

# How does the balance of securities lending affect investors' sentiment in the securities margin trading market? ——An Empirical Study Based on Impulse Response Function

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## Abstract:

In 2010, China launched the “margin trading and securities lending” pilot program for the first time as an initial exploration of the short selling mechanism. Subsequently, it has been expanded multiple times. With the increase in the number of underlying stocks and the relaxation of short selling constraints, there has been a noticeable shortage of securities lending sources. To address this issue, China introduced the “securities lending” policy after margin trading, and selected 90 stocks as the first batch of pilot stocks. Although the short selling mechanism has been developed in China for 14 years, compared with other mature capital markets, relevant regulations and the scale of short selling transactions in China are still in the development stage. Following a wave of market downturns in the second half of 2023, rumors about securities lending and shorting the market continued to ferment, and investor sentiment hit rock bottom. In response to market conditions, the China Securities Regulatory Commission (CSRC) has taken a series of measures to strengthen supervision of securities lending businesses, maintain fair market trading order, and ensure the smooth operation of the capital market. Therefore, continuous monitoring of the impact of the short selling mechanism on China's capital market is necessary.

This study selects all A-shares disclosed by the exchanges as research objects. The research period is from March 2021 to February 2024. On the premise of referencing existing academic achievements at home and abroad, PCA (Principal Component Analysis) is used to construct investor sentiment proxy variables, subjective risk premium variables are set, and VAR models and impulse response functions are used to explore the relationship and transmission mechanism between securities lending balance, subjective risk premium, and investor sentiment, and suggestions for policy formulation are made.

**Keywords:** Short selling; Investor sentiment; Securities lending; Subjective risk premium

## 1. Introduction

Short selling mechanism has been widely discussed and researched since its inception. Capital markets in developed Western countries developed relatively early and are relatively mature, so early research mainly came from these markets. Miller (1977) pointed out that short selling constraints can cause stock prices to deviate from their actual value because they cannot accurately reflect the information of pessimistic investors. Diamond and Verrecchia (1987) believed that under short selling constraint mechanisms, asset prices absorb negative information at a slower rate, reducing the efficiency of asset pricing. Based on this, more researchers conducted empirical analyses based on different capital markets. For example, studies on the New York Stock Exchange (Charles Jones, Lam-

ont, 2002), the Hong Kong Stock Exchange (Eric Chang, 2007), and other countries' capital markets (Bris, Goetzmann, Zhu, 2007) found that stocks with high short selling costs tend to have higher market capitalization, lower future returns, implying that short selling constraints can lead to overvalued stock prices, limiting the entry of negative information into the market and preventing negative information from being reflected in stock prices. The above studies all discuss the negative impact of short selling constraints on pricing efficiency from the perspective of hindering the entry of negative information into the market.

Before the introduction of margin trading and securities lending in China, the short selling mechanism in the Chinese stock market was not sound. Influenced by the 1998 Asian financial crisis, Hong Kong tightened its

regulation of short selling transactions. Fung and Draper (1999) found that the pricing of stock index futures was significantly overvalued. In addition, Liao Shiguang and Yang Chaojun (2005) found that the impact of the short selling mechanism on the market is affected by factors such as trader type, operation type, and information disclosure level, rather than a simple positive effect. Chang et al. (2007) found that relaxing short selling constraints exacerbated stock price volatility. As for the impact of the short selling mechanism on stock pricing efficiency, scholars have not reached a consensus. Before the formal introduction of margin trading and securities lending in China, Zhou Chunsheng et al. (2005) speculated through theoretical models that introducing the short selling mechanism may help to make stock prices closer to their actual value. In general, research on the Chinese market before the relaxation of short selling constraints is relatively limited, and most of it is based on data from the Hong Kong market, thus its reference value is limited.

Since the introduction of the short selling mechanism in 2010, researchers in China have conducted many studies based on the short selling mechanism in the Chinese capital market. In the early stage of margin trading and securities lending pilot, Xu Hongwei and Chen Xin (2012) conducted a study based on the DID model, analyzing data from 250 trading days before and after the first batch of stocks were included in margin trading and securities lending, and found that the short selling mechanism did not significantly affect stock price returns and their distribution. This may be due to factors such as the market still being in the process of continuous improvement, constraints such as few securities lending targets, limited securities lending sources, and investor cautiousness. With the orderly expansion of securities lending targets in 2011 and 2013, more research samples and time intervals provided better conditions for further research. After studying margin trading and securities lending sample stocks and control groups using a double difference model, Xiao Hao (2014) found that margin trading and securities lending can reduce the heterogeneity volatility of individual stocks by reducing noise trading. Li Zhisheng (2015) found that the short selling mechanism can reduce stock price volatility, heterogeneous volatility, and jump risk, and there is a positive relationship between margin trading and securities lending transaction volume and pricing efficiency. Xie Lixu and Zhang Xindong (2019) studied the changes in stock liquidity during the gradual expansion of margin trading and securities lending targets from 2011 to 2013, and found that the gradual advancement of margin trading and securities lending business has increasingly promoted the liquidity of stocks. This conclusion supplements existing empirical evidence on the impact of the short selling

mechanism on market quality.

There are many irrational investor behaviors in the real market that cannot be explained by traditional financial classic models, such as overreaction, herd behavior, etc., so behavioral finance emerges. Many Nobel laureates have made outstanding contributions in the field of behavioral finance: Robert J. Shiller warned of technical bubbles and real estate bubbles in "Irrational Exuberance," believing that volatility caused by psychological factors is inherent in all asset markets. Richard Thaler, in his book "Misbehaving," outlined the development of behavioral finance and challenged traditional economic theories, arguing that its core assumptions are flawed. In the field of behavioral finance, there are many classic theoretical models based on investor sentiment, and the impact of investor sentiment on market volatility has received widespread attention in many studies. Zhang Zongxin and Wang Hailiang (2013) analyzed the logical relationship among belief adjustment, investor sentiment, and market volatility. After empirical research, they found that investor sentiment has a significant positive impact on market returns and volatility. In addition, different information preferences will have different effects on the magnitude of sentiment fluctuations, and investors who prefer fundamental information have stronger sentiment stability. Yang Bin's (2014) study showed that the impact of investor sentiment on stock volatility is periodic, and different types of investors have different effects on stock volatility. Xiong Wei and Chen Langnan (2015) explored the dynamic relationship among stock-specific volatility, stock returns, and investor sentiment from both theoretical and empirical perspectives, and believed that the differences in cross-sectional returns of stocks with different specific volatilities are mainly determined by market liquidity and investor sentiment.

From the perspective of past literature, in studies on the impact of the short selling mechanism on the stock market, many research problems focus on liquidity, pricing efficiency, etc., and there are differences in the conclusions drawn for the same problem. However, there are relatively few literatures on the relationship between the short selling mechanism and investor sentiment. There are also many studies on the short selling mechanism in China's capital market, with various research methods and perspectives. However, existing literature mainly focuses on the study of margin trading and securities lending policies. The "securities lending" policy introduced in 2013 further relaxed short selling constraints. Therefore, it is necessary to study its impact on the stock market in conjunction with the "securities lending" business. This paper focuses on the margin trading and securities lending market, and explores the relationship and impact mechanism between securities lending balance, investor sentiment, and subject-

tive risk premium.

## 2. Data and Methodology

### 2.1 Data acquisition

All data in this article are sourced from the Wind financial database, covering monthly data from March 2021 to February 2024. The trading data of margin trading and securities lending targets are obtained from the WIND Margin Trading and Securities Lending Concept Index, which includes all A-shares disclosed by the exchanges as margin trading and securities lending targets. The securities lending balance is based on the monthly data of the end-of-month balance of securities lending in the Wind securities lending market trading statistics.

### 2.2 Variable Description

#### 2.2.1 Investor sentiment

Zhang Zongxin and Wang Hailiang (2013) constructed an investor sentiment index using indicators such as the discount rate of closed-end funds, the average price-to-earnings ratio of A-shares, and the volatility of the Shanghai Stock Exchange Composite Index. However, these selected indicators are not the most suitable for the purpose of this study. Firstly, closed-end funds are difficult to serve as indicators describing investor sentiment at present, as their quantity and quality may no longer effectively characterize investor sentiment. Secondly, the investor sentiment index derived from them fails to differentiate the investment sentiment in the margin trading and securities

lending stock market from that of the entire A-share market. Therefore, this study starts from the monthly trading data of the WIND Margin Trading and Securities Lending Concept Index and uses six proxy variables for investor sentiment through Principal Component Analysis (PCA) to construct the Investor Sentiment Index (SENT). The proxy variables include turnover rate (TURN), trading volume (VOL), trading value (AMOUNT), trailing price-to-earnings ratio (PE\_TTM), trailing price-to-sales ratio (PS\_TTM), and price-to-book ratio (PB).

First, we conducted two important tests: the Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) test. The result of the Bartlett's test of sphericity indicates rejection of the null hypothesis, implying significant correlations among variables, providing a basis for factor analysis. Meanwhile, the KMO test yielded a result of 0.792, indicating that the remaining variables are suitable for factor analysis.

Subsequently, for the proxy variables of the five identified sentiment indices, the original data were standardized to ensure analysis on the same scale. The correlation matrix of the standardized matrix was computed to understand the correlation structure among variables. The decomposition of the correlation matrix eigenvalues yielded eigenvalues and corresponding eigenvectors, which play a crucial role in principal component analysis (PCA). Finally, we determined the principal components U, selecting the principal components corresponding to the largest eigenvalues to reduce the dimensionality of the original data and enable pattern recognition.

**Table 1. Total Variance Explained by Effective Factors**

Principal Component	Eigenvalue	Difference	Variance Explained	Cumulative Variance Explained
1	3.32604	1.83073	0.6652	0.6652
2	1.49531	1.38269	0.2991	0.9643
3	0.11261	0.06386	0.0225	0.9868
4	0.04874	0.03145	0.0097	0.9965
5	0.01729	0	0.0035	1.0000

**Table 2. Principal Component Analysis Matrix**

Variable name	Component 1	Component 2
Turnover Rate(TURN)	0.5177	-0.1964
Trading Value (AMOUNT)	0.4211	-0.5111
Trading Volume (VOL)	0.5030	-0.2437
Price-to-Book Ratio (PB)	0.3954	0.5575
Trailing Price-to-Sales Ratio (PS_TTM)	0.3812	0.5745

We incorporate components with eigenvalues greater than 1 into the principal components. By selecting Component 1 and Component 2, the cumulative variance explained is 96%, indicating that these two components effectively explain the majority of the information. Therefore, we include the first two principal components in constructing the investor sentiment index.

The constructed investor sentiment index is calculated as follows:

$$\begin{aligned} \text{Investor Sentiment Index} = & 0.6652 * (0.5177 * \text{Turnover Rate (TURN)} + 0.4211 * \text{Trading Value (AMOUNT)} \\ & + 0.5030 * \text{Trading Volume (VOL)} + 0.3954 * \text{Price-to-Book Ratio (PB)} + 0.3812 * \text{Trailing Price-to-Sales Ratio (PS\_TTM)}) \\ & + [0.2991 * (-0.1964) * \text{Turnover Rate (TURN)} + (-0.5111) * \text{Trading Value (AMOUNT)} \\ & + (-0.2437) * \text{Trading Volume (VOL)} + 0.5575 * \text{Price-to-Book Ratio (PB)} + 0.5745 * \text{Trailing Price-to-Sales Ratio (PS\_TTM)}]. \end{aligned}$$

### 2.2.2 Subjective risk premium

Changes in investors' subjective risk premium can effectively explain stock market volatility. Zhang Zongxin and Wang Hailiang (2013) found that its variation has a

very significant positive impact on investor sentiment. Therefore, this study introduces the variable of subjective risk premium and explores its relationship with investor sentiment as well as investor margin trading and securities lending behavior. The study uses the ratio of monthly return volatility of the Shanghai and Shenzhen stock indices to the monthly return volatility of the Shanghai Treasury Bond Index as an indirect measure of investor subjective risk premium.

## 2.3 Model Construction

### 2.3.1 Stationarity Test and Cointegration Test

To examine the impact of securities lending balance on subjective risk premium and investor sentiment, this study employs multivariate linear regression and impulse response functions for verification. To avoid the issue of "spurious regression," it is necessary to conduct Augmented Dickey-Fuller (ADF) unit root tests on the relevant observed variables. The test results indicate that the securities lending balance, subjective risk premium, and investor sentiment all exhibit first-order unit root processes. After first-order differencing, the series of these variables accept the hypothesis of stationarity.

**Table 3. Stationarity Test**

Variable Name	ADF Value	1%Critical Value	5%Critical Value	10%Critical Value	Stationary
Securities Lending Balance's First Difference	-4.835	-4.297	-3.564	-3.218	Stationary
Subjective Risk Premium's First Difference	-7.199	-4.297	-3.564	-3.218	Stationary
Investor Sentiment's First Difference	-6.992	-4.297	-3.564	-3.218	Stationary

We conducted cointegration tests on the three variables using the Engle-Granger (E-G) two-step method. First, we established regression models: under the condition of variable stationarity, we built regression models between two variables. This means selecting one independent variable and one dependent variable and estimating their linear relationship using the least squares method. Then, we tested the stationarity of residuals. In the first step,

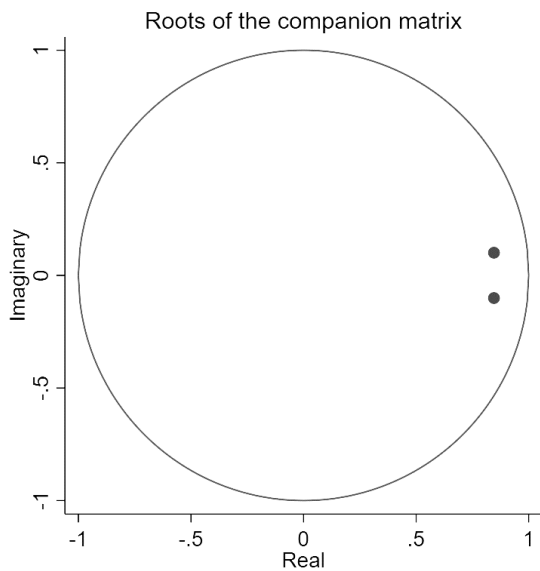
residuals of the regression model (i.e., the differences between actual observed values and model-predicted values) were obtained. Subsequently, these residuals underwent unit root tests (ADF tests) to confirm their stationarity. If the residuals are stationary, it indicates the existence of a long-term, stable cointegration relationship between the two variables.

**Table 4. Cointegration Test**

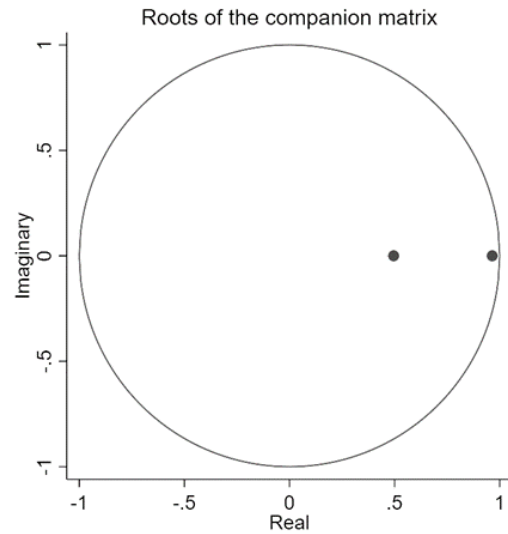
Cointegration Test for Different Variables	T-statistic	Conclusion
Securities Lending Balance and Subjective Risk Premium	-4.319	Cointegration
Securities Lending Balance and Investor Sentiment	-5.461	Cointegration
Subjective Risk Premium and Investor Sentiment	-6.951	Cointegration

**2.3.2 Determination of Lag Order and Construction of VAR Model**

The article conducts a vector autoregression (VAR) analysis on the pairwise relationships between the three variables. Firstly, the lag order is determined based on criteria such as AIC, HQIC, SBIC, etc. When studying the relationships between the three variables pairwise, a lag order of one should be used. The Granger causality test is employed to robustly test the lag order's validity. It is found that the subjective risk premium at lag one is the Granger cause of the securities lending balance, and the securities lending balance at lag one is the Granger cause of investor sentiment. However, there is no Granger causality between the subjective risk premium and investor sentiment, which differs from the conclusion of Zhang Zongxin and Wang Hailiang's (2013) study. Based on these findings, a VAR model is constructed for regression analysis, and the stability of the VAR model is tested. Two models are used for regression analysis: Model 1 has the subjective risk premium as the explanatory variable and the securities lending balance as the explained variable; Model 2 has the securities lending balance as the explanatory variable and investor sentiment as the explained variable. Subsequently, stability testing is conducted, and the results show that the AR characteristic polynomial has no roots outside the unit circle. Therefore, the VAR model specified in this article meets the stability condition. Based on this result, the impulse response functions obtained are robust and reliable.



**Figure 1 Unit Circle Test for Model 1**



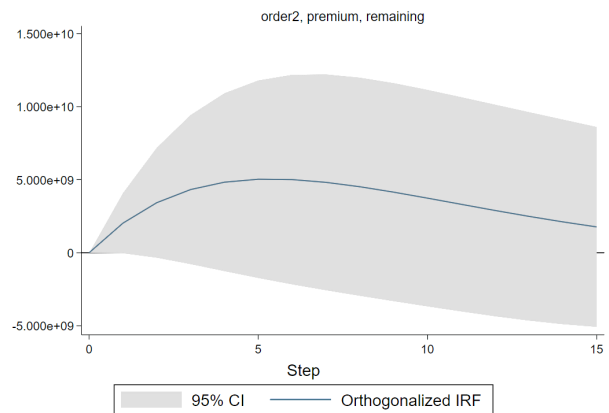
**Figure 2 Unit Circle Test for Model 2**

**3. Results**

To visually observe the relationship and mechanism among subjective risk premium, securities lending balance, and investor sentiment, we conducted validation through constructing impulse response functions.

**3.1 Impact of Subjective Risk Premium on Securities Lending Balance**

As shown in Figure , in Model 1 where subjective risk premium serves as the explanatory variable and securities lending balance as the explained variable, we observe a gradually increasing impact of subjective risk premium on securities lending balance, reaching its peak in the fourth period, followed by a gradual decline. This suggests that as investors subjectively perceive market risks, they begin to actively engage in short selling activities, borrowing through securities lending in the limited availability of securities, leading to an increase in securities lending balance.

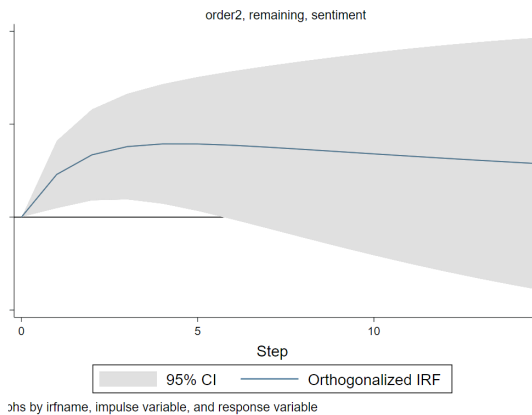


Graphs by irfname, impulse variable, and response variable

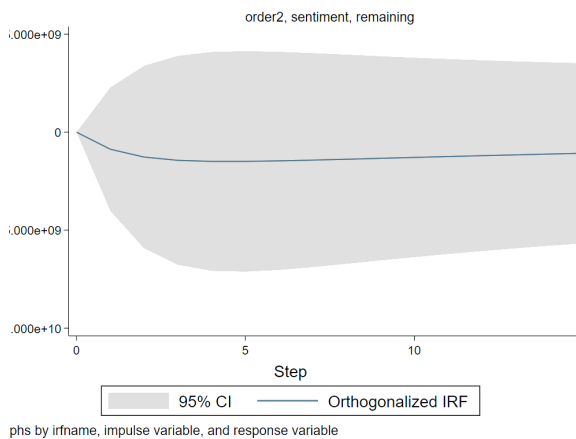
**Figure 3. The impulse response graph of securities lending balance to subjective risk premium**

### 3.2 Impact of Securities Lending Balance on Investor Sentiment

As illustrated in Figure , in Model 2 where securities lending balance serves as the explanatory variable and investor sentiment as the explained variable, we observe that the lagged two periods of securities lending balance have the greatest positive impact on investor sentiment, which gradually diminishes over time. Securities lending balance consistently exerts a positive impact on sentiment, indicating that higher securities lending balance correlates with more frequent market participant activities, hence higher sentiment levels. Furthermore, the figure demonstrates a sustained weakening negative impact of investor sentiment on securities lending balance. The fluctuations between the two variables are reciprocal. Long-term observations suggest that an increase in securities lending balance enhances investor sentiment, while an increase in sentiment levels reduces short selling through securities lending, indicating the presence of a negative feedback mechanism between the two.



**Figure 4. The impulse response graph of investor sentiment to securities lending balance**



**Figure 5. The impulse response graph of securities lending balance to investor sentiment**

### 4. Policy Recommendations

Based on the empirical results of the research and the current situation of China's capital market, this paper proposes the following three policy recommendations.

First, actively guide investors to form rational expectations to avoid irrational adjustments in investor sentiment that may lead to market shocks, thereby protecting small and medium investors. We should explore appropriate methods and regulatory measures, flexibly utilize tools, maintain a fair market order, and promote the healthy and substantial development of the stock market. The irrational adjustment of investor subjective risk will increase overall systemic risks, which is not conducive to protecting small and medium investors and reflects the inefficiency of the market. Therefore, it is necessary to strengthen the overall governance level of the stock market, improve the efficiency and transparency of the capital market, and guide investors' rational expectations.

Second, prevent improper arbitrage activities and maintain stable market operation. The China Securities Regulatory Commission (CSRC) recently announced strict prohibition of securities firms from providing margin securities to investors who engage in intraday trading using securities lending, also known as "disguised T+0 trading," aiming to reduce short selling liquidity. To ensure fair market order, the CSRC requires securities firms to strengthen the management of client trading behaviors and strictly prohibit providing margin securities to investors engaging in intraday trading using securities lending. Intraday trading refers to investors using securities lending instruments to buy and sell the same stock within a single trading day. Specifically, this trading strategy allows investors to sell stocks through securities lending and buy back the same quantity of stocks on the same day to profit from the price difference without holding overnight positions. We should strive to maintain the fairness of the market order, strengthen industry regulation, prevent the occurrence of improper arbitrage activities, and ensure that the short selling mechanism can play a role in improving pricing efficiency without being used for improper arbitrage by certain investors.

Third, optimize the structure of short-selling business investors. There is an imbalance in the investor structure of China's capital market, and short-selling business is no exception. As of August 2023, the number of institutional accounts for margin trading and securities lending nationwide was only 51,000, while individual accounts reached 6.613 million. Compared with institutional investors, individual investors in China are more prone to engage in chasing high and selling low trading, mainly due to insufficient information collection and analysis capabilities.

ties. This phenomenon will exacerbate the synchronicity of stock prices, thereby weakening the role of the short selling mechanism in improving stock pricing efficiency. Therefore, while considering reducing trading costs, we need to be cautious about policies to lower the entry threshold for short selling transactions. Factors such as financial literacy, investment experience, and information analysis ability of short sellers have significant impacts on the effectiveness of policy implementation. Therefore, strengthening investor education is crucial

## 5. Conclusion

This paper investigates the relationship and mechanism of influence among investor sentiment, securities lending balance, and subjective risk premium by constructing a VAR model. It examines how changes in subjective risk premium affect investor short-selling behavior and sentiment. The research findings demonstrate that changes in investor subjective risk premium affect investor sentiment through alterations in short-selling behavior via securities lending. Specifically, adjustments in subjective risk premium lead to changes in investor short-selling behavior, indicating a positive impact of subjective risk premium on securities lending balance. However, there is no causal relationship between changes in securities lending balance and adjustments in subjective risk premium, suggesting that investors tend to engage more actively in short selling when they perceive an increase in market risk. Changes in investor short-selling behavior significantly positively influence investor sentiment, while investor sentiment exerts a negative impact on securities lending balance, stabilizing it through negative feedback. This implies that when investors engage more actively in short selling, it positively enhances investor sentiment, reflecting the “bottom-fishing” mentality, where investors believe in an impending rebound after a sharp decline. This, in turn, suppresses investor short-selling behavior, leading to stability in securities lending transactions.

## References

- [1]Miller E.M. (1977). Risk, Uncertainty, and Divergence of Opinion. *Journal of Finance*, 32(4), 1151-1168.
- [2]Diamond D.W., & Verrecchia R.E. (1987). Constraints on Short-Selling and Asset Price Adjustment to Private Information. *Journal of Financial Economics*, 18(2), 277-311.
- [3]Jones C.M., & Lamont O.A. (2002). Short Sale Constraints and Stock Returns. *Journal of Financial Economics*, 66(2-3), 207-239.
- [4]Chang E.C. (2007). Short-Sales Constraints and Price Discovery: Evidence from the Hong Kong Market. *Journal of Finance*, 62(5), 2097-2121.
- [5]
- [6]Biais, B., Bisiere, C., & Decamps, J.P. (1999). Short Sales Constraints, Liquidity and Price Discovery: An Empirical Analysis on the Paris Bourse. *European Financial Management*, 5(3), 395-410.
- [7]Fung J.K., & Draper P. (1999). Mispricing of Index Futures Contracts and Short Sales Constraints. *Journal of Futures Markets*, 19(6), 695-715.
- [8]Chang E.C. (2007). Short-Sales Constraints and Pricing Discovery: Evidence from the Hong Kong Market. *Journal of Finance*, 62(5), 2097-2121.
- [9]Liao S.G., & Yang Z.J. (2005). Short-Selling Mechanism, Volatility, Liquidity—An Empirical Study Based on the Hong Kong Stock Market. *Management World*, 12, 6-13+171.
- [10]Zhou C.S., Yang Y.H., & Wang Y.P. (2005). Research on Transaction-Based Price Manipulation in China’s Stock Market. *Economic Research*, 10, 70-78.
- [11]Xu H.W., & Chen X. (2012). Does the Introduction of Margin Trading and Short Selling Improve the Pricing Efficiency of Underlying Stocks in China? An Empirical Study Based on the Double Difference Model. *Management World*, 05, 52-61.
- [12]Xiao H., & Kong A.G. (2014). Mechanism of Margin Trading and Short Selling on the Characteristic Volatility of Stock Prices: Empirical Evidence Based on the Double Difference Model. *Management World*, 08, 30-43+187-188.
- [13]Li Z.S., Chen C., & Lin B.X. (2015). Does the Short-Selling Mechanism Improve the Pricing Efficiency of the Chinese Stock Market? Evidence from a Natural Experiment. *Economic Research*, 50(04), 165-177.
- [14]Xie L.X., Zhang X.D., & Zhang Y. (2018). Expansion of Margin Trading and Short Selling and Liquidity. *Management Science*, 31(06), 46-57.
- [15]Chu J., & Fang J.X. (2016). The Arrangement of China’s Margin Trading and Short Selling System and the Worsening of Stock Price Crash Risk. *Economic Research*, 51(05), 143-158.
- [16]Zhang Z.X., & Wang H.L. (2013). Investor Sentiment, Adjustment of Subjective Beliefs and Market Volatility. *Financial Research*, 2013(04), 142-155.
- [17]Yang B. (2015). An Empirical Study on the Impact of Investor Sentiment on Stock Market Returns and Volatility in China. Liaoning University.
- [18]Xiong W., & Chen L.N. (2015). Stock Characteristic Volatility, Stock Returns and Investor Sentiment. *Management Science*, 28(05), 106-115.
- [19]Shiller, R.J. (2016). *Irrational Exuberance*. Third Edition. Renmin University of China Press.
- [20]Taylor, R. (2016). *The Behavioural Economics*. First Edition. CITIC Press.