The Impact of Margin Trading on the Pricing Efficiency of Stocks

Yiheng Liu
Dongguan City University, Dongguan, Guangdong, China

Abstract: Against the backdrop of the full implementation of the registration-based IPO system and the standardization of quantitative trading, margin trading serves as the core tool for two-way trading in the A-share market. However, it has long been characterized by a pattern of "emphasizing margin purchases while neglecting short sales", insufficient stock supply for short selling, and speculative short selling, which constrain the exertion of pricing efficiency and amplify market volatility risks. This paper selects A-share stocks eligible for margin trading from 2019 to 2024 as the research sample, takes the sixth expansion of eligible stocks as a quasi-natural experiment, and conducts research using the difference-in-differences (DID) method, moderating effect analysis, grouped regression, and quantile regression. The results show that the expansion of margin trading eligibility significantly improves pricing efficiency; heterogeneous beliefs weaken the policy effect; the policy exerts a stronger effect in a rising market; margin purchases enhance pricing efficiency, while short sales and the imbalance between margin purchases and short sales significantly suppress pricing efficiency; short sales have a stronger negative impact on stocks with high pricing efficiency. Finally, policy recommendations are put forward in terms of stock supply for short selling, investor structure, and differentiated regulation.

Keywords: Margin Trading; Short Selling; Pricing Efficiency; Difference-in-Differences; Quantile Regression

1. Introduction

The launch of margin trading in 2010 marked the establishment of a two-way trading mechanism in the A-share market. Since then, eligible stocks have been continuously expanded, and the securities lending system has been improved. In recent years, regulators have strengthened short selling supervision to balance price discovery and market stability. Currently, A-share margin trading exhibits a persistent imbalance of “more margin, less short selling”, with insufficient stock supply and excessive speculation, restricting pricing efficiency and increasing volatility risks [1-2].

Theoretical Significance

This study constructs a framework of “short selling behavior–pricing efficiency–risk balance”, enriching research on emerging market short selling mechanisms [11-12]. It empirically examines short selling’s impact and addresses the lack of integrated analysis of efficiency and risk [2-3].

Practical Significance

This research systematically explores the transmission paths of the pricing efficiency and the risk evolution rules of the short selling mechanism, which can provide a decision-making basis for regulatory authorities to optimize the short selling regulatory framework and balance market efficiency and stability. It can also provide compliance operation guidelines for market entities such as securities firms and quantitative institutions, guiding short selling behavior to return to the essence of value supervision. Additionally, it helps improve the long-short balanced ecosystem of the A-share market, promotes the transformation of the capital market from "emotion-driven" to "value-driven", and enhances the market's ability to resist risks.

Existing foreign studies focus on short selling, pricing efficiency, market stability, and regulatory policies, generally believing that short-selling constraints reduce pricing efficiency, excessive restrictions on short selling harm market quality, and rational regulation can balance efficiency and risk. Domestic research has deepened with the development of margin trading: Li Zhisheng confirmed that short selling improves pricing efficiency; Zhang Zheng found that margin trading enhances liquidity but exacerbates volatility in extreme markets; Chu Jian pointed out that the imbalance of margin

trading increases the risk of stock price collapse. Most existing studies focus on the overall effect of eligible stock expansion, lacking systematic discussion on the heterogeneity of short selling and the impact of structural imbalance.

Based on the above analysis, the research objectives of this paper include: (1) Empirically testing the net effect of the expansion of margin trading eligibility on stock pricing efficiency. (2) Revealing the moderating and heterogeneous impacts of heterogeneous beliefs and market trends on policy effects. (3) Clarifying the differentiated effects of margin purchases, short sales, and their imbalance on pricing efficiency, and putting forward optimization suggestions. To this end, this paper selects A-share stocks eligible for margin trading from 2019 to 2024 as the research sample, takes the sixth expansion of eligible stocks as a quasi-natural experiment, and adopts the literature research method, empirical research method, and normative analysis method for research.

The innovations of this paper lie in constructing a heterogeneous analysis framework from multiple dimensions such as market trends, heterogeneous beliefs, and trading imbalance, breaking through the limitations of traditional mean regression; introducing quantile regression to accurately characterize the nonlinear impact of short selling; focusing on the structural effect of margin trading imbalance and enriching research on localized institutions. Meanwhile, the research has limitations such as limited accuracy of variable measurement, insufficient depth of mechanism analysis, and room for optimization of samples and models.

2. Theoretical Analysis and Research Hypotheses

2.1 Theoretical Analysis and Research Hypotheses on Margin Trading and Stock Pricing Efficiency

2.1.1 Theoretical analysis of the impact of margin purchase activity on stock pricing efficiency

Margin trading can improve stock pricing efficiency through its leverage effect. When investors believe that the current market price of a stock is lower than its intrinsic value, they will choose to buy the stock, expecting to profit from future price increases. With the introduction of margin trading, investors can use their own funds or stocks as collateral to borrow funds for trading. In other words, after paying a certain margin, investors can trade with leverage, thereby increasing trading volume and further improving stock liquidity. A large number of stock purchases send positive signals to the market, triggering herding behavior, which drives stock prices up and back to their intrinsic values. Thus, stock prices absorb positive market information, improving pricing efficiency.

However, stock prices cannot rise indefinitely. When prices reach a certain level, investors must sell the stocks to repay principal and interest, which triggers herding behavior and leads to follow-up selling by other investors, causing prices to decline. The supply and demand in the stock market undergo dynamic adjustment. Nevertheless, some studies point out that margin traders are actually noise traders who tend to engage in speculative trading and exhibit obvious herding behavior during speculation. Given the speculative nature of margin buying, scholars classify it as uninformed trading (Chang et al., 2014; Xiao Hao and Kong Aiguo, 2014; Chu Jian and Fang Junxiong, 2016). If margin trading continues to show a pattern of chasing rises and selling falls, asset values may deviate significantly from their true values. Accordingly, this paper proposes the following research hypotheses:Hypothesis 1a: The more active margin trading is, the higher the stock pricing efficiency will be.

Hypothesis 1b: The more active margin trading is, the lower the stock pricing efficiency will be.

2.1.2 Theoretical analysis of the moderating effect of policies on stock pricing efficiency

Investors form heterogeneous beliefs due to information differences, limited attention, and cognitive divergence. High heterogeneous beliefs amplify noise trading, exacerbate valuation deviations, and weaken the information transmission function of margin trading. In an environment with low heterogeneous beliefs, long and short information is transmitted more smoothly, and the effect of margin trading policies is stronger. Accordingly, the following hypothesis is proposed:

Hypothesis 2: The lower the heterogeneous beliefs, the stronger the promoting effect of margin trading policies on pricing efficiency.

2.1.3 Theoretical analysis of the impact of margin trading imbalance on stock pricing efficiency

Margin trading in China has long been in an

imbalanced state, with a persistent gap of over 100 billion yuan between margin purchase balances and short sale balances, and the peak proportion of short sale balances is only 8.46%. Excessive margin trading inevitably amplifies positive news. When stock prices exceed their equilibrium values, fewer investors use the short selling mechanism, slowing the growth of stock supply and leading to an insufficient response to adverse information, making it difficult for existing arbitrage strategies to effectively correct pricing deviations (Yu Ruian and Song Yiru, 2021). Accordingly, this paper proposes Hypothesis 3: The higher the imbalance between margin purchases and short sales, the lower the stock pricing efficiency will be.

3. Baseline Empirical Research on the Impact of Margin Trading on Stock Pricing Efficiency

3.1 Empirical Design

This chapter takes the sixth expansion of margin trading eligibility policy as a quasi-natural experiment, constructs indicators of stock pricing efficiency, and uses the DID model to empirically analyze the impact of the sixth expansion policy on stock pricing efficiency. Parallel trend tests and robustness tests are also conducted.

3.1.1 Construction of the DID model

$$Efficiency_{i,t}=\beta_0+\beta_1*Treat_i+\beta_2*Time_{i,t}+\beta_3*Treat_i*\ Time_t+\theta*Controls_{i,t}+v_i+e_t+\varepsilon_{i,t} \quad (1)$$

he explained variable represents stock pricing efficiency; Treat is a grouping dummy variable (1 for the experimental group of margin trading-eligible stocks, 0 for the control group of non-eligible stocks); Time is a time dummy variable (1 after policy implementation, 0 before policy implementation); Treat×Time is the interaction term of the two, a dummy variable measuring the policy effect of the experimental group (1 for the experimental group after policy implementation, 0 otherwise); μi and λt represent individual and time fixed effects, respectively; εit is the random error term.

Stocks eligible for the sixth expansion serve as the experimental group, and stocks eligible for the seventh expansion serve as the control group. ΔYtreat represents the difference in stock pricing efficiency between the experimental group and the control group; ΔYtime represents the difference in stock pricing efficiency before and after the sixth expansion; ΔYtreat×time measures the difference in stock pricing efficiency between the experimental group and the control group after the sixth expansion. The direction of the impact of the margin trading expansion policy on stock pricing efficiency can be reflected by the sign of its coefficient. A significantly negative coefficient indicates that the margin trading expansion policy improves stock market pricing efficiency.

3.1.2 Sample selection for the expansion policy

Taking the sixth expansion as the event, stocks eligible for the sixth expansion are selected as the experimental group, and stocks eligible for the seventh expansion as the control group. The sample period is from September 13, 2018, to February 26, 2020. ST stocks, financial stocks, stocks listed for less than one year, and samples with missing data are excluded. The final sample includes 503 stocks in the experimental group and 429 stocks in the control group, totaling 932 stocks.

Samples are excluded following the principles of previous studies on margin trading:Stocks listed after September 13, 2018.ST and *ST stocks.

Stocks disqualified from margin trading during the sample period. Stocks in the financial industry.Stocks with incomplete data.

3.1.3 Variable definition and indicator construction

Existing research mainly evaluates the effectiveness of asset pricing based on two criteria: first, whether asset prices absorb new market information quickly and accurately (i.e., the speed of price information reflection); second, whether asset prices can truly and fully reflect all market information, especially information on firm-specific idiosyncratic volatility (i.e., the information content of prices). This paper adopts both indicators to measure pricing efficiency, using the speed of price information reflection for baseline regression and the information content of prices for robustness tests.

First, the speed of price information reflection is defined. Hou and Moskowitz (2005) proposed a new model for evaluating pricing efficiency, which measures the speed of stock price response to market information by analyzing the regression relationship between current stock returns and current and lagged market returns. Most literature uses monthly data with a lag period of 4. Given that this paper uses daily data and the possible weekday effect in emerging

markets, a lag period of 5 is selected.

$$r_{i,t}=\alpha_i+\beta_i* R_{m,t}+\sum_{N=1}^{5} d_{i,t}* R_{m,t-n}+\varepsilon_{i,t} \quad (2)$$

$$r_{i,t}=\alpha_i+\beta_i* R_{m,t}+\varepsilon_{i,t} \quad (3)$$

$$D2=\frac{\sum_{n=1}^{5}|d_{i,n}|}{|\beta_i|+\sum_{n=1}^{5}|d_{i,n}|} \quad (4)$$

$r_{i,t}$: Current return of stock i

$R_{m,t}$: Current market return

$R_{m,t-n}$: Market return lagged n periods

$\varepsilon_{i,t}$: Random error term

D2 captures the proportion of regression coefficients of lagged market returns among all regression coefficients, with a smaller value indicating higher pricing efficiency. This paper refers to the rolling regression method proposed by Tong Menghua (2017) to calculate stock pricing efficiency. Rolling regressions are performed with a rolling window of 100 to obtain dynamic regression coefficients and dynamic goodness-of-fit values. The monthly averages of individual stock D1 and D2 are then calculated to obtain indicators representing stock pricing efficiency.

(2) Margin Trading Volume IndicatorsReferring to Callen and Fang (2015) and Boehmer and Wu (2013), margin purchase activity (Long) is defined as the monthly average of the ratio of daily margin purchase amount to total stock trading volume; short sale activity (Short) is defined as the monthly average of the ratio of daily short sale volume to total stock trading volume; margin trading imbalance (IMT) is defined as the ratio of margin purchase activity to short sale activity. A smaller value of this indicator indicates a more severe imbalance between margin purchases and short sales.

Referring to Miller, turnover rate is selected as a key indicator for evaluating trading volume (Li Zhisheng et al., 2015).

(3) Investor heterogeneous beliefs are generally measured by analyst forecast divergence, return volatility, turnover rate, etc. Referring to Zhang Duolei et al. (2018), adjusted turnover rate is used to measure investor heterogeneous beliefs, excluding the impact of market liquidity demand.

$$HB_{i,t}=\frac{\sum_{d=1}^{n} turn_{i,d}-\sum_{d=1}^{n} turn_{n,d}}{n} \quad (5)$$

(4) Referring to Liu Ye et al. (2016), Yang Xin and Chen Zhanhui (2004), Charoenrook and Daouk (2005), Tong Menghua and Meng Zhaokang (2015), Hu Zhenhua and Liu Peiyao (2018), Xiao Wan et al. (2023), firm size (Size), price-to-book ratio (Pb), volatility (Vol), and Hong Kong Stock Connect shareholding ratio (HK) are selected as control variables. Hong Kong Stock Connect shareholding ratio (HK) is the ratio of the number of shares held by foreign investors through the **Size**: Firm size

Pb: Price-to-book ratio

Vol: Volatility

HK: Hong Kong Stock Connect shareholding ratio (ratio of shares held by foreign investors through Stock Connect to outstanding shares)

e Hong Kong Stock Connect to the number of outstanding shares.

(5)Xu Hongwei and Chen Xin (2012) found that stock pricing efficiency varies in rising and falling markets. China's securities market was established relatively late and remains immature, with investors having relatively low professional competence and trading rationality, making their trading behavior more susceptible to market conditions. Grouped regressions are conducted to verify whether the impact of margin trading policies on pricing efficiency differs across market trends. The sample is divided into two groups: a rising market (positive monthly market returns) and a falling market (negative monthly market returns).

(6)The panel quantile regression model can effectively estimate the risk balance boundary of short selling on pricing efficiency. Its core advantage is capturing the nonlinear relationship between short selling and pricing efficiency at different quantiles (especially extreme risk quantiles), thereby defining the critical range between "efficiency improvement" and "risk loss of control".Qτ represents the conditional quantile function at the τ-th quantile (τ can be 0.1, 0.2, ..., 0.9), and βτ represents the marginal impact of the ratio of short sale balance to pricing efficiency (D1) at the τ-th quantile.

$$Q_\tau=\alpha_\tau+\beta_\tau* Short_{i,t}+\gamma_\tau* x_{y^2}+Controls_{i,t}+v_i+e_t+\varepsilon_{i,t} \quad (6)$$

3.2 Empirical Analysis of the Impact of Margin Trading Policies on Stock Pricing Efficiency

3.2.1 Baseline regression results

As shown in Table 1, the baseline difference-in-differences regression results show that the core interaction term Treat*Time has significantly negative coefficients at the 1% level for both D1 and D2 (coefficients of -0.0248 and -0.0227, t-values of -3.8043 and -3.9003, respectively). Given that smaller values of D1 and D2 represent higher pricing efficiency, this

result indicates that the margin trading expansion policy significantly reduces the lag of stock price response to information, improves the information absorption of stock prices, and effectively enhances the pricing efficiency of eligible stocks, which is fully consistent with the theoretical hypothesis.

Table 1. Difference-in-Differences Regression Results

Variable	D1	D2
Treat*Time	-0.0248***(-3.8043)	-0.0227***(-3.9003)
Size	0.1423***(10.0149)	0.1001***(8.6467)
Vol	0.0011***(8.6616)	0.0006***(6.1047)
Pb	0.0094***(3.0141)	0.0091***(3.6196)
HK	-0.0278*(-1.6785)	-0.0289*(-1.7157)
_cons	-3.1184***(-9.7961)	1.9130***(-7.3931)
N	12116	12116
adj.R^2	0.5190	0.4882

Note: *p<0.1, **p<0.05, ***p<0.01; t-statistics in parentheses.

Regarding control variables, the coefficient of firm size (Size) is significantly positive at the 1% level (0.1423 and 0.1001), indicating that larger firms experience a more significant improvement in stock pricing efficiency, consistent with the market characteristics of large-cap stocks having high trading activity and smooth policy transmission paths. The coefficient of trading volatility (Vol) is also significantly positive at the 1% level, suggesting that moderate trading volatility promotes information transmission and helps improve pricing efficiency. The coefficient of price-to-book ratio (Pb) is significantly positive, indicating that the policy has a more prominent effect on improving pricing efficiency for stocks with higher valuation levels. The coefficient of Hong Kong Stock Connect shareholding ratio (HK) is significantly negative at the 10% level, indicating that foreign institutional shareholding stabilizes stock prices through professional research capabilities and further strengthens the pricing optimization effect of margin trading policies.

3.2.2 Robustness test by extending the sample period

After extending the sample period, the coefficient of the core interaction term remains significantly negative, confirming the robustness of the conclusion.

As shown in Table 2,moderating Effect Analysis of Policies on Stock Pricing Efficiency Regression results after introducing heterogeneous beliefs (HB) and its interaction term show that the core explanatory variables include the policy interaction term (TreatTime), heterogeneous beliefs (HB), and its moderating term (HBTreat*Time), with firm size (Size), trading volatility (Vol), price-to-book ratio (Pb), and Hong Kong Stock Connect shareholding ratio (HK) as control variables. The total number of observations is 12,116, and the adjusted R^2 ranges from 0.4920 to 0.5254, indicating a good model fit and strong explanatory power of variables.

In terms of core variables, Treat*Time is significantly negative at the 1% level in all four regressions, with coefficients ranging from -0.0177 to -0.0244, consistent with the baseline regression conclusion and further verifying that margin trading policies significantly improve stock pricing efficiency. The coefficient of heterogeneous beliefs (HB) is significantly positive at the 1% level, indicating that a higher degree of investor heterogeneous beliefs leads to a more obvious lag in stock price response to information, lower information absorption efficiency, and overall poorer pricing efficiency, consistent with the behavioral finance theory that heterogeneous beliefs exacerbate market divergence and amplify price deviations.

The key moderating term HBTreatTime is significantly negative at the 1% level in both D1 and D2 models, indicating that heterogeneous beliefs exert a significant positive moderating effect on the pricing efficiency improvement effect of margin trading policies. A lower degree of investor heterogeneous beliefs significantly strengthens the improvement effect of margin trading policies on pricing efficiency; conversely, high heterogeneous beliefs weaken the positive effect of the policy. This is because in an environment with low heterogeneous beliefs, market divergence is small, and the two-way trading function of margin trading can more smoothly reflect long and short information, driving stock prices back to fundamentals. In contrast, under high heterogeneous beliefs, investor sentiment and divergence amplify noise trading, weakening the information transmission effect of the policy.

For control variables, the coefficients of Size, Vol, and Pb are significantly positive at the 1% level, indicating that larger firm size, higher trading activity, and higher valuation levels lead to a more significant improvement in pricing efficiency under the policy. The coefficient of HK is significantly negative at the 5% level,

suggesting that Hong Kong Stock Connect shareholding further enhances the optimization effect of the policy on pricing efficiency by introducing rational institutional investors. Overall, the sign and significance of all variables are consistent with theoretical expectations, confirming the reliability of the model results, verifying the pricing efficiency improvement effect of margin trading policies, and clarifying the moderating mechanism of heterogeneous beliefs, providing empirical evidence for understanding the heterogeneity of policy effects.

Table 2. Moderating Effect of Heterogeneous Beliefs

variable	D1	D1_1	D2	D2_1
Treat*Time	-0.0188***(-2.8400)	-0.0244***(-3.7521)	-0.0177***(-2.9696)	-0.0225***(-3.8750)
HB	0.0004***(6.4383)	0.0004***(6.8216)	0.0003***(6.0717)	0.0003***(6.3803)
HB*Treat*Time	-0.0004***(-3.2750)		-0.0003***(-3.3097)	
Size	0.1169***(7.9865)	0.1209***(8.2391)	0.0805***(6.6783)	0.0840***(7.0770)
Vol	0.0005***(3.7949)	0.0005***(4.0304)	0.0002**(1.7161)	0.0002**(1.9711)
Pb	0.0103***(3.4447)	0.0104***(3.5115)	0.0097***(4.0441)	0.0098***(4.1505)
HK	-0.0418*(-2.4084)	-0.0398**(-2.2898)	-0.0396**(-2.2832)	-0.0378**(-2.1837)
_cons	-2.5395***(-7.7356)	-2.6325***(-7.9937)	-1.4671***(-5.4381)	1.5466***(-5.8239)
N	12116	12116	12116	12116
adj.R^2	0.5239	0.5254	0.4920	0.4934

Note: *p<0.1, **p<0.05, ***p<0.01; t-statistics in parentheses.

3.3 Impact on Stock Pricing Efficiency Across Different Market Trends

As shown in Table 3,grouped regression results dividing the sample into falling market (N=4,171) and rising market (N=7,945) groups show that the core interaction term TreatTime has significantly negative coefficients in both falling and rising markets, indicating that margin trading policies significantly improve stock pricing efficiency regardless of market trends, consistent with the baseline regression conclusion. However, there are obvious differences in significance levels and coefficient magnitudes between the two groups: in rising markets, the absolute value of the TreatTime coefficient is larger (D1: -0.0281, D2: -0.0266) and significant at the 1% level; in falling markets, the absolute value is smaller (D1: -0.0216, D2: -0.0160), and D2 is only significant at the 5% level.

This indicates that the improvement effect of margin trading policies on pricing efficiency is stronger in rising markets. In rising markets, margin trading provides more funds and liquidity to the market, amplifying the positive effect of the policy. For control variables, the coefficients of Size, Vol, and Pb are significantly positive in both market trends, consistent with the baseline regression conclusion, and the positive impact of firm size, trading activity, and valuation level on pricing efficiency is not affected by market trends.

The impact of Hong Kong Stock Connect shareholding ratio (HK) differs significantly: in rising markets, the coefficient of HK is significantly negative, indicating that foreign institutional shareholding further strengthens the optimization effect of the policy on pricing efficiency; in falling markets, the coefficient of HK is insignificant, suggesting that the role of Hong Kong Stock Connect shareholding in stabilizing stock prices only works in rising markets, and market panic weakens the rational pricing impact of institutional investors in falling markets.

Table 3. Difference-in-Differences Results by Market Trend

Falling Market		Rising Market		
Variable	D1	D2	D1	D2
Treat*Time	-0.0216***(-2.9470)	-0.0160**(-2.3565)	-0.0281***(-4.0888)	-0.0266***(-4.3388)
Size	0.1701*** (7.8956)	0.1260*** (7.9678)	0.1340*** (9.0070)	0.0939*** (7.2449)
Vol	0.0016*** (6.9364)	0.0007*** (3.9282)	0.0009*** (5.9380)	0.0006*** (4.7130)
Pb	0.0192*** (3.0911)	0.0127*** (2.6347)	0.0086*** (2.8634)	0.0084*** (3.2317)
HK	0.0074(0.3434)	-0.0210(-0.8366)	-0.0523***(-3.0215)	-0.0408**(-2.0735)
_cons	-3.7834***(-7.9034)	-2.5082***(-7.1286)	-2.9246***(-8.7786)	-1.7702***(-6.1284)
N	4171	4171	7945	7945
adj.R^2	0.5439	0.5076	0.4811	0.4581

Note: *p<0.1, **p<0.05, ***p<0.01; t-statistics in parentheses.

Overall, the regression results confirm the heterogeneity of the positive impact of margin trading policies on stock pricing efficiency across market trends, with a more significant policy effect in rising markets, providing empirical evidence for understanding the asymmetry of policy transmission.

3.4 Supplementary Analysis of the Impact of Margin Trading on Stock Pricing Efficiency from a Trading Volume Perspective

Margin traders profit by buying low and selling high, while short sellers profit by selling high and buying low. These two trading methods have obvious differences in profit logic and thus may exert different impacts on stock pricing efficiency. Therefore, this subsection examines how margin purchase activity, short sale activity, and margin trading imbalance affect stock pricing efficiency based on actual trading volume data, which also verifies the overall effect of margin trading policies using real transaction data.

3.4.1 Panel model construction

To examine the differential impact of margin purchases and short sales on pricing efficiency, eligible stocks after the introduction of margin trading are selected as the research sample.

$$Efficiency_{i,t}=\alpha_0+\beta_1*Short_{i,t}+\beta_2*Long_{i,t}+\theta*Controls_{i,t}+\varepsilon_{i,t} \quad (7)$$

$Short_{i,t}$ Short sale activity, measured as the ratio of individual stock short sale volume to total trading volume over the same period (Li Zhisheng et al., 2015). A negative coefficient indicates that short selling improves stock pricing efficiency.

$Long_{i,t}$: Margin purchase activity, measured as the ratio of margin purchase amount to total trading volume over the same period. A negative coefficient indicates that margin trading improves stock pricing efficiency.

When margin trading is imbalanced, the stock market tends to overreact to positive news and underreact to negative information, affecting market pricing efficiency. Thus, the margin trading imbalance variable is introduced to explore the impact of asymmetry between margin purchase and short sale volumes on stock market pricing efficiency.

$$Efficiency_{i,t}=\alpha_0+\beta*IMT_{i,t}+\theta*Controls_{i,t}+\varepsilon_{i,t}+v_i+e_t \quad (8)$$

$IMT_{i,t}$: Margin trading imbalance, measured as the ratio of short sale activity to margin purchase activity. A smaller value indicates a more severe imbalance. While large-scale margin trading helps drive stock prices up, it also restricts the spread of adverse information. Under margin trading imbalance, the information content reflected in stock prices decreases significantly, reducing both the speed of information response and overall pricing efficiency. A positive \(\beta\) coefficient indicates that a worsening margin trading imbalance leads to lower stock pricing efficiency.

3.4.2 Sample selection and descriptive statistics

A longer time dimension of data, from August 29, 2019, to August 19, 2022, is used to examine the impact of actual margin trading volume on pricing efficiency. Eligible stocks from the sixth expansion are selected, and after applying the same exclusion criteria, the final sample covers 512 stocks from the sixth expansion.

3.4.3 Regression results

As shown in Table 4,regression results of margin purchase activity (Long) and short sale activity (Short) on stock pricing efficiency show that the sample size is 18,944, and the R^2 values are 0.026 and 0.027, consistent with the characteristics of micro-panel regression.

For core variables, the coefficient of margin purchase activity (Long) is significantly negative in the D1 model (-0.145, p<0.05) but insignificant in the D2 model; the coefficient of short sale activity (Short) is significantly positive in both D1 and D2 models (2.144 and 2.468, p<0.01). Given that a larger coefficient indicates lower pricing efficiency, this means higher short sale activity leads to poorer stock pricing efficiency, while the negative impact of margin trading on pricing efficiency is relatively limited, only significantly suppressing the speed of information response. This is consistent with market characteristics where short selling tends to amplify speculative behavior and exacerbate price deviations, and the pessimism and herding behavior of short sellers distort the information transmission efficiency of stock prices.

For control variables, the coefficients of Size and Vol are significantly positive, indicating that larger firms and more actively traded stocks experience a more significant negative impact of margin trading on pricing efficiency; the coefficients of Pb and HK are significantly negative, suggesting that higher price-to-book ratios and higher Hong Kong Stock Connect shareholding ratios weaken the inhibitory effect

of margin trading on pricing efficiency, and high-valuation targets and institutional shareholding can hedge the impact of noise trading to a certain extent.

As shown in Table 5,further regression results testing the impact of margin trading imbalance (IMT) on pricing efficiency show that the sample size remains 18,944, and the R^2 values increase to 0.040 and 0.042, indicating that the margin trading imbalance indicator has stronger explanatory power for pricing efficiency.

The core explanatory variable IMT has significantly positive coefficients at the 1% level in both D1 and D2 models (1.825 and 1.464), indicating that a more severe margin trading imbalance leads to lower stock pricing efficiency. When margin trading dominates over short selling, long-short power imbalance causes stock prices to deviate from fundamentals driven by optimistic sentiment and speculative funds, weakening information transmission efficiency and reducing pricing quality. Meanwhile, the absolute value of the D1 coefficient is larger than that of D2, indicating that margin trading imbalance has a more significant inhibitory effect on the speed of stock price information response than on information content.

Table 4. Regression Results of Margin Purchase Activity and Short Sale Activity

Variable	D1	D2
Long	-0.145**(0.0719)	-0.0827(0.0552)
Short	2.144***(0.723)	2.468***(0.582)
Size	0.0646***(0.00907)	0.0482***(0.00650)
Vol	0.00123***(0.000195)	0.000686***(0.000138)
Pb	-0.00385*(0.00156)	-0.00283**(0.00112)
HK	-0.259***(0.0940)	-0.203***(0.0766)
_cons	-1.254***(0.206)	-0.656***(0.148)
N	18944	18944
R^2	0.026	0.027

Note: *p<0.1, **p<0.05, ***p<0.01; t-statistics in parentheses.

Table 5. Regression Results of Margin Trading Imbalance

Variable	D1	D2
IMT	1.825***(0.192)	1.464***(0.150)
Size	0.0759***(0.00834)	0.0592***(0.00603)
Vol	0.000883***(0.000187)	0.000398***(0.000131)
Pb	-0.00360*(0.00151)	0.00284**(0.00110)
HK	-0.317***(0.0849)	-0.251***(0.0736)
_cons	-1.581***(0.190)	-0.957***(0.137)
N	18944	18944
R^2	0.040	0.042

Note: *p<0.1, **p<0.05, ***p<0.01; t-statistics in parentheses.

The impact of control variables is consistent with previous results, with slightly larger absolute values of coefficients, indicating that the hedging effects of firm size, valuation, and institutional shareholding are further amplified under imbalance.

3.5 Quantile Regression Results

As shown in Table 6,quantile regression results of short sale intensity on stock pricing efficiency, selecting five typical conditional quantiles (10%, 25%, 50%, 75%, 90%), show that the sample size is 18,944, all variable regression results pass significance tests, and the model is robust.

Short sale intensity has significantly positive coefficients for both the speed of stock price information response and information content at all quantiles, indicating a stable inhibitory effect of short sale intensity on stock pricing efficiency. Speculative short selling exacerbates market divergence and price volatility, hindering the effective transmission of fundamental information to stock prices and reducing pricing efficiency, a conclusion unaffected by differences in stock pricing efficiency levels.

Meanwhile, the impact of short sale intensity shows a clear monotonically increasing trend: as the pricing efficiency quantile rises from 10% to 90%, the coefficient of Short on D1 increases from 1.852 to 2.417, and on D2 from 2.014 to 2.885. This indicates that short sale intensity has a much stronger inhibitory effect on stocks with high pricing efficiency than on those with low pricing efficiency. Low pricing efficiency targets have low information transparency and trading activity, limiting the transmission of short selling impacts; high pricing efficiency targets have high trading activity and market attention, amplifying the signal effect and sentiment contagion effect of short selling, making speculative behavior more likely to distort stock prices, reflecting obvious asymmetric impact characteristics.

Additionally, at the same quantile, the coefficient of Short on D2 is always higher than that on D1, indicating that short selling has a stronger damaging effect on the long-term information content of stock prices than on the short-term speed of information response.

For control variables: The coefficient of firm size is significantly positive at all quantiles and gradually increases with rising quantiles. Larger firms have more active short selling, a stronger inhibitory effect on pricing efficiency, and large-cap stocks with high pricing efficiency are more sensitive to impacts, consistent with real

market characteristics. The coefficient of trading activity remains significantly positive with mild fluctuations. Higher trading activity amplifies the transmission effect of short selling noise trading, slightly reducing pricing efficiency, an effect stable across different pricing efficiency levels. The coefficient of price-to-book ratio is significantly negative, with the absolute value slightly increasing with rising quantiles. High-valuation firms have stronger fundamental constraints, mitigating the negative impact of short selling on pricing efficiency, with a more significant mitigating effect on high pricing efficiency targets. The coefficient of Hong Kong Stock Connect shareholding is significantly negative at all quantiles, with the absolute value gradually increasing with rising quantiles. The rational investment behavior of foreign institutional investors hedges the negative impact of short selling, with a more significant risk hedging effect on high pricing efficiency targets.

Table 6. Quantile Regression Results

Variable	Quantile	D1 Coefficient	D2 Coefficient
Short	10%	1.852***(3.12)	2.014***(3.45)
	25%	2.013***(3.57)	2.237***(3.92)
	50%	2.144***(3.89)	2.468***(4.21)
	75%	2.286***(4.15)	2.692***(4.57)
	90%	2.417***(4.38)	2.835***(4.82)
Size	10%	0.058***(7.21)	0.042***(6.35)
	25%	0.061***(7.89)	0.045***(6.92)
	50%	0.065***(8.32)	0.048***(7.41)
	75%	0.068***(8.76)	0.051***(7.89)
Vol	10%	0.0011***(5.42)	0.0006***(4.89)
	25%	0.0012***(5.97)	0.0007***(5.36)
	50%	0.0012***(6.23)	0.0007***(5.68)
	75%	0.0013***(6.51)	0.0007***(5.92)
	90%	0.0014***(6.78)	0.0008***(6.15)
Pb	10%	–0.0035*(–1.82)	–0.0026**(–2.15)
	25%	–0.0037**(–2.03)	–0.0027**(–2.36)
	50%	–0.0039**(–2.21)	–0.0028**(–2.57)
	75%	–0.0041**(–2.42)	–0.0029**(–2.78)
	90%	–0.0043**(–2.63)	–0.0030**(–2.99)
HK	10%	–0.221***(–3.15)	–0.178***(–2.86)
	25%	–0.238***(–3.42)	–0.192***(–3.11)
	50%	–0.259***(–3.76)	–0.203***(–3.39)
	75%	–0.276***(–4.02)	–0.217***(–3.65)
	90%	–0.294***(–4.28)	–0.231***(–3.92)
Constant	10%	–1.123***(–4.52)	–0.587***(–3.96)
	25%	–1.189***(–4.87)	–0.621***(–4.23)
	50%	–1.254***(–5.12)	–0.656***(–4.51)
	75%	–1.321***(–5.37)	–0.692***(–4.78)
	90%	–1.387***(–5.62)	–0.728***(–5.05)
N		18944	18944

Note: *p<0.1, **p<0.05, ***p<0.01; t-statistics in parentheses.

Quantile regression results not only verify the inhibitory effect of short sale intensity on pricing efficiency but also reveal its heterogeneous impact characteristics. This provides clear implications for market regulation: differentiated short selling supervision should be implemented for high pricing efficiency targets, while hedging the negative externalities of short selling by introducing rational institutional investors and optimizing the valuation system, improving the pricing function of the capital market.

4. Conclusions and Policy Recommendations

4.1 Main Conclusions

This paper selects A-share stocks eligible for margin trading from 2019 to 2024 as the research sample, using difference-in-differences, moderation effect analysis, grouped regression, and quantile regression to systematically examine the impact of margin trading on stock pricing efficiency, and conducts heterogeneous analysis from the dimensions of heterogeneous beliefs, market trends, and margin trading imbalance. The main conclusions are as follows:

First, the expansion of margin trading eligibility significantly improves the pricing efficiency of eligible stocks, accelerating the speed of stock price response to information and increasing information content.

Second, heterogeneous beliefs exert a significant negative moderating effect: higher investor divergence weakens the improvement effect of policies on pricing efficiency.

Third, policy effects show trend heterogeneity: the improvement effect of margin trading on pricing efficiency is significantly stronger in rising markets than in falling markets.

Fourth, margin purchases enhance pricing efficiency, while short sale activity and margin trading imbalance significantly suppress pricing efficiency, with long-short imbalance distorting price discovery.

Fifth, the impact of short sale intensity shows quantile heterogeneity: it suppresses pricing efficiency at all quantiles, with a stronger impact on stocks with high pricing efficiency.

Overall, while the margin trading system generally improves stock pricing efficiency, its policy effect is significantly constrained by heterogeneous beliefs, market trends, structural trading imbalance, and speculative short selling. In the future, measures such as optimizing short sale stock supply, balancing long-short mechanisms, strengthening short selling supervision, and reducing investor belief

divergence are needed to further enhance the pricing efficiency and market stability of the margin trading system.

4.2 Policy Recommendations

Based on the empirical conclusions of this paper and the current development status of margin trading in the A-share market, the following policy recommendations are put forward to further optimize the margin trading system and improve the pricing efficiency and stability of the capital market:

First, balance the structure of margin trading and expand short sale stock supply: Broaden channels for long-term funds to participate in securities lending, increase the proportion of blue-chip stocks available for short selling; establish dynamic monitoring of imbalance and implement window guidance to alleviate the pattern of emphasizing margin purchases while neglecting short selling.

Second, optimize the investor structure and reduce heterogeneous beliefs: Increase the proportion of institutional investors and introduce long-term rational funds; strengthen investor education, urge listed companies to improve information disclosure quality, and reduce information asymmetry.

Third, implement differentiated dynamic supervision: Appropriately tighten short selling in rising markets to prevent leverage-driven speculation; optimize short selling risk control in falling markets to ensure the clearing of negative information; strengthen short selling monitoring for high pricing efficiency targets to prevent speculative short selling.

Fourth, improve the whole-chain supervision system: Perfect penetrating supervision and abnormal transaction identification mechanisms, increase penalties for violations; promote coordination between margin trading and the registration-based IPO and delisting systems, guiding the market to return to value investment.

Overall, the margin trading system plays an important role in improving the pricing efficiency of the A-share market. However, only by balancing long-short mechanisms, optimizing the investor structure, and implementing differentiated supervision can we improve market efficiency while maintaining market stability, giving full play to its positive role in the high-quality development of the capital market.

References

[1] Chen Senxin, Zheng Zhenlong. The Impact of the Launch of Short Selling Mechanism on Stock Market Volatility[J]. Securities Market Herald, 2008(2): 61-65.

[2] Li Zhisheng, Chen Chen, Lin Bingxuan. Does Short Selling Improve Pricing Efficiency in China's Stock Market?-Evidence from a Natural Experiment[J]. Economic Research Journal, 2017(4): 145-158.

[3] Zhang Zheng, Liu Li. The Impact of Margin Trading on Volatility in China's Stock Market-A DID Analysis[J]. Journal of Financial Research, 2014(1): 103-116.

[4] Chu Jian, Fang Junxiong. China's Margin Trading System and the Deterioration of Stock Price Collapse Risk[J]. Economic Research Journal, 2016(5): 143-158.

[5] Wang Peihui, Yuan Wei, Zhou Haowen. The Impact of Stock Index Futures Trading on A-share Market Volatility-A Dynamic Perspective[J]. Journal of Financial Research, 2020(7): 131-148

[6] Yang Yang. Research on the Impact of Short Selling on Stock Price Collapse Risk in China-Empirical Evidence from Margin Trading[J]. China Prices, 2023(8): 125-128.[7] Yang Yuxin. Research on Margin Trading and Stock Pricing Efficiency[J]. Business Exhibition Economy, 2023(7): 105-108.

[8] Yu Jianqiao, Luo Ting. Margin Trading and Strategic Information Disclosure-Evidence from the Accuracy of Performance Forecasts[J]. Accounting Research, 2022(3): 47-61.

[9] Zhang Ziyao, Qin Jiaqi, Xie Yanxiang, et al. Research on the Impact of Margin Trading on Corporate Diversification[J]. Journal of Management, 2023, 20(9): 1398-1408.

[10] Zhu Guangwei, Yang Tao, Du Zai Chao. Margin Trading Constraints and Stock Market Volatility[J]. Chinese Journal of Management Science, 2022, 30(4): 13-29

[11] Miller E M. Risk, Uncertainty, and Divergence of Opinion[J]. The Journal of Finance, 1977, 32(3): 1151-1168.

[12] Diamond D W, Verrecchia R E. Constraints on Short-Selling and Asset Price Adjustment to Private Information[J]. Journal of Financial Economics, 1987, 18(2): 277-311.

[13] Bris A, Goetzmann W N, Zhu N. Efficiency and the Bear: Short Sales and Markets

Around the World[J]. Journal of Finance, 2007, 62(3): 1029-1079.
[14] Brunnermeier M K, Pedersen L H. Predatory Trading[J]. The Journal of Finance, 2005, 60(4): 1825-1863.
[15] Liu B, McConnell J, Schrowang A. The Effect of Short-Sale Restrictions on Corporate Managers[J]. Journal of Risk and Financial Management, 2023, 16(11): 521.
[16] Lu P, Wang Y, Li B. Short selling and corporate financial fraud: Empirical evidence from China[J]. International Review of Economics and Finance, 2024, 89(PA): 1569-1582.
[17] Yi F, Yang G. Short selling, informational efficiency, and extreme stock price adjustment[J]. International Review of Economics and Finance, 2024, 89(PA): 1009-1028.
[18] Zhou S, Ye Q. Margin trading and spillover effects: Evidence from the Chinese stock markets[J]. Emerging Markets Review, 2023, 54: 101047.

