Improved Turtle Trading Strategy and Empirical Analysis

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Abstract—**With the advancement of China's financial reform, the futures market has developed rapidly. More and more investors are starting to invest in futures. In order to survive in the futures market, investors must build a perfect and feasible trading strategy. Therefore, investors must study how to build a feasible trading system. The purpose of this research is to find out the problems existing in the original turtle trade system, and to fix these problems to make it a viable trading system. Based on the original sea turtle trading strategy, this study not only introduces the average line as the basis for the trend judgment, but also improves the original sea turtle trading system. The experiment shows that the improved sea turtle trading system not only improves the profit and loss ratio, but also reduces the retracement rate of capital, and finally solves the existing problems of the original sea turtle trading strategy.**

Keywords—Turtle trading strategy; Moving average; Trading System; TradeBlazer

I. INTRODUCTION

The turtle trading system, founded and publicized by Richard Denis, is one of the few publicly traded strategies in the market [1]. It includes four crucial aspects: choosing trading varieties, managing funds, entering and leaving the market, and controlling risks. Turtle trading system is a trend tracking system, its success rate is very low, but its capital management mode is very advanced, it can control the losses generated by the transaction, and as far as possible to grasp the trend of the trend [2]. The turtle trade system has made remarkable achievements in history, but its defects are also very obvious. For example, its retracting rate is very large, and it sometimes returns about half of its profits. In a real trading environment, neither institutional investors nor individual investors can bear such a large withdrawal. On the one hand, it is the need for institutional investors to control the withdrawal of funds [3]. On the other hand, the withdrawal of funds will produce psychological pressure on traders, which makes it impossible for traders to carry out the turtle trading system strictly. In addition, the turtle trade system generally applies only to metal futures with strong trend, which yields very poor returns on agricultural futures. This leads to a single species of futures that can be invested by the turtles trading system, and can not invest multiple futures types to reduce the risk of transactions. Therefore, this study is based on the original turtle trading system to optimize and upgrade, give full play to the advantages of the turtle trading system itself, reduce the withdrawal and improve the success rate [4]. The main method of this paper is to use Tradeblazer software to program and test. The empirical results show that the improved trading system can not only control the risk better, but also apply the system to a wider variety of futures trading [5]. The improved turtle trading system can provide investors with trading ideas.

II. APPLICATION ANALYSIS OF THE ORIGINAL TURTLE TRADING SYSTEM

This study selects five futures varieties for empirical testing. These futures varieties are rebar of Shanghai futures exchange; coking coal of Dalian commodity exchange; cotton, sugar and PTA of Zhengzhou commodity exchange. Because futures contracts are discontinuous, the index of corresponding futures varieties is selected for testing. The above five futures varieties are tested by the original turtle trade system. The cycle is 4 hours, and the results of historical back test are shown in Table I.

TABLE I. ANALYSIS OF RESEARCH RESULTS OF ORIGINAL TURTLE TRADE RULES

Futures commodity	Rate of return	Maximum retracement	Profit and loss ratio	Winning probability	True victory
Cotton	87.28%	23.82%	1.73	45.33%	0.78
White sugar	38.63%	19.27%	1.35	43.02%	0.58
Coking coal	52.74%	11.07%	1.83	38.22%	0.70
Screw thread steel	158.75%	23.75%	2.40	53.67%	1.29
PTA	86.70%	21.80%	1.65	42.31%	0.70

Using the sea turtle trading system to test the futures varieties with better liquidity and better trend in the three commodity futures exchanges, it is found that five futures varieties can be profitable, only two varieties have higher

returns, and the other three varieties have a general yield rate. As can be seen from table I, when the turtle trade system is used for trading, there will be a larger withdrawal of the five varieties. In terms of profit, the use of the turtle trading system can effectively seize every big trend and increase the profit by increasing the position. It can really cut the loss and run the profit. If the winning rate is high, the profit and loss ratio is not necessarily high, but if the profit and loss ratio is high, the winning rate is not necessarily high. The true victory is equal to the product of the rate of profit and loss. When evaluating the performance of a trading system, the real winner rate can evaluate the advantages and disadvantages of a trading system. It takes into account the winning rate and the profit and loss ratio, and its evaluation criterion is that if the performance of this index is greater than the 0.8 trading system is qualified, if the index is below 0.8, it is not qualified. From Table I, we can see that the performance of the five varieties is evaluated with the true victory rate, of which four futures varieties are not good, because the true winning rate of the four futures varieties is less than 0.8, and their evaluation is unqualified. In addition, a fatal drawback of the turtle trading system is a large withdrawal. In the test of rebar futures, this index is qualified, but its withdrawal reached 23.75%, which is intolerable to ordinary traders. In the long run, the turtle trading system can make profits in rebar futures. But because of the large withdrawal of funds, traders will be under great psychological pressure and will probably abandon the turtle trading system. As we can see, the Turtle Trading System performs best in rebars, probably because the rebars are trendy and noiseless. However, it is not ruled out that the performance of rebar during this test period is accidental. Maybe it hasn't been through a shock cycle yet, and it's hard to say if the turtle trading system will perform well when the shock cycle arrives. All futures varieties are tested in a four hour K-line chart. The position of the warehouse is determined according to the volatility. When the fluctuation rate is large, the warehouse size is small, and when the fluctuation rate is small, the warehouse position is large. This study did not change the Turtle Trading System's profitable position increase strategy, so all the tests in Table I have increased positions. From the test of Table I, we can see that the five varieties have a relatively large withdrawal rate and a relatively low winning rate.

III. OPTIMIZATION AND UPGRADING OF THE ORIGINAL SEA TURTLE TRADING SYSTEM

A. *Optimizing the original turtle trade system, establishing a new version of trading strategy and its theoretical analysis*

In the first part of this study, the application of the original Turtle trading system was analyzed, and the problems of the original Turtle trading system were found. In this part, we propose three upgrades: upgrade the filter, upgrade the exit strategy, and optimize the parameters. Tradeblazer is an important trading system development software in China. Tradeblazer is used to test five important futures varieties in China's futures market. The test lasted from July 26, 2009 to July 26, 2013.

First, filter upgrade. This article compares two filters. The filter of the original sea turtle trading system is by judging

whether the last breakthrough is successful, and the other is to judge whether the 20 cycle averages are above the 60 cycle averages. After testing, we find that the latter is better and more consistent with the essence of trend trading system. The principle is that the 60 cycle mean line represents the direction of the medium and long term trend, and the 20 period average line represents the direction of the short-term average. The 20-cycle mean above the 60-cycle mean indicates a strong trend in long and short cycles, and it is a favorable time to establish a long position. Similarly, the 20 period of moving average in the 60 cycle average line to establish a short position position is also homeopathic. This filtering method is consistent with the first principle of trend trading.

Second, upgrade the exit strategy. In the original sea turtle trading system, the exit strategy for the multi head position is to judge whether to break through the lowest price of the 10 cycle. The exit strategy for the empty position is to judge whether to break through the highest price of the 10 cycle; if the price fluctuation breaks through the lowest price or the highest price in the 10 cycle, all the positions will be leveled off. This exit strategy will result in a very large withdrawal of earnings, while tracking profit is the best way to control retracement. Therefore, the method of tracking profit is adopted in this paper. The specific method is to withdraw 40% of the profits, and to take away all holdings. The test results show that the profit and loss ratio of the trading system is better if the method of tracking and check is adopted, and the profit and loss ratio of the original sea turtle trading system exit method is relatively poor.

Third, parameter optimization. In this paper, the parameters of the original Turtle trading system are further optimized. First, the average real fluctuation amplitude of the 20 cycle of the original turtle trade system was changed to the average real fluctuation range of the 22 cycle. Then the short period of system 1 is shortened from 10 cycles to 5 cycles, and the long period index of system 2 is extended from 55 cycles to 70 cycles. Finally, the rule of increasing the position gradually increased by 0. 8N from 0. 5N. The optimization of these parameters is based on the actual situation of China's futures market fluctuations. China's futures market is not as mature as the European and American futures market, so a longer average fluctuation cycle is needed to measure the risk. Therefore, the original 10 cycle breakthrough strategy is only suitable for the European and American futures market. In the Chinese futures market, the index needs to be shortened to 4 cycles, which can increase the sensitivity of the trading system and reduce the risk. The long cycle needs to be extended to the 70 cycle, too, because the volatility of China's futures market is too frequent. The 55 cycles in European and American markets are difficult to judge the medium and long-term trend of China's futures market. It takes 70 cycles to judge in China's futures market. The increase in the distance between the positions increased from 0. 5N to 0. 8N, because the volatility in the Chinese market is larger than that in the European and American markets. Turtle trading system is more suitable for the market with a clear trend, when the market in the round-trip wide oscillation may produce a continuous stop loss. Ninety-five percent of the Turtle Trading System's profits come from five percent of trading, so capital management and risk control are

the top priorities. The original turtle trade system uses 1% of the capital each time it establishes its position, which makes the withdrawal of funds larger. After testing, the proportion of the funds was changed to 0.3%, so that the withdrawal of funds will be greatly reduced, and the trading system is relatively high returns.

B. *The system test of the new trading system*

This paper also uses the 4 hour trading data of 5 major futures markets in China futures market from July 26, 2009 to July 26, 2013 to test the new trading system. Based on the original Turtle Trading system, two upgrades were made to compare the performance of the two upgrades with the original Turtle Trading system. The first revision of the turtles trading system is based on the rules of the trends trade, which reduces the number of reverse trade by adding filters to the original sea turtle trading system, thus filtering out some counter trade transactions. Theoretically, after filtering out some false signals, the rate of return should increase. The following is the analysis of the results of the test.

TABLE II TEST RESULTS OF SEA TURTLE SYSTEM AND MOVING AVERAGE FILTER COMBINATION

Futures commodity	Rate of return	Maximum retracement	Profit and loss ratio	Winning probability	True victory
Cotton	131.08%	3.73%	2.86	48.36%	1.38
White sugar	68.25%	22.59%	2.22	51.57%	1.14
Coking coal	82.63%	2.39%	1.74	51.28%	0.89
Screw thread steel	193.74%	3.93%	3.09	55.42%	1.71
PTA	123.30%	4.70%	2.19	47.31%	1.04

The test data of the comparison Table I and Table II showed that the income level of all futures varieties except white sugar had been greatly improved, the maximum retracting margin decreased significantly. The real winning rate of the new version of the new sea turtle trading system was higher than the original sea turtle trading system, and the true winning rates of all kinds of species were more than 0.8. The greater the true success rate, the better the trading system. The profit level of the white sugar futures trading has not increased, but the maximum retracement is reduced by half and the real success rate has been improved much, so the improved sea turtle trading system is still better than the original sea turtle trading system. The testing fee is set according to the standards of the Futures Company, and the slippery point will inevitably occur during the actual operation of the procedural transaction, which will deviate from the test results. This paper does not set a sliding point, because the sliding point phenomenon can not be predicted beforehand, so it will increase the transaction costs, which will cause the transaction system to reduce the return. On the whole, the improved turtle trading system is suitable for trading more futures varieties.

TABLE III SEA TURTLE SYSTEM + AVERAGE FILTER + PARAMETER OPTIMIZATION COMBINATION RESEARCH SAMPLE BACK TEST RESULTS

Futures commodity	Rate of return	Maximum retracement	Profit and loss ratio	Winning probability	True victory
Cotton	149.56%	6.94%	2.23	39.78%	0.89
White sugar	112.82%	4.39%	1.56	43.63%	0.68
Coking coal	77.86%	2.02%	2.66	53.16%	1.41
Screw thread steel	231.64%	4.31%	2.59	57.14%	1.48
PTA	125.45%	5.19%	2.06	46.58%	0.96

The greater the true success rate, the better the trading system. According to this idea, we select the corresponding index parameters to optimize, in order to further improve the performance of the trading system. Table III is the test data for optimizing the parameters of the transaction system. The test of comparison Table III and Table II shows that the number of trading signals of most futures varieties has been reduced; the income level of other futures varieties except coking coal has been raised to a different extent, and the maximum retracting range is reduced again. Filtering out some false trading signals will also filter out the real breaking trading signals, which is inevitable. This will lead to lower income levels, but the success rate has increased. Overall, the true success rate has increased. But the key index to evaluate the effectiveness of a trading system is whether the true success rate is higher than 0.8. From the test data in Table II and Table III, it is obvious that the turtle trade system with optimized parameters is better. It has not only increased the level of earnings but also reduced the maximum retracement.

C. *Whether the test trading system is overoptimized*

In order to test the over optimization of the improved trading system, this paper adopts the 4 hour trading data of 5 major futures varieties from July 26, 2013 to July 26, 2018, and carries out simulation transactions on the two new versions of the system. The test data are compared with the original original trading system, and the test results are shown in Table IV. From Table IV, we can see that even with the increase in transaction time, the new version of the trading system can achieve a steady return. Moreover, profit and loss ratio and income level are obviously better than those of the original

trading system. Therefore, it can be proved that the new version of transaction system does not exist over optimization.

TABLE IV   WHETHER OVER-OPTIMIZED TEST RESULTS

Futures commodity	Rate of return	Maximum retracement	Profit and loss ratio	Winning probability	True victory
Cotton	151.51%	5.94%	2.43	41.78%	1.02
White sugar	122.87%	3.39%	1.71	47.63%	0.81
Coking coal	97.84%	3.02%	2.81	54.36%	1.53
Screw thread steel	242.61%	4.31%	2.59	54.14%	1.40
PTA	135.25%	3.19%	2.13	47.28%	1.01

IV. SUMMARY

Firstly, this paper uses the experimental data to explain some problems in the turtle trading system, and puts forward some improvement methods according to the existing problems. The first step is to use the moving average as the filter, and the second step is to optimize some parameters of the turtle trading system. The results of the empirical test show that the improved sea turtle trading system has a better performance than the original sea turtle trading system with higher returns and smaller retracement, and has a wider adaptability. Finally, by adding data samples to test the new trading system, the empirical results show that the new version of the turtle trading does not exist parameters over-optimization. The profitability of the improved trading system has been further improved, and the transaction risk has been further reduced. Such a trading system will not allow investors to bear the pressure of large withdrawal, so investors can more firmly implement the trading system. And such a trading system enables investment to survive longer in the market. In futures investment, capital management determines the survival or death of investors in the market. The improved trading system has less than 1/8 funds, lower than the original trading system, so the new version of the sea turtle trading system has a lower risk. The new version of the turtle trading system is traded on the basis of the average real fluctuation (ATR) and 0.3% of total capital. Even in the worst case, the loss is less than 0.5% of the total fund. In long-term transactions, the improved trading system can survive longer in the market. At the same time, we also see that when the amount of money is very large, it is necessary to build investment portfolios in order to control risks. Therefore, in future research, we should regard portfolio as a new research direction.

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