ISSN: 2688-9323

Best Daily Trading Strategy for Gold and Bitcoin

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Abstract

Nowadays, market traders often buy and sell volatile assets, but each purchase generates a commission. In order to satisfy investors' goal of maximizing their total return, it is important to develop a model that uses only past daily price flows so far to determine whether investors should buy, hold or sell assets in their portfolios. In this paper, after analyzing the influencing factors of trading strategy, the five-day mean operation method is used to establish the judgment model of bull and bear market. With the help of the ARIMA time prediction model, the future transaction price is predicted and passed the white noise test to verify the stability of the data, and then establish the scoring formula of the trading strategy. We then use this formula to assess the feasibility of the transaction.In addition, combined with the risk prediction situation, we finally build the optimal trade strategy model. For problem I, first of all, according to the characteristics of gold and bitcoin gains, we use data analysis to judge the bull and bear market criteria. Secondly, combining the bull and bear market with the multiplication ratio, we establish a visual model with python, formulate a reasonable scoring formula, find out the optimal operation decision, and maximize the target income. For problem II , based on the optimal decision model obtained in problem I, we illustrate its rationality using the hypothesis method combined with practice. We give evidence from risk consideration and profit maximization that our model gives the best strategy. For problem III , under the transaction rules still following the above problem I , the maximum total asset trend chart is drawn based on the determined range of gold and bitcoin transaction costs, under different transaction costs. Then, combining the chart of total assets under the different transaction costs, the maximum total asset value is calculated, and finally determines the degree that the strategy is sensitive to transaction costs and how transaction costs affect the strategy and results. For problem Ⅳ, for the topic given two kinds of financial products investment and the completed work, we in 1 page, our strategy, model and results to convey to investors, and in the strategy part in the form of points, facilitate our investors more clearly and easily understand.

Keywords

Investment Strategy; Investment Risk; The Maximum Total Return; Finance.

1. Introduction

1.1. Background

Capitalist countries are where stocks rise, and for the raising of more and wider capital, stocks gradually emerged from the early 17th century. The United States was the first country to have a stock market, where investors traded in a wide variety of securities. Market traders often buy and sell shares, with the goal of maximizing their total returns. There are often returns and commissions for each purchase and sale.

Since entering the 21st century, the global economic development has entered the extraordinary leapfrog track, which has directly promoted the rapid development of the financial system and created favorable conditions for people to make personal investment.

ISSN: 2688-9323

Especially in the current situation, for individuals, how to make more effective personal investment decisions is constantly related to the scientific nature of personal investment, and will also have a great impact on the personal investment model. Investors value the amount of wealth rather than the final amount of wealth; investors tend to keep their assets and sell their assets for the same amount of loss and profit than [1].

Therefore, it is particularly important to develop an investment model that uses only the past daily price flow up to date to determine whether investors should buy, hold, or sell the assets in their portfolio.

1.2. Introduction of Finance

Under the rapid development of the market economy, the capital market is becoming increasingly complex and changeable, and the investment subjects are vulnerable to a variety of factors to make wrong investment decisions and damage their own economic benefits. Starting from traditional finance, investors make investment decisions that are rational [2]. at present, the global capital market is growing, the financial investment channels are broader, and the corresponding risk problems are also increasing. In this regard, investors can introduce the financial foundation and choose the investment strategy correctly, to effectively avoid risks and obtain considerable returns [3].

Traditional finance takes the effective market hypothesis as the core, and analyzes the complex investment decision-making process by setting ideal assumptions and conditions and deriving simple mathematical formulas. Its concise and perfect models and conclusions used to be the leading force in the operation of the capital market [4]. MIT business school professor Stephen in his classic "new classical finance" with credible theory evidence, shows the no-arbitrage analysis principle and effective market hypothesis constitutes the core premise of modern finance, and based on the neoclassical economics of market "vision" provides a simple and convincing explanation [5].

After reading the relevant financial works, we take the guidance of the traditional finance theory and believe that investors need to comprehensively consider the profit and investment risks to make the best investment decision.

2. Problem Statement and Analysis

2.1. Statement of Questions

In this issue, we are given two selected cases of gold and bitcoin and some related assumptions, including the past daily price of gold and bitcoin, our initial transaction time, the amount of the initial investment, the length of the trade period, the content contained in the account and the cost of each trade (purchase or sale). we will address the following issues based on the price data due until the day:

A mathematical model that can give the best strategy for daily trade is developed;

Based on the above model and the initial investment conditions of US $1,000, the investment value was obtained on October 9,2021;

Evidence is presented that the above model can provide the best trade strategy;

Consider the influence of the transaction price, determine the sensitivity of the strategy subject to the transaction price and how the transaction price affects the strategy and results given by the model;

Communicate our strategies with traders to ensure that the above model is practical.

2.2. Overall Analysis

For the two financial products given by the topic, it is first necessary to make clear that the investment strategy is a prediction of the future uncertain market. Therefore, to develop an

ISSN: 2688-9323

investment strategy, it is necessary to establish a prediction model of the future market, so that the predicted results to determine the size of the investment amount and the buying and selling strategy.

3. Basic Assumptions

- Hypothesis 1: During the investment period, we only consider the average risk loss caused by unpredictable factors;
- Assume 2: the profit margin of the investment project is stable during the forecast period;
- Assume 3: The data given in the Appendix is true, reliable and well representative;
- Assume four: no other human intervention, no big change in social policy.

4. Glossary

- Bull bear market: Bull and bear markets are two different trends expected in the stock market.
- Bull market: A specific term for expecting a bullish stock market and a bullish outlook.
- Bear market: A specific term for expecting a bearish, pessimistic outlook.
- Investment risk: Uncertainty about future investment income, the risk of income loss or even principal loss in the investment.
- Separation rate: refers to the gap between the market index or closing price and a moving average price.

5. Problem I Best Trade Decision Model

5.1. Model Preparation

5.1.1. Bull and Bear Market Analysis

To help investors achieve their goal of maximizing returns and make the best trade decisions, we think it need to establish a suitable trade scoring system and make corresponding trade decisions based on the evaluation of the scoring system. In order to make the scoring system more reasonable, it is particularly important to fully understand the bull and bear market of gold and Bitcoin. Therefore, we first draw the mean increase map of gold and bitcoin with python, and analyze it to judge the gold and bitcoin bull bear market and draw their respective bull bear market map according to the relevant values obtained. The average gains of gold and Bitcoin are shown in Figures 1 and 2:

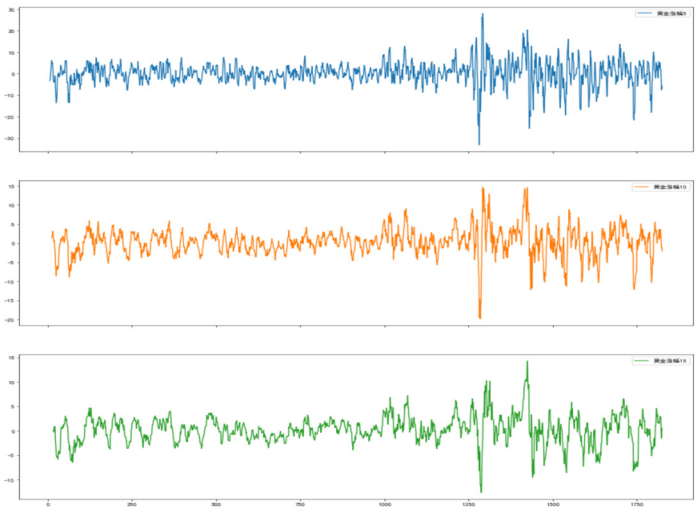


Figure 1. Gold rise chart

ISSN: 2688-9323

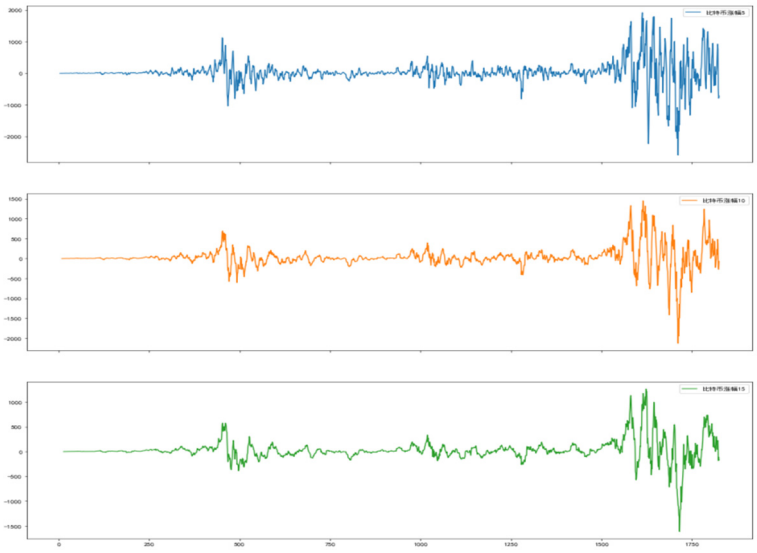


Figure 2. Bitcoin rise chart

By analyzing the figure above, the following:

With the average gain over the past five days, the average bitcoin gain is 2,000. But if the average increase of the past ten days is calculated on the sample, the average maximum increase drops to 1,000 and is easy to miss drastic changes. At the same time, due to the smaller increase, we decided to calculate the average maximum increase based on the increase over the past 15 days.

This article provides that n day good departure rate = (current price-n average price) / n average price

Bull market assessment index = the first 90-day average x 0.666+ gold 15-day divergence rate of the first 90-day average x 0.333

(The average greater than the bull market assessment index is a bull market and less than a bear market)

Subsequently, their respective bull and bear market evaluation indicators were calculated based on the average of gold and bitcoin gains and then calculated using the above method to judge the bull and bear market of gold and bitcoin, and draw their respective bull and bear market maps, as shown in Figures 3 and 4:

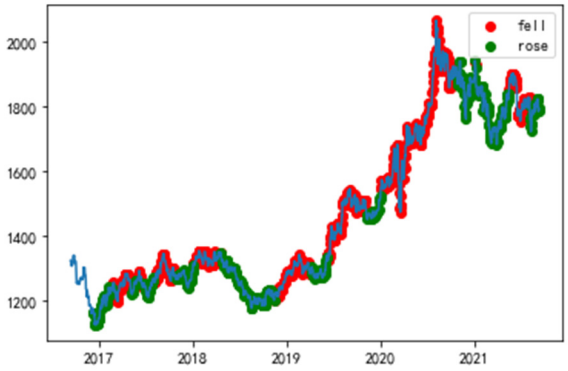


Figure 3. Gold bull bear market chart

Finally, the above calculated index voting method is used to determine the bull and bear market time, such as: according to the index concluded that today is a gold bull market, from a quarter ago to the bull market is today, but yesterday calculated as a bear market, and tomorrow is also calculated as a bear market, the results of today's calculation may be greater error. To solve this

ISSN: 2688-9323

error, all the time initial value of 0, the current calculation is made as a bull market, then the value of the previous quarter plus 1, as a bear market minus 1. The result is greater than a bull market, less than 0 is a bear market.

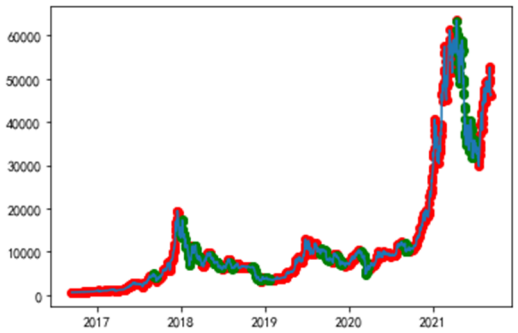


Figure 4. Bitcoin bull and bear market chart

5.1.2. Risk Analysis

In the process of investors making financial investment, risk is also a factor that must be considered. In order to make the best trade decision made by the investors optimal, we will analyze the risk of the investment and make the designed model more complete.

Based on the good separation rate and bull market data calculated by gold and bitcoin, the formula is used to calculate their respective investment risks, and draw their respective purchase risk map.

Gold purchase risk = Gold 15-day good departure rate X0.333+ gold bull market X0.666

The gold purchase risk chart is shown in the figure below:

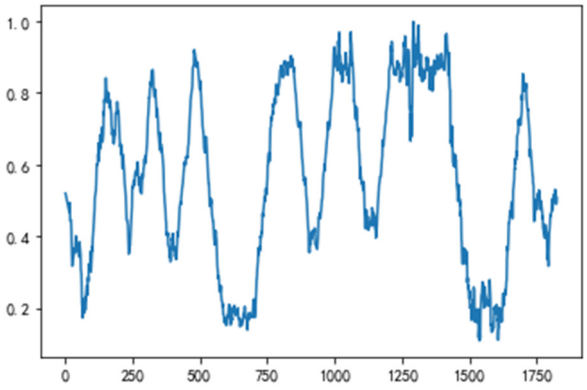


Figure 5. Gold purchase risk chart

Bitcoin purchase risk = Bitcoin 5-day good departure rate X 0.333+ bitcoin bull market X0.666

The Bitcoin purchase risk chart is shown below:

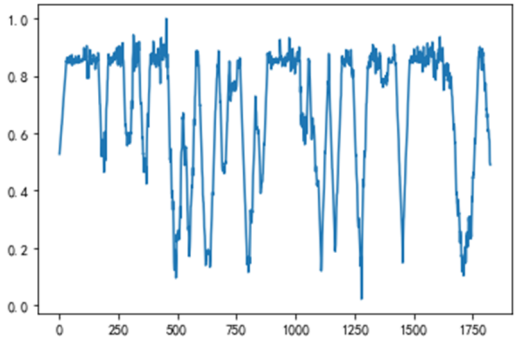


Figure 6. Bitcoin purchase risk chart

ISSN: 2688-9323

5.2. Model Data Processing

5.2.1. Establishment and Prediction of the Arima Time-series Prediction Model

The future should be predicted before making optimal decisions.

The ARIMA model (autoregressive moving mean model) is commonly used to fit sequences whose sequence properties do not change over time, i.e., stable time series. The ARIMA model is proposed to model, estimate, test, and predict the stationary time series. The ARIMA (p, q) model is a hybrid of the two models. The AR model is a linear prediction. For a stable time, series yt, yt is considered related to the previous results, which can be expressed as a p-order autoregressive model, recorded as AR (p), and the formula is:

$$yt= \beta 0+\beta 1yt- 1+\beta 2yt - 2...+ +\beta pyt - p+\varepsilon t \quad (1)$$

In formula (1), yt is a smooth time series,0Is the constant term, I (i = 1, 2, ..., p) is the model parameters of the AR model, representing the order of the AR model, tIs the error. If the current result ytRelated with the previous perturbation, it is called order q moving average model, recorded as MA (q), the formula is:

$$yt= \varepsilon t-\theta 1\varepsilon t - 1-\theta 2\varepsilon t - 2-...-\theta q\varepsilon t - q \quad (2)$$

In formula (2), I (i = 1,2,..., p) is the model parameters of the MA model, and q represents the order of the MA model, tFor error. The ARIMA model is the most commonly used model to fit a stationary time series, ytThe value is not only the p sequence value, but also the q disturbance term, with the formula:

$$yt = \beta 0+\beta 1yt - 1+\beta 2yt - 2...++\beta pyt - p+\varepsilon t-\theta 1\varepsilon t - 1-\theta 2\varepsilon t - 2 -...-\theta q\varepsilon t - q \quad (3)$$

In formula (3), i (i = 1,2..., p) and oneself I (i = 1,2, ...The p) is the model parameters of the ARIMA model, {t} It is the white noise sequence, p, q are non-negative integers. However, the d in ARIMA indicates that the timing data needs to go through several orders of differential differentiation to be stable.

In this paper, the ARIMA model is established to model and predict the data provided in the attachment. but before formally starting the model, we performed the stationarity test of the data used by the model.

5.2.2. Data Stationarity Test

To make the data stationarity test, we took adfuller unit root test, residue test and Durbin-Watson test, and gave the following instructions in turn.

1) adfuller unit root test

Data test results are shown in the following figure:

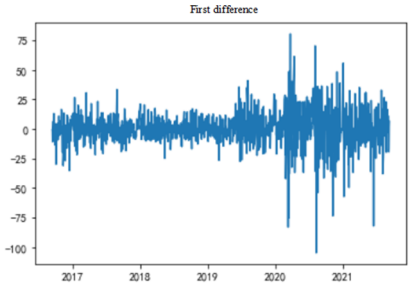


Figure 7. Adfuller unit root test output results

ISSN: 2688-9323

Of the five results of the output, we interpret it first:

The first is the result of the adt-test, simply the T values, representing the t-statistic.

The second is referred to as the p-value, representing the probability value corresponding to the t-statistic.

The third one represents the delay.

The fourth represents the number of tests.

The fifth, used to fit the first observation together, is the value of the critical ADF test at the 99%, 95%, and 90% confidence intervals.

Secondly, before conducting the stability evaluation, we should pay attention to the following two points:

The first point, the comparison of 1%, 5%, 10% and ADF Test result, both less than 1%, 5%, and 10%, indicates a very good rejection of the hypothesis.

The second point, p value requirement less than a given significant level and p value less than 0.05, equal to 0 is best. the null hypothesis of the ADF test is the existence of unit root, and if this statistic is a number at less than 1% level, the null hypothesis can be significantly rejected that the data is stable. Note that the ADF value is generally negative and positive, but it can only be considered at less than 1% level and significantly reject the null hypothesis.(The original hypothesis is not a stationary time series)

Model the output results and map the ACF and PACF shapes (as shown in Figure 8 and Figure 9).

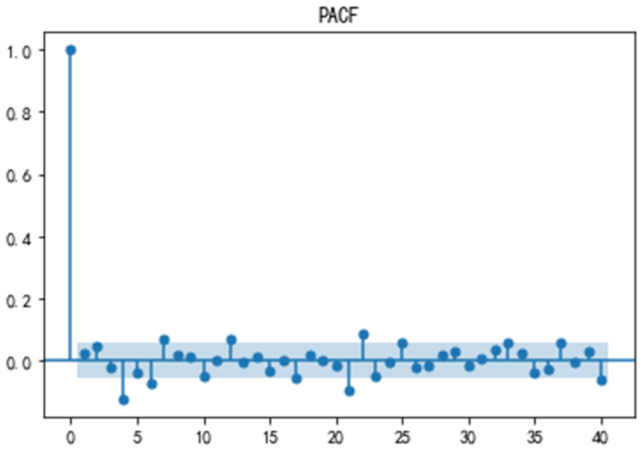


Figure 8. PACF

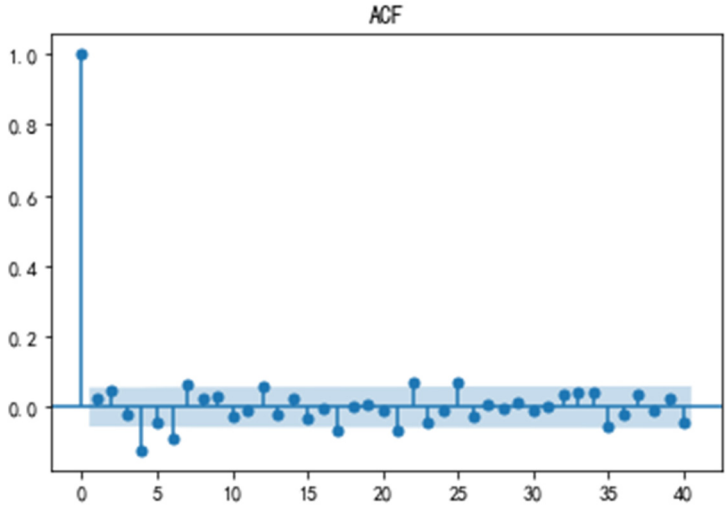


Figure 9. ACF

ISSN: 2688-9323

Then, we will summarize the above two figures into words. (See Table 1)

Table 1. With a summary

Model	ACF	PACF
AR(p)	Attenuation tends to zero (geometric or oscillatory)	Censored after p-order
MA(q)	Censored after q-order	Attenuation tends to zero (geometric or oscillatory)
ARMA (p, q)	Decay tends to zero after q-order (geometric or oscillatory)	Decay tends to zero after p-order (geometric or oscillatory)

Based on the above content, we have found that the:

The P value of the original data is> 0.05, hence the stationarity requirement;

The P-value of the first order difference of <0.05 and T values below 1%, 15% and 10% can very significantly reject the null hypothesis, indicating that the data is stable.

The first-order differential data has been stable and no need to continue the second-order difference.

2) residual test

If the residuals are a white noise sequence, it means that the useful information in the time series has been extracted, and the remaining data are all randomly perturbated, and these data can no longer be predicted and used. The residual map drawn according to the data provided in the attachment is shown in the following figure, where the red line is a normally distributed reference line. The results show that the residual difference roughly meets the white noise.

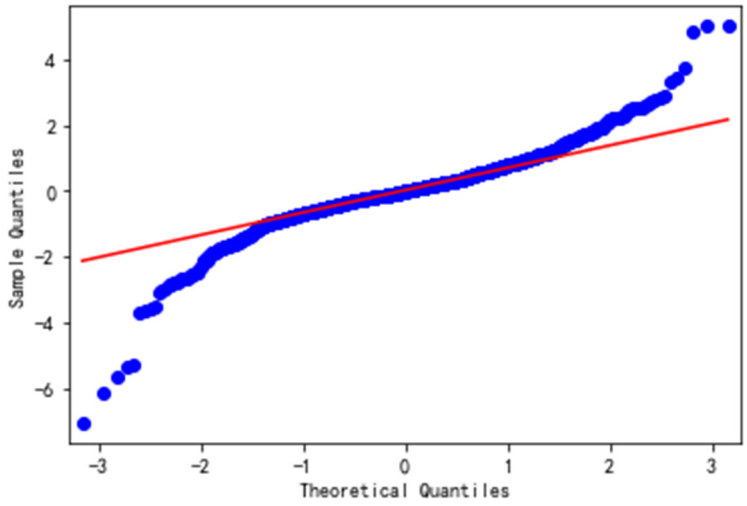


Figure 10. Residual Fig

3) Durbin-Watson test (DW test)

This method is used to test the first-order autocorrelation of the residuals in the regression analysis (especially for the Time-series data). the rule is: the closer the statistic value is to 2, the better, generally between 1 and 3, less than 1 means that the residue has autocorrelation. The test results are shown in Figure 10 and will not be described here.

5.3. Model Builds an Optimal Decision Model of --Based on Temporal Prediction

The above ARIMA forecast gold and bitcoin prediction model is shown in the following figure:

ISSN: 2688-9323

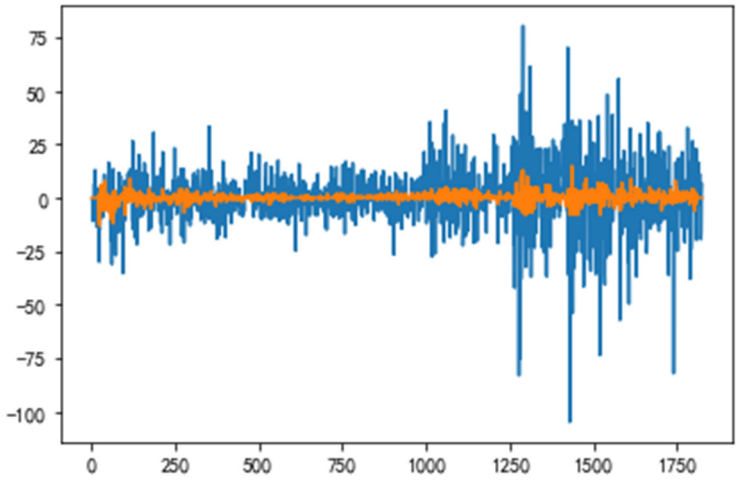


Figure 11. Predicting gold gains

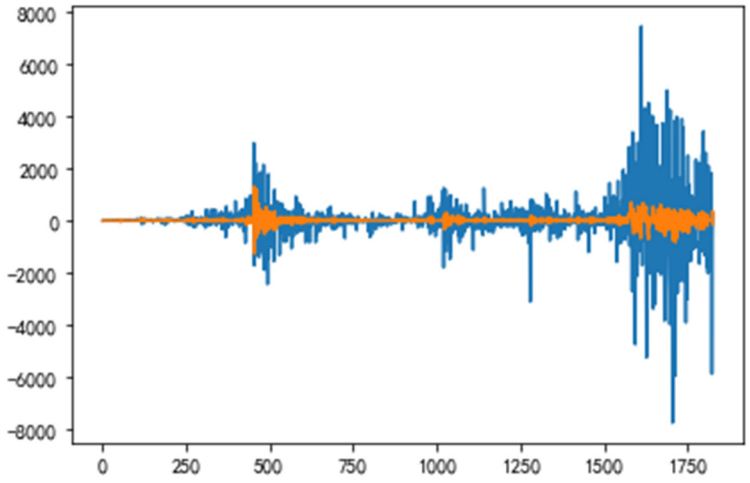
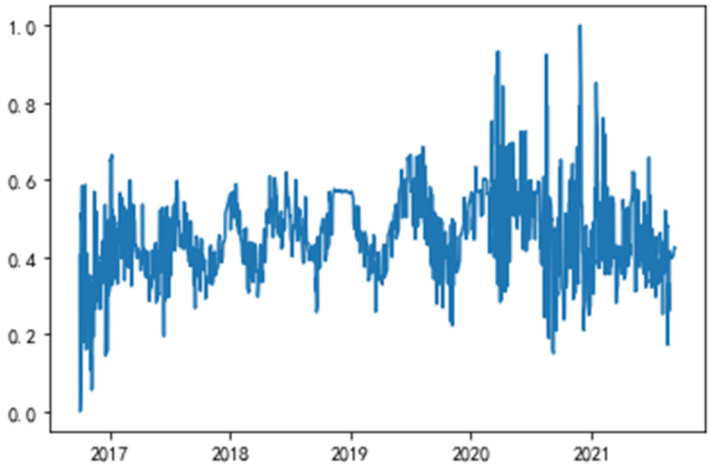


Figure 12. Predicts bitcoin gains

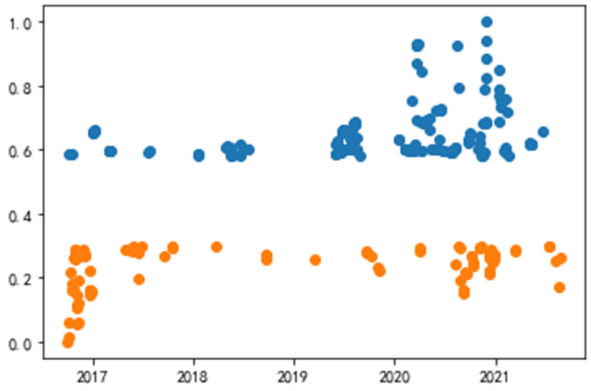
On this basis, the purchase score was calculated and the gold and Bitcoins were drawn (see Figure 13 and Figure 14):

Buy score = gain X10 + bull market X5-residuals + 1 / buy risk



(a)

ISSN: 2688-9323



(b)

Figure 13. Gold Buy score chart

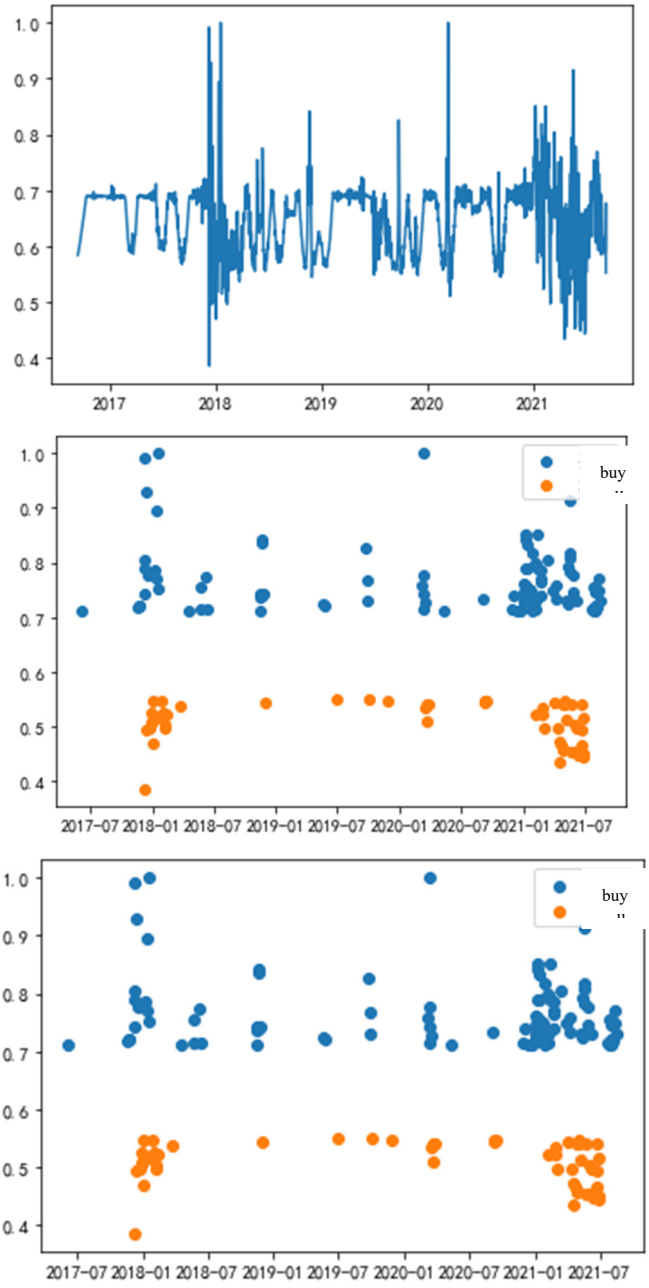


Figure 14. Bitcoin buy score chart

ISSN: 2688-9323

Combining the above analysis yields the optimal trading strategy as follows:
To start buying and selling, note the following matters:
Buy gold score greater than 0.58, less than 0.3, Bitcoin score greater than 0.71, less than 0.56, gold purchase standard is 0.58, selling standard is 0.3; Bitcoin purchase standard is 0.71, selling standard is 0.56;
Trading rules;
To judge whether it is a golden trading day is to consider gold, not to consider gold;
When bitcoin and gold can be bought simultaneously, if the gold buy score is-0.58> (Bitcoin buy score-0.71) X2 (gold score is lower than bitcoin, more room to rise);
Purchase Amount = Current Cash Line X Purchase Score X (1-handling fee) / Current price;
Sales Amount = Holding Share * (1-score + sales standard)

5.4. Calculation of Investment Value

See Figure 15 for the results of the total asset value calculation.

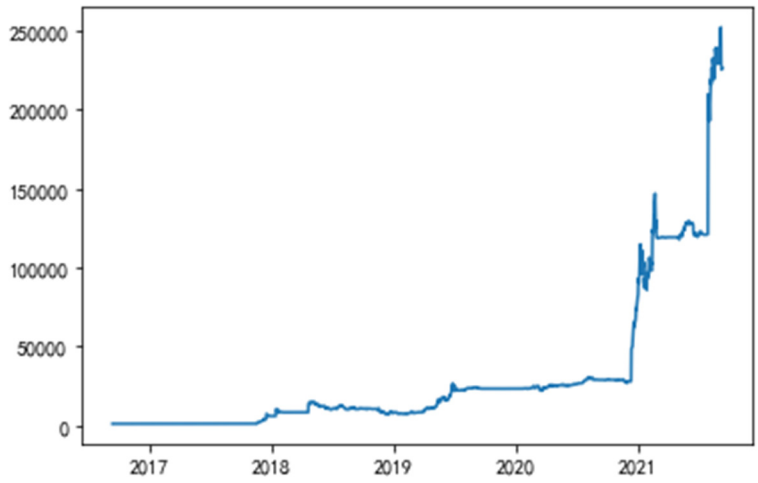


Figure 15. Value of total assets

Finally, based on the above model and strategy, the maximum total asset value of the initial investment of $1,000 was $250,000 on September 10,2021.

6. Problem II Evidence Which Supporting Model

6.1. Explain the Rationality of the Hypothesis Method

The trading strategy given above is a comprehensive consideration based on the combination of risk and profit. for question 2, we use the hypothesis method to illustrate the given model as the optimal strategy.
In practice, we find that there is a huge difference between actual profit and theoretically simulated profit. Assuming only buying bitcoin, the final theoretical maximum gain under all ideal conditions is $3,58,499.29,00835,003.However, in reality, investors face huge risks, and as a rational investor will not choose too risky decisions. On the contrary, assuming only considering minimizing the risk, investors only buy gold, the maximum theoretical income gain is only $7,357.4500000000,023. the maximum return under this decision is far lower than investors' psychological expectations, and investors will not make such decisions. In addition, no one can buy and sell at the most appropriate point every time, and then this theory of maximum income does not exist.
Therefore, the final conclusion is that in order to make the best trade decision, the risks and profits must be considered comprehensively, and the model we have established accordingly is

ISSN: 2688-9323

reasonable.

7. Determination of Three Sensitivity

7.1. Impact of Transaction Cost Change on the Strategy

Discuss the impact of transaction cost change on the results, and the percentage change range of gold transaction cost is: 0.01-0.11, and the percentage change range of bitcoin transaction amount is: 0.01-0.21.

At the same time, the trading rules of the above Question 1 are still followed: buy gold score greater than 0.58, selling at less than 0.3, buy at Bitcoin score greater than 0.71, sell less than 0.56, gold purchase standard 0.58, and selling standard 0.3.

Finally, chart the maximum total assets at different transaction costs. (As shown in Figure 16)

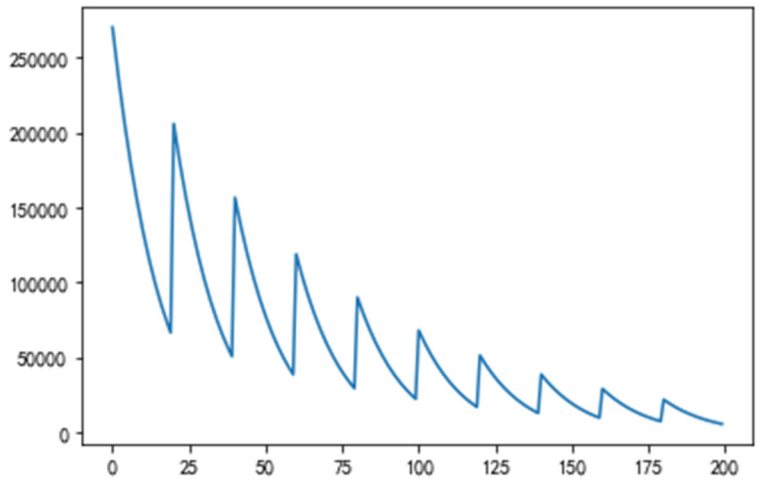


Figure 16. Maximum Total Assets chart

7.2. Impact of Transaction Cost on Transaction Results

Combined with the above chart of total assets under different transaction costs, the calculation results of maximum total asset value are taken from the top four to Table 2.

Table 2. The calculation results

	gold commission	Bitcoin commission	Total assets
0	0.01	0.01	270048.051325
1	0.01	0.02	252424.698239
2	0.01	0.03	235802.096407
3	0.01	0.04	220131.941916
4	0.01	0.05	205367.852276

8. Problem Ⅳ Memorandum

For the two financial products given the topic, the first need to make clear that the investment strategy is a prediction of the future uncertain market. Therefore, to develop the best investment strategy, we need to build a prediction model for the future market first. Then predict the results with the model to determine the investment amount and make buying and selling decisions.

This paper uses the data given in the attachment to analyze the increase, and takes the 15-day average increase of gold and the 5-day average increase of bitcoin as the basis for judging the bull and bear market. this article stipulates that:

ISSN: 2688-9323

Rate = (Current Price-n AM) / n Am

Bull market assessment index = the first 90-day average x0.666+ gold 15-day divergence rate of the first 90-day average x0.333

(The average greater than the bull market assessment index is a bull market and less than a bear market.)

Next, we conducted the risk analysis and Arima time series prediction, and developed the corresponding scoring criteria:

Buy score = gain X10 + bull market X5-residuals + 1 / buy risk

Then, develop our trading strategy based on the ratings calculated above:

1. It should be bought when gold score is greater than 0.58, sold below 0.3; bought when Bitcoin score is greater than 0.71, sold below 0.56, namely gold buying standard is 0.58 and selling standard is 0.3.

2. Judge whether it is a gold trading day, if so, consider whether gold is traded, and if not, gold is not considered.

3. When bitcoin and gold can be bought simultaneously, if the gold buy score is-0.58> (Bitcoin buy score-0.71) X2, the gold score is lower than bitcoin, and there is more room to rise.

4. Formulate purchase amount: purchase amount = current cash amount X purchase score X (1-handling fee) / current price.

5. Formulate selling quota: selling quota = holding share * (1-score + selling standard).

Finally, under this strategy, the maximum total asset value obtained is $250,000.

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