The Impact of Securities Margin Trading on the Stock Market Volatility and Liquidity —— Based on the Empirical Results of Shanghai and Shenzhen Markets

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ABSTRACT

Securities margin trading is a momentous financial innovation in China's capital market, since formally carried out in March 2010. The intention of this policy is to enhance the liquidity of the stock market, as well as to reduce the market volatility. In order to study whether the securities margin trading has achieved the desired effect, this paper focus on the trading data of Shanghai and Shenzhen stock exchange from March 2010 to November 2020, and analyses the influence of margining trading and short selling on stock market volatility and liquidity, with the methods of the VAR model, Granger causality test, impulse-response analysis and variance decomposition. The empirical results show that, firstly, there is a long-term equilibrium relationship among securities margin trading, the volatility and the liquidity of stock market, no matter in Shanghai or Shenzhen. Secondly, the Granger causality test shows that with the regularization of margin trading and short selling, its changes have a two-way impact on the volatility and liquidity of the Shanghai and Shenzhen stock markets. Thirdly, according to the results of impulse-response and variance decomposition, margin trading and short selling play a significant role in restraining abnormal fluctuations of the stock market, although they do not account for a high proportion of stock trading, which is consistent with the initial intention of financial innovation. However, as for liquidity, impulse-response shows that margin lending and short selling significantly enhance it, but variance decomposition shows the opposite.

Keywords: VAR Model, Securities Margin Trading, Stock Market Volatility and Liquidity

1. INTRODUCTION

Margin trading is essentially a kind of credit trading, which is the behavior of investors to provide collateral to qualified securities companies, in order to borrow funds to buy securities or borrow securities and sell them for capital gains. Margin trading and short selling has been carried out in the United States for decades, while the capital market in China started late and is not mature enough, with the short selling mechanism has been a market void for quite a long time. After years of preparation, Chinese authorities officially launched the pilot project of securities margin trading on March 31, 2010, which filled the market void of short selling in the A-share market and attracted the investors' attention. After nearly ten years of development, the margin trading and short selling business promoted the development of the China securities market to a certain extent.

The initial intention of the securities margin trading is to reduce the abnormal fluctuation of the stock market, to improve the existing capital market structure, and to enhance the market liquidity. However, after the implementation of this business, with the expansion of the stocks and the growth of trading volume, it is whether this credit system plays a preset role in the complex market environment and what was achieved that become one of the research hotspots. Therefore, this paper will make an empirical study on the impact of the securities margin trading on the stock market volatility and liquidity by comparing the data derived from Shanghai and Shenzhen stock exchange.

2. LITERATURE REVIEW

In recent years, this relationship between margin trading and short selling trading as well as stock market volatility and liquidity has been discussed by many scholars both at home and abroad.

On the one side, there is no consensus on the impact of securities margin trading on stock market volatility. Some maintains that margin trading makes share prices more volatile. Liu and Song (2015) pointed out that margin trading and short selling transactions threaten the stability of the financial system and may cause systemic financial risks. Conversely, some scholars hold the view that securities margin trading can play a role in stabilizing the market and reducing volatility. Feng, Chen Xuan and Zhang (2015) empirically tested the influence of securities margin trading on stock market volatility before and after the routinization of margin trading. The results show that, compared with short selling during the pilot period, margin trading can suppress the fluctuation more. Also, the function of short selling to suppress the fluctuation of stock price begins to show after the routinization.

On the other side, liquidity is a prerequisite for the smooth operation of financial markets. Margin trading and short selling may improve the liquidity of the stock market, but it may have a negative impact on the liquidity. For the former, the leverage effect brought by margin trading will increase the capital supply and stock demand, improving the liquidity of the securities market by enlarging the total supply and demand. At the same time, because the behavior of optimistic investors and pessimistic investors can all be reflected in the stock price through margin trading and short selling, it can also theoretically optimize the market liquidity. According to Yang and Wu (2011), they believed that margin trading and short selling could reduce stock volatility and improve liquidity in the short term. Huang (2018) studied the A-share market in Shanghai and Shenzhen by using the double-difference model and fixed-effect regression model, and found that compared with short selling, margin trading has a more obvious effect on the improvement of stock market liquidity. On the contrary, the adverse information caused by short selling can affect other investors, which may depress the stock market liquidity. Chu and Fang (2016) found that the implementation of margin trading and short selling may aggravate the stock market crash, which indicates that it may worsen the liquidity of the securities market.

To sum up, due to different selection of research models, data scale and research methods, scholars' make different conclusions on the impact of securities margin trading on the stock market volatility and liquidity.

3. THE INTRODUCTION OF MODEL AND VARIABLES

3.1. Model Construction

Vector Auto-regressive (VAR) model is a method for data analysis using various vector variables. VAR model is not based on economic theories, but based on statistical properties of data. All endogenous variable in the system are taken as the explained variable to construct the regression function in VAR model, and the lagged value of all endogenous variables in the system as the explanatory variable. This model has become one of the mainstream models in economic research because of its wide range of application. The general expression of VAR model is:

$$Y_t = \alpha + \sum_{i=1}^{p} b_i Y_{t-i} + \mu_t$$

μ_t is a white noise, which satisfies the classical assumption of zero mean value, homoscedasticity, no autocorrelation and no correlation with explanatory variables.

3.2. Sample Selection

In this paper, it takes the Shanghai Composite Index (SHCI) to represent the Shanghai stock market. The sample stocks of SHCI are all listed in Shanghai stock exchange, including A-shares and B-shares, which reflect the changes of stock prices. The Shenzhen Component Index (SZCI) represents the stock market status in the Shenzhen stock exchange, selecting 500 representative listed companies as sample stocks according to certain standards. Both SHCI and SZCI cover most of the fluent stock in the Shanghai and Shenzhen stock markets, having good representativeness of the stock price changes in China's securities market.

China's pilot work of margin trading and short selling was officially launched on March 31, 2010, so this paper selects the stock markets daily data from March 31, 2010 to November 5, 2020 as sample. In this paper, the overall sample is divided into two sample periods to eliminate the influence of the newly added stocks on margin trading and short selling. The phase I is from March 31, 2010 to September 12, 2014, where the securities margin trading was in rapid change, and the market volatility was relatively high. The phase II is from September 15, 2014 to November 5, 2020, where the stock prices were stable and the growth rate was moderated. This paper will examine the impact of margin trading and short selling on the stock markets in Shanghai and Shenzhen. The data are from the RESSET.

3.3. Index Definition

3.3.1. Volatility Index

For the limitation of unstable variance, this paper uses the fluctuation range of the stock market index as the measure of market volatility and defines it as VOL. The definitions of VOL are as follows:

$$VOL_h = \frac{P_{ht}^H - P_{ht}^L}{(P_{ht}^H + P_{ht}^L)/2} \times 100$$

$$VOL_s = \frac{P_{st}^H - P_{st}^L}{(P_{st}^H + P_{st}^L)/2} \times 100$$

VOL_h is a measure of how volatile Shanghai stock market is, where P_{ht}^H is the highest price of SHCI on the very day t, while P_{ht}^L is the lowest daily price. As the same definition, VOL_s is the Shenzhen stock market volatility index, where P_{st}^H is the SZCI highest price and P_{st}^L is the lowest. The VOL indexes are all multiply by 100 to enlarge themselves.

3.3.2. Liquidity Index

Scholars tend to describe the liquidity indicators in different dimensions, such as depicting liquidity through trading volume or turnover rate as the liquidity index. However, the methods above only take the liquidity of assets into account and have ignored the changes of securities prices. Liquidity is the ability of mutual conversion between securities and cash. Therefore, this paper believes that stock liquidity should be characterized from three aspects of volume, price and time, so the liquidity index is defined as:

$$LIQ_h = \frac{10000 \times |R_{ht}|}{V_{ht}}$$

$$LIQ_s = \frac{10000 \times |R_{st}|}{V_{st}}$$

LIQ_h and LIQ_s are the liquidity of the Shanghai and Shenzhen stock markets, with R_{ht} and R_{st} to be the daily returns. The daily stock returns are defined as $R_{ht} = (P_{ht}^C - P_{ht}^O)/P_{ht}^O$ and $R_{st} = (P_{st}^C - P_{st}^O)/P_{st}^O$, in which P_{ht}^O and P_{st}^O are the opening price in the day t, while P_{ht}^C and P_{st}^C are the closing price. V_{ht} and V_{st} are

on behalf of the stock market trading volume in Shanghai and Shenzhen, for which the unit is billions.

It is generally believed that market liquidity is directly proportional to turnover and inversely proportional to return rate. Nonetheless, since the daily rate of return may be extremely small, LIQ indexes are multiplied by 10000 to enlarge themselves.

3.3.3. Margin Trading and Short Selling Index

In order to make all variables stable, the data of margin trading and short selling are processed by taking logarithm. The margin trading of Shanghai and Shenzhen stock market is measured by the daily margin trading purchases on the two stock exchanges, which are represented by MT_h and MT_s respectively. Similarly, the daily sales of short selling in Shanghai and Shenzhen stock exchanges, which defined as SS_h and SS_s, respectively represent the short selling business.

4. EMPIRICAL ANALYSIS

4.1. Unit Root Test

When VAR model is used to study the influence of margin trading and short selling on stock market volatility and liquidity, it is of great significance to determine whether the time series is stationary series by using unit root test. In this paper, ADF test is used to test the stationarity of VOL, LIQ, MT and SS, as shown in table 1. At 1% significance level, the t-statistic of all variables are less than the critical value, so as to reject the null hypothesis. Therefore, it comes to the conclusion that all indexes are stationary.

Table 1 The results of ADF test

Variables	(C, T, L)	T-statistics	1% Critical Value	5% Critical Value	10% Critical Value
VOL_h	(C, 0, 6)	-8.110772	-3.432701	-2.862465	-2.567307
VOL_s	(C, 0, 7)	-8.503116	-3.432702	-2.862465	-2.567307
LIQ_h	(C, 0, 8)	-7.087428	-3.432703	-2.862465	-2.567308
LIQ_s	(C, 0, 11)	-7.337553	-3.432706	-2.862467	-2.567308
MT_h	(C, 0, 6)	-3.848004	-3.432701	-2.862465	-2.567307
MT_s	(C, 0, 7)	-3.518552	-3.432702	-2.862465	-2.567307
SS_h	(C, 0, 10)	-5.827208	-3.432705	-2.862466	-2.567308
SS_s	(C, 0, 26)	-4.101070	-3.432721	-2.862473	-2.567312

4.2. Co-integration Test

The co-integration test can be used to determine whether there are long-term relationships among

variables, provided that these variables are integrated of the same order. In the Shanghai and Shenzhen markets, all indicators meet the conditions of stationarity, so the co-integration test can be carried out. Before the VAR model is built, the optimal lag order needs to be

determined first. According to the information criterion, the VAR model is set with the lag order of 3. Based on the setting of VAR model, Johansen test is adopted in two markets and two phases respectively.

Both in Shanghai and Shenzhen markets, the null hypothesis of three co-integration relationships is accepted at the significance level of 1%, denoting the variables in the first and the second phases have passed the co-integration test. The empirical results show that there are long-term equilibrium relationships among stock market volatility, liquidity, margin trading and short selling.

4.3. Granger Causality Test

The co-integration test only proves the existence of long-term equilibrium relationships among the market volatility, market liquidity and the securities margin trading in the Shanghai and Shenzhen stock markets, but the causal links among the variables need to be further verified. Granger causality test is used to determine the causal relationships as shown in Figure 1. Since the purpose of the research is to explore the impact and effect of the securities margin trading system, the one-way impact on the stock market volatility and liquidity will be discussed. For the Shanghai stock market, in two phases, the margin trading and short selling both have an impact on the liquidity and volatility of the stock market, and sometimes the impact is even two-way. In addition, the two-way causal relationship is more obvious in the phase II, showing the market is increasingly closely linked. For the Shenzhen stock market, short selling is not the cause of stock market volatility and liquidity at the beginning, but the margin trading is still. In the second phase, margin trading and short selling are the reasons for the existence of stock market volatility and liquidity, and the interaction is more obvious. The above results show that with the development of the financial system, it has a more and more profound impact on the volatility and liquidity of the stock market.
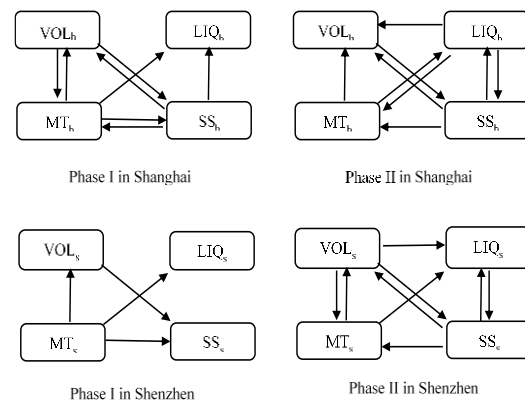

Figure 1 Causal relationship of VOL, LIQ, MT and SS in Shanghai and Shenzhen stock market

4.4. Impulse-Response Analysis

Impulse-response analysis is to estimate the impact of the exogenous economic shocks on the whole system. In this paper, the impulse-response mainly analyzes the response of the stock market volatility and liquidity after margin trading and short selling. The results are shown in Figure 2, where the first and second columns listed are the Shanghai stock market in two phases and the third and fourth columns are the Shenzhen stock market.

For The Shanghai stock market, it can be seen from the figure that the impact of margin trading on volatility is negative in both periods, while the impact of short selling on volatility changes from positive to negative, indicating that short selling is gradually helpful to reduce the stock volatility. The effect on liquidity is the same, suggesting that in Shanghai, the securities margin trading system has partly suppressed liquidity.

The impact of the financial system on volatility basically remains unchanged in two phases in the Shenzhen market. However, for liquidity, the impact of margin trading changes from negative to positive, and short selling also significantly increases the stock liquidity.
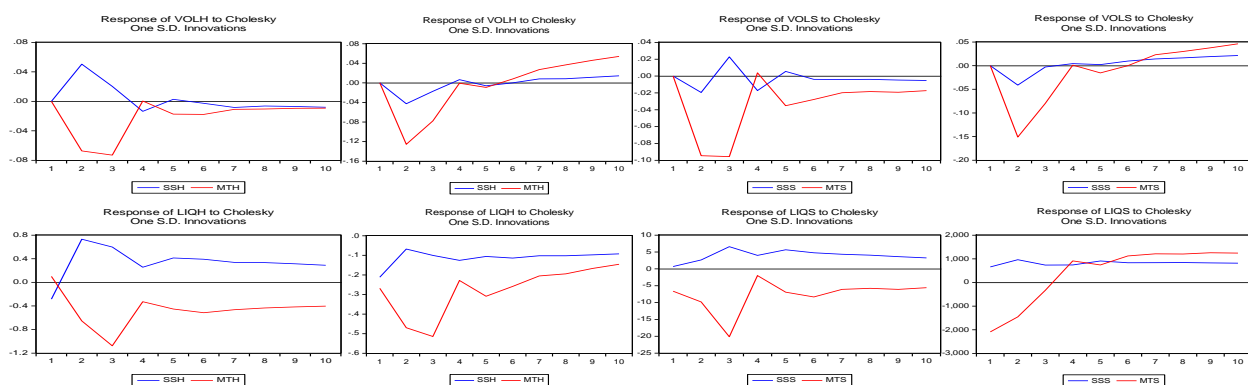

Figure 2 Impose-Response of VOL and LIQ

4.5. Variance Decomposition

Variance decomposition is based on the analysis of structure impact of exogenous shocks on the changes of endogenous variables, usually using the variance to measure and further rating the importance of the different structural shocks. This paper selects the lag order of 10 to construct the variance decomposition for market volatility and liquidity indexes. The results in the 10th period are shown in table 2, from which it can be seen that most of the fluctuations of the Shanghai and Shenzhen stock markets are due to their own disturbances, such as industry factors, macroeconomic environment and business cycle, while the margin trading and short selling has a low contribution to the stock market fluctuations. In the phase I, the sums of securities margin trading contribution are 2.63% in Shanghai and 2.97% in Shenzhen. In the phase II, they go down to 2.46% and 2.17%, showing after the routinization of securities margin trading, their influence on the stock market rises and inhibitory effect on abnormal fluctuations in the stock market is revealed gradually.

For liquidity indexes, variance decomposition results reveal that the market volatility is the major influence. In the first phase, the combined effect of margin trading and short selling on Shanghai stock market liquidity is 7.92%, while on Shenzhen to be 8.35%. However, the combined effect has sunk to around 6.29% in Shanghai and 0.47% in Shenzhen respectively in the second phase. Therefore, with the development of the securities margin trading system, the liquidity of the stock market is increasingly affected by itself, which makes it more resistant to external shocks.

Table 2 Variance decompositions of the VOL and LIQ

Phase I			
	VOL_h	LIQ_h	MT_h	SS_h
VOL_h	97.02071	0.344167	2.010751	0.624371
LIQ_h	42.91349	49.16356	4.924000	2.998949
	VOL_s	LIQ_s	MT_s	SS_s
VOL_s	96.77969	0.244550	2.803163	0.172594
LIQ_s	38.49333	53.15805	6.820780	1.527838
Phase II			
	VOL_h	LIQ_h	MT_h	SS_h
VOL_h	96.89303	0.633855	2.265447	0.207668
LIQ_h	38.57437	55.12092	5.465178	0.839530
	VOL_s	LIQ_s	MT_s	SS_s
VOL_s	97.34630	0.478759	1.994184	0.180753
LIQ_s	0.164357	99.35316	0.334913	0.147567

5. CONCLUSION

It can be concluded that firstly, there is a long-term equilibrium relationship among securities margin trading, the volatility and the liquidity of stock market, no matter in Shanghai or Shenzhen. Secondly, the Granger causality test shows that with the regularization of margin trading and short selling, its changes have a two-way impact on the volatility and liquidity of the Shanghai and Shenzhen stock markets. Thirdly, according to the results of impulse-response and variance decomposition, margin trading and short selling play a significant role in restraining abnormal fluctuations of the stock market, although they do not account for a high proportion of stock trading, which is consistent with the initial intention of financial innovation. However, as for liquidity, impulse-response shows that margin lending and short selling significantly enhance it, but variance decomposition shows the opposite.

In conclusion, the empirical analysis shows that although the influence of margin trading and short selling, as the causes of stock market fluctuations, is relatively small, with the increase of trading scale, the influencing effect is becoming increasingly obvious and the margin trading system will play a vital role in the future. Securities margin trading tends to have significant impact on market liquidity. However, the direction of this effect is not clear, of which one possible explanation is that the investors lack the understanding for securities short-selling. As a result, the mismatch between supply and demand of short selling restricts the expansion of securities trading and the volume gap between margin trading and short selling is larger, making complex impact on stock market liquidity.

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