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An empirical study of industry momentum strategy on Chinese stock market, 2006-2021

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Data Science

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CHAPTER 1 INTRODUCTION TO MOMENTUM STRATEGY

1.1 Momentum strategy definition and types

Momentum strategy refers to the continuous movement trend of stock returns in time, that is to say, the stocks with good returns in the early period will continue to perform well in the future, and the stocks with poor returns in the early period will continue to perform poorly. On the contrary, in the securities market, the stocks that perform well in the early stage will perform poorly in the future, while the stocks that perform poorly in the early stage will perform better.

Based on the momentum strategy of stocks, investors can take appropriate investment methods for investment and trading, that is, to buy stocks with excellent performance in the early stage, and sell stocks with poor performance in the early stage, so as to obtain momentum gains. This investment method is called momentum trading strategy.

As for the specific source performance of momentum strategy, there are many discussions and explanations on the specific definition of momentum strategy in the past. The following is the specific classification of the concept of momentum strategy. Through the explanation of scholars, to clarify the concept of this paper.

The most common is the price momentum of the stock, according to Charles m. c. Lee and Bhaskaran Swaminathan (2000) that is, the performance that the price continues the original trend of change and continues to rise to obtain income. Therefore, using the price momentum strategy to construct the investment strategy is to buy the stocks with strong price rise in the early stage as the investment portfolio, in order to obtain the excess rate of return that exceeds the average return of the market.

In fact, style momentum strategies, according to Hsiu-Lang Chen, Werner De Bondt (2004), is a form of style rotation that can serve this purpose. One buys stocks with characteristics that are currently in favor and one sells stocks with characteristics that are out-of-favor. If nothing else, the pressure from clients may sway managers to adjust their fund marketing.

Industry momentum, according to Jegadeesh and Titman (1993), means that the stock price of an industry has a continuous upward trend as a whole. Usually, the trend of economic development is oriented, the sunrise industries and new

economic growth points will show the momentum strategy of the industry. Investors can buy the industry's leading stocks with good prospects as a portfolio to obtain momentum gains.

Industry momentum strategy means that the performance of industry index return has a certain historical trend, that is, the industry with excellent performance in the past will continue to maintain a high return in the next period of time, while the industry with poor performance in the past will continue to maintain a low return in the next period of time. According to the industry momentum strategy theory, we can buy the stock portfolio of the industry with excellent recent return performance, and sell the stock portfolio of the industry with poor recent return performance to construct the investment portfolio, so as to obtain the excess return. This kind of trading strategy based on industry momentum strategy is called industry momentum trading strategy.

As for the reason of momentum strategy, there is no consistent conclusion in the current academic circles. Both traditional finance school and behavioral finance school have given relevant theoretical explanations.

There are many different explanations for the momentum strategy in traditional finance, mainly including: (1) dynamic risk model which regards risk factors as time-varying; (2) three factor model which considers market value scale, book to market ratio and P/E ratio of listed companies; (3) other models which add other important factors on the basis of three factor model. Generally speaking, although the traditional finance based on the efficient market hypothesis tries to explain the momentum strategy from different angles, the explanation is not satisfactory, and the explanation put forward by the traditional finance scholars is even contradictory to the actual results.

Different from the traditional financial scholars, behavioral finance scholars believe that the market inefficiency is not caused by factors that cannot be considered, and question the three premises of the efficient market hypothesis. On this basis, behavioral finance scholars have put forward a number of behavioral finance theoretical models, including BSV model, DHS model, HS model and so on. These models explain the phenomenon of "under reaction" and "over reaction" in the market from a specific point of view, and their explanatory power has greatly exceeded the theoretical models proposed by the traditional financial school.

According to the theory of behavioral finance, there are "under reaction" and

"over reaction" in the financial market, which shows that the financial assets have short-term price trend and long-term price reversal. In the stock market, the reaction mechanism of price to information is manifested in the common phenomenon of "chasing up and down" in the short term and price reversal in the long term. From the perspective of the industry, the release of relevant industry level news cannot fully reflect the changes in industry-related stock prices, which makes the stock market show a more significant industry rotation on the whole.

CHAPTER 2 RESEARCH RESULTS

2.1 Introduction

In this chapter, we will use the relevant industry return data and research model will be mentioned below to make an empirical study on the industry momentum effect on Chinese stock market. In addition, in order to better analyze the momentum effect of Chinese stock industry, we divide this chapter into several parts, in which I will mention about research data, methodology, and the industry momentum effect research results. This paper is divided into the following three parts.

The first part is the mechanism and model construction of industry momentum strategy. Based on the daily close price of Shenwan industrial sub index from January 1, 2005 to January 1, 2021, and referring to the methods used by Jegadeesh and Titman (1993), this paper constructs the industry "winner portfolio" and industry "loser portfolio", and selects different formation period and holding period to construct a variety of trading strategies.

The second part is the empirical study of industry momentum effect. This paper evaluates the performance of industry "winner portfolio", industry "loser portfolio" and industry momentum trading strategy in different formation period and holding period portfolio, and tests whether they can obtain the return relative to the benchmark index, and the significance of the ability to obtain this return. In addition, in order to evaluate the effectiveness of industry momentum trading strategy in practical operation, this part also discusses the case of transaction cost of 0.13%, in order to determine its impact on the return of industry momentum trading strategy.

The third part is the conclusion and analysis. After the empirical study on the momentum effect of Chinese industry, we summarize the empirical conclusions and shortcomings, and point out the direction for further research.

2.2 Data

In order to better study the industry momentum effect of Chinese stock market,

we first need to classify the stocks on Chinese stock market according to their industries. In this paper, we adopt the Shenwan industry classification standard (Shenyin Wanguo Securities Research Institute industry classification standard, <http://www.swsindex.com/idx0200.aspx?columnid=8838&type=Day>).

Shenwan industry classification standard is a kind of industry classification standard dedicated to the field of investment. This standard examines the correlation between products and services of listed companies, and considers the current situation and characteristics of Chinese industry development, which is different from other industry classification standards based on economic statistics and regulatory purposes. According to the links and differences among various industries, Shenyin Wanguo industry classification standard divides all industries into three categories, namely, the first level industry classification standard, the second level industry classification standard and the third level industry classification standard. The first level industry includes several more subdivided second level industries, and the second level industry includes several more subdivided third level industries. Shenyin Wanguo Securities Research Institute has formulated corresponding industry classification index for all three industry classification standards, which is used to reflect the stock price performance of Listed Companies in various industries. It is mainly used by investment professionals for comparative analysis of company value, industry asset allocation and investment performance evaluation. The industry classification standard has been widely recognized by professionals in the field of investment, and is a very authoritative industry classification standard in the industry.

On this basis, in order to ensure sufficient sample formation and certain market representativeness, and considering that the reform of non-tradable shares may have a certain impact on the overall results, this paper selects the daily closed price of Shenwan industry sub index from January 1, 2005 to January 1, 2021, with a total of 832 weeks in sixteen years. Considering that Shenwan industry classification includes all the listed companies of Shanghai and Shenzhen stock market, we select the Shanghai and Shenzhen 300 index as the market benchmark index, which can better reflect the overall performance of Shanghai and Shenzhen stock markets.

2.3 Methodology

2.3.1 Construction of "winner portfolio" and "loser portfolio"

In this paper, the decile method used by Jegadeesh and Titman (1993) is used to establish the "winner portfolio" and "loser portfolio". The method is to rank according to the income performance of each industry in the formation period, and to group according to the ranking results of each industry. In addition, according to the research of Jegadeesh and Titman (1993) and other scholars, the decile method is usually better than other grouping methods, so we also use the decile method for grouping. That is to say, all industry samples are equally divided into 10 groups. The industry portfolio with the top 10% return rate is regarded as the "winner portfolio" of the industry, and the industry portfolio with the bottom 10% return rate is regarded as the "loser portfolio" of the industry, and the sample industries with the "winner portfolio" of the industry and the "loser portfolio" of the industry are given the same weight. To be specific, all stock listed companies in China are divided into 31 specific industries according to Shenwan class industry classification standard, so we regard the industry portfolio with the top three returns as the "winner portfolio" of the industry, and the industry portfolio with the bottom three returns as the "loser portfolio" of the industry.

2.3.2 Selection of time interval

In the research of momentum effect, the choice of time interval between formation period and holding period is always a key parameter setting. According to the previous scholars' relevant research, although the research angle may be biased, but still draw a more consistent conclusion: in the short term of 2 weeks to 8 weeks, momentum effect will be more significant; in the medium and long term of 2 months to 6 months, momentum reversal effect will be more significant. In order to refine the research and try to make a more comprehensive analysis on the momentum effect of industries in the short, medium and long term. We set the time interval of formation period and holding period as 1 month to 12 months (1, 3, 6, 12 months) respectively. This time interval basically covers the time interval in which momentum effect is more

significant in previous scholars' relevant research, and accordingly construct 16 kinds of industry momentum trading strategies.

2.3.3 Data processing steps

In this paper, the data processing process is divided into the following steps.

(1) Select a certain length of time interval as the formation period of industry stock portfolio, and record it as J , and calculate the return rate of each industry index in this formation period, record it as $R_{i,t}(J)$;

(2) According to the rate of return of each industry index in the formation period J , the industry "winner portfolio" (W) and the industry "loser portfolio" (L) are constructed by the tenth method;

(3) After the formation period J is determined, a certain time interval is taken as the holding period of "winner portfolio" and "loser portfolio", which is recorded as K . Accordingly, this trading strategy is recorded as strategy (J, K) , and then the return of the industry "winner portfolio" in the holding period is calculated as $R_{W,t}(J, K)$, and the return of the industry "loser portfolio" is recorded as $R_{L,t}(J, K)$. At the same time, the cumulative return of the benchmark index (CSI 300 index) during the holding period is calculated as $R_T(k)$;

(4) Repeat the above three steps in turn. In this process, because each industry will be reordered in different formation periods, the composition of industry "winner portfolio" and industry "loser portfolio" will continue to change. And during the calculations, we consider the transaction fee when we buy and sell portfolios.

(5) The annualized returns of 16 strategies in 15 years from 2006 to 2020 are calculated for long and long-short respectively. At the same time, it calculates the annual return rate of CSI 300 index from 2006 to 2020 for a total of 15 years for buying and holding. Then put them in the same table for comparison.

(6) The return rate of the whole period of 16 strategies in 15 years from 2006 to 2020 is calculated. At the same time, we calculate the return rate of the whole period of CSI 300 in the whole 15 years from 2006 to 2020. Then put them in the same table for comparison.

(7) The annual maximum drawdown of 16 strategies in 15 years from 2006 to 2020 is calculated. At the same time, the annual maximum drawdown of CSI 300 from 2006 to 2020 is calculated. Then put them in the same table for comparison.

(8) The whole period maximum drawdown of 16 strategies in 15 years from 2006 to 2020 is calculated. At the same time, it calculates the maximum drawdown of CSI 300 in the whole range of 15 years from 2006 to 2020. Then put them in the same table for comparison.

2.4 Results

2.4.1 Momentum strategy for two different strategies with transaction cost

2.4.1.1 Momentum strategy of buying "winner portfolio"

Through data processing, we get the "winner portfolio" income data constructed according to the equal weight of Jegadeesh and Titman methods as follows.

Table 3.1 annual and whole period return of buying "winner portfolio" for industry momentum strategy on Chinese stock market

Strategy Date (Year)	(1,1)	(1,3)	(1,6)	(1,12)	(3,1)	(3,3)	(3,6)	(3,12)	(6,1)	(6,3)	(6,6)	(6,12)	(12,1)	(12,3)	(12,6)	(12,12)	CSI 300
2006	80.90%	70.75%	69.41%	68.50%	97.53%	88.55%	74.67%	73.94%	71.88%	69.69%	66.59%	75.14%	75.04%	73.65%	74.94%	77.23%	73.19%
2007	141.61%	131.72%	114.59%	113.89%	129.03%	109.82%	98.57%	106.80%	104.71%	89.47%	97.87%	99.15%	101.49%	88.77%	95.32%	104.67%	114.32%
2008	-41.03%	-54.76%	-62.00%	-60.91%	-41.14%	-59.16%	-65.33%	-62.57%	-62.77%	-68.31%	-66.79%	-66.47%	-66.75%	-72.25%	-75.93%	-74.83%	-76.51%
2009	94.70%	89.62%	88.79%	86.31%	85.91%	84.53%	82.55%	82.85%	82.32%	84.06%	75.94%	77.90%	57.98%	63.17%	67.81%	75.08%	73.80%
2010	1.92%	3.30%	6.13%	4.30%	2.28%	8.66%	12.92%	9.00%	8.30%	10.64%	9.80%	9.43%	3.30%	2.35%	5.92%	13.15%	-7.82%
2011	-26.84%	-14.01%	-15.96%	-15.35%	-5.28%	-10.49%	-17.34%	-16.30%	-20.49%	-19.52%	-21.29%	-18.17%	-17.41%	-15.52%	-15.33%	-12.65%	-17.99%
2012	-13.99%	-6.05%	-8.47%	-2.83%	9.17%	9.76%	9.05%	9.45%	6.30%	6.00%	8.03%	8.27%	14.71%	12.07%	11.07%	10.77%	-17.96%
2013	51.19%	44.99%	38.19%	37.07%	53.88%	49.42%	48.74%	49.42%	44.30%	46.97%	47.90%	47.50%	49.41%	47.79%	45.34%	47.47%	17.73%
2014	30.99%	23.71%	20.51%	21.97%	14.50%	14.54%	21.06%	18.66%	29.94%	27.54%	29.01%	19.19%	52.34%	36.83%	34.66%	13.19%	16.67%
2015	78.13%	44.49%	41.44%	47.68%	64.89%	20.23%	26.07%	39.31%	13.36%	6.87%	26.38%	47.16%	52.28%	58.09%	75.59%	60.66%	33.69%
2016	17.39%	13.35%	18.36%	15.76%	16.33%	21.40%	27.54%	21.09%	33.21%	26.76%	26.11%	20.89%	34.23%	34.17%	20.93%	10.09%	1.58%
2017	1.18%	-11.67%	-5.68%	-6.51%	-15.18%	-11.91%	-7.89%	-7.90%	-0.58%	-5.06%	1.54%	-4.66%	7.81%	1.49%	-4.32%	-11.37%	11.97%
2018	-0.04%	-5.84%	-15.60%	-17.92%	-2.43%	-5.86%	-14.08%	-23.24%	-22.38%	-18.17%	-24.79%	-26.11%	-34.18%	-29.69%	-25.55%	-27.30%	-19.37%
2019	-11.85%	17.70%	19.95%	20.80%	7.38%	28.79%	28.29%	26.46%	3.28%	26.65%	24.39%	24.68%	24.11%	28.22%	23.02%	29.83%	19.11%
2020	52.71%	50.60%	32.66%	32.69%	39.64%	42.98%	32.77%	39.96%	40.67%	28.38%	23.17%	40.65%	24.39%	15.89%	22.28%	35.45%	31.34%
2006-2020	456.95%	397.90%	342.32%	345.44%	456.52%	391.25%	357.58%	366.93%	332.04%	311.96%	323.88%	354.55%	378.77%	345.02%	355.75%	351.46%	253.77%

Source: Own calculations

From Table 3.1, we can clearly see that when the holding period and formation period of "winner portfolio" are from 1 month to 12 months, and the holding period is 1 months to 12 months, "winner portfolio" can obtain significant returns. Among the specific trading strategies, the "winner portfolio" which performs better in the formation period still has a good performance in the next holding period, and the acquisition of return reflects a certain trend.

Specifically, in all 16 trading strategies, 2 trading strategies can obtain significant returns more than 200%, and 7 trading strategies can obtain significant returns more than 100%, and 7 trading strategies can obtain significant returns between 50% and 100%. Among all the trading strategies that can obtain significant return, the average return rate of "winner portfolio" is 113.01% for 15 years and 7.53% for annual return, and the trading strategy that can obtain the highest return rate is (1,1), that is, the trading strategy with a formation period of 1 months and a holding period of 1 months, which can obtain a return rate as high as 203.19% for the whole period and 13.55% for annual return.

Our results show that there is a significant industry momentum strategy on Chinese stock market with considering the transaction cost caused by frequent position swap.

3.4.1.2 Momentum strategy of buying "winner portfolio" and selling "loser portfolio"

We use the equal weight method to construct the "winner portfolio" and "loser portfolio", and use the industry momentum trading strategy by holding the "winner portfolio" and selling the "loser portfolio". The return of the industry momentum trading is as follows.

Table 3.2 Annual and whole period return of buying "winner portfolio" and selling "loser portfolio" for industry momentum strategy on Chinese stock market

Strategy Date (Year)	(1,1)	(1,3)	(1,6)	(1,12)	(3,1)	(3,3)	(3,6)	(3,12)	(6,1)	(6,3)	(6,6)	(6,12)	(12,1)	(12,3)	(12,6)	(12,12)	CSI 300
2006	16.51%	4.62%	3.63%	7.48%	31.67%	25.83%	8.82%	11.62%	18.95%	9.33%	8.08%	15.93%	20.14%	15.81%	16.66%	21.71%	73.19%
2007	47.80%	20.76%	-4.04%	-5.55%	19.99%	-13.15%	-23.00%	-15.72%	-8.71%	-37.87%	-31.35%	-28.63%	-23.92%	-41.91%	-40.53%	-16.56%	114.32%
2008	23.36%	7.69%	-4.16%	-4.05%	21.89%	6.99%	-8.91%	-6.56%	-15.40%	-19.31%	-13.99%	-11.01%	-7.51%	-21.10%	-33.87%	-26.23%	-76.51%
2009	-4.64%	-5.33%	-3.05%	-6.00%	-4.96%	-3.99%	-8.66%	-12.51%	-0.84%	-14.62%	-23.04%	-23.65%	-37.15%	-32.44%	-35.03%	-23.66%	73.80%
2010	-7.75%	-2.41%	2.45%	-1.14%	-4.50%	6.43%	13.00%	4.95%	18.61%	17.34%	11.74%	11.84%	7.51%	10.79%	15.93%	26.11%	-7.82%
2011	-13.88%	6.34%	-1.67%	-1.42%	13.90%	0.60%	-8.25%	-5.50%	-12.44%	-12.86%	-13.22%	-7.19%	0.35%	-2.40%	-4.14%	1.08%	-17.99%
2012	-16.49%	1.07%	-4.70%	7.55%	25.19%	23.40%	26.08%	30.28%	19.16%	24.74%	28.38%	31.45%	39.92%	42.12%	40.00%	38.19%	-17.96%
2013	38.35%	25.45%	16.16%	12.31%	46.50%	36.57%	31.66%	32.73%	39.64%	38.18%	38.61%	31.27%	47.34%	41.38%	34.08%	31.76%	17.73%
2014	40.14%	28.57%	25.22%	24.59%	27.00%	22.78%	27.40%	15.62%	45.78%	47.26%	45.65%	18.73%	69.73%	48.07%	32.19%	0.32%	16.67%
2015	47.49%	-11.07%	-17.94%	-9.18%	19.20%	-34.13%	-32.25%	-22.12%	-25.37%	-28.99%	-22.09%	-19.50%	0.82%	10.72%	7.54%	5.54%	33.69%
2016	13.60%	0.24%	7.67%	2.11%	6.72%	16.75%	25.25%	12.10%	31.22%	27.70%	26.65%	9.66%	16.26%	17.66%	6.60%	-3.95%	1.58%
2017	2.77%	-7.03%	5.35%	6.16%	-10.65%	2.48%	9.23%	9.72%	22.63%	18.71%	22.07%	8.96%	23.92%	19.48%	9.69%	-1.19%	11.97%
2018	38.42%	28.48%	6.39%	-0.82%	23.58%	21.90%	3.72%	-12.00%	-1.08%	-5.71%	-18.19%	-20.89%	-21.78%	-15.96%	-17.19%	-20.08%	-19.37%
2019	-61.24%	-11.16%	-7.11%	-3.02%	-16.03%	21.75%	15.13%	10.58%	-28.82%	12.80%	7.03%	6.59%	18.90%	19.71%	12.59%	14.23%	19.11%
2020	14.86%	19.14%	5.45%	4.53%	15.15%	15.64%	0.08%	13.52%	24.88%	7.03%	-7.89%	21.66%	-1.06%	-9.00%	2.16%	15.14%	31.34%
2006-2020	179.29%	105.35%	29.65%	33.55%	214.66%	149.85%	79.29%	66.69%	128.19%	83.72%	58.44%	45.22%	153.46%	102.92%	46.69%	62.40%	253.77%

Source: Own calculations

From Table 3.2, we can clearly see that when the holding period and formation period of momentum trading strategy are between 1 and 12 months, the strategy can obtain more significant returns.

Specifically: in all 16 trading strategies, 3 trading strategies can obtain the significant returns which is between 150% to 215%, and 3 trading strategies can obtain significant returns which is between 100% to 150%, and 9 trading strategies cannot obtain significant returns which is between 25% to 100%. Among all the trading strategies that can obtain significant returns, the average return rate is 147.68% for the whole period and 9.85% for each year, and the trading strategy that can obtain the highest return rate is (3,1), that is, the trading strategy with 3 months formation period and 1 months holding period, the strategy can obtain 214.66% return rate for the whole period and 14.31% for each year.

In order to more intuitively understand the industry momentum trading strategy's ability to obtain returns compared with the CSI 300 index, we take the industry

momentum trading strategy (1,1) as an example, that is, the formation period is 1 months and the holding period is 1 months, and compare the cumulative returns between the trading strategy and the benchmark index (CSI 300 index) from January 1, 2006 to January 1, 2021.

Table 3.3 Annual and whole period return of (1,1) strategy of buying "winner portfolio" for industry momentum strategy on Chinese stock market

Date (Year) \ Strategy	(1,1)	CSI 300
2006	80.90%	73.19%
2007	141.61%	114.32%
2008	-41.03%	-76.51%
2009	94.70%	73.80%
2010	1.92%	-7.82%
2011	-26.84%	-17.99%
2012	-13.99%	-17.96%
2013	51.19%	17.73%
2014	30.99%	16.67%
2015	78.13%	33.69%
2016	17.39%	1.58%
2017	1.18%	11.97%
2018	-0.04%	-19.37%
2019	-11.85%	19.11%
2020	52.71%	31.34%
2006-2020	456.95%	253.77%

Source: Own calculations

From Table 3.3, we can see that during the period from January 1, 2006 to January 1, 2021, the momentum trading strategy (1,1) of the industry has achieved a cumulative return of 456.95%, that is, an annualized return of 30.46%. In this period, the cumulative growth of the CSI 300 index is only 253.77%, and the annualized return is only 16.92%. Thus, during the eight years, the momentum trading strategy (1,1) far outperforms the CSI 300 index and can obtain an annual return of 13.55%. In addition, we can also see that momentum trading strategy (1,1) has a significant correlation with the rise and fall of CSI 300 index, and the volatility of the former is significantly greater than that of the

latter. Specifically, when the CSI 300 index is in the rising market, the industry momentum trading strategy (1,1) will have a greater increase, while when the CSI 300 index is in the falling market, the industry momentum trading strategy (1,1) will have a greater decrease.

3.4.2 Maximum drawdown for two different strategies

3.4.2.1 Maximum drawdown for buying “winner portfolio”

Through data processing, we get the "winner portfolio" maximum drawdown data constructed according to the equal weight of Jegadeesh and Titman methods as follows.

Table 3.4 Annual and whole period maximum drawdown for buying “winner portfolio” for industry momentum strategy on Chinese stock market

Strategy Date (Year)	(1,1)	(1,3)	(1,6)	(1,12)	(3,1)	(3,3)	(3,6)	(3,12)	(6,1)	(6,3)	(6,6)	(6,12)	(12,1)	(12,3)	(12,6)	(12,12)	CSI 300
2006	7.38%	7.94%	7.39%	7.75%	7.01%	7.42%	7.89%	7.55%	7.62%	7.62%	8.08%	7.45%	7.62%	7.62%	7.42%	6.67%	9.74%
2007	22.00%	23.70%	24.64%	20.95%	27.48%	25.56%	25.38%	20.94%	25.40%	26.55%	24.53%	21.04%	25.40%	26.55%	25.56%	19.46%	15.57%
2008	64.20%	67.35%	67.53%	68.01%	64.70%	67.25%	67.90%	68.49%	65.41%	67.14%	67.52%	69.57%	67.73%	69.49%	67.25%	71.59%	69.29%
2009	28.62%	26.62%	24.67%	21.79%	31.72%	27.09%	25.12%	20.29%	28.24%	27.86%	24.69%	19.41%	28.24%	18.66%	27.09%	14.23%	24.91%
2010	30.67%	26.21%	27.17%	26.88%	23.06%	23.43%	23.91%	24.34%	29.07%	24.20%	23.19%	24.79%	25.20%	27.99%	23.43%	24.39%	28.55%
2011	21.15%	17.23%	19.99%	17.97%	10.32%	17.64%	19.53%	16.67%	24.79%	23.84%	19.24%	17.36%	16.18%	15.84%	17.64%	14.82%	21.87%
2012	17.34%	8.81%	13.63%	10.28%	7.72%	7.41%	7.50%	7.72%	8.29%	8.16%	8.24%	7.88%	8.43%	8.43%	7.41%	8.18%	21.41%
2013	12.44%	11.97%	12.82%	13.32%	9.56%	9.56%	11.17%	11.19%	9.56%	10.61%	12.26%	11.51%	9.56%	10.52%	9.56%	11.33%	19.32%
2014	4.14%	5.66%	6.77%	7.66%	13.32%	7.38%	6.97%	10.49%	6.04%	4.65%	6.51%	11.81%	1.89%	6.69%	7.38%	13.96%	7.41%
2015	21.97%	30.98%	33.17%	34.44%	28.25%	36.72%	34.94%	36.57%	40.96%	39.77%	40.16%	37.17%	38.89%	35.32%	36.72%	34.49%	35.06%
2016	12.88%	16.65%	13.00%	15.46%	23.26%	21.38%	12.40%	15.28%	6.52%	7.24%	6.82%	13.56%	11.19%	9.97%	21.38%	16.28%	16.37%
2017	8.75%	8.29%	7.30%	8.33%	9.21%	12.22%	10.50%	9.40%	10.34%	12.38%	9.68%	8.01%	6.65%	9.17%	12.22%	14.91%	2.21%
2018	10.50%	8.64%	13.58%	14.82%	13.62%	11.35%	17.13%	20.89%	23.86%	20.76%	25.75%	24.52%	36.32%	33.87%	11.35%	27.73%	25.17%
2019	31.13%	11.78%	8.91%	7.47%	15.69%	8.88%	5.92%	5.38%	23.39%	5.40%	4.96%	5.50%	11.75%	7.25%	8.88%	4.56%	8.60%
2020	14.49%	10.98%	9.90%	8.74%	21.44%	11.56%	10.01%	7.17%	7.84%	8.34%	10.45%	9.67%	11.60%	12.04%	11.56%	10.68%	11.49%
2006-2020	64.55%	69.47%	71.55%	70.36%	67.30%	71.35%	72.92%	70.87%	71.97%	73.78%	72.85%	72.12%	73.85%	75.66%	71.35%	73.65%	70.75%

Source: Own calculations

From Table 3.4, we can clearly see that maximum drawdown for all 16 strategies are relatively stable and close to maximum drawdown for CSI 300. When the holding period and formation period of "winner portfolio" are from 1 month to 12 months, and the formation period is 1 month, 3 months and 12 months, and the holding period is 3 months, "winner portfolio" has a slightly lower maximum drawdown than CSI 300, which are 64.55%, 69.47%, 70.36% and 67.30% respectively. Among the specific trading strategies, the "winner portfolio" which performs better in the return still has a good performance of maximum drawdown.

Specifically: in all 16 trading strategies, 4 trading strategies can obtain a slightly lower maximum drawdown than CSI 300, and 12 trading strategies can obtain a slightly higher maximum drawdown than CSI 300. Among all the trading strategies that can obtain lower maximum drawdown than CSI 300, the average maximum drawdown of "winner portfolio" is 67.92%, and the trading strategy that can obtain the lowest maximum drawdown is (1,1), that is, the trading strategy with a formation period of 1 months and a holding period of 1 months, which can obtain maximum drawdown as low as 64.55%.

Our results show that the risk for long strategy of industry momentum strategy on Chinese stock market is relatively same as CSI 300, which is acceptable in the perspective of investment.

3.4.2.2 Maximum drawdown for buying “winner portfolio” and selling “loser portfolio”

We use the equal weight method to construct the "winner portfolio" and "loser portfolio", and use the industry momentum trading strategy by holding the "winner portfolio" and selling the "loser portfolio". The maximum drawdown of the industry momentum trading is as follows.

Table 3.5 Annual and whole period maximum drawdown for buying “winner portfolio” and selling “loser portfolio” for industry momentum strategy on Chinese stock market

Strategy Date (Year)	(1,1)	(1,3)	(1,6)	(1,12)	(3,1)	(3,3)	(3,6)	(3,12)	(6,1)	(6,3)	(6,6)	(6,12)	(12,1)	(12,3)	(12,6)	(12,12)	CSI 300
2006	12.43%	13.08%	11.52%	5.91%	15.40%	14.65%	16.90%	6.75%	16.37%	16.68%	13.24%	7.72%	9.74%	15.64%	14.65%	12.69%	9.74%
2007	11.72%	15.52%	12.70%	6.12%	24.92%	28.62%	23.12%	15.90%	20.55%	34.82%	28.51%	25.43%	27.73%	36.55%	28.62%	17.05%	15.57%
2008	11.23%	8.51%	4.05%	2.25%	8.18%	6.13%	5.47%	2.48%	7.23%	12.37%	11.90%	6.82%	9.34%	10.33%	6.13%	18.79%	69.29%
2009	17.35%	14.54%	6.99%	9.42%	24.90%	15.19%	13.77%	18.61%	15.43%	22.99%	30.23%	29.45%	43.66%	38.82%	15.19%	35.20%	24.91%
2010	17.43%	6.33%	2.77%	2.70%	11.76%	5.52%	3.83%	6.01%	8.31%	4.32%	8.14%	6.43%	8.56%	6.94%	5.52%	3.11%	28.55%
2011	10.90%	4.20%	5.50%	1.71%	4.94%	8.62%	9.96%	6.23%	19.06%	16.71%	13.09%	8.98%	13.80%	15.55%	8.62%	11.80%	21.87%
2012	23.86%	9.02%	6.36%	1.68%	13.78%	11.70%	8.69%	2.73%	10.80%	8.41%	5.90%	0.85%	7.05%	4.51%	11.70%	0.52%	21.41%
2013	4.15%	3.31%	3.96%	3.65%	5.41%	7.01%	7.41%	7.42%	8.55%	8.25%	6.54%	10.27%	6.01%	7.65%	7.01%	12.46%	19.32%
2014	4.03%	9.30%	6.11%	2.77%	12.46%	11.57%	6.67%	9.95%	9.41%	4.16%	3.98%	11.42%	1.61%	7.06%	11.57%	18.99%	7.41%
2015	27.85%	30.07%	22.94%	20.73%	24.88%	42.78%	32.72%	32.05%	47.55%	40.05%	37.24%	37.37%	63.82%	37.83%	42.78%	32.67%	35.06%
2016	7.71%	8.43%	8.04%	2.53%	14.85%	9.52%	9.35%	7.00%	12.04%	9.38%	7.26%	7.36%	8.16%	8.77%	9.52%	33.19%	16.37%
2017	12.74%	8.75%	2.52%	3.42%	11.37%	6.00%	2.57%	3.33%	6.33%	6.49%	4.21%	5.04%	7.49%	7.56%	6.00%	16.96%	2.21%
2018	13.13%	9.35%	9.54%	8.39%	21.82%	15.60%	17.55%	23.17%	24.02%	26.42%	34.71%	31.16%	39.50%	36.12%	15.60%	29.56%	25.17%
2019	43.11%	12.39%	10.36%	5.90%	15.53%	2.27%	4.59%	5.72%	29.40%	7.62%	13.36%	7.88%	9.45%	10.89%	2.27%	6.53%	8.60%
2020	16.75%	7.31%	7.04%	0.57%	21.85%	14.34%	12.46%	8.17%	7.79%	9.63%	18.73%	9.36%	19.06%	21.60%	14.34%	3.88%	11.49%
2006-2020	58.07%	34.81%	27.44%	22.15%	37.89%	47.69%	48.76%	37.25%	47.55%	65.09%	62.57%	54.14%	65.57%	73.76%	47.69%	60.65%	70.75%

Source: Own calculations

From Table 3.5, we can clearly see that maximum drawdown for all 16 strategies are not stable but the values are significantly low compare to CSI 300. When the holding period and formation period of buying “winner portfolio” and selling “loser portfolio” are from 1 month to 12 months, and the formation period is from 1 month to months, and the holding period is from 1 month to months, "winner portfolio" has a significantly lower maximum drawdown than CSI 300. Among the specific trading strategies, the buying “winner portfolio” and selling “loser portfolio” which performs better in the return still has a good performance of maximum drawdown.

Specifically: in all 16 trading strategies, 15 trading strategies can obtain a significantly lower maximum drawdown than the SCI 300, and 1 trading strategies can obtain a slightly higher maximum drawdown than the SCI 300. Among all the trading strategies that can obtain lower maximum drawdown than the SCI 300, the average maximum drawdown of "winner portfolio" is 47.82%, and the trading strategy that can obtain the lowest maximum drawdown is (1,12), that is, the trading strategy with a formation period of 1 months and a holding period of 12 months, which can obtain maximum drawdown as low as 22.15%.

Our results show that the risk for short strategy of industry momentum strategy on Chinese stock market is significantly lower than CSI 300, which is well acceptable in the perspective of investment.

CHAPTER 3 CONCLUSIONS

This chapter uses Jegadeesh and Titman's momentum strategy research method to construct industry "winner portfolio" and industry "loser portfolio", and chooses different observation period and holding period to construct a variety of trading strategies. Then we evaluate the performance of industry "winner portfolio", industry "loser portfolio" and industry momentum trading strategy in different formation period, holding period portfolio, and test whether they can obtain the return relative to the benchmark index (CSI 300 index), and the significance of the ability to obtain this return. In addition, in order to evaluate the effectiveness of industry momentum trading strategy in practice, this chapter also discusses the transaction cost of 0.13%, in order to determine its impact on the return of industry momentum trading strategy.

Through the empirical study of this chapter, we find that there are the following characteristics on Chinese stock market.

The momentum strategy of the industry is more significant in the formation period and holding period less than 6 months. In the formation period and holding period less than 12 months, most of the "winner portfolio" can obtain more than 10% of the return. In addition, the trading strategy to obtain the highest return is (1,1). That is to say, the trading strategy with a formation period of 1 month and a holding period of 1 month can obtain a return of 13.55%.

By holding the "winner portfolio" and selling the "loser portfolio", the industry

momentum trading strategy can obtain significant returns in the observation period and the holding period from 1 month to 6 months. In addition, the trading strategy with the highest return is (3,1), that is, the trading strategy with the formation period of 3 months and the holding period of 1 month, which can obtain the return of 14.31%.

In practice, a large number of trading strategy positions will cause high transaction costs, thus eroding the momentum strategy, momentum reversal strategy and most of the returns obtained by momentum trading strategy. When the transaction cost is 0.13%, the return of momentum strategy is eroded by the high transaction cost. Momentum reversal strategy can still obtain significant return, but its holding period is greatly extended, and momentum trading strategy has been unable to obtain significant return.

According to Jegadeesh and Titman (1993), the return of portfolio is nearly 1% by compared with the market return. Rey and Schmid (2007) show that investors can obtain 44% of the annual excess by buying the stocks with the best return performance in the Swiss market index in the same formation period and shorting the stocks with the worst performance in the same formation period. According to the research of wermers, Barras and scallet (2010), only 0.6% of the mutual funds in the nearly \$1.2 billion mutual fund industry can outperform the market index after considering the transaction costs, management fees and risks. My result shows most of the "winner portfolio" can obtain more than 10% of the return by buying them.

REFERENCES

- Chen, H., De, Bondt, W. Style momentum within the S&P500 index [J]. *Journal of Empirical Finance*, 2004, 11:483-507.
- Jegadeesh, N. and Titman, S. Overreaction, delayed reaction, and contrarian profits [J]. *Review of Financial Studies*, 1995, 8: 973-993.
- Jegadeesh, N. and Titman, S. Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency [J]. *Journal of Finance*, 1993, 48.
- Jegadeesh, N., Titman, S. Cross-sectional and time-series determinants of momentum returns [J]. *The Review of Financial Studies*, 2002, 56:699-720.
- Jegadeesh, N., Titman, S. Profitability of Momentum Strategies: An Evaluation of Alternative Explanations [J]. *Journal of Finance*, 2001, 56.
- Lee, C., Swaminathan, B, Price momentum and trading volume [J]. *Journal of Finance*, 2000, 55, 2017 — 2070.
- Wang Changyun. An Empirical Study on the return momentum of Chinese stock market [J]. *China finance*, 2003, (12): 56-68. (In Chinese)
- Wu Shinong, Wu Chaopeng. Empirical research on "price inertia strategy" and "surplus inertia strategy" on Chinese stock market [J]. *Economic science*, 2003, 4:41-50. (In Chinese)
- Zhu Zhanyu, Wu Chongfeng, Wang Chengwei. Research on the profitability of Chinese stock market price momentum under different test cycles [J]. *World Economy*, 2003, 8:62-67. (In Chinese)