

# Research on the Conducting Effect of Monetary Policy on Stock Market Based on Investor Sentiment

Xin Jin, Mengting Li, and Tianxi Jin

**Abstract**—The research of stock market plays an important role in capital market and risk control. For the significant impact on the stock market, this paper studies the effect of monetary policy on the stock market as well as the effect of investor sentiment on the conducting effect of monetary policy by establishing VAR model. This paper also analyses the influence of monetary policy and investor sentiment on stock price in stages by combining specific events in the sample interval and using the structural mutation model. The study reveals that investor sentiment will greatly impact on the transmission of monetary policy, And with a relatively small influence, the impact of monetary policy on the stock market is not always present.

**Index Terms**—Conducting effect, investor sentiment, monetary policy, stock market.

## I. INTRODUCTION

The transmission mechanism of monetary policy has always been an important content of monetary policy research. Although monetary policy has multiple transmission paths, the ultimate goal cannot be achieved without the financial market [1]. China's financial market is an important part of the stock market, at the same time, the stock market is a barometer of the macro economy, being affected by many macro factors. As important means of macro-control, monetary policy has paid attention to its impact on the stock market [2], [3]. In addition, compared with other countries, the volatility of China's stock market is more obvious, which is closely related to the large proportion of individual investors [4]. Under the influence of herd effect, the behavior of individual investors is an important cause of stock market volatility. For instance, securities investment activity is the behavior of a person under the influence of certain emotions. And Investors' psychology and behavioral decisions driven by it also affect the influence of monetary policy on the stock market [5]. Therefore, it is necessary to study whether the investor sentiment will affect the conduction of monetary policy. This paper combines macroeconomics with behavioral finance. With reference to the existing literature, taking monetary policy and investor sentiment as two research indicators, this paper studies the role of investor sentiment in the mechanism of monetary policy's influence on stock prices, and improves the transmission mechanism of monetary policy to the stock market. At the same time, the structural mutation model is used to analyze the transmission effect of monetary policy on the stock market and the effect of investor sentiment

in different stages, and the practical significance is explained.

## II. LITERATURE REVIEW

### A. Monetary Policy and Stock Market

Foreign scholars, at the beginning of this study, consider money supply as a proxy index of monetary policy. Using graphic test to do an empirical study of the relationship between the US money supply and the stock market, Sprinkle found that the change of stock price lags behind the change of money supply, and put forward the idea that money supply can be used as a leading indicator to predict the change of stock price in the future [6]. Subsequently, Hamburger and Kochin refined the empirical approach based on the study of Sprinkle [7]. Thorbecke and Lastrapes in order to solve the endogenous problem between stock market and monetary policy, VAR model was used to study the relationship between them [8].

### B. Investor Sentiment and Stock Market

Baker and Wurgler selected six proxy variables using the principal component analysis method to construct a comprehensive index of investor sentiment, and concluded that investor sentiment has a cross-sectional effect on the stock market [9]. Moreover, Chinese scholars began their research on this aspect late, and Wang Meijin and Sun Jianjun used CCTV to construct the index of investor sentiment, and studied the relationship between investor sentiment and stock market income [10]. Song Zefang and Li Yuan studied the relationship between stock characteristics and investor sentiment and got the scale conclusion that large and high price-to-book ratio stocks are more vulnerable to the influence of investor sentiment [11].

### C. Monetary Policy and Investor Sentiment

From the previous studies, when scholars study the relationship between monetary policy and investor sentiment, they mostly study investor sentiment as an intermediary variable in monetary policy transmission. The conclusion obtained by Chen Qian shows that investor sentiment has a certain influence on the regulatory effect of monetary policy on the stock market [12]. And Chen Ying put forward the view that money supply is an important indicator variable of investor sentiment [13]. Furthermore, Yuan Jing found that the monetary policy formulated by China should have a weak ability to deal with financial risk [14].

## III. RESEARCH DESIGN

This paper selects monthly data from January 2003 to December 2018. And the relevant data come from CSMAR

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database.

A. Selection of Monetary Policy Indicators

The ultimate goal of monetary policy is generally achieved through economic variables acting as intermediate targets, and the proxy variable of this paper selects the money supply [15]. Chinese money supply is divided into three levels: cash in circulation (M0), narrow money supply (M1) and broad money supply (M2). Because China’s broad money supply has changed its caliber many times, this paper chooses narrow money supply M1 as proxy index.

B. Selection of Stock Market Indicators

At present, there are two representative indexes in China’s stock market: Shenzhen Component Index and Shanghai Composite Index, both of which can better reflect the movement of China’s stock market. This paper selects the Shanghai Composite Index monthly closing price (CLIDX) as the proxy index [16].

C. Selection of Investor Emotional Indicators

Investor sentiment reflects the willingness or expectations of market participants. Their will or expectation is influenced by multiple factors. And this paper follows the construction of the classic Baker and Wurgler index of investor sentiment, but has been modified according to the characteristics of the Chinese stock market [17]. This paper selects the consumer confidence index, the closed fund average discount rate, the market turnover rate, the new opening number, the Shanghai and Shenzhen monthly trading volume five indexes to construct the investor sentiment. And principal component analysis was performed for these five variables. According to the results, select the eigenvalue greater than 1 principal component. Therefore, the first two principal components are extracted and standardized, and the weighted averages are constructed to build the investor sentiment index:

$$IS = 44.012 * FAC_1 + 40.9 * FAC_2 \quad (1)$$

IV. EMPIRICAL ANALYSIS

In this part, using the proxy variables of monetary policy and stock market, the VAR model was established and compared respectively in the absence of investor sentiment to study the influence of investor sentiment on the transmission effect of monetary policy on stock market. Considered the volatility of stock market price and money supply, the logarithm of M1 and CLIDX was taken, and the original sequence was converted into LNM1 and LNCLIDX and in order to prevent multicollinearity. Firstly, the stationary test of time series was carried out. The test results are shown in Table I.

Then the lag order was determined. This paper determined the lag order according to AIC and SC criteria. The lag period of VAR model with or without investor sentiment was 8. Then the Johnson co-integration test was carried out. When there was no co-integration relationship and at most one co-integration relationship, the P values of investor sentiment without and with investor sentiment were 0.018, 0.068 and 0.03, 0.147, respectively. Therefore, a co-integration relationship was determined in both cases.

TABLE I: STATIONARY TEST

variable	ADF	(c,t,p)	1%critical value	Prob	conclusion
LNMI	-1.29	(c,0,12)	-3.47	0.633	Unsteady
LNCLIDX	-1.73	(c,t,7)	-3.46	0.416	Unsteady
IS	-2.38	(c,t,0)	-3.46	0.149	Unsteady
ΔLNMI	-16.58	(c,0,11)	-3.46	0.000	Steady
ΔLNCLIDX	-12.16	(c,0,7)	-3.46	0.000	Steady
ΔIS	-16.13	(c,t,0)	-3.46	0.000	Steady

A. Monetary Policy and Stock Market

The long-term co-integration relationship between variables ensures that a stable VAR model can be established, and here we used LNM1 and LNCLIDX to establish a VAR model without investor sentiment. The initial VAR model is:

$$Y_t = l + \sum_{i=1}^8 A_i * Y_{t-i} + \varepsilon \quad (2)$$

$Y_t = [LNMI, LNCLIDX]^T$  represents the spot value of the dependent variable and the independent variable, 8 is the lag order,  $A_i$  is the corresponding coefficient matrix and  $\varepsilon = [\varepsilon_1, \varepsilon_2]^T$  is the random disturbance term. Some parameters of the model are shown in Table II.

TABLE II: VAR(8) MODEL PARAMETER

	LNCLIDX	LNMI
LNCLIDX(-8)	-0.144	0.003
LNMI(-8)	-0.107	-0.239
C	0.273	0.026

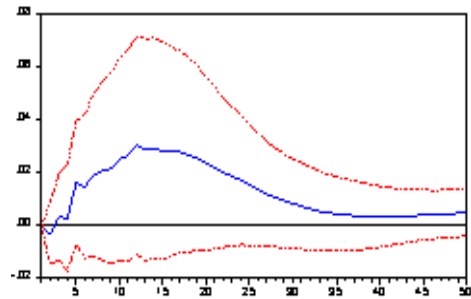


Fig. 1. Pulse response diagram.

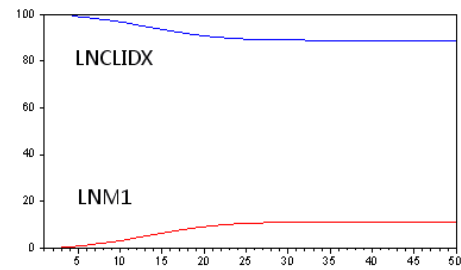


Fig. 2. Variance decomposition diagram.

The stability test was first performed. The test results show that all the characteristic roots are in the unit circle, indicating that the VAR model is stable. After that, impulse response analysis and variance decomposition were performed. And the results are shown in Fig. 1 and Fig. 2. According to the results of the impulse response in the case of no investor sentiment, impact on share price at the beginning of the money supply has a small negative consequence as the change

of time to the third phase of turning into a positive influence and gradually increases to 12 and peak, and then decreases in 40 period began to stabilize.

According to the result of variance decomposition, it can be seen that although the contribution rate of stock price to itself has been decreasing gradually, it has always occupied a dominant position. The influence of money supply on stock price has not been significant until the second period.

**B. VAR Model with Investor Sentiment**

The VAR (8) model was established by using the three variables LNM1, LNCLIDX and IS. And according initial VAR model is:

$$Y_t = l + \sum_{i=1}^8 A_i * Y_{t-i} + \varepsilon \tag{3}$$

Some parameters of the model are shown in Table III. The stability test was carried out first. All characteristic roots fall within the unit circle, and the model is stable. After that, impulse response analysis and variance decomposition were performed. And the results are shown in Fig. 3 and Fig. 4. According to the impulse response graph, the impact on the money supply has a small negative impact in the first two periods, and changes from the third period to a positive impact, which expands and reaches the peak in the 13th period. And the impact gradually decreases in the later period, and begins to stabilize in the 38th period. From the result of variance decomposition, we can see that the influence of investor sentiment and money supply on stock price appears from the second period, and the influence of investor sentiment gradually expands and tends to stabilize in the later period. The effect of money supply has been relatively small, and very stable.

TABLE III: VAR(8) MODEL PARAMETER

	LNCLIDX	LNM1	IS
LNCLIDX(-8)	-0.172	0.017	-26.081
LNM1(-8)	0.055	-0.239	-85.597
IS(-8)	-0.00002	-0.00004	-86.867
C	1.217	0.456	-86.867

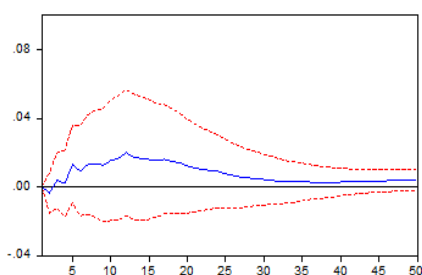


Fig. 3. Pulse response diagram.

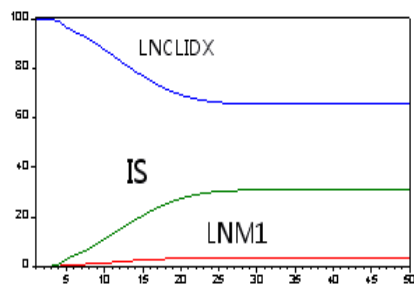


Fig. 4. Variance decomposition diagram.

**C. Comparative Analysis of VAR Model**

According to the comparison between results of impulse response and variance decomposition analysis, the effect of money supply with investor sentiment and money supply without investor sentiment on stock price is roughly the same, but the existence of investor sentiment reduces the contribution rate of money supply disturbance, that is investor sentiment has an impact on the transmission effect of monetary policy. Meanwhile, monetary policy has a small transmission effect on the stock market, while investor sentiment has a significant impact on stock prices.

**V. ESTABLISHMENT AND ANALYSIS OF EMPIRICAL MODELING FOR PHASED STUDY**

In the previous section, we proved that monetary policy does have a conduction effect on the stock market, and the presence of investor sentiment will have an impact on the conduction effect. Therefore, we conducted a structural mutation test on the Shanghai Composite Index to study whether monetary policy plays a role in the stock market at the time of huge fluctuations, and whether and how the stock market volatility is affected by monetary policy and investor sentiment.

**A. Structural Mutation**

The mutation point test was first performed. In this paper, eviews8.0 was used to perform the mutation point test. According to the theory of Bai-Perron [18], [19], mutation point test was carried out. And according to Table IV, the Shanghai Composite Index has three mutation points: July 2007, November 2009 and November 2014. Chow test was conducted on mutation points, and the results are shown in Table V. The adjoint probability of the statistics is approximately zero, and the null hypothesis is rejected. It is believed that the data were in the above three points do have mutation points.

According to the adjustment and change of China's monetary policy, corresponding to the three abrupt changes of the Shanghai Composite Index, China's required reserve ratio was in the stage of dramatic increase and adjustment in July 2007, and the money supply was rapidly declining and it was small. In 2009, the required reserve ratio was relatively stable and not adjusted. Before the mutation point in November 2014, the money supply rose slightly and the People's Bank of China (PBOC) cut the required reserve ratio twice in April and June to support economic restructuring. There may be a delayed effect on the November 2014 mutation point. Among the three abrupt changes, there are two changes in China's monetary policy.

TABLE IV: RESULT OF MUTATION POINT TEST

Break dates	Sequential	Repartition
1	2007M07	2007M07
2	2009M11	2009M11
3	2014M11	2014M11

TABLE V: CHOW TESTING

Chow Breakpoint Test: 2007M07 2011M01 2015M09			
F-statistic	22.845	Prob.F(9,180)	0.000
Log likelihood	146.275	Prob.Chi-Square(9)	0.000
Wald Statistics	205.603	Prob.Chi-Square(9)	0.000

Therefore, the prediction of the mutation of the Shanghai Composite Index is related to the adjustment of monetary policy. In order to prove the effectiveness of the structural mutation point and analyze the changes before and after the mutation point and the impact of monetary policy adjustment on the change of the Shanghai Composite Index, the VAR model was built in stages.

*B. Establish VAR Model in Stages*

First of all, the optimal lag order of VAR model is determined according to AIC and SC criterion. The lag period selection of VAR model in each stage was 2. And then we did the co-integration test. In the absence of co-integration relationship, P values in all stages were less than 0.05. At most one co-integration relationship, P values were greater than 0.05, so the null hypothesis was accepted. Therefore, a co-integration relationship was determined at each stage, and then the VAR model was built in stages.

Phase I: VAR (2) model January 2003- July 2007.

$$\begin{bmatrix} LNCLIDX \\ LNM1 \\ IS \end{bmatrix} = \begin{bmatrix} -2.855 \\ 0.16 \\ -867.027 \end{bmatrix} + \begin{bmatrix} 1.138^* & 0.091^* & 239.778^* \\ 0.334 & 0.891^* & -191.045^* \\ -0.0002 & -0.0001 & 0.539^* \end{bmatrix} \begin{bmatrix} LNCLIDX_{t-1} \\ LNM1_{t-1} \\ IS_{t-1} \end{bmatrix} + \begin{bmatrix} -0.033 & -0.084 & -174.559^* \\ -0.154 & 0.092 & 222.076^* \\ -0.0003 & 0.0001 & -0.063 \end{bmatrix} \begin{bmatrix} LNCLIDX_{t-2} \\ LNM1_{t-2} \\ IS_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{bmatrix} \quad (4)$$

(\* is the significant coefficient at the 5% level)

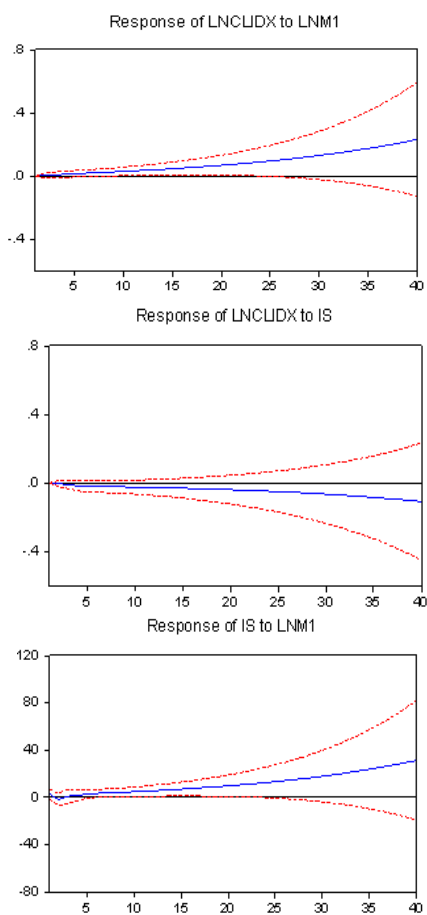


Fig. 5. The first phase impulse response diagram.

At this stage, between early 2003 and September 2003, the reserve requirement ratio was in the downward phase, after which it was in a steady rise, and after 2004, the PBOC continued to adopt tightening policies due to excessive

growth in credit and rising prices [20]. In 2007, in particular, GDP and CPI growth hit records, and the PBOC raised reserve requirements 10 times a year. Investor sentiment and stock price volatility declined in the early period, both of which reached the lowest point, and then rose again. The rising state lasted until May 2007, after which the stock price fell. Before that, monetary policy had taken a major turn, and the state had begun to raise the reserve requirement ratio and gradually reduce the total amount of money in circulation on the market.

According to Fig. 5, monetary policy has a positive cumulative pulse effect on investor sentiment and stock price, so when money supply changes, investor sentiment and stock price change in the same direction. The adjustment of monetary policy affected investor sentiment and further led to the change of stock price. When money supply increases, investor sentiment and stock price rise, whereas when monetary policy tightens, investor sentiment and stock price fall. After the reserve requirement ratio adjustment, investor sentiment and stock prices also changed. At this stage, the monetary policy has obvious transmission effect.

Phase II: VAR (2) model from July 2007 to November 2009

$$\begin{bmatrix} LNCLIDX \\ LNM1 \\ IS \end{bmatrix} = \begin{bmatrix} 6.198 \\ 0.051 \\ 12.271 \end{bmatrix} + \begin{bmatrix} 0.441^* & 0.044 & 55.553 \\ 1.736 & 0.746 & 82.825 \\ 0.0015 & 0.0002 & 0.307 \end{bmatrix} \begin{bmatrix} LNCLIDX_{t-1} \\ LNM1_{t-1} \\ IS_{t-1} \end{bmatrix} + \begin{bmatrix} 0.265 & -0.059^* & -70.234^* \\ -2.061^* & 0.262 & -74.13 \\ 0.002^* & 1.01 & 0.38 \end{bmatrix} \begin{bmatrix} LNCLIDX_{t-2} \\ LNM1_{t-2} \\ IS_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{bmatrix} \quad (5)$$

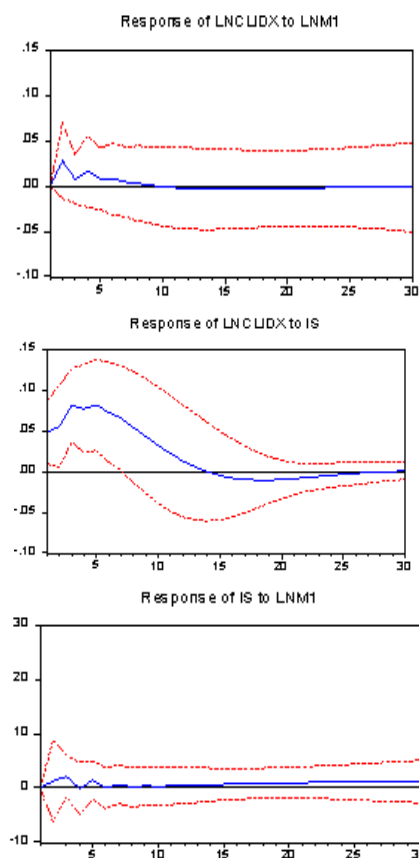


Fig. 6. The second phase impulse response diagram.

From the beginning of 2008 to June 2008, the PBOC raised the reserve requirement ratio six times with the strong

regulation. In September 2008, to respond to the financial crisis and increase the money supply, the PBOC lowered its reserve requirement ratio [20]. This was followed by four further cuts in October and December 2008. In 2009, China's overall macroeconomic situation was positive and the reserve requirement ratio remained stable. During this period, stock price and investor sentiment continued to fall through mid-2008, reaching their lowest point in October 2008 before rising.

Based on the impulse response, Fig. 6 shows that this phase of monetary policy has a certain positive effect on investment sentiment and stock price in the early stage, and the cumulative impulse effect tends to be zero in the later stage. The transmission effect of monetary policy on stock market is not obvious later. As a result, the previous stock price and investor sentiment continued to decline, affected by monetary policy, deposit reserve ratio increased, money supply decreased, affected investor sentiment and stock price fluctuations, resulting in its decline.

Phase III: VAR (2) model November 2009- November 2014.

$$\begin{bmatrix} LNCLIDX \\ LNM1 \\ IS \end{bmatrix} = \begin{bmatrix} 5.307 \\ 1.793 \\ -307.997 \end{bmatrix} + \begin{bmatrix} 0.795^* & 0.056 & 124.245^* \\ -0.416 & 0.581^* & -173.062^* \\ 0.0005 & 0.0003 & 0.567^* \end{bmatrix} \begin{bmatrix} LNCLIDX_{t-1} \\ LNM1_{t-1} \\ IS_{t-1} \end{bmatrix} \quad (6)$$

$$+ \begin{bmatrix} -0.192 & -0.111 & -93.082^* \\ 0.239 & 0.311^* & 178.398^* \\ 0.0009^* & -0.0003 & 0.168 \end{bmatrix} \begin{bmatrix} LNCLIDX_{t-2} \\ LNM1_{t-2} \\ IS_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{bmatrix}$$

In 2010, the PBOC, being aware of the trend in monetary policy from "moderate easing" to "excessive easing", raised its reserve requirement ratio on January 18, 2010. Since then, the PBOC has raised reserve requirements 11 times from February 2010 to June 2011 to guard against inflation. After the end of 2011, the PBOC cut the reserve requirement ratio three more times between February 2012 and April 2014 [21].

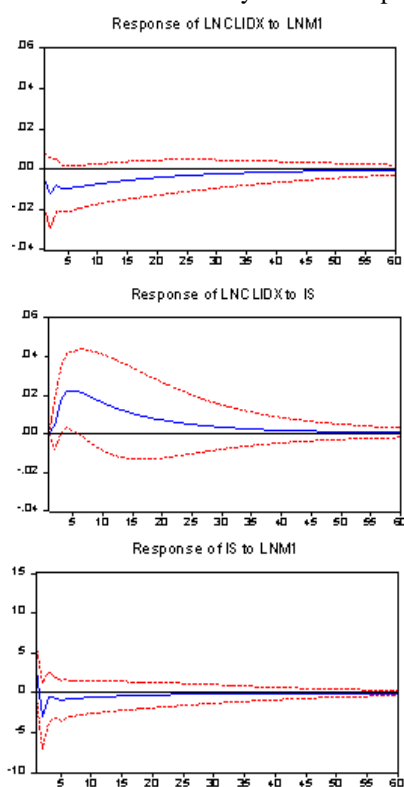


Fig. 7. The third phase impulse response diagram.

Stock market was in good shape at the beginning of the third phase, with stock price and investor sentiment more stable, before falling to its lowest point in November 2012. According to the impulse response results, Fig. 7. At this stage, the influence of money supply on investor sentiment is positive in the first stage, negative in the cumulative impulse effect from the second stage, and close to zero in the later stage. The influence of money supply on stock price first increases negatively, then decreases gradually and approaches zero. The cumulative impulse effect of investor sentiment on stock prices is positive, reaching the peak in the fourth period, and then gradually decreasing, and approaching zero in the later period. Therefore, under the influence of monetary policy, the money supply decreased, and investor sentiment generally showed a downward trend from the end of 2009 to the middle of 2011, which further affected the stock market. In the later stage, the cumulative impulse effect tends to be zero, and monetary policy has a weak impact on investor sentiment and stock prices. Investor sentiment and the stock market did not change with the money supply during this period. In this stage, the transmission effect of monetary policy is relatively obvious in the early stage before the middle of 2011, but weak in the later stage.

Phase IV: VAR (2) model November 2014-December 2018

$$\begin{bmatrix} LNCLIDX \\ LNM1 \\ IS \end{bmatrix} = \begin{bmatrix} 2.915 \\ 0.023 \\ -427.221 \end{bmatrix} + \begin{bmatrix} 1.028^* & 0.097 & 118.21^* \\ -1.21^* & 0.874^* & -407.959^* \\ -0.0003 & -0.0004 & 0.264 \end{bmatrix} \begin{bmatrix} LNCLIDX_{t-1} \\ LNM1_{t-1} \\ IS_{t-1} \end{bmatrix} \quad (7)$$

$$+ \begin{bmatrix} -0.128 & -0.059 & -28.991 \\ 1.055^* & 0.103 & 389.89^* \\ -0.001 & 5.92 & -0.0825 \end{bmatrix} \begin{bmatrix} LNCLIDX_{t-2} \\ LNM1_{t-2} \\ IS_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{bmatrix}$$

At this stage, the PBOC continued to cut the required reserve ratio, and the money supply continued to increase. Investor sentiment and stock price rose rapidly at the beginning of this period, then leveled off after falling in the second half of 2015, inconsistent with the changes in increasing money supply.

According to impulse response Fig. 8, the cumulative impulse effect of monetary policy on investor sentiment, stock price and investor sentiment on stock price tends to be zero in the later period. This indicates that the monetary policy transmission effect is not obvious at this stage, and investor sentiment and stock price are also affected by other factors.

According to the model established above and the impulse response analysis, it can be seen that the transmission effect of monetary policy in the first and second stages is obvious, while that in the third and fourth stages is not obvious, indicating that the influence of monetary policy on the stock market and investor sentiment of intermediary variables does not always exist. At some points, changes in the stock market affected by monetary policy are not consistent with the model, which shows that investor sentiment and volatility in the stock market are also influenced by other factors, and when other factors exist, the role of monetary policy is easily covered. For example, in the fourth stage, the late money supply continued to rise, while investor sentiment and stock prices fell because the central bank cut interest rates in 2014, although it led to an increase in the money supply, which in turn led to a brief rise in investor sentiment and stock prices. However, since the country's other basic economic indicators did not rise in line

with the stock market, and the stock market lacked light and strong support, the stock market and investor sentiment still showed a downward trend. Thus, changes in the stock market and investor sentiment are not entirely influenced by monetary policy.

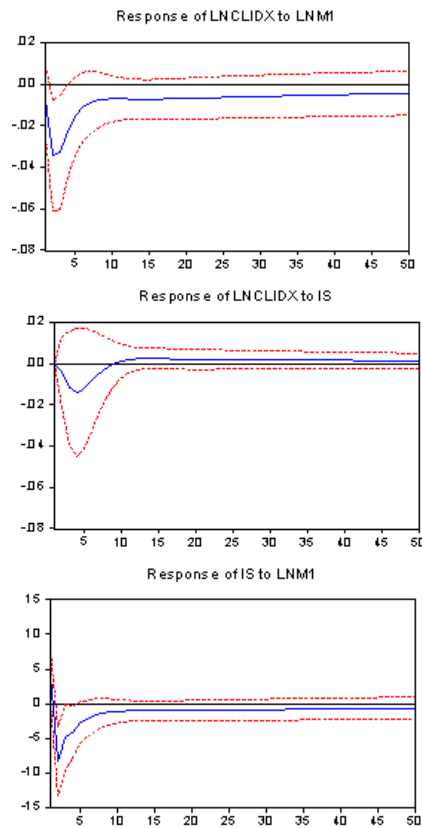


Fig. 8. The fourth stage impulse response diagram.

## VI. CONCLUSION

Through empirical analysis, this paper concludes that investor sentiment has a significant impact on stock price, and investor sentiment has a certain impact on the transmission effect of monetary policy on the stock market. When investor sentiment exists, the transmission effect of monetary policy on the stock market will decrease. Through the analysis of the structural mutation model and the establishment of VAR model for different stages, it can be concluded that the great change of the stock market is related to the adjustment of monetary policy. Although monetary policy may have an impact on investor sentiment and stock market, it is not stable. In addition, monetary policy is not the only influencing factor of stock market and investor sentiment, and its role in some stages is not obvious. When some other factors coexist, the transmission effect of monetary policy is easily overridden by other factors due to their greater influence.

### CONFLICT OF INTEREST

The authors declare no conflict of interest.

### AUTHOR CONTRIBUTIONS

All authors conducted the research. The first author put forward research idea and designed research scheme. The second author collected data and made empirical analysis.

The third author collected the research - related information.

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