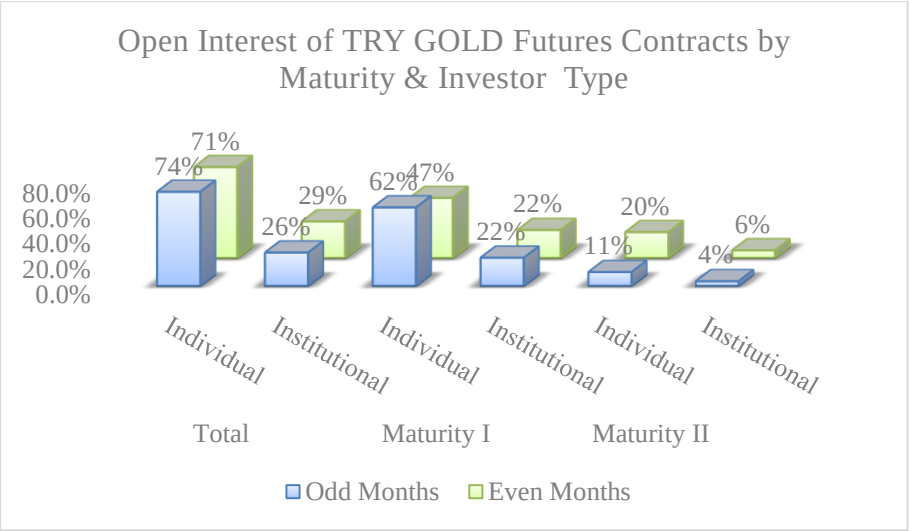

Figure 15: Open Interest of TRY GOLD Futures Contracts by Maturity & Investor Type

The breakdown of the daily average open interest for individual and institutional traders is 75% and 25% respectively when all months and contracts are considered. Figures 14 and 15 indicate that, unlike the stock index and currency contracts, the individual traders not only are more active in generating trading volume but they also hold larger positions compared to the institutional investors in the gold contracts.

4.2.4 Day Trading

Since day trading involves buying and selling the exact same amount of a particular futures contract on the same day and this kind of a transaction does not require posting margins overnight, the impact of margin changes on day trading volume may be different. Therefore, before performing empirical analyses, the proportion of day trading in total trading volume and also the percentages of day trading in each maturity month are analyzed.

The data set provides information on the number of long positions, number of short positions, number of previous day's long position, number of previous day's short position and the trading volume for each account on each contract for each day over the sample period. Using this information, in the first step the accounts that carry the same number of long or short positions two days in a row are identified. This step makes it possible to sort out the accounts whose positions do not change at the end of a specific day compared to the previous day. In the second step, these same accounts

are examined to see if they have any trading volume during the second day in which their positions do not change. If an account does not change its long or short position two days in a row but has non-zero trading volume on the second day, this implies that the second day's trading volume is purely day trading. In the final step, the day trading volumes from each account are summed up on a monthly basis and the day trading volume for each month is calculated. The day trading volume for each maturity month is determined in a similar fashion. It is also important to note that the day trading volumes calculated in this manner represent the minimum day trading volumes in the market since an account may execute transactions on a contract resulting in a change in the number of positions but the total daily trading volume of that account may include both day trading transactions and those transactions that cause the end-of-day positions to change. Since the data set does not include the intraday activities of accounts, it is not possible to determine the level of day trading volumes created in such a manner.

Results of these analyses show that for the BIST 30 contracts approximately 29.7% of monthly trading volume arises from day trading. 97.5% of the total day trading volume is in the nearby contracts and this proportion decreases to 95.3% in maturity months with a simultaneous increase in the day trading of the next nearest contract. For the USD/TRY FX contracts, only 16.9% of monthly trading is day trading. Similar to the index futures, 92.0% of the total day trading volume is in the nearby contracts and this proportion decreases to 87.5% in maturity months with a simultaneous increase in the day trading of the next nearest contract. For the TRY GOLD futures, approximately 11.0% of monthly trading volume arises from day trading. For the maturity months, a similar trend is observed and 76.5% of the total day trading volume is in the nearby contracts and this proportion decreases to 69.2% in maturity months with a simultaneous increase in the day trading of the next nearest contract.

4.3 Determinants of Trading Activity

Analyses up until this point show that time to maturity is a significant factor affecting trading activity. Following the literature, this study also analyzes price volatility, price changes and interest rates as other potential determinants of trading activity. The relationship between trading activity and volatility is extensively examined in the

literature and several studies documented that price changes have an informational impact on trading activity. Some studies present evidence that high prices act as signals of low systematic risk causing a decrease in the motivation for hedging and information-based speculative trading. Studies also show that interest rates as a representative of storage and holding costs may be another factor affecting the trading volume.

Due to the impact of prices on trading activity and the relationship between price and margin levels, the impact of margin levels on trading activity may be ambiguous. The relationship between the settlement price, trading volume and margin levels is presented in Figure 16 for each instrument type. As can be seen from the figure, during the periods where the prices are high, trading volume is likely to decrease. Figure 16 also shows that the exchange manages margins in line with price changes and determines the level of margins in a way to maintain a consistent ratio of the required margin value to the value of a futures contract across time. In other words, the margins are increased as prices increase and decreased as prices decrease. Over the sample period it seems that this ratio is determined as %10, %9 and %8 on average for the BIST 30 INDEX, USD/TRY FX, and TRY GOLD contracts, respectively. While the ratio is more stable for the index and gold futures, it decreases for currency futures over time as prices increase and margin levels decrease.

As long as the adjustments in margins are determined in line with the changes in market conditions, a change in trading activity resulting from margin level changes is not expected to occur. However, if margin changes are larger or smaller than that is necessary to reflect the changes in market conditions, or if margin levels are not changed at all in the face of market changes, then trading activity may be affected. The following analysis methodologies make it possible to address these issues.

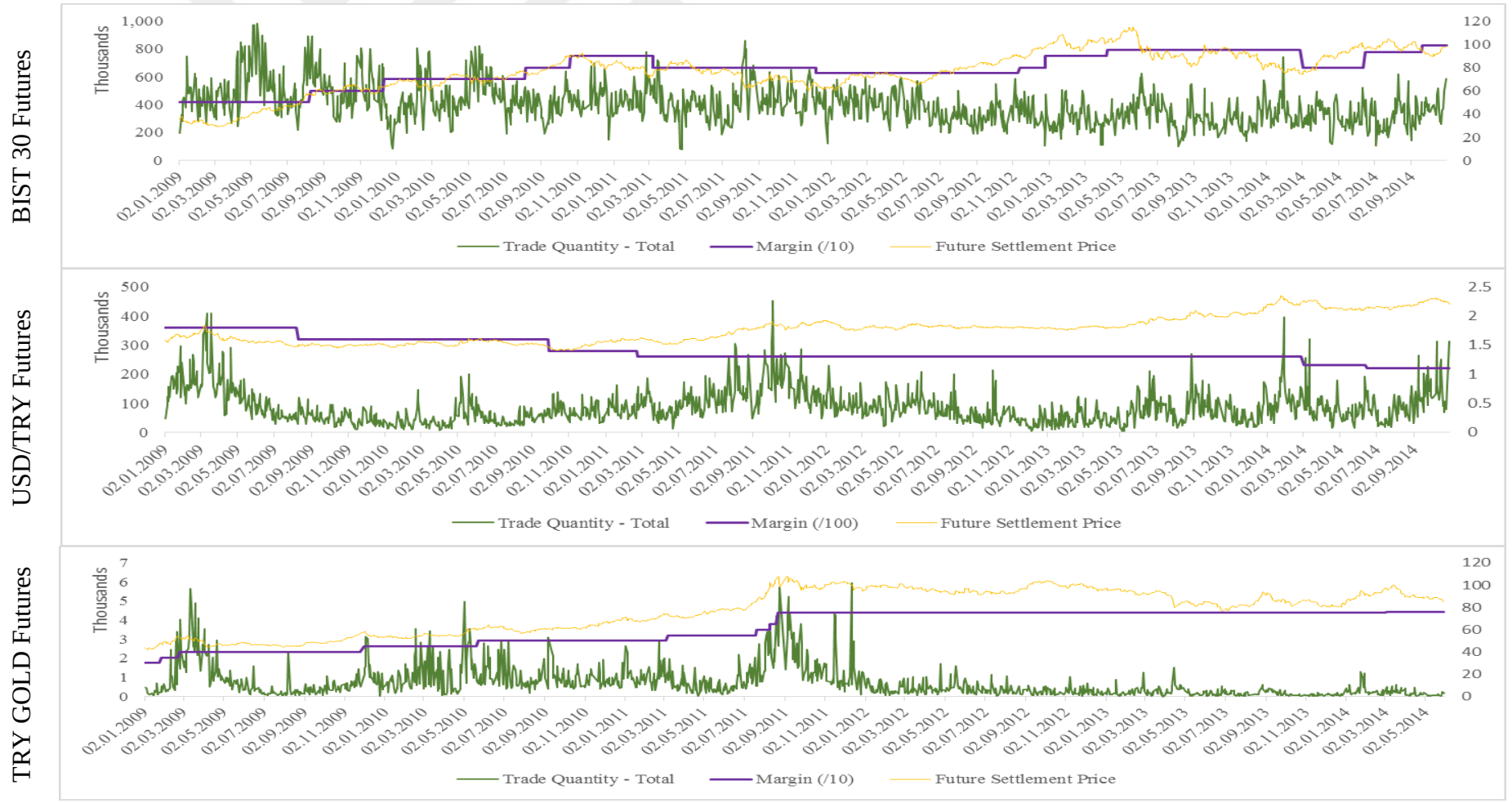

Figure 16: Daily Trading Volume, Margin Level and Settlement Price Series (2009-2014)

4.4 Methods of Measuring Volatility

Historical volatility can be calculated by using several widely accepted methods such as the close-to-close, exponentially weighted, Parkinson, Garman-Klass, Rogers-Satchell and Yang-Zhang volatilities. The close-to-close and exponentially weighted volatility measures use closing prices[20] in the market. The Parkinson measure uses the high and low prices instead of using closing prices. The Garman-Klass, Rogers-Satchell and Yang-Zhang are more advanced volatility measures that use all opening (O), high (H), low (L) and closing (C) prices. Since volatility is not constant during the trading day, advanced volatility measures are more preferable since they include more information about the price process.

4.4.1 Close-to-Close Volatility

Volatility is defined as the annualized standard deviation of log returns and is calculated by the following formula:

$$\text{Close} - \text{to} - \text{Close Volatility} = \sigma = \sqrt{\frac{1}{N}\sum_{t=1}^{N}(x_t - \bar{x})^2}$$

$$x_t = log\frac{p_t}{p_{t-1}}$$

$$\bar{x} = average(x_t)$$

In these equations, p_t is day t's closing price, p_{t-1} is previous day's (t-1) closing price and N is the number of data points.

4.4.2 Garman Klass Volatility

The Garman-Klass volatility is calculated by using the following formula using opening , closing , high, and, low prices:

$$\text{Garman Klass Volatility} = 0.511(u-d)^2 - 0.019[c(u+d) - 2ud] - 0.383c^2$$

In this equation; u is the normalized high price, d is the normalized low price and c

[20] Closing prices in all formulas are the settlement prices for the contracts on a given day.

is the normalized closing price. u, d and c are calculated by the formulas below where p_h is day t's high price, p_l is day t's low price, p_o is day t's opening price and p_c is day t's closing price.

$u = \log p_h - \log p_o$

$d = \log p_l - \log p_o$

$c = \log p_c - \log p_o$

4.4.3 Yang Zhang Volatility

The Yang-Zhang volatility is a modified version of the Garman-Klass volatility. Yang Zhang Volatility is designed to accommodate opening price jumps and has the smallest variance among all estimators with similar properties. It is calculated by using the following formula given a historical data set containing N periods of opening, high, low and closing prices:

$$\text{Yang Zhang Volatility} = V_o + kV_c + (1-k)V_{RS}$$

$$V_o = \frac{1}{N-1}\sum_{t=1}^{N}(o_t - \bar{o})^2 \quad \bar{o} = \frac{1}{N}\sum_{t=1}^{N} o_t$$

$$V_c = \frac{1}{N-1}\sum_{t=1}^{N}(c_t - \bar{c})^2 \quad \bar{c} = \frac{1}{N}\sum_{t=1}^{N} c_t$$

$$V_{RS} = \frac{1}{N}\sum_{t=1}^{N}[u_t(u_t - c_t) + d_t(d_t - c_t)]$$

When k equals k_0 the variance of the volatility estimator reaches the minimum value.

$$k_0 = \frac{0.34}{1.34 + \frac{N+1}{N-1}}$$

In this equation; o is the normalized opening price, u is the normalized high price, d is the normalized low price and c is the normalized closing price. o, u, d and c are calculated as follows where p_h is day t's high price, p_l is day t's low price, p_o is day t's opening price, p_c is day t's closing price and p_{pc} is day t-1's closing price.

$o = \log p_o - \log p_{pc}$

$$u = \log p_h - \log p_o$$
$$d = \log p_l - \log p_o$$
$$c = \log p_c - \log p_o$$

4.5 Description of the Data Used for Empirical Analyses

In the first step, for each instrument type, three types of series are constructed from both the trading volume and the open interest series. The first series is the trading activity of all investors, the second series is the trading activity of individual investors and the third series is the trading activity of institutional investors. The open interest and trading volume for the nearby and next nearest contracts are aggregated while constructing each of these series and the distant contracts are excluded. The sample period of these series is from January 2009 to October 2014 for the BIST 30 and USD/TRY contracts and from January 2009 to May 2014 for the TRY GOLD contracts. These series are used in the regression analyses performed to examine the impact of margin changes on trading activity with control variables.

In the second step, for each instrument type, series with different time intervals are constructed around the effective date of each margin change. These series are used in the event study methodology that is used to determine the impact of margin changes following the effective date of change in the margin level, hereafter called the "event-day". The data series for the different time intervals are constructed in a similar fashion as above for all investors and each investor type and for the nearby and next nearby contracts, excluding the distant contracts.

Over the sample period, there are a total of 12 margin changes with 9 increases and 3 decreases for the BIST 30 INDEX contracts. For the USD/TRY FX contracts, there are 5 margin decreases and for the TRY GOLD contract there are 9 margin increases during the sample period. 9 of the 12 margin changes for the BIST 30 INDEX contract, 3 of the 8 margin changes for the USD/TRY FX contract and 8 of the 9 margin changes for the TRY GOLD contracts were implemented before the merger in 2013 and the remaining changes were implemented after the merger.

As stated before, a contract-based margining system was in place until the merger and

the required margin for each instrument type was being determined by the Exchange. Following the merger, a portfolio-based margining approach was adopted the parameters constituting the basis for margin calculations started to be determined by Takasbank.

Information on margin changes is presented in Tables 5 and 6. Dates represent the effective date of the changes and the margin amounts represent the margin levels that must be charged for one long or short position. Percentage changes in the initial margin levels represent the Turkish Lira change in the margin requirement divided by the Turkish Lira amount of the margin prior to the change.

Tables 5 and 6 also include the information of a time interval[21] surrounding the effective date of change in the margin level. These time intervals are used as "event windows" in the event study analysis and comprise of 30 trading days[22] preceding and 5 trading days succeeding the effective date of the margin changes for each of the contracts. These event windows are time periods during which no other margın changes or significant events related to the market or the contracts take place so that these other events do not create a confounding effect with the margin change under analysis. The 35-day event window is chosen as the longest possible window during which there are no other confounding events. For the TRY GOLD contract, there were three margin changes for which such a window could not be constructed as a result of margin change dates being too close to one another, and therefore, these changes are dropped from the event study analyses.

In the final step, trading volume series are constructed for each account that trades actively on each of the 30 trading days prior to the effective date of margin change. Trading volumes of these accounts on the nearby and next nearest contracts are aggregated while constructing these series for each instrument type and these series are used in the event study analysis.

[21] These intervals exclude weekends, holidays and half days.
[22] 25 trading days are used for the BIST 30 INDEX futures contract's margin change with the effective date December 26, 2012.

Table 5: Information on Margin Changes, January 2009 – October 2014

Contract/ Exchange & Effective Date	New Margin Level (TRY)	Change in Margin Level (%)	Time Interval (Event Window)
BIST 30 INDEX Futures Contracts			
Turkdex			
August 10, 2009	600	20.0%	June 29, 2009 - August 17, 2009
December 11, 2009	700	16.7%	October 23, 2009 - December 18, 2009
August 6, 2010	800	14.3%	June 25, 2010 - August 13, 2010
October 20, 2010	900	12.5%	September 3, 2010 - October 27, 2010
March 7, 2011	800	-11.1%	January 24, 2011 - March 14, 2011
December 7, 2011	750	-6.3%	October 20, 2011 - December 14, 2011
November 12, 2012	800	6.7%	September 25, 2012 - November 19, 2012
December 26, 2012	900	12.5%	November 21, 2012 - January 3, 2013
April 9, 2013	950	5.6%	February 26, 2013 - April 16, 2013
Borsa Istanbul - Derivatives Market			
March 3, 2014	795	-16.3%	January 20, 2014 - March 10, 2014
June 16, 2014	930	17.0%	May 2, 2014 - June 23, 2014
September 19, 2014	990	6.5%	August 8, 2014 - September 26, 2014

Table 6: Information on Margin Changes, September 2007 – October 2014

Contract/ Exchange & Effective Date	New Margin Level (TRY)	Change in Margin Level (%)	Time Interval (Event Window)
USD/TRY FX Futures Contracts			
Turkdex			
August 10, 2009	160	-11.1%	June 29, 2009 - August 17, 2009
September 29, 2010	140	-12.5%	August 12, 2010 - October 6, 2010
February 23, 2011	130	-7,1%	January 12, 2011 - March 2, 2011
Borsa Istanbul - Derivatives Market			
March 3, 2014	115	-11,5%	January 20, 2014 - March 10, 2014
June 16, 2014	110	-4,3%	May 2, 2014 - June 23, 2014
TRY GOLD Futures Contracts			
Turkdex			
January 26, 2009	350	16,7%	December 12, 2008 - February 2, 2009
February 23, 2009	400	14,3%	Omitted
December 1, 2009	450	12,5%	October 13, 2009- December 8, 2009
May 24, 2010	500	11,1%	April 8, 2010 - May 31, 2010
March 7, 2011	550	10,0%	January 24, 2011 - March 14, 2011
July 20, 2011	600	9,1%	June 8, 2011 - July 27, 2011
August 10, 2011	650	8,3%	Omitted
August 22, 2011	750	15,4%	Omitted
Borsa Istanbul - Derivatives Market			
March 3, 2014	760	1,3%	January 20, 2014 - March 10, 2014

4.6 Empirical Methodology

4.6.1 Regression Analysis

First, time series regression analyses are performed to examine the impact of margin changes on trading activity using the series described in the previous section. Following the literature, other determinants of trading activity are included in regression model as control variables and variables of interest, trading volume and open interest, are used as the dependent variables. The regression model is specified as follows:

$$TA_t = \alpha_0 + \alpha_1 \left(\frac{M}{CV}\right) + \alpha_2 TA_{t-1} + \alpha_3 P_t + \alpha_4 V_t + \alpha_5 R_t + \alpha_6 TTM_t + \varepsilon$$

In this equation, M is the Turkish Lira margin required for one contract, CV is the Turkish Lira value of one futures contract. TA_t is trading activity measured by trading volume (TV_t) or open interest (OI_t), TA_{t-1} is the lagged trading activity, P_t is settlement price of the nearby contract, V_t is historical volatility of the nearby futures contract's price, R_t is the interest rate, TTM_t is time to maturity of the contract.

The first dependent variable, trading volume, TV_t is measured by the number of contracts traded. The second dependent variable, open interest OI_t is measured by the number of outstanding futures positions that have not been closed as of the end of the trading day. Logarithmic transformations of both of the dependent variables are used in the estimations.

The first independent variable is the margin level which is measured as the ratio of the required Turkish Lira margin to the Turkish Lira value of the futures contract. The futures contract value is calculated by multiplying the contract size by the settlement price of the nearby contract. This is the variable of interest in the regression model and may have a positive, negative or no impact on the level of trading. As explained above, if the margin change is in line with the changes in market conditions (such as price, volatility, etc.) then the traders may already anticipate this change and their trading activity may not be affected once the margin change in place. However, if the margin change is too large or too small in comparison to the changes in market conditions,

then the margin levels may encourage (too small) or discourage (too large) trading activity.

The first control variable is the settlement price P_t of a futures contract on a given trading day. This variable is included in the model in order to account for the relationship that exists between margin levels, price and volatility. A negative relationship between trading activity and prices is expected since higher margins are required for higher price levels.

The volatility variable is shown to be one of the main determinants of the margin levels and historical volatility, V_t is measured by the methods described in Section 4.4. Volatilities are scaled by 1,000. This variable may have a positive or negative impact on the level of trading activity. On the one hand, derivative contracts are most useful when the volatility of the underlying asset's price increases. This would imply that higher trading may result after an increase in volatility. On the other hand, margin levels are increased after volatility increases and this may discourage traders to trade in the contracts.

The third control variable is the interest rate, R_t and is proxied by the six-month LIBOR rate since it is the most widely used proxy while pricing derivatives. The "risk - free" nature of the interest rate has an important role since it defines the expected growth rates of the underlying asset prices in a risk-neutral world. The interest rate variable also is logarithmically transformed while using in the regression estimations. This variable is included in the model in order to account for the opportunity cost of posting margins. If margin levels are increased, this may represent a higher opportunity cost for the traders and, therefore, may have a negative impact on the level of trading.

The last control variable, time to maturity, TTM, is included in the regression equation in order to control for the maturity effect. In order to minimize the maturity effects, trading activities on the nearby and next nearest contracts are aggregated and single series are constructed. It is observed that just before the nearby contract reaches maturity there is a drastic increase in both the trading volume and the open interest of the next nearest contracts. TTM is a dummy variable included in the regressions in

order to control for this drastic change in trading activity and is equal to one during the four days prior to the expiration date and zero otherwise.

In addition to the control variables described above, a number of dummy variables are included in the regressions in order to account for the effect of some major market events. The first trade day dummy, D_{FT}, controls for the effect of the first trading day on open interest; the foreign holiday dummy, D_{FH}, controls for impact of foreign holidays on trading volume; the 2009 May dummy, D_{2009M5}, controls for the significant increase in trading volume following the credit crisis in 2008 and finally the 2010 second quarter dummy, D_{2010Q2}, controls for the impact of the Greece debt crisis on trading activity.

The regression parameters are estimated by using the Ordinary least squares (OLS) methodology. Standard errors are corrected for heteroscedasticity and autocorrelation by the Newey and West heteroscedasticity and autocorrelation consistent covariance matrix.

4.6.2 Event Study Analysis

In this part of the study, the impact of margin changes on trading activity is analyzed by examining the changes in trading volume and open interest during an event window constructed around the "event-day". The construction of these windows are described above. The event windows include the 30 trading days preceding and the 5 trading days succeeding the effective date of the margin changes. Instead of testing the differences in trading activity means before and after the event day as most of the previous studies[23], in this study a "predicted" value of trading activity is first estimated in order to serve as the value of "normal" trading activity that would be observed in the absence of the margin change. In order to calculate this "predicted" value of trading activity, $f(ta_{it})$, first the following regression equation is estimated over the period between days -30 and -1 preceding the event day and it models the effect of all related variables on trading activity except for the margin changes:

[23] As additional analyses, the results of testing the differences in means across an 11-day window around the effective day of margin changes are summarized in the Appendix section (Table B1 and Table B2)

$$TA_t = \alpha_0 + \alpha_1 P_t + \alpha_2 V_t + \alpha_3 TTM_t + \varepsilon_t$$

The variables in this equation are defined as before. TA_t is the trading activity measured by either trading volume (TV_t) or open interest (OI_t), P_t is settlement price of the nearby contract, V_t is the historical volatility of the underlying asset's price and TTM_t is time to maturity dummy. In addition, the first trade day dummy, D_{FT}, and the foreign holiday dummy, D_{FH}, are also used in the regression model.

Once the regression coefficients are estimated, these coefficients are used to calculate the predicted values of trading activity (volume or open interest) during days +1 to +5 following the event day. Since the predicted values are calculated by using coefficients estimated from a time window during which no other margin changes or major market or contract related events take place, these values represent the trading activity that should be "normally" observed in the absence of a margin change. As a final step, the difference between the predicted and actual values of trading activity is calculated in order to measure the effect of margin changes on trading activity:

$$ATA_{it} = \varphi_{it} = ta_{it} - f(ta_{it})$$

In this equation φ_{it} is the abnormal trading activity on instrument type i at time t, ta_{it} is the actual value of trading activity on instrument type i at time t and $f(ta_{it})$ is the predicted value of trading activity on instrument type i at time t. In this context, abnormal trading activity is the trading activity that is estimated to be generated as a result of a margin change. The actual value of trading activity, as the name implies, is the observed value of trading activity.

The null hypothesis to test is about the mean of the abnormal trading activity. The value of abnormal trading activity is squared. If margin changes have no impact on trading activity then abnormal trading activity throughout the five-day window should be equal to 0. If the null hypothesis is rejected then it can be concluded that margins have an impact on trading activity. Formally, the relevant hypotheses are written as follows:

$$H_0: \sum_{i=1}^{N} {\varphi_{it}}^2 = 0$$

$$H_1: \sum_{i=1}^{N} {\varphi_{it}}^2 \neq 0$$

In order to test the null hypothesis, the following test statistic is used:

$$test\ statistic = \frac{RSS - RSS_1}{RSS_1} \times \frac{T_1 - k}{T_2}$$

In this equation T_2 is the number of observations that the model is attempting to predict, T_1 is the number of observations between days -30 and -1 in the event window and k is the number of parameters that is used in the regression model. The test statistic is distributed as F(T_2, T_1-k).

CHAPTER 5

EMPIRICAL RESULTS

This chapter is organized into two sub-sections in order to provide the empirical results obtained by employing the Eviews software. The first section provides the results of regression analyses examining the impact of margin levels on trading activity using the sample period from 2009 to 2014. The second section presents the event study analysis results.

5.1 Regression Results

The results of the regression estimations are reported in Table 7 for trading volume and in Table 8 for open interest. Both tables present the results for all three contract types. For each instrument type, results are shown for all investors first and then for individual and institutional investors separately.

In Table 7, when the coefficient estimates for the margin variable is examined, it is observed that it is significantly negative in all models except for the institutional investor model for the BIST 30 INDEX contract where it is not significant. These results are in line with the previous literature findings and indicate that an increase in margin levels relative to the contract size discourages traders in the market and the trading volume declines. When the coefficients of the control variables are examined, it is seen that the past trading volume and volatility variables and the time to maturity dummy have significantly positive coefficients and the settlement price has significantly negative coefficients for all contract and investor types. The only exception is the insignificant coefficient of the settlement price variable in the institutional investor model for the BIST 30 INDEX contract and the individual investor model for the USD/TRY FX contract. The coefficients of the time to maturity dummies in the individual investor model for the BIST 30 INDEX contract and

institutional investor model for the TRY GOLD contract are also insignificant. The interest rate variable has both significantly negative and positive coefficients in the models for the BIST 30 INDEX and USD/TRY FX contracts. The coefficients of the interest rate variable are insignificant in the TRY GOLD contract models. When the coefficients of the dummy variables are examined, it is seen that the 2009 May and 2010 second quarter dummies have significantly positive coefficients and the foreign holiday dummy has significantly negative coefficients for all contract and investor types. The only exception is the insignificant coefficients of the 2009 May and 2010 second quarter dummies in the institutional investor models. These results also are consistent with the previous literature and the hypotheses formed in this study.

In Table 8, the results that are presented for open interest are mixed. Changes in margins seem to have a significant and negative effect only on the TRY GOLD contract open interest held by both trader types and the BIST 30 INDEX contract open interest held by individual traders. Although the margin changes have a consistently negative effect on the trading volume in these three contracts, only the open interest of the TRY/GOLD contract is affected from margin changes.

Results of the regression analyses should be interpreted considering the differences between the transactions that generate trading volume and open interest in the market. Trading volume is the total quantity of derivatives contracts bought and sold during a trading period. Open interest is the number of outstanding derivatives positions that have not been closed at the end of a trading day. When positions are opened either as a buy or sell, both of these transactions add to the open interest. As a result of the opening transactions, both trading volume and open interest increase in the market. When traders want to get out of their positions they need to enter into closing transactions. The precondition of a closing transaction is the existence of an opening transaction. Closing transactions decrease open interest but still increase trading volume. There are different types of traders in the market. Some traders hold their positions for a long time while some others get out of their positions in a short time interval, within the same day or within a few days. The first group of traders increases both trading volume and open interest; however, the second group of investors increases only the trading volume. Moreover, the contribution of the second group to trading volume is much larger as a result of more frequent trading. For instance, the

trading volume arising from day trading is part of the second group. A differentiation between trading volumes arising from the transactions of these two groups should also be considered while interpreting the results of the regression equations. If trading volume of the first group of long-term traders changes after the margin level changes, then open interest would change also due to the trading volume change. However, if the trading volume arising from the transactions of the second group of short-term traders changes following the margin changes, this time open interest would not change due to the changes in trading volume.

For the BIST 30 INDEX contract, the trading volume of the individual investors is almost 70% of the total trading volume but this ratio becomes reversed for open interest and nearly 75% of the total open interest is held by institutional investors. These ratios indicate that institutional investors hold the substantial proportion of open interest in the market whereas individual investors do not hold onto most of their positions and close out in a short time. This difference in trading strategies suggests that a substantial proportion of total trading volume of individual traders is in the form of short-term trading. This implication may be interpreted to mean that margin levels have a negative impact on trading volume but no direct impact on open interest. For individual investors, after margin levels increase (decrease) both types of trading volume decrease (increase). Open interest decreases (increases) at the same time since long-term trading decreases (increases) as a result of the margin increase (decrease). The change in open interest arises from the change in trading volume, not from the change in margin levels. This interpretation is consistent with the observation that the coefficient for institutional investors is insignificant in the open interest models. Neither the trading volume nor the open interest of institutional investors is affected from margin level changes.

For the USD/TRY FX contract, results in Tables 7 and 8 imply that as margin levels increase, trading volume changes in the negative direction without impacting open interest. These results further suggest that short-term trading volume is affected from margin changes; however, open interest does not change since long-term trading volume is unaffected.

For the TRY/GOLD contract, the results in Tables 7 and 8 suggest that as margin levels

increase, long-term trading volume decreases and there is a simultaneous decrease in open interest also arising from the changes in the trading volume.

Table 7: Results of Regression Analyses on Trading Volume

Contract	Trading Volume	Intercept	Margin/Contract Value	Trading Volume	Settlement Price	Volatility	Interest Rate	Time to Maturity	Foreign Holiday	2009 May	2010 Q2	Adj R^2
		α_0	M/CV	TV_{t-1}	P_t	V_t	R_t	TTM	D_{FH}	D_{2009M5}	D_{2010Q2}	
BIST 30 INDEX Futures	All investors	8.03	-1.88	0.44	-0.01	0.19	-0.11	0.13	-0.44	0.18	0.20	0.61
		(18.13)*	(-2.08)*	(15.46)*	(-7.88)*	(3.26)*	(-2.27)*	(5.91)*	(-11.40)*	(4.62)*	(7.87)*	
	Individual	7.23	-2.36	0.52	-0.01	0.17	-0.18	0.02	-0.37	0.15	0.21	0.69
		(15.76)*	(-2.75)*	(18.18)*	(-9.12)*	(3.03)*	(-3.97)*	(0.81)	(-10.89)*	(3.78)*	(8.91)*	
	Institutional	6.47	0.45	0.39	0.001	0.23	0.19	0.35	-0.57	0.19	0.10	0.46
		(18.75)*	(0.39)	(14.99)*	(1.60)	(3.75)*	(2.89)*	(12.96)*	(-9.76)*	(4.52)*	(1.73)	
USD/TRY FX Futures	All investors	5.68	-10.38	0.48	-0.64	1.61	0.94	0.21	-0.48	0.18	0.12	0.57
		(10.68)*	(-5.27)*	(14.07)*	(-4.00)*	(2.60)*	(-7.93)*	(6.04)*	(-7.93)*	(2.49)*	(1.88)	
	Individual	3.74	-4.55	0.50	-0.08	1.61	0.96	0.13	-0.46	0.17	0.16	0.64
		(8.63)*	(-2.58)*	(14.85)*	(-0.52)	(2.41)*	(7.89)*	(3.70)*	(-8.23)*	(2.48)*	(2.68)*	
	Institutional	8.66	-22.97	0.45	-1.99	1.71	1.01	0.36	-0.59	0.13	0.07	0.44
		(11.98)*	(-8.11)*	(13.75)*	(-7.94)*	(3.10)*	(7.13)*	(7.21)*	(-6.10)*	(1.46)	(0.81)	
TRY GOLD Futures	All investors	6.23	-35.80	0.56	-0.01	0.79	-0.07	0.20	-0.40	0.26	0.33	0.56
		(9.13)*	(-6.15)*	(14.69)*	(-4.24)*	(4.59)*	(-0.45)	(3.04)*	(-3.55)*	(2.84)*	(3.31)*	
	Individual	5.09	-30.70	0.59	-0.0005	0.81	0.005	0.20	-0.33	0.30	0.33	0.57
		(8.28)*	(-5.72)*	(15.91)*	(-2.99)*	(4.80)*	(0.03)	(3.37)*	(-3.27)*	(3.61)*	(3.87)*	
	Institutional	11.04	-70.51	0.39	-0.02	0.46	-0.51	0.14	-0.49	0.23	0.37	0.40
		(9.31)*	(-7.14)*	(8.58)*	(-6.58)*	(2.18)*	(-1.77)	(1.09)	(-2.22)*	(1.35)	(1.70)	

Model: $TV_t = \alpha_0 + \alpha_1\left(\frac{M}{CV}\right) + \alpha_2 TV_{t-1} + \alpha_3 P_t + \alpha_4 V_t + \alpha_5 R_t + \alpha_6 TTM_t + \varepsilon$ Note: t Statistics in parentheses *Significant at the 5% level

Table 8: Results of Regression Analyses on Open Interest

Contract	Open Interest	Intercept α_0	Margin/Contract Value M/CV	Open Interest TO_{t-1}	Settlement Price P_t	Volatility V_t	Interest Rate R_t	Time to Maturity TTM	First Trade Day D_{FT}	Adj R^2
BIST 30 INDEX Futures	All investors	0.30	0.06	0.97	0.00	(-0.06)	0.004	0.01	-0.23	0.96
		(3.43)*	(0.54)	(136.37)*	(0.29)	(-2.33)*	(0.43)	(3.47)*	(-15.75)*	
	Individual	0.70	-0.48	0.95	-0.00	(-0.27)	-0.003	-0.01	-0.12	0.96
		(7.47)*	(-3.04)*	(142.66)*	(-5.09)*	(-6.60)*	(-0.31)	(-2.37)*	(-9.53)*	
	Institutional	0.24	0.15	0.98	0.00	-0.01	0.01	0.02	-0.26	0.97
		(3.21)*	(1.09)	(155.15)*	(1.25)	(-0.18)	(0.64)	(4.13)*	(-13.99)*	
USD/TRY FX Futures	All investors	0.42	0.24	0.95	0.06	-0.46	0.01	-0.02	-0.26	0.96
		(4.61)*	(1.06)	(101.69)*	(3.10)*	(-1.31)	(0.53)	(-2.99)*	(-8.03)*	
	Individual	0.64	-0.04	0.93	0.04	-0.01	0.03	-0.02	-0.18	0.93
		(6.76)*	(-0.19)	(104.90)*	(2.12)*	(-0.02)	(2.13)*	(-3.25)*	(-6.77)*	
	Institutional	0.34	0.46	0.96	0.08	-0.74	0.002	-0.02	-0.31	0.95
		(3.68)*	(1.44)	(108.29)*	(2.90)*	(-1.77)	(0.08)	(-1.85)	(-7.60)*	
TRY GOLD Futures	All investors	0.46	-3.01	0.98	0.00	-0.37	-0.002	0.004	-0.26	0.98
		(4.42)*	(-4.20)*	(161.87)*	(-2.69)*	(-1.50)	(-0.11)	(0.36)	(-5.10)*	
	Individual	0.54	-3.54	0.97	-0.00	-0.43	-0.004	0.004	-0.15	0.98
		(5.48)*	(-5.03)*	(165.35)*	(-3.11)*	(-1.62)	(-0.30)	(0.28)	(-3.18)*	
	Institutional	1.02	-5.67	0.94	-0.00	-0.04	-0.01	0.002	-0.98	0.93
		(3.01)*	(-2.73)*	(56.87)*	(-2.75)*	(-0.05)	(-0.17)	(0.10)	(-3.85)*	

Model: $OI_t = \alpha_0 + \alpha_1\left(\frac{M}{CV}\right) + \alpha_2 OI_{t-1} + \alpha_3 P_t + \alpha_4 V_t + \alpha_5 R_t + \alpha_6 TTM_t + \varepsilon$ Note: t Statistics in parentheses *Significant at the 5% level

5.2 Results of Event Study Analyses

The results of the event study analyses are reported in Table 9 for trading volume and in Table 10 for open interest. Both tables present the results for all three contract types. For each instrument type, results are shown for all investors first and then for individual and institutional investors separately.

The results for both the trading volume and open interest analyses indicate that for the majority of the margin changes, it is not possible to provide evidence of a significant change in trading activity during the five days immediately following the margin change. Since the results are mostly insignificant, the same analyses are repeated by using data at the account level for those individual and institutional traders that actively traded on each of the 30 days preceding the event day. More specifically, for all margin changes regarding the BIST 30 INDEX, 1,141 individual and 156 institutional accounts are analyzed with the event study methodology using separate regression equations for each account. For the USD/TRY FX contract, 16 individual and 5 institutional accounts and for the TRY GOLD, one individual account were analyzed. Similar to the aggregated results, most of the F statistics were insignificant.

As stated in the previous sections, the regulatory authority manages margins in line with the price changes in the market and determines margins in a way to maintain a consistent ratio of required margin value to the value of a futures contract across time. The insignificant trading activity changes that are observed during the 5 days immediately following the margin changes may imply that the regulatory authority may not be quick enough to adjust the margin levels unless some extreme price movements occur. Instead, the regulators seem to wait until more definitive and pronounced price trends occur in the market before changing the margin levels. In fact, in most of the cases, margins seemed to be adjusted at the ends of price trends. When the reaction by the regulators to the price trends is delayed in such a manner, the market seems to anticipate the margin change that will occur towards the end of the price trend. As a result, when the trading activity is analyzed for the days that immediately follow the effective date of the margin changes, it is not surprising to find that there is no significant reaction in the market and the trading activity does not seem to change in response to the margin changes.

Table 9: Results of Event Study Analyses on Trading Activity

Contract	Exchange/ Effective Date	All Investors		Individual		Institutional	
		F-stat	p-value	F-stat	p-value	F-stat	p-value
BIST 30 INDEX Futures	Turkdex						
	August 10, 2009	1.83	0.14	1.78	0.15	2.25	0.07
	December 11, 2009	1.08	0.40	1.30	0.29	1.06	0.41
	August 6, 2010	1.18	0.35	1.12	0.38	0.98	0.46
	October 20, 2010	1.01	0.43	2.39	0.07	2.01	0.11
	March 7, 2011	0.22	0.97	0.62	0.71	1.09	0.40
	December 7, 2011	0.29	0.93	0.36	0.90	0.23	0.96
	November 12, 2012	0.41	0.86	0.47	0.82	0.54	0.77
	December 26, 2012	4.65	0.01*	0.95	0.47	6.56	0.00*
	April 9, 2013	1.26	0.31	1.77	0.15	0.15	0.99
	BIST Derivatives Market						
	March 3, 2014	0.88	0.52	0.66	0.68	1.44	0.24
	June 16, 2014	3.09	0.02*	2.04	0.10	4.64	0.00*
	September 19, 2014	0.23	0.96	0.10	1.00	0.97	0.47
USD/TRY FX Futures	Turkdex						
	August 10, 2009	7.58	0.00*	8.01	0.00*	3.18	0.02*
	September 29, 2010	0.43	0.85	0.37	0.89	0.28	0.94
	February 23, 2011	2.05	0.11	2.41	0.06	1.68	0.18
	BIST Derivatives Market						
	March 3, 2014	3.47	0.01*	2.51	0.05*	3.73	0.01*
	June 16, 2014	0.59	0.74	0.31	0.93	0.99	0.45
TRY GOLD Futures	Turkdex						
	January 26, 2009	1.14	0.37	1.24	0.33	0.60	0.73
	December 1, 2009	1.90	0.12	2.06	0.10	1.15	0.36
	May 24, 2010	2.05	0.10	3.12	0.02*	3.11	0.02*
	March 7, 2011	1.01	0.44	0.92	0.50	1.27	0.31
	July 20, 2011	2.62	0.04	1.18	0.35	5.26	0.00
	BIST Derivatives Market						
	March 3, 2014	1.61	0.19	1.58	0.20	1.47	0.16

*Significant at the 5% level

Table 10: Results of Event Study Analyses on Open Interest

Contract	Exchange/ Effective Date	All Investors		Individual		Institutional	
		F-stat	p-value	F-stat	p-value	F-stat	p-value
BIST 30 INDEX Futures	Turkdex						
	August 10, 2009	5.27	0.00*	4.75	0.00*	5.16	0.00*
	December 11, 2009	0.96	0.47	1.34	0.28	1.05	0.42
	August 6, 2010	0.34	0.91	1.62	0.18	1.09	0.39
	October 20, 2010	2.41	0.06	7.59	0.00*	0.76	0.59
	March 7, 2011	3.99	0.01*	0.18	0.98	3.79	0.01*
	December 7, 2011	0.71	0.64	0.70	0.65	0.39	0.88
	November 12, 2012	0.38	0.89	0.44	0.85	0.39	0.88
	December 26, 2012	14.60	0.00*	3.95	0.01*	7.48	0.00*
	April 9, 2013	0.13	0.99	0.83	0.56	0.52	0.79
	BIST Derivatives Market						
	March 3, 2014	2.40	0.06	1.63	0.18	2.43	0.05*
	June 16, 2014	1.79	0.14	0.65	0.69	1.77	0.14
	September 19, 2014	2.06	0.10	0.79	0.59	1.84	0.13
USD/TRY FX Futures	Turkdex						
	August 10, 2009	8.95	0.00*	4.21	0.00*	9.22	0.00*
	September 29, 2010	1.41	0.25	2.43	0.06	1.00	0.45
	February 23, 2011	0.18	0.97	1.20	0.34	0.70	0.63
	BIST Derivatives Market						
	March 3, 2014	3.22	0.02*	1.37	0.26	5.97	0.00*
	June 16, 2014	3.47	0.01*	0.72	0.64	13.34	0.00*
TRY GOLD Futures	Turkdex						
	January 26, 2009	0.23	0.96	0.61	0.72	0.73	0.63
	December 1, 2009	1.91	0.12	0.74	0.62	2.98	0.03*
	May 24, 2010	1.28	0.30	0.64	0.69	0.88	0.53
	March 7, 2011	0.14	0.99	0.13	0.99	0.35	0.90
	July 20, 2011	3.74	0.01*	5.28	0.00*	2.32	0.07
	BIST Derivatives Market						
	March 3, 2014	0.05	0.99	0.03	0.99	1.54	0.21

*Significant at the 5% level

CHAPTER 6

SUMMARY AND CONCLUSION

In this study the impact of margin levels on futures trading activity, as measured by trading volume and open interest, is analyzed. Data on the three most liquid futures, namely the BIST 30 INDEX, USD/TRY FX, and, TRY GOLD contracts, are used in the analyses over the sample period from January 2009 to October 2014. The impact of margin levels on trading activity is analyzed by using a data set that makes it possible to trace the trading activity of each maturity month, each investor type and each account separately. While identifying investors as individual or institutional makes it possible to trace their trading activity separately, identifying each account makes it possible to trace their trading activity and to determine day trading volumes.

Before conducting empirical tests, both trading volume and open interest data of each instrument type is analyzed in detail and these results provide important insights into the empirical analyses. In accordance with the results of preliminary analyses, data used in the empirical analysis is limited to the nearby and next nearest contract due to the low trading activity in the distant contracts. Trading activities on the nearby and next nearest contracts are aggregated to obtain single series for each instrument type and these series are used in the empirical analyses. Within each instrument type, different series are constructed for all investors as well as for each investor type and for each account. Thus, the impact of margin levels on trading activity is examined considering the trading activity of the entire market as well as considering the differences between investor types and accounts.

In the empirical analyses, first regression analyses are performed in order to examine the impact of margin levels on trading activity. Next, an event study methodology is adopted to examine the immediate impact of margin changes on trading activity during the days following the margin changes. Two aspects of the empirical analyses are particularly worth emphasizing. First, unlike most of the previous studies, while examining the impact of margin levels on trading activity, the ratio of the margin level

to contract value, rather than the margin level itself, is included as an independent variable in regression models. The rationale behind this approach is the argument that exogenous margin levels may affect trading activity rather than endogenous margin levels which means as long as margins are determined as required by the market conditions there will be no change in trading activity as a result of a change in the margin levels. Second, in the previous studies, when an event study methodology is adopted, the mean values of trading activity are compared on a before- and after-event basis in order to analyze the impact of margin changes. In this study, the predicted value of trading activity is estimated for the 5 days immediately following the effective date of the margin change by using coefficients from a regression that is estimated with data from the period between days -30 to -1 preceding the margin change date. These predicted values are compared to the actual trading activity values in order to test the impact of the margin changes.

Results of the regression analyses imply that margin levels have a significant impact on trading volume without necessarily having a direct impact on open interest. As margin levels increase, trading volume decreases and it seems that there is an indirect impact of margin levels on open interest. Results do not show clear differences in the impact of margin levels on the trading activity of individual versus institutional traders. However, the findings are consistent with the hypothesis that the impact of margin levels on trading activity changes depending on the trader types in the market who have different trading strategies and also different cost and risk preferences. For this reason, trading volume is categorized further by considering the holding period of positions, opening transactions and closing transactions. Results show that if margin levels affect long-term traders, then open interest also changes due to the change in trading volume. However, if margin changes have an impact only on short-term traders, then no change is observed in open interest. These results also may be interpreted to imply that margins impose significant transaction costs and execution costs rather than opportunity costs or default costs. This result regarding the opportunity cost is consistent with previous studies which argue that the opportunity cost of posting margin is zero since margins requirements may be satisfied by posting in the form of Treasury securities and traders receive interests payments on these securities as well as on the principal amounts they hold at the Takasbank. Takasbank accepts assets other than cash in Turkish Lira such as convertible foreign currency,

government domestic debt securities or stocks included in the BIST 30 index.[24] In addition, Takasbank pays interest on cash collaterals according to the current market conditions on a best efforts basis.

Results of the event study analyses are consistent with the argument that exogenous margin levels may affect trading activity rather than endogenous margin levels which means that if margins are not larger or smaller than that is required by market conditions then there will be no impact on trading activity. After the effective date of margin changes, no significant changes in trading volume and open interest are observed. Analyses imply that the regulatory authority may wait too long for definitive price trends to appear before changing the margin levels and in most of the cases margins seemed to be adjusted at the end of trends as a constant ratio of the margin level to the contract value. These changes seem to be anticipated by traders in advance and, therefore, no significant change in trading activity is observed during the days immediately following the margin change dates.

[24] At least 50% of the margin requirement should be comprised of cash collateral denominated in Turkish Lira when a new position is opened in the Market.

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APPENDIX A

LITERATURE REVIEW SUMMARY

Table A1/a: Sample Data Used in Previous Studies

Year	Author/ Reference	Data		
		Exchange	Contracts used in analyses	Sample Period
1967	Nathan [22]	Chicago Board of Trade (CBOT)	Corn, wheat and soybean futures contracts	1956-1966
1969	McCain [21]	Chicago Board of Trade (CBOT)	Wheat futures contracts	1936-1968
1972	Bear [3]	Chicago Board of Trade (CBOT)	Wheat and soybean futures contracts	1948-1969
1986	Fishe and Goldberg [12]	Chicago Board of Trade (CBOT)	Corn, iced broilers, soybeans, soybean oil, soybean meal, wheat, plywood, oats, silver, and gold futures contracts	1972-1978
1986	Hartzmark [18]	Chicago Board of Trade (CBOT) Chicago Mercantile Exchange (CME)	Wheat and U.S. Treasury bond futures contracts (CBT) Pork bellies and feeder cattle futures contracts (CME)	1977-1981
1984	Figlewski [11]	Chicago Mercantile Exchange (CME) ICE Futures US (NYBOT)	Stock index futures (S&P 500, Nyse Composite, Value Line)	1975-1983
1985	Tomek [28]	Chicago Board of Trade (CBOT) Chicago Mercantile Exchange (CME)	Soybeans, corn, wheat, live hogs, treasury bonds, silver, copper, gold futures contracts	1970-1982

Table A1/b: Sample Data Used in Previous Studies

Year	Author/ Reference	Data		
		Exchange	Contracts used in analyses	Sample Period
1986	Gay et al. [15]	Chicago Board of Trade (CBOT)	Wheat, corn, oats, soybeans, soybean oil, soybean meal, gold, silver, GNMAs, and T-Bonds futures contracts	1979-1983
1990	Fishe et al. [13]	Chicago Board of Trade (CBOT)	Corn, gold, iced broilers, oats, plywood, silver, soybeans, soymeal, soyoil, wheat futures contracts	1972-1988
1999	Longin [20]	Commodity Exchange (COMEX)	Silver futures contracts	1975-1994
1999	Adrangi and Chatrath [1]	Chicago Board of Trade (CBOT)	Soybean and corn futures contracts	1986-1995
2003	Dutt and Wein [9]	Chicago Board of Trade (CBOT)	Corn, oats, wheat, gold, 10-year treasury notes, and the Dow Jones Industrial Average Index futures contracts	1982-2001
2013	Phylaktis and Aristidou [24]	Athens Derivatives Exchange (ADEX)	FTSE/ASE 20 Index futures contracts	1999-2005
2014	Chou et al. [7]	Taiwan Futures Exchange (TAIFEX)	Index and Mini Index futures contracts	2002-2008

Table A2/a: Methods and Results of Empirical Studies Analyzing the Impact of Margins on Volatility

Year	Author	Method Used in Empirical Studies (Impact of Margins On Volatility)	Results of Empirical Studies
1972	Bear [3]	Margin levels are used as a basis for rational subgrouping methodology. Relation between margin levels and price behavior is analysed using serial correlation and run analysis. The characteristics of the distributions of daily price changes are examined. Each subgroup is compared with the normal distribution by the Kolmogorov-Smirnov one sample test and with each other by the Kolmogorov-Smirnov two sample test.	Positive, negative and independent price behavior periods are systematically evident over the range of margin levels. Large price changes are clustered and positively dependent. Price Change distributions in different margin-grouped periods are significantly different but all leptokurtic. Variation in observed dependency and distribution properties are consistent with the hypothesis that high margin levels randomize price behavior.
1985	Tomek [28]	Price data is clasified into periods with different levels of margins. First-order autocorrelation coefficients are determined for each group. Kolmogorov- smirnov test is performed. Statistics are computed to test for deviations of the distributions of price changes from normal distribution and also differences between price changes distributions of smallest margin group and largest margin group. Departure from normality is measured by a kurtosis statistic.	Margin levels do not effect the degree of autocorrelation in prices. Results suggest significant departures of the distributions from normality. Generally, distributions shift toward normality and become platykurtic as the margin levels increase.
1986	Hartzmark [18]	Price volatility is calculated in two different ways: average of the square of the day-to-day change in the log of the closing price and open, high, low and close (OHLC) volatility index. Nearby price volatility measures averaged for 25 trading days before and after margin changes. For absolute price changed squared F-statistics and for volatility index t-statistics are computed. (wilcoxon rank-sum test is used)	There is no support to predict a systematic relationship between margin changes and price volatility. There is a significant change in OHLCi n 4 of the 13 cases (at the 2.5% level) There is a significant change in the squared absolute price change in 1 of the 13 cases (at the 5% level)

Table A2/b: Methods and Results of Empirical Studies Analyzing the Impact of Margins on Volatility

Year	Author	Method Used in Empirical Studies (Impact of Margins On Volatility)	Results of Empirical Studies
1990	Fishe et al. [13]	Price volatility (standard deviation of the difference between high and low prices for the day) is calculated for twenty day before and after the margin change. Pearson's X^2 Test is conducted. (for all margin changes, only for margin increases and only for margin decreases) To find out the differentiation among margin changes by size of the change the percentage change in price volatility is regressed before and after the margin change on the percentage change in margins and percentage change in open interest. T-statistics are computed. Percentage change in price volatillity is measured by the change in the standart deviation of the difference between the high and low prices of the day.	The results are mixed and show that there is an inconsistent relationship between margin changes and price volatility. When all contracts are considered no statistically significant coefficient are found.
1999	Adrangi and Chatrath [1]	Tests for endogeneity of the margin and volatility variables are conducted. Hausman (1978) specification test in an errors-in-variables model is conducted. Following the evidence on endogeneity, the relationship between volatility, margins, and trading activity is examined using the trivariate near-vector autoregressive (VAR) model.	For the change in margins , initial margins as a percentage of contract value, and the conditional volatility (only weakly for jump volatility), the hypothesis of nonendogeneity is strongly rejected No evidence is found to indicate that extreme volatility is impacted by either futures trading activity or margins.
2014	Chou et al. [7]	Parkinson high-low volatility and realized volatility (square root of the sum of 5-minute intraday squared returns) are used. Results are controlled for other factors that affect volatility. Regressions for the high-low volatility (also for realized volatility) on margin changes and on other control variables are conducted.	Negative relations between margins and volatility are obtained but the relation was generally not statistically significant. These results are obtained without using control factors that may also affect volatility. Results of analysis which is conducted by using control factors show that margins are positively related to volatility which means higher margins induce higher volatility.

Table A3/a: Methods and Results of Empirical Studies Analyzing the Impact of Margins on Trading Activity

Year	Author/ Reference	Method Used in Empirical Studies (Impact of Margins On Trading Activity)	Results of Empirical Studies
1985	Tomek [28]	A trend based procedure is used. A linear trend equation was fitted to the ten days of observations on trading activity (open interest and trading volume) before each margin change and the linear trend is projected for three days after the margin change. The actual open interest minus the trend forecast (forecast error) and standard error of the forecast are calculated and the t-ratio of the error relative to the standard deviation is concluded.	•Impact on Open Interest: For the margin increases; nearly in %25 of the 111 cases there is a significant negative relation and nearly in %19 of those cases there is a significant positive relation. %51 of the 111 cases open interest and margins are inversely related when the significance is not considered. For the margin decreases; nearly in %30 of the 101 cases there is a significant negative relation and nearly in %17 of those cases there is a significant positive relation. %62 of the 101 cases open interest and margins are inversely related when the significance is not considered. •Impact on Trading Volume: The variation of volume is found more than open interest. 36 of the 101 trend equations fitted to the ten days prior to a margin decrease had significant trends. Weak relationship is found between margins and volumes. Clear empirical evidence of the relation between margins and volume or open interest can be obtained when other factors held constant.
1986	Fishe and Goldberg [12]	•New data series (3-day and 5-day averages of open interest and volume on all contracts) were produced for empirical tests using the dates of each margin change. The 3-day and 5-day averages were grouped into three groups (nearby, intermediate and distant) depending on delivery dates. •OLS regressions are performed. (A linear relationship is hypothesized between open interest or volume and margins)	•Impact on Open Interest: For the nearby contracts, margin change is significant: 10% increase in margin requirements will reduce open interest by between 1/3 and 1/2%. For the intermediate and distant contracts, the margin change is consistently negative but insignificant. Significance levels are fairly similar between 3 day and 5 day series. •Impact on Trading Volume: The margin change variable was significant in all of the 3-day average regressions (10% increase in margin requirements increase trading volume by 14.62%) and insignificant in the 5-day average regressions, but the sign was positive in all of the regressions. After margins increase in the market traders holding positions and not participate in daily trading liquidate their positions. As a result, open interest of in the market decrease while the trading volume increases.

Table A3/b: Methods and Results of Empirical Studies Analyzing the Impact of Margins on Trading Activity

Year	Author	Method Used in Empirical Studies (Impact of Margins On Trading Activity)	Results of Empirical Studies
1986	Hartzmark [18]	• Open interest and trading volume across all maturities are aggregated and market total values were produced for the empirical tests. •Wilcoxon Rank-Sum Test is used. 1. The average of market activity (Open Interest, Volume, Commercial-Noncommercial Percent) is calculated for 15 and 30 trading days before and after margin changes) 2. The effect of margins on composition of traders is determined by calculating the averages of three measures (noncommercial index, success index, size index) 15 trading days before and after the margin changes.	•Impact on Open Interest: In 9 of 13 cases the sign of the relation is negative. 7 of 9 cases t-statistics are significant at the %1 level. •Impact on Trading Volume: In 9 of 13 cases there is no significant change in trading volume before and after margin changes. 4 of 13 cases t-statistics are significant at the %5 level and the sign is negative. 9 of the 13 cases volume and margins are inversely related when the significance is not considered.
1999	Adrangi and Chatrath [1]	1. Regression analyses are performed. (The endogeneity of the trading activity and margin variables is controlled). 2. Two-stage least squares (2SLS) model is estimated. (A further examination of the impact of margins on trading activity is conducted.) 3. OLS regressions are performed. (The role of contract maturity in trading activity-margins relationship is controlled more directly)	•Impact on Trading Activity (Open Interest and Trading Volume): Margin coefficients are estimated negative and significant at the 1% level for all groups of traders for both corn and soybean futures. Negative impact of margin changes on volume and open interest is larger for the nearby contract. Evidences are found showing that as margin levels changes makeup of traders of corn contracts change also. But this is not the case for soybean futures.
2003	Dutt and Wein [9]	Daily observations of settlement prices and trading volume for the nearby contracts are used in empirical analysis. A constant elasticity model is specified. Variability estimates are calculated for 20 days before and after the margin change for each futures contract. Margins are adjusted by the estimated volatilities and regression estimates are used finally. Factors other than margin which may also affect trading activity are controlled.	•Impact on Trading Volume: Before Margin adjustment: Margin coefficients of wheat, oats, 10-year treasury bills and gold futures are estimated significantly positive. Margin coefficients of Dow Jones and corn futures are estimated negatively. While it is significant for corn and insignificant at 5% of significance level. After Margin adjustment: Margin coefficients of all contracts are statistically significant and negative.

Table A3/c: Methods and Results of Empirical Studies Analyzing the Impact of Margins on Trading Activity

Year	Author	Method Used in Empirical Studies (Impact of Margins On Trading Activity)	Results of Empirical Studies
2013	Phylaktis and Aristidou [24]	Bivariate GARCH –M models are constructed using the selected univariate GARCH-M models. Conditional means and variances of stock returns and trading volume are calculated. The relationship between volatility is taken into consideration as well the relationship between trading volume and margins adjusted by volatility while constructing the models. The effects of margin requirements on trading volume are examined by using three different GARCH-M models. These models differ from each other according to the adjustment of the margins. (model 1: not adjusted, model 2: adjusted for underlying price risk using the conditional variance of the change in daily settlement prices are lagged once, model 3.adjusted for underlying price risk using the conditional variance of the change in daily settlement prices lagged twice.	•Impact on Trading Volume: Before Margin adjustment: Margin level variable is found to be negative and statistically significant at the 5% level. (model 1) After Margin adjustment: Coefficient examining the effect of margin levels on trading volume is found to be positive and insignificant. (model 2 & model 3)
2014	Chou et al. [7]	1. Event study is performed. (The average trading activity for 15 trading days before and after margin changes is calculated) 2. Regression analyses are performed. (Factors other than margin which may also affect trading activity are controlled). (Four equation structural models is used in reduced form to estimate the relations among margin changes, trading activities, price volatility and bid-ask spreads. Parameters are estimated by OLS method) 3. The trading volume regressions are estimated separately for each trader type. 4. Margin requirements are measured by the ratio of initial margins to futures contract values for controlling the influences of changing futures contract values on this ratio, dummy variables are also used alternatively to capture the effect of margin changes.	•Impact on Trading Activity (Open Interest and Trading Volume): Open interest and volume are significantly negatively related to margin increases. Margin increases reduce trading activity of both individual and institutional traders. The negative relation is valid not only for nearby contracts but also for the first and second deferred contracts. After regression analyses margin coefficients are estimated negative and significant at the 1% level. Margin changes affect trading volume of institutional traders more than individual traders. Individual day traders and individual non-day traders react to margin changes similarly.

APPENDIX B

EVENT STUDY – T TEST RESULTS

Table B4/a: Results of Event Study Analyses on Trading Volume

Contract	Exchange/ Effective Date	All Investors				Individual				Institutional			
		Before	After	t-stat	p-value	Before	After	t-stat	p-value	Before	After	t-stat	p-value
BIST 30 INDEX Futures	Turkdex												
	August 10, 2009	711,377	710,532	0.01	0.99	556,320	580,185	-0.35	0.73	155,057	130,347	1.00	0.35
	December 11, 2009	533,397	324,000	2.49	0.04	457,219	273,138	2.62	0.03	76,178	50,862	1.41	0.20
	August 6, 2010	460,227	411,753	1.06	0.32	369,014	331,011	1.04	0.33	91,213	80,741	0.89	0.40
	October 20, 2010	497,887	424,250	1.60	0.17	371,720	282,673	2.62	0.04	126,166	141,578	-0,50	0.63
	March 7, 2011	534,080	479,599	1.31	0.23	368,636	358,351	0.32	0.76	165,444	121,248	2.73	0.03
	December 7, 2011	430,370	461,984	-0.62	0.55	326,632	334,140	-0.20	0.85	103,738	127,845	-1.70	0.13
	November 12, 2012	463,351	389,982	1.83	0.10	327,194	262,210	2.18	0.06	136,157	127,772	0.51	0.62
	December 26, 2012	240,637	316,776	-0.97	0.37	149,859	168,357	-0.60	0.57	90,778	148,419	-1.03	0.34
	April 9, 2013	285,376	306,252	-0.55	0.60	196,691	215,877	-0.68	0.51	88,684	90,375	-0.16	0.88
	BIST Derivatives Market												
	March 3, 2014	360,699	282,043	1.60	0.14	195,705	188,179	0.36	0.73	164,994	93,864	2.17	0.06
	June 16, 2014	394,428	332,065	1.76	0.11	277,550	183,722	1.90	0.09	116,878	85,981	1.32	0.22
	September 19, 2014	325,207	382,659	-1.57	0.16	227,591	276,858	-1.73	0.12	97,616	105,800	-0,87	0.40

Table B5/b: Results of Event Study Analyses on Trading Volume

Contract	Exchange/ Effective Date	All Investors				Individual				Institutional			
		Before	After	t-stat	p-value	Before	After	t-stat	p-value	Before	After	t-stat	p-value
USD/TRY FX Futures	Turkdex												
	August 10, 2009	57,316	97,918	-3.53	0.01	40,778	65,476	-2.75	0.03	16,539	32,443	-3.95	0.001
	September 29, 2010	68,533	80,256	-0.74	0.48	36,175	48,008	-1.31	0.23	32,357	32,248	0.02	0.99
	February 23, 2011	87,569	118,163	-1.19	0.28	50,042	69,820	-1.25	0.26	37,527	48,343	-0.77	0.47
	BIST Derivatives Market												
	March 3, 2014	121,948	130,380	-0.22	0.83	83,605	73,106	0.56	0.59	38,344	57,274	-0.81	0.44
	June 16, 2014	111,826	88,223	0.75	0.47	86,992	69,218	0.78	0.46	24,834	19,006	0.59	0.57
TRY GOLD Futures	Turkdex												
	January 26, 2009	275	428	-1.13	0.29	141	314	-2.77	0.02	134	114	0.20	0.85
	December 1, 2009	877	2,174	-3.12	0.01	779	1,784	-2.92	0.02	98	390	-2.49	0.04
	May 24, 2010	1,377	871	2.05	0.07	1,008	716	2.14	0.06	369	155	1.48	0.18
	March 7, 2011	1,355	1,107	0.67	0.52	877	754	0.63	0.54	477	354	0.63	0.55
	July 20, 2011	1,145	1,389	-0.49	0.63	690	1,144	-1.45	0.18	455	245	0.69	0.51
	BIST Derivatives Market												
	March 3, 2014	170	264	-0.95	0.37	156	263	-1.12	0.30	14	0	2.67	0.03

Table B2/a: Results of Event Study Analyses on Open Interest

Contract	Exchange/ Effective Date	All Investors				Individual				Institutional			
		Before	After	t-stat	p-value	Before	After	t-stat	p-value	Before	After	t-stat	p-value
BIST 30 INDEX Futures	Turkdex												
	August 10, 2009	210,961	192,825	5.00	0.001	124,391	107,679	4.12	0.001	297,532	277,970	5.45	0.001
	December 11, 2009	219,195	222,142	-1.08	0.31	120,992	120,139	0.22	0.83	317,398	324,144	-2.56	0.03
	August 6, 2010	211,729	202,882	2.12	0.07	159,975	142,666	3.52	0.01	263,484	263,098	0.08	0.94
	October 20, 2010	213,013	211,474	0.97	0.37	143,948	124,418	4.31	0.01	282,079	298,530	-2.48	0.05
	March 7, 2011	179,501	209,811	-8.21	0.001	90,470	98,186	-2.35	0.05	268,532	321,435	-11.79	0.001
	December 7, 2011	182,170	185,491	-1.43	0.19	64,912	64,460	0.27	0.79	299,428	306,521	-2.12	0.07
	November 12, 2012	233,388	235,925	-0.64	0.54	100,717	102,653	-0.69	0.51	366,059	369,196	-0.50	0.63
	December 26, 2012	263,422	226,826	2.34	0.06	92,159	85,243	1.94	0.10	434,686	368,408	2.29	0.06
	April 9, 2013	216,429	219,330	-0.89	0.40	89,632	87,742	1.04	0.33	343,227	350,918	-1.17	0.27
	BIST Derivatives Market												
	March 3, 2014	302,470	297,055	0.71	0.50	88,188	96,898	-2.46	0.04	516,752	497,212	1.28	0.24
	June 16, 2014	244,820	247,960	-0.90	0.39	107,098	100,960	1.27	0.24	382,542	394,960	-3.44	0.01
	September 19, 2014	204,461	224,021	-6.44	0.001	94,708	100,804	-3.32	0.01	314,215	347,239	-6.24	0.001

Table B2/b: Results of Event Study Analyses on Open Interest

Contract	Exchange/ Effective Date	All Investors				Individual				Institutional			
		Before	After	t-stat	p-value	Before	After	t-stat	p-value	Before	After	t-stat	p-value
USD/TRY FX Futures	Turkdex												
	August 10, 2009	119,297	127,434	-2.96	0.02	100,968	105,447	-1.41	0.20	137,626	149,421	-3.74	0.01
	September 29, 2010	108,091	124,501	-6.20	0.001	98,323	110,951	-4.69	0.001	117,859	138,052	-7.02	0.001
	February 23, 2011	81,846	77,049	1.24	0.26	91,452	85,203	1.84	0.12	72,240	68,894	0.67	0.53
	BIST Derivatives Market												
	March 3, 2014	183,162	195,213	-0.93	0.38	141,730	158,357	-2.55	0.03	224,594	232,069	-0.33	0.75
	June 16, 2014	143,761	148,959	-1.51	0.17	113,636	138,036	-3.94	0.001	173,887	159,881	7.69	0.001
TRY GOLD Futures	Turkdex												
	January 26, 2009	501	551	-1.20	0.27	451	574	-3.41	0.01	550	528	0.29	0.78
	December 1, 2009	1,087	1,354	-2.01	0.08	2,061	2,501	-1.83	0.10	113	207	-1.83	0.10
	May 24, 2010	3,587	3,479	1.66	0.14	4,188	4,030	1.38	0.21	2,986	2,928	1.31	0.23
	March 7, 2011	2,599	2,369	1.98	0.08	3,128	3,041	0.58	0.58	2,070	1,696	2.19	0.06
	July 20, 2011	2,436	2,249	2.87	0.02	3,075	2,736	3.37	0.01	1,797	1,763	0.80	0.44
	BIST Derivatives Market												
	March 3, 2014	448	493	-1.52	0.17	851	958	-1.66	0.14	46	28	2.92	0.02