Student name: <u>XIUHAN FENG</u>   Student number: <u>18141111</u>

School: <u>National college of Ireland</u>   Course: <u>Finance</u>

Degree to be awarded: <u>Master of Science in Finance</u>

Title of Thesis: <u>Research on the effect of short - selling mechanism on A - share volatility in China</u>

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For completion by the School: <u>National college of Ireland</u>

The aforementioned thesis was received by

Date: <u>August 18, 2020</u>

Abstract

At present China pay more and more attention to the ability of direct financing of the stock market, and financing efficiency is limited by the market mechanism, in the Chinese stock market has been the single market before 2010, often resulting in the stock market boom collapsed, increase of market risk will no doubt stop many internal and outside investors to affect its role in equity markets. In 2010, margin and short-selling and stock index futures trading systems were introduced to make up for the absence of short selling mechanism for the smooth operation of the stock market. On the one hand, short-selling can restrain the unreasonable rise of stock prices and enhance market liquidity; on the other hand, when the market is in a bear market cycle, it will increase the risk of stock market crash. Therefore, whether the launch of the shorting mechanism can play a role in stabilizing the market needs to be further studied.

On the basis of theoretical analysis and empirical analysis, this paper first introduces the development status of margin trading and short selling business, the choice of different margin trading and short selling business modes and the existing problems in China's short selling mechanism. This paper uses VAR model and GARCH model to select the underlying stocks launched from March 31, 2010 to December 31, 2015 for empirical analysis. The empirical results show that margin trading and short selling have no significant impact on market volatility in these five years, but they have increased market liquidity. Finally, the article combines the problems existing and the empirical results to put forward relevant suggestions.

Key words

Margin trading and short selling; Volatility; VAR model; GARCH (1,1)

Submission of Thesis and Dissertation

National College of Ireland
Research Students Declaration Form
(Thesis/Author Declaration Form)

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Material submitted for award

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Signature of research student: <u>XIUHAN FENG</u>
Date: <u>August 18, 2020</u>

Acknowledgements

Contents

Chapter1 Introduction

1.1 Reasons for selecting the topic

Some literature reviews have studied the impact of margin trading and short selling on stock market fluctuations, and the conclusions are also different. As a short selling method, the margin trading mechanism is launched to reduce market volatility. Secondly, the mechanism can also prevent over-speculation of stocks. However, since the official opening of China's bilateral market on March 31, 2010, the stock market still has a sharp rise and fall, and many stock prices are far higher than their intrinsic value, which has led some people to doubt the effectiveness of the short selling mechanism on the stock market. Based on the above problems, this paper collects relevant market data of margin trading and short selling to analyze the impact of short selling mechanism on China's stock market.

1.2 Background of Topic Selection

In the development process in recent years, the main problems of A shares are reflected in the large fluctuation of stocks and the inflated valuation. In 2010, short selling and stock index futures trading were officially started. Because of its leverage effect, the risk of investment trading will increase. Therefore, the opening of short selling and stock index futures trading accounts requires investors to have 500,000 funds and to conduct evaluation tests on investors. Only investors who meet the above harsh requirements can short trading, which makes it difficult for small and medium-sized investors to short stocks. Therefore, the introduction of margin trading and short selling mechanism in China has limited influence on the stock market. As that investor structure of China 's stock market is different from that of other mature capitalist country, The number of individual investors is large, accounting for 97% of the A-share market, many of its investors do not have relevant knowledge and working experience, which leads to a large speculative component in China's stock market. Individual investors expect to sell stocks at a profit when the stock price rises or buy stocks at a lower stock price when the stock price falls. This trading method causes sharp fluctuations in the stock market and increases the risks in the stock market. The latest example is the great bull market from 2014 to 2015. The Shanghai Composite Index started from about 2,000 points and soared by more than 3,000 points in less than a year. After reaching the highest 5,178 points, it immediately turned downward and plunged. Since then, China's stock market has been in a unilateral downward trend for a long time. Another problem is the serious speculation in A shares. For example, in 2018, some stocks with extremely poor performance were hyped by hot money. As a result, more and more individual investors bought stocks in pursuit of high returns

and followed the transaction. However, the final result was that the valuation would return after the surge, and many investors suffered serious losses. Under the background of the launch of margin trading and short selling, how does this affect the fluctuation and liquidity changes in China's stock market? These problems deserve further discussion and study.

1.3 Significance of Research

There are two problems in the research of margin trading and short selling in China.

There are two problems in the research of margin trading and short selling in China. First, it has been less than 10 years since the official launch of margin trading and short selling and stock index futures in China, and there are not many data that can be studied. Moreover, since 2015, China has maintained restrictions on short selling, which has slowed the development of margin trading and short selling in the past 10 years.

The second is the impact of short selling on volatility. Some scholars believe that the introduction of short selling mechanism increases the volatility of stocks and is not conducive to the healthy development of the stock market. Other scholars believe that the short selling mechanism just reduces the fluctuation of the stock market, which is in line with the purpose of introducing the mechanism. The theoretical significance of this paper is to use VAR model and GARCH model to study whether margin trading and short selling can stabilize market fluctuations and prevent virtual high valuation, which can provide new ideas for other people to study short selling mechanism in the future and further enrich the research results of China's A-share short selling mechanism. The practical significance is that the fluctuation of the stock market is related to the healthy development of the whole market. Exploring the influence of short selling from these two angles can provide investors with new investment strategies in the future investment and provide limited reference value for the construction and improvement of relevant departments in the future mechanism.

Chapter 2 Literature Review

At present, there is no consensus in the theoretical circle on the impact of margin trading and short selling on the volatility of the stock market. The volatility of short selling mechanism is usually affected by trading leverage, investors' psychological expectations and the long-term return rate of the stock market.

2.1 Support the view

Some studies show that the introduction of margin trading and short selling will increase the volatility of the stock market. Short selling will increase the supply of stocks under the action of trading leverage, thus increasing the volatility of the market. Tomas Garbaravicius (2018) (Garbaravicius, 2018) believes that investors' use of leverage and expected inertia will aggravate the volatility of the stock market. Yaoqiang Peng (2016) (Peng, 2016) believes that in a market with high information symmetry, there is a positive relationship between the decline of securities prices and short selling, but if the information is asymmetric, short selling will have a greater impact on the decline of stocks. Hu Huafeng (2012) (Huafeng, 2012) also had to sell short mechanism after empirical analysis of Hong Kong stocks, which would increase the fluctuation of stock prices. ChuJian and Fang Junxiong (2010) (Junxiong, 2010) used DID double difference model to study China's stock market and found that leveraged financing will encourage market speculation, while different investors in the market get different information, which will easily lead to overvaluation of stock valuation. In addition, there are more financing transactions in the market, which will accumulate market risks. Henry and McKenzie (2006) (McKenzie, 2006)took the daily trading data of Hong Kong stock market as the research object, and found that the stock volatility increased after the introduction of short selling. Hsieh, David A (Hsieh, 2000) found through the dummy variable method that when financial leverage increases, stocks with margin trading and short selling qualifications will increase market volatility and liquidity with the change of time and market control variables.

Because the existence of short selling mechanism will lead to the amplification of investors' fear and cause panic selling. Restrictions on short selling can slow down the harm of the financial crisis. Allen. Franklin (1991) (Allen.Franklin, 1991) believed that imposing restrictions on short selling can effectively alleviate the negative psychology of investors and maintain the stability of the market. Sheu, She-Jiun Wei and Yu-Chen (Sheu, 2019) studied the options trading data in Taiwan and found that the volatility of the market is affected by investors' mentality in the process of margin trading and short selling by using multi-factor model.

Short selling will lead to a decline in the long-term return rate of the stock market and increase the volatility of the market. Schmedders Karl (Karl, 2019) conducted an in-depth study on the relationship between volatility and liquidity in short selling markets. The data of Athens Stock Exchange (ATHEX) are selected to study the impact on market volatility under three different short selling restriction periods. By using econometric methods, it is proved that under the condition of allowing short selling, the total stock return fluctuates greatly in the short term, but the impact on market liquidity is not significant. Shkilkp (2007) (Shkilko, 2007) found through quantitative analysis that short selling is mostly disorderly, and this abnormal buying will aggravate the fluctuation of stock price.

2.2 objection

Some scholars believe that short selling will not aggravate the volatility of the market or show no obvious change. Porter and Smith (2000) (Smith and Caginalp, 2000) believe that short selling mechanism cannot have obvious influence on stock market bubble and bubble cycle in their research on short selling mechanism and market bubble. Zhan Huiying (zhihui, 2009)(2010) conducted a study on the Shanghai stock market and found that Granger causality test found that short selling had no effect on volatility. Kruas and Rubin (2003) (Rubin) established a model to study the volatility of short selling and stock market waves. They found that under different constraints, the volatility of stock market did not change significantly and there was no significant correlation between short selling and stock market volatility. Battalio and Schultz (2006) (Schultz, 2006) found that there is no significant correlation between short selling and Internet stock prices in the US stock market during the Internet bubble period. Yang Deyong (2011) (Deyong, 2011) used VAR model to find that the change of short selling balance has little effect on the fluctuation of stock market. Hardouvelis, Gikas A (Hardouvelis, 2002) took NYSE stock index as the research object and found that short selling orders do not aggravate the volatility of the market. The most important factor causing the price fluctuation in the securities market is the daily frequent trading orders.

2.3 Summary

(1) There are still differences between China and other countries on the impact of short selling mechanism on stock market fluctuations, but the main views are divided into the following three types. The first is that the short selling mechanism reduce the fluctuation of the stock market. The second is that the short selling mechanism has no influence on the fluctuation of the stock market. The third is that the short selling mechanism will aggravate the fluctuation of the stock market. Due to the different research objects, sample data and model methods selected

by different scholars, many scholars have finally come to different conclusions about the changes of short selling on market volatility. Of course, both viewpoints are reasonable. We should not only realize the positive role of short selling market, but also guard against the unstable factors in the market caused by short selling. The supervision and management of short selling risks is also the core issue to be studied in this paper.

(2) The research on margin trading and short selling in developed countries is earlier than that in China. Foreign research tends to only study the impact of securities on market volatility, while China's research considers margin trading and short selling at the same time. This may be because before the launch of the bilateral market, China had been dominated by the unilateral market, and investors' thinking was mainly focused on buying short to make profits. Therefore, since then, the market has encountered problems in its development and the loopholes in the market have gradually been exposed., some Chinese scholars have paid more and more attention to domestic short buying and short selling.

(3) On the whole, China's margin trading and short selling are in a stage of rapid development. All aspects are not mature enough and face various risks and challenges. With the continuous changes of the market, the relationship between margin trading and short selling system and market volatility needs further research.

2.4 The research methods
(1) Descriptive research method: relevant information can be obtained by collecting literature, so as to accurately understand the history and current situation of the problem to be studied, and provide a basis for this paper to study the problem by referring to and analyzing the existing research experience and results.

(2) Comparative research method: The paper compares the margin and short selling business models of China's stock markets with those of developed countries, analyzes the characteristics and business processes of various models, and then compares them from three dimensions: the proportion of margin and short selling, the development of short selling business and the structure of market investors.

(3) Empirical analysis: Based on the theory of literature review, VAR model and GARCH model are used to analyze the volatility of the stock market after the introduction of margin trading and short selling in China from May 2010 to December 2015, so as to draw conclusions and put forward relevant policy Suggestions.

2.5 Innovation and Deficiency

Previous scholars have mostly discussed the impact of short selling mechanism on the stock market based on stock index futures or some important stock indexes. In addition, most of the articles are based on the markets of developed countries, and few are based on China's A-share market. This article is from the perspective of margin trading. In terms of research methods, many articles have used financial time series model and value-at-risk model to study the impact of short selling on stock volatility, However, the time span of the research is too short, which will lead to the decline of analysis accuracy. Therefore, this paper will choose a 5-year time length to study through VAR model and GARCH model to further confirm whether margin trading and short selling have obvious impact on A-share market. In addition, the deficiency is the shortage of variables. The fluctuation of the stock market is interfered by various external factors. China's supervision system for short selling mechanism is also constantly changing. However, the variables selected for the research are limited, which will lead to the research results not being consistent with the reality.

Chapter 3 The Basic Theory and Historical Development of Margin Trading

3.1 Margin trading and short selling

Margin trading and short selling consists of two parts, namely margin trading and short selling. Financing transaction is the behavior that investors provide collateral to securities companies and then borrow funds from securities companies to purchase securities. Short selling is the behavior that investors borrow securities from securities companies and then sell them. Within a specified period of time, they buy the same amount and type of securities and return them to securities dealers. Margin trading is also called short selling, and short selling is also called short selling.

3.2 Features

(1) Leverage. Margin trading means that investors can borrow funds to buy securities or sell securities by paying a certain margin. The smaller the margin requirement, the higher the leverage. This means that investors can make several times of investment operations in the market with less principal, thus obtaining larger profits. However, due to the uncertainty of market stock price fluctuation, margin trading is often accompanied by higher risks while enlarging investors' trading returns. Investors need to learn to predict market risks, understand market trends, invest cautiously, and avoid huge losses accompanied by high risks. This is the leverage of margin trading and short selling.

(2) Duality of credit. In margin trading, the first level of credit relationship comes from securities dealers who do not need to pay the full amount of funds to buy securities or borrow securities to sell them according to the credit rating of investors. Brokers will help investors to advance part of the difference. The second level of credit relationship is that the accounts advanced by the broker come from their own funds, customer deposits, bank loans or financing in the money market. During the pilot period, China only allowed securities companies to use their own funds and securities to engage in margin trading and short selling. Therefore, at the beginning of the establishment of this policy, China had only the first level of credit relationship.

(3) Short selling mechanism. Since the introduction of margin trading and short selling system, investors can borrow shares and sell them first, then buy them back and return them to securities dealers after the stock price falls. This means that when the stock price falls, it can also make profits. The biggest difference between margin trading and ordinary stock trading is that, Margin trading has changed the unilateral market situation.

For ordinary stock trading, investors need to buy stocks before selling them. However, the bilateral market transactions allow investors to bring benefits when stock prices rise or fall.

3.3 Historical Development of Global Margin Trading

Country or region	Stock Market yield (9.1-9.17)	Stock Market yield (9.18-9.22)	Stock Market yield (9.23-10.9)	Intraday amplitude (9.1-9.18)	Intraday amplitude (9.19-10.9)
The United States	-9.90%	8.50%	-21.50%	2.90%	4.90%
The British	-12.80%	8.10%	-17.80%	2.80%	4.80%
Canada	-13.80%	8.70%	-22.10%	2.90%	5.20%
The French	-10.80%	8.10%	-19.10%	3%	4.80%
Germany	-8.70%	5.60%	-19%	2.60%	4%
Italy	-10.50%	7.10%	-20.30%	2.70%	4.70%
Japan	-10.50%	5.20%	-24.30%	2.70%	3.70%
South Korea	-1.60%	4.90%	-11.30%	3.20%	3.60%
Singapore	-10.90%	5.20%	-17.40%	3%	4.30%
On average	-9.94%	6.82%	-19.20%	2.87%	4.44%

Figure 1

The system of margin trading and short selling originated in the United States. Before 1929, the economic growth rate of the United States exceeded 10% for three consecutive years, the monetary policy was loose, the loan interest rate remained at a low level of 5%, and the stock leverage was developed. Ordinary investors could obtain 10 times the leverage, while large investors could obtain 25 times the leverage. Banks liked the profits brought by stock financing (the stock financing interest rate was 15% at that time). The United States has always maintained an attitude of not intervening too much in the short selling policy and allowing it to develop freely. The short selling mechanism has developed to a certain extent in the United States. However, since 1929, the U.S. Stock market has experienced a serious crisis. Large investors like Jesse Livermore short U.S. Stocks, which led to a 2% drop in U.S. Stocks. At the same time, with 22 million U.S. Dollars of gold flowing from Britain to Wall Street, the U.S. Stock bubble broke out cumulatively. Although professionals such as Edward Meeker, an economist at the New York Stock Exchange, pointed out directly that the stock market crash had nothing to do with short selling, many people still believed that the "short attack" aggravated the stock market crisis. Therefore, (Morales, 2018) in 1934, the U.S. Congress discussed the impact of short selling mechanism on the market and promulgated the Securities Exchange Law, forming the legal system of the U.S. Securities credit trading system. The law provides for margin trading and short selling. The U.S. Federal Reserve, as the regulatory body for this mechanism, has the right to formulate detailed implementation rules, which is conducive to preventing some immoral securities dealers or investors from using credit trading to depress securities prices and manipulate the market. For example, the up-tick rule for short selling in margin trading and short selling stipulates that the short selling price of short selling

in margin trading should be at least higher than the recent selling price and not lower than the price of the last transaction. Such regulations are conducive to preventing short sellers from selling maliciously when the stock market price goes down, thus avoiding the occurrence of rapid stock price decline. In 2004, the U.S. Securities and Exchange Commission formulated the rule SHO to replace the short selling provisions of the Securities and Exchange Act. During the outbreak of the stock market financial crisis in 2008, the market value shrank seriously. European and American countries adopted a temporary policy of banning short selling, while some risk-averse countries completely stopped short selling. The United States, Japan, Europe and other countries have successively issued a large number of trading rules, such as banning naked short selling of financial stocks to prevent the rapid bursting of market bubbles. All countries hope to increase the liquidity of the market and help investors restore confidence by strengthening the disclosure of short selling information and banning short selling, so as to ensure the stable development of the stock market. However, after the implementation of the measures to prohibit short selling, it has no obvious impact on the stock market yield and the volatility of stock prices. As shown in Figure 1, before the introduction of the ban on short selling, the stock market returns of the nine major countries that implemented the ban on short selling fell by an average of 9.94% from September 1 to September 18, 2008, with South Korea falling by only 1.6%, with the smallest drop. However, European and American countries and Japan have fallen by a large margin, nearly 10%. After the promulgation of the ban on short selling policy, from September 18 to September 22, the stock market yield rose by an average of 6.82%, with both Europe and the United States rising above the average. But between 23 September and 9 October, the return rate of the stock market dropped sharply, with an average drop of nearly 20%. After ban, the return rate of the stock fell twice as much as before the ban. No matter after the ban on selling was unprecedented or later, the return rate of the stock was lower than the return rate of the market. The stock market was facing a serious crisis and did not find that the trend was better than the market. In addition, before the ban on short selling was implemented (from September 1 to September 18), the average daily fluctuation of stock prices was 2.87%. From September 19 to October 9 after the implementation of the short selling ban, the daily fluctuation range of the stock market price was 4.44%. As can be seen from this, the implementation of short selling restrictions only plays a short-term role in stabilizing the volatility of the stock market and improving the return rate of the stock market. However, as the financial crisis continues to worsen, the daily fluctuation of stock prices will also increase. No matter whether the market has implemented the short selling ban or not, there is no evidence

that the short selling ban is effective. This measure only stimulates the market in the short term, postpones the decline of stock market returns, but does not reduce the fluctuation of the market and prevent the decline of stock prices. This policy of banning short selling has caused disputes and doubts between the market and investors. At the same time, it has also allowed various countries to find and establish effective short selling mechanisms. A short selling research report released by the UK Financial Services Authority in 2009 said, "We believe that any direct restrictions on short selling cannot be fully and reasonably explained. However, short selling may cause extreme market risks. We will keep a close eye on the market and take emergency measures including restricting trading when necessary." Each country draws lessons from the financial crisis and the sub-prime mortgage crisis, adjusts its future regulatory policies accordingly, and takes preventive measures in advance against the potential crisis existing in two-way transactions. After the financial crisis, the United States has taken three measures to further improve the credit transaction supervision system: promulgating the ban on short selling, amending the rule SHO.

3.4 Credit Patterns of Countries in the World
3.2.1 Decentralized credit model

The decentralized credit model is suitable for countries with developed financial markets, while the margin trading and short selling business in the United States is a typical decentralized credit model. In this mode, investors first need to have a credit account. When investors have a demand for margin trading and short selling credit, securities companies will provide funds. When the securities company's own funds and securities are insufficient, it will only borrow money from the bank or obtain funds through financing repurchase. The securities sources of securities companies include securities obtained from financing business, self-owned securities, customer securities balances and securities borrowed from other financial institutions. This model depends on a perfect credit management system and legal and regulatory constraints, and needs the cooperation of short-term capital market and long-term capital market. The relationship between the financial markets in the United States is closely connected, and the restrictions on the trading objects and scope of margin trading are relatively loose. At the same time, many financial institutions participate extensively. The source of margin trading is not only limited to securities companies. Therefore, under the decentralized credit mode, there is no complicated process for credit transactions in the United States, the overall efficiency of the market is greatly improved, and the transaction cost of investor fees is relatively low, which brings a relatively stable source of income for long-term investment. The deficiency lies in its

relatively high flexibility, which makes it difficult for the government to control. Moreover, financial derivatives under this mode develop at a fast speed and have a wide variety of functions. If traders and investment banks ignore risks and use leveraged trading crazily, it will cause serious harm to the market. (Salinger, 2002)

3.2.2 Centralized credit model

(1) Single track system

Due to Japan's failure in World War II and economic decline, in order to restore and activate the stock market, Japan introduced a margin credit trading system for the first time. This model in Japan is called single track system and belongs to one of the special forms under the centralized credit model. The most important core of the whole stock market is the securities finance company, which is set up by banks. Its function is to provide refinancing services for banks, shareholders, stabilization funds, money markets, non-bank financial institutions and securities dealers. When securities firms are short of funds or securities, they cannot directly borrow securities or funds from banks and non-bank financial institutions. They must carry out refinancing business through securities finance companies. Finally, credit traders will finance securities and funds from securities firms. Most of Japan's credit transactions are highly controlled by the government. The government provides funds to financial and securities companies. The biggest difference between centralized credit mode and decentralized credit mode is that the whole margin trading process revolves around financial and securities companies. Securities companies are the only trading channel, and margin trading is limited by government control. The advantage of this model is that it is conducive to the government's intervention in the stock market, to understand and master the outflow and inflow of funds in the stock market, and to monitor and restrict margin trading and short selling by controlling the core of securities finance companies when the stock market fluctuates abnormally, thus effectively reducing financial risks. However, due to the strict class relationship and the single source of funds and securities for securities firms, this mode will reduce the work efficiency of the market and financial securities companies. Excessive government intervention will also hinder investors' trading enthusiasm, thus affecting the liquidity of the stock market.

(2) Two-track system

Margin trading in Taiwan began in 1962, At first, investors only need to prepay a certain amount of guarantee before they can trade stocks. However, some investors will also carry out reverse operations before delivery to make up for the price difference. This kind of trading

behavior encourages the speculation of market investors, increases the fluctuation of the market. As a result, Taiwan's securities market regulators raised the guarantee amount of credit transactions to 100% in order to weaken the leverage of margin trading and short selling. Although the market risks have weakened, they have hindered the investment desire of leveraged traders. In 1974, Taiwan issued the "Regulations on the Administration of Securities Finance", allowing a group of securities dealers or banks that meet the regulations to carry out short selling. With the development of the market, more and more investors have an understanding of the rules of credit transactions. A single securities finance company is not enough to meet the needs of investors in the whole market. Therefore, Taiwan revised the previous law to stipulate that securities firms can directly conduct credit transactions to investors after applying to Fuhua Securities Finance Company. This policy has relaxed market restrictions, increased the amount of market transactions, and increased the activity of the market. In order to prevent Fuhua Securities Finance Company from monopolizing the market, the regulatory authorities have set up three new securities finance companies, forming a pattern in which many securities firms and many securities finance companies compete with each other in the market. Traders have chosen more ways and the competition among institutions has become more intense.

The two-track system represented by Taiwan is an improvement on Japan's single-track system. The biggest difference between this model and Japan's single-track system is that securities finance companies can also directly provide investors with margin trading and short selling, so investors can have one more channel to integrate funds and securities, which is more flexible. Secondly, under the two-track system, licensed securities firms can borrow medium-and long-term loans directly through banks and short-term loans from the money market, while unlicensed securities firms must borrow funds through securities finance companies. The characteristic of this system is that some securities firms can directly borrow funds from banks without passing through securities finance companies, which greatly weakens the monopoly position of securities finance companies, strengthens the connection between securities firms and short-term capital markets, and also forms a competitive relationship between securities firms and financial securities companies. However, the two-track system has the characteristic of unclear delivery responsibility.

3.4.3 Credit mode of the Central Clearing Company

In Hong Kong, Under the credit mode of the Central Clearing Company, margin trading and

short selling are carried out separately. During short selling, short selling customers send entrustment applications to securities dealers, and then securities dealers transfer the received applications to the Central Clearing Company. After the Central Clearing Company finally issues short selling entrustment, the Central Clearing Company matches relevant transactions and lends securities to short sellers. When financing, one must reach an agreement with a securities firm and withdraw and provide guarantee funds through a credit account before one can carry out financing business. Because this mode cannot directly pass through the central clearing company system when short selling, it has the characteristics of centralized credit mode, while it can directly pass through securities dealers when financing, which is similar to the decentralized credit mode in the United States. Therefore, this mode is essentially a combination of decentralized credit mode and centralized credit mode. This mode is characterized by relatively independent margin trading and short selling, which is difficult to manage and easy to cause chaos.

Choice and Enlightenment of China's Margin Trading Business Model

China's financial system is not as perfect as that of developed countries. The market itself has weak awareness of risk control and supervision. The financial market mainly relies on government regulation. Since 2011, when the China Securities Regulatory Commission and Zhongdeng Company established the China Securities Finance Corporation, China Securities Companies can only use their own funds or refinancing funds to provide short selling and short selling services for investors. Investors' short selling and short selling collateral must also be monetary funds or securities of designated securities companies. When the funds or securities of securities companies are insufficient, they cannot directly borrow securities or funds from other non-bank financial institutions. They can only refinance through securities finance companies, and only some qualified securities firms can carry out selling and buying within the law. Based on the above characteristics, China has adopted a business model similar to Japan's single-track centralized credit system. This model is strongly controlled by the government, resulting in marketization, low market efficiency and high transaction costs. However, the government's regulatory ability can quickly identify market risks and effectively inhibit the occurrence of some immoral speculation. The single-track model is more in line with the needs of China at present. After China's financial market becomes more and more perfect in the future, China can also consider a decentralized credit model similar to that of the United States and use market competition for margin trading.

Chapter 4 The Current Situation and Existing Problems of Margin Trading and Short Selling in China

4.1 The Development of Margin Trading in China

（1） Initial phase

At the initial stage, China's margin trading and short selling business lacked corresponding legal and institutional supervision, and was affected by some immoral transactions in the market during its development. Therefore, the early margin trading and short selling were prohibited by the state in China. After that, in order to regulate transaction and standardize relevant laws and regulations, the People's Securities Law of China was passed in October 2005. The promulgation of this law regulated margin trading and lifted the restrictions on margin trading. China and Shanghai Stock Exchange, China Deng Company and China Securities Association have detailed the relevant laws and regulations, standardizing the conditions, procedures and supervision and management in margin trading. In 2006, market began to face a great bull market. Due to careful consideration of financial risk supervision and risk leverage, the pilot of margin trading and short selling was temporarily stranded.

（2） Preparation phase

In April 2008, the State Council issued a series of regulations related to the supervision and management of securities companies and risk control, strictly regulating the setting of accounts, the leverage ratio and the collection of margin. The margin ratio of margin trading and short selling shall not be less than 50%. Since October 2008, some securities companies in China have started the full-network test of margin trading and short selling, making full preparations for the development of margin trading and short selling, and it has also achieved the expected results. However, due to the impact of the US subprime mortgage crisis in 2008, the global economy has been severely hit, the global stock market has plummeted, investors have suffered heavy losses, and all walks of life such as finance, securities, banks and so on have entered a state of depression. However, China's margin trading and short selling business has just started,

the experience of investment management is not sufficient, and the countermeasures for risk control and other aspects are not perfect enough. Due to the careful consideration of financial risk supervision by the regulatory authorities, the margin trading and short selling pilot has to be temporarily postponed under the influence of the financial crisis.

（3）Pilot phase

With the easing of the financial crisis, China began to try again to promote the pilot work of margin trading and short selling. After preparatory work, on March 16, 2010, six securities companies, CITIC, Guotai Junan, Guoxin, Everbright, Haitong and Guangfa, obtained the first batch of pilot qualifications for this mechanism. Starting from March 31, margin trading and short selling of securities companies began to be officially declared, which marked the start of this mechanism in China. With the development of the pilot project, According to the market situation to carry out the operation and management of securities companies, Net capital assessment and risk control assessment, The CSRC has gradually approved more and more qualified securities companies. Expanding the scope of the pilot and lowering the entry threshold, more and more opportunities poured into the market, which increased the enthusiasm of securities firms. By the end of 2010, 25 securities companies had started margin trading and short selling business. (LLC, 2019)

（4）Normative developments

With the continuous development of margin trading and short selling business, starting from 2011, the China Securities Regulatory Commission （CSRC） has revised and improved the previous regulations and rules in combination with the market situation and the problems existing in the pilot. The margin trading and short selling business has changed from the pilot to the routine. On October 19, 2011, China's first securities and finance company was officially approved. From 2013 to 2015, China has continuously encouraged and supported the development of margin trading and short selling, and the scale is constantly expanding. Due to the serious stock market crash in China, in July 2015, the CSRC had to make strict regulations on margin trading, specifying the daily average securities assets of not less than 500,000 yuan in the last 20 trading days as the conditions for opening credit accounts and increasing the margin ratio for margin trading to 100%, which is conducive to reducing the leverage of margin trading. From 2016 to June 2019, China learned the lessons of the stock market crash. In order to prevent excessive financial leverage, the supervision of China's margin trading and short selling

business is still tightened. In August 2019, China Securities Regulatory Commission relaxed the restrictions on margin trading and revised the Detailed Rules, abolishing the minimum guarantee and approving some capital as collateral, thus enhancing the flexibility of margin trading. China will constantly adjust the margin trading and short selling business in a timely manner according to the changes in the market, and continuously standardize and improve the development of the financial market. (Ye, 2020)

4.2 The Current Situation of Margin Trading in China

(1) Current Situation of Changes in Balance of Margin Financing and Short Selling
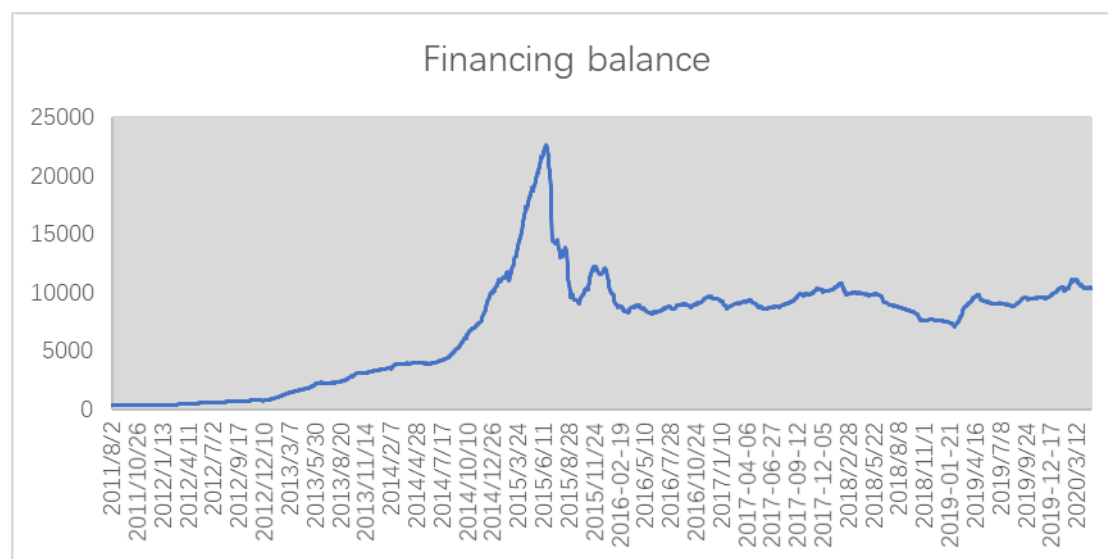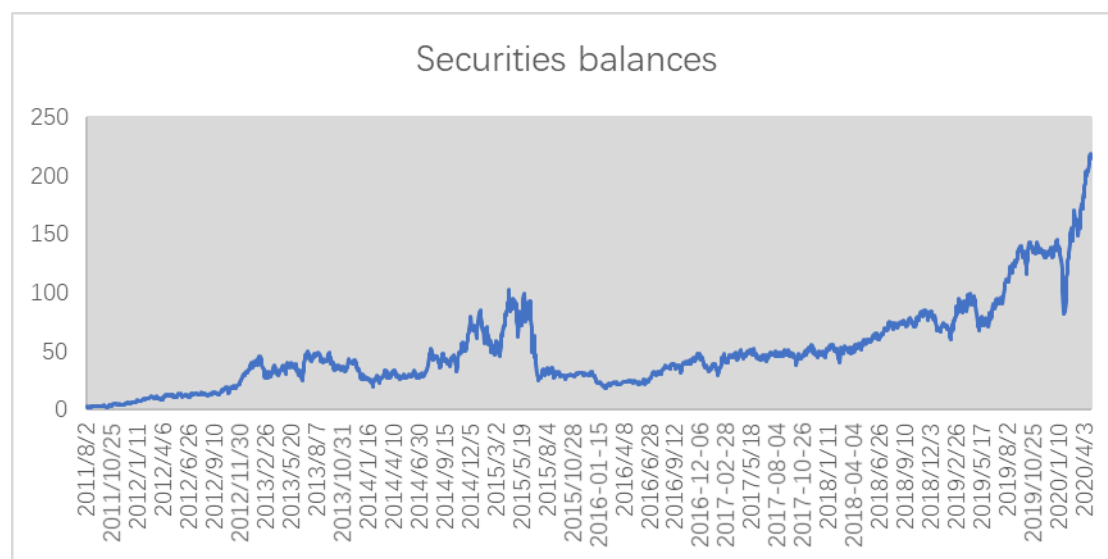

Figure 2

Figure 3

As shown in Figures 2 and 3, from the launch of margin trading and short selling in China in 2010 to March 2020, the overall trading scale showed a fluctuating upward trend. When margin trading and short selling were first implemented, the balance was about 35 billion yuan. From 2013 to 2015, China continuously encouraged and supported the development of margin trading and short selling. The number of securities expanded to 900. As can be seen from Figure 2, the margin trading balance rose sharply from 2014 to 2015, reaching its peak in mid-2015, with the balance increasing by about 22 times. A serious stock market crash broke out in China in June 2015. As stock index futures encouraged naked short selling and reduced margin when they were launched, some immoral investors and securities firms seized this loophole to make profits from malicious short selling, which increased the sharp rise and fall of A-share market. In just four weeks, the Shanghai Composite Index has fallen 1,800 points, or nearly 35%, and all walks of life have suffered heavy losses. From July to December 2015, the year-on-year growth rate of margin trading and short selling balance dropped sharply from 200.8% to 14.5%. From 2016 to 2019, the balance of margin trading and short selling tended to stabilize. In December 2016, the number of margin trading and short selling targets was expanded to 950. However, the balance still decreased by 20.0%. Until June 2019, in order to prevent excessive financial leverage, the supervision of margin trading and short selling in China was still tightened, and the balance during this period was basically the same. At the end of 2019, the number of stocks subject to margin trading and short selling expanded to 1600, and the balance of margin trading and short selling increased by 34.9%. From 2019 to 2020, the balance of short selling showed an upward trend, which may be due to China's relaxation of restrictions on short selling.

In general, China has expanded margin trading and short selling four times in the past nine years. The establishment of refinancing mechanism in 2012 has enriched the trading channels in China's financial market and provided sufficient funds for the market. The scale of this mechanism has gradually increased. In May 2014, a bull market broke out in China's stock market, and more and more investors joined in margin trading, thus further expanding the scale of margin trading. In June 2015, the bull market turned into a bear market, the stock price fell rapidly and the stock market suffered heavy losses. In February 2016, China adopted strict restrictions and appropriate expansion methods to carry out margin trading and short selling, trying to maintain the balance leverage, effectively increasing market activity. In addition, the change range of financing balance is between (0，250 billion) yuan, the change range of short selling balance is about (0，250 million) yuan. This shows that the growth rate of margin

trading is much higher than that of short selling. This is because the operation of margin trading is easier than short selling and the requirements of margin trading are less limited than short selling. In order to reduce the leverage of margin trading, the margin of margin trading is increased to 100%, and the increase of transaction cost inhibits the enthusiasm of investors. (Wan, 2020)

(2) Current Situation of Refinancing Business

In the process of margin trading, securities firms can provide their own funds and securities to customers, and can also provide funds to customers through refinancing business. Refinancing business refers to that in the process of margin trading, securities firms borrow funds or securities from relevant financial institutions to provide them to investors for use, and refinancing companies earn the difference.
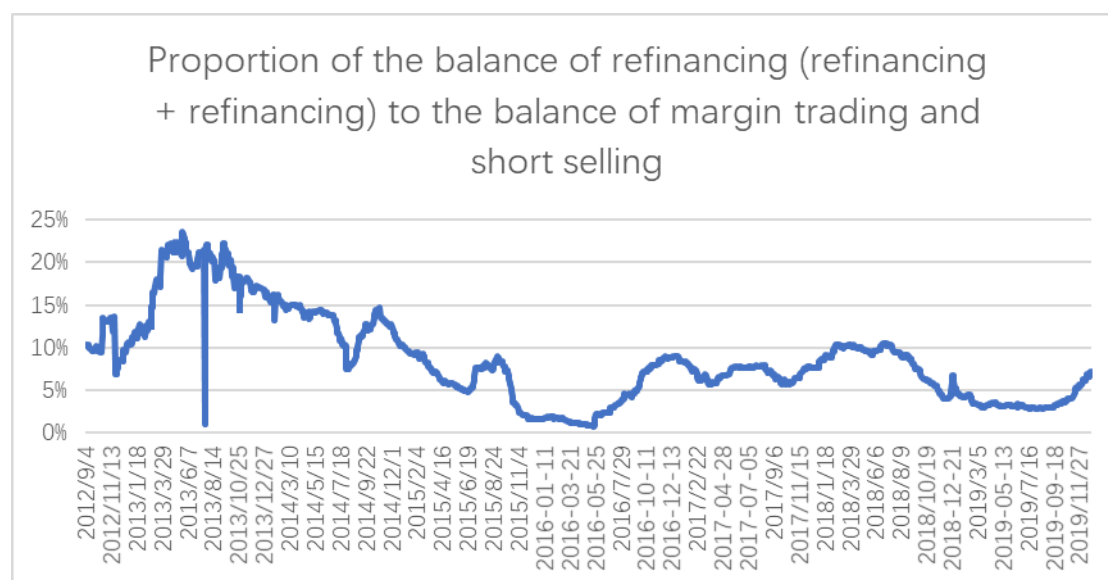
Figure 4

As shown in Figure 4, judging from the change trend, after the refinancing business was launched in 2012, the refinancing balance accounted for only 9% of the margin trading balance, and the overall refinancing market was relatively small. Beginning in November 2012, The proportion of refinancing business in margin trading and short selling is gradually increasing, By May 2013, due to the rapid growth of loans, insufficient liquidity in the banking industry and the shortage of funds in the market, some financial institutions in China had to refinance funds to securities finance companies for margin trading. Therefore, the proportion of refinancing balance in margin trading reached its peak, accounting for about 23%. However, the

proportion of refinancing balance to margin trading and short selling balance began to face fluctuating decline, which lasted until May 2016, when refinancing business dropped to only 1%. From June 2016 to the end of 2019, in order to promote the development of refinancing business in China, the Securities and Futures Company added 43 securities firms to join refinancing. The proportion of refinancing funds in the balance of margin trading and short selling also gradually increased, and the proportion of refinancing balance in the balance of margin trading and short selling basically remained between 5% and 10%. Judging from the development of the above situation, the development of refinancing business is limited, because most securities firms prefer to use their own funds and securities to carry out margin trading and short selling, and only about 10% of the funds come from securities finance companies. Unless facing the situation of tight funds or narrow financing channels, securities companies will consider refinancing from securities finance companies. (Fortune, 2019)

Time limit(day)	Refinancing rate	Transfer securities into the rate	Margin transfer rate
3		1.50%	4%
7	6.20%	1.60%	3.90%
14	6.30%	1.70%	3.80%
28	6.40%	1.80%	3.70%
182	5.80%	2%	3.50%
average	6.18%	1.78%	3.73%

Figure 5

Figure 5 shows the rates of refinancing and short selling respectively. As can be seen from the figure, the average rate of refinancing is 6.18%, which is significantly higher than the average integration rate of 1.78% and the average financing rate of 3.73%. Securities dealers rely more on refinancing than on refinancing. Although China slightly lowered the 182-day financing transfer rate to attract securities firms to borrow funds and securities from financial securities companies, the cost of refinancing is still relatively high for securities firms, and most securities companies are more inclined to solve the shortage of funds through self-financing. According to the data released by securities finance companies on cngold.org website in 2014, the financing interest rate of securities firms is about 8.6%, which may be slightly lower than this value in actual business. If securities firms consider borrowing funds from securities finance companies in margin trading, Then the cost of providing funds by securities finance companies will be about 1% higher than the cost of their own funds. Securities firms get less income through refinancing than through margin trading with their own funds, and at present Chinese securities

firms can raise their own funds through other cheaper ways, so refinancing business is developing slowly in China.

4.3 Problems Existing in Margin Trading

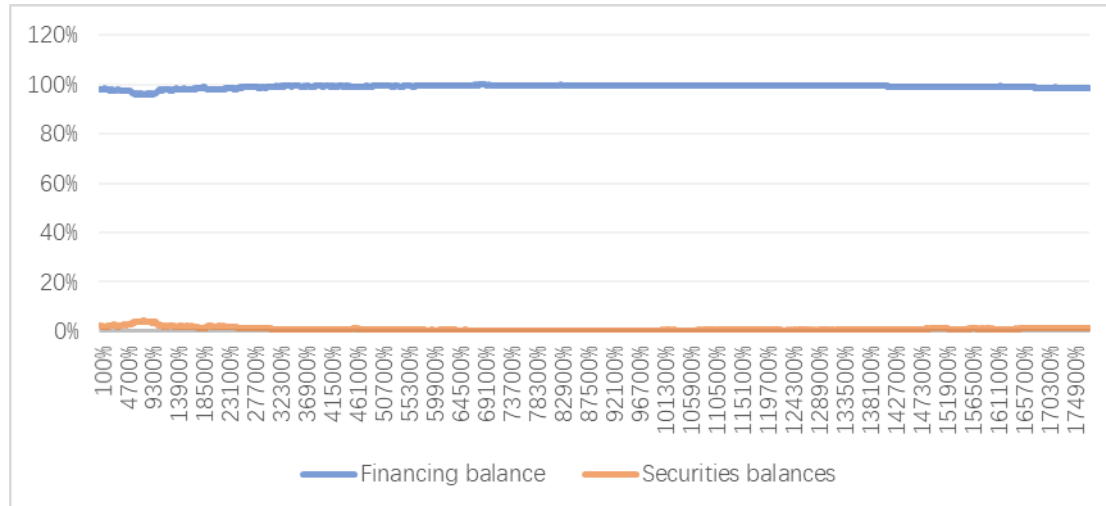(1) Unbalanced development of margin trading and short selling

Figure 6

Figure 6, the proportion of margin trading balance in China has remained stable at 98%, while the proportion of short selling balance has remained at 2%. The development of margin trading and short selling in China is unbalanced, and the scale ratio of the two is seriously out of balance. Compared with countries with developed financial markets, such as the United States, the proportion of short selling balance in the United States is between 20% and 30%, and there is a huge gap between China and the United States. The reasons are as follows: First, China has always been developing unilateral markets. As China's stock market has been depressed in recent years, Chinese regulators worry that the bilateral market will lead to a sharp drop in stock prices. Market risks cannot be regulated and controlled in a timely manner. (Hendershott, 2020)Thus causing huge economic losses, Therefore, Chinese regulators have not vigorously promoted the development of bilateral markets. But to rely on the government to regulate the development of the market, this disturbs the order of the market, hinders the liquidity of the market, and leads to a large gap between margin trading and short selling. Secondly, for most Chinese shareholders who do not have relevant expertise. At the same time, the stock market has been at a low level for a long time, leaving little room for investors to short. Second, short selling is in short supply in China. When the stock price falls, many investors need short selling. However, shareholders of listed companies worry that after lending shares, the oversupply of

shares will lead to a drop in the stock price, and the income that can be earned from short selling in the future is far greater than that brought by short selling. Therefore, many shareholders of A-share listed companies will not consider making money through short selling even if they have capital needs. At most, they will pledge their shares. Third, when investors need short selling, Securities companies can only find the source of short selling through their own funds and refinancing. Neither securities companies nor financial securities companies can store short selling. Therefore, when investors need short selling, securities firms can only temporarily find the source of short selling, which leads to the problems of low efficiency and long cycle of short selling. When securities firms find the source of short selling, investors may have missed the best investment opportunity. Fourth, at present, most of the underlying stocks of margin trading and short selling in China are large blue chips. The stock price valuation is lower than the market value and the cost performance is not high, which makes it difficult to attract investors to invest. Generally speaking, there is a huge gap between margin trading and short selling in China. Such unbalanced development tends to make the overall stock price high and the short selling function plays a weak role in the market.

(2) The transaction cost is relatively high

In margin trading, securities firms can choose their own funds or refinancing funds for trading. If securities companies choose refinancing to obtain funds and securities, then the financing rate of refinancing is higher than the loan interest rate of the central bank. Although the short selling rate is lower than the financing rate, it is difficult for securities finance companies to find suitable securities in time, and it is difficult for securities firms to benefit from the smaller short selling space. For investors, when conducting margin trading, they need to pay margin, annual interest on margin trading, stamp duty and trading commission. First of all, for the payment of margin, when investors buy securities through margin trading, the margin ratio shall not be less than 100%, and when short selling, the margin ratio shall not be less than 50%. The conditions of margin limit the enthusiasm of some investors. Some investors are unable to provide enough margin and the number of people who can carry out margin trading is limited. If customers cannot return margin trading or margin trading within the specified time, then the margin will be owned by the securities company, which also increases the potential risks and transaction costs. Second, securities companies levy 8.6% of the annual interest on margin trading and 10% of the annual interest on short selling, with the cost of short selling ranging from 6% to 7%. Compared with other developed countries, the annual interest rate for margin trading and short

selling in the United States and Japan remains below 2%. In contrast, China's annual interest rate is very heavy, which has caused huge cost pressure to investors. Third, in addition to the annual interest on margin trading and short selling, customers also need to pay credit commission fees. Different securities companies need to pay different commission fees. The average commission in China is 0.2% of the transaction amount. Compared with the transaction fee in the United States, regardless of the transaction amount, only US $10 is required. Compared with other countries, the handling fee for margin trading and short selling in China is relatively high, which also reduces the profit margin for some investors who want to earn accumulated income from price difference through speculation. For those investors who wish to invest a large amount of money in margin trading and short selling, for example, the final transaction amount of investors is 100 million yuan, and they need to pay a commission fee of at least 200,000 yuan. The high handling fee not only attacks the enthusiasm of investors, but also leads some investors to engage in illegal speculation through some regulatory loopholes to seek more profits. (Zhang, 2005)

(3) Investors lack professional knowledge

In margin trading, most of them are individual investors. Although institutional professional investors are increasing year by year, they only account for 3%. On the one hand, for most individual investors, they are accustomed to making more profitable investment operations in the past and lack professional knowledge and judgment on short selling. When some individual investors are uncertain about their market environment, their decisions and judgments are easily interfered by other traders, forming the behavior of following others in trading. This is what behavioral finance calls "herd effect". There are a large number of individual investors in the market. They cannot rely on a large amount of information by themselves. Some people can only follow others to buy. Such transactions will cause great fluctuations in the stock market in a short period of time, which is not conducive to the stable development of the financial market. On the other hand, for investors in professional institutions, Professional investors are more suitable for margin trading, because most professional investors have sufficient funds to carry out large-scale margin trading. In addition, professional investors have a better understanding of the analysis of individual stock information fundamentals and risk prediction ability in the margin trading market than individual investors. As China's financial markets are held back by the government, Professional institutional investors also need to conduct short selling and short selling under the restrictions of the Chinese government. Moreover, in order to obtain more

profits, securities companies often only rely on their own funds and securities for margin trading, and rarely conduct large-scale margin trading through refinancing funds. Therefore, the scale of margin trading is limited, the total category of securities is single, and professional investors cannot conduct large-scale margin trading.

(4) The refinancing mechanism is not perfect enough

China officially launched refinancing business in August 2012, but according to the previous analysis of the current situation, securities companies only account for about 10% of the refinancing business in the process of margin trading and short selling, and the small proportion of refinancing business limits the scale development. In the refinancing business, there are the following problems: First, the term of refinancing is not flexible enough. There are fixed terms for refinancing and short selling respectively, with the minimum term being 3 days and the maximum term being only 128 days. These fixed terms greatly limit the willingness of securities dealers to borrow funds or securities from financial securities companies. If the securities firm only wants to borrow a 5-day short-term fund, but according to the refinancing business regulations, the securities firm has to sign a fixed term of 7-day contract, and still needs to pay the refinancing rate within the prescribed period, which increases the cost of the securities firm. In addition, most investors tend to short for a short period of time, most short selling transactions sell the borrowed securities on the same day and return the securities to the securities dealers on the same day, which can effectively avoid the delivery of interest and increase the profit margin. From this, it can be seen that the fixed term setting in refinancing business is not flexible enough to meet the demand of short selling in the market. Second, the rate of refinancing business is on the high side, The rate for refinancing is 6.18% and that for short selling is 3.73%, While the refinancing rate in developed countries is between 0.2% and 0.4%, Higher rates are difficult to attract securities firms to participate in refinancing business, Securities firms are more willing to conduct short-term transactions through their own funds and securities and earn income by earning interest. If China does not lower the refinancing rate, in the long run, this will limit the further expansion of margin trading and short selling. Most investors are only willing to earn short-term interest spread. (Sergiy, 2020)

Chapter 5 An Empirical Analysis of Margin Trading on Volatility of China's A-share Market

5.1 Data selection

March 31, 2010 is the official launch time of China's margin trading and short selling business. The sample data selected in this paper are the daily amplitude and daily turnover of the Shanghai and Shenzhen 300 Index for a total of 6 years from May 21, 2010 to December 30, 2015, and the overall margin buying and short selling amount of the margin trading and short selling sector. The data are all from historical trading information published by Dongfang Fortune.

Judging from the current situation of A-share market, the compilation method of Shanghai and Shenzhen 300 Index is better than that of Shanghai Securities Index and Shenzhen Securities Index. The Shanghai and Shenzhen 300 Index has a high market value coverage rate and a high correlation with existing market indexes. The sample stocks are concentrated in a large number of high-quality stocks in the market. In addition, the Shanghai and Shenzhen 300 Index can show the overall trend of A-share stocks, because it includes many stocks with strong liquidity, large scale, active trading and strong sensitivity. Therefore, the selection of Shanghai and Shenzhen 300 Index can better measure the volatility and liquidity. Similarly, the overall margin trading and short selling sector can more representative reflect the overall impact of margin trading on the volatility of A-share market.

5.2 Indicator selection

(1) Calculation of Stock Return Rate

In order to reduce the fluctuation of data, the index of stock market return rate is processed by the logarithm of the daily closing price of Shanghai and Shenzhen 300 index.

Return i, t=ln (Pt)-ln (Pt-1)

Return i, t is the logarithmic return rate of the i-th stock in the t-th period, and P t and P t-1 are the closing prices of the i-th stock in the t-th period and the t-1 period respectively.

(2) Calculation and Description of Volatility

The daily amplitude of Shanghai and Shenzhen 300 Index is used to represent the volatility of the market. The intraday amplitude is the ratio of the difference between the highest price and the lowest price on the same day and the median value of the highest price and the lowest price on the same day. The formula is:

Vol= (Ph-Pl)/(Ph + Pl)/2) * 100%

Vol is the volatility of the market, Ph is the daily highest price of the Shanghai and Shenzhen 300 index, and PL is the daily lowest price. Source: Dongfang Fortune Network.

(3) Liquidity

Generally, the turnover rate of stocks is used to measure the liquidity of the stock market. The turnover rate of stocks = turnover/total number of shares issued * 100%. Since the Shanghai and Shenzhen 300 Index consists of tradable shares, tradable shares refer to shares that have been issued and held by shareholders. Therefore, there is no need to consider the total number of shares issued, and the liquidity of the market can be directly determined by the daily turnover and recorded as L.

(4) In addition, margin trading represents variables. This article will also select the daily margin purchase amount (RZ) representing the short-selling transaction and the daily short-selling amount (RQ) representing the short-selling transaction. The data were collected and sorted out from Dongfang Fortune Network. ·

(5) Because the values of each data are very large, in order to reduce the fluctuation of the data, logarithmic processing is carried out on the following data to facilitate subsequent modeling.

RZ=ln (RZ)

RQ=ln (RQ)

L=ln (L)

(6) Model Selection

In this paper, VAR model and GARCH (1, 1) model are mainly used for modeling research and analysis. Since VAR model is a "vector" autoregressive model composed of univariate AR model and multivariate. Therefore, this paper will study the impact of margin purchases and short selling on market volatility and liquidity. VAR model can better help to study the impact, positive and negative and causal relationships among these four variables. The GARCH (1, 1) model is adopted mainly because the variance of the error term in GARCH (1, 1) is composed of a constant term, the change of the previous moment (ARCH term) and the variance of the previous moment (GARCH term). This paper will use the change rate of margin purchases, the change rate of short selling and the market volatility to construct GARCH (1, 1) model to study the influence of the change rate of margin selling on the market volatility.

(7) All the modeling processes are completed in Eviews 10.

2. Empirical analysis

5.3 VAR model
5.3.1 Descriptive tests

	RZ	RQ	L	VOL
Mean	3.32E+11	4.45E+09	22.8582	0.017289
Median	9.78E+10	2.03E+09	22.78242	0.014144
Maximum	2.29E+12	2.58E+10	24.9522	0.108284
Minimum	6.23E+08	409900	21.50722	0.003489
Std. Dev.	5.36E+11	6.00E+09	0.633995	0.011608
Skewness	1.971497	1.792022	0.765343	2.707211
Kurtosis	6.014883	5.521043	3.563723	14.49114
Jarque-Bera	1399.16	1090.459	242.4638	14704.14
Probability	0	0	0	0
Sum	4.53E+14	6.07E+12	49990.88	37.81121
Sum Sq. Dev.	3.91E+26	4.90E+22	878.6622	0.294574
Observations	1363	1363	2187	2187

Figure 7

Figure 8
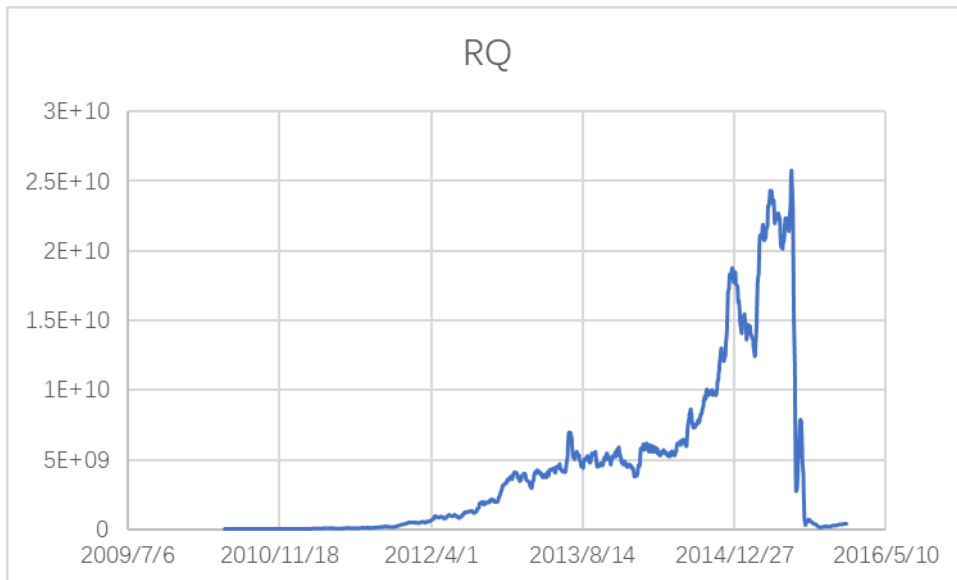
Figure 9

As shown in the figure 7, from the statistical characteristics, the average of the four variables is greater than the median, indicating that the test results show a right-biased distribution. In addition, the kurtosis of the four variables is greater than 3 and the skewness is greater than 0, which indicates that the data have obvious characteristics of sharp peaks and thick tails. Finally, the adjoint probability of J-B statistics is 0, so the original assumption can be rejected, and all four variables do not obey normal distribution. From the data of four variables during the period from May 21, 2010 to December 31, 2015, the maximum value of market volatility index exceeds the minimum value by about ten times, which shows that China's stock market

fluctuates violently. The standard deviation of short selling volume is 6 times larger than that of margin buying volume. It can be preliminarily judged that short selling volume is more stable than short selling volume. This shows that short selling volume and short selling volume are unequal. Margin selling and short selling volume may have different impacts on market volatility, especially short selling volume may also be affected by other factors. Judging from the time trend, in the early days when China just introduced margin trading and short selling, short buying and short selling both increased from March 2010 to 2013, but the change was not significant. Starting from 2015, margin trading and short selling suddenly rose sharply. The amount of margin buying and short selling rose to the maximum values of 2.29 E+12 and 2.58 E+10 respectively in June 2015, and then began to decline. This directly reflects the strong volatility and significant leverage trend of short buying and short selling. To sum up, it can be found that the changes and fluctuations of margin trading and short selling will obviously fluctuate in 2015, which is related to the rapid expansion of margin trading and short selling. Next, we will analyze the impact of short selling on market volatility through the construction of the model.

5.3.2 Unit root test

		ADF	1% critical value	(c,t,k)	conclusion
original	RZ	-3.759775	0.0189	(c,0,21)	Accept the null hypothesis that the sequence is unstable
	RQ	-2.034262	0.5814	(c,0,13)	Accept the null hypothesis that the sequence is unstable
	VOL	-7.691518	0.0000	(c,0,4)	Reject the null hypothesis and the sequence is stationary
	L	-4.216231	0.0043	(c,0,3)	Reject the null hypothesis and the sequence is stationary
differential	RZ	-8.199679	0.0000		Reject the null hypothesis and the sequence is stationary
	RQ	-7.131652	0.0000		Reject the null hypothesis and the sequence is stationary
	VOL	-22.68006	0.0000		Reject the null hypothesis and the sequence is stationary
	L	-24.58051	0.0000		Reject the null hypothesis and the sequence is stationary

Figure 10

Firstly, the intercept term and trend are selected, and the optimal lag order is determined by comparing AIC, SC and HQC. The results show that the ADF values of VOL and L are both less than the critical value of 1% and Durbin-Watson stat is close to 2, which indicates that the original data sequence is stationary. However, the ADF values of RZ and RQ show that they are non-stationary sequences at the level of 1% of the critical value, so the four variables need to be further differentiated. After the first-order difference, RZ, RQ, VOL and L are all stationary, all less than 1% of the critical value, and the four variables are first-order single-integer sequences.

5.3.3 Cointegration test

There are two ways of cointegration test, one is ENGLE GRANGER, the other is JOHANSEN test. However, the results of ENGLE GRANGER will be biased when the samples are limited. Since the selected data is limited to a total of 1400 data from 2010 to 2015 and the sample is limited, JOHANSEN test is selected. On the basis of JOHANSEN test based on VAR, this paper conducts cointegration test on the relationship among VOL, RZ, RQ and L variables to determine whether short selling mechanism has a long-term stable relationship with market volatility and liquidity. Firstly, the optimal lag order is determined by VAR, P=3.

The test results show that there is at least one cointegration relationship between Trace statistical and Max-Eigen statistical at the critical level of 5%. Therefore, VOL and RZ and RQ or L and RZ and RQ have a cointegration relationship, which shows that there is a long-term stable variable relationship between these two groups of variable groups, that is, short selling mechanism has a long-term stable relationship with market volatility and liquidity. Due to the cointegration relationship, the following tests can be processed with the original data.

5.3.4 Granger causality test

Granger causality test is to see if the information after the explanatory variable has the ability to predict the explained variable. This is a multivariable case, so the equations are as follows:

$$y_t = \sum_{i-1}^{q} \alpha_i x_{t-i} + \sum_{j-1}^{q} \beta_j y_{t-j} + u_{1t}$$

$$x_t = \sum_{i-1}^{s} \lambda_i x_{t-i} + \sum_{j-1}^{s} \delta_j y_{t-j} + u_{2t}$$

 By establishing the above-mentioned self-vector regression VAR model, it tests whether there is causal relationship between VOL and RZ, VOL and RQ, L and RZ and L and RQ, and further proves whether the empirical conclusion is credible by using GRANGER test. Before establishing the model, it is necessary to determine the hysteresis order, and determine P=3 by verifying AIC and SC.

Null Hypothesis:	Obs	F-Statistic	Prob.
RZ does not Granger Cause VOL	1360	15.9966	3.E-10
VOL does not Granger Cause RZ		2.40567	0.0658
RQ does not Granger Cause VOL	1360	0.13462	0.9394
VOL does not Granger Cause RQ		1.09047	0.3520
RQ does not Granger Cause L	1360	0.17071	0.9162
L does not Granger Cause RQ		0.72613	0.5364
RZ does not Granger Cause L	1360	7.42471	6.E-05
L does not Granger Cause RZ		0.32859	0.8047

Figure 11

From the above table 11, the following conclusions can be drawn:

(1) The amount of financing purchases is the reason for the change of market volatility, but the change of market volatility will not affect the amount of financing purchases. Market volatility and the amount of financing purchases constitute one-way reasons.

(2) There is no causal relationship between the amount of short selling and volatility, and the volatility of the market will not affect the amount of short selling.

(3) The amount of financing purchases is the cause of liquidity, but the size of market liquidity is not the cause of the amount of financing purchases.

(4) The causal relationship between short selling volume and liquidity is not obvious.

Generally speaking, first of all, there is no obvious causal relationship between the selling volume of short selling and the volatility and liquidity of the market, and the P value is greater than the critical value of 0.05, the original assumption should be accepted. Second, the volatility of the market will cause changes in short buying and short selling, However, the amount of short selling has no special impact on the volatility of the market. Even if the amount of short selling suddenly increases or decreases, it will not cause a significant change in the volatility of the market, or the increase in short selling is not the only reason for the increase in the volatility of the A-share market. Third, margin trading will affect market liquidity, but the amount of

short selling has no effect on market liquidity.

5.3.5 Impulse response function

The impulse response function can comprehensively reflect the dynamic relationship between various variables. Next, the stability of variables and the optimal lag order are determined in VAR model, where the optimal lag order is 3. AR root test is carried out on this model. As can be seen from the figure, all values fall within the circle, which indicates that VAR model is stable and impulse response function and variance analysis can be established. Then the impulse response analysis of VOL to RZ and RQ and L to RZ and RQ is made respectively to intuitively describe the dynamic response of margin trading and short selling to market volatility and liquidity, as shown in the following figure 12:
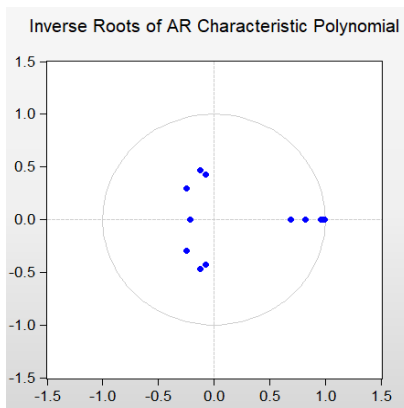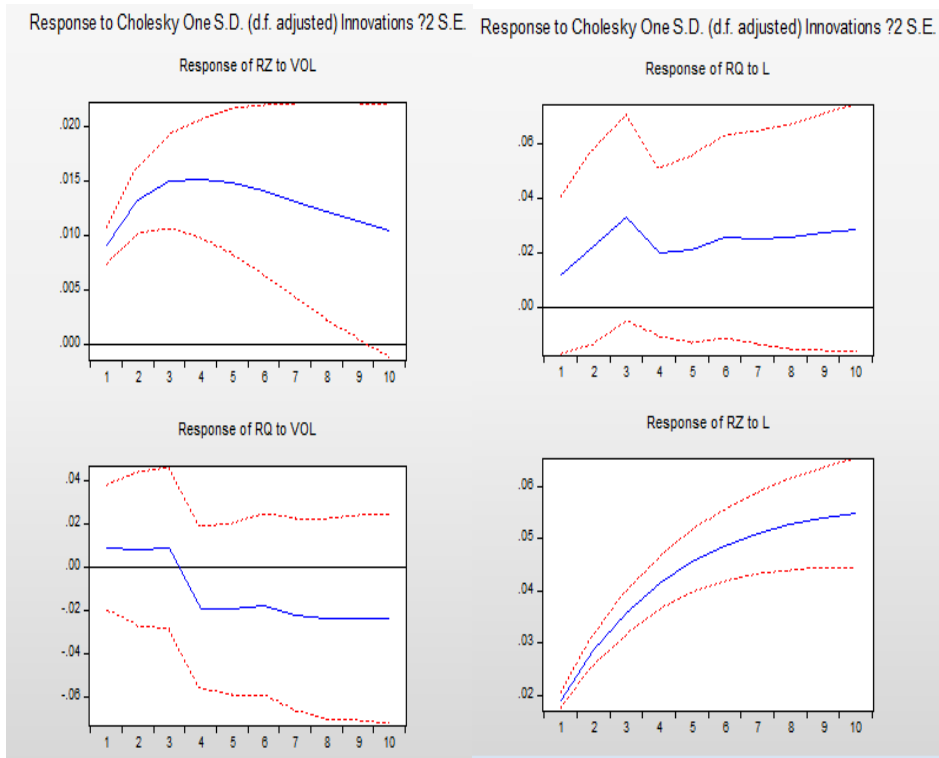

Figure 12

Figure 13

Under the impulse response analysis, it can be seen that:

(1) For market volatility, when RZ increases the standard error of one unit on the first day, VOL will rise sharply, reach the highest value on the third day, and then decline slowly from the fourth day to the tenth day. Buy short trading has a positive impact on market volatility. For RQ, the unit standard error of short selling remained basically stable from the first day to the third day, but on the 3.5 day, the impact direction of short selling changed from positive to negative, and the impact became smaller and smaller.

(2) For market liquidity, when RZ increases by one unit standard error, L will increase, sharply from the first day to the fifth day, and slowly increase from the sixth day to the tenth day. However, if RQ increases by one unit of standard error, L will increase, reach the peak on the third day, then slowly decline from the third day, and the change from the fifth day to the tenth day shows a slow upward trend. As can be seen from the figure, the impact of short selling on market liquidity is more obvious than that of short selling. Margin trading will have a long-term positive impact on market liquidity.

(3) To sum up, the impact of short selling on the liquidity and volatility of the market is stronger than that of short selling. Short buying and short selling have long-term stable effects

on the liquidity and volatility of the market, but short selling has relatively small effects on the market.

5.3.6 Analysis of variance

Variance decomposition can decompose the variance of one variable into each disturbance term in the VAR model system. The prediction variance of a variable may be caused by itself or by other variables in the system.

	VOL with RZ and RQ			
Period	S.E.	VOL	RZ	RQ
1	0.009753	100.0000	0.000000	0.000000
2	0.010442	97.81583	2.169695	0.014477
3	0.010812	97.55970	2.407029	0.033273
4	0.011314	97.34412	2.623518	0.032365
5	0.011571	96.98639	2.982667	0.030948
6	0.011738	96.77295	3.196755	0.030295
7	0.011869	96.61990	3.350405	0.029690
8	0.011957	96.49794	3.471824	0.030239
9	0.012018	96.41644	3.552158	0.031407
10	0.012062	96.36233	3.604225	0.033448

	L with RZ and RQ			
Period	S.E.	L	RQ	RZ
1	0.214600	100.0000	0.000000	0.000000
2	0.255432	99.98007	0.005483	0.014445
3	0.282215	99.69488	0.048815	0.256310
4	0.308306	99.44288	0.064102	0.493017
5	0.329396	99.18270	0.075924	0.741380
6	0.347266	98.91081	0.099505	0.989681
7	0.363045	98.65945	0.125508	1.215045
8	0.377015	98.43521	0.152683	1.412108
9	0.389498	98.23603	0.183939	1.580033
10	0.400758	98.06183	0.218769	1.719402

Figure 14

(1) From the variance analysis results of VOL, RZ and RQ, it can be seen that the variance contribution rate of short selling and short selling to market volatility and liquidity both show a slow upward trend with the change of cycle, but the variance contribution rate is relatively small. Comparing the variance contribution rate of margin trading and short selling, we can find that the variance contribution rate of short selling is significantly higher than that of short selling. Comparatively speaking, short selling has a stronger impact on market volatility than short selling. This shows that short selling mechanism is only one of the reasons that affect

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market volatility and liquidity, and market volatility and liquidity are also affected by other factors.

(2) According to the data of 6 years from 2010 to 2015, China's short selling is far more active than short selling. Although China started to launch a short selling mechanism in 2010, it is obvious that the short selling mechanism has little impact on the volatility and liquidity of the market, and short selling has been at a relatively weak stage.

5.4 GARCH model

From the above conclusions, we can see that margin trading has certain influence on market volatility and liquidity, but the relationship between margin trading and market volatility is not obvious. Next, ARCH model and GARCH model are used for further testing. By selecting the amplitude of the Shanghai and Shenzhen 300 Index from 2008 to 2015 as the market volatility, the amount of margin purchases and short selling from 2010 to 2015 are also selected.

Next, the change rate X1 of the independent variable margin purchase amount and X2 of the short selling amount will be determined. The dependent variable is the amplitude Y of the Shanghai and Shenzhen 300 index, that is, the volatility VOL.

$X1= (RZt-RZt-1)/RZt-1$

$X2= (RQt-RQt-1)/RQt-1$

$Y= (Ph-Pl) / ((Ph + Pl)/2) * 100\%$

5.4.1 Descriptive test

First of all, the volatility of csi 300 index from 2008 to 2015 is divided into two stages, namely, the launch of margin financing from 2008 to March 31, 2010 and the launch of margin financing from April 2010 to December 31, 2015.

	2007_2010_VOL	2010_2015 VOL
Mean	0.030164	0.019208
Median	0.026194	0.015645
Maximum	0.100393	0.108284
Minimum	0.006533	0.004364
Std. Dev.	0.016151	0.012404
Skewness	1.233337	2.713572
Kurtosis	4.658035	13.93429
Jarque-Bera	201.6996	9040.100
Probability	0	0.000000
Sum	16.52982	27.96670
Sum Sq. Dev.	0.142693	0.223874
Observations	548	1456

Figure 15

As can be seen from the figure, in the five years after the introduction of margin trading and short selling, the mean value and variance of volatility in the A-share market decreased compared with the previous four years, but the difference was not particularly significant. This result can be preliminarily judged that short selling mechanism does not increase the impact on market volatility after its introduction, but relevant models still need to be established to further confirm the impact of margin lending on market volatility.

5.4.2 ARCH effect

(1) Stationarity test

	ADF	1% critical value	(c,t,k)
VOL(Y)	-7.890151	0.0000	(c,0,4)
RZ (x1)	-8.201086	0.0000	(c,0,20)
RQ(x2)	-6.019762	0.0000	(c,0,12)

Figure 16

First of all, according to AIS and SC criteria, the most suitable unit root test method is selected. Then through the unit root test, it can be seen that the ADF values of volatility, the change rate of margin purchase amount and the change rate of short selling amount are all less than the critical value of 0.05. Therefore, the original assumption is rejected. The above three sequences are stationary sequences and there is no unit root.

(2) Autocorrelation test

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|**** |	|**** |	1	0.557	0.557	423.62	0.000
|**** |	|** |	2	0.485	0.253	744.77	0.000
|*** |	|* |	3	0.471	0.198	1047.8	0.000
|*** |	|* |	4	0.459	0.151	1336.3	0.000
|*** |	|* |	5	0.449	0.120	1612.0	0.000
|*** |	| |	6	0.406	0.042	1837.6	0.000
|*** |	| |	7	0.400	0.064	2057.4	0.000
|*** |	| |	8	0.383	0.039	2258.7	0.000
|*** |	| |	9	0.372	0.039	2449.1	0.000
|** |	| |	10	0.337	-0.008	2605.2	0.000

Figure 17

Heteroskedasticity Test: ARCH

F-statistic	181.2149	Prob. F(6,1349)	0.0000
Obs*R-squared	605.1680	Prob. Chi-Square(6)	0.0000

Figure 18

As can be seen from table 17, the statistical results show that this set of data has sixth-order autocorrelation. Next, the conditional heteroscedasticity test is carried out. Through the test results, it can be seen that the significance level corresponding to the statistics is less than 0.05, which indicates that the residual sequence has heteroscedasticity, so the sequence conforms to ARCH effect. Therefore, in the following model selection, GARCH model should be selected to study the impact of margin trading and short selling on market volatility.

(3) GARCH (q, p) model

According to AIC and SC principles, GARCH (1, 1), GARCH (1, 2), GARCH (2, 1) and GARCH (2, 2) are constructed first, and the fitting effects of the four methods are compared. Finally, GARCH (1, 1) has the best goodness of fit. After that, the statistical results of GARCH (1, 1) model show that the margin coefficient is less than the critical value of 0.01, but the margin coefficient is greater than the critical value of 0.01. Next, only GARCH (1, 1) regression analysis is carried out on the coefficient of financing purchase amount. The results are as follows:

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.015963	0.00028	57.05812	0
RZ_M	0.023168	0.004697	4.932147	0
Variance Equation				
C	2.76E-06	4.62E-07	5.965916	0
RESID(-1)^2	0.082421	0.006469	12.74142	0
GARCH(-1)	0.892731	0.006304	141.61	0

Figure 19

From the results of GARCH model：$\beta^2 = 2.76E\text{-}06 + 0.082421\mu^2 + 0.892731\ \beta^2$

The coefficient of financing obviously passed the threshold level test of 0.01. From the perspective of economic significance, when the daily financing purchases increased by 0.01, the Shanghai and Shenzhen 300 index rose 0.023. In addition, the coefficient of financing is positive, which indicates that the change of financing purchase amount will increase the market volatility, but the impact on the market volatility is very limited. At present, short selling has no obvious influence on the fluctuation of Shanghai and Shenzhen 300 Index.

5.5 Empirical results

This chapter mainly studies the influence of margin purchase amount and short selling amount on the volatility and liquidity of A-share market, as well as the influence of margin purchase amount change rate and short selling amount change rate on the volatility of A-share market. From these two parts, this paper discusses the relationship between the introduction of short selling mechanism and the volatility of A-share market. The first part of this chapter mainly starts from VAR model, and uses Granger, impulse response and variance decomposition to study the relationship between margin trading and market volatility and liquidity. The second part mainly uses GARCH (1, 1) model to study the symmetry of financial series, thus discussing the influence of short selling mechanism on volatility.

Through the above empirical analysis, the following conclusions can be drawn:

(1) The VAR model research and analysis in the first part. For financing, in Granger test, short buying will affect the volatility and liquidity of the market, with one-way causality. In the impulse response analysis, generally speaking, the impact of short-selling trading on market volatility and liquidity is stronger than that of short-selling market, and the impact of financing trading on market volatility and liquidity is positive. In the analysis of variance, the variance contribution rate of the buy-short trade representative shows an upward trend on the volatility

and liquidity of the market with the change of time.

For short selling, first, there is no Granger causality between short selling volume and market liquidity and volatility. Second, in the impulse response, short selling has a weak impact on market volatility and liquidity. As can be seen from the figure, short selling has a positive impact on market volatility in the early stage and weakens after negative impact in the later stage, while short selling has been in the stage of positive impact on market liquidity. Third, in the analysis of variance, whether it is the impact on market volatility or the impact on market liquidity, the variance contribution rate of short selling transactions increases slowly with the change of time, but the variance contribution rate is small and not as large as that of financing transactions. Generally speaking, since the implementation of margin trading, margin trading has a long-term and sustained impact on the volatility and liquidity of the market, but the main reason is that margin trading has obvious impact on the volatility and liquidity of the market, and margin trading is not very active. From March 31, 2010 to December 31, 2015, the relationship between the development of short selling business and changes in market volatility is not obvious. There are two reasons for this problem. The first is that short selling accounts for a relatively low proportion of the total turnover and total turnover in the A-share market, and the value of some constituent stocks is underestimated. Randomly select a day from the Shanghai and Shenzhen 300 Index. Take December 21, 2010 as an example, the total transaction amount is 112.462 billion yuan, while the corresponding financing purchase amount is 8.168 billion yuan, accounting for 7.26% of the total transaction amount. The Shanghai and Shenzhen 300 Index's total turnover was 7.985 billion shares, and the short selling volume was 10.5 million shares, accounting for 0.13% of the total turnover. It can be seen that both margin purchases and short selling account for a relatively low proportion of the total market. It can be seen from this that although margin trading and short selling have developed rapidly since its launch, this is only one of the factors that affect market volatility and liquidity, which are also affected by many factors. The second reason is that the structure of investors is unreasonable. Starting from March 31, 2010, most investors who open accounts for margin trading and short selling choose margin trading to buy securities, and few choose margin trading, because the A-share market has been affected by a single short selling mechanism for many years, and by analyzing the underlying securities of listed companies that can conduct margin trading and short selling in China, it can be found that almost all of them are large blue chips. Judging from the current valuation of A-share market, the valuation of large blue-chip stocks is lower than that of small and medium-sized stocks, so no investors dare to sell short selling. Similarly,

securities dealers will not lend low-valued large blue-chip stocks to investors. In addition, due to the short start-up time of margin trading and short selling, securities dealers lack securities that can be lent, which leads to the situation that investors cannot finance securities. In addition, in order to inhibit investors' investment behavior, the setting of short selling margin is higher than that of margin, which forms one of the reasons why the short selling market is not as active as the margin, that is, the short selling under VAR model has more obvious influence on market volatility and liquidity than the short selling.

(2) The second part mainly studies and analyzes the GARCH (1, 1) model. Margin trading will increase the volatility of the market, but its impact is limited, while short selling has no impact on the volatility of the market for the time being. The reason for this problem may be the limited number of margin trading and short selling targets. So far, the number of underlying securities is only 896, and many major shareholders are state-owned enterprises. Their willingness to lend securities is not strong, while major shareholders of ordinary listed companies are worried that short selling will lead to a drop in stock prices. Therefore, it is not seen in GARCH (1, 1) that the impact of short selling on market volatility is probably caused by the small number of short selling targets, resulting in the lack of universality of data and models.

Chapter 6 Conclusion Analysis and Suggestions

6.1 Research Conclusions

This paper uses VAR model and GARCH model to study the impact of margin trading on the volatility of A-share market from the launch of margin trading to the stock market crash in 2015. Through theoretical analysis and empirical analysis, the following conclusions can be drawn:

(1) In the five years after the launch of margin trading and short selling, margin trading still accounts for the main proportion, and the status has not been significantly improved. Even during the stock market crash in 2015, the development and prohibition of margin trading and short selling have no obvious impact on market volatility. This is because the number of short selling transactions is relatively small. Although the short selling system is developing rapidly, it has not significantly increased the volatility of the stock market. However, in the long run, with the increase in the number of short selling, short selling will play a positive role in the stability of the market.

(2) A large number of literature studies in China and developed countries show that the introduction of margin trading and short selling system can inhibit the volatility of the stock market to a certain extent, especially during the stock market crash, margin trading and short selling can help the falling stock prices gradually resume to rise and gradually stabilize the market. This paper also confirms through empirical research that the margin trading system does not aggravate the market volatility, and the reasons for increasing the market volatility are affected by many factors. As Kruas and Rubin found in the research, margin trading has little impact on the market under different constraints. Some scholars believe that margin trading and short selling will increase the volatility of the market in the short term, but in the long run, margin trading and short selling can help the market reduce financial leverage and market volatility. However, for the potential risks of margin trading and short selling, such as investors' blind purchase of stocks will lead to a sharp drop in stock prices in the market, if China cannot supervise and prevent them in time, it is easy to cause serious losses.

6.2 Recommendations

Next, according to the problems existing in margin trading and short selling, this paper will give the following suggestions to promote the long-term development of China's stock market.

(1) Perfect the system of margin trading and short selling

In the 10 years of the development of margin trading and short selling, China has expanded margin trading and short selling five times. However, at present, there are 3,622 stocks in Shanghai and Shenzhen stock markets, but only 1,066 stocks support this mechanism, accounting for only 29.43% of the total market. Compared with other developed capital markets, the overall share of available stocks is still very small. Therefore, in order to promote the further expansion of China's market, it is necessary to improve system. First, China's market regulators should adjust the thinking of short selling for profits, encourage bilateral market transactions, change the serious imbalance between margin trading and short selling, and guide investors to actively carry out margin trading within the scope prescribed by law. Second, while gradually increasing the number and scope, it is also necessary to improve the quality of the target of margin trading and short selling. Enrich the variety of securities, With the development of the market, The Chinese government should minimize its intervention in margin trading and short selling, With the maturity of market, Gradually adjust the monorail centralized credit system in the pilot phase to a double-track system or a decentralized credit system similar to that in the United States. Let the market compete freely within the scope of risk control, More stocks can participate in margin trading, and investors can also choose more different types of securities for margin trading, which can not only improve the enthusiasm of investors to participate in margin trading, reasonably expand the scale of margin trading, but also promote the long-term and stable development of the financial market. Third, Chinese regulators also need to constantly adjust the margin management system with the changes in the securities market, including margin system, information disclosure system, delisting system, investor protection system, etc. At present, some detailed rules and regulations in margin trading and short selling are not perfect enough. From the perspective of margin system, the margin does not stipulate the necessary cash ratio, and the minimum margin ratio stipulated by the stock exchange limits the maximum leverage for investors to sell short. If the exchange can adjust the margin ratio according to changes in market conditions, When the stock price is valued below the market price, The exchange can temporarily restrict large-scale margin trading in the market and reduce the financial leverage in the market by increasing the minimum margin ratio for margin trading and short selling and reducing the available funds in investors' accounts, so as to keep margin trading and short selling basically the same and avoid large-scale fluctuations in the market. When the stock price is higher than the market price, the margin ratio can be appropriately reduced to stimulate more investors to carry out margin trading. Judging from the information disclosure system, China has not made detailed regulations on the time and quality of

information disclosure, which will allow some insiders with relevant interests to use the information of listed companies they have to spread false short selling information, carry out immoral market manipulation, and make stock prices plummet to gain profits. Therefore, the participants in the process of margin trading include securities companies, Financial institutions, A listed company, Investors and other internal personnel shall make true disclosure of basic information such as the daily margin purchase amount and short selling amount within the scope specified in the time. Strict tracking, supervision and control should be carried out on some large short selling transactions and individual stock transactions with abnormal prices in the market. At the same time, relevant disclosure reports should be carried out. Only in this way can the interests of individual investors and some small and medium-sized enterprises be protected, fair competition in the market be ensured, and the long-term and sustainable development of the margin trading and short selling market be promoted. In addition, for those who carry out illegal transactions in the market, relevant legal responsibilities should be investigated, so as to effectively protect the interests of other investors and ensure the healthy development of the margin trading market. As for the delisting system, China should strictly select securities companies that can conduct margin trading and short selling, reduce the risk of a sharp drop in stock prices caused by delisting, and protect the interests of investors. Judging from the investor protection system, the current protection of investors in the capital market by Chinese laws is very fragile. The 2005 Securities Law stipulates that investors who have been infringed by interests need to find evidence of insider trading before they can impose civil penalties on insider trading and those who operate market behaviors. First of all, the information that individual investors and insiders can grasp is not equal, and it is difficult for investors to find evidence of insider trading for insiders of listed companies after their interests are infringed. Secondly, some courts now either do not file a lawsuit against shareholders' rights protection or reject it after filing a case. (Chague, 2020)Finally, the cost of safeguarding rights is relatively high for small and medium-sized investors, and most investors choose silence after their interests are infringed. Therefore, China needs to further adjust the investor protection system, reduce the cost of safeguarding rights and raise the cost of illegal activities, so as to reduce immoral margin trading and increase the investment enthusiasm of small and medium-sized enterprises. As there are still many defects in the supporting systems related to margin trading and short selling, China still needs to continuously improve the detailed rules and regulations with the changes in the market, strengthen the supervision of market transactions, improve the quality, and promote the sustained and stable development of margin trading and

short selling.

(2) Improving the structure of market investors

Judging from the proportion of investors in the margin trading and short selling market, the proportion of individual investors is far greater than that of institutional investors. However, due to the lack of relevant professional knowledge and analytical ability of most individual investors, some irrational investment behaviors will lead to obvious fluctuations in the margin trading and short selling market. In order to maintain the stable development of margin trading and short selling market, First, China should actively guide individual investors to conduct legal and compliant transactions. Individual investors are encouraged to learn basic financial theories and pay attention to relevant market news. At the same time, in this era of rapid information development, Individual investors should also learn some econometric modeling methods independently, such as VAR model, which can help individual investors to evaluate the business situation, compare competitors and identify existing risks in combination with historical data and the company's financial statement information, so as to select appropriate stocks for investment transactions. Second, investors should be helped to establish a good investment mentality. First, "herding" should be avoided. Investors should learn to remain rational. Secondly, individual investors should look for their own investment methods and portfolios, allocate their assets rationally, avoid putting all their funds into high-risk and high-return financial products, and learn to diversify their investments so as to maximize their benefits as much as possible. Finally, in the process of investment, individual investors should learn to stop losses in time to avoid lucky psychology, otherwise they may face huge losses. Third, China should expand the number of institutional investors, let more professional investors lead the development of the market, set an example of value investment for individual investors, and help individual investors understand the trading mechanism of short selling and short selling. Only by continuously expanding the proportion of professional investors can the long-term and stable development of the bilateral market be promoted and frequent sharp market fluctuations be avoided. Finally, China's regulators need to strictly supervise and manage the margin trading and short selling market, increase the transparency of market information, prohibit market manipulation and false information, and crack down on illegal acts in the market，which can protect the personal interests of investors and active the market.

(3) Improve refinancing business

In the margin market, the introduction of refinancing business is to enrich the channels for securities companies to borrow funds and securities. However, the rate of refinancing business is relatively high. Securities dealers often choose to give up refinancing and short selling in order to obtain more profit space. However, customers can only make margin trading and short selling when securities dealers have their own funds and securities, which leads to inactive margin trading and short selling market and weak liquidity. In addition, even if securities firms are willing to borrow funds and securities from financial securities companies, due to the lack of securities storage by financial securities companies, they have to temporarily look for securities from outside, which will lead investors to miss the best investment opportunity. Therefore, China's financial and securities companies should establish a securities storage system to collect and find securities from qualified listed companies on a daily basis to ensure sufficient supply of securities. Only in this way can the current situation of low proportion of short selling be improved and the scale of short selling be continuously expanded. In addition, under the condition of ensuring sufficient securities, a more flexible method is used to evaluate the rate corresponding to the term of refinancing. An appropriate reduction in the rate can encourage securities firms to refinance and short selling to financial and securities institutions, and then lend the borrowed funds and securities to investors to balance the development of margin trading and short selling.

(4) Establishing a risk prevention mechanism for margin trading and short selling

The stock market crash in 2015 dealt a severe blow to the Chinese market. In order to stabilize the market and reduce the volatility of the market, China imitated the measures adopted by European and American countries in the face of the financial crisis in 2008 and imposed temporary restrictions on short selling. However, restricting short selling can only help stock prices to resume rising in the short term, but in the long run, restricting short selling cannot change the situation that stock prices continue to fall. Therefore, in the face of the global financial crisis, China can use the method of banning short selling to help the stock market through short-term difficult times, especially to properly protect the stocks of some important financial modules. In order to avoid huge losses caused by the stock market crash, China should take risk prevention measures in advance. First of all, the CSRC needs to do a good job in the daily management of securities companies, listed companies, banks and other financial institutions of information disclosure, enhance the transparency of information, regularly or irregularly conduct spot checks on listed companies, and strictly carry out annual audit

inventory. At the same time, regulators need to strictly examine the qualifications of companies that can carry out margin trading and short selling. To carry out credit management rating on listed companies with margin trading and short selling qualifications, to stop the securities of companies with low credit rating from participating in margin trading in a timely manner, to refuse the companies with problems from entering the market from the root, to improve the quality of securities of listed companies, and to ensure the fair and just development of the market. Similarly, securities companies should evaluate the capital capacity of investors and try to avoid the risk of not collecting the lent funds and securities within the specified time. At the same time, securities companies also need to prepare certain funds to prevent the normal turnover of their own funds after customers default on credit. Finally, China still needs to continuously improve the laws and regulations on margin trading and short selling with the changes in the market, protect the relevant rights and interests of investors, and resolutely crack down on improper market operations and other acts. Only by doing a good job in the risk prevention mechanism of the margin trading and short selling market in advance and strictly supervising and managing the development of the market can we flexibly deal with risks when major risks occur, reduce the losses in the stock market and ensure the long-term and stable development of margin trading in China.

Reference

Allen.Franklin. (1991). Arbitrage, Short Sales, and Financial innovation.

Chague, F. (2020). Securities Lending and Short Selling. *Revista Brasileira de Gestão de Negócios*.

Deyong, Y. (2011). The impact of margin trading on the liquidity and volatility of the securities market based on the empirical research of the Shanghai security market. *2011 International Conference on Business Management and Electronic Information Business Management and Electronic Information*.

Fortune, P. (2019). Margin Lending and Stock Market Volatility. *New England Economic Review*.

Garbaravicius, T. (2018). Short selling in Extrem Events. Journal of Financial Stability. *Journal of Financial Stability*, pp. 74-63.

Hardouvelis, G. A. (2002). The Asymmetric Relation Between Initial Margin Requirements and Stock Market Volatility Across Bull and Bear Markets. *Review of Financial Studies*.

Hendershott, T. (2020). Short Selling and Price Discovery in Corporate Bonds. *Journal of Financial & Quantitative Analysis*.

Hsieh, D. A. (2000). Margin Regulation and Stock Market Volatility. *Journal of Finance (Wiley-Blackwell)*.

Huafeng, H. (2012). Research on short selling and market volatility and liquidity: an empirical analysis based on the stock market in Hong Kong, China. *Journal of Shanghai university of finance and economics*, pp. 82-89.

Junxiong, F. (2010). VaR method of short selling mechanism and its empirical analysis. *Journal of yunnan normal university*.

Karl, S. (2019). Margin Trading and Volatility: Further Evidence from China's Stock Market. *Emerging Markets Finance & Trade*.

LLC, N. (2019). New Asia-Pacific Financial Markets Study Findings Reported from Shanghai Jiao Tong University (Margin-trading Volatility and Stock Price Crash Risk). *Investment Weekly News*.

McKenzie, H. a. (2006). Effect of the ban on short selling on market prices and volatility.

Morales, L. E. (2018). The effects of international price volatility on farmer prices and marketing margins in cattle markets. *International Food & Agribusiness Management Review*.

Peng, Y. (2016). Research on the Impact of Short Selling Mechanism on Investors' Positive Feedback Trading Behavior. *Modern Economy*, pp. 116-54.

Rubin, K. (n.d.). The Effect of Short Sale Constraint Removal on Volatility in the Presence of Heterogeneous Beliefs. *International Review of Finance*, pp. 66-73.

Salinger, M. A. (2002). Stock Market Margin Requirements and Volatility: Implications for Regulation of Stock Index Futures. *Journal of Financial Services Research*.

Schultz, B. (2006). Options and the Bubble. *The Journal of Finance*, pp. 11-23.

Sergiy, L. (2020). Securitization as an innovative refinancing mechanism and an effective asset management tool in a sustainable development environment. *E3S Web of Conferences*.

Sheu. (2019). Margin Trading and Volatility: Further Evidence from China's Stock Market. *Emerging Markets Finance & Trade*.

Shkilko. (2007). Price-destabilizing short selling.

Smith and Caginalp, G. (2000). Overreactions, Momentum, Liquidity, and Price Bubbles Inlaboratory and Field Stock Markets. *The Journal of Psychology and Financial Markets*.

Wan, X. (2020, 1). The impact of short-selling and margin-buying on liquidity: Evidence from the Chinese stock market.

Ye, Q. (2020). Short-selling, margin-trading, and stock liquidity: Evidence from the Chinese stock markets. *International Business School Suzhou, Xi'an Jiaotong-Liverpool University*.

Zhang, W. D. (2005). Margin borrowing, stock returns, and market volatility: Evidence from

margin credit balance. *Economics Letters*.

zhihui, G. (2009). Short-selling constraint, investor behavior and pricing bubble in a-share market . *Financial research*, pp. 88-90.

The appendix

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.056917	91.77737	29.79707	0.0000
At most 1	0.006526	12.13844	15.49471	0.1504
At most 2	0.002382	3.240618	3.841466	0.0718

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.056917	79.63893	21.13162	0.0000
At most 1	0.006526	8.897823	14.26460	0.2948
At most 2	0.002382	3.240618	3.841466	0.0718

L with RZ and RQ

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.016769	34.03262	29.79707	0.0153
At most 1	0.005671	11.05038	15.49471	0.2084
At most 2	0.002441	3.321481	3.841466	0.0684

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.016769	22.98224	21.13162	0.0272
At most 1	0.005671	7.728900	14.26460	0.4069
At most 2	0.002441	3.321481	3.841466	0.0684

The VAR model

VAR (Vector Autoregression) model was proposed by SIMS (C.A. Ims,1980), who promoted the wide application of dynamic analysis of economic system and was one of the mainstream models in the world today. The VAR model is mainly used to predict and analyze the dynamic impact of random disturbance on the system, as well as the magnitude, positive and negative impact and duration of the impact.

The definition of VAR model is: set $Y_t = (y_1 \ y_2 \ \cdots \ y_{N})^T$ is N * 1 order of Sequence dependent variable column vector, then the p-order VAR model (denoted as VAR(P)):

$$Y_t = \sum_{i=1}^{p} \Pi_i Y_{t-i} + U_t = \Pi_1 Y_{t-1} + \Pi_2 Y_{t-2} + \cdots + \Pi_p Y_{t-p} + U_t$$

The purpose of VAR model: (1) prediction, and it can be used for long-term prediction;

(2) Impulse response analysis and variance decomposition are used for dynamic structure analysis among variables. Therefore, VAR model can be used for both prediction and structural analysis.

Next, three main methods of VAR will be introduced emphatically:

1. Granger causality test
(1) Definition

The Granger causality regression test formula between x_t and y_t is:

$$y_t = \sum_{i=1}^{p} \alpha_i y_{t-i} + \sum_{i=1}^{p} \beta_i x_{t-i} + u_{1t}$$

$$x_t = \sum_{i=1}^{p} \alpha_i x_{t-i} + \sum_{i=1}^{p} \beta_i y_{t-i} + u_{2t}$$

If necessary, displacement term, trend term and seasonal dummy variable can be added into the above equation. The null hypothesis to test the existence of Granger non-causality between x_t and y_t is: $H_0 : \beta_1 = \beta_2 = \ldots = \beta_p = 0$

2. IRF: Impulse-response function

For VAR model, it is difficult to interpret the economic value of a single parameter estimate. Besides prediction, the most important applications are impulse response analysis and variance decomposition. Impulse response function describes the response of an endogenous variable to the impact of residual (called Innovation). Specifically, it describes the effect (dynamic effect) of an impact of the size of a standard deviation (from within or outside the system) on the current and future values of the endogenous variable on the random error term. This method of analysis is called the impulse response function.

3. Variance decomposition

In the application of VAR model, the variance decomposition method can also be used to study the dynamic characteristics of the model. The impulse response function describes the impact of the impact of each endogenous variable in the VAR model on itself and other endogenous variables, or the impulse response function observes the response of each variable in the model to the impact over time. And variance decomposition is to further evaluate the endogenous variables to predict the variance of the contribution. Sims proposed the variance decomposition method in 1980, which quantitatively but coarsely measured the influence relationship between variables. Variance decomposition is the ratio of the impact of different new interest impacts on the standard deviation of the analysis and prediction residual, that is, the contribution ratio of corresponding endogenous variables to standard deviation. Impulse response analysis and variance decomposition are both useful tools for analyzing the relationship between economic variables.

If the correlation between perturbations is small, the impulse response and variance decomposition will be basically the same in various orders. Many current economic variables are sometimes highly correlated and require further analysis.

ARCH-GARCH model

The autoregressive conditional heteroscovariance (ARCH) model was first proposed by Robert Engle in 1982. Later, scholars from various countries improved and expanded the ARCH model in various aspects, such as GARCH, EARCH, ARCH-M, EGARCH and Garch-M. The following article will introduce in detail the representative literature and research trends of arch-Garch model in the development process.

1. The ARCH model
(1) Introduction

In the analysis and prediction of economic structure, traditional econometric modeling is mainly to model the conditional mean value of first-order moments, such as autoregression model:

$y = a y_{t-1} + \varepsilon_t$

Where the error sequence ε_t of the model is an unrelated sequence with zero mean value, it is assumed that ε_t has ε_t constant conditional variance, and the modeling of second moment is not taken into account.

Engle (1982) creatively proposed an autoregressive conditional heteroscedasticity (ARCH) model for volatility modeling: $h_t = \alpha_0 + \sum_{j=1}^{p} \alpha_j \varepsilon_{t-j}^2$

Among $\alpha_0 > 0, \alpha_j \geq 0, j = 1,...,p$ Here p is the order of the model. Model is the ARCH model proposed by Engle, also known as the linear ARCH model. The conditional variance of the error term is the function of its past error square, so it can reflect the influence of the past fluctuation on the current fluctuation.

The Arch-M model was first proposed by Engle, Lilien and Robins in 1985 and officially published in 1987. The ARCH model considers the time-varying factors of conditional variance to analyze volatility, which is inseparable from risk. Therefore, Engle et al. further considered the important use of conditional variance as a risk measurement that changes over time, and linked risk with return, thus putting forward an important branch of ARCH model family.

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4. Jonhansen system cointegration test
(1) Definition

Jonhansen (1995) co-integration test is a test method based on VAR model, but it can also be directly used for co-integration test between multiple variables.

H0: There are 0 cointegration relationships;

H1: There are M cointegration relationships.

Test trace statistics: $LR_{tr} = -n \sum_{i=M+1}^{N} \log(1 - \lambda_i)$

Where, M is the number of cointegration vectors; λ_i is the i eigenvalue arranged by size; N sample size.

Johanson test is not an independent test that can be completed once, but a continuous test process for different values. EViews starts from testing the null hypothesis that there is no co-integration relationship, followed by a maximum of one co-integration relationship, up to a maximum of N-1 co-integration relationship, requiring N tests in total.

(2) Comparison between Johanson and EG co-integration test
(a) It is unnecessary for Johanson to divide endogenous and exogenous variables, but the EG co-integration test based on a single equation must divide endogenous and exogenous variables.
(b) Johanson cointegration test can give all co-integration relationships, but EG cannot.
(c) The Johanson co-integration test has more stable efficacy. Therefore, Johnson cointegration test is superior to EG test.

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2. GARCH model
(1) Introduction of GARCH model

When people found that ARCH model could not express the information that autocorrelation coefficient fading slowly in some cases, and the estimation of completely free lag distribution in practical application often led to the damage of non-negative constraints, GARCH model came into being.

According to GARCH model, in a certain period, the variance of the error term depends not only on the variance of the error term in the past, but also on the error term itself.

The ARCH model of the Generalized (Generalized autoregressive conditionally heteroscedastic) is by the Engle students Bollerslev (1986) and Taylor (1986) independently developed. GARCH model allows conditional variance to depend on itself in the early stage, the simplest being GARCH(1,1).

$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta_1 \sigma_{t-1}^2$

Similarly, GARCH (p, q): $\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i u_{t-i}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2$

In practical applications, only the lower order GARCH model is often used.

GARCH (1,1) is the most popular, because it has only three parameters to be estimated. Compared with the classical ARCH model proposed by Engle before, the amount of estimation is greatly reduced.

(2) Advantages of GARCH model
(a) GARCH is simpler and more applicable. The GARCH model considers the autoregression of heteroscedasticity itself.
(b) There are many parameters in ARCH model, so it is difficult to estimate them. However, GARCH model can save the parameters of ARCH model in practical application.
(c) ARCH model provides a more flexible hysteresis structure, which complements the defect that ARCH model cannot describe the slow fading speed of autocorrelation coefficient.
(3) Disadvantages of GARCH model