# Effects of individual margin requirement and risk preference on individual margin trading
## 自我擔保維持率與風險偏好對個人證券信用交易比率之影響

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**Abstract:** Using a total of 25,000 individual accounts provided by the Taiwan Stock Exchange Corporation, this paper discusses the methodologies used for securities margin trading and explores whether a difference in the individual margin requirements and risk preferences set by investors would change the securities margin trading ratio. The individual margin requirements set by investors depending on the degree of leverage regarding investment targets. And, the margin trading ratios set by investors depending on the size of their leveraged positions. Therefore, investors can adjust the risks associated with investment portfolios according to the degree of leverage and leveraged positions. In addition, because the degree of risk aversion exhibited by individual investors varied, the investment portfolio risks differed. This study explores whether risk preference influences the relationship between the individual margin requirement set by investors and the margin trading ratio they adopt. The empirical results indicate that the investors adopt a low margin trading ratio when they set a high individual margin requirement. The trading mechanism for individual margin requirements can reduce volatility effects and mitigate the influences exerted on individual margin trading. Moreover, a low degree of risk preference increases the sensitivity of individual margin requirements toward individual margin trading.

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# 1. Introduction

Margin trading is a type of trading behavior generated to satisfy investors who cannot purchase or sell stocks in large volumes because of inadequate capital or financial resources. Margin trading exhibits leverage effects that enable investors to conveniently employ high operating leverages to maximize their profit levels. In addition, the existence of the margin trading system influences the operations of securities markets. Chordia, Richard and Avanidhar (2001) stated that margin trading system stimulates the trading activity through margin purchase and short sale, thus influencing the market liquidity.

Margin trading primarily comprise two major arbitrage models, namely the margin purchase and short sale arbitrage models. These two models represent the opinions of margin trading investors on the future market trend. The present study inferred that changes in the volumes of margin purchase and short sale can be employed to observe the tendency of most market participants (i.e., the retail investors) and to forecast changes in the future market trend. Obtaining such information is thus beneficial for investors when determining which investment strategies to employ.

Individual investors can adjust the risks associated with investment portfolios through securities margin trading. The adjustment method can be discussed using the management for the degree of leverage and leveraged position. Because margin trading is essentially a type of leveraged trading, individual investors can determine the extent of their leveraged positions in investment targets by setting the margin requirements and then adjusting investment portfolio risks. In addition, investors can determine the extent of their leveraged positions by setting the margin trading ratio and thereby adjusting investment portfolio risks. Therefore, individual investors simultaneously set the margin requirements and margin trading ratios, which mutually influence each other in risk adjustment, to adjust the investment portfolio risks. Moreover, investors can define their own margin requirements to determine their capital contribution ratios, subsequently changing the margin trading costs and their

intentions to use margin trading. Consequently, whether the relationship between individual margin requirement and margin trading ratio is influenced by risk adjustment or trading cost remains indeterminate. Currently, because obtaining data of individual accounts used for margin trading is difficult, scholars have yet to conduct any relevant studies on how predefining individual margin requirements can change individual margin trading activities. Thus, this study contributes greatly by investigating such a topic.

The authorities of securities markets are concerned that an increase in market price volatility may likely result in a substantial financial loss for investors in margin trading, which increase the chances for investors to breach contracts. Consequently, as a default settlement rule for investors, the securities exchanges will formulate a minimum margin requirement to ensure that investors adhere to their contracts, thereby safeguarding the law of obligations for credit providers.[2] In fact, the function of the minimum margin requirement for securities margin trading is similar to that of the futures margin requirement because both were developed to avoid defaulting on settlements in leveraged investments. Numerous theoretical models have verified that the margin levels in statutory futures are determined according to factors such as the default risk, price level, trade volume, published rate, and price limits (Fishe *et al*., 1990; Goldberg and Hachey, 1992; Wang and Chueh, 2006). In addition, the futures margin is an additional trading cost for investors, and an increase in the margin reduces the market liquidity (Fishe and Goldberg, 1986; Fishe *et al*., 1990; Ma, Kao and Frohlicb, 1993). Some studies have determined that an increase in the statutory minimum margin requirement decreases the excess volatility in stock prices (Hardouvelis and Kim, 1995; Hardouvelis and

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[2] According to the relevant regulations indicated in "Regulations Governing the Conduct of Securities Trading Margin Purchase and Short Sale Operations by Securities Firms" and "Operating Rules for Securities Firms Handling Margin Purchases and Short Sales of Securities," when the margin ratio does not equal 120%, the securities firms should notify the clients to make a supplementary payment of the margin purchase within two business days, or penalty will be imposed on the pledged collateral on the following business day. The minimum margin requirement should at least cover the maximum risk of decline for two business days. In 1997, the Asian financial crisis greatly affected Taiwan and led to a continual decline of the Taiwan stock market. To avoid the occurrence of force sell and selling climax, the authorities reduced the minimum margin requirement on June 5, 1998 from the original 140% to 120% from and have since then maintained this requirement.

Panayiotis, 2002). The aforementioned studies have examined the relationship between the statutory margin requirement and market quality. The individual margin requirements set by investors are relevant to the risk structure or trading cost involved in individual investment portfolios; however, no studies have conducted in-depth investigations on the relevant topics.

First, when investors set individual margin requirements, they must consider the principle that the set margin requirement must be higher than the statutory minimum margin requirement to maintain their positions in margin trading, continue their investments, and meet the regulations of the securities exchanges. If the individual investors employ margin trading to adjust investment portfolio risks, the investors must consider adjusting the degree of leverage in individual margin trading. This suggests that the degree of leverage and investment risk is low (high) when a high (low) individual margin requirement is set. The second consideration is adjusting the holding position in individual margin trading, indicating that investors encounter high (low) investment portfolio risks when the margin trading ratio is high (low). Individual investors consider their degree of risk preference to ascertain the risks associated with the targeted investment portfolios that they need to assume and then simultaneously set the margin requirements and margin trading ratios to determine the target risks associated with the investment portfolios. Therefore, when target risks in investment portfolios are involved, the high (low) individual margin requirements will reduce (increase) the risks of margin trading, and the investors could thus increase (decrease) the margin risks involved in individual margin trading ratios. Under such circumstance, the individual margin requirement is positively correlated with the margin trading ratio. In addition, the individual margin requirements set by the individual investors represent their capital contribution ratios in margin trading. The higher is the capital ratio, the higher is the capital cost. Thus, the intention of the investors to use margin trading is reduced. Furthermore, a high capital ratio crowded out the usable amount of capital, thus reducing the extent of margin trading. Therefore, at a fixed amount of usable capital, the high (low) individual margin requirements set by the individual investors increase (decrease) the trading costs, and the reduced (increased) extent of the margin trading reduces (increases) individual margin trading ratios. In this circumstance, the individual margin requirements are negatively associated with

the margin trading ratios. In this study, we attempt to focus on exploring whether the relationship between the individual margin requirement and margin trading ratio adjusted by individual investors are determined according to risk adjustment or trading cost adjustment. Because individual accounts are required to calculate individual margin requirements and margin trading ratios, no research has been conducted on the related topics.

Because the degree of risk aversion exhibited by individual investors varied, the risks for the investment portfolios set by the investors were inconsistent. Nevertheless, whether the relationship between the individual margin requirement and margin trading ratio set by individual investors is influenced by their risk preferences and whether changes in the market price limits exert various effects on individual margin trading activities have yet to be determined. Previous studies have indicated that individual investors hold various investment preferences, indicating that they avert risk to varying degrees (Anbar and Melek, 2010; Bodie and Crane, 1997; Hartog, Ada, and Jonker, 2002). This study employed trading frequency, trading experience, and risk degree to measure the degree of risk aversion exhibited by individual investors. Barber and Odean (2001) considered trading frequency as a measurement index for risk aversion. Based on overconfidence theory, we assert that overconfident dealers actively conduct irrational trading because of the misperception that profits would eventually exceed losses. Consequently, the overconfident dealers have a high degree of risk tolerance, are less sensitive to price volatility, frequently engage in trading to pursue high profits, and demonstrate behaviors similar to those of risk lovers (Barber and Odean, 2001; Mark and Matti, 2009; Lin and Ma, 2014). We maintain that a high trading frequency increases the probability of using margin trading, and the two are positively correlated. Regarding trading experience, this study asserts that he interval transaction amount increases as the trading experience of the investors increases. Subsequently, we subtracted the margin trading amount from the daily turnover as a method to control the influences of trading experience on margin trading and considered that investors with abundant trading experience (large trading amount for actuals) demonstrate behaviors that are similar to those of risk-averse investors and typically prefer low margin trading ratios. Regarding risk degree, a high risk degree value suggests that the investors adopted a high margin trading ratio in the trading

process and thus tended to be risk lovers who prefer using margin trading for investments.

In this study, we employed the trading data in the individual accounts of 25,000 investors from July 16, 2007 to December 31, 2009 provided by the Taiwan Stock Exchange Corporation to investigate the influences of changes in the individual margin requirement and risk preference on individual margin trading. The empirical results revealed the following: (a) The individual margin requirements and margin trading ratios set by the individual investors were negatively correlated. (b) The trading mechanism involved in the individual margin requirement can reduce volatility effects and mitigate influences on individual margin trading. (c) The individual investors who had a high (low) risk preference exhibited a low (high) degree of risk aversion and set an individual margin requirement that exhibited a low (high) sensitivity toward changes in the margin trading ratio. This paper is divided into five sections. Section 2 presents the relevant literature that regards the margin requirement as a type of safe trading mechanism and provides the hypotheses of this study, Section 3 discusses our sample selection and research methods, and Section 4 focuses on the descriptive statistics and empirical results. Finally, Section 5 concludes this study.

## 2. Literature review and hypotheses

### 2.1 Influences of the individual margin requirement on the margin trading ratio

When using the financial leverage as the method for conducting investments, investors are required to provide their minimum self-owned capital or relevant securities as collateral to prevent defaulting on settlements, such as futures margins and the minimum margin requirement for the margin trading. Previous studies have indicated that the margins and margin requirements set by investors influence market liquidity and volatility. Regarding the market liquidity, Fishe and Goldberg (1986) reported that an increase in the margin requirement increases the trading cost and reduces the futures trading activity. Kalavathi and Shanker (1991) proposed a theoretical model indicating that margins reduce the

futures demand and effectiveness of risk aversion for risk-averse investors, thus decreasing the trade volume. Adrangi and Chatrath (1999) suggested that the margin requirement generates negative effects on the trading activity for various types of trader. Regarding volatility, Hardouvelis (1990) considered that arbitragers holding investment portfolios that are high in risk and low in cash are sensitive to changes in the margin requirements and verified that the margin requirements and stock liquidity are inversely correlated. Hardouvelis and Kim (1995) suggested that the margin requirements reduce excess liquidity and real stock values. Hardouvelis and Panayiotis (2002) verified that, in normal and bull markets, a high initial margin reduces the follow-up stock volatility, whereas no influences are exerted in the bear market. Therefore, the adjustment of the margin requirements influences variations in trading costs and results in trading risk changes. However, thus far, no studies have investigated the setting of the individual margin requirement.

We inferred that the individual margin requirements set by individual investors exert two possible influences on the individual margin trading ratios. The first influence involves trading cost adjustment: a high (low) individual margin requirement set by an individual investor and a high (low) capital contribution ratio increase (reduce) the trading cost. Thus, the extent of the margin trading used by the individual investors is decreased (increased), reducing individual margin trading ratio. The extent of the margin trading and margin trading ratio are negatively correlated. The second influence involves risk adjustment: a high (low) individual margin requirement reduces (increases) the margin trading risks. Under the condition that the risks for investment portfolios are constant, the investors can increase (reduce) the individual margin trading ratios. Therefore, the individual margin requirement and margin trading ratio are positively correlated. Consequently, we proposed the following hypotheses:

**$H_{1a}$:** Based on trading cost adjustment, the individual margin requirement and margin trading ratio are negatively correlated.

**$H_{1b}$:** Based on the risk adjustment, the individual margin requirement and margin trading ratio are positively correlated.

## 2.2 Influences of the degree of risk aversion and individual margin requirement

Because individual investors avert risks to varying degrees, the level of investment risks they are willing to undertake differ. Therefore, the changes in the individual margin requirements (price limits) may exert dissimilar effects on individual margin trading adopted by the investors. Kihlstrom and Laffont (1979) considered that individuals with a low degree of risk aversion are likely to engage in high-risk jobs. Cramer *et al*. (2002) determined that people with a low degree of risk aversion are likely to engage in entrepreneurships. Therefore, we inferred that the individual investors with a low degree of risk aversion tend to engage in high-risk margin trading. Bodie and Crane (1997) determined that the diverse investment characteristics of investors indicates their degrees of risk aversion that result in various investment strategies. Thus, we can obtain the risk preferences of the investors through their investment characteristics.

Regarding the individual risk preference, we employed trading frequency, trading experience and risk degree to evaluate the degree of risk aversion among individual investors. Barber and Odean (2001) considered *TF* as a measurement index for risk aversion. Based on overconfidence theory, we assert that overconfident dealers actively conduct irrational trading because of the misperception that profits would eventually exceed losses. Consequently, overconfident dealers have a high degree of risk tolerance, are less sensitive to price volatility, are prone to pursue high profits through frequent trading, and demonstrate behaviors that are similar to those of risk lovers (Barber and Odean, 2001; Mark and Matti, 2009). We considered that a high trading frequency increases the probability of using margin trading, implying a positive correlation between the two. Furthermore, the more experienced is an investor in trading, the higher is the amount the investor invests in interval trading. We controlled the influences of trading experience on margin trading by subtracting the daily turnover from the margin trading sum, and considered that investors with abundant trading experience (large amount of spot transaction) have the tendency to avert risk and adopt a low margin trading ratio. In terms of risk degree, we assert that a high risk degree value represents a high tendency to adopt a high margin trading ratio in the trading processes, to prefer risk, and to use margin trading in trading activities. We proposed the following hypotheses:

**H$_{2a}$:** Individual investors with high trading frequency exhibit a low degree of risk aversion and the individual margin requirements they adopt are less sensitive toward margin trading activities.

**H$_{2b}$:** Individual investors with abundant trading experience exhibit a high degree of risk aversion and the individual margin requirements they adopt are more sensitive toward margin trading activities.

**H$_{2c}$:** Individual investors who exhibit a high risk degree have a low degree of risk aversion and the individual margin requirements they adopt are less sensitive toward the margin trading activity.

# 3. Research design and methodology

### 3.1 Sample selection and data source

This paper presents a study on the effects of the individual margin requirement and risk preference on individual margin trading. Thus, the securities exchange data obtained from the individual accounts, including the trading prices and volumes of spot transaction, margin purchase, and short sale, were employed to calculate the individual margin trading ratio. In addition, to calculate the individual margin ratio, the trading data of the margin purchase and short sale were required. Specifically, the margin purchase data comprised the amount, margin, and securities market value, and the short sale data comprised the turnover, margin, and securities market value. This study employed the trading data from 25,000 anonymous individual accounts from July 16, 2007 to December 31, 2009 that were randomly sampled by the Taiwan Stock Exchange Corporation. Thus, the accounts were not specially selected and were in accordance with the principle of randomization in statistical sampling. The trading frequency as shown in the trading data primarily focused on the daily trading data on the stocks purchased and sold by the 25,000 investors. The trading data in the individual accounts can be divided into two major parts: the first part is the order book and trade data of individual investors, and the second part is the margin trading data of the individual investors.[3]

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[3] Based on the industry–academic collaboration with the Taiwan Stock Exchange, the data of the individual accounts were provided by the Taiwan Stock Exchange.

In addition, the variables including the margin trading ratio and individual margin requirement calculated in this study were actually related to the concept of flow, indicating that a certain period of time is required to elapse in order to calculate the ratio of the margin trading value to the total trading value and the individual margin requirement of the individual investors. We referred to the method proposed by Fama and MacBeth (1973) to calculate the regression and divided the data within the period of this research into intervals. Specifically, an interval included 10 days for a total of 62 intervals for analysis, and more than 1,000,000 sampling interval data were sampled. To enhance the robustness of this study, we employed 30 days as one sampling interval to calculate the numerical values and examine whether the selected interval results in changes.

### 3.2 Definition of the research variables

### 3.2.1 Individual margin trading

The margin trading ratio calculated from the 10-day (30-day) spot transaction and margin trading data for individual $I$ in a specific sampling interval involves categorizing margin trading into two major types, namely the margin purchase and short sale. Therefore, we investigated the following three types of margin trading for discussion: the margin trading ratio ($MTR$), margin purchase ratio ($MPR$), and short sale ratio ($SSR$). The equations are presented as follows:

$$MTR = \frac{\text{Margin purchase turnover} + \text{Short sale turnover}}{(\text{Spot turnover at purchasing} + \text{Margin purchase turnover}) + (\text{Spot turnover at selling} + \text{Short sale turnover})} \quad (1)$$

$$MPR = \frac{\text{Margin purchase turnover}}{(\text{Spot turnover at purchasing} + \text{Margin purchase turnover}) + (\text{Spot turnover at selling} + \text{Short sale turnover})} \quad (2)$$

$$SSR = \frac{\text{Margin purchase turnover}}{(\text{Spot turnover at purchasing} + \text{Margin purchase turnover}) + (\text{Spot turnover at selling} + \text{Short sale turnover})} \quad (3)$$

For the margin trading ratios, we employed the log-odd ratio method to convert the numerical values, transforming the discrete data into continuous data for empirical analysis to conform to statistical implications.

Keep rate ($KR$) is one of the safe trading mechanisms in the market. The individual margin requirement for Individual $I$ ($KR_I$) is calculated as follows:

$$KR_I = \frac{\sum_{i=1}^{n} \begin{smallmatrix}\textit{Securities market value} \\ \textit{of the collateral}_i\end{smallmatrix} + \textit{Total margin for margin purchase} + \sum_{j=1}^{m} \begin{smallmatrix}\textit{Collateral payment for} \\ \textit{short sale}_j\end{smallmatrix} + \textit{Total margin for short sale}}{\sum_{i=1}^{n} \textit{Margin purchase amount}_i + \sum_{j=1}^{m} \textit{Securities market price for short sale}_j} \quad (4)$$

For an individual investor, the daily duration of margin trading accumulated involves n margin purchase and m short sale. The $i=1\sim n$ is $i$th margin purchase, $j=1\sim m$ is $j$th short sale, and $KR_I$ can be used to calculate the daily margin ratio. To ensure that every sampled investor has only one margin requirement and one corresponding individual *MTR* in each sampling interval, we employed the simple average of 10 days (30 days) to represent the individual margin requirement in a specific sampling interval.

### 3.2.2 Variables of the characteristics of individual investors

The variables regarding the characteristics of individual investors can be used to determine the degree of risk aversion of individual investors. Thus, based on the individual accounts data obtained in this study the 25,000 individual accounts were used to calculate the total trading frequency (*TF*) each investor conducted within an interval of 10 days between the research periods of July 16, 2007 and December 31, 2009. According to overconfidence theory, overconfident dealers tend to undergo irrational trading because of the misperception that profits would eventually exceed losses. Consequently, overconfident dealers have a high degree of risk tolerance, are less sensitive about price volatility, are prone to pursue high profits through frequent trading activities, and demonstrate behaviors that are similar to those of risk lovers. Therefore, we considered that investors with a high Trading Frequency are likely to use margin trading.

The trading experience (*TE*) of the investors were evaluated using the value obtained from the following: (the total turnover per interval－the margin trading amounts per interval). We determined that the investors with more *TE* had a high total interval trading amount. When the spot transaction amount is used to control the influences of *TE* on margin trading, a high value suggests that the investors had a more conservative behavior during spot trading. Thus, we considered that an investor with abundant *TE* would less likely use margin trading for investing in the market.

$$Trading\ Experience = the\ total\ turnover\ per\ interval$$
$$- the\ margin\ trading\ amounts\ per\ interval \quad (5)$$

To evaluate the risk degree (*RD*) of the investors, we employed the value obtained from the following: (margin trading frequency per interval / total margin trading frequency per interval). We considered that investors who frequently engage in margin trading would obtain a high *RD* value, indicating that they prefer using margin trading and are risk lovers. Moreover, a high *RD* value indicates that the margin trading ratio the investor adopts for investment is high and that the investors tend to prefer undertaking risks.

$$Risk\ Degree = \frac{Margin\ trading\ frequency\ per\ interval}{Total\ margin\ trading\ frequency\ per\ interval} \quad (6)$$

### 3.2.3 Control variables for market trading activities

The control variables in this study must be able to control the changes in the environmental and economic trends and most of the trading activities, such as the effects of the 2008 financial crisis on the Taiwan stock market. We referred to the research methods proposed by Boehmer, Saar and Yu (2005) and Madhavan, Porter and Weaver (2005) to control the influences of the market on the market liquidity variables, selecting the following three control variables: market volatility, market volume, and market rate of return.

Market volatility is the natural logarithm of the highest price of the Taiwan Capitalization Weighted Stock Index minus the lowest price. To correspond with the *MTR* adopted by the individual investors at a certain sampling interval, we employed the market volatility of the trading days in which the investors conducted trading within a specific sampling interval to calculate the average values. The natural logarithm of the daily total trading volume of the Taiwan securities market is the market volume. We employed the market volume on the trading day in which the investors conducted trading within a specific sampling interval to calculate the averages. The rate of return is calculated using the daily closing price and closing price of the previous business day according to the Taiwan Capitalization Weighted Stock Index. We employed the market rate of return on the trading days in which the investors conducted trading within a specific sampling interval to calculate the averages.

### 3.3 Research design and empirical model

To examine the proposed hypotheses, we designed the following regression equation:

$$Y_{I,t} = \alpha + \beta_1 KR_{I,t\ 1} + \beta_2 Trading\ Frequency_{I,t} + \beta_3 Trading\ Experience_{I,t} + \beta_4 Risk\ Degree_{I,t}$$
$$+ \beta_5 KR_{I,t} \times Trading\ Frequency_{I,t} + \beta_6 \times Trading\ Experience_{I,t} + \beta_7 \times Risk\ Degree_{I,t} \quad (7)$$
$$+ \beta_i Control\ Variables_{I,t} + \varepsilon_{I,t}$$

where *I* is the individual investors and *t* is the sampling interval. The dependent variable $Y_I$ was employed to analyze the individual *MTR* (*MTR_I*) and individual risk preference. The research variables were applied to the regression model according to each research hypothesis, including the individual margin requirements for previous period ($KR_{I,t-1}$). To determine the degree of risk aversion of the investors, we used *TF*, *TE*, and *RD* to examine their influences on the safe trading mechanism and individual *MTR*. The control variables included market volatility, market volume, and market rate of return. Regarding the regression model, we referred to the concept practiced by Fama and MacBeth (1973). First, in the cross-section, the regression analysis was conducted using the averages of each interval to obtain the coefficients. Because the research period of the samples were from July 16, 2007 to December 31, 2009, we used 10 trading days as an interval, yielding a total of 62 sampling intervals and 62 regression equations, which were then used to calculate the average of the regression coefficients to verify the hypotheses proposed in this study.

### 3.4 Robustness test

This study employed price limits as the variable for the robustness analysis. Because price limits and margin requirement exhibited similar effects, they may possibly have substitution effects for the safe trading mechanism. The theoretical models proposed by Brennan (1986), Chowdhry and Nanda (1998), and Chou, Lin and Yu (2000) indicated that price limits and margin requirement exhibited substitution effects. In addition, the empirical results obtained in Ackert and Hunter (1994) and Chen (1998) have suggested that the extent of the margin and price limits are negatively correlated.

Numerous studies have investigated the influences of price limits on market

quality in which the volatility, liquidity, order flow, and price trend were incorporated (Chen, 1998; Chan, Kim and Rhee, 2005). Phylaktis, Kavussanos and Manalis (1999) determined that price limits can suppress the excessive volatility in the stock market. Arak and Cook (1997) and Chung and Gan (2005) have determined that price limits exert a cooling effect, preventing the stock market from experiencing extreme price fluctuation. Therefore, we inferred that price limits exert a volatility reduction effect on individual margin trading. Because price limits generate a volatility suppression effect (Phylaktis, Kavussanos and Manalis, 1999), we considered that, when the stock market implements price limits, the volatility in the market and investment risk of margin trading can be reduced, thus increasing the intention of individual investors to use margin trading.

In Taiwan, the stock market primarily has 3.5% and 7% price limits, and the same sampled investors must have conducted margin trading with the two price limits. Therefore, we used only the period during which the price limits were 3.5% and 7% to compare the differences in individual margin trading. However, a stock market constrained by a price limit of 3.5% rarely occurs; this generally occurs when the market experiences substantial economic events to prevent investors from engaging in irrational trading that may result in an atypical stock price decline.

To employ price limits in the robustness test, we designed the following regression equation:

$$
\begin{aligned}
Y_{I,t} = {} & \alpha + \beta_1 KR_{I,t-1} + \beta_2 D_{7\%,,I,t} + \beta_3 Trading\ Frequency_{I,t} + \beta_4 Trading\ Experience_{I,t} + \beta_5 Risk\ Degree_{I,t} \\
& + \beta_6 KR_{I,t} \times D_{7\%,I,t} + \beta_7 KR_{I,t} \times Trading\ Frequency_{I,t} + \beta_8 Trading\ Experience_{I,t} + \beta_9 Risk\ Degree_{I,t} \quad (8) \\
& + \beta_i Control\ Variables_{I,t} + \varepsilon_{I,t}
\end{aligned}
$$

where *I* is the individual investor and *t* is the sampling interval. The dependent variable $Y_I$ was employed to analyze the individual *MTR* ($MTR_I$) and individual risk preference, and the research variables included the individual margin requirement ($KR_{I,t-1}$) for the previous period. $D_{7\%}$ is a dummy variable, in which a value of "one" indicates that the price limit is at 7%, and a value of "zero" indicates that the price limit is at 3.5%. Subsequently, $KR_{I,t-1}$ and $D_{7\%,I}$ are multiplied ($KR_I*D_{7\%,I}$). To obtain the degree of risk preference of the individual investors, we employed *TF*, *TE*, and *RD* to examine their influences on the safe

trading mechanism and individual *MTR*. The control variables were market volatility, market volume, and market rate of return.

# 4. Empirical result and analysis

## 4.1 The description of the sampled data

Table 1 shows the descriptive statistics of the sampled investors. Because we need to determine the individual margin requirements set by the individual investors, we employed 10 days as an interval for each sampling interval. The samples were collected within the research period from July 16, 2007 to December 31, 2009. A total of 62 sampling intervals were obtained, and all of the conditions of the samples can be inferred from the averages and median values. The samples consisted of 25,000 individual investors; however, not every investor traded during each interval, and each trading behavior was inconsistent. Nevertheless, overall, the results of all intervals were approximately similar. The average of the *MTR* was 0.56 (0.58 for Interval 1, 0.46 for Interval 2, 0.56 for Interval 61, and 0.55 for Interval 62). The average of the margin requirement was 171.10 (170.29 for Interval 1, 169.51 for Interval 2, 172.69 for Interval 61, and 172.44 for Interval 62). In addition, the average *TF*, *TE*, and *RD* were 116.73, 11.05, and 0.55, respectively. The market volatility, market volume, and market rate of return representing the control variables yielded the averages of 4.62, 18.70, and 0.03, respectively.

## 4.2 *T*-test: The influences of risk preference on the individual margin trading ratio

We employed the *t*-test to examine the influences of *TF* of the investors on the individual *MTR* and margin requirement. In Table 2, the samples were pooled into two groups on the basis of the medians of the *TF* in each interval. One group had a *TF* value larger than the median ($> 50\%$), and the other group had a *TF* value smaller than the median ($< 50\%$). The two groups of samples were employed to indicate whether the investors who traded frequently or infrequently and to determine whether distinct degrees of risk aversion result in dissimilar margin trading behaviors. The results for the *MTR* indicated that the *MTR*

**Table 1**
**Basic statistical results of the individual accounts**

| Interval | Margin trade ratio | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Mean | | | | | | | Median | | | | | | |
| | KR | TF | TE | RD | Volatility | Volume | Rate of return | KR | TF | TE | RD | Volatility | Volume | Rate of return |
| 1 | 170.29 | 148.68 | 11.44 | 0.52 | 4.83 | 19.32 | -0.39 | 167.48 | 63.00 | 11.44 | 0.51 | 4.82 | 19.31 | -0.33 |
| 2 | 169.51 | 121.28 | 11.42 | 0.53 | 5.07 | 19.02 | -0.32 | 167.41 | 51.00 | 11.42 | 0.52 | 5.06 | 19.02 | -0.28 |
| 3 | 169.55 | 115.47 | 11.31 | 0.53 | 4.96 | 18.80 | -0.40 | 167.70 | 46.00 | 11.32 | 0.51 | 4.95 | 18.79 | -0.34 |
| 4 | 170.07 | 116.73 | 11.28 | 0.54 | 4.74 | 18.72 | 0.39 | 168.26 | 45.00 | 11.31 | 0.52 | 4.74 | 18.72 | 0.38 |
| 5 | 170.23 | 107.90 | 11.25 | 0.54 | 4.72 | 18.69 | 0.29 | 168.10 | 44.00 | 11.28 | 0.52 | 4.73 | 18.69 | 0.27 |
| ... | ... | | | | | | ... | ... | | | | | | ... |
| 58 | 172.28 | 100.22 | 11.00 | 0.55 | 4.42 | 18.37 | 0.13 | 169.33 | 43.00 | 11.00 | 0.53 | 4.41 | 18.36 | 0.18 |
| 59 | 172.33 | 121.46 | 11.04 | 0.55 | 4.18 | 18.60 | 0.10 | 169.03 | 51.00 | 11.06 | 0.53 | 4.17 | 18.60 | 0.11 |
| 60 | 172.32 | 114.97 | 11.07 | 0.55 | 4.31 | 18.63 | 0.02 | 169.07 | 49.00 | 11.07 | 0.53 | 4.30 | 18.63 | 0.06 |
| 61 | 172.69 | 115.05 | 11.05 | 0.54 | 4.31 | 18.63 | 0.07 | 169.37 | 49.00 | 11.05 | 0.52 | 4.29 | 18.62 | 0.09 |
| 62 | 172.44 | 78.42 | 11.11 | 0.55 | 4.03 | 18.74 | 0.61 | 169.31 | 33.00 | 11.12 | 0.53 | 4.03 | 18.74 | 0.60 |
| Mean | 171.10 | 116.73 | 11.05 | 0.55 | 4.62 | 18.70 | 0.03 | 168.51 | 47.55 | 11.06 | 0.53 | 4.61 | 18.70 | 0.05 |

Note: Margin Trade Ratio (*MTR*) = (margin purchase trading amount + short sale trading amount) / (margin purchase trading amount + short sale trading amount + actuals trading amount at purchasing and selling); Keep Rate (*KR*) = {( securities market value of the margin collateral + total margin for margin purchase) + (collateral payment for short sale + total margin for short sale)} / (margin purchase amount + securities market price for short sale); Trading Frequency (*TF*) = the number of times sampled investors traded within the sampling intervals; Trading Experience (*TE*) = the total turnover per interval − the margin trading amounts per interval; Risk Degree (*RD*) = margin trading frequency per interval / Total margin trading frequency per interval; *Volatility* = the natural logarithm of the highest price of the Taiwan Capitalization Weighted Stock Index minus the lowest price; *Volume* = the natural logarithm of the daily total volume of the Taiwan securities market; and *Rate of Return* = the rate of return of the Taiwan Capitalization Weighted Stock Index.

**Table 2**
**The *T*-test of the influences of the individual margin on the individual margin trading ratio**

| Interval | MTR | | | | KR | | | |
|---|---|---|---|---|---|---|---|---|
| | >50% | <50% | Difference | *t*-value | >50% | <50% | Difference | *t*-value |
| 1 | 0.58 | 0.51 | 0.07 | 4.81*** | 169.90 | 169.90 | 0.03 | 0.62 |
| 2 | 0.48 | 0.37 | 0.11 | 7.41*** | 169.10 | 169.50 | -0.46 | -7.81*** |
| 3 | 0.52 | 0.44 | 0.09 | 4.50*** | 169.00 | 169.50 | -0.45 | -6.60*** |
| 4 | 0.61 | 0.44 | 0.17 | 11.31*** | 169.80 | 169.90 | -0.12 | -1.93* |
| 5 | 0.65 | 0.44 | 0.21 | 12.30*** | 170.00 | 170.10 | -0.11 | -1.77* |
| 6 | 0.66 | 0.49 | 0.17 | 10.18*** | 170.80 | 170.70 | 0.11 | 1.91* |
| 7 | 0.66 | 0.36 | 0.29 | 20.65*** | 169.70 | 169.60 | 0.14 | 2.51*** |
| 8 | 0.67 | 0.49 | 0.18 | 9.64*** | 169.70 | 169.90 | -0.25 | -4.30*** |
| 9 | 0.55 | 0.44 | 0.11 | 6.06*** | 169.20 | 170.10 | -0.98 | -14.14*** |
| 10 | 0.64 | 0.48 | 0.17 | 8.61*** | 168.90 | 169.60 | -0.70 | -9.54*** |
| … | … | … | … | … | … | … | … | … |
| 54 | 0.66 | 0.54 | 0.12 | 7.55*** | 170.90 | 170.80 | 0.11 | 1.90* |
| 55 | 0.73 | 0.55 | 0.11 | 9.74*** | 171.40 | 171.00 | 0.35 | 5.71*** |
| 56 | 0.64 | 0.45 | 0.19 | 13.90*** | 171.50 | 171.10 | 0.32 | 5.99*** |
| 57 | 0.76 | 0.43 | 0.06 | 20.46*** | 171.40 | 170.90 | 0.49 | 8.22*** |
| 58 | 0.64 | 0.53 | 0.11 | 5.12*** | 171.70 | 171.80 | -0.11 | -1.74* |
| 59 | 0.69 | 0.47 | 0.22 | 14.12*** | 171.90 | 171.80 | 0.14 | 2.24*** |
| 60 | 0.64 | 0.51 | 0.13 | 8.26*** | 171.90 | 171.90 | -0.03 | -0.39 |
| 61 | 0.64 | 0.43 | 0.21 | 14.84*** | 171.30 | 172.80 | -1.44 | -18.52*** |
| 62 | 0.64 | 0.41 | 0.23 | 11.38*** | 174.30 | 175.70 | -1.36 | -14.17** |
| Average | 0.62 | 0.45 | 0.15 | 10.25*** | 168.68 | 168.97 | -0.27 | -3.46*** |

Note: Investors with a *TF* higher than the median ($> 50\%$) are investors who traded frequently, and those with a *TF* lower than the median ($< 50\%$) are investors who traded infrequently. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

adopted by the investors involved in frequent trading was significantly higher than that of investors who traded infrequently (Interval 1: 0.58 versus 0.51; Interval 2: 0.48 versus 0.37; Interval 61: 0.64 versus 0.43; Interval 62: 0.62 versus 0.41). However, an opposite phenomenon was observed for individual margin requirement. Specifically, the margin requirements set by the investors who seldom traded were significantly higher than those set by the investors who frequently traded (Interval 1: 169.90 versus 169.90; Interval 2: 169.5 versus 169.10; Interval 61: 172.80 versus 171.30; Interval 62: 175.70 versus 174.30).

The results shown in Table 2 indicated that investors who frequently traded exhibited behaviors similar to those of risk lovers, often employed margin trading for investments, and maintained the margin requirements at a minimum. Thus, the results support $H_{2a}$ and $H_{2c}$. We inferred that the higher the *TF* and *RD* were, the lower the degree of risk aversion was and the lower the sensitivity of the margin requirement toward the margin trading activity was. When the investors traded infrequently, they demonstrated behaviors of risk-averse investors, were reluctant to use a highly risky margin trading for investments, and maintained the margin requirement within a high level. Therefore, the inference for $H_{2b}$ was supported. We considered that the higher the *TE* was, the higher the degree of risk aversion was and the higher the sensitivity of the margin requirement toward the margin trading activity was.

### 4.3 Regression analysis: The influences of the safe trading mechanism on the individual margin trading ratio

To extensively examine the influences of the changes in the margin requirement and risk preference on the individual margin trading activity, we employed the aforementioned regression model to verify whether the inference relevant to the influences of the margin requirement and risk preference on the individual margin trading activity is supported. In Table 3, the *MTR*, *MPR*, and *SSR* in Panel A were significantly negatively correlated with the margin requirement. Thus, a high (low) individual margin requirement and a high (low) capital contribution ratio increased (reduced) the trading cost and reduced the individual *MTR*. The results support $H_{1a}$, suggesting that the margin requirement and *MTR* were negatively correlated. The difference between Panels B and A was that the values of the margin requirement and *MTR* selected for calculation were from different intervals. The purpose was to enhance the robustness of this study, and the results corresponded with those for Panel A, which indicate that the margin requirement and *MTR* are negatively correlated.

Through *TF*, *TE*, and *RD*, we obtained the degree of risk aversion exhibited by individual investors to verify whether investors' sensitivity to margin trading differed according to their degree of risk aversion. Table 3 indicates that the *MTR*, *MPR*, and *SSR* are significantly negatively correlated with the individual margin requirement and *TE* and significantly positively correlated with *TF* and *RD*.

**Table 3**

**Regression analysis of the influences of the *MTR* on the individual margin requirement and risk preference**

| Model | Panel A: 10 days | | | | | | | | Panel B: 30 days | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MTR | | MPR | | SSR | | SMT | | MTR | | MPR | | SSR | | SMT | |
| Variable | Estimate | t-value | Estimate | t-value | Estimat | t-value | Estimate. | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate. | t-value |
| *Intercept* | 4.04 | 1.21 | -4.08 | -0.86 | 4.22 | 0.47 | 5.93 | 1.82* | 3.29 | 1.87* | -5.48 | -2.27** | 5.10 | 0.80 | 8.02 | 4.57*** |
| *KR* | -0.02 | -4.93*** | -0.02 | -6.14*** | 0.02 | 0.66 | -0.02 | -5.90*** | -0.02 | -7.26*** | -0.03 | -11.0*** | 0.03 | 1.20 | -0.02 | -10.2*** |
| *TF* | 0.00 | 8.31*** | 0.01 | 11.07*** | 0.00 | 1.62 | 0.01 | 14.44*** | 0.00 | 11.62*** | 0.00 | 21.87*** | 0.00 | 2.76*** | 0.00 | 29.65*** |
| *TE* | -0.73 | -21.9*** | -0.98 | -28.2*** | -0.16 | -22.5*** | -0.02 | -4.07*** | -0.54 | -29.3*** | -1.03 | -49.1*** | -0.05 | -41.0*** | -0.07 | -4.92*** |
| *RD* | 1.35 | 3.58*** | 0.75 | 1.66* | 1.96 | 10.39*** | 1.83 | 4.97*** | 1.22 | 5.45*** | 0.77 | 3.50*** | 0.78 | 20.82*** | 2.31 | 9.10*** |
| *KR * TF* | 0.00 | -7.30*** | 0.00 | -10.5*** | 0.00 | -0.03 | 0.00 | -12.5*** | 0.00 | -10.9*** | 0.00 | -21.2*** | 0.00 | 1.23 | 0.00 | -27.0*** |
| *KR * TE* | 0.00 | 5.24*** | 0.00 | 5.82*** | 0.00 | -0.73 | 0.00 | 6.27*** | 0.00 | 8.33*** | 0.00 | 11.48*** | 0.00 | -1.25 | 0.00 | 12.01*** |
| *KR * RD* | -0.01 | -2.55** | 0.00 | -1.22 | 0.00 | 0.04 | -0.01 | -3.59*** | -0.01 | -3.98*** | -0.01 | -2.93** | 0.00 | -0.57 | -0.01 | -6.96*** |
| *Volatility* | -0.15 | -1.72* | -0.15 | -1.44 | 0.22 | 0.64 | -0.16 | -1.73* | -0.17 | -3.14*** | -0.16 | -2.05** | 0.68 | 2.44** | -0.14 | -2.17** |
| *Volume* | 0.28 | 1.43 | 0.92 | 4.21*** | -0.14 | -0.34 | 0.35 | 1.78* | 0.21 | 2.59*** | 1.03 | 9.27*** | -0.42 | -1.11 | 0.25 | 2.61** |
| *Rate of return* | 0.10 | 5.11*** | 0.13 | 6.04*** | -0.04 | -0.38 | 0.11 | 6.02*** | 0.16 | 13.03*** | 0.24 | 16.42*** | -0.06 | -1.18 | 0.21 | 16.16*** |
| *F*-value | 2159.62 | | 3334.03 | | 141.61 | | 1087.04 | | 2742.40 | | 10769.90 | | 363.99 | | 3028.26 | |
| $R^2$ | 0.48 | | 0.56 | | 0.43 | | 0.35 | | 0.49 | | 0.42 | | 0.53 | | 0.31 | |

Note: Margin Trade Ratio (*MTR*) = (margin purchase trading amount + short sale trading amount) / (margin purchase trading amount + short sale trading amount + actuals trading amount at purchasing and selling); Keep Rate (*KR*) = {( securities market value of the margin collateral + total margin for margin purchase) + (collateral payment for short sale + total margin for short sale)} / (margin purchase amount + securities market price for short sale); Trading Frequency (*TF*) = the number of times sampled investors traded within the sampling intervals; Trading Experience (*TE*) = the total turnover per interval – the margin trading amounts per interval; Risk Degree (*RD*) = margin trading frequency per interval / Total margin trading frequency per interval; *Volatility* = the natural logarithm of the highest price of the Taiwan Capitalization Weighted Stock Index minus the lowest price; *Volume* = the natural logarithm of the daily total volume of the Taiwan securities market; and *Rate of Return* = the rate of return of the Taiwan Capitalization Weighted Stock Index. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Therefore, this result supported the hypothesis proposed in this study. Regarding *TF*, Barber and Odean (2001) considered *TF* as a measurement index for risk aversion. When an investor trade frequently, we inferred that the investor had a tendency of being a risk lover and was not sensitive toward price volatility and thus was strongly capable of enduring risks. Therefore, a high *TF* increased the probability of the investors using margin trading, suggesting that *TF* and margin trading are positively correlated. Investors with more *TE* invested a larger total amount in interval trading. We subtracted the interval margin trading amount from the interval turnover to control the influences of *TE* on margin trading, where a high interval margin trading amount represents a low *MTR* and a risk-averse investor. Regarding the *RD*, we divided the *TF* per interval by the total *TF* per interval, in which a high resulting value suggests that that the investors tended to be risk lovers and prefer using margin trading for investments.

## 4.4 Regression analysis: The influences of the individual risk preference on the margin trading ratio

According to the aforementioned hypotheses, a high or low *TF* indicated the level of risk aversion exhibited by the investors. Therefore, we employed *TF* of the study samples; that is, the total *TF* was employed as the basis to divide the investors into those who traded frequently and those who traded infrequently to analyze whether these two types of investor exhibited differed in terms of their trading behaviors. We employed the median in each interval *TF* as the basis, arranging the *TF* that was higher than the median to represent the investors who traded frequently and the *TF* that was lower than the median to represent the investors who traded infrequently. Subsequently, whether a discrepancy in the *TF* results in differences in the *MTR* was explored, the results of which are shown in Table 4. According to Panel A, for investors who traded frequently, the *MTR*, *MPR*, and *SSR* were significantly negatively correlated with the individual margin requirement and *TE* but significantly positively correlated with *TF* and *RD*. Therefore, the results shown in Table 4 are similar to those presented in Table 3. For investors who traded infrequently, the *MTR*, *MPR*, and *SSR* were significantly negatively correlated with the individual margin requirement and *TE* and significantly positively correlated with *TF* and *RD*. In addition, a similar

**Table 4**

**The influences of the *MTR* on the investors who traded frequently and infrequently**

| | High trading frequency | | | | | | | | Low trading frequency | | | | | | | |
| | MTR | | MPR | | SSR | | SMT | | MTR | | MPR | | SSR | | SMT | |
| Model | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Panel A: 10 days** | | | | | | | | | | | | | | | | |
| Intercept | 2.41 | 0.70 | -4.74 | -0.26 | -4.74 | 0.10 | 5.32 | 1.33 | 2.34 | 0.45 | -1.00 | -0.39 | 17.52 | 0.76 | 0.85 | 0.09 |
| KR | -0.02 | -3.90*** | -0.03 | -5.45*** | 0.02 | 0.61 | -0.03 | -5.68*** | -0.02 | -3.32*** | -0.02 | -3.14*** | 0.00 | -0.12 | -0.02 | -3.25*** |
| TF | 0.00 | 4.62*** | 0.01 | 7.11*** | 0.00 | 1.04 | 0.01 | 9.58*** | 0.02 | 2.89*** | 0.03 | 2.77*** | -0.04 | -0.94 | 0.03 | 3.84*** |
| TE | -0.65 | -11.46*** | -0.97 | -14.82*** | -0.10 | -18.57*** | -0.06 | -0.70 | -0.92 | -18.05*** | -1.08 | -23.78*** | -0.55 | -15.95*** | -0.09 | -1.07 |
| RD | 1.12 | 2.05** | 1.97 | 2.22** | 1.10 | 10.00*** | 1.43 | 2.67*** | 1.62 | 2.60** | 1.33 | 1.96*** | 1.07 | 2.30** | 1.98 | 3.48*** |
| KR * TF | 0.00 | -4.03*** | 0.00 | -6.82*** | 0.00 | 0.52 | 0.00 | -8.30*** | 0.00 | -2.49** | 0.00 | -2.65*** | 0.00 | 0.32 | 0.00 | -3.07*** |
| KR * TE | 0.00 | 3.81*** | 0.00 | 4.79*** | 0.00 | -0.60 | 0.00 | 5.31*** | 0.00 | 4.16*** | 0.00 | 3.91*** | 0.00 | -0.01 | 0.00 | 4.17*** |
| KR * RD | 0.00 | -1.30 | 0.00 | -0.23 | 0.00 | -0.25 | 0.00 | -1.67* | -0.01 | -2.14** | -0.01 | -2.25** | 0.00 | -0.13 | -0.01 | -2.77*** |
| Volatility | -0.21 | -1.43 | -0.18 | -0.95 | 0.38 | 0.66 | -0.23 | -1.46 | -0.08 | -0.76 | -0.09 | -0.91 | -0.06 | 0.00 | -0.08 | -0.86 |
| Volume | 0.36 | 1.00 | 1.02 | 2.48** | 0.24 | -0.11 | 0.48 | 1.18 | 0.44 | 1.92* | 0.71 | 3.22*** | -0.51 | -0.36 | 0.60 | 2.87*** |
| Rate of return | 0.16 | 5.45*** | 0.25 | 7.27*** | -0.10 | -0.92 | 0.19 | 6.69*** | 0.04 | 1.41 | 0.03 | 1.05 | 0.03 | 0.39 | 0.03 | 1.56 |
| F-Value | 864.22 | | 1799.51 | | 70.36 | | 886.84 | | 851.75 | | 2046.38 | | 304.40 | | 211.27 | |
| R² | 0.38 | | 0.56 | | 0.41 | | 0.38 | | 0.51 | | 0.61 | | 0.56 | | 0.20 | |
| **Panel B: 30 days** | | | | | | | | | | | | | | | | |
| Intercept | 2.64 | 0.94 | -1.18 | 0.42 | -1.23 | 0.37 | 12.01 | 4.33*** | 2.85 | 1.24 | -6.20 | -2.42** | 9.92 | 0.86 | -1.68 | -0.58 |
| KR | -0.01 | -5.46*** | -0.04 | -13.70*** | 0.03 | 1.41 | -0.04 | -12.94*** | -0.02 | -6.33*** | -0.01 | -3.09*** | -0.01 | -0.43 | -0.01 | -3.39*** |
| TF | 0.00 | 6.26*** | 0.00 | 15.00*** | 0.00 | 2.27** | 0.00 | 21.97*** | 0.00 | 2.49** | 0.01 | 5.24*** | 0.01 | 0.31 | 0.01 | 6.55*** |
| TE | -0.39 | -14.87*** | -1.14 | -29.31*** | -0.06 | -32.80*** | -0.22 | -3.56*** | -0.79 | -27.19*** | -1.03 | -40.05*** | -0.44 | -26.61*** | -0.03 | -3.44*** |
| RD | 1.18 | 3.97*** | 2.71 | 4.99*** | 0.02 | 18.73*** | 1.77 | 5.33*** | 1.17 | 2.85*** | 1.60 | 2.61** | 4.28 | 7.83*** | 2.42 | 5.72*** |
| KR * TF | 0.00 | -5.99*** | 0.00 | -14.71*** | 0.00 | 1.17 | 0.00 | -20.20*** | 0.00 | -2.34** | 0.00 | -5.15*** | 0.00 | 0.33 | 0.00 | -5.38*** |
| KR * TE | 0.00 | 5.70*** | 0.00 | 12.66*** | 0.00 | -1.33 | 0.00 | 13.46*** | 0.00 | 7.94*** | 0.00 | 5.13*** | 0.00 | 0.25 | 0.00 | 5.36*** |
| KR * RD | 0.00 | -2.65*** | 0.00 | 0.33 | -0.01 | -0.88 | -0.01 | -3.75*** | -0.01 | -2.45** | -0.01 | -4.54*** | 0.01 | 0.19 | -0.01 | -5.12*** |
| Volatility | -0.13 | -1.97* | -0.19 | -1.41 | 0.82 | 2.59** | -0.11 | -0.93 | -0.14 | -1.77* | -0.09 | -1.25 | 0.17 | 0.49 | -0.07 | -1.09 |
| Volume | 0.17 | 1.80* | 0.95 | 5.11*** | -0.13 | -0.81 | 0.17 | 1.10 | 0.37 | 2.81*** | 0.96 | 7.51*** | -0.25 | -0.44 | 0.70 | 5.84*** |
| Rate of return | 0.23 | 13.43*** | 0.42 | 18.63*** | -0.09 | -1.49 | 0.33 | 17.06*** | 0.07 | 3.89*** | 0.05 | 2.47** | 0.07 | 0.64 | 0.08 | 4.04*** |
| F-value | 959.38 | | 1599.91 | | 94.31 | | 1125.95 | | 1287.23 | | 2234.03 | | 73.69 | | 226.75 | |
| R² | 0.32 | | 0.56 | | 0.42 | | 0.35 | | 0.50 | | 0.60 | | 0.41 | | 0.15 | |

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

phenomenon was observed for the other interval (Panel B in Table 4), further demonstrating the robustness of the results in this study.

## 4.5 Robust regression analysis: The influences of the safe trading mechanism on the individual trading volume

To strengthen the empirical results of this study, we employed the total amount and price limits in margin trading to conduct the robust regression analysis. Tables 3, 4, and 5 show the empirical results. We determined that the results shown in Tables 3, 4, and 5 are similar because they indicated that a high individual margin requirement and *TE* reduced the total amount invested in the margin trading, whereas a high *TF* and *RD* increased the total amount invested in margin trading. According to Table 4, we identified that the total amount invested in margin trading by the investors who traded frequently was significantly negatively correlated with the individual margin requirement and *TE* and significantly positively correlated with *TF* and *RD*. Furthermore, the result for the investors who traded infrequently show that the total amount invested in the margin trading is significantly negatively correlated with the individual margin requirement and *TE* and significantly positively correlated with *TF* and *RD*. Although the intervals used for Panels A and B in Table 4 differed, the obtained results are similar, further verifying the robustness of this study.

Table 5 presents the results obtained when price limits were included in the model and indicates that price limits suppress price volatility and is a type of safe trading mechanism (Wang, Cheng and Chen, 2014). In Table 5, Panel A shows that the *MTR* and individual margin requirement are significantly negatively associated, indicating that an investor who has a high demand of self-owned capital ratio sets a high individual margin requirement and refrains from using high-risk margin trading, which decreases their margin trading volume. In addition, Table 5 suggests that the dummy variable coefficient ($D_{7\%}$) representing price limits is a significant negative value. We assert that, when the price limit of the market is relaxed, investors are thus prone to influences from price fluctuations, prompting them to refrain from engaging in risky margin trading.

The product of individual margin requirement multiplied by $D_{7\%}$ was a significant positive value, indicating that the two safe trading mechanisms (i.e.,

**Table 5**

**The influences of the *MTR* on the individual margin requirement and risk preference (including the price system)**

| Model | Panel A: 10 days | | | | | | | | Panel B: 30 days | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MTR | | MPR | | SSR | | SMT | | MTR | | MPR | | SSR | | SMT | |
| Variable | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value | Estimate | t-value |
| *Intercept* | 4.05 | 1.21 | -4.07 | -0.86 | 4.22 | 0.47 | 5.95 | 1.83* | 3.32 | 1.90* | -5.44 | -2.25** | 5.02 | 0.80 | 8.07 | 4.60*** |
| KR | -0.02 | -4.95*** | -0.02 | -6.15*** | 0.02 | 0.66 | -0.02 | -5.91*** | -0.02 | -7.2*** | -0.03 | -11.0*** | -0.03 | -1.20 | -0.02 | -10.2*** |
| TF | 0.00 | 8.31*** | 0.01 | 11.07*** | 0.00 | 1.62 | 0.01 | 14.44*** | 0.00 | 11.6*** | 0.00 | 21.7*** | 0.00 | 2.77*** | 0.00 | 29.5*** |
| TE | -0.73 | -21.9*** | -0.98 | -28.2*** | -0.16 | -22.5*** | -0.02 | -4.05*** | -0.54 | -29.*** | -1.03 | -48.8*** | -0.05 | -41.0*** | -0.07 | -4.76*** |
| RD | 1.34 | 3.57*** | 0.75 | 1.67* | 1.96 | 10.39*** | 1.83 | 4.96*** | 1.22 | 5.46*** | 0.77 | 3.48* | 0.79 | 20.84*** | 2.32 | 9.11*** |
| $D_{7\%}$ | 0.00 | -0.44 | 0.00 | -1.97** | 0.00 | -1.74* | 0.00 | -0.92 | 0.00 | -3.1*** | 0.00 | -3.96*** | -7.32 | -0.50 | 0.00 | -3.57*** |
| $KR * D_{7\%}$ | 0.00 | -0.46 | 0.00 | -0.89 | 0.00 | 0.14 | 0.00 | -0.87 | 0.00 | -4.3*** | 0.00 | -5.65*** | 0.04 | 0.51 | 0.00 | -5.59*** |
| $TF * D_{7\%}$ | 0.00 | -2.29** | 0.00 | -3.59*** | 0.00 | -0.54 | 0.00 | -4.00*** | 0.00 | -6.1*** | 0.00 | -3.80*** | 0.00 | 1.21 | 0.00 | -3.83*** |
| $KR * TF$ | 0.00 | -7.30*** | 0.00 | -10.5*** | 0.00 | -0.03 | 0.00 | -12.5*** | 0.00 | -11.*** | 0.00 | -21.1*** | 0.00 | 1.22 | 0.00 | -26.9*** |
| $KR * TE$ | 0.00 | 5.23*** | 0.00 | 5.82*** | 0.00 | -0.73 | 0.00 | 6.27*** | 0.00 | 8.38*** | 0.00 | 11.5*** | 0.00 | -1.24 | 0.00 | 12.0*** |
| $KR * RD$ | -0.01 | -2.54** | 0.00 | -1.21 | 0.00 | 0.04 | -0.01 | -3.58*** | -0.01 | -4.0*** | -0.01 | -2.95*** | 0.00 | -0.57 | -0.01 | -6.98*** |
| *Volatility* | -0.15 | -1.73* | -0.15 | -1.45 | 0.22 | 0.64 | -0.16 | -1.74* | -0.17 | -3.1*** | -0.16 | -2.07** | 0.69 | 2.45** | -0.15 | -2.20** |
| *Volume* | 0.28 | 1.43 | 0.92 | 4.20*** | -0.14 | -0.34 | 0.35 | 1.78* | 0.21 | 2.57** | 1.03 | 9.24*** | -0.41 | -1.11 | 0.25 | 2.59** |
| *Rate of return* | 0.10 | 5.11*** | 0.13 | 6.03*** | -0.04 | -0.38 | 0.11 | 6.01*** | 0.16 | 13.02*** | 0.24 | 16.41*** | -0.06 | -1.17 | 0.21 | 16.16*** |
| *F*-value | 1859.62 | | 1334.03 | | 541.61 | | 1087.04 | | 2742.40 | | 10769.90 | | 363.99 | | 3028.26 | |
| $R^2$ | 0.48 | | 0.52 | | 0.46 | | 0.45 | | 0.59 | | 0.32 | | 0.58 | | 0.45 | |

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

individual margin requirement and price limit mechanisms) exhibit substituting effects on the individual margin trading volume. In addition, the multiplication of *TF* and the two aforementioned types of safe trading mechanism yielded a significant positive value, indicating that investors with a low (high) degree of risk aversion are less (more) sensitive toward the safe trading mechanisms, which consequently influence their margin trading volume. Regarding the *MTR*, the price limit is significantly negatively correlated with the *MTR*, *MPR*, and *SSR*. We assert that price limit has a suppressing effect on the margin trading ratios. When price limits are implemented, the investors avoid using high-risk margin trading to sell and purchase stocks through margin trading, which maintains market prices, thus preventing investors from experiencing financial losses.

# 5. Conclusion

The safe trading mechanisms in the securities exchanges are designed to prevent individual investors from experiencing losses caused by irrational stock price volatility. Because individual margin trading is a type of investment associated with high leverage, protection through safe trading mechanisms is required to reduce the risks in investments. However, previous studies have not investigated the individual margin requirement or considered the factor of the individual risk preference. More importantly, no studies have focused on the influences of the safe trading mechanisms and individual risk preference on individual margin trading. Therefore, this study attempted to determine how safe trading mechanisms and individual risk preference can change the intention of investors to adopt individual margin trading for investments.

We employed the accounts of 25,000 individual investors for analysis. The empirical results are presented as follows: First, a high individual margin requirement set by the investors decreased the individual *MTR*. A high individual margin requirement implied that an investor tended to avert risks, assume a high trading cost, and was less likely to adopt the margin trading investment strategy associated with a high leverage. Second, a low degree of risk aversion exhibited by the investor suggested that the individual investor was willing to undertake investments associated with high risks and increase the *MTR*. Finally, when the price limit was relaxed to 7%, the margin trading activity was reduced. However,

when the individual margin requirement was simultaneously increased, the risk assumed by the individual investors was reduced, increasing their use of margin trading. Therefore, the individual margin requirement and price limit mechanisms exhibited substitution effects.

The empirical results suggested that a high individual margin requirement set by the investor reduced the individual *MTR*. Because the individual margin requirement set in the individual margin trading must be higher than the statutory minimum margin requirement to maintain their positions in the margin trading, the difference between the individual margin requirement and statutory minimum margin requirement can be regarded as the increase in individual margin requirement. Therefore, if policy makers plan to raise the statutory minimum margin requirement, an individual investor, on the premise that the increase in individual margin requirement remains constant, must increase his or her individual margin requirement. The findings of this study can serve as a reference for policy makers to understand that an increase in the statutory minimum margin requirement may reduce the individual margin trading. In addition, the empirical results indicated that a relaxed price limit heightened the price volatility risks that the individual investors must undertake and reduced the margin trading associated with a high leverage, suggesting that the individual investors adjust the associated risks and are not irrational retail investors. Finally, an increase in the *TF* suggested that the investors exhibited a high degree of risk aversion and increased the sensitivity of individual margin trading toward changes in the individual margin requirement or price limit. Therefore, the individual investors who cannot undertake risks must depend on safe trading mechanisms, which substantially influence their margin trading behaviors.

In this study, we determined that the individual investors typically consider the extent to which safe trading mechanisms can protect them from financial losses and subsequently adjust the investment risks they could undertake. In other words, when the market trading mechanism was relaxed (strict) and the extent of protection was low (high), the individual investors tended to conduct investments associated with high (low) risks. The results obtained in this study can be offered to policy makers and the Taiwan Stock Exchange as reference. In light of the intense competition among international securities markets, relevant safe trading mechanisms can be relaxed to increase the market competitiveness

and liquidity of Taiwan's securities market and to attract foreign investors. Because individual investors are capable of adjusting investment risks independently, they need not be overly protected.

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