

Research On the Impact of Margin Trading on The Stock Idiosyncratic Volatility

Qian Zhao*, Caixia Zhou

School of Economics and Management, Nanjing University of Science and Technology, Nanjing, China

*Corresponding author: zq2658601792@163.com

Abstract. In classical asset pricing model, expected stock return is only determined by systematic risk, and idiosyncratic risk can be completely dispersed without asset pricing effect. However, the real world and the assumptions of classical asset pricing model are different, as idiosyncratic risk cannot be completely dispersed and has pricing effect. Recent studies found that the stock idiosyncratic volatility can actually predict stock return negatively, indicating the existence of the "Idiosyncratic volatility puzzle" in the Chinese stock market. There are constraints on margin trading in the Chinese stock market, which can affect investors' investment behavior and expectation of stock return. This article adopts difference-in-differences model and multivariable linear regression mode to test the impact of margin trading on idiosyncratic volatility, and further investigate the impact of margin trading on the "Idiosyncratic volatility puzzle". The research results found that: In the process from the establishment of the margin trading system to the gradual expansion of underlying stocks, the impact of margin trading on idiosyncratic volatility has shifted from a positive impact to a negative impact. That is to say, margin trading has transitioned from initially increasing idiosyncratic volatility to later reducing idiosyncratic volatility, gradually playing a role in price discovery and reducing idiosyncratic risk in the stock market. The gradual improvement of the margin trading system is driving the development and maturity of the Chinese stock market.

Keywords: Margin trading Idiosyncratic volatility Pricing effect.

1. Introduction

Traditional financial theory believes that the expected stock return only depends on systemic risk, and non-systemic idiosyncratic risks can be completely dispersed without pricing effect. Due to the strict assumptions such as complete rationality and complete information required; it does not conform to the actual situation of the stock market. Black, Jensen, and Scholes (1972) first found through empirical research that idiosyncratic volatility (IVOL), which is used to characterize nonsystematic risk in stocks, has an impact on expected stock returns [1]. Different scholars have conducted research on such "market anomalies" from different perspectives and attempted to provide explanations. Merton (1987) found through the establishment of an incomplete market pricing model that investors cannot diversify their investments and achieve complete diversification of idiosyncratic risks. Therefore, idiosyncratic volatility can affect the expected return of stocks, and idiosyncratic risks also require compensation from returns. Mitton and Vorkink (2007) [3], Bali and Cakici (2008) [4], among others, studied from the perspectives of investor heterogeneity and short selling restrictions. Barberis and Huang (2008) conducted research from the perspective of information asymmetry [5], both confirming a positive correlation between idiosyncratic volatility and stock returns.

However, Miller (1977) found a negative correlation between trait volatility and expected returns under the premise of heterogeneous beliefs and short selling restrictions [6]. Ang et al (2006) used the US stock market as the research object [7] and Ang et al (2007) found a negative correlation between idiosyncratic volatility and stock returns based on empirical analysis of multinational data [8]. Due to the negative correlation between the two, which is contrary to classical risk pricing theory, it is known as the "Idiosyncratic volatility puzzle". The study by Long et al (2018) [9] also confirmed that the "Idiosyncratic volatility puzzle" also exists in the Chinese stock market.

In response to the explanation of the "Idiosyncratic volatility puzzle", Miller (1977) pioneered the idea that short selling restrictions prevent investors from expressing their pessimism in the market, resulting in excessively high stock prices. However, stock prices will eventually decline, leading to a negative correlation between idiosyncratic volatility and stock returns. Boehme et al. (2009) also believe that the short selling mechanism can affect the "Idiosyncratic volatility puzzle" [10]. Although China established the margin trading system in 2010, margin trading has always been under control, providing a practical entry point for studying the impact of short selling restrictions on the "Idiosyncratic volatility puzzle". Previous studies on the impact of margin trading and securities lending systems on stock idiosyncratic volatility have not reached consistent conclusions. Some scholars have studied that the margin trading can accelerate information transmission, reduce information asymmetry, reduce foam, reduce noise trading, and reduce heterogeneous beliefs, and found that margin trading can reduce idiosyncratic volatility. Some studies have also found that margin trading can increase the idiosyncratic volatility of stocks.

What is the impact of the margin trading system in the Chinese stock market on the idiosyncratic volatility of stocks? Is its impact stable, or is it changing with the continuous expansion of margin trading targets? This article will take the underlying stocks of margin trading as the research object, and use multivariable linear regression mode and difference-in-differences model to study the impact of margin trading on stock idiosyncratic volatility. The innovation of this article is to focus on the changes in the impact of margin trading on stock idiosyncratic volatility during the establishment and continuous expansion of the margin trading system in the Chinese stock market.

2. Impact mechanism and hypothesis to be verified

China's the margin trading system has been officially implemented since March 2010. As of the end of 2022, the underlying stocks of margin trading have undergone seven expansions. The number of underlying stocks has increased from 90 to 2200, an increase of approximately 23.44 times. The balance of margin trading has also increased from 12.772 billion yuan on December 31, 2010 to 1540.392 billion yuan on December 31, 2022, and its impact on the stock market is increasingly expanding.

The academic community mostly explains the impact mechanism of margin trading on stock idiosyncratic volatility from three aspects: information asymmetry, noise trading, and heterogeneous beliefs.

Firstly, from the perspective of information asymmetry, there are differences in the information held by investors. The information superior can transmit more information to the market through margin trading, which helps to reduce information asymmetry, reduce idiosyncratic risk, and thus reduce idiosyncratic volatility.

Secondly, from the perspective of noise trading, there are a large number of noise traders among Chinese stock market investors. The margin trading system enables noise traders to amplify trading volume to a greater extent, exacerbate short-term stock price fluctuations, reduce the idiosyncratic information contained in stock prices, further increase idiosyncratic risk, and improve idiosyncratic volatility. Information superior can transmit true information to the market through margin trading, promoting the return of stock prices to their true values. However, due to the time required for stock price return, information superior may engage in short-term forward trend trading, releasing erroneous information to the market for profit; It may also attract more noisy traders to "follow the trend" in trading, and at this time, at this point, the margin trading system will further expand the dissemination of erroneous information, increase the idiosyncratic risk of stocks, and increase idiosyncratic volatility.

Thirdly, from the perspective of heterogeneous beliefs, there are differences in the expectations of different investors for the same stock. With the help of the margin trading system, not only bullish investors can purchase stocks to express their bullish expectations, but bearish investors can also express their bearish expectations through margin trading. The optimistic and pessimistic emotions

of different investors can be fully expressed in the market, avoiding the stock market being dominated by unilateral emotions, which helps to reduce the idiosyncratic volatility of stocks.

From the above analysis, it can be seen that the impact of margin trading on stock idiosyncratic volatility is uncertain. With the establishment and continuous improvement of the margin trading system, these changes will also have an impact on the effect of margin trading on stock idiosyncratic volatility. Based on the actual operation of China's margin trading system, the hypotheses to be verified in this article are proposed:

H1: Margin trading has an impact on the idiosyncratic volatility of stocks.

H2: With the gradual expansion of margin trading targets, the direction of the impact of margin trading on the idiosyncratic volatility of stocks will change.

3. Research design

3.1 Sample Data Description

This article takes the newly added target stocks from the establishment of the margin trading system to six expansions of the target stocks between 2010 and 2022 as the sample stocks for the processing group, and conducts the following processing: firstly, exclude stocks that have been transferred out during the research period; Secondly, exclude data with monthly transactions less than 10 days during the study period; Thirdly, excluding listed stocks in the financial industry, as the proportion of margin trading target stocks in the financial industry is relatively large, it is difficult to match non target stocks for research; Fourthly, exclude stocks with negative profitability; Fifthly, exclude stocks that were delisted by S.T. or delisted during the research period to avoid the impact of extreme values on the research results.

The margin trading data is sourced from the CSMAR database, the company's financial data is sourced from the Wind database, and the stock return, risk-free return, and three factor data are sourced from the RESSET database. Empirical research is mainly completed through Stata and R software.

3.2 Extracting Idiosyncratic Volatility

This article regresses the daily excess return (excluding risk-free interest rates) of each stock based on the Fama French three factor model, as shown in formula (1).

$$re_{it} = a_{it} + \beta_i^{mkt} r_{mrf_t} + \beta_i^{smb} smb_t + \beta_i^{hml} hml_t + \varepsilon_{it} \quad (1)$$

Then calculate the monthly sample standard deviation of the residuals as the idiosyncratic volatility.

3.3 Model Settings

The difference-in-differences model is very suitable for testing the impact of institutional changes, and can intuitively demonstrate the impact of institutional changes on the target audience, i.e. the processing group. By comparing the changes in the control group that were not affected before and after the implementation of the system, it is possible to identify and analyze which impacts were caused by the system changes. Therefore, this article uses difference-in-differences model to test the impact of the establishment of the margin trading system and the expansion of the target on idiosyncratic volatility. The difference-in-differences model is shown in formula (2).

$$IV_{it} = \alpha_0 + \alpha_1 MD_i + \alpha_2 MT_i + \alpha_3 MT_i \times MD_i + \sum Controls_{it} + \varepsilon_{it} \quad (2)$$

The definitions of variables involved in the above formula are shown in Table 1.

Table 1. Variable Definition

Variable name	symbol	Variable Definition
Excess Return	re	Stock excess returns, individual stock returns - risk-free returns
Market Profitability	rmrf	Market portfolio yield - risk-free interest rate
Small Minus Big	smb	The data source is RESSET Database
High Minus Low	hml	The data source is RESSET Database
Idiosyncratic Volatility	IV	Standard deviation of fitting residuals for Fama- French three factor model
Variable Grouping	MD	Is the stock the target stock for margin trading? Yes, it is "1"; otherwise, the value is "0"
Time Dummy Variable	MT	Before the expansion target of margin trading, the value is "0"; otherwise, the value is "1"
Total Value	size	The product of the total number of shares issued and the monthly closing price
Circulation Market Value	mktvalue	The product of the number of outstanding shares of an individual stock and the monthly closing price
Turn Volume	trdsum	Sum of daily trading volume during the period of monthly opening date and trading volume
Turnover Rate	turnover	The ratio of individual stock trading volume to the number of outstanding shares
Book-to-market Ratio	bm	Shareholders' equity/company market value

4. Empirical analysis

We will take the establishment of the margin trading system and six expansions of the target stock as time nodes, and use one year before and after every time node as the research interval to empirically analyze the impact of the expansion of the target stock on the idiosyncratic volatility of stocks.

Using the newly added target stocks as the experimental group, in order to reduce the difference between the experimental group and the control group, the propensity score matching method (PSM) was applied to match one control group stock for each experimental group stock. The matching variables are total value, turnover rate, and chg. The matching variables are the average value of the year before stock expansion, and the Logit model is used to calculate propensity scores. The control group of stocks is selected based on the nearest neighbor principle. Finally, the difference-in-differences model was used to test the impact of the margin trading system on the idiosyncratic volatility of stocks, as shown in Table 2 and Table 3. T statistic in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

From the results in Table 2, it can be seen that the coefficient of MD×MT is significant except for the expansion of the target stock on September 22, 2014, indicating that the establishment of the margin trading system and the expansion of the target stock have a significant impact on the idiosyncratic volatility of the target stock. In addition, the coefficient of MD×MT shows a trend from positive to negative, indicating that in the gradual expansion of the underlying stock, the impact of the margin trading system on the idiosyncratic volatility of stocks has changed, confirming the hypothesis 2 to be verified.

From the establishment of the margin trading system on March 31, 2010 to the second expansion of the margin trading target on January 31, 2013, the coefficient of MD×MT is significantly positive, which means that in the early stages of the implementation of the margin trading system, it will expand the idiosyncratic volatility of the underlying stocks, failing to play a role in price discovery and instead increasing the idiosyncratic risk of stocks. From the third expansion of the margin trading target on September 16, 2013 to the sixth expansion on August 19, 2019, except for the fifth expansion on December 12, 2016, the coefficient of MD×MT is significantly negative, indicating that with the

gradual improvement of the margin trading system and the gradual increase of the underlying stocks, margin trading can significantly reduce the characteristic volatility of the underlying stocks and play a role in price discovery. This change in trend may be due to the following three reasons: Firstly, with the development and improvement of the Chinese stock market, the margin trading system is gradually sound, market investors increase, transaction volume increases, and it is more difficult for information superior to conduct directional trading to obtain the maximum price difference. Information superior who release true information to the market dominate, leading to a decrease in the idiosyncratic risk of stocks; Secondly, the admission conditions for margin trading are relatively high, and many retail investors cannot engage in margin trading due to the lack of basic conditions, which will not further increase their idiosyncratic risks; Thirdly, margin trading allows traders to express their bullish or bearish expectations of assets, allowing stock prices to be adjusted in a timely manner, making it easier to return to their true value, and reducing the idiosyncratic risk of stocks.

Table 2. Empirical results (1)

	2010.3.31	2011.12.5	2013.1.31
MD	-0.0001 (-0.75)	-0.0002** (-2.16)	0.0001 (1.22)
MT	0.0001 (1.01)	-0.0001 (-0.97)	0.0001** (2.12)
MD×MT	0.0003* (1.82)	0.0003*** (2.72)	0.0002** (2.49)
size	-0.0005 (-0.99)	0.0004*** (3.65)	0.0006*** (4.59)
mktvalue	-0.0000 (-0.83)	0.0000 (0.14)	-0.0002*** (-4.05)
trdsum	0.0008 (1.47)	-0.0004*** (-3.79)	-0.0006*** (-4.80)
turnover	-0.0003 (-0.53)	0.0006*** (5.46)	0.0008*** (6.22)
bm	-0.0008*** (-4.55)	-0.0004*** (-3.22)	-0.0003*** (-6.03)

Table 3. Empirical results (2)

	2013.9.16	2014.9.22	2016.12.12	2019.8.19
MD	-0.0000 (-0.42)	-0.0003*** (-3.50)	0.0001 (0.87)	-0.0000 (-0.30)
MT	0.0002** (2.07)	0.0005** (2.29)	-0.0001 (-1.24)	-0.0001 (-1.47)
MD×MT	-0.0005*** (-2.85)	-0.0002 (-1.01)	0.0002** (2.20)	-0.0002*** (-3.00)
size	-0.0020** (-1.97)	-0.0068*** (-8.19)	-0.0005 (-0.81)	-0.0021*** (-6.22)
mktvalue	-0.0002*** (-2.82)	0.0006*** (4.35)	-0.0001 (-0.44)	-0.0003*** (-6.84)
trdsum	0.0027** (2.40)	0.0070*** (8.64)	0.0006 (0.93)	0.0024*** (7.03)
turnover	-0.0019** (-1.89)	-0.0057*** (-7.02)	-0.0000 (-0.05)	-0.0017** (-4.93)
bm	0.0001 (1.28)	-0.0001 (-0.70)	-0.0011*** (-6.64)	0.0001** (2.08)

5. Summary

Through empirical analysis, the conclusion and inspiration obtained in this article are as follows: margin trading has a significant impact on the idiosyncratic volatility of stocks, and as the target stocks of margin trading expand, the impact gradually shifts from positive to negative. This indicates that China's stock market is further improving, and the margin trading system is also maturing, gradually playing a role in price discovery and reducing market idiosyncratic risks.

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