International Journal of Latest Research in Engineering and Technology (IJLRET)
ISSN: 2454-5031
www.ijlret.com || Volume 04 - Issue 08 || August 2018 || PP. 89-93

Research on the Return of Shanghai Lead Futures Based on GARCH Model

Shuying Du[1], Wei Li[2], Fang Chen[*]

1,2 Department of Mathematics and Finance
Hunan University of Humanities Science and TechnologyLoudi , China
**Corresponding author, E-mail address: fangchen198810@163.com*

Abstract: Shanghai Lead Futures was listed on the Shanghai Futures Exchange on March 24, 2011. Futures trading is focused on matching the bidding price, and the price formed by it is ahead of the price change in the spot market. Therefore, this article will take the price of Shanghai Lead futures as an example, through the GARCH model to conduct a comprehensive and in-depth exploration and analysis of its volatility. In this way, an objective evaluation of the Shanghai-Lead Futures Market was made.

Keywords: futures; Shanghai-lead futures; GARCH model
Fund project: This article is the result of the school youth fund project (QN201614).

1. Introduction

Futures, usually referring to futures contracts, is a contract. A standardized contract that is formulated by futures exchanges to deliver a certain amount of subject matter at a specific time and place in the future. Lead is one of the most important basic metals in the national economy. The trading volume of Shanghai Lead futures on the first day of trading was more than 70,000 lots, with a turnover of more than 35.4 billion. Now the overall operation is stable, with typical analytical significance. This article also gives a basic introduction to various statistical methods that must be used in the construction of GARCH model, including sequence stationarity test, variable correlation test, and GARCH effect test. Therefore, this article will use Eviews software for a total of 221 trading days in the six months after December 2017, and the daily closing price of Shanghai-lead futures with 222 daily returns calculated will be used as a sample for quantitative analysis through the GARCH model.

2. Introduction to GARCH Model

Through an in-depth study of the literature, it is found that compared with the ARCH model, the GARCH model does not impose any restrictive conditions on the parameters, which makes the solution process easier and faster. At the same time, the GARCH model has a wider range of use when the sample size is relatively small. The GARCH model can effectively simulate the volatility of the daily closing price of China's Shanghai Lead futures. It can help investors accurately grasp investment risks during the investment process and make correct investment decisions at key moments.

If the variance is represented by the ARMA model, the deformation of the ARCH model is the GARCH model (Bollerslev, 1986).

The GARCH(p,q) model can be expressed as

$$\partial_{\mathrm{t}}^2 = \partial_0 + \partial_1 \varepsilon_{t-1}^2 + \cdots + \partial_q \varepsilon_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \cdots + \beta_p \sigma_{t-p}^2$$

International Journal of Latest Research in Engineering and Technology (IJLRET)
ISSN: 2454-5031
www.ijlret.com || Volume 04 - Issue 08 || August 2018 || PP. 89-93

The IGARCH(p,q) model can be expressed as:

$$\partial_t^2 = \partial_0 + \sum_{i=1}^{p} \partial_i \varepsilon_{t-i}^2 + \sum_{i=1}^{q} \beta_i \sigma_{t-i}^2$$

with the understanding that : $\sum_{i=1}^{p} \partial_i + \sum_{i=1}^{q} \beta_i = 1$

The GARCH-M model introduces heteroscedastic terms into the mean number equation. A simple GARCH-M (1, 1) model can be expressed as

$$y_t = \Upsilon x_t + \Phi \sigma_{t-1} + \varepsilon_t$$

$$\partial_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$

The residuals are defined as: $\varepsilon_t \sim N\left(0, \sigma_t^2\right)$

3. GARCH model building

3.1Yield data generation

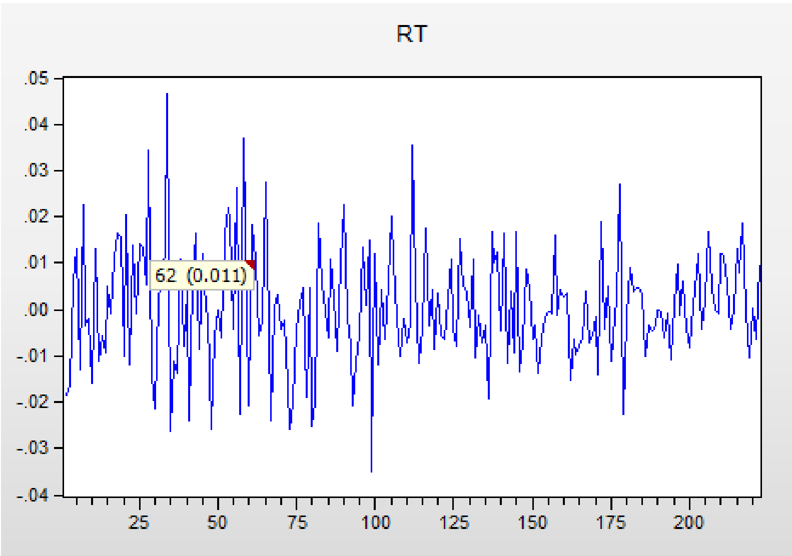

Fig.1 The line graph of Shanghai Lead futures yield series rt

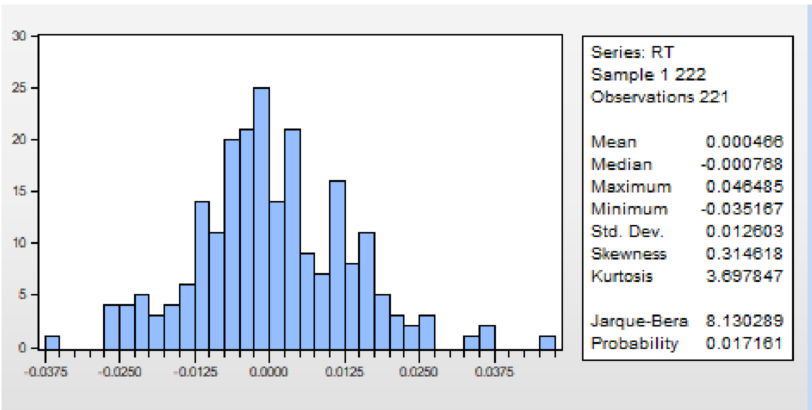

Fig.2 The histogram and related statistics of Shanghai-lead lead rate series rt

From Figure 1, we can see that the Shanghai-lead futures yield series rt has obvious aggregation, a high rate of return followed by a higher rate, a low rate of return followed by a lower rate of return. According to the data in Figure 2, the Shanghai-lead futures yield series has a sharp peak-to-tail phenomenon (3.697847 kurtosis), and the JB statistic P is 0.017161, indicating that the Shanghai-lead futures yield series is not a normal distribution.

3.2 Checking the Stationarity of Shanghai Lead Futures Yield Series

Date: 05/29/18 Time: 16:28
Sample: 1 222
Included observations: 221

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.080	-0.080	1.4332	0.231
		2	0.019	0.012	1.5111	0.470
		3	-0.096	-0.094	3.5824	0.310
		4	0.066	0.052	4.5653	0.335
		5	-0.119	-0.109	7.7732	0.169
		6	0.142	0.119	12.368	0.054
		7	0.087	0.119	14.107	0.049
		8	0.022	0.012	14.215	0.076
		9	-0.057	-0.021	14.966	0.092
		10	0.000	-0.015	14.966	0.133
		11	0.058	0.081	15.754	0.151
		12	-0.008	-0.002	15.768	0.202
		13	-0.058	-0.086	16.568	0.220
		14	-0.034	-0.059	16.840	0.265
		15	-0.024	-0.034	16.978	0.320
		16	-0.039	-0.030	17.352	0.363

Fig.3 Autocorrelation and partial correlation of Shanghai Lead futures yield

From the series of autocorrelation coefficients (AC) and partial autocorrelation coefficients (PAC), we can see that there is no autocorrelation and partial autocorrelation in the Shanghai Lead futures yield series, which is likely to be a smooth time series. However, to further prove its stability, we conducted a further unit root test.

Null Hypothesis: RT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-16.06531	0.0000
Test critical values:	1% level	-3.460035	
	5% level	-2.874495	
	10% level	-2.573751	

*MacKinnon (1996) one-sided p-values.

Fig.4 Unit root test results of Shanghai Lead futures yield series

From the results, we can see that the ADF test value is less than the critical value of each significant level, and the probability of committing the first type of error is less than 0.0000, indicating that we cannot reject the original assumption that the Shanghai-lead futures yield series is a stationary time series.

3.3 Estimation of equations

Since the Shanghai-lead futures yield series is a stationary time series, we can use the following equation to fit.

$$r_t = m_t + e_t$$

Dependent Variable: RT
Method: Least Squares
Date: 05/29/18 Time: 16:31
Sample (adjusted): 2 222
Included observations: 221 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000466	0.000848	0.550095	0.5828

R-squared	0.000000	Mean dependent var	0.000466
Adjusted R-squared	0.000000	S.D. dependent var	0.012603
S.E. of regression	0.012603	Akaike info criterion	-5.905232
Sum squared resid	0.034944	Schwarz criterion	-5.889856
Log likelihood	653.5282	Hannan-Quinn criter.	-5.899024
Durbin-Watson stat	2.147006		

Figure 5 Equation estimation results

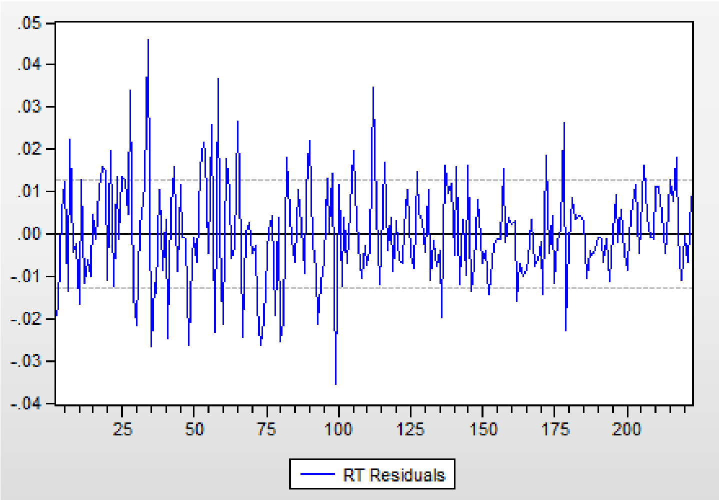

Figure 6 Regression residuals

The regression equation can be derived from the estimation results shown in Figure 5:

$$r_t = 0.000466 m_t + e_t$$

The intercept was not significant at a significance level of 0.5. Therefore, in order to more accurately estimate the equation, we observe the residual of the previous estimation result, and we can get the regression residual map as shown in Fig. 6. The residual map shows that the residual may have heteroskedasticity.

4. In conclusion

The GARCH model was used to perform statistical fitting analysis on the return rate of the daily closing price of Shanghai-lead futures from December 2017 to May 2018. It was found that the yield has such important statistical characteristics as peak tail-heel and heteroscedasticity, and the GARCH effect. Significantly exists in the yield of Shanghai Lead futures. If a country's securities market is relatively developed, it is normal for a certain rate of return to fluctuate, which can increase the vitality of our securities market. But from the above model we can see that Shanghai-lead futures still need a period of growth, investors The need for rational investment and the full play of the role of the financial market are the gradual maturation of China's securities market.

References

[1] Peng Hongfeng, Ye Yonggang. Dynamic optimal hedge ratio estimation and comparison based on modified ECM-GARCH model[J]. Chinese Journal of Management Science, 2007(05):29-35.

[2] Zhang Yunpeng. Research on financial market risk based on GARCH model [D]. Jilin University, 2009.

[3] Yang Erpeng, Zhang Desheng, Li Wenjing. Research on the statistical forecast of yield of Shanghai and Shenzhen 300 Index based on GARCH model[J]. Journal of Yangtze University of Science and Technology, 2010,7(01):151-153+388.

[4] Xiao Jing. Shanghai Lead Futures sailed at the time [J]. Resource Recycling, 2011(03):36-39.

[5] Liu Xibiao. Estimation of hedging ratio of lead futures based on time-varying normal Copula-GJR model [J]. Times Finance, 2016(02): 222+224.