International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

An Empirical Study on the Impact of CSI 300 Index Options on Stock Market Volatility

Shuyao Liu [1], Meihua Wang[1]

[1]School of Economics and Management, XIDIAN University, 266 Xinglong Section of Xifeng Road, Xi'an, Shaanxi 710126, China
806412586[at]qq.com

Abstract: ***In order to further improve the risk management system and stimulate the vitality of the financial market, CICC officially listed and traded CSI 300 stock index options on December 23, 2019. This means that my country's options market has further developed. The CSI 300 index covers the stocks with high market capitalization and high liquidity in the Shanghai and Shenzhen stock markets. This article discusses the impact of the launch of stock index options on the volatility of the stock market, and uses the closing price data to establish a GARCH model to compare CSI 300 index options. Empirical analysis of the impact of the launch of the stock market on the volatility of the stock market. The conclusion reached is that the introduction of stock index options has increased market volatility, but the overall impact is not significant.***

Keywords: Stock Market; Volatility; GARCH Model; CSI 300 Index

1. Introduction

Lamoureux (1991)[5] used the American market stock index options to study and concluded that the introduction of stock index options had no significant impact on the volatility of its cousin's market. Filis, Floros and Eeckels (2011)[6] studied the impact of the first Greek stock option transaction on stock price volatility from 1999 to 2002. JP Tang (2015)[7] analyzed that the launch of KOSPI200 index options has increased the liquidity and volatility of KOSPI200 index futures.

The CSI 300 Index is the most important reference index in Chinese securities market. It has a larger scale than the SSE 50 Index, a larger market capacity, and higher price fluctuations, and it has a good representation. The launch of CSI 300 index options provides investors with more arbitrage trading opportunities. Chinese investment market has also entered a new stage of development, further promoting the international development of Chinese financial market.

Due to the relatively early listing time of the SSE 50ETF, there are more studies on the market volatility of the SSE 50ETF option launch. The listing time of the CSI 300 index option is relatively short. This article will analyze the CSI 300 index option pair based on scholars' Empirical analysis of the impact of market volatility.

The arrangement of this paper is as follows. Chapter 2 briefly introduces the measurement model and selects the data needed for the experiment. The third chapter conducts empirical analysis and establishes a suitable measurement model. The fourth chapter carries on the conclusion analysis and prospect.

2. Model and sample data selection

2.1 ARCH Model and GARCH Model

The second assumption of traditional econometrics on time series variables: It is assumed that the volatility of time series variables is fixed and does not conform to reality. For example, the volatility of stock returns varies with time, not constant. This makes traditional time series analysis ineffective for practical problems. Robert Engel proposed the ARCH model in 1982 to solve the volatility problem of time series, when he studied the volatility of the inflation rate in the UK.

The full name of ARCH model is "autoregressive conditional heteroscedasticity model", which solves the problems caused by the second assumption (constant variance) of time series variables in traditional econometrics. To express ε_t return or return residual, assuming $\varepsilon_t = \sigma_t * z_t$where $z_t \sim iid(0,1)$ (i.e. independent and identically distributed, all conform to the normal distribution with expectation of 0 and variance of 1), the expression of the ARCH model The form is:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \cdots \alpha_q \varepsilon_{t-q}^2 \quad (1)$$

Among them, $\alpha_0 > 0, \alpha_1 \geq 0, i > 0$, that is, the income of each period is a linear combination of non-negative numbers, and the constant term is a positive number.

The GARCH model is called the generalized ARCH model. It is an extension of the ARCH model. It is the most widely used model of time series volatility. It makes up for the shortcomings of ARCH and better describes the volatility aggregation type and heteroscedasticity of the financial market.

The expression form of the GARCH(p,q) model is as follows:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \cdots \alpha_q \varepsilon_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \cdots \beta_p \sigma_{t-p}^2 \quad (2)$$

Studies have shown that option returns will produce volatility aggregation over time. This article is to study the impact of option launches on market volatility, so the GARCH (1, 1) model will be used in the subsequent model establishment.

2.2 Data selection

This article takes the impact of the CSI 300 index options launched by China on the volatility of the Chinese market. We will select the subject matter of the CSI 300 index

options——the CSI 300 Index as our research object. Because the CSI 300 index options were listed on December 23, 2019, we will select the daily closing price of the index from June 24, 2019 to June 19, 2020 as the research object, a total of 243 data, as the full sample A. With the option launch date on December 23, 2019 as the demarcation point, the previous 124 closing price data are taken as sub-sample A1, and the subsequent 119 samples are taken as sub-sample A2. The sample data in this article comes from the wind database. The software used in this article is EViews8.

3. Empirical Research

3.1 Descriptive statistics

Since the stock price sequence is usually not a stationary sequence, we use the logarithmic first-order difference processing of the closing price to obtain the time series of the return:

$$r_t = lnP_t - lnP_{t-1} \quad (3)$$

where P_t is the closing price of the CSI 300 Index on day t.

In order to ensure the effectiveness of the model, we eliminate extreme values. The kurtosis of the full-sample statistic is 4.836016, which is greater than 3, with sharp features, and the skewness is -0.389024, which is less than 0, indicating that there are more obvious left-skewed features. The JB statistic is 39.92882, which is greater than the critical value, and P tends to 0, so we can reject the null hypothesis that the return rate sequence obeys a normal distribution. The sequence has the characteristics of sharp peaks, thick tails, and left-bias, which is suitable for establishing a GARCH model.

3.2 Stationarity test

Since the use of the GARCH model for financial time series modeling requires that the tested return rate series be stable, the stationarity test of the return rate time series should be performed using the ADF test method.

Table 1: ADF Test Results

ADF test	ADF test value	P Value
Full sample	-16.85719	0.0000
Subsample A1	-10.91296	0.0000
Subsample A2	-12.28151	0.0000

Through the ADF test results, it can be found that the ADF test values of the full sample, A1 sample and A2 sample are much smaller than the critical value, and the P value tends to 0. Therefore, the null hypothesis is rejected and the sequence is considered to be stationary.

3.3 Establishment of the mean return model

Before establishing the GARCH model, it is necessary to establish the mean equation model of the rate of return, use the autoregressive moving average model for analysis, and judge from the autocorrelation graph and partial autocorrelation graph through EViews8. The autocorrelation and partial autocorrelation of the sequence both fall within two standard deviations, and the sequence with a P value greater than 0.05 has no significant correlation. Since there is no significant correlation, the mean value equation is set as a white noise process. Set up the model:

$$r_t = \pi_t + \varepsilon_t \quad (4)$$

3.4 ARCH effect test

There are two methods for half of the ARCH test, one is the ARCH-LM test, and the other is the square correlation plot test of the residuals. Since the autoregressive moving average model (ARMA) was not established in the previous step, r was de-averaged and w=r-0.000610 was set to obtain a new residual time series, and the autocorrelation test was performed on the residual square. From the results of EViews8, it can be judged that the Q statistic is not significant, the establishment of the equation is correct, and that there is an ARCH effect, the GARCH model should be selected for modeling.

3.5 GARCH model establishment

Generally, the GARCH (1, 1) model is used for the volatility of the stock market, which can fit the time series of returns well. Therefore, this article also establishes a GARCH (1, 1) model to study the impact of the CSI 300 index options listing on the CSI 300 index, and introduces a dummy variable d1 to distinguish between options before and after listing. When d1=0, it means the CSI 300 index Before the option is launched, when d1=1, it means after the option is launched. By observing the sign and absolute value of dummy variables, the impact of option launch on stock market volatility is observed.

The GARCH (1, 1) model with dummy variables introduced is defined as:

$$\gamma_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \gamma_{t-1}^2 + \eta d1_t \quad (5)$$

According to the results of EViews8, the GARCH (1, 1) model can be established as follows:

$$\sigma_t^2 = 5.40E\text{-}06 + 0.060317\varepsilon_{t-1}^2 + 0.864339\sigma_{t-1}^2 + 6.43E\text{-}06d1 \quad (6)$$

From the results of EViews8, it can be seen that the coefficient of the dummy variable d1 is significant, and the coefficient value is 6.43E-06, which is positive. It is believed that the launch of options has increased market volatility, but the volatility is small, indicating that the launch of CSI 300 index options has Market volatility has little impact. At the same time, the coefficient of ARCH is 0.060317 and the coefficient of GARCH is 0.864339. The sum of the two is less than 1 and greater than 0, which is in line with the constraints of the parameters in the GARCH condition equation. On the whole, it is believed that the launch of Chinese CSI 300 index options has little effect on market volatility.

4. Conclusion

This article establishes a GARCH (1, 1) model, and introduces a dummy variable d1 to distinguish different times before and after the option is launched, taking the closing price of CSI 300 from June 24, 2019 to June 19, 2020 as a full sample Established a stable time series through the logarithmic return of the closing price, and put forward the influence of extreme

values to analyze. The results show that the introduction of stock index options slightly aggravated the volatility of the market, but the impact was not significant. The reasons for the increased market volatility caused by the launch of options may be due to the emergence of the epidemic, which has caused excessive turbulence in the stock market, which affects investor confidence; After half a year of listing, there were not enough transaction data, small sample size, and the market was not active enough to give full play to the risk management function of options

The listing of CSI 300 index options has enriched Chinese existing options and also provides investors with a wider range of options for arbitrage strategies. The introduction of stock index options is conducive to investors using options to lock in downside risks while retaining the profit opportunities brought by future market rises. Investors can transform from a single, trend-oriented investment to a diversified, strategic investment, and use a combination of diversified derivatives to further enhance returns, reduce risks, smooth the yield curve, and reduce market cycle disturbances to performance. Make finance better serve the real economy.

References

[1] Chu , Q.C, Hsieh, W.G, Tse, Y. Price discovery on the S&P500index markets : analysis of spot index, index futures and SPDRs. International Reviews of Financial Analysis, 1999.
[2] Brorsen B. W. Futures trading, transaction costs, and stock market volatility. Journal of Futures Markets, 1991.
[3] Maosen Zhong, Darrat A F, Rafael Otero.Price discovery and volatility spillovers in index future markets: ome evidence from Mexico. Journal of Banking and Finance, 2004.
[4] Jan S. Henneke T. Rachev, Frank J. Fabozzi, et al. MCMC-based estimation of Markov Switching ARMA-GARCH models[J]. Applied Economics, XLIII(3),pp.259-271, 2011.
[5] Lamourex, C. G(1991). Option listing does not affect the variance of the underlying stock: A Cautionary Tale.
[6] Filis G, Floros C, Eeckels B. Option listing, returns and volatility: evidence from Greece[J]. Applied Financial Economics,2011,21(19):1423-1435.
[7] Tang J P. The Effect on KOSPI 200 Futures after Launching KOSPI 200 Option. International Conference on Industrial Technology and Management Science.2015