# Whether Short Selling Improve Price Efficiency and Liquidity in the Chinese Stock Market

## ——Research Based on Natural Experimental Data

Jianye Jin*

The High School Affiliated to the Renmin University of China, Beijing, 100086, China

* Corresponding author. Email: stalan-ace12@outlook.com

**ABSTRACT.** This paper constructed different indicators to test the effect of the margin trading reform in China's A-share market using detailed data between 2010 to 2014. The empirical evidence showed that the underlying group's liquidity after the reform increases relative to the non-underlying group's. And there was no clear evidence of the improvement of market efficiency for the underlying group. In terms of volatility, the spill-over effect was significant. These findings had implications for future advancement in the stock market.

**Keywords:** Short-selling; Margin Trading; Liquidity; Market Efficiency; Volatility

## 1 Introduction

Price efficiency, price volatility, and liquidity are the main characteristics of the stock market efficiency and quality. The efficient market hypothesis states that share prices


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reflect all information under the no-arbitrage condition. And the foundation of no-arbitrage equilibrium is no short-sales constraint. However, there are short-sales constrictions in all financial markets to some extent (Bris et al., 2007). Before 2010, short-selling was not allowed in the A-share market of China. However, some underlying stocks can conduct short-selling with certain conditions after the margin trading reform in March 2010. The first batch of margin trading targets mainly includes nearly 90 stocks. They are the components of the Shanghai 50 Index and Shenzhen Composite Index. The margin balance in the China's A-share market had reached 266.4 billion yuan up to September 30, 2013.

On the one hand, lots of research have shown that short-sale restrictions harmed price efficiency. Miller (1977) pointed out that when there were short-sale constraints, pessimistic investors could not participate in the market. As a result, asset prices could not effectively reflect negative information. Diamond and Verrecchia (1987) have shown that short-sale constraints reduce the speed of price adjustment to information. Hong and Stein (2003) found that short-sale constrictions would accumulate negative information and lead to asset bubbles. Therefore, it contributed to the market collapse and huge volatility.

On the other hand, short-sale constraints were beneficial for asset price efficiency and market equilibrium. Allen and Gale (1991) used theoretical modeling to show that the market can achieve efficient equilibrium and perfect competition with short-sale constraints. Without short-sale restrictions, effective equilibrium and perfect competition would not be achieved. Goldstein and Guembel (2008) found that the manipulative behavior and predatory trading strategies of short sellers would reduce the price efficiency of assets. Moreover, short sellers overreact to information (Brunnermeier and Pedersen, 2005), which may exacerbate sharp fluctuations (irrationality) when the market falls.

With contradictory results in the research above, the effects of the reform on market price efficiency, volatility, and liquidity need to be further studied. Besides, only part of the underlying stocks is allowed for short selling in China's margin trading system, and the underlying stocks are adjusted in batches. Therefore, it is still necessary to study the effect even though there are tons of research on it. In this paper, the indicator construction was based on the four adjustments in margin and short-selling goals from 2010 to 2014. I constructed liquidity, volatility, and price efficiency indicators and comprehensively applied the difference-in-difference model (DID) and propensity score matching (PSM) to test the effect of the margin trading reform in the A-share market of China.

The contributions of this paper are as follows. Firstly, I tested the effect of marginal reform from three dimensions: liquidity, volatility, and pricing efficiency. While previous studies only focused on one dimension. Secondly, this paper analyzed the mechanism and influence path of margin trading effects on the three dimensions deeply. Thirdly, this paper analyzed the impact of different company characteristics on the effectiveness of the margin trading reform as well, and suggestions for the follow-up implementation of the policy were recommended. The following arrangement of the paper is as follows: the second part is the theoretical analysis, concluding literature review, hypotheses, and mechanism analysis; the third part shows data description and empirical method; the empirical results and the robustness test are shown in the fourth part; the last part is the conclusion and suggestion.

# 2 Theoretical Analysis

## 2.1 Literature Review

As mentioned in the introduction, Miller (1997), Diamond and Verrecchia (1987), and Duffie et al. (2002) believed that the increase of search costs and related transaction costs would form endogenous short-sale constraints, thus reducing the efficiency of asset pricing. Bai et al. (2006) revealed that short-sale constraints would limit both risk hedging and information arbitrage, thus damaging the price efficiency of the market. Hong and Stein (2003) demonstrated that when there is a short-sale constraint, the price cannot accurately reflect the market information (especially the negative information) due to the slow absorption of information, so it may cause the stock price to change significantly or even crash.

Nevertheless, Allen and Gale (1991), Goldstein and Guembel (2008), and Brunnermeier and Pedersen (2005) indicated that when there is no short-sale constraint, the market cannot achieve efficient equilibrium and perfect competition. In addition, it will reduce the price efficiency of assets, and even the short sale mechanism will make the market overreact to negative information, causing a crash.

Similar to the research on the short-sale constraint, empirical research on short-selling itself also diverges from each other. Some studies have shown that the short sale mechanism could promote the negative information of the company to be absorbed by the stock price (Miller, 1977), thus improving price efficiency and capital market effectiveness (Boehmer and Wu, 2012; Li et al., 2015). Boehmer and Wu (2012) have shown that the short sale mechanism was conducive to improving market price efficiency and correcting stock mispricing (Miller, 1977; Bris et al., 2007), reducing stock price overvaluation (Nagel, 2005). Aitken et al. (1998) and Danielsen and Sorescu (2001) et al. found that the short sale mechanism could accelerate the

absorption of negative information by asset prices. Based on the short-sale volume research, Boehmer et al. (2008) and Diether et al. (2009) pointed out that the trading behavior of short sellers can help the market to modify the mispricing, which improves the price efficiency.

However, other studies revealed that when the market falls, allowing short sale is more likely to make investors lose confidence (Aitken et al., 1998; Morris and Shin, 1998). The resulting panic will increase the risk of a market crash, which is not beneficial for market stability and development.

In addition, some scholars pointed out that the impact of the short-sale mechanism on asset pricing efficiency is obscure. Some scholars found a weak impact of the mechanisms on asset pricing efficiency (Alexander and Peterson, 2008; Xu and Chen, 2012).

In Chinese research, Chen and Zhang (2009) found that the degree of investors' heterogeneous beliefs makes it possible for the Chinese market to crash. Huang et al. (2013) took the first batch of 90 stocks available for margin trading in China as samples. It revealed that the introduction of margin trading expands the choice space and means for investors, which is conducive to their timely response to market information.

Some scholars also studied the relationship between short selling and liquidity. Woolridge and Dickinson (1994) found that short sellers enhanced market liquidity by increasing short-sale volume in rising markets and reducing short-sale volume in falling markets. Through the research on 111 countries' stock markets, Charoenrook and Daouk (2003) found that the developed markets without short-sale constraints had significantly higher market liquidity than the emerging markets with strict short-sale constraints. Liao and Yang (2005a) identified that the liquidity of the Hong

Kong stock market first decreased and then increased after the introduction of the short-sale mechanism.

There are also studies of the relationship between short selling and volatility. Henry and McKenzie (2006) and Chang et al. (2007) studied the American and Hong Kong markets, respectively. They found that the short-sale mechanism would increase market volatility. Bris et al. (2007), Liao and Yang (2005a), and Liao and Yang (2005b) indicated that short selling reduced the volatility of the market after studying the US, Hong Kong, and Taiwan markets. In their research of the short-sale mechanism in the Taiwan stock market, they found a long-term and stable co-integration relationship between the short-sale volume and the weighted index. And they also found the existence of the short sale mechanism does not affect or exacerbate the volatility. In August 2000, the research report of Chase Manhattan Bank showed a very significant positive correlation between the short sale volume and the stock price index, which means the short sale can play a role in smoothing the sharp fluctuations of the stock price index. In addition, some scholars believed that the impact of the short-sale mechanism on market stability is obscure. Battalio & Schultz (2006) and Wang et al. (2008) demonstrated that the short-sale mechanism has no significant impact on market volatility. Figlewski & Webb (1993) stated that the correlation between the short-sale mechanism and subsequent market fluctuations was not significant. Huang & Wu (2009) argued that margin trading and short selling may have different impacts on market volatility.

## 2.2 Hypotheses

Based on the analysis above, I put up with two hypotheses:

(1) Margin trading reform improved market efficiency;

(2) Margin trading reform improved market liquidity

As for the market efficiency, I constructed volatility and stock price synchronicity. As for the market liquidity, I constructed depth, turnover, and Amihud liquidity indicators. If the volatility and stock price synchronicity decreased after the margin trading reform, then the market efficiency is improved, which means that hypothesis 1 holds. If the depth, turnover, and Amihud liquidity increased after the margin trading reform, then the market liquidity is improved, which means that hypothesis 2 holds.

### 2.3 Mechanism Analysis

(1) Since margin trading is a hedging tool, more institutional investors are attracted after the trading is available. Therefore, it improves market liquidity. And the improvement effect depends on the shareholding ratio of institutional investors and the balance of short selling. The higher ratio or the balance is, the better the effect is.

(2) Margin trading promotes the release of corporate information, improves the transparency of stocks, and reduces uncertainty. Therefore, it attracts more investors. Since small or new-born companies (especially the ones in the IT industry) have high opacity, their stocks may improve more from margin trading than other stocks.

## 3 Empirical Method

### 3.1 Indicator Construction

TOV is the monthly turnover rate. In month t, I took the mean of daily turnover rate of individual shares in months t-2, t-1, and t. The larger the TOV is, the higher the market liquidity is.

Based on Amihud (2002), I constructed LogAmihud as a liquidity indicator. In month t, I took the natural logarithm of the ratio of trading volume to the absolute

value of the month return in months t-2, t-1, and t. The larger the LogAmihud is, the higher the market liquidity is.

Depth is the volatility of TOV divided by the daily rate of return of an individual stock for months t-2, t-1, and t. The deeper the Depth, the more liquid the market.

Var is the monthly volatility. In monthly t, I took the volatility of the daily rate of return of individual stocks in months t-2, t-1, and t. The smaller the Var, the more efficient the market.

$R^2$ is the stock price synchronicity. In month t, I conducted the regression (1) with monthly stock daily rate of return $r_{i,t}$ and market composite index rate $r_{m,t}$ in months t-2, t-1, and t. The smaller the $R^2$, the more efficient the market.

$$ri,t=\alpha+\beta irm,t+\varepsilon i,t \quad (1)$$

### 3.2 Regression Model

$$dVar_{i,t} = \alpha + \beta_i Biaodi_{i,t} + \gamma_i X_{i,t} + \varepsilon_{i,t} \quad (2)$$

$\mathrm{dVar_{i,t}}$ is the change in several indicators, including $\mathrm{dDepth_{i,t}}$, $\mathrm{dLogAmihud_{i,t}}$, $\mathrm{dTOV_{i,t}}$, $\mathrm{dR^2_{i,t}}$, and $\mathrm{dVar_{i,t}}$. $\mathrm{Biaodi_{i,t}}$ is the dummy variable of the underlying stocks. If a stock has been added to the target list of margin trading and short selling from March 2010 to December 2013, the value is 1; otherwise, it is 0. $\mathrm{X_{i,t}}$ is the company characteristic, including ROA, Size, and Ind. They are control variables. Particularly, ROA is the return of asset. Size is the natural logarithm of company market capitalization. And Ind is the company industry. The data is from the companies' financial reports of the underlying stocks in the year before they were added to the list. $\varepsilon_{i,t}$ is the interference term.

# 4 Empirical REsults

## 4.1 Data Description

This paper used the daily transaction data and annual financial report data of China's A-share market from January 2009 to December 2015 in the RESSET database. Then, I extracted the daily return rate of individual shares, daily turnover rate, the daily return rate of the A-stock index in the whole market, ROA, current market value, industry, and company establishment time data. Next, I selected the transfer in and out of the underlying stock and the balance data of margin trading and short selling. I merged them with the previous data. In this paper, the daily rate of return was treated with a 1% extreme value, and the missing value was deleted.

**Table 1.** Variable Definition

| Variable | Symbol | Meaning |
|---|---|---|
| Dependent Variable | Turnover | The Rate of Turnover |
| | Depth | Market Depth |
| | LogAmihud | Natural Logarithm of Liquidity |
| | $R^2$ | Natural Logarithm of Stock Price Synchronicity |
| | Var | Volatility |
| Independent Variable | Biaodi | If a stock has been added to the target list of margin trading and short selling during the |

| | | |
|---|---|---|
| | | sample period, the value is 1; otherwise, it is 0 |
| Control Variable | ROA | Return on Assets |
| | Size | Natural Logarithm of Company Market Capitalization |
| | Ind | Company Industry |

### 4.2 Descriptive Statistics

There are 4680 data obtained after the aggregation, and the descriptive statistics are shown in Table 2.

**Table 2.** Descriptive Statistics

| Variable | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|
| ROA | 0.04 | 0.05 | -0.28 | 0.48 |
| Size | 22.10 | 1.04 | 19.54 | 27.97 |
| LogAmihud | -0.42 | 0.68 | -2.61 | 2.44 |
| Depth | -0.24 | 0.47 | -2.69 | 2.74 |
| TOV | -0.01 | 0.01 | -0.07 | 0.06 |
| $R^2$ | -0.02 | 0.16 | -0.68 | 0.52 |
| Var | 0.00 | 0.00 | 0.00 | 0.00 |

As shown in Table 2, the mean, standard deviation, minimum, and maximum values of ROA are 0.04, 0.05, -0.28, and 0.48, respectively. The mean, standard deviation, minimum, and maximum values of Size are 22.10, 1.04, 19.54, and 27.97, respectively. The mean, standard deviation, minimum, and maximum values of the liquidity indicator LogAmihud are -0.42, 0.68, -2.61, and 2.44, respectively. The mean, standard deviation, minimum, and maximum values of Depth are -0.24, 0.47, -2.69, and 2.74, respectively. The mean, standard deviation, minimum, and maximum values of TOV are -0.01, 0.01, -0.07, and 0.06, respectively. The mean, standard deviation, minimum, and maximum values of $R^2$ are -0.02, 0.16, -0.68, and 0.52, respectively.

### 4.3 Regression Results of Formula (2)

Table 3 shows the regression results of the univariate Biaodi. The dependent variables in the five columns are LogAmihud, Depth, TOV, $R^2$ and Var.

**Table 3.** Adding Control Variables

| Variable | LogAmihud | Depth | TOV | $R^2$ | Var |
|---|---|---|---|---|---|
| Biaodi | 0.156*** | 0.107*** | 0.00370*** | -0.00436 | 3.66e-05*** |
| | (0.0197) | (0.0121) | (0.000283) | (0.00424) | (5.93e-06) |
| Constant | -0.497*** | -0.293*** | -0.00939*** | -0.0138*** | -0.000160*** |

| | | | | | |
|---|---|---|---|---|---|
| | (0.0122) | (0.00876) | (0.000213) | (0.00311) | (4.15e-06) |
| Observations | 4,680 | 4,680 | 4,680 | 4,680 | 4,680 |
| R-squared | 0.017 | 0.017 | 0.038 | 0.000 | 0.009 |

Notes: All regressions contain a constant. Standard errors in parentheses are robust and clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1.

From the perspective of liquidity, as shown in the first column, the regression coefficient of Biaodi is 0.156, which is significant at the 1% level. This reveals that the liquidity measured by LogAmihud after the margin event increased by 0.156 relative to the underlying group than the non-underlying group. As shown in the second column, the regression coefficient of Biaodi is 0.107, which is significant at the 1% level. This points out that the market depth, as measured by Depth, increased by 0.107 relative to the underlying group after the margin trading event. As shown in the third column, the regression coefficient of Biaodi is 0.00370, which is significant at the 1% level. This reveals that the turnover rate measured by TOV after the margin trading event increased by 0.00370 relative to the target group than the non-target group.

From the perspective of pricing efficiency, as shown in the fourth column, the regression coefficient of Biaodi is not significant. As shown in column 5, the regression coefficient of Biaodi is $3.66 \times 10^{-5}$, which is significant at the 1% level. This indicates that the volatility measured by Var increases by $3.66 \times 10^{-5}$ in the underlying group compared with the non-underlying group after margin trading. This shows that there is no significant evidence of the impact of margin trading events on the market in terms of market synchronization. However, the volatility of the

underlying group of stocks increased to a certain extent after margin trading events. However, after analyzing the volatility before and after the event, I found that it was because of the spillover effect of the underlying group. In other words, the volatility of the non-underlying group declined more than the underlying group.

**Table 4.** Univariate regression

| **Variable** | **LogAmihud** | **Depth** | **TOV** | $R^2$ | **Var** |
|---|---|---|---|---|---|
| Biaodi | 0.0973*** | 0.0848*** | 0.00199*** | -0.00520 | 3.08e-05*** |
| | (0.0233) | (0.0148) | (0.000352) | (0.00522) | (7.27e-06) |
| Size | 0.0100 | 0.0212*** | 0.00149*** | -0.00385 | -6.99e-07 |
| | (0.0110) | (0.00767) | (0.000157) | (0.00299) | (3.57e-06) |
| ROA | 3.267*** | 0.0536 | 0.0132*** | 0.297*** | 0.000457*** |
| | (0.194) | (0.134) | (0.00277) | (0.0463) | (6.28e-05) |
| Constant | -0.840*** | -0.754*** | -0.0422*** | 0.0592 | -0.000163** |
| | (0.236) | (0.165) | (0.00342) | (0.0643) | (7.68e-05) |
| Observations | 4,647 | 4,647 | 4,647 | 4,647 | 4,647 |

| | | | | | |
|---|---|---|---|---|---|
| R-squared | 0.081 | 0.019 | 0.058 | 0.009 | 0.020 |

Notes: All regressions contain a constant. Standard errors in parentheses are robust and clustered at the district level. *** p<0.01, ** p<0.05, * p<0.1.

Table 4 reveals the regression results by adding company market capitalization (Size) and return on assets (ROA) based on Biaodi. The dependent variables in the five columns are LogAmihud, Depth, TOV, and Var. As shown in the first column, the regression coefficient of Biaodi is 0.0973, which is significant at the 1% level. This indicates that the liquidity measured by LogAmihud after the margin trading event increased by 0.0973 relative to the non-underlying group. The regression coefficient of Size was not significant. The regression coefficient of ROA is 0.0973, which is significant at the 1% level. This indicates ROA is positively correlated with liquidity. As shown in the second column, the regression coefficient of Biaodi is 0.0848, which is significant at the 1% level. This indicates that the market depth measured by Depth after the margin trading event increased by 0.0848 relative to the non-underlying group. The regression coefficient of Size is 0.0212, which is significant at the 1% level. This indicates Size is positively correlated with market depth. The regression coefficient of ROA was not significant. As shown in the third column, the regression coefficient of Biaodi is 0.00199, which is significant at the 1% level. This indicates that the turnover rate measured by TOV after the margin trading event increased by 0.00199 relative to the non-underlying group. The regression coefficient of Size is 0.00149, which is significant at the 1% level. This indicates Size is positively correlated with the turnover rate. The regression coefficient of ROA is 0.0132, which is significant at the 1% level. This indicates ROA is positively

correlated with the turnover rate. As shown in the fourth column, the regression coefficient of Biaodi and Size were not significant. The regression coefficient of ROA is 0.297, which is significant at the 1% level. This indicates ROA is positively correlated with synchronicity. As shown in the fifth column, the regression coefficient of Biaodi is $3.08 \times 10^{-5}$, which is significant at the 1% level. This indicates that the volatility measured by Var after the margin trading event increased by $3.08 \times 10^{-5}$ relative to the non-underlying group. The regression coefficient of Size is not significant. The regression coefficient of ROA is 0.000457, which is significant at the 1% level. This indicates ROA is positively correlated with volatility.

### 4.4 Robustness Test

Because of the limited space, some results are not listed. I tested robustness of empirical results mainly from the following aspects. Firstly, I made a regression based on whether the stocks belong to the Shanghai and Shenzhen markets, the main board, and the GEM. The conclusions were consistent. Secondly, the liquidity and pricing efficiency indicators constructed in this paper were based on the 3-month observation window. This paper also tested the indicator construction of different observation windows, such as 1-month and 6-month. The conclusions were consistent. To test the robustness of the influences of margin trading, this paper also used the propensity score matching (PSM) method to make sample adjustments. The analysis results were consistent.

## 5 Conclusion

Margin and short-selling reform have achieved good results, but there is still room for improvement. In terms of liquidity, the target group improved more significantly.

Therefore, I recommend expanding the range of targets to improve liquidity. From the perspective of market synchronicity, this paper did not find direct evidence, which needed further analysis. In terms of volatility, the spill-over effect was significant. Therefore, the scope of the target should be moderately expanded. More research and friendly programs may be needed for small-cap stocks and stocks with smaller ROA to achieve better market quality improvement effects.

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