ANALYSIS OF SHANGHAI YIELD INDEX VOLATILITY BASED ON GARCH MODEL

Li PENG [1] Yue-e ZHONG[1*]
[1]（Department of Mathematics and Finance
Hunan University of Humanities Science and Technology Loudi , China
[/*]corresponding author 16033478@qq.com，ITEM :15C019)

ABSTRACT

This article selects from the Shanghai composite index since January 4, 2002 (2018) on June 15, a total of 3990 data of the daily closing price, and through Eviews conversion yield in pairs, and then using processing of data to test the volatility of the stock market. The stock market is full of uncertainty, so this paper GARCH model is established based on the Shanghai composite index, using the GARCH model to see the change rule of Shanghai stock market return volatility. It can also finds out China's stock market return volatility.

KEYWORDS- *Shanghai index, logarithmic yield, GARCH model, yields volatility;*

I. INTRODUCTION

Compared with the international financial markets, the development of Chinese stock market is not long, in late 1990 and early 1991, the Shanghai stock exchange and shenzhen stock exchanges are allowed to set up respectively, formally established the stock market in China. China's stock market has developed rapidly in recent years. China's stock market has been going for more than two decades. In 1999, the introduction of the securities law marked the establishment of the legal status of China's capital market and the further development and expansion of the stock market in the regulation.China's stock market was relatively stable from the establishment of China's stock market until 2005. But there was a bull market in 2005, peaking at 6,000 points. In 2008, China suffered from the impact of the us subprime crisis, leading to a sustained decline in stock prices and a bear market, which lasted until the first half of 2009.Then from 2009 to 2015 the stock market began to be good. In the first half of 2015, there was another bull market, with share prices peaking at 4,500 points. Since the second half of 2015, the stock market has entered a bear market again, and prices have continued to fall. It wasn't until 2016 that it began to stabilize.Therefore, by researching on the yield of Shanghai stock index volatility in our country, selecting nearly 12 years of the Shanghai index daily closing price data as the research object, useing GARCH model research methods and researching on the yield of Shanghai stock index volatility, this artical aims to reveal the yield of China's stock market volatility.

II. LITERATURE REVIEW

Han chao[2] (2015) established the GARCH model to prove that the yield sequence has significant GARCH effect. Jin lee[3](2017)concluded that Chinese stock market's volatility, high frequency fluctuations, continuity and instability of volatility and significant ARCH effect by using the ARCH model and researching the yield of Shanghai stock index volatility. Yingying,Zhang yong, Wu Runheng[4](2005), they think that yield sequence has the remarkable heteroscedasticity, and GARCH model can be used for fitting and prediction and analysis, and the analysis of features of Chinese stock market is better. Wu Qianwen[5](2014) found that there are obvious conditionl heteroscedasticity through the study of the empirical analysis of Shanghai stock index daily yield returns volatility. With the ARCH effect, so you can use the ARCH model yield volatility change rule. Zou na and zhang wei[6] (2010) studied the stock

market and found that the volatility of China's stock index returns has the characteristics of group mechanism and ARCH effect. Ma guoteng and zhao yan[7] (2010) conducted an empirical study on the stock market and found that the index rate of return of China's securities market presents the characteristics of peak and thick tail. Yu Xiong[10] (2015) using the ARCH model in the study found that Shanghai stock market exists obvious lever effect and the use of the ARCH model can better predict yield volatility change law of GARCH model which can better fit the volatility of Shanghai stock market returns. However, the model also has some shortcomings, because it does not take into account other relevant influencing factors, it has certain limitations.

III. THEORETICAL MODEL INTRODUCTION

According to the data characteristics of the research object, the internal change rule is explored, the dynamic model is established, and the method of fitting and parameter estimation is called time series analysis. In the process of analysis, the sample was first tested for stationarity, which was converted into stationary time series data, and then fitted with the model.

The simplest form of the GARCH model is as follows：

$$Y_t = X_t \Upsilon + £_t$$

$$¢_t^2 = w + \sim £_{t-1}^2 + \quad ¢_{t-1}^2$$

$¢_t^2$ is the conditional variance, which is the function of mean variance w, residual square of mean variance $£_{t-1}^2$ (ARCH term) and predicted variance $¢_{t-1}^2$ (GARCH term) of the previous period.

IV. THE EMPERICIAL ANALYSIS

In order to study the stock market return volatility, this paper selected the Shanghai security index as the research objection. Its sample ranges from January 4, 2002 to June 15, 2018, a total of 3990 data, and the data is from the great wisdom software. The obtained data are sorted out by logarithmic rate of return, where p represents the daily closing price data of Shanghai composite index from 2002 to 2018) to build a model.

The logarithmic processing calculation formula is as follows:

$$r_t = \ln p_t - \ln p_{t-1}$$

4.1. Shanghai index daily rate of return statistical description

A statistical description of the daily rate of return sequence of Shanghai index

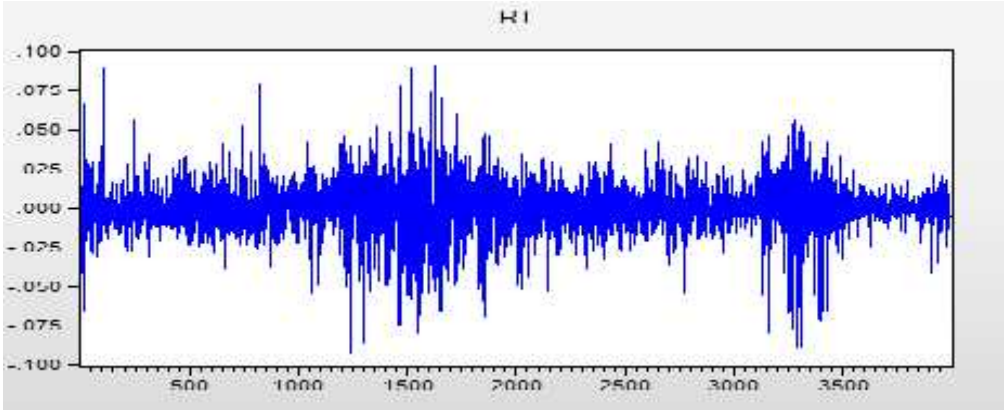


Figure 1 Linear graph of Shanghai index yield rate series rt

By analyzing the figure 1 rt logarithm yield of Shanghai stock index sequence of linear graph, it can be seen that the logarithm yield fluctuation shows obvious cluster phenomenon, that is, a high yield after getting higher yields, a low yield after getting lower yields. It also has obvious characteristics of time variability and suddenness. The fluctuation is small in some time and large in some time.

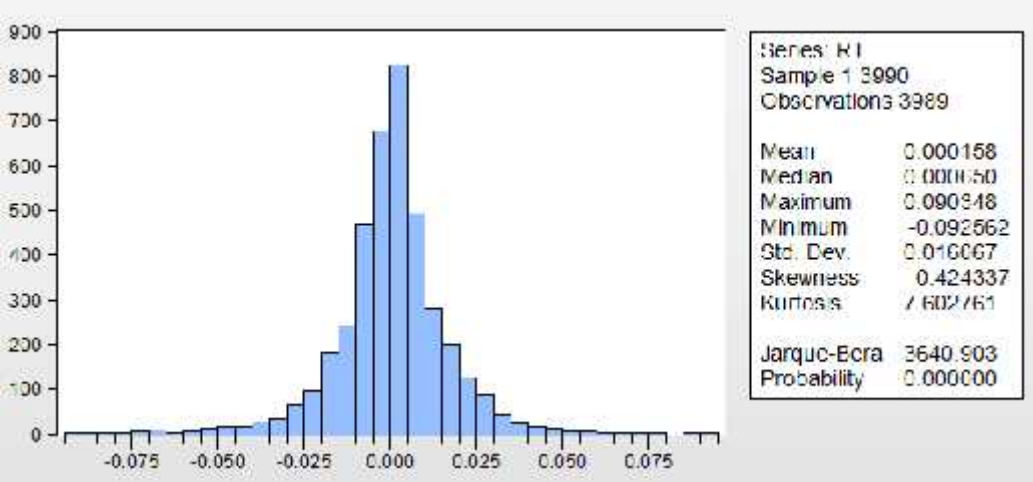
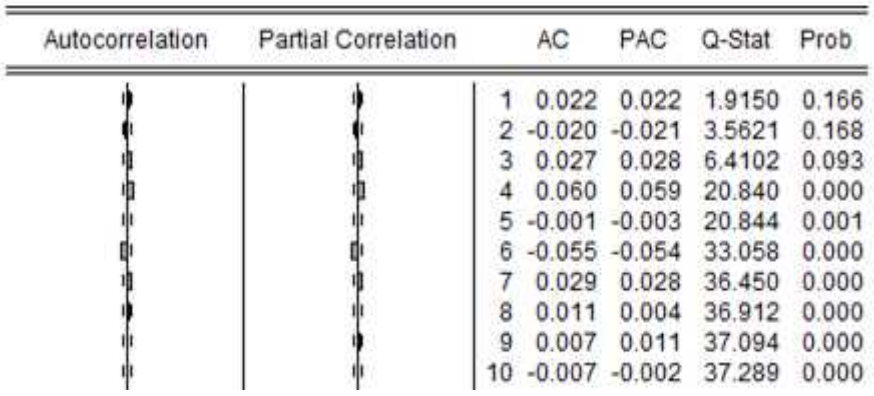


Figure 2 Histogram and related statistics of rt of Shanghai index return rate series

According to the figure 2 shows that the basic statistics, the Shanghai index yield sequence has obvious peak phenomenon (kurtosis = 7.602761), back at the same time, JB statistics p value is zero, that the Shanghai composite index yield sequence does not obey the normal distribution.

4.2. The stability test -ADF test of Shanghai index yield series



	AC	PAC	Q-Stat	Prob
1	0.022	0.022	1.9150	0.166
2	-0.020	-0.021	3.5621	0.168
3	0.027	0.028	6.4102	0.093
4	0.060	0.059	20.840	0.000
5	-0.001	-0.003	20.844	0.001
6	-0.055	-0.054	33.058	0.000
7	0.029	0.028	36.450	0.000
8	0.011	0.004	36.912	0.000
9	0.007	0.011	37.094	0.000
10	-0.007	-0.002	37.289	0.000

Figure 3 Autocorrelation and partial autocorrelation of stock prices

We can know from the sequence of the autocorrelation coefficients (AC) and partial autocorrelation coefficient (PAC) that the Shanghai index price yield sequence does not exist autocorrelation and partial autocorrelation problem; it may be a stationary time series. In order to further verify the stability, we carry on the further unit root test.

4.3. Unit Root Test

Table 1. Unit root test results of Shanghai index return rate series

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-61.76764	0.0001
Test critical values:	1% level	-3.431805	
	5% level	-2.862068	
	10% level	-2.567094	

It can be seen from table 1 results level ADF test values are much smaller than the critical value, and the probability of the first kind of mistake is less than 0.0001, we can't refuse the Shanghai composite index yield sequence is stationary time series of the original assumption.

4.4. Estimation of equation

Since the Shanghai stock exchange rate series is a stationary time series, we can use the equation to fit it. Equation is as follows: $r_t = x¥_{t-2} + £_t$

There is exist Heteroskedasticity, which can be seen from table 2

Table 2:Heteroskedasticity Test: ARCH

F-statistic	114.4465	Prob. F(1,3986)	0.0000
Obs*R-squared	111.3080	Prob. Chi-Square(1)	0.0000

4.5. GARCH estimation of Shanghai index yield series

Table 3: GARCH estimation results of Shanghai index yield series

GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

	Variance Equation			
C	9.26E-07	1.79E-07	5.171955	0.0000
RESID(-1)^2	0.061898	0.003954	15.65625	0.0000
GARCH(-1)	0.936635	0.003617	258.9802	0.0000

R-squared	0.000297	Mean dependent var	0.000162
Adjusted R-squared	0.000297	S.D. dependent var	0.016070
S.E. of regression	0.016067	Akaike info criterion	-5.740121
Sum squared resid	1.029032	Schwarz criterion	-5.733810
Log likelihood	11446.93	Hannan-Quinn criter.	-5.737883
Durbin-Watson stat	1.954419		

It can be seen from the GARCH estimation results of Shanghai index return rate series in table 3 that the ARCH term and GARCH coefficient of GARCH equation are significant.

V. CONCLUSIONS AND SUGGESTIONS

In this paper, using the Shanghai composite index, yield from 2002 to 2018 on June 15, 3990 data as sample, GARCH model, the empirical analysis was carried out on the return volatility. The results show that the Shanghai composite index residuals can be better fitting for using the GARCH model. The yield of Shanghai stock index sequence has heteroscedasticity, yields are rush thick tail and aggregation phenomenon, and they do not obey the normal distribution, the ARCH and GARCH effect are significant, that is, a high yield after getting higher yields, a low yield after getting lower yields. It also has obvious characteristics of time variability and suddenness. The fluctuation is small in some time and large in some time. The model established by GARCH model for volatility of yield can be well fitted. After the GARCH regression, the heteroscedasticity of the residual error can be eliminated. It can be seen that the GARCH model is effective in estimating and predicting the volatility of China's stock market return.

In order to ensure the stability of the stock market, we can use the historical data of the market to build a model to analyze the volatility of market returns and predict the future volatility of the market. However, the data used in the prediction of the model may be too long to reach the expected effect, so the updated parameter data is also needed.

REFERENCES

[1] Zhang chengsi Financial Econometrics --Ttime Series Analysis Vision [M] Renmin University of China Press, 2016.

[2] Han chao. Analysis on Volatility of Shanghai 50 index yield based on GARCH Model [J]. Financial Economy,2015(12):161-163.

[3] Li jin. Volatility Analysis of daily Return Rate of Shanghai index based on ARCH model [J]. Modern Economic Information,2017(11):268-269.

[4] Yingying, Zhang yong, Wu runheng. Characteristics and Volatility Analysis of Shanghai index returns [J]. Statistics and Information BBS,2005(02):63-67.

[5] Wu qianwen. Empirical Analysis of Shanghai index yield Volatility: based on ARCH family model [J]. Regional Finance Research,2014(04):42-48.

[6] Zou na. Zhang wei. Stock Volatility Analysis based on GARCH model [J] Knowledge Economy,2010 (12).

[7] Ma guo-teng, Zhao yan. Empirical Analysis of yield Volatility of Shanghai and Shenzhen Stock Indexes -- based on TARCH model [J]. Economic BBS, 2010 (2).

[8] Sun shiqian. Empirical Research on the Stock Market Calendar Effect based on the GARCH ethnic model [J]. Tax Payment,2018(03):159-160.

[9] Xu xuchu. Yang ning's Volatility Analysis of Stock Index Returns based on GARCH model [J]. Journal of Liaocheng University,2017(12):65-69.

[10] Yu xiong. Empirical Analysis of Shanghai Yield Index Volatility -- based on ARCH family model [J]. Commercial Economy,2015(06):45-46.