Modelling and Forecasting Cyts Stock Prices Using Garch Model

Yanzhen Li, Lingrui Zhang
College of Finance, Xi’an Eurasia University, Xi’an, Shaanxi 710065, China

ABSTRACT. As one of the emerging industries that have developed rapidly in recent years, tourism has attracted the attention of many investors. As a brand leader and standard-setter in China's tourism industry, CYTS's practice and exploration in tourism + has a guiding role that cannot be ignored in the development of our country's tourism industry. Therefore, this paper takes the CYTS stock price as the research object, predicts the stock price through the GARCH model to provide investors with investment reference, and finds: (1) CYTS stock return sequence shows the characteristics of peak and fat tail, and the finding of ARCH effect resulting in using GARCH as forecasting model. (2) In the short term, the results of stock prices predicted by the GARCH model are relatively close to the actual stock trends. (3) When analyzing stock trends in the long-term, it is necessary to consider major events at home and abroad, economic policy changes, etc., and the GARCH model can be used for short-term forecasting.

KEYWORDS: Forecasting stock price, Garch model, Cyts

1. Introduction

From 2015 to 2019, China's total GDP has increased year by year. As of the end of 2019, the total GDP was 99.1 trillion yuan, a growth of 6.1% over the previous year. With the growth of GDP and personal disposable income, the demand for maintaining and increasing the value of their own assets has gradually increased. As a common investment tool, stocks gradually become a more desirable investment choice. However, stock investment has a higher risk, which makes the judgment of risk and price forecast very important.

With the continuous improvement of living standards, residents have more diversified physical and spiritual demands. Tourism has become an important choice for mass leisure and entertainment. The development momentum of the tourism industry has also grown by leaps and bounds in recent years, and the development momentum of the industry has attracted investors. Attention to its points. Among them, as a part of the tourism industry, CYTS tourism + practice and exploration has a guiding role that cannot be ignored in the development of my country's tourism industry. It is a witness to the reform and opening up of China's tourism industry; it is also a pioneer of the business model of China's tourism industry; Now it has become a brand leader and standard-setter in China's tourism industry. Therefore, this article takes the research of CYTS stock price as the research object, uses the GARCH model to measure and predict its stock fluctuations, and then predicts its stock price, to provide investors with investment reference, and to further enrich the application research of using the GARCH model to predict the stock price of the travel industry.

2. Literature Review

Foreign scholars have discovered the characteristics of changes in stock prices since 1970 and launched research on stock markets and stock prices. The research in this area has become increasingly perfect.

Foreign studies on the factors affecting stock prices mainly focus on the impact of changes in national economic policies on the stock market, and the impact of investor behavior on stock price fluctuations based on the perspective of behavioral finance. Many empirical results show that GARCH (1,1), GARCH (1,2), GARCH (2,1) can already reflect the price volatility of financial products in most cases. Among them, the GARCH model has become the main tool to measure the volatility of the financial market.

Domestic scholars have also conducted related researches on the operation of GARCH model in Eviews software and the use of GARCH model for stock price forecasting. Zhang Xiaotong (2003) discussed how the GARCH model is operated and applied in the Eviews software. Gao Tiemei (2006) linked theory with practical application, and analyzed the effect of GARCH applied to stock volatility through experiments and comparisons. Chen Xiaoxin (2012) proved that the GARCH model can indeed be applied to stock prices with a high degree of fit. Chen Cong (2015) used the
GARCH model to calculate most of the stock prices in the agricultural listed sectors and found that it has strong persistence.

However, when the GARCH model is used for regression processing, the average value obtained does not change much. This also proves that the agricultural sector’s stock prices are affected in a wide range and cannot rely solely on the GARCH model. However, for the stocks of companies that have been on the market for a long time, the GARCH model can still be used to analyze and forecast them. Considering the actual application, the GARCH model can be used to analyze it first, and then the influencing factors can be used for comprehensive analysis. As a result, this is also possible for forecasting. Shi Min (2018) chose the GARCH model and BP neural network to estimate the price of a specific stock, and found that the predicted results of the two methods and the actual error are very small, but due to the different industries and the nature of the stocks, it is impossible to determine which is the best, but it can be proved that both methods are acceptable as predictive tools.

3. An Empirical Analysis of Cyts Stock Price Forecast Based on Garch Model

3.1 Data Selection

This paper selects the daily closing price of CYTS stock from January 2, 2014 to February 21, 2020 for data analysis. The volatility of the closing price from January 2, 2014 to January 21, 2020 is used as historical data, and the daily closing prices from January 24, 2020 to February 21, 2020 are used to compare and analyze the prediction results of the model.

3.2 Empirical Analysis

3.2.1 Draw a Timing Diagram

We use Eviews 7.2 to conduct the empirical analysis and testing, and the daily closing prices of CYTS stock are collected from the Wind Database, covering from January 2, 2014 to January 21, 2020, resulting in 1468 observations.

Assuming the rate of return $R_t$ is given by

$$r_t = \ln\left(\frac{Y_t}{Y_{t-1}}\right)$$

(1)

Where $Y_t$ is the closing price on day $t$, and $Y_{t-1}$ is the closing price on day $t-1$.

A sample time series is generated for the daily return rate of the stock. Perform basic statistical analysis on the sequence. The sequence and basic statistical characteristics of 1470 samples are as follows:

![Fig.1 Cyts Daily Return Sample](image)

From the linear graph of the logarithmic return sequence $r$ of CYTS stocks, it can be observed that the “clustering” phenomenon of the volatility of the logarithmic return is relatively small in the period from the 550th observation to the 950th observation, and in the 250th data to the 500th data and the time period from the 1000th data to the 1400th data are very large.

The average return sequence of CYTS stocks is -1.59e-05, the standard deviation is 0.024494, and the skewness is -0.325272. It can be seen that this sequence is sorted from left to right, and its kurtosis value is 6.624980. In addition, the magnitude of its change is much higher than the standard 3, showing the characteristics of peak fat tail.
3.2.2 Stationarity Test

The stationarity test is performed on the return sequence, and it is found that the statistic value of the ADF test is -29.95548, which corresponds to a p-value of 0.0000. Rejecting the null hypothesis at a significance level of 1%, it is more appropriate to use the GARCH model in this case.

<table>
<thead>
<tr>
<th>Augmented Dickey-Fuller test statistic</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% level</td>
<td>-29.95548</td>
<td>0.0000</td>
</tr>
<tr>
<td>5% level</td>
<td>-3.434600</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.86304</td>
<td></td>
</tr>
</tbody>
</table>

3.2.3 Mean Value Equation Establishment

Establish first-order and second-order models respectively, and use AIC and SC criteria to determine the final mean equation model.

It can be seen from the Table 2-2 below that MA(2) and ARMA(2.2) are more in line with the requirements of establishing a model, where the AR(2) has the minimum SC value, and the ARMA(2.2) has the minimum AIC value and relatively small SC value. Hence, we choose ARMA (2.2) to establish the mean value equation.

<table>
<thead>
<tr>
<th>Mean equation</th>
<th>AIC</th>
<th>SC</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR(1)</td>
<td>-4.580052</td>
<td>-4.576447</td>
</tr>
<tr>
<td>AR(2)</td>
<td>-4.592430</td>
<td>-4.585216</td>
</tr>
<tr>
<td>MA(1)</td>
<td>-4.580863</td>
<td>-4.577260</td>
</tr>
<tr>
<td>MA(2)</td>
<td>-4.592253</td>
<td>-4.585047</td>
</tr>
<tr>
<td>ARMA(1,1)</td>
<td>-4.584964</td>
<td>-4.577555</td>
</tr>
<tr>
<td>ARMA(1,2)</td>
<td>-4.590654</td>
<td>-4.579839</td>
</tr>
<tr>
<td>ARMA(2,1)</td>
<td>-4.591111</td>
<td>-4.580291</td>
</tr>
<tr>
<td>ARMA(2,2)</td>
<td>-4.599189</td>
<td>-4.584762</td>
</tr>
</tbody>
</table>

3.2.4 Heteroscedasticity Test

From the time series diagram of the return rate, we can see that its distribution has a trend of clustering. In statistics, it can be called heteroscedasticity. ARCH test method is used to verify the specific differences:

Analyzing the heteroscedasticity test results presented in Table 2-3, we can find that the value of P corresponding to the F statistic is 0, indicating that the model has verified its effect, and R² is 65.98276, and the value of P is still zero, which proves that the sequence has heteroscedasticity .

Through the use of the ARCH effect to test the rate of return of CYTS, it has proved some of its characteristics, and it is concluded that the GARCH model has the effect of measuring the yield curve.
### 3.2.5 Volatility Prediction Based on GARCH Model

In order to make this research more comprehensive, we use the GARCH model for empirical analysis, which is a principal modeling instrument. Because it adds a term to the calculation equation, the results tend to be more average and it is easy to show a flexible lag structure. The GARCH equation not only includes the lag term, but also includes the lag term of heteroscedasticity itself, which is more beneficial for effectively predicting the fluctuation of financial information sequence. It can be seen from the above that there is a high-order ARCH effect in the residual sequence, so the GARCH (1, 1) model can be used, and the average value of the daily return of CYTS and the conditional variance equation can be estimated as follows:

\[
\sigma_t^2 = 6.20E-06 + (0.076832\epsilon_{t-1}^2) + (0.913335\sigma_{t-1}^2)
\]

From the results, \(0.076832 + 0.913335\times 0.990167<1\). It proves that the conditional variance has a certain memory storage capacity, that is, the price fluctuation of CYTS has a long duration.

### 3.2.6 Arch Effect Test

The above table shows that the variance equation of GARCH (1,1) is estimated as:

\[
\sigma_t^2 = 6.20E-06 + (0.076832\epsilon_{t-1}^2) + (0.913335\sigma_{t-1}^2)
\]

From the results, \(0.076832+0.913335\times 0.990167<1\). It proves that the conditional variance has a certain memory storage capacity, that is, the price fluctuation of CYTS has a long duration.
P=0.1072 greater than 0.05 indicates that the ARCH effect has been eliminated.

3.2.7 Cys Stock Price Forecast

Excluding the Chinese New Year holiday, use the above GARCH (1,1) model to predict the return fluctuation data from February 5, 2020 to February 21, 2020, and then gradually predict the stock price. The results are shown in the following figure:

Table 4 Forecast and Actual Stock Prices of Cys Stocks

<table>
<thead>
<tr>
<th>Date</th>
<th>Predictive value</th>
<th>Actual value</th>
<th>Relative error</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020-02-05</td>
<td>9.881982</td>
<td>9.94</td>
<td>0.60%</td>
</tr>
<tr>
<td>2020-02-06</td>
<td>9.911514</td>
<td>10.2</td>
<td>2.84%</td>
</tr>
<tr>
<td>2020-02-07</td>
<td>10.00254</td>
<td>10.5</td>
<td>4.76%</td>
</tr>
<tr>
<td>2020-02-10</td>
<td>10.09511</td>
<td>10.5</td>
<td>3.80%</td>
</tr>
<tr>
<td>2020-02-11</td>
<td>10.081</td>
<td>10.36</td>
<td>2.50%</td>
</tr>
<tr>
<td>2020-02-12</td>
<td>10.0285</td>
<td>10.61</td>
<td>5.46%</td>
</tr>
<tr>
<td>2020-02-13</td>
<td>10.12887</td>
<td>10.41</td>
<td>2.68%</td>
</tr>
<tr>
<td>2020-02-14</td>
<td>10.044</td>
<td>10.42</td>
<td>3.55%</td>
</tr>
<tr>
<td>2020-02-17</td>
<td>10.05281</td>
<td>10.82</td>
<td>7.11%</td>
</tr>
<tr>
<td>2020-2-18</td>
<td>10.19384</td>
<td>11</td>
<td>7.27%</td>
</tr>
<tr>
<td>2020-2-19</td>
<td>10.22873</td>
<td>11.2</td>
<td>8.66%</td>
</tr>
<tr>
<td>2020-2-20</td>
<td>10.2864</td>
<td>11.48</td>
<td>10.00%</td>
</tr>
<tr>
<td>2020-02-21</td>
<td>10.3748</td>
<td>11.22</td>
<td>7.48%</td>
</tr>
</tbody>
</table>

It is not difficult to see from the comparison between the predicted value and the actual value in the above figure that the GARCH model is more accurate in predicting prices, and its error is small, indicating that my country CYTS stocks conform to the GARCH effect (that is, heteroscedasticity). However, the fluctuation trend of stock prices in real life is irregular and can be found. Due to the influence of many external factors, there have been many sharp declines or sharp rises in the history of the development of my country's stock market. The stock price of CYTS on February 20, 2020, which is predicted this time, fluctuates greatly. It may be due to the epidemic that caused the global stock market to plummet. Among them, the tourism industry has also been greatly affected, and CYTS has inevitably experienced sharp fluctuations in its stock prices.

4. Empirical Result Analysis

The time series analysis model is an effective tool to reflect the fluctuations of stock prices. By fitting the GARCH model, the horizontal model and the volatility model of the closing price of CYTS stocks are combined for empirical analysis. The results show that the model is effective. This Paper mainly analyzes and forecasts the daily return rate of CYTS in time series, which proves the feasibility of the fitting model to predict the short-term stock volatility in the future to a certain extent. The specific conclusions are as follows:

(1) During the sample period, the market shrink but the trend did not decline significantly. At that time, It shows the phenomenon of volatility aggregation. Looking at its kurtosis, it can rise, which shows how stocks fluctuate under extreme price conditions. The skewness is negative, showing the characteristics of sharp peaks and fat tails, so the GARCH (1,1) model is more suitable.

(2) When the GARCH model is established, the model fitting effect of GARCH (1, 1) is better. The volatility of CYTS stocks is stable and highly sustainable. Thus, the CYTS is affected by external influences and the development and changes are relatively small to some extent. Whether it is “good news” or “bad news” in the market, It won’t significantly affect the price of CYTS stock. Based on that, it can be inferred that CYTS stocks can be calculated by extrapolation. To Forecast its future changes, Comparing the forecasting results from January 23 to February 21, 2020 with the actual stock price, it is found that the forecast error is small, but the forecast error on February 21 is large. This is related to the outbreak of the Covid-19 Pandemic, which has caused severe damage to the global economy. Tourism is one of the most influential industries.

(3) Model forecasts can only be used as short-term forecasts. Long-term forecasts are more likely to change, and there are many factors that need to be considered, such as market development, changes in enterprises, and national policies. Any of these factors would lead to a large impact on the stock market. Therefore, it is necessary to conduct comprehensive analysis in the long-term combined with multiple factors, and to make investment decisions in the short-term combined with the prediction results of the model.
5. Summary and Conclusions

This paper investigates relevant literature on foreign stock volatility measurement and result prediction. Combining the actual situation of my country’s stock market, starts with a single stock of CYTS to predicts stock prices through the GARCH model, and draws the following conclusions:

(1) The CYTS stock return sequence shows the characteristics of peak and fat tail, and there is an ARCH effect, which can be predicted by the GARCH model.

(2) In the short term, the results of the stock price predicted by the GARCH model are close to the actual stock trend, but the stock price is relatively volatile due to the impact of the 2020 epidemic in February, so the stock price predicted on February 20 is relative lower than the actual price by 10%.

(3) When analyzing stock trends in the long-term, it is necessary to consider major events changes in economic policies globally. The GARCH model can be used for short-term forecasting.

References


