

MACD Algorithm Research and MACD Expert System Application Analysis

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Abstract

This paper takes the MACD algorithm as the research object, analyzes the MACD algorithm in detail, and conducts research on its application in practice. With 2020.08.24 as an important time point, three variables X_1 , X_2 , and X_3 are defined, and a test plan is set based on the classic theory of Gerd Appel. The MACD expert system calculates that: in the first time period, the variables X_1 , X_2 , and X_3 are 57.59%, 20.37%, and 37.35%, respectively; the variables X_2 , and X_3 are all positive values. In the second time period, the variables X_1 , X_2 , and X_3 are respectively: 45.68%, 1.90%, and 1.74%; the variables X_2 , and X_3 are all positive values. In the third time period, the variables X_1 , X_2 , and X_3 are respectively: 53.54%, 16.63%, and 45.74%; the variables X_2 , and X_3 are all positive values. The variable X_2 of the first time period takes the maximum value, and the variable X_3 of the third time period takes the maximum value. Empirical analysis shows that after 2020.08.24, the exponential function does not become a waveform decreasing function. The theoretical and practical analysis shows the effectiveness of the MACD algorithm.

Keywords

MACD expert system; Empirical analysis; Registration system; Computing science.

1. Introduction

The GEM pilot registration system reform was launched. On April 27, 2020, the 13th meeting of the Central Comprehensive Deepening Reform Committee reviewed and approved the "General Implementation Plan for the ChiNext Reform and Pilot Registration System", emphasizing the promotion of the ChiNext reform and the pilot registration system. It is an important arrangement for deepening the reform of the capital market, improving the basic system of the capital market, and enhancing the function of the capital market. The passage of this plan means that the reform of the pilot registration system for the Growth Enterprise Market has officially started. The China Securities Regulatory Commission immediately announced the implementation of the reform plan, and the "Administrative Measures for the Registration and Management of Initial Public Offerings on the Growth Enterprise Market (for Trial Implementation)", "Administrative Measures for the Registration and Management of Securities Issuance of Companies Listed on the Growth Enterprise Market (for Trial Implementation)" and "Measures for the Continuous Supervision of Listed Companies on the Growth Enterprise Market (for Trial Implementation)" The draft and the revised draft of the "Administrative Measures for Securities Issuance and Listing Sponsor Business" are open to the public for comments. The relevant person in charge of the China Securities Regulatory Commission stated that the pilot registration system reform for the GEM adheres to "one main line, three overall plans." "One main thread" is a stock issuance registration system with information disclosure as the core, which improves transparency and authenticity. Investors make independent value judgments and truly give the market the right to choose. "Three

overall plans": First, promote the reform of the Growth Enterprise Market and the construction of a multi-level capital market system, adhere to the strategic development of the Growth Enterprise Market and other sectors, and form an appropriate competitive landscape with different focuses and complement each other; the second is to coordinate the promotion of the registration system and Other basic system construction, implement a package of reform measures, and improve supporting systems; the third is to coordinate incremental reforms and stock reforms, accommodate stock reforms, stabilize stock listed companies and investor expectations, and implement reforms steadily [1-2].

After Jianbo's Zhang (2020) registration system and the new trading system are implemented on August 24, 2020, market volatility will increase, which will benefit securities firms and venture capital companies. In the long run, the implementation of the registration system will, on the one hand, set off a climax of direct financing: a new wave of direct financing from the capital market to replace creditor bank financing. Following the sci-tech innovation board, the exit channels for technology companies and start-up companies have been expanded again. The combination of the two forms the wealth effect of innovation and entrepreneurship, and encourages more social resources to tilt towards technological innovation companies and start-up companies. The two sectors jointly build China's "Nasdaq" and boost the growth of China's Silicon Valley! As a global innovation, humanities, and ecological city, it acts as the "engine" of innovation and entrepreneurship [3].

Zhongming Cao (2020), judging from the performance of the ChiNext in the first week, the stock stocks have begun to implement a 20% limit on the rise and fall, which has led to more active trading on the ChiNext and high market sentiment. For example, in terms of turnover, the average daily turnover on the Growth Enterprise Market in the first week was 258 billion yuan. Even after excluding new shares, the average daily turnover was as high as 235.8 billion yuan, which was significantly higher than the 174.6 billion yuan in the previous week. For example, on August 25, the turnover of 846 stocks on the Growth Enterprise Market was 271.3 billion yuan, accounting for 46.28% of the turnover of more than 2280 stocks in Shenzhen Stock Exchange, and even exceeded the 262.3 billion yuan of the constituent stocks of the Shanghai and Shenzhen 300 Index that day. In terms of stock price fluctuations, more obvious changes have also occurred after the implementation of the new trading system. Excluding the factor of 18 new stocks, the average daily amplitude of stock stocks on the ChiNext in the first week was 6.6%, compared with 4.98%, 4.75% and 4.2% in the previous three weeks. The data shows that before the implementation of the new trading system, the average daily amplitude of the ChiNext was relatively stable, but it was significantly enlarged after the implementation of the new rules. The GEM implements a differentiated trading system with a new trading system, which further enlarges the profitability of the market and also enlarges the investment risk of the market [4].

The Longwo (2020) Growth Enterprise Market Component Index (399006) is on a "monitor" (monitor) on a similarly weak head and shoulders. The recent strength of the ChiNext Composite Index is due to the speculation of low-priced stocks, while ChiNext stocks with larger market capitalizations have weakened. The four largest stocks with market capitalization are Ningde Times (300750), Mindray Medical (300760), and Oriental Fortune (300059). And Zhifei Bio (300122) both peaked in July. According to data from the Shenzhen Stock Exchange website, the current GEM market value is RMB 9.57 trillion, with an average price-to-earnings ratio of 58.9 times. The turnover on Thursday was 253.2 billion, while the Shanghai Stock Exchange website indicated that the A-share transaction value of the main board of the Shanghai Stock Exchange was only 245.6 billion. In any case, investors should not expect a bigger bull market on the ChiNext, and the market will not repeat the tragic crash of 2015 [5].

2. Data and Model

It has been 11 months since China's Growth Enterprise Market implemented the new trading system on August 24, 2020. Now we use the classic Geral Appel theory and MACD (Moving Average Convergence and Divergence) index to demonstrate Analyze the ChiNext market.

First, define three variables: X_1 =winning rate, X_2 =annual rate of return, X_3 =net profit rate.

MACD mathematical formula:

$$\text{MACD} = 12\text{-daysEMA} - 26\text{-daysEMA} \tag{1}$$

Index Mean Index (Exponential Moving Average) EMA mathematical formula:

$$\text{EMA}_{\text{today}} = \frac{p_1 + (1-\alpha)p_2 + (1-\alpha)^2 p_3 + (1-\alpha)^3 p_4 + \dots}{1 + (1-\alpha) + (1-\alpha)^2 + (1-\alpha)^3 + \dots} \tag{2}$$

$$\alpha = \frac{2}{N+1}$$

N is the number of cycles

Where $p_i (i = 1, 2, \dots, n)$ is the closing price of the first i day, n is the number of moving average periods

$$\text{DIF} = \text{EMA (SHORT)} - \text{EMA (LONG)} \tag{3}$$

MACD system test source code

LONG 10 200 26

SHORT 2 200 12

M 2 200 9

DIFF:=EMA(CLOSE,SHORT) - EMA(CLOSE,LONG);

DEA := EMA(DIFF,M);

MACD := 2*(DIFF-DEA);

ENTERLONG:CROSS(MACD,0);

EXITLONG:CROSS(0,MACD);

Testing time:

(i) 2018.10.18~2020.08.24;

(ii) 2020.08.24~2021.07.20;

(iii) 2018.10.18~2021.07.20;

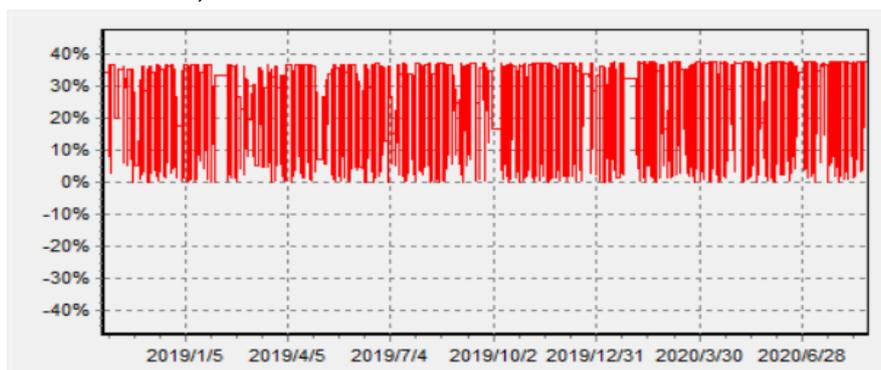


Figure 1. Yield curve in the first time period

Table 1. 2018.10.18~2020.08.24 test data table

| | |
|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| System test settings | |
| Test method: stock selection formula-MACD buy | |
| Test time: 2018/10/18 — 2020/8/24 Excluding forced liquidation | |
| Test stocks: 980 stocks in total | Initial investment: 1,000,000.00 yuan |
| Buying conditions: | |
| One of the following groups is established: | |
| 1. The following conditions are met at the same time | |
| 1.1 Stock selection formula: MACD buy (26,12,9) [daily line] | |
| When the conditions are met: According to the middle price: the closing price is used to buy with all funds | |
| When a continuous signal appears: no longer buy | |
| Selling conditions: no selling conditions | |
| Closing conditions: (close the position at the closing price) | |
| Index stock picking: stock picking formula: MACD sell (12,26,9) [daily] | |
| System test summary | |
| Number of tested stocks: 980 | |
| Annual return: 20.37% | Annual transactions: 3,513.82 |
| Win rate: 57.59% | Success rate: 57.59% |
| Average profit: 56,824.23 yuan | Average annual signal number: 7,242.55 times |
| Maximum single profit: 3,239,091.00 yuan | Maximum single loss: -794,445.00 yuan |
| Number of transactions: 6442 | Number of profitable transactions: 3710 (57.59%) |
| Net profit: 366,061,696.00 yuan | Net profit margin: 37.35% |
| Simple holding net profit: 841,797,376.00 yuan Simple holding net profit rate: 85.90% | |
| Ideal model net profit: 4.90743470379703195E22 yuan | |
| Ideal model net profit margin: 5,007,586,659,139,584.00% | |

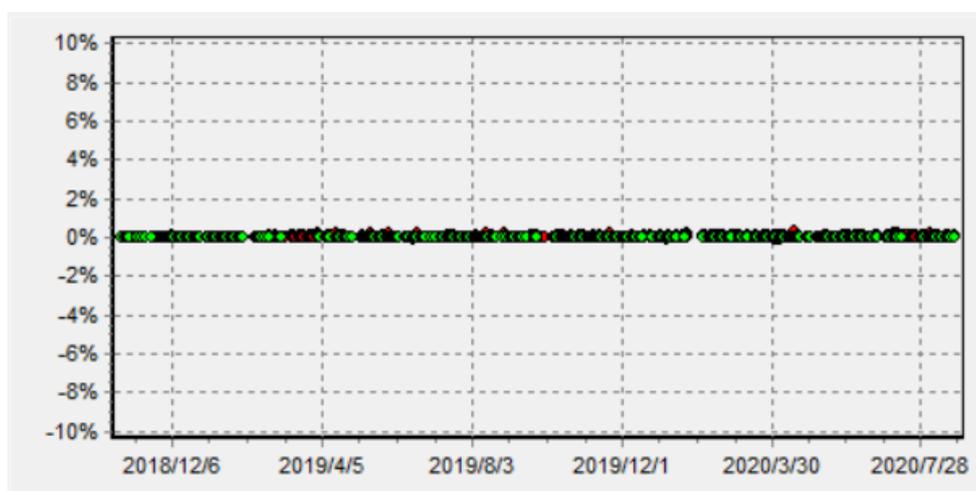


Figure 2. Number of transactions in the first time period

Table 2. 2018.10.18~2020.08.24 test result statistics table

| Win rate X_1 | Annual return X_2 | Net profit margin X_3 | Annual transactions | Remark |
|----------------|---------------------|-------------------------|---------------------|--------|
| 57.59% | 20.37% | 37.35% | 3,513.82 | |

Table 3. 2020.08.24~2021.07.20 test data table

| |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>System test settings</p> <p>Test method: stock selection formula-MACD buy</p> <p>Test time: 2020/8/24 — 2021/7/20 Excluding forced liquidation</p> <p>Test stocks: 980 stocks in total Initial investment: 1,000,000.00 yuan</p> <p>Buying conditions:</p> <p>One of the following groups is established:</p> <p>1. The following conditions are met at the same time</p> <p>1.1 Stock selection formula: MACD buy (26,12,9) [daily line]</p> <p> When the conditions are met: According to the middle price: the closing price is used to buy with all funds</p> <p> When a continuous signal appears: no longer buy</p> <p>Selling conditions: no selling conditions</p> <p>Closing conditions: (close the position at the closing price)</p> <p>Index stock picking: stock picking formula: MACD sell (12,26,9) [daily]</p> <p>System test summary</p> <p>Number of tested stocks: 980</p> <p> Annual return: 1.90% Annual transactions: 4,217.45</p> <p> Win rate: 45.68% Success rate: 45.68%</p> <p> Average profit: RMB 4,406.15 Average annual signal number: 8,976.00 times</p> <p>Maximum single profit: 2,552,341.00 yuan Maximum single loss:-1,146,524.25 yuan</p> <p>Number of transactions: 3866 Number of profitable transactions: 1766 (45.68%)</p> <p> Net profit: 17,034,176.00 yuan Net profit margin: 1.74%</p> <p>Simple holding net profit: -5,271,206.00 yuan Simple holding net profit rate: -0.54%</p> <p> Ideal model net profit: -4.88534346746455654E19 yuan</p> <p> Ideal model net profit margin: -4,985,044,598,784.00%</p> |
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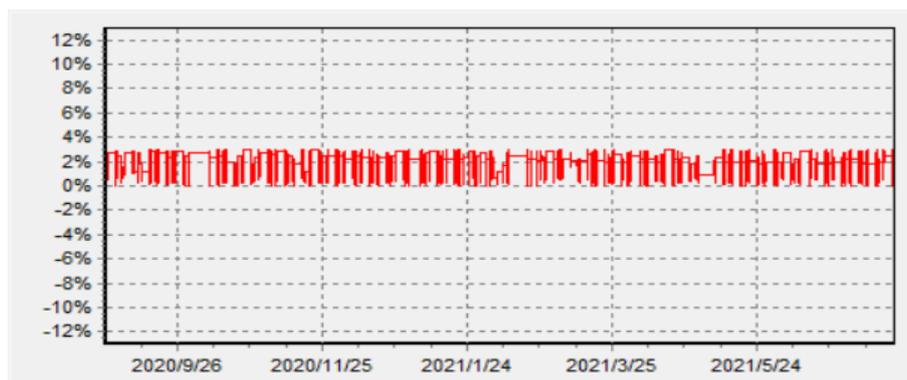


Figure 3. Yield curve in the second time period

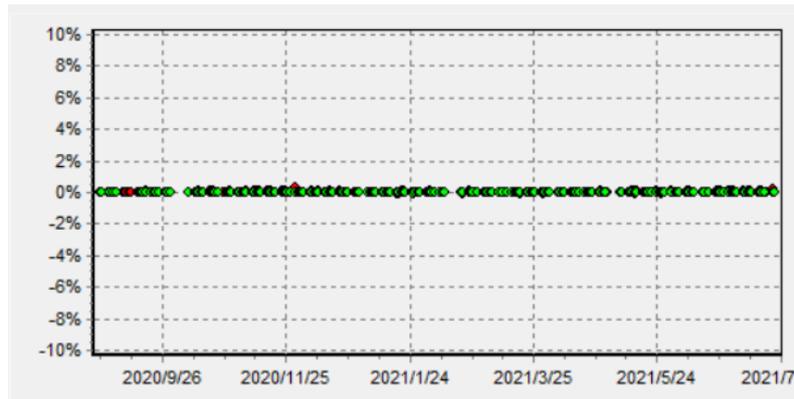


Figure 4. Number of transactions in the second time period

Table 4. Statistics of test results from 2020.08.24 to 2021.07.20

| Win rate X_1 | Annual return rate X_2 | Net profit rate X_3 | Number of transactions in a year | Remark |
|----------------|--------------------------|-----------------------|----------------------------------|--------|
| 45.68% | 1.90% | 1.74% | 4,217.45 | |

Table 5. 2018.10.18~2021.07.20 test data table

| | |
|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| System test settings | |
| Test method: stock selection formula-MACD buy | |
| Test time: 2018/10/18 — 2021/7/20 Excluding forced liquidation | |
| Test stocks: 980 stocks in total | Initial investment: 1,000,000.00 yuan |
| Buying conditions: | |
| One of the following groups is established: | |
| 1. The following conditions are met at the same time | |
| 1.1 Stock selection formula: MACD buy (26,12,9) [daily line] | |
| When the conditions are met: According to the middle price: the closing price is used to buy with all funds | |
| When a continuous signal appears: no longer buy | |
| Selling conditions: no selling conditions | |
| Closing conditions: (close the position at the closing price) | |
| Index stock picking: stock picking formula: MACD sell (12,26,9) [daily] | |
| System test summary | |
| Number of tested stocks: 980 | |
| Annual return: 16.63% | Annual transactions: 3,806.91 |
| Win rate: 53.54% | Success rate: 53.54% |
| Average profit: RMB 42,818.05 | Average annual signal number: 7,796.73 times |
| Maximum single profit: 3,955,460.00 yuan | Maximum single loss: -2,339,210.50 yuan |
| Number of transactions: 10469 | Number of profitable transactions: 5605 (53.54%) |
| Net profit: 448,262,144.00 yuan | Net profit margin: 45.74% |
| Simple holding net profit: 1,723,179,392.00 yuan Simple holding net profit rate: 175.83% | |
| Ideal model net profit: 7.41915886925604266E22 yuan | |
| Ideal model net profit margin: 7,570,570,275,192,832.00% | |

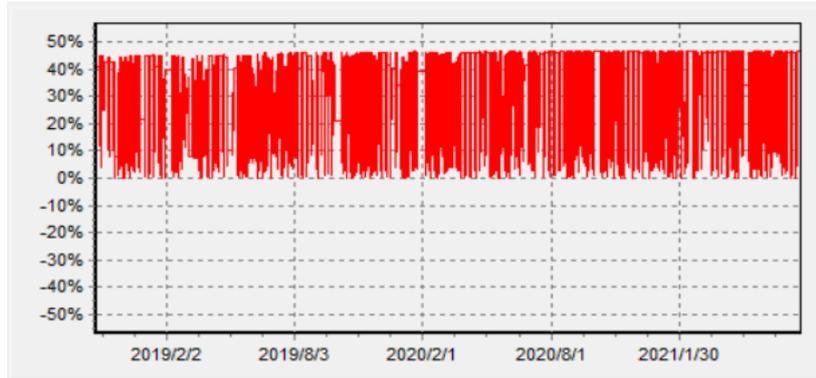


Figure 5. Yield curve in the third time period

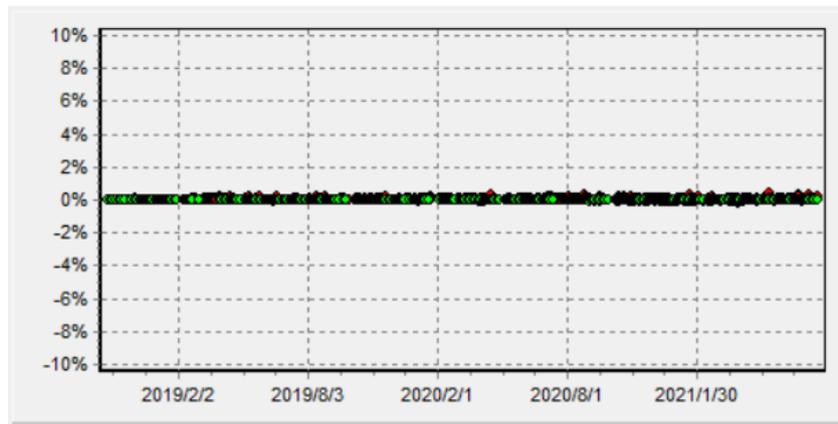


Figure 6. Number of transactions in the third time period

Table 6. 2020.08.24~2021.07.20 test result statistics table

| Win rateX1 | Annual return rateX2 | Net profit rateX3 | Number of transactions in a year | Remark |
|------------|----------------------|-------------------|----------------------------------|--------|
| 53.54% | 16.63% | 45.74% | 3,806.91 | |

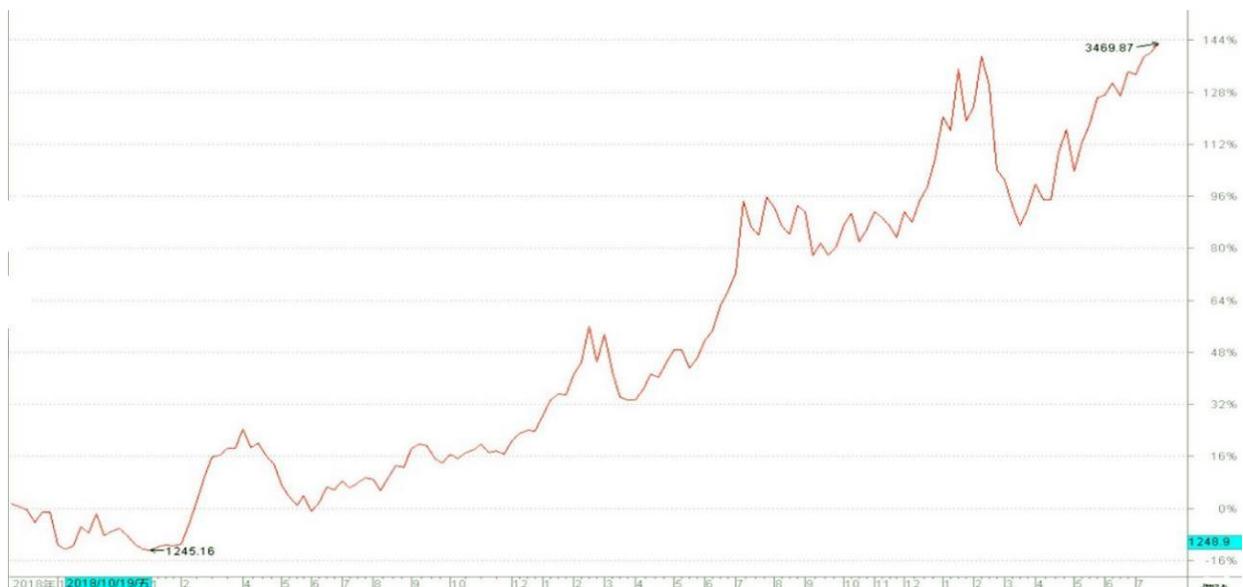


Figure 7. The Growth Enterprise Market Index Curve

3. Conclusion

From the above calculation results, we can see that for the first time period from 2018.10.18 to 2020.08.24, the winning rate is X_1 , the annual rate of return is X_2 , and the net profit rate X_3 is 57.59%, 20.37%, and 37.35%; the annual rate of return is X_2 and the net profit rate is X_3 . All are positive values. For the second time period from 2020.08.24 to 2021.07.20, the winning rate is X_1 , the annual rate of return is X_2 , and the net profit rate is X_3 : 45.68% 1.90%, 1.74%; the annual rate of return X_2 and net profit rate X_3 are all positive. In the third time period from 2018.10.18 to 2021.07.20, the winning rate X_1 , the annual return rate X_2 , and the net profit rate X_3 are 53.54%, 16.63%, and 45.74% respectively; the annual return rate X_2 and the net profit rate X_3 are all positive. The above results show that no matter what time period, the MACD expert system can obtain positive returns. It can be seen from comparison that the annual return rate X_2 in the first time period achieves the maximum value, and the net profit rate X_3 in the third time period achieves the maximum value. It can be seen from Figure 7 that the ChiNext Index did not drop sharply after 2020.08.24, but set a new high after strong consolidation.

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