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The Implementation and Refinement of Western Hedge Fund Strategy in Chinese Market: Index Rebalancing of CSI 500

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Abstract: *Index Rebalancing is a strategy based on the changes of constituent stocks within the index. The strategy takes long positions for the added stocks and takes short positions for the eliminated stocks. This work is motivated to implement the strategy due to the existence of arbitrage opportunity. With the aid of the China Securities 500 Index (CSI 500), the strategy has been systematically studied in this work. The strategy uses the performance of CSI 500 from Dec 2013 to Dec 2019, 13 times of rebalancing in total. This work calculates the profit and loss of the portfolio and draws the diagram to illustrate it. The volatility is also calculated to show the risk of the portfolio. Numbers of refinements are used in the work, including the adjustment of holding period, Beta hedging and money management. The research results indicate that when the holding period is 20 days, the return is the largest. Beta-hedging is significantly effective, and the use of maximum drawback and take profit can significantly reduce the probability of loss. The strategy is proved to be profitable in inefficient markets. In addition, other investment and business concerns for the strategy are also discussed, as well as the trading recommendation. This work can be helpful for better understanding and applying the strategy.*

Keywords: *Index Rebalancing, CSI 500, Hedging, Refinements, Data Analysis*

1. Introduction

1.1 Idea

The alpha of the Index Rebalancing strategy comes from the mainly two factors: (1) other portfolios with passive investment strategy that track the index (2) and the inefficiency of the market. This work is motivated to implement this strategy because it is believed there is arbitrage opportunity between the time when index is rebalanced and when the market is adjusted.

1.2 *Highlights*

1.2.1 Strategy Overview

Index Rebalancing is a strategy based on the changes of constituent stocks within the index. The strategy takes long positions for the added stocks and take short positions for the eliminated stocks.[1] This strategy is effective because arbitrage opportunities can be generated by the inefficiency of short-term prices. For example, if new stocks are added to the index, the ETFs on the market will buy these new stocks in order to track the changes of the index to ensure consistency with it. As the demand for the stocks increases, the short-term price will rise, so the strategy takes long positions of these stocks. It is the same for the stocks that are being short.

China Securities 500 Index (CSI 500) is one of the indexes developed by China Securities Index Co., Ltd. T[2]. In its sample space, the index eliminates the top 300 stocks in the total market value and the CSI 300 index, and chooses the top 500 stocks in the total market value from the remaining within all A-

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shares, which comprehensively reflect the stock price performance of a group of small and medium-sized companies in China's A-share market. Generally, the index adjusts the constituent stocks every 6 months, and the implementation time of the adjustment is the next trading day on the second Friday in June and December of each year.[3] When building a portfolio, investors can refer to the proportion of the constituent stocks in the CSI 500 (weight coefficient), because the index considers the trading volume, liquidity and market value of the stocks when determining the constituent stocks. In addition, the index is based on the performance of the company to determine the weight coefficient, so using this method to build the portfolio is optimum. What's more, it is decided that the initial position is 2 million RMB, the asset is 1 million RMB that is used to long, and the strategy borrow stocks worth 1 million RMB to short.

In the Index Rebalancing strategy, the asset class and instrument type are both equity. It is traded twice a year according to the changes of CSI 500. The strategy is hybrid since it uses the changes of the constituent stocks as a reference of whether longing or shorting, but the stocks chosen can also be modified by one's own judgment. For better performance, the strategy applies notional-neutral to hedge the market risk, which means half of the money is used to take long positions and the other half is used to take short positions.

1.2.2 Performance Estimate

In the prediction, the annualized return of this strategy should be about 8%, because the annualized return of the China securities 500 ETF in the past five years is about 8%. Moreover, since the daily volatility of the Chinese stock market is 1%, it forecasted that the annualized volatility maybe 11%, so the Sharpe ratio should be 0.73.

As Table.1 shows, in the implementation stage, strategy obtained the results from a holding period of 60 days. But the result is not optimistic, even a lot of losses. Therefore, this work changed the number of days of holding period in the refinement and found that when the holding period is 20 days, there is a maximum return. So based on a holding period of 20 days, this work firstly added beta-hedging as Table.2 shows, then the work separately take profit and use maximum drawback based on the results after beta-hedging (Table.3).

Table.1 Results for different holding periods.

Holding Period	Annualized Volatility	Annualized Return	Sharpe Ratio
10	2.51%	-1.51%	-0.6017
20	3.80%	0.71%	0.1878
30	4.75%	-0.45%	-0.0946
40	5.50%	-0.62%	-0.1121
50	5.74%	-2.10%	-0.3663
60	6.66%	-0.66%	-0.0996

Table.2 Results for using beta hedging.

	Annualized Volatility	Annualized Return	Sharpe Ratio
Before beta-hedging	3.80%	0.71%	0.1878
After beta-hedging	3.91%	0.89%	0.2278

Table.3 Results for using other refinements.

	Annualized Volatility	Annualized Return	Sharpe Ratio
After take profit	2.59%	1.65%	0.6347
After using maximum drawback	1.97%	1.37%	0.6936

2. Specification

2.1 Data

2.1.1 Data Universe

Since CSI 500, which is the index that the strategy based on, is an index about A-Shares stocks in

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Chinese market, the universe of the strategy are stocks either adding to or deleting from CSI 500 index when the index is rebalanced, which happens twice a year.

2.1.2 Data Sources

WIND is used as the primary data source, because WIND is the market leader of financial service industry in China. Established only three years after the first stock issued in China, WIND served over 90% financial institutions in China.[4] It is believed that WIND is the most comprehensive financial database if this work want to understand the Chinese stock market.

To implement the research, the list of newly adding and deleting stocks of CSI 500 every time after the index is rebalanced during the past 10 years need to be obtained. The daily prices of stocks are also needed to calculate and analyze the return of the portfolio. The list of stocks is published on the website by CSI, so it is free to obtain. The historical prices of each stocks are gained from WIND, to which this work have the university access, so payment for the database is not necessary.

2.1.3 Date Range

The performance of CSI 500 from Dec 2013 to Dec 2019 is used, 13 times of rebalancing in total. It is believed 13 groups of data will be enough for tanning the data and then testing. Either prolonging the data range to years previous to 2013 or using recent years' data, the result won't be accurate. Considering the limited time given to this work, the way to process data is very simple. The first-four-year and a half data is used as the training data, and the last two years as the test data. For each year, the index is rebalanced twice. So, in total, there are 9 groups of in-sample data, and 4 groups of out-of-sample data. To simplify the implementation, reserved data or Calibration sample is not needed.

2.2 Strategy

2.2.1 Signal Generation

The signal for trading is very simple and easy to understand. If the stock is just added to the member list of the current period, the strategy will long it. If the stock is deleted from this period's member list, the strategy will short it. To clarify it, the equation is showed as following:

Assume: s = stocks on the member list of CSI 500

A={stocks on the member list of CSI 500 for period i}=$\{s^i_1, s^i_2, s^i_3, \ldots, s^i_{500}\}$

B={stocks on the member list of CSI 500 for period $i+1$}=$\{ s^{i+1}_1, s^{i+1}_2, s^{i+1}_3, \ldots, s^{i+1}_{500}\}$

$$a = \begin{cases} 1, \text{ if } s \in B \backslash A \\ 0, \text{ if } s \in A \cap B \\ -1, \text{ if } s \in A \backslash B \end{cases}$$

Define the signal as a:

If a = 1, long the stock; if a = -1, short the stock; if a = 0, do nothing about it.

2.2.2 Portfolio Construction

The frequency of the portfolio is twice a year, immediately after the index is rebalanced. For the sizing, the initial position is 2 million RMB. The asset is 1 million RMB, for which the strategy use it to long. The strategy borrow stocks worth 1 million RMB as the short. For the hedging, since the strategy long and short have the same size, the portfolio is RMB neutral. The strategy haven't considered money management in the implementation yet. The holding period is 60 days.

2.2.3 Trade Execution

It is assumed that the costs of the portfolio only involve with commission fees, tax, and the bid-ask spread. It is also assumed that the commission fee and tax together is 0.25% and the bid-ask spread is 0.01 RMB for every 1 yuan of the stock price. The trade is executed in A-Shares market in China immediately after the index is rebalanced. The strategy does not adopt any order management.

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2.3 Research

2.3.1 Economic Intuition

Economic intuitively, it is believed the price of newly added stocks will increase and the price of deleted stocks will decrease because of the adaption of passive investment strategy by other investors. The passive investment strategy, such as ETFs, will follow CSI 500, buying the added and selling the deleted.[5] Therefore, as new stocks are added to the index, the demand for the added stocks will increase, resulting in an increase in price until the new equilibrium point is reached. Similarly, as new stocks are deleted from the index, the supply for deleted stocks will increase and then the price will decrease to a lower equilibrium point.

It is also believed that the market is not efficient enough, which means the stock price will adjust to the available information relatively slowly. So, there is a time gap between when the new member list is announced and when the stock price is adjusted to the new equilibrium point. Taking advantage of it, the strategy long the added stocks, of which price will increase, and short the deleted stocks, of which price will decrease, to make a profit.

2.3.2 Analysis

This work will calculate the profit and loss of the portfolio and draw the diagram to illustrate that, then annualizing the return by using 120 days per year. The work will also calculate the volatility to show the risk of the portfolio and the Sharpe ratio to analyze how much extra return it can generate compared to the risk-free after adjusting the risk.

3. Implementation

3.1 Results

3.1.1 PnL Graph

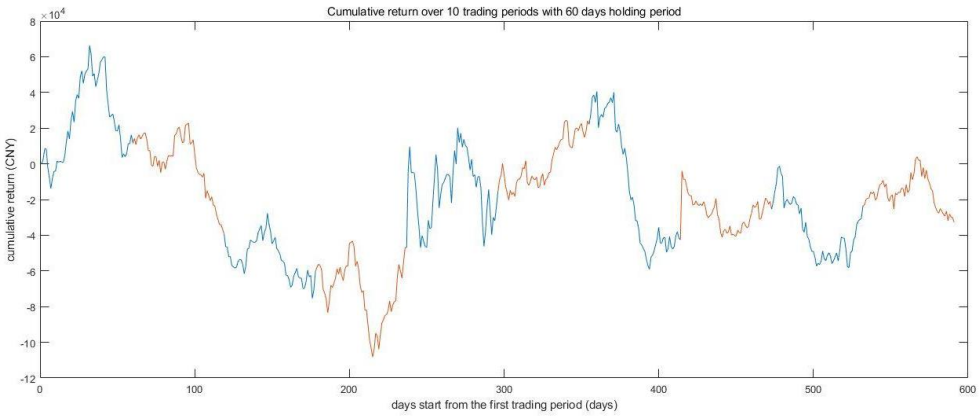

Figure 1. The accumulated return for 9 trading periods.

In Fig.1, the x-axis refers to the trading period (60 trading days per period), and the y-axis refers to the accumulated return when a total of 1 million RMB is invested. It is obvious that there was a large loss in the first two trading periods, and then the return began to fluctuate, but the strategy was still losing money until the end of the trade.

3.1.2 Summary Statistics

Table 4. Results for initial implementation.

Holding Period	Annualized Volatility	Annualized Return	Sharpe Ratio
60	6.66%	-0.66%	-0.0996

Table.4 shows that the annualized return and the Sharpe ratio are negative, and the volatility is high in this condition, so some more refinements need to be done to improve the strategy.

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3.2 *Differences From Expectation*

Contrary to the predictions, the return is not positive and stable, so it is a strategy with high risk and negative returns. The reason for the analysis is that China's stock market has not yet reached the standard of a weak efficient market.[6][7]There are many speculators in the market, due to a large number of speculative transactions, many stock prices have seriously deviated from their intrinsic value, so the strategy results have not met expectations. There are even some junk stocks at high prices.

3.3 Difficulties

3.3.1 Difficulties in processing data

When getting data, it is found that some stocks have been temporarily suspended due to special reasons，so the strategy is unable to trade these stocks. This work have two cases to solve this problem：
a. some stocks are out of the market on the rebalance day, because the companies may be broken. In this case, the work do not trade those stocks because they are illiquid. b.some stocks were in the market at the rebalance day, but they were out of the market when the strategy wanted to close the position. In this case, it is decided to close the position of these stocks at the day before they came out of the market and other stocks of the portfolio are unaffected.

3.3.2 Difficulties in determining the appropriate principal

When determining the initial investment amount, if the principal is too small, the effect of the strategy cannot be intuitively seen. It is determined that one million CNY would be appropriate for the principal after several attempts.

4. Refinements

4.1 Implemented

4.1.1 Refinement 1: Adjusting the Holding Period

The strategy is event-driven, and the buying and selling power generated by the rebalancing of the index will only last for a certain period. If the holding period is too short, there might not be enough time for passive investors to react; if the holding period is too long and most of the passive investors in the market have finished adjusting their portfolio, the change within the index component stocks will no longer be a reliable signal for the stocks' future returns. In the initial implementation, the holding period for the stocks was 60 days. The cumulative return increased and then decreased in each trading period, which indicates that a trading period between 0 to 60 days might be more profitable. Therefore, in the first refinement, the strategy tried different holding periods from 10 days to 60 days in order to find the optimal holding period that can maximize the return.

4.1.2 Refinement 2: Beta Hedging

In the initial implementation, RMB-neutral portfolio construction is used. However, the market risk was not completely hedged by RMB-neutral hedging. In addition to RMB-neutral hedging, beta-neutral portfolio construction is used for the second refinement. By direct hedging the beta in the initial implementation using ETF, the strategy can significantly reduce the market risk of the portfolio. Therefore, this work expect that the implementation with beta hedging will generate a more profitable result.[8]

4.1.3 Refinement 3: Money Management

4.1.3.1 Take Profit

In the initial implementation, it is found that the cumulative return first increases and then decreases within most of the trading periods. Therefore, it is decided to set a take profit command to avoid losses caused by the decline in investment value at the end of each trading period.

By setting a take profit command, the work will close the position automatically when the investment value reaches the specific price level. The strategy set a parameter P1, which represents the take-profit price as a percentage of the previous portfolio value in every period. In order to find the optimal value for P1, the investment values under different take-profit prices P1 is calculated. （P1 ∈{0.001i：i=1000,1001,……1049,1050}, When P1> 1.05, no portfolio value reaches the take profit price in all

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trading period, so the case of P1> 1.05 is not considered.)[9][10]

4.1.3.2 Maximum Drawback

This work considers setting a stop loss level for the strategy to reduce the loss when the value of the portfolio falls sharply. At first, it is considered setting up a stop-loss price. Figure # shows the cumulative return after 10 trading periods under different stop-loss prices. It is notable that setting any stop-loss price has led to a reduction in the profits. One possible explanation is that, during most trading periods of the initial implementation, the value of the investment increases first and then decreases. Setting a stop-loss level can control the loss when the return drops off its starting position, which usually happens at the end of each trading period when the return has already exceeded its peak. However, the work is unable to tell when the return first starts to drop after it reaches the peak, and thus the work fail to take advantage of the profits generated at the beginning of each trading period by setting a stop-loss price. [11]

In order to solve the previous problem, it is decided to use the maximum drawback as an indicator for closing position, which can not only stop the loss but also allow us to close the position when the return just starts to decline after it reaches the peak. The strategy used the parameter P2 to denote the maximum drawback as a percentage of the initial value in every trading period. When the value of the portfolio falls more than the maximum drawback after it reaches the first peak, ths work close the position and stop trading. In order to find the optimal value for P2, cumulative returns under different values of P2 is calculated. （P2 ∈{0.001i：i=0,1……200}，When P1> 0.2, No decline has reached the maximum drawback, so the case of P2> 0.2 is not considered.)

In Figure 2, the stop-loss is not triggered when the stop-loss level is under 0.96 (horizontal line), and the cumulative returns when the stop-loss is triggered are lower than the returns when the stop-loss is not triggered.

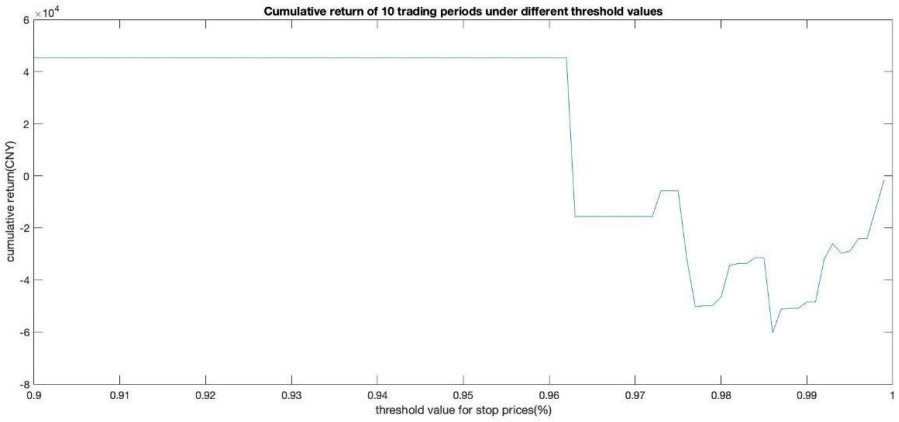

Figure 2. Cumulative returns under different stop-loss prices.

4.2 Results

4.2.1 Refinement 1: Adjusting the Holding Period

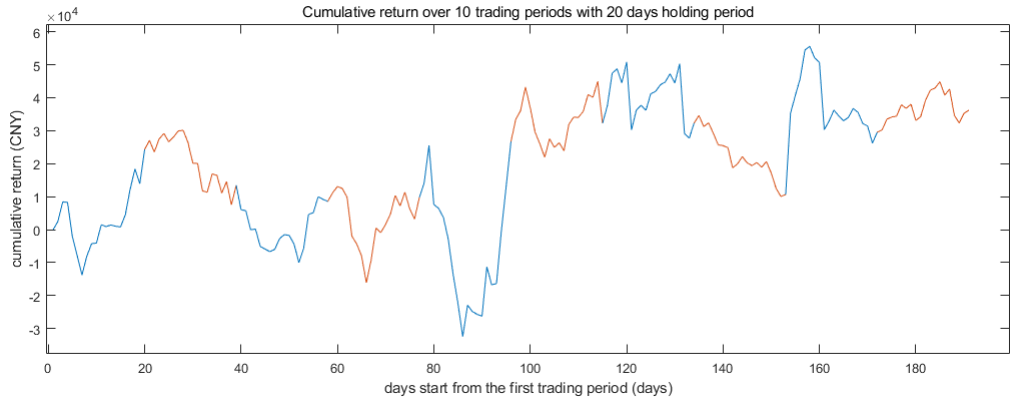

Figure 3. Cumulative return over 16 trading periods for holding a period of 20 days.

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The work implemented the strategy with the holding period of 10 days, 20 days, 30 days, 40 days, 50 days and 60 days, respectively. The transaction costs and data range remain the same as the initial implementation. Fig.3 and Fig.4 show the cumulative return over 16 trading periods for holding a period of 20 days and 40 days (the cumulative return figure for 10 days, 30 days, and 50 days are enclosed in the appendix). Table.5 shows the statistics of the implementations after adjusting the holding period.

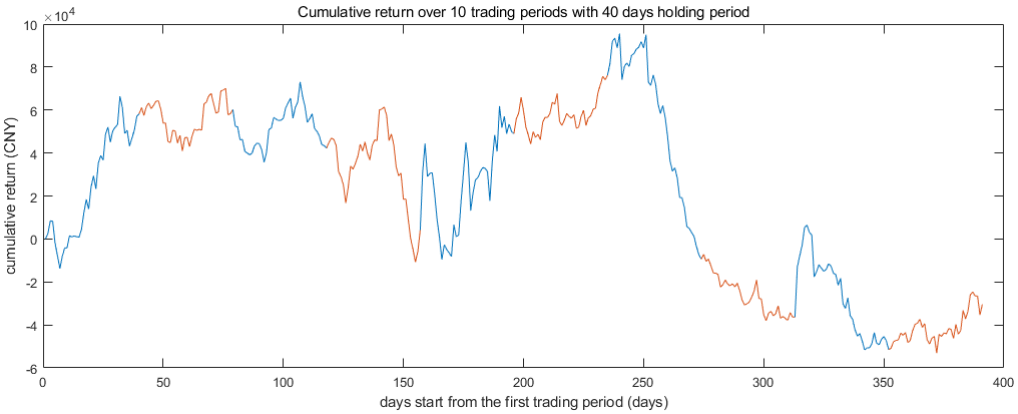

Figure 4. Cumulative return over 16 trading periods for holding a period of 40 days.

Figure 3&4. Cumulative return for 10 trading periods from 2013-2017, with holding a period of 20 days and 40 days. Red and blue lines indicate different trading periods. The x-axis shows the days from the first trading period, and the y-axis represents the cumulative return in CNY. Days between two consecutive trading periods are not shown in the figure.

Table 5. Statistics for different holding periods from 10 days to 60 days.

Holding Period	Annualized Volatility	Annualized Return	Sharpe Ratio
10	2.51%	-1.51%	-0.6017
20	3.80%	0.71%	0.1878
30	4.75%	-0.45%	-0.0946
40	5.50%	-0.62%	-0.1121
50	5.74%	-2.10%	-0.3663
60	6.66%	-0.66%	-0.0996

The annualized volatility increases with the length of the holding period, and the annualized return first increases and then decreases, which is consistent with the expectations. According to the results, the implementation with 20 days holding period has the largest Sharpe ratio and the highest annualized return. Since Chinese stock market is an emerging stock market, it is less efficient compared to mature markets. Therefore, 10 days holding period might not be long enough for passive investors to react to the index-rebalancing, which accounts for the negative Sharpe ratio that got from the implementation with 10 days holding period. However, most of the passive investors will finish adjusting their portfolio within one month after the index-rebalancing, which is approximately 20 trading days. This could possibly explain why 20 days is the optimal holding period for the implementation. If the holding period is longer than 20 days, the purchasing and selling power generated by index-rebalancing becomes negligible compared to market fluctuations. For other holding periods, the strategy might earn profits during the certain trading period, but the overall annualized return and Sharpe ratio ended up being negative due to the significant loss at the last few trading periods as shown in the appendix.

4.2.2 Refinement 2: Beta Hedging

In the second refinement, CSI 500 ETF is used to directly hedge the market risk of the previous long-short strategy. The transaction cost for trading CSI 500 ETF is 1.15% of the value of the ETF traded, and the beta values were calculated on a rolling basis using the previous two years data for each trading period. Figure 5 shows the comparison between the strategy implemented with beta hedging and without beta hedging for 20 days holding period, and table # shows the annualized volatility, annualized return and the Sharpe ratio.

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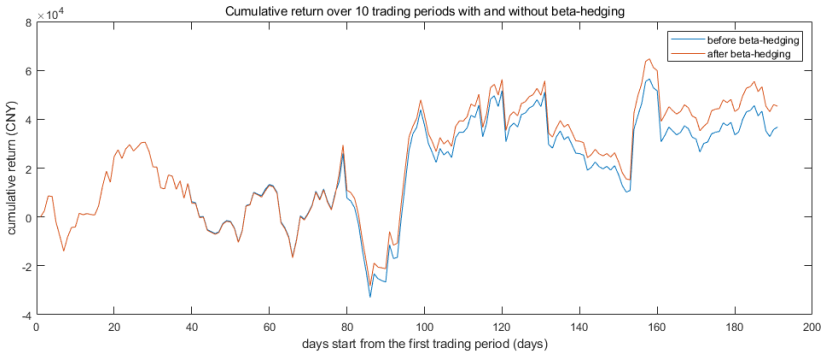

Figure 5. Cumulative return of 20 days holding period for 10 trading periods before and after beta-hedging.

Table 6. Statistics for index-rebalancing strategy implemented with beta-hedging and without beta-hedging for 20 days holding period.

	Annualized Volatility	**Annualized Return**	**Sharpe Ratio**
Before beta-hedging	3.80%	0.71%	0.1878
After beta-hedging	3.91%	0.89%	0.2278

According to table 6, the annualized return and Sharpe ratio after implementing beta-hedging are higher than the results before beta-hedging with similar volatility, which is consistent with the expectations. Figure 5 shows the cumulative return for the 20 days holding period before and after beta-hedging, and it is noticeable that as the time increases the profit from beta-hedging also increases. As it has been mentioned before, in some cases the strategy might experience a drop in the cumulative return during the last few trading periods, which resulted in a negative annualized return and Sharpe ratio overall. However, beta-hedging can ameliorate the situation by offering effective protection against any possible loss during the last few trading periods.

4.2.3 Refinement 3: Money Management

4.2.3.1 Take Profit

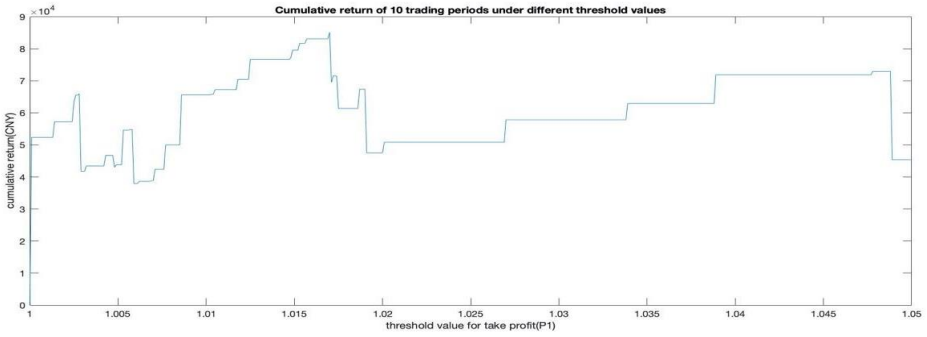

Figure.6 The value of the portfolio under different P1.

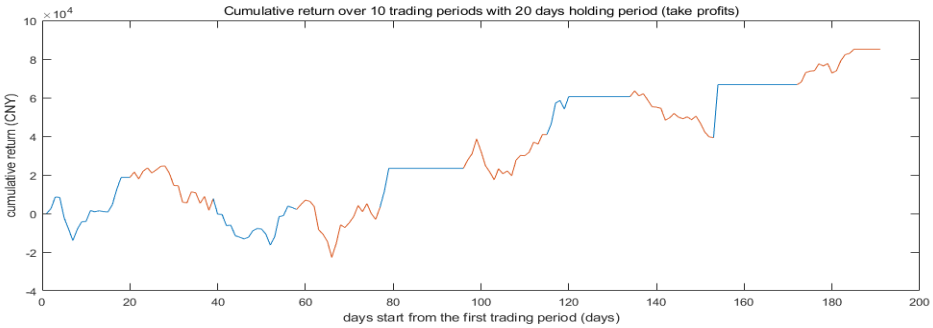

Figure.7 Cumulative return over 10 trading periods with 20 days holding period with take profit command.

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The work implemented take profit on the strategy and calculated the cumulative return over 10 trading periods with 20 days holding period from 2013 to 2017. The take profit parameter P1 is 1.017.

Table.7 Statistics for implementation with and without taking profit for 20 days holding period.

	Annualized Volatility	**Annualized Return**	**Sharpe Ratio**
Before take profit	3.91%	0.89%	0.2278
After take profit	2.59%	1.65%	0.6347

According to the Table.7, due to Take Profit, the Sharpe ratio of the strategy has been improved. From Fig.7, for some of the trading period when the take profit command is not triggered, the strategy might still suffer losses in the trading. Also, the strategy might lose some profits if the return keeps going up after closing the position using take profit command. However, compared to the potential loss without the take profit command, these compensates are acceptable.

4.2.3.2 Maximum Drawback

The maximum drawback is used as a stop loss for the strategy and calculated the cumulative return over 10 trading periods from 2013-2017 with 20 days holding period. The take profit parameter P2 is equal to 0.001. When the decline of the investment value reaches than the threshold, the strategy closes the position and stop trading.

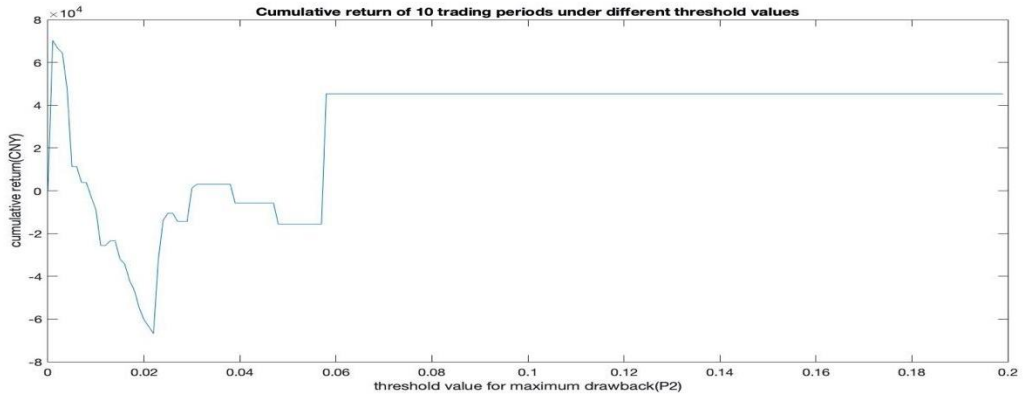

Figure 8. Portfolio value under different P2.

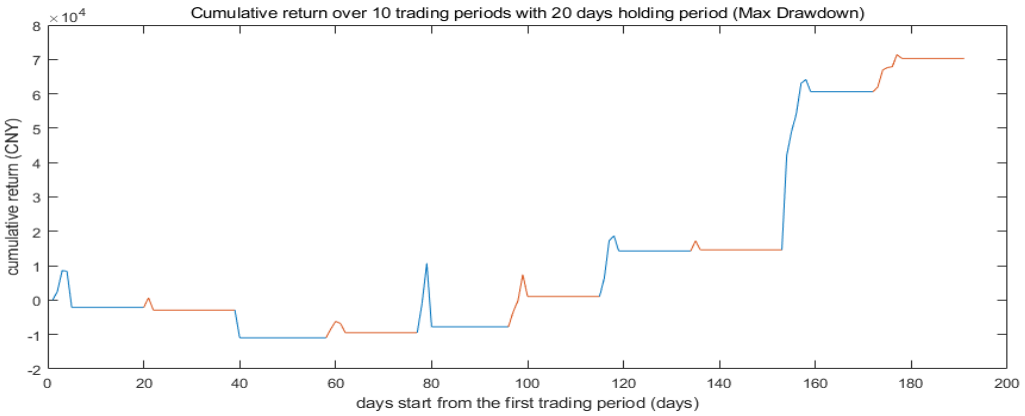

Figure 9. Cumulative return using maximum drawback as stop loss.

Table 8. Statistics for index-rebalancing strategy implemented with using maximum drawback and without using maximum drawback for 20 days holding period.

	Annualized Volatility	**Annualized Return**	**Sharpe Ratio**
Before using the maximum drawback	3.91%	0.89%	0.2278
After using the maximum drawback	1.97%	1.37%	0.6936

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According to the Table.8, through the implementation of using maximum drawback as stop-loss the Sharpe ratio of the strategy has been improved. And according to the Figure 9, using a maximum drawback allows the strategy to avoid a sharp drop in the value of the portfolio. It can also be noticed that since P2 is a relatively small value, the strategy close the position and stop trading earlier in most trading periods. In some circumstances when the value of portfolios first decreases and then increases, the strategy may miss some potential profits.

4.3 Proposals

4.3.1 Proposal 1: Trade the component stocks selectively

In the implementations, the work longed every newly added component stock and shorted every eliminated stock without selection. However, some of the stocks are prone to have liquidity issues and contribute little to the portfolio. For example, the stock sz002345 was unavailable for trading during May 2015, and trading stocks like sz002345 will increase the liquidity risk of the portfolio. For further improvement, the work can select those stocks that occupy relatively large capitalization and high liquidity instead of trading all the stocks unbiasedly to decrease the overall risk of the portfolio.

4.3.2 Proposal 2: Consider PE ratio during the portfolio construction

The PE ratio can be used to determine whether most of the stocks in the market are currently overvalued or undervalued, and adjust the short and long shares based on this. For example, when the PE ratio of most of the stocks in the market is high, then the work predict that most of the stocks are currently overvalued. Based on this prediction, the work will increase the share of short stocks in the strategy and vice versa.

5. Conclusion

5.1 *Final Selection*

20 days is chosen as the holding period and based on beta-hedging. Maximum drawback is used with a parameter of 0.001, and also use take profit with a parameter of 1.017. It can be seen from the results of implementation and refinement that when the holding period is 20 days, the return is the largest. Beta-hedging is significantly effective, and the use of maximum drawback and take profit can significantly reduce the probability of loss.

5.2 Out of Sample Test(s)

5.2.1 PnL Graph

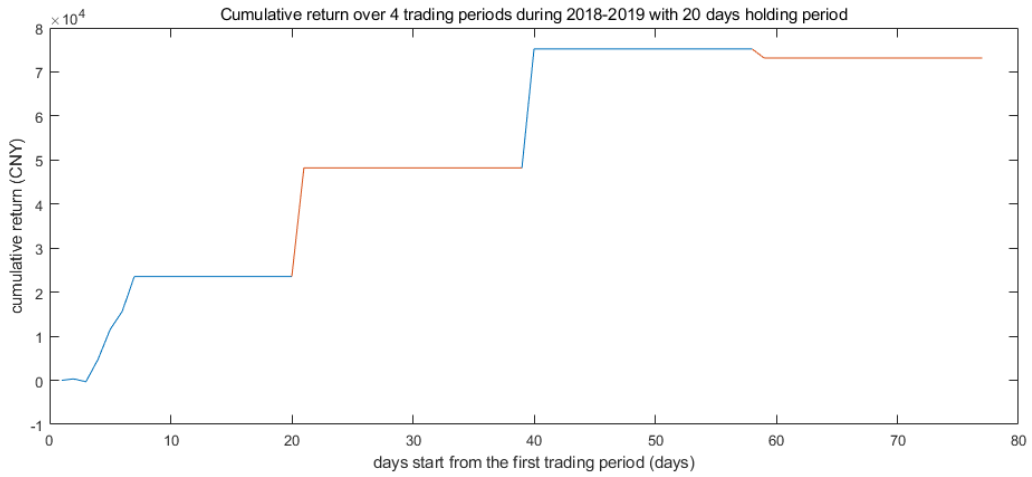

Figure 10. Cumulative return for 4 trading periods in out of sample test.

In Fig.10, the red and blue lines indicate different trading periods. The x-axis shows the days from the first trading period, and the y-axis represents the cumulative return in CNY. It can be seen from the figure that the return is nearly 80,000 yuan. In the first three trading periods, the strategy closed the

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positions ahead of time because of triggering the take profit, thus making a considerable return. However, in the fourth trading period, it triggered the order of maximum drawback, so there were some losses.

5.2.2 Summary Statistics

Table 9. Results from out of sample test.

Holding Period	Annualized Volatility	Annualized Return	Sharpe Ratio
20 days	2.12%	3.59%	1.6962

From the test results, it is clear that the strategy only need to take a small risk, and it can get an annualized return of about 3.59%, which is a good choice for risk-averse investors.

5.3 *Additional Considerations*

5.3.1 Other Investment Concerns

Return: No tax benefits.

Risk 1) Liquidity risk: A special event that causes the market to become less liquid is bad for trading, such as suspending, which will make investors can't close the positions in time and cause unnecessary losses. 2) Policy risk: Countries can change policies in different periods according to the changes in the macro-environment. For example, if the government implements loose monetary policy, the probability of stock price rising will increase, and the short position will suffer loss. 3) Operations: Studies suggest that index rebalancing anomalies generate excess risk-adjusted returns caused by stock index funds and institutional investors that benchmark the indexes. For a long-term investor, maintaining a mix of investments that deliver returns and manage risk requires timely adjustments, since, over time, there are three common occurrences that can shift a portfolio away from its initial asset allocation.1) Performance - As assets rise or fall in value, their weights also change based on how they have performed relative to the portfolio.2) Behavior biases – Often, even the smartest investors will make emotional or irrational decisions when it comes to choosing assets. 3) Unbalanced Income Reinvestment - Investors sometimes reinvest income produced by a specific investment product back into that same product.

Correlation: Although the strategy have a beta hedge, the risk from upcoming short-term market shock cannot be eliminated by using the historical beta value. From 2015-2019, the Chinese A-Shares is in a bear market and there is a corresponding decline of return in the implementations. Therefore, the portfolio is affected by the timing factor.

5.3.2 Business Concerns

Operation: the portfolio does not have any legal risk.

Future: In the future, the stock market will gradually mature and become efficient There will be no arbitrage opportunities in the market. The stock price will fully reflect its intrinsic value. The strategy can only get lower returns, so the value of the strategy will decay.

Environment: 1) Benefit: Gives insight view of investors: Because this strategy is low-risk and low-return, it is suitable for risk-averse investors who do not require high returns 2) Marketability: The strategy is simple because it basically follows the changes in the index, and investors only need to trade twice a year. So it can be favored by most long-term traders.

5.4 Trading Recommendation

From the results above (shown in Table.9 and Fig.10), it can be clearly seen that under this strategy, all 4 groups of out of sample data perform outstandingly. The Sharpe ratio is higher than the in-sample ones, which means that this strategy has a low risk. In addition, the annualized return ratio is 3.59%, much higher than that of the in-sample ones.

In conclusion, it turns out that the strategy is profitable in inefficient markets. China's financial market is not mature yet, so there are many arbitrage and speculation opportunities. Before the market becoming efficient, using the strategy can help investors to obtain considerable returns. In general, it is recommend using the strategy for risk-averse investors, instead of those who want to make a significant profit in a very short period of time. Further research might be conducted to investigate the optimal holding period as the time grows to ensure a considerable return when the market becomes more efficient in the future.

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