Optimize Momentum Strategy by Using Transaction Costs and Stock Trading Volume Based on CSI500

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Abstract. The momentum effect is one of the most typical market anomalies. Momentum methods are frequently employed in European nations, but less so in China's local market. The performance of the momentum effect in the domestic stock market as well as the similarities and variations between domestic and overseas momentum effects have recently come under the focus of a number of studies. So, in order to optimize the momentum strategy in the Chinese A-share market and assist Chinese investors in improving their investment strategies and achieving higher returns, this paper first presents the results of recent research on the momentum effect in the Chinese stock market. It then builds a trading model based on the CSI500 data in China using transaction costs and stock trading volume between 2001 and 2023 (based on the first trading day). By analyzing the price trends of the Chinese stock market from 2000 to the present, this paper calculated the optimal investment strategy based on the mo-mentum strategy. The results show that China lacks the capacity and mechanisms to achieve short sale, therefore it may not always possible to pursue optimal strategies in Chinese stock market.

Keywords: Stock Market · Momentum Strategy · Transaction Costs · Stock Trading Volume

1 Introduction

Stocks play a crucial role in the study of finance as long-term credit instruments on the capital market. The price at which a stock trades reflects both the company's operational circumstances and the logic of stock purchasers' actions. A number of reliable conclusions can be drawn to develop or improve trading strategies from them if the trading volume and transaction price of a specified set of equities are chosen for data analysis. To date, there are still many researchers studying the stock markets of various countries in the hope of obtaining general patterns or finding the differences in the trends of stock prices in different countries and constructing profitable trading strategies [1]. The momentum effect is one of the most important findings among them.

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The momentum effect was hypothesized by Jegadeesh and Titman based on their investigation of the US stock market [2]. A stock with better returns in the short term is likely to have higher returns in the future, but a stock with lower returns in the short term will similarly have lower returns in the future, according to their theory. It is now widely accepted that momentum effect results from incomplete market efficiency and insufficient investor response to fresh information. The prospect theory and understanding of psychology have both been employed by researchers to explain this investor behavior [3].

There are already a large number of studies that support the existence of momentum effects in developed country stock markets. Moskowitz et al. documented their method of purchasing high-return stocks and selling low-return equities over the course of a year, and the strategy performed extremely well [4]. China, as a developing country, has also caught the interest of many scholars as the stock market scenario differs greatly from that of established countries [5]. The findings of the research of Li Dong point to the existence of a momentum impact in the Chinese stock market as well [6]. This creates a necessary condition for the development of momentum strategies. Other scholars have also suggested that momentum effects exist in the Chinese stock market and that momentum techniques perform well there. Wang Shuo et al. found that the momentum investment technique has some relevance in the Chinese A-share market after studying the CSI 300 index and various portfolios during the past ten years [7]. Chen Xinxin proposed the relationship between the momentum effect and investor sentiment [8]. Some people have also studied quantitative investment strategies based on momentum strategy [9]. Wang Mingtao et al. studied the different returns of momentum trading strategies in bear market and bull market [10].

Consequently, based on the previous studies, we further explore the performance of CSI500-based momentum strategies in the Chinese stock market and strive to uncover the best investment strategies utilizing CSI500-based transaction costs and stock trading volume. To accomplish this, we looked at CSI500 data for ten equities from the years 2001 through 2023. (calculated from the first trading day). Stock volume was introduced, and several momentum techniques were contrasted using the Sharpe ratio and maximum retracement. Next, using three equities, we developed an investment plan. The ultimate outcome we obtained is the portfolio's ideal weighting for that time period.

2 Method

2.1 Method Introduction

Momentum Strategy is an investment strategy that predicts future performance based on asset prices and their past performance. The basic idea is that if a stock has done well in the past few months, it is likely to continue to do well in the coming months.

There are two forms of momentum strategy: short-term momentum strategy and long-term momentum strategy. Short-term momentum strategies advise investors to invest in stocks that have performed well recently, in the hope of achieving higher returns. This strategy usually uses technical analysis tools, where use trend lines to determine the direction of the stock. Long-term momentum strategies advise investors to invest in stocks that have performed well in the recent past in the hope of achieving higher returns. This

strategy typically uses fundamental analysis tools, such as financial statement analysis, industry analysis, etc., to determine the direction of the stock.

The implementation process of momentum strategy is as follows: First, the investor needs to determine the investment target, that is, the rate of return that the investor wants to get. Second, investors need to determine the portfolio, namely the portfolio of stocks investors want to invest in and determine the weight of the assets in the portfolio. Then, the investor needs to determine the investment strategy, that is, the investment strategy that the investor wants to adopt, such as short-term momentum strategy or long-term momentum strategy. Next, investors need to choose appropriate technical analysis tools or fundamental analysis tools according to the chosen investment strategy to determine the trend of the stock. Finally, investors need to buy and sell according to the trend of the stock, in order to get the maximum benefit. In short, momentum strategy is an investment strategy that predicts the future stock price trend based on the historical trend of stock price, and suggests investors to invest in those stocks that have performed well in the recent period in order to obtain higher returns. The process of implementing momentum strategy includes determining the investment objective, determining the investment portfolio, determining the investment strategy, choosing the appropriate technical analysis tool or fundamental analysis tool, and conducting the trading operation.

Variable specification: used the pro_api interface in the tushare package for python to retrieve the CSI 500 stock data which data for the last 20 years, 2001 to 2023 to be precise.

2.2 Data Source and Basic Data Processing

The data used in this study were selected from the list of China's CSI 500 stocks (CSI 500 is one of the indexes developed by China Securities Index Co., LTD. The stocks in the sample space are composed of 500 stocks with the highest total market value, which comprehensively reflects the stock price performance of many small and medium-sized enterprises with market value in China's A-share market.) Select 10 stocks whose data have existed for 20 years and download the price data of each stock since 2000. All stock price data adopt the forward adjusted option opening price, and the specific stock code is shown in Table 1. The data comes from the tushare pro_api token.

In terms of basic data processing, in order to better display the data, missing data items are excluded from the formula, so as to obtain the development situation of each CSI 500 in the past 20 years. Meanwhile, we use a simple average moving index to reduce the trading frequency and set different rolling periods to reduce the investment cost. The returns of transition_ret_df and test_ret_df were calculated respectively, and then the regression was performed to get beta, alpha and r-squared. Finally, a curve with time as the horizontal axis and stock price as the vertical axis was made.

Table 1. Stock list

	alpha	beta	sigma	rsquared
000729SZ	0.000696	-0.037518	0.029701	0.001408
000739SZ	0.000566	0.044265	0.038295	0.001959
600282SH	0.000322	0.048786	0.036949	0.002380
600315SH	0.000941	0.018072	0.032791	0.000327
600399SH	0.000663	0.047564	0.037847	0.002263
600673SH	0.000693	0.060844	0.044480	0.003702
600739SH	0.001590	0.027328	0.054389	0.000747
600764SH	0.000648	0.003837	0.045900	0.000015
600867SH	0.000654	0.004171	0.036747	0.000017
600871SH	0.000670	0.070878	0.034241	0.005022

3   Results and Discussion

This paper derives alpha, beta, sigma, rsquared for the momentum strategy by linear regression and use these values to calculate cumulative returns.At the same time,we also set different transaction cost rates and subtract the transaction costs from the cumulative returns to get the performance of our portfolio and the impact of transaction costs on the portfolio.

Figure 1 shows the stock price and transaction costs from 2001 to 2022 that include 1.0% of the transition performance share price. As can be seen from the figure, the average trend of all stocks in 2007 was a rapid rise, which may be due to the financial crisis at that time, which led to the rapid increase of labor cost in China and thus promoted the increase of transition cost, but the transition cost kept rising during the test of 2010–2022 performance.

Figure 2 shows the stock price and transaction costs for 2001 to 2022 including 0.5% of the transition performance share price. As can be seen from the figure, the overall trend is similar to Fig. 1, but it declined in the second half of 2008 and then continued
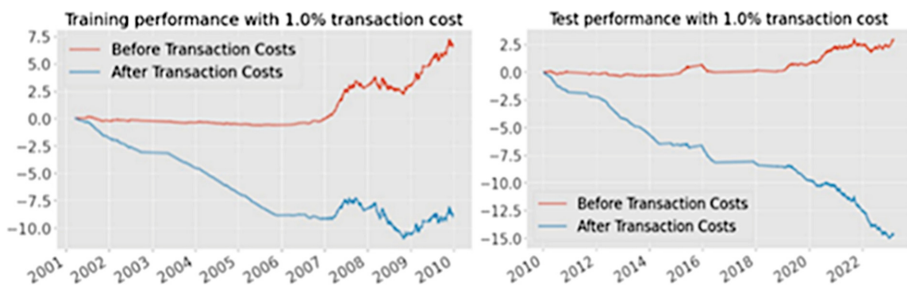

Fig. 1. With 1.0% transaction cost. (Note: select some stocks of the same type and the average value as example)
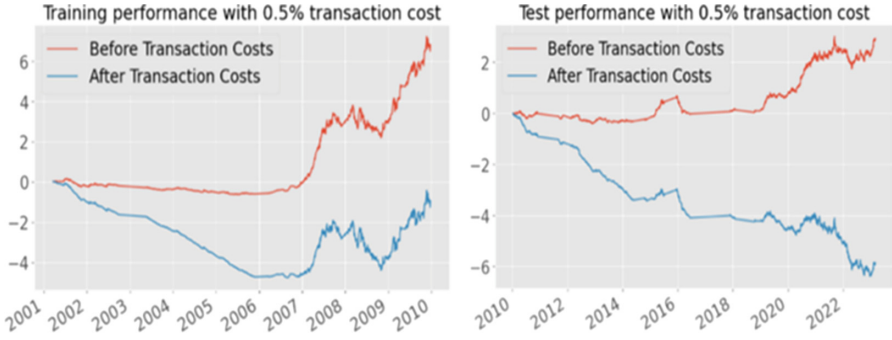
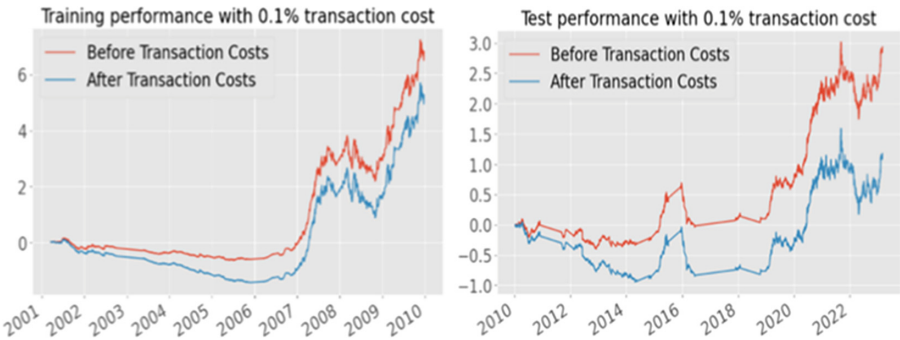**Fig. 2.** With 0.5% transaction cost

Fig. 3. With 0.1% transaction cost

to soar. However, after the addition of transition costs, the state of continuous decline from 2001 to 2007 can also show that the proportion of transaction costs is increasing.

Figure 3 shows the stock price and transaction costs from 2001 to 2022 that include 0.1% of the transition performance share price. The picture clearly shows the comparison before and after the addition of transition costs. The overall trend is roughly the same, so
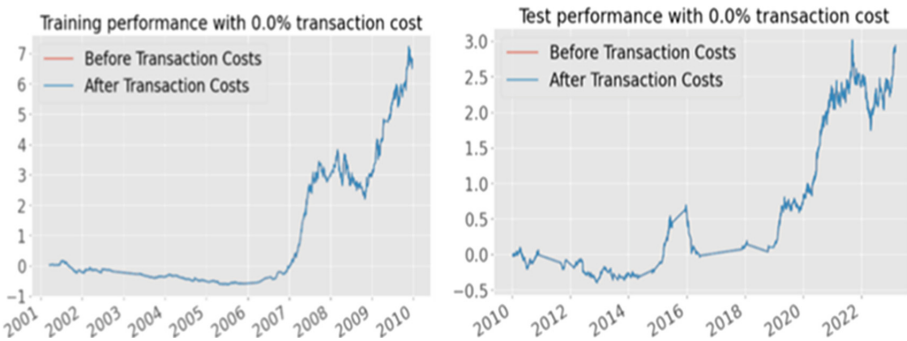
Fig. 4. With 0.0% transaction cost

it can be concluded that the less the proportion of transition costs, the less the impact on the overall trend, and the gap before and after remains in a relatively constant interval.

Figure 4 serves as a reference sample. In the absence of training costs, the overall increase increased from -0.5 to 4.0 at the end of 2007, followed by a very small decline at the end of 2008. In the results of the test, the downward trend from 2010 to 2014, but the amplitude is not very large, floating in the range of 0 to -0.5, increasing rapidly in 2015, then experiencing a period of stagnation and then surging to around 3.0.

4   Conclusion

Momentum strategy has many advantages to improve investors' return on investment, because it can take advantage of market price changes to gain income, also it can help investors reduce investment risk, because it can help investors choose the right portfolio in the case of price changes.Thirdly analyze the market, as it can help investors better analyze market trends and price changes.

Momentum strategy also has some disadvantages and may bring high risk, because it may enable investors to gain large gains in the short term, but it may also bring the risk of losing the investment meanwhile momentum strategies are expensive to trade because investors need to constantly buy and sell stocks to generate income.

It may be subject to market volatility because it may expose investors to losses in the event of market volatility. By analyzing the price trends of the Chinese stock market from 2000 to the present, this paper calculated the optimal investment strategy based on the momentum strategy.But China lacks the capacity and mechanisms to achieve short sale, therefore it may not always possible to pursue optimal strategies in Chinese stock market.

References

1. Pang, D., Shi, D. H., Cao, M.: An empirical study of Chinese individual investors' adoption of stock trend trading strategies. World Economic 26, 117 (2003).
2. Jegadeesh, N., Titman, S.: Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. The journal of Finance, (1993).
3. Mark, G., Bing, H.: Prospect theory, mental accounting, and momentum. Journal of Financial Economics, 311–339 (2005).
4. Tobias, J., et al.: Time series momentum. Journal of Financial Economics, 228–250 (2012).
5. Yao, Y., Zhong, Q., Zhai, J.. Noise trading, momentum effects and momentum strategies. Management Review 33(2), 44-54 (2021).
6. Li, D.: A Quantitative Empirical Study of Momentum effect in Chinese Stock Market Under different Market Status. Shanghai Jiao Tong University, (2016).
7. Wang, S., et al.: Research on hybrid strategy of momentum and value effect based on Chinese and American stock markets. Journal of Zhejiang Institute of Science and Technology, 338–346 (2022).
8. Chen, X. X.: Research on the momentum effect of China's A-share market. Guangxi University for Nationalities, (2022).

9. Wang, R. Z.: Alpha momentum-based trading system design. Nanjing University, (2012).
10. Wang, M. T., Lai, S.: A Study on the Effectiveness of New Momentum Trading Strategy in A-Share Market - An Empirical Test Based on the Highest Price in the Past 52 Weeks. Securities Market Herald, (2015).