

Research on Algorithm and Application of Counter-trend RSI Expert System

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Abstract

This article analyzes the mathematical model of the RSI expert system, and uses the mathematical model as the theoretical basis for application analysis in practice. With 2020.08.24 as an important time point, three variables X1, X2, and X3 are defined. Based on Welles Wilder's classic theory, three test plans are set. According to the calculation of the RSI expert system, in the three test periods, the variables X2 are: 1.53%, 42.93%, 2.60%, 1.32%, 15.90%, 2.97%, 1.48%, 40.47%, 3.13%; the variables X3 are respectively: 2.81%, 78.71%, 4.77%, 1.21%, 14.58%, 2.72%, 4.06%, 111.29%, 8.59%; all positive values. The above results show that no matter what the scheme, any time period, the positive maximum value can be obtained according to the RSI expert system, among which scheme 2 is the best. The variable X3 takes the maximum value in the third time period. The mathematical model of the RSI expert system has been well verified in practice.

Keywords

RSI Expert System; Big Data; Data Analysis; Computing Science.

1. Introduction

On April 27, 2020, the 13th meeting of the Comprehensive Deepening Reform Committee of the Central Committee of China reviewed and approved a number of major reform plans including the "General Implementation Plan for the Reform of the Growth Enterprise Market and the Pilot Registration System" (hereinafter referred to as the "General Plan"). The China Securities Regulatory Commission and the Shenzhen Stock Exchange (hereinafter referred to as the Shenzhen Stock Exchange) respectively conducted official interpretations. The major official media and cyberspace quickly interpreted it from different angles. In order to implement the "Overall Plan", the China Securities Regulatory Commission publicly solicited opinions from the public on the "Regulations for the Registration and Management of Initial Public Offerings on the Growth Enterprise Market (Trial)" and other four regulations. The Shenzhen Stock Exchange issued and implemented one rule and solicited public opinions on eight major rules, covering aspects such as the review of the issuance and listing of the ChiNext, securities trading, and continuous supervision. Following the Science and Technology Innovation Board, the GEM has officially become the second registration system for A-shares in accordance with the new version of the Securities Law that was formally implemented on March 1, 2020. When the new crown pneumonia epidemic hits the global economy, the implementation of the registration system on the Growth Enterprise Market, one of the main financing channels for SMEs, will help greatly alleviate the financing difficulties of enterprises, especially technology-based SMEs, increase the proportion of direct financing, and dredge liquidity, To help the development of the real economy; at the same time, it is also a key opportunity to promote the process of comprehensive registration system reform and seek "opportunities" in "crisis". In general, the pilot registration system reform for the Growth Enterprise Market adheres to "one main line, three overall plans." "One main thread": a stock issuance registration system with information disclosure as the core. "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].

Li Yongsen (2021) In 2021, the system construction will continue to play the role of the capital market as a basic guarantee, and promote the construction of the capital market's basic system. First, fully implement the new "Securities Law" and speed up the legislative process of the futures law; second, complete the formulation and improvement of the supporting system of the "Criminal Law Amendment (11)", revise and improve the standards for prosecution of criminal cases, and improve the punishment mechanism , Strengthen deterrence; third, comprehensively promote the reform of the registration system, give full play to the basic guarantee role of system construction, firmly adhere to the core of information disclosure, continue to improve and optimize the registration system of the science and technology innovation board and the growth enterprise board, and further improve the market transaction mechanism. Further reform the system of price limits and T+1 revolving transactions; fourth, strengthen investor protection mechanisms, optimize various institutional investment systems, and promote the conversion of household savings to investment; fifth, implement the results of the new three board reforms and improve differentiation System, Shanghai Stock Exchange, Shenzhen Stock Exchange, National Equities Exchange and Clearing Corporation, China Settlement, etc. will do a good job in the formulation or revision of supporting business rules related to the transfer mechanism, and further clarify and refine various specific institutional arrangements [3].

Shi Yunjin (2020) From August 24, 2020, after the implementation of the ChiNext registration system reform and the implementation of the new trading system, the trading system reform of the stock part may have a greater impact on the market in the short term. From the historical experience of trading system changes, the trading system reform Will lead to increased market volatility. There have been three changes to the trading system in the history of China's A-shares: December 1996; March 2010 and April 2010; these three changes in the trading system in history have all triggered increased market volatility. The three-time trading system changed the previous period. The market has seen a significant rise, while valuations are relatively high, and ultimately a sharp downward adjustment in the short term. After the first two trading system changes, the market eventually followed the original upward trend and reached new highs [4].

Gui Haoming (2020) believes that changes in the trading system will not change market trends. After the reform of the GEM trading system, the volatility of some stocks has been significantly enlarged, and some of them have experienced violent fluctuations, showing strong signs of excessive speculation. Therefore, in actual operation, the ChiNext will divert funds from the Sci-tech Innovation Board and other sectors to a certain extent, forming an irrational differentiation pattern among the sectors. Therefore, changes in the trading system have an impact on the market. The problem is that this impact is local and short-lived, rather than trending. But from the law, it should be said that it is completely controllable [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 Welles Wilder theory and the RSI (Relative Strength Index) index to empirically analyze this Growth Enterprise Market.

RSI (Relative Strength Index) index mathematical formula:

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

RSI (Relative Strength Index) index mathematical formula:

$$RSI = \frac{100 \times RS}{1 + RS} \tag{1}$$

$$RS = \frac{\text{Average Rise Point in } i \text{ days}}{\text{Average Dropped Point in } i \text{ days}} \quad (i = 1, 2, \dots, n) \tag{2}$$

Based on the classic theory of Welles Wilder, three test schemes are designed:

- (i) Buy when RSI14DAY crosses 20. When RSI14DAY is greater than 60, sell.
- (ii) Buy when RSI14DAY crosses 50. When RSI14DAY breaks below 70, sell.
- (iii) Buy when RSI14DAY crosses 20. When RSI14DAY breaks below 70, sell.

RSI system test source code

```
N1 1 100 14
LL 0 40 20
LH 60 100 80
LC := REF(CLOSE,1);
RSI:SMA(MAX(CLOSE-LC,0),N1,1)/SMA(ABS(CLOSE-LC),N1,1)*100,colorwhite;
ENTERLONG:CROSS(RSI,LL);
EXITLONG:CROSS(LH,RSI).
```

Testing time:

- (i) 2018.10.18~2020.08.24;
- (ii) 2020.08.24~2021.07.20;
- (iii) 2018.10.18~2021.07.20;

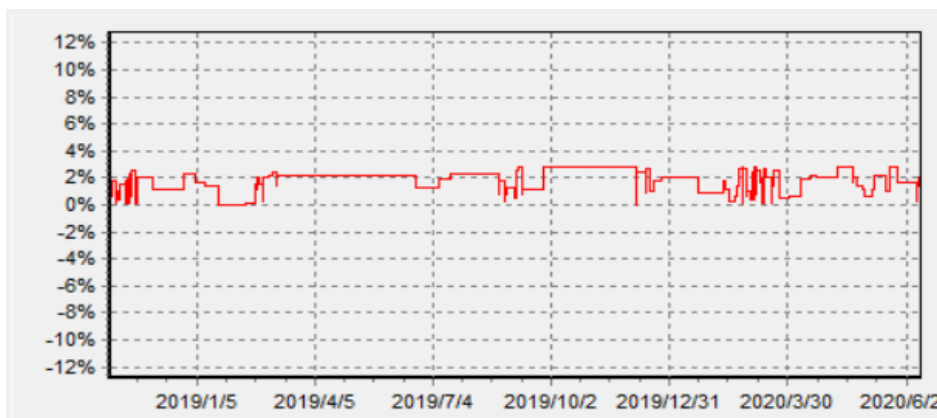


Figure 1. The first time period option 1 Yield curve

Table 1. 2018.10.18-2020.08.24 Plan 1 test data table

System test settings	
Test method: technical index-RSI14	
testing time:2018/10/18 — 2020/8/24 Excluding forced liquidation	
Test stocks: 980 in total	Initial investment: 1,000,000.00 yuan
Buying conditions:	
One of the following groups is established:	
The following conditions are met at the same time	
1.1 Technical indicators: RSI14 (14) indicator line WP crosses 20 [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)	
Indicator stock selection: Technical indicators: RSI14 (14) indicator line WP is greater than 60 [daily line]	
System test summary	
Number of test stocks:	980
Annual rate of return:	1.53%
Annual transactions:	97.09
Win rate:	89.89%
Success rate:	89.39%
Average profit:	154,648.45yuan
Annual average number of signals:	195.27 times
Maximum single profit:	456,683.19 yuan
Maximum single loss:	-175,463.25 yuan
Number of transactions:	178
Number of profitable transactions:	160 (89.89%)
Net profit:	27,527,424.00 yuan
Net profit margin:	2.81%
Simple holding net profit: 1,678,322,944.00 yuan Simple holding net profit rate: 171.26%	
Ideal model net profit: 9.80997759767881408E22 yuan	
Ideal model net profit margin: 10,010,181,492,539,392.00%	

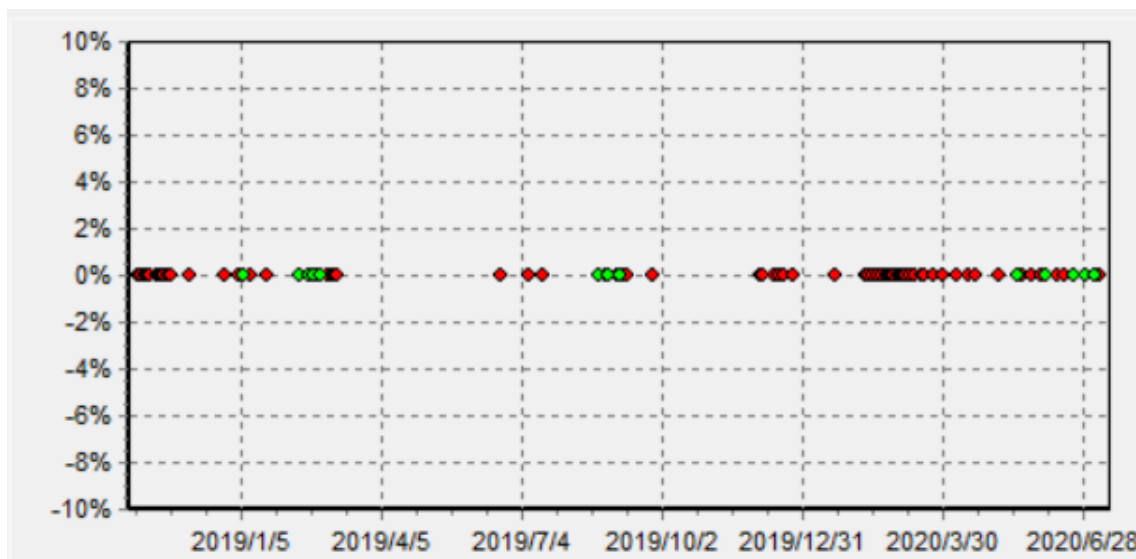


Figure 2. The number of transactions in Plan 1 during the first time period

Table 2. 2018.10.18~2020.08.24 Scheme 2 test data table

Test method: technical index-RSI14	
Test time: 2018/10/18 — 2020/8/24 Excluding forced liquidation	
Test stocks: 980 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. Technical indicators: RSI14 (14) indicator line WP crosses 50 [daily]	
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)	
Indicator stock selection: Technical indicators: RSI14 (14) indicator line WP breaks below 70 [daily line]	
System test summary	
Number of tested stocks: 980	
Annual return: 42.93%	Annual transactions: 1,819.09
Win rate: 82.70%	Success rate: 80.64%
Average profit: 231,290.52 yuan	Average annual signal number: 4,111.09 times
Maximum single profit: 5,047,715.50 yuan	Maximum single loss: -1,133,283.63 yuan
Number of transactions: 3335	Number of profitable transactions: 2758 (82.70%)
Net profit: 771,353,856.00 yuan	Net profit margin: 78.71%
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%	

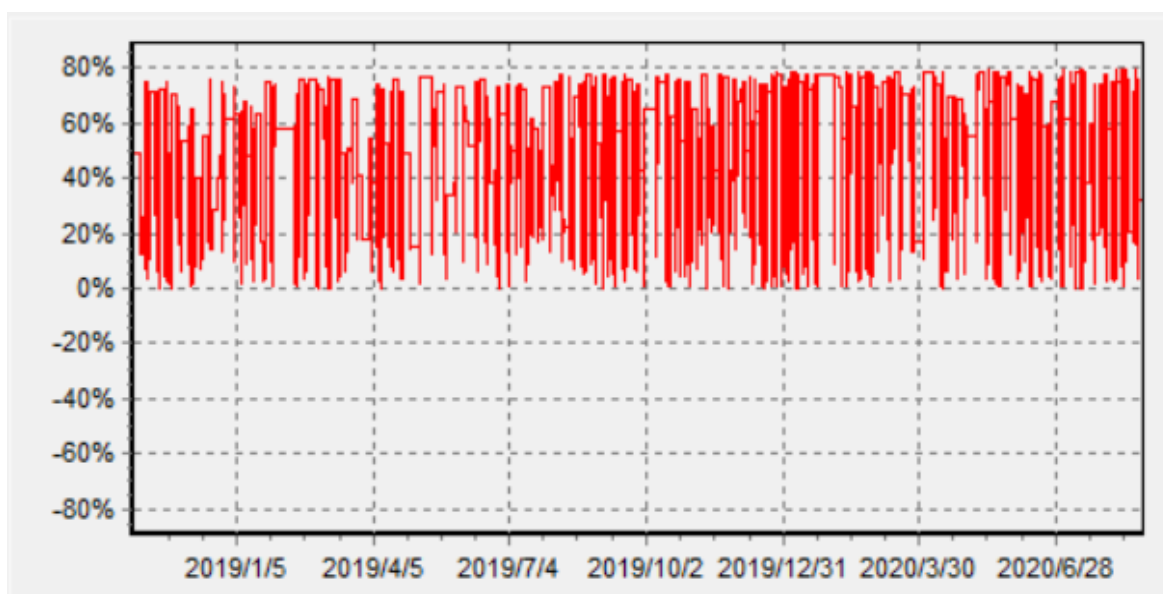


Figure 3. Yield curve of Option 2 during the first time period

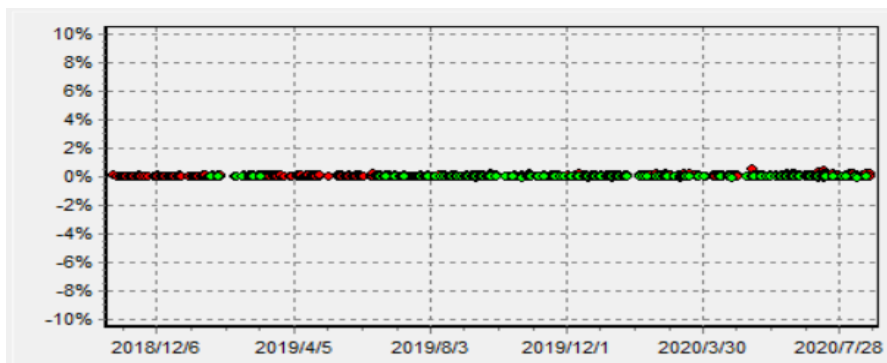


Figure 4. Number of transactions for Option 2 during the first time period

Table 3. 2018.10.18~2020.08.24 Scheme 3 test data table

System test settings Test method: technical index-RSI14	
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 Technical indicators: RSI14 (14) indicator line WP crosses 20 [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)	
Indicator stock selection: Technical indicators: RSI14 (14) indicator line WP breaks below 70 [daily line]	
System test summary	
Number of tested stocks: 980	
Annual return: 2.60%	Annual transactions: 90.55
Win rate: 92.77%	Success rate: 92.26%
Average profit: 281,701.78 yuan	Average annual signal number: 187.09 times
Maximum single profit: 1,345,876.00 yuan	Maximum single loss: -237,197.77 yuan
Number of transactions: 166	Number of profitable transactions: 154 (92.77%)
Net profit: 46,762,496.00 yuan	Net profit margin: 4.77%
Simple holding net profit: 2,514,848,768.00 yuan Simple holding net profit rate: 256.62%	
Ideal model net profit: 1.47125114843613415E23 yuan	
Ideal model net profit margin: 15,012,767,199,133,696.00%	

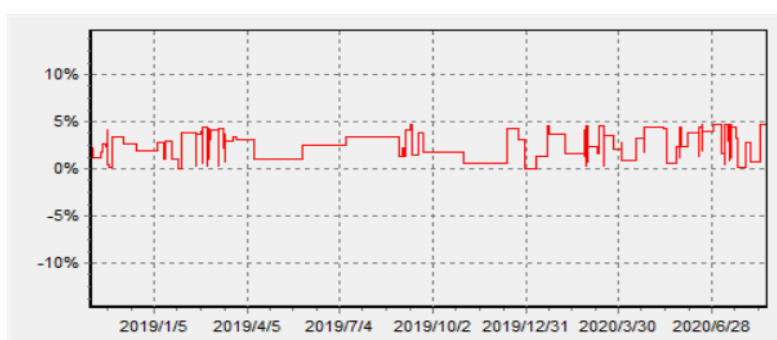


Figure 5. The first time period option 3 Yield curve

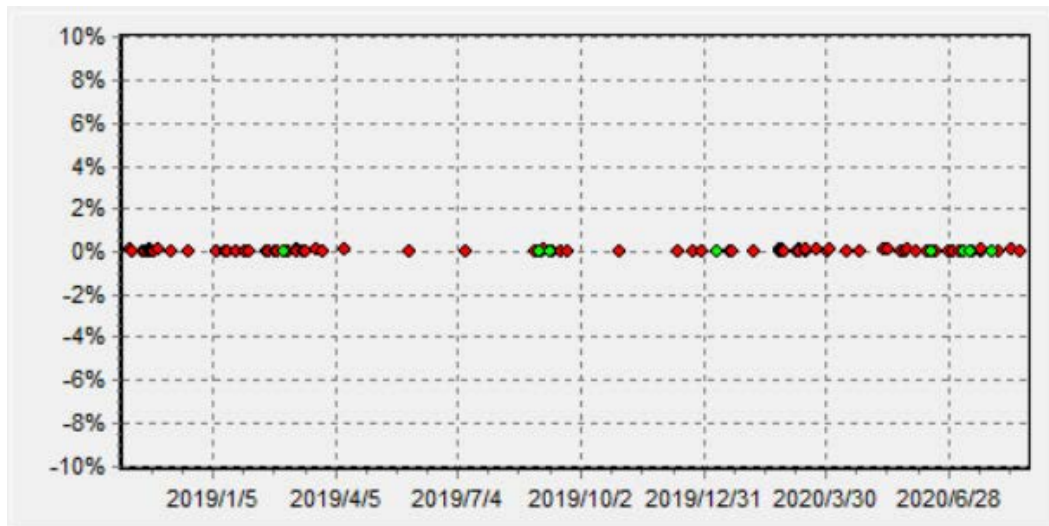


Figure 6. The number of transactions in the first time period Plan 3

Table 4. 2018.10.18~2020.08.24 test results statistics table

	Win rate X1	Annual rate of return X2	Net profit rate X3	Annual transactions	Remark
Plan 1	89.89%	1.53%	2.81%	97.09	
Plan 2	82.70%	42.93%	78.71%	1,819.09	
Plan 3	92.77%	2.60%	4.77%	90.55	

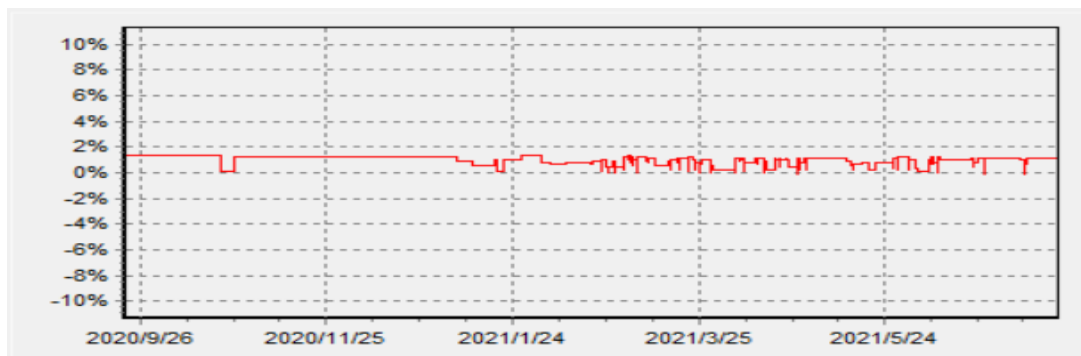


Figure 7. Yield curve of Option 1 during the second time period

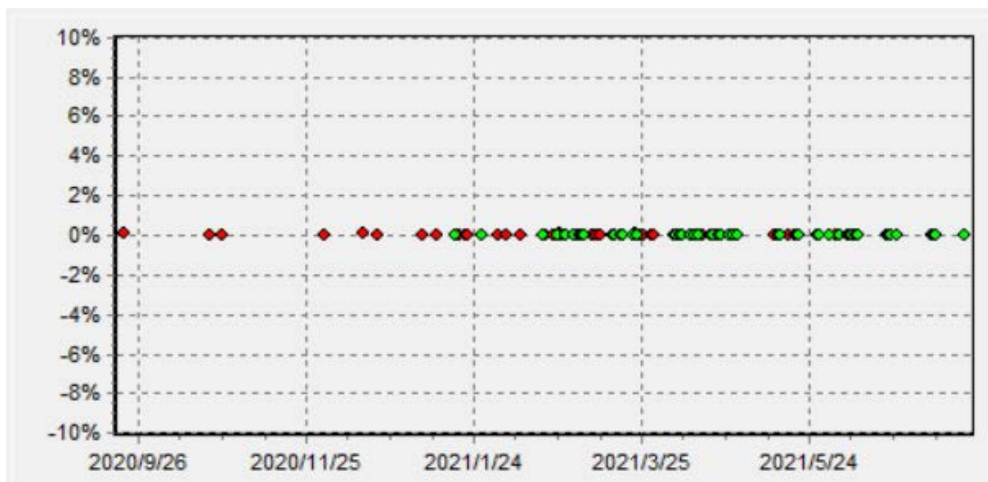


Figure 8. Number of transactions for Option 1 during the second time period

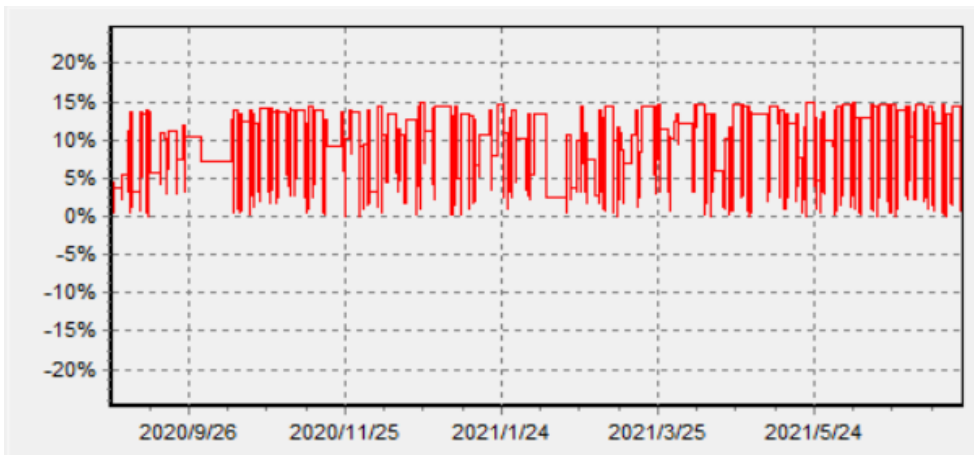


Figure 9. The second time period option 2 Yield curve

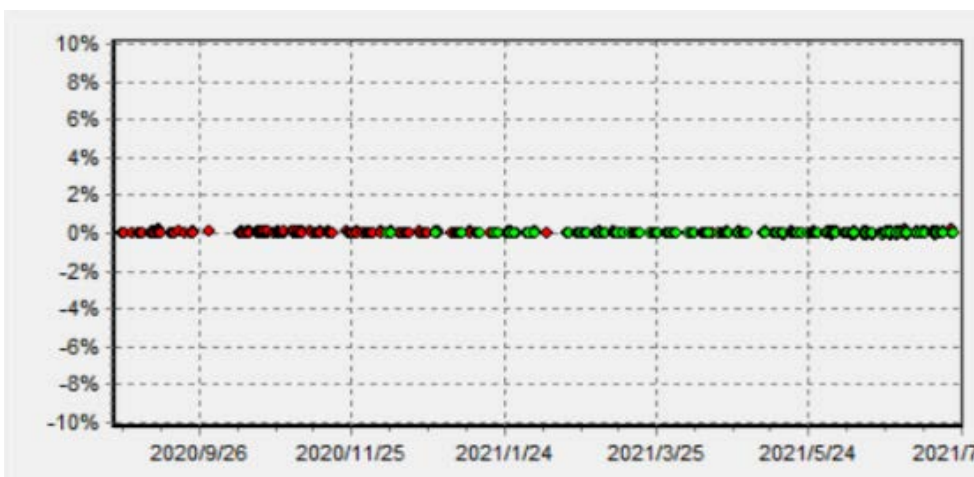


Figure 10. The second time period option 2 number of transactions

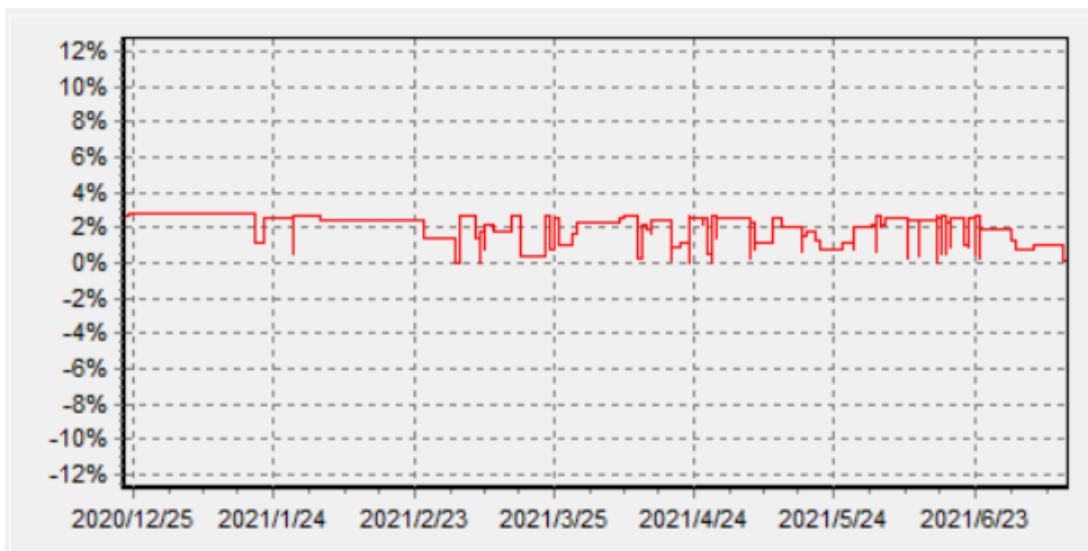


Figure 11. The second time period option 3 Yield curve

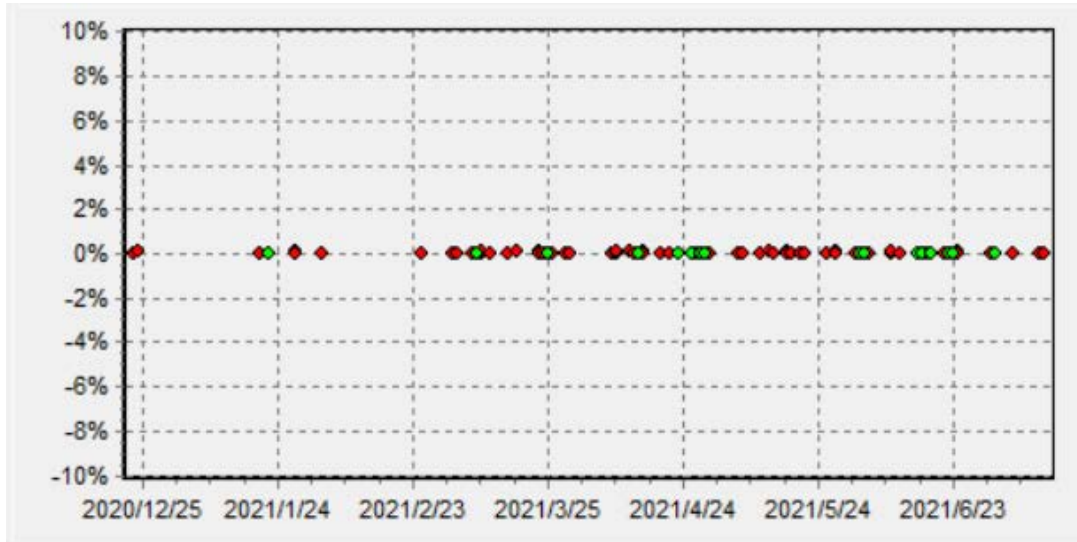


Figure 12. The second time period option 3 number of transactions

Table 5. 2018.08.24~2021.07.20 test results statistics table

	Win rate X1	Annual rate of return X2	Net profit rate X3	Net profit rate	Remark
Plan1	65.57%	1.32%	1.21%	199.64	
Plan2	64.94%	15.90%	14.58%	1,409.45	
Plan3	81.06%	2.97%	2.72%	144.00	

The calculation data table is omitted, and the result is shown in Figure 7-12

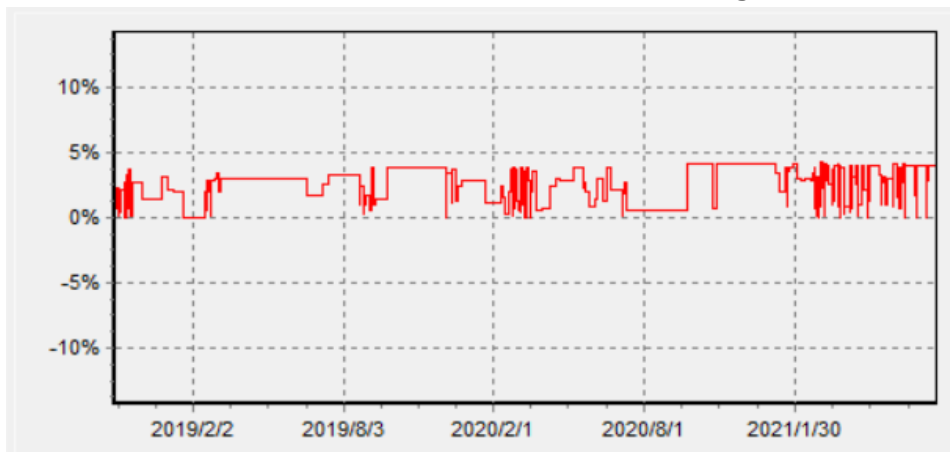


Figure 13. Yield curve of Option 1 during the third time period

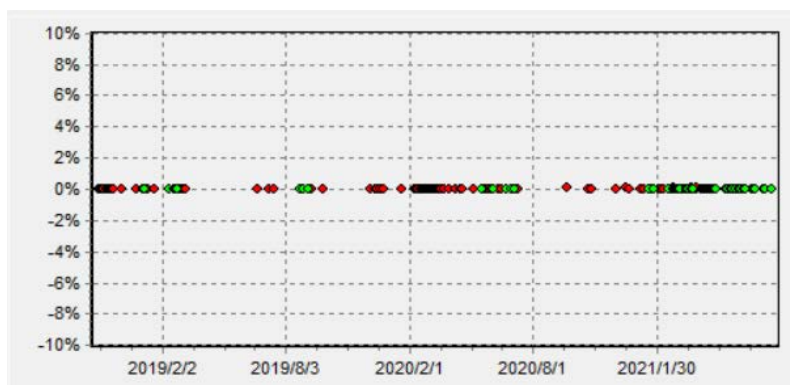


Figure 14. Number of transactions for Option 1 during the third time period

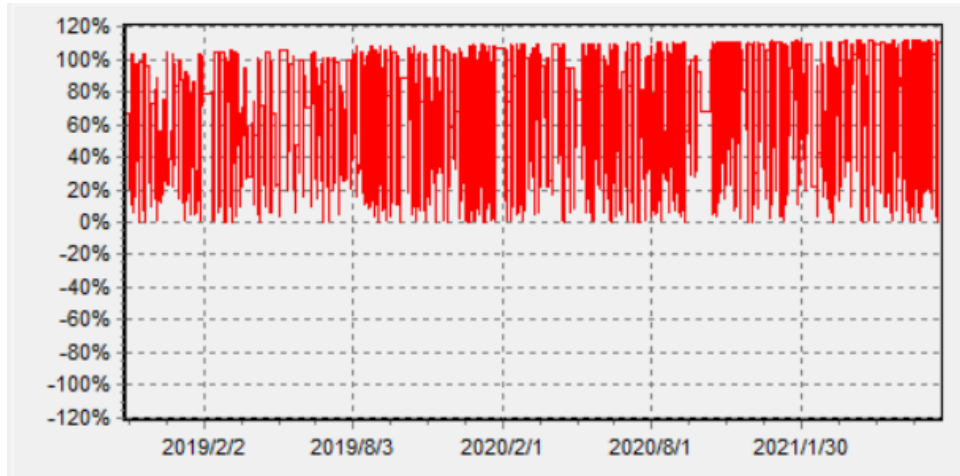


Figure 15. The yield curve of Option 2 during the third time period

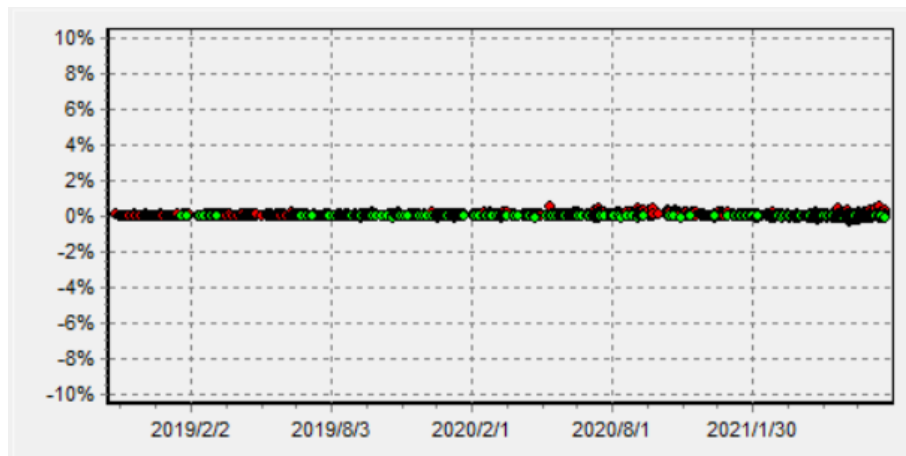


Figure 16. The number of transactions for Option 2 during the third time period

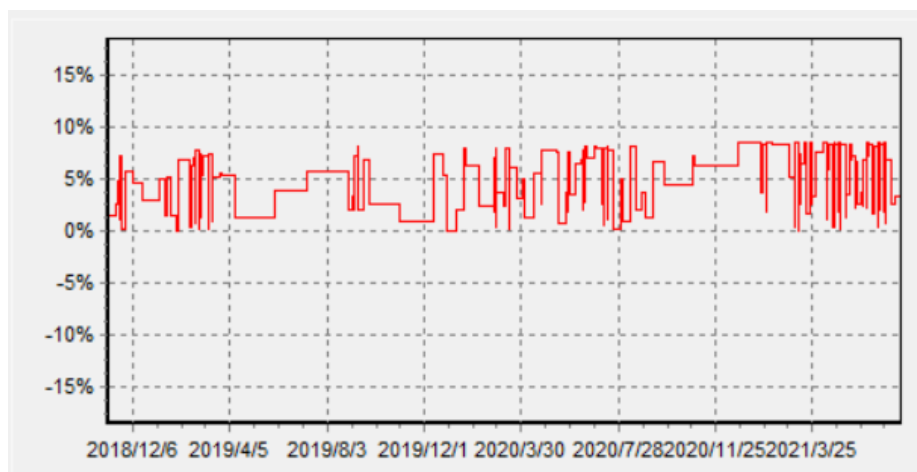


Figure 17. The yield curve of Option 3 during the third time period

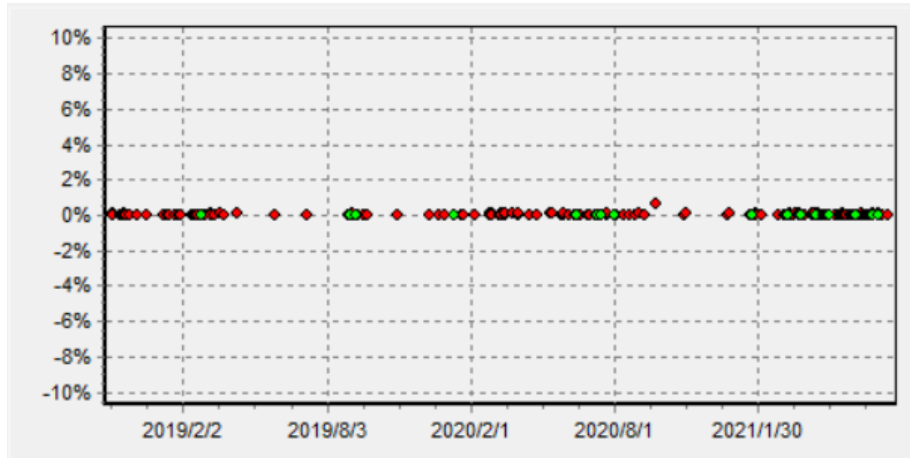


Figure 18. The number of transactions in Option 3 during the third time period

Table 6. 2018.10.18~2021.07.20 test results statistics table

	Win rateX1	Annual rate of returnX2	Net profit rateX3	Annual transactions	Remark
Plan1	77.56%	1.48%	4.06%	131.27	
Plan2	77.99%	40.47%	111.29%	1,733.45	
Plan3	87.91%	3.13%	8.59%	111.27	

The calculation data table is omitted, and the result is shown in Figure 13-18



Figure 19. Growth Enterprise Market Index Curve

3. Conclusion

From the above calculation results, it can be seen that in the first time period from 2018.10.18 to 2020.08.24, the annual return X2 of plans 1, 2 and 3 are: 1.53%, 42.93%, and 2.60%; the net profit of plans 1, 2, and 3. The rates X3 are: 2.81%, 78.71%, 4.77%; all are positive values. For the second time period from 2020.08.24 to 2021.07.20, the annual return X2 of plans 1, 2 and 3 are: 1.32%, 15.90%, and 2.97%; the net profit rate X3 of plans 1, 2 and 3 are: 1.21 %, 14.58%, 2.72%; all are positive values. For the third time period from 2018.10.18 to 2021.07.20, the annual return X2 of plans 1, 2 and 3 are: 1.48%, 40.47%, and 3.13%; the net profit rate X3 of plans 1, 2 and 3 are: 4.06 %, 111.29%, 8.59%; all are positive values. The above results show that no matter what the scheme, any period of time can get a positive

return according to the RSI expert system, because the winning rate is slightly worse and the return is higher than several times, so scheme 2 is the best. On the premise of selecting Option 2, the net profit rate X2 is the highest in the third time period. It can be seen from Figure 19 that the ChiNext Index did not drop significantly after 2020.08.24, but set a new high after a strong consolidation.

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