ISSN 2616-5902 Vol. 4, Issue 5: 57-60, DOI: 10.25236/AJBM.2022.040512

Research on Financial Market Price Direction Based on ARIMA Model

Haoyu Liu*, Zhibing Sun, Xi Liu

Changsha University of Science and Technology, Changsha, Hunan, 410000, China
**Corresponding author*

Abstract: *With the development of financial markets, virtual currencies, represented by bitcoin, are gradually replacing the process of money anchored by gold, and more and more people are choosing these two assets for investment. In this paper, to predict and give trading decisions for bitcoin and gold, we calculate the assets' unit price, increase, and deviation rate. In order to predict the financial data, ARIMA model is used to predict the unit price, rising rate and other indexes. Finally achieved satisfactory results. These prediction results can provide valuable guidance for investors' strategies.*

Keywords: *Quantitative transaction; ARIMA model; Trading strategy*

1. Introduction

Since the collapse of the Bretton Woods system, gold prices rose from $ 35 per ounce to a time over $ 2000 per ounce. “International Monetary Fund Agreement", revised in 1978, announced that gold is no longer a monetary value standard. This precious metal officially entered the stage of non-monetization in a legal sense. Currently, international gold market is dominated by futures trading. Some scholars have studied the fluctuation of gold prices. Larry and Fabio applied theoretical models and empirical research to show that exchange rate movements between major currencies are the main cause of gold price movements. [1]

Bitcoin is a kind of virtual currency. It can meet the needs of decentralization, strict control of the money supply rate, prediction of the total amount of money circulation, and effective inflation control. Bitcoin has the similar function of currency.[2] With capital at work, bitcoin has become a popular investment in the financial markets nowadays, along with stocks, futures, and gold. In contrast to fiat currencies, bitcoin does not have a centralized issuer though it can be mined, bought, or sold by anyone.[3]

2. Financial Asset Price Forecast Based on ARIMA Model

Analysis of gold and bitcoin splicing statistics. The data includes the unit price of gold and bitcoin from September 2016 to September 2021. The unit price of gold has missing values. We used SPSS software arithmetic means value method to complete the dataset. Then calculate rise rate, BIAS, and other indicators.

After analyzing and processing the statistics, we concluded that the prices of gold and bitcoin are predictable.

To better visualize the data, we splice the two datasets and calculate the daily rises of gold and bitcoin separately, and made a graph comparing the average values of both rises at different times.

If gold rises by 18, it means the mean value of gold has risen in the previous 18 days of the current period.

Analyzing the Figure 1 further, if the mean value is calculated based on the rise of bitcoin in the first five days, the maximum rise is more than $2000; but if calculated based on the first ten days, the maximum is $1000, which indicates that the price of bitcoin changes dramatically. If not buy or sell timely, the trader will lose interest. Consider the bitcoin commission, the trader should operate too often. Hence, we will evaluate the future price trend of bitcoin based on the six-day range of increase.

Also take the gold commission into account, while the fluctuations of gold are smaller, we choose to evaluate its trend based on the 16-days range of increase. [4]

ISSN 2616-5902 Vol. 4, Issue 5: 57-60, DOI: 10.25236/AJBM.2022.040512

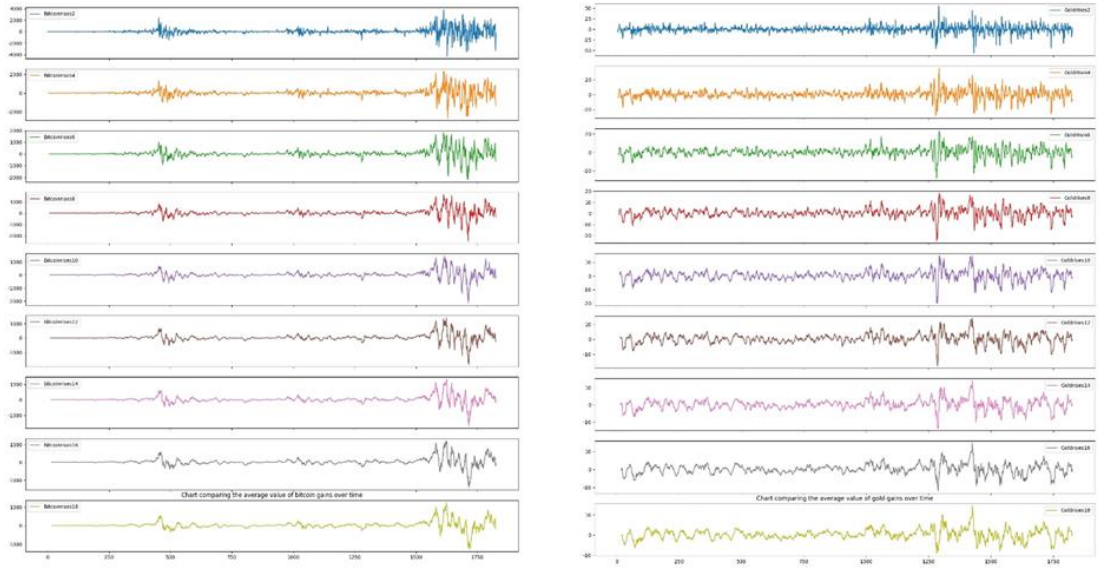

Figure 1: Bitcoin Rise (left) and Gold Rise (right)

In 1970, Box, an American statistician, proposed a method for classical analysis theory, modeling, and forecasting of time series, which is known as the Box-Jenkins modeling method. A time series (or dynamic series) is a series of values of the same statistical indicators arranged in the order of their occurrence in time. Its main purpose is to make predictions based on historical data. The current research on time series can be divided into ARMA models, ARIMA models and seasonal models, etc. ARIMA models are more advantageous in analyzing time-dependent series.[5]

The ARIMA model is used to predict the delayed amount of the model-dependent variable, the delayed amount of the model generated after the uncertainty bias, and the current amount of the model as the time series gradually stabilizes. The mathematical principle of the ARIMA model is shown below.

First, assume that $\{w_i, i = 0,1, \ldots\}$ is a random sequence if there exists a non-negative integer d such that:

$$\nabla^d w_i = y_i \tag{1}$$

is a ARMA (p, q) sequence, which is smooth and reversible. That is, the sequence $y_i i = 0,1, \ldots\}$ satisfying the stochastic difference equation:

$$\varphi(B) y_i = \phi(B) x_i \tag{2}$$

In this formula : $\nabla = 1 - B$, is a difference operator; B is a lag operator, namely $By_i = y_{i-1}$ and $\phi_p \varphi_q = 0$. Meanwhile, $\{x_i, i = 0,1, \ldots\}$ is a white noise series, i.e., $Ex_i^2 = \sigma^2 < \infty$. Then, $\{ y_i, i = 0,1, \ldots\}$ is said to be an autoregressive moving average series, denoted as ARIMA (p, d, q).

$$\phi(B) = 1 - \phi_1(B)B^2 - \cdots \phi_p(B)B^q = 1 - \sum^{p} \phi_n B_n \neq 0, |B| \leq 1 \tag{3}$$

$$\varphi(B) = 1 - \varphi_1(B)B^2 - \cdots \varphi_p(B)B^q = 1 - \sum^{p} \varphi_n B_n \neq 0, |B| \leq 1 \tag{4}$$

Combining and analyzing the above equations, we get:

$$\phi(B)(1 - B)^d w_i = \phi(B) x_i \tag{5}$$

Make $\psi(B) = \varphi(B)(1 - B)^d$, Then the above equation can be written as:

$$\psi(B) = \varphi(B)(1 - B)^d \tag{6}$$

3. Model Solving

Before the AMRIMA model can be predicted, a model test is required. We first calculate the residual values and plot the Q-Q plot as Figure 2:

ISSN 2616-5902 Vol. 4, Issue 5: 57-60, DOI: 10.25236/AJBM.2022.040512

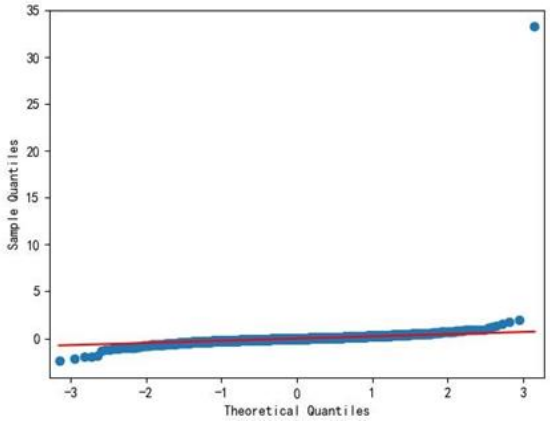

Figure 2: ARIMA residual Q-Q plot chart

As can be seen from the Figure 2, the series test result is roughly in line with the normal distribution, so it is roughly in line with the white noise series, indicating that the useful information in the time series has been extracted, and the rest is all random perturbations, which cannot be predicted and used.

We performed a D-W test on the data for first-order autocorrelation, and we obtained a D-W value of 2.017920, which is very close to 2, so there is no first-order autocorrelation.

The concept of the ARIMA model has been introduced. In the following work, we will use the model to predict the prices in the short term.

The unit price trend and increase obtained from the forecast model are shown in the Figure 3 and 4 below.

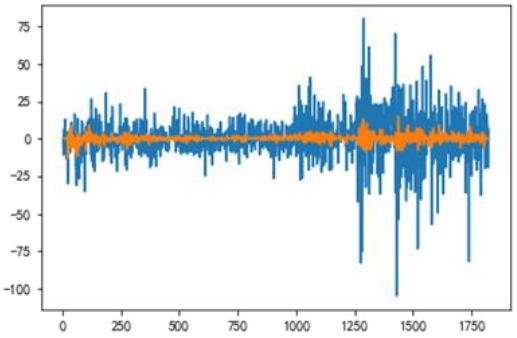

Figure 3: Gold rise rate

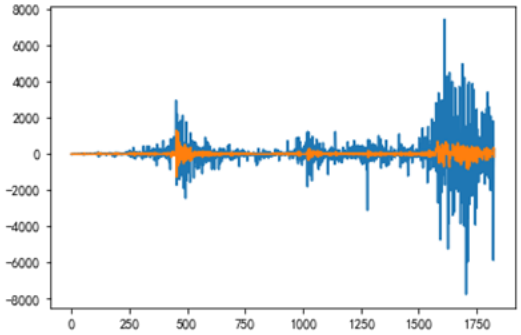

Figure 4: Bitcoin rise rate

In summary, the trick to build a robust time series forecasting model is to eliminate as much noise as possible. For our data, we find that the seasonal ARIMA model with regression variables provides the most accurate forecasts.

4. Conclusion

In this paper, we developed a model that would provide the best daily trading strategy based only on price data up to that day. The original time series data has strong instability, to further explore the information behind the data, we first determine whether the original data has noise. After determining that the raw data had noise, we apply the moving average method to the original data for data smoothing. To solve this problem, the statistics of gold and bitcoin are spliced together to facilitate data processing and analysis. Then, calculate the mean values, rise rates and BIAS of gold and bitcoin are calculated. Afterwards, the corresponding index values could be predicted by the ARIMA model.

References

[1] Sjaastad L A, Scacciavillani F. The Price of Gold and the Exchange Rates [J]. Economics Discussion/ Working Papers, 1995.

[2] Zhang Siyu. Taking Bitcoin as an example to explore virtual currency investment [J]. Modern

ISSN 2616-5902 Vol. 4, Issue 5: 57-60, DOI: 10.25236/AJBM.2022.040512

Business, 2022 (03): 101-103.
[3] Li Jiahong, Li Ping.Research on the relationship between the main assets of Bitcoin and China Financial Market during the epidemic period [J]. Management Comments, 2021, 33 (11): 286-297.
[4] Sun Jing, Xiong Yan, Zhang Heng, Liu Zhiping. Sortment Multi-Objective Planning Method for Multi-Disease Portfolio [J]. Control and Decision, 2020, 35 (03): 645-650.
[5] Song Yuping, Sun Yankun. High-frequency financial time sequence prediction - ARIMA model based on adaptive filtration method [J]. Journal of Jilin Institute of Technology, 2021, 37 (02): 82-86.