

An Empirical Analysis of Price Momentum Effect in A-share Market

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Abstract. This article sorts the returns of listed companies in the A-share market from May 1991 to April 2022 over the past J months, selects winners and losers, constructs a zero investment portfolio, and holds it for K months. The results showed that there is a reversal effect in the short term and a momentum effect in the medium to long term. Only when the holding period is one month, no obvious pattern can be observed. This article is interested in the combination of winners and losers with a holding period of one month. Next, Fama-MacBeth regression is used to further verify whether there is momentum effect in the A-share market when the holding period is one month. It was found that when the holding period is one month, there is no momentum effect in the A-share market, and there is a significant reversal effect in the short to medium term. In addition to the reversal effect in the short to medium term, winners and losers also experience a reversal in the long term. Taking the split share structure reform as the dividing point, winners and losers only have mid-term and long-term reversals before the reform, and there will also be short-term reversals after the reform. In addition, winners and losers have short-term and long-term reversals during bull markets, while bear markets have neither momentum nor reversal effects, while volatile markets only have short-term reversals.

Keywords: A-share Market; The Momentum Effect; The Reversal Effect; Fama-MacBeth Regression.

1. Introduction

In the 1970s, American economics professor Eugene Fama proposed the "Efficient Market Hypothesis" for the first time on the basis of summarizing previous theoretical and empirical research, forming a framework system of efficient market theory, which believed that the returns of stocks were unpredictable. For a long time since its introduction, this theory has played a leading role in the research on the development of the entire Western financial market, and Western economists have never stopped researching and debating the effectiveness of the securities market. In the past 20 years, a large number of empirical studies have tested this hypothesis. It is found that stock prices do not follow random walk, and their returns are predictable.

Since the 1980s, a large amount of empirical research has focused on various anomalies of efficient markets, with momentum effects and reversal effects being typical anomalies. The momentum effect suggests that stock prices follow the rule of "the strong remain strong, the weak remain weak", and the return on stocks tends to continue the original direction of movement, meaning that stocks with higher returns in the past can still achieve higher returns in the future. On the contrary, the reversal effect believes that the stock price has the characteristics of "mean reversion", and the stock return has the opposite trend to the original movement direction, that is, the stocks with higher returns in the past will get lower returns in the future, and will eventually return to the market equilibrium price. Since their introduction, the momentum effect and reversal effect have received widespread attention from academia and industry. Not only in the US stock market, but also in other developed country stock markets, both momentum and reversal strategies have strong applicability. Unlike other financial market anomalies, momentum and reversal effects have not shown signs of disappearing or weakening after receiving widespread attention from the academic community, and no reasonable explanation has been found for them.

The Chinese stock market began with the trial operation of the Shenzhen Stock Exchange on December 1, 1990, and the establishment of the Shanghai Stock Exchange on December 19. It has been developing for over thirty years now. During this period, the Shanghai and Shenzhen stock

markets gradually grew from a local stock market to a national stock market, and the stock market grew stronger and more standardized after multiple reforms. However, compared to the more than 100 year history of stock development in developed countries in Europe and America, China's stock market is still immature. There are many retail investors in the Chinese market, who pay attention to insider information and neglect the analysis of company value, and engage in speculation and following the trend. These behaviors are not conducive to the standardization of China's stock market and the improvement of market efficiency, and can easily trigger irrational behavior among investors, causing them to lose investment confidence and delaying the development of the stock market. Our country's market has undergone reforms, as well as brief bull and bear markets, as well as long-term volatile markets. For different periods, Chinese scholars have come to different conclusions about momentum and reversal effects. Therefore, it is necessary to re-examine whether the current A-share market has momentum or reversal effects.

2. Literature

2.1 Efficient Market Theory

As the founder of market efficiency theory, Fama (1970) [1] proposed the Efficient Markets Hypothesis, which divides efficient markets into weak form efficiency, semi strong form efficiency, and strong form efficiency. He believes that all strategies in an efficient market are futile and ineffective, which means that from the perspective of EMH theory, it is not believed that existing market information can be used to predict asset prices and obtain excess returns. Because the prices of stocks in the market already reflect all their information well, any arbitrage opportunities will be immediately eliminated by the market. In other words, any strategy cannot obtain excess returns.

However, with the passage of time and the deepening of research, EMH still faces challenges from theory and practice, which mainly come from three aspects: first, investors in reality are bounded rationality rather than completely rational. Human beings live in a very complex environment, and there is also completeness in the transmission process of messages. In terms of physiology, people's cognitive ability is also limited, and they cannot fully understand the world or fully control emotions. Therefore, there are great differences between bounded rationality investors and completely rational investors in investment strategy selection and information screening. Secondly, it is normal for investors to deviate from rationality. History is always strikingly similar, and investors habitually repeat the mistakes they made before, and they often have a herd mentality when making decisions. Finally, EMH believes that hedging can correct investors' misvaluations of asset prices in the market. Barberis and Thaler (2001) [2] argue that using hedging to eliminate the impact of market mispricing poses certain risks. In practice, an increasing number of market anomalies cannot be explained by traditional financial theories, such as the January effect, momentum effect, reversal effect, etc. The foundation of effective markets is beginning to shake, and behavioral finance theory is gradually developing.

2.2 Momentum/Reversal Investment Strategy

Momentum investment strategy and reverse investment strategy are widely studied in academia and the industry. Momentum investment strategy refers to sorting stocks based on their average returns over a period of time, with the group with higher returns being the winner and the group with lower returns being the loser, in order to construct a zero investment portfolio of buying winners and selling losers. On the contrary, the reverse investment strategy is to build a zero investment portfolio of buying losers and selling winners. Research has shown that both zero investment portfolios can bring positive investment returns.

De Bondt and Thaler (1985) [3] conducted a study on company stocks from 1933 to 1985. They first ranked the stocks based on their cumulative returns for the first three years, and then identified the investment portfolios of stocks with higher cumulative returns as winners. The investment portfolios of stocks with lower cumulative returns were identified as losers. After constructing the

investment portfolios, Calculate the return rates of the winner and loser portfolios separately over the next 60 months, and the results show that the return of the winner portfolio is lower than that of the loser portfolio, and the results are significant. They refer to this phenomenon as the reversal effect corresponding to the momentum effect. Jegadeesh and Titman (1993) [4] conducted a study on stocks in the United States securities price research from 1965 to 1989. They calculated returns for one to four quarters based on daily stock returns and referred to this stage as the formation period. Next, they sorted the stock returns during the formation period into winners' and losers' portfolios, constructing a zero investment portfolio of buying winners' and selling losers' portfolios, And holding these stocks for one to four quarters, it was found that the investment portfolio constructed in this way has a positive return during the holding period and can achieve an average annual investment return of 12%. They call this investment strategy momentum investment strategy. Michael et al. (2004) [5] used monthly data on NYSE and AMEX stocks from January 1926 to December 1995 and divided the market state into two states: up and down. They found that the profit of momentum strategy largely depends on the market state. Only when the market is in an up state, momentum strategy can profit, and momentum strategy profit increases with the increase of past market returns, but there is a long-term reversal, When the market is in a downward state, there is no momentum effect and there will be a long-term reversal. Moskowitz and Grinblatt (1999) [6] argue that the momentum effect returns of individual stocks come from the momentum effect returns of the industry. George and Hwang (2004) [7] used stocks from all CRSPs from July 1963 to December 2001 to study the anchoring effect of 52-week highs on momentum strategy returns. The results showed that the momentum strategy of 52-week highs performed better than JT individual stock momentum strategy and MG industry momentum strategy, and the momentum returns of this strategy did not reverse in the long term.

Yin Libo and Ma Danrong (2020) [8] empirically tested whether there is an acceleration/deceleration effect of momentum in the A-share market. They found that the return of winner portfolios with medium to long term stock price decelerations and increases is higher than that of winner portfolios with accelerated increases. The return of loser portfolios with medium to long term stock price decelerations and decreases is lower than that of loser portfolios with accelerated declines. On this basis, they constructed a deceleration momentum strategy that can achieve stable returns over the medium to long term compared to traditional momentum strategies, namely the arbitrage trading strategy of buying deceleration winner combinations and selling deceleration loser combinations, which can bring significant excess returns to investors over a relatively long holding period, and the volatility of this return is lower than that of acceleration winner/acceleration loser combinations. Wang Hao (2018) [9] and others used data from the A-share market from 1997 to 2017 as research samples to empirically analyze the performance of cross-sectional and time series momentum (reversal) strategies, and used the income decomposition method to study the causes of strategy returns. They also found significant cross-sectional reversal effects and time series momentum effects in the A-share market, with the latter performing slightly better than the former. The research on momentum strategy and reversal strategy by Wang Yonghong and Zhao Xuejun (2001) [10] shows the characteristic of return reversal. Yang Junfang (2019) [11] used the research methods of Jegadeesh and Titman, Moskowitz and Grinblatt, and George and Hwang to test the momentum effect of China's Shanghai and Shenzhen stock markets. The results showed that the momentum returns of JT and GH in China's Shanghai and Shenzhen stock markets were significantly negative, indicating a significant reversal effect in China's stock market.

2.3 Relevant Explanations for Momentum/Reversal Effects

Barberis et al. (1998) [12] argue that the short-term momentum effect exists because investors slowly modify existing ideas when new information appears, while the long-term reversal is due to overreaction when investors completely modify existing ideas. Daniel et al. Hong and Stein (1999) [14] believe that there are two types of investors in the market, one is information investors who rely entirely on their private information, and the other is momentum traders who rely entirely on

information about past stock price fluctuations, with insufficient short-term response and excessive long-term response, leading to momentum effects in the short term and reversals in the long term.

2.4 Literature Review

The research in the above literature mainly focuses on price momentum, and momentum strategies also include surplus momentum, residual momentum, etc. In terms of time, they can be divided into daily momentum, weekly momentum, etc. The focus of this article is also on price momentum. Momentum strategy or reversal strategy can achieve considerable returns in many markets, and there is a certain connection between this strategy and market state. At different times, market state varies, and the momentum and reversal effects are not fixed, requiring timely adjustment of the strategy.

For the research on the momentum effect in the A-share market, the research conclusions of many literature are not the same, and even contradictory to each other. For example, Wang Yonghong and Zhao Xuejun (2001) [10] believe that there is a significant reversal effect in the Shanghai and Shenzhen stock markets based on stock market data from 1993 to 2000. Zhu Zhanyu et al. (2003) [15] believe that there is a significant short-term momentum effect in the Shanghai and Shenzhen stock markets based on stock market data from 1995 to 2001. Zhu Xi (2008) [16] believes that A-shares have short-term momentum effects, medium-term reversal effects, and long-term momentum effects based on data from 1997 to 2005. The differences in these conclusions can be attributed to scholars using different data samples, which mainly refer to two aspects of differences: firstly, in terms of time, if the selected sample time is inconsistent, the market will be inconsistent, and the empirical results will naturally be inconsistent; Secondly, in terms of stocks, selecting stocks with different company characteristics should result in different analysis conclusions.

Most studies occurred many years ago, and the time span of the data was greatly constrained. Since the establishment of the Chinese stock market, there has been a total of 30 years, and the history is too short. If we only study data from a certain 10 or 20 years, there may be occasional phenomena that seriously affect the research conclusions. Therefore, this article will conduct an overall empirical study on all listed companies from May 1991 to present (April 2022), and divide the period into before and after the equity split reform, bull market, bear market, and volatile market. Only select samples of winners and losers for research. The biggest difference between this article and most literature is that most literature only uses the method of constructing investment portfolios, and this article also uses Fama-MacBeth regression for research.

3. Data and Methods

The research data of this article comes from the monthly stock return file in the stock market trading data of CSMAR database. The monthly return is selected based on the monthly stock return considering cash dividend reinvestment. This article excludes a few possible extreme data sources, including *ST and ST, which have small trading volumes and typically experience sharp rises and falls, as well as significant delisting risks. The time interval selected in this article is from May 1991 to April 2022, which is the latest data available from the early establishment of China's stock market to the time of research. It covers almost all months of trading data since the establishment of China's stock market. Compared with data from 10 or 20 years, it can ensure the objectivity and comprehensiveness of research conclusions to a greater extent.

This article adopts the overlapping sampling method proposed by Jegadeesh and Titman (1993) [4], which means that at any given period t , the momentum strategy consists of K winning and losing combinations. Specifically, the JT momentum strategy used in this article is to calculate the returns of individual stocks in the past J periods at a given time t , and divide them into five equal parts in ascending order. The 20% stocks with the lowest returns form the loser combination L , and the 20% stocks with the highest returns form the winner combination W . After the formation period, after an interval of one period, buy the winning combination and sell the losing combination, and then hold the K -period. At any period t , the JT momentum strategy includes K winning and losing combinations

established in $t-K, t-K+1, \dots, t-1$ periods. Thus, the arithmetic mean value of the winner's portfolio income is R_{Wt} , and the arithmetic mean value of the loser's portfolio income is R_{Lt} , then the JT momentum income in period t can be expressed as: $D_t = R_{Wt} - R_{Lt}$.

The biggest difference between this article and most existing literature in terms of research methods is that existing literature only constructs winner and loser investment portfolios when studying momentum effects. In addition to constructing winner and loser investment portfolios, this article also uses Fama-MacBeth regression method to perform cross-sectional regression at each time, and then calculate the mean and standard error of the regression coefficients. By using the sign of the regression coefficient, it is possible to determine whether there is a momentum effect, and at the same time, to determine the degree to which the expected returns are explained by the returns during the formation period and the returns from the previous month.

4. Empirical Analysis

4.1 Portfolio Analysis

The sample selected in this article is the monthly returns of A-share listed companies from May 1991 to April 2022, with a total of 586539 monthly observations. According to the JT momentum strategy, the formation period is divided into 3 months, 6 months, 9 months, and 12 months, with holding periods of 1 month, 3 months, 6 months, 9 months, and 12 months. The average monthly returns of the winner and loser portfolios are shown in Table 1, with t-values in parentheses. From the table, it can be seen that most of the 20 investment portfolios have significant positive excess returns, indicating that the A-share market in China has a general and strong momentum effect, while the reversal effect is weak.

Specifically, when the formation period is 3 months, the yield of the winner portfolio with a holding period of 1 month and 3 months is lower than that of the loser portfolio, with -0.82% and -1.22%, respectively, but with weaker significance. The yield of winner portfolios with a holding period of 6 months, 9 months, and 12 months is significantly higher than that of loser portfolios, especially when the holding period is 6 months, the average monthly excess return is 6.19%. For investment portfolios with formation periods of 6, 9, and 12 months, the momentum and reversal effects are still weak at holding periods of 1 and 3 months. However, holding periods of 6, 9, and 12 months have strong momentum effects and can generate significant momentum returns. The zero investment portfolio with a formation period of 6 months and a holding period of 9 months has the highest monthly return of 7.12%, with a t-value of 27.89.

Table 1. Monthly average returns of winner and loser portfolios

J		K=1	3	6	9	12
3	W	0.0154	0.0143	0.0609	0.0484	0.0452
		(2.5244)	(3.9823)	(14.2073)	(14.4687)	(12.6375)
	L	0.0236	0.0264	-0.0010	0.0123	0.0155
		(2.7395)	(5.3880)	(-0.2965)	(4.0622)	(6.2222)
	W-L	-0.0082	-0.0122	0.0619	0.0361	0.0297
		(-1.3895)	(-2.6174)	(16.4557)	(10.7412)	(8.6907)
6	W	0.0200	0.0174	0.0561	0.0625	0.0541
		(2.8761)	(4.5461)	(15.8745)	(19.6003)	(19.9279)
	L	0.0155	0.0208	-0.0068	-0.0088	0.0015
		(2.2418)	(4.8165)	(-2.636)	(-4.0606)	(0.6737)
	W-L	0.0045	-0.0034	0.0629	0.0712	0.0527
		(1.2385)	(-1.3406)	(30.1304)	(27.8897)	(23.9751)
9	W	0.0192	0.0179	0.0482	0.0574	0.0602
		(2.6610)	(4.5908)	(15.5036)	(22.0776)	(22.7546)
	L	0.0158	0.0185	-0.0034	-0.0101	-0.0098
		(2.3712)	(4.6551)	(-1.3422)	(-5.3399)	(-5.9087)
	W-L	0.0034	-0.0007	0.0516	0.0675	0.0700
		(0.9951)	(-0.3247)	(29.6248)	(41.0158)	(38.3642)
12	W	0.0150	0.0170	0.0434	0.0515	0.0561
		(2.0541)	(4.2073)	(14.8217)	(21.2796)	(24.7033)
	L	0.0139	0.0176	-0.0007	-0.0067	-0.0098
		(2.0146)	(4.4334)	(-0.2742)	(-3.5472)	(-6.1921)
	W-L	0.0011	-0.0005	0.0441	0.0582	0.0659
		(0.3190)	(-0.2189)	(24.6589)	(39.2255)	(46.6667)

From the above table, it can also be seen that the momentum effect and reversal effect of the A-share market seem to be only related to the holding period. When the holding period is 6 months, 9 months, and 12 months, the portfolio returns are significantly positive, indicating a strong momentum effect in the medium to long term. When the holding period is 3 months, the portfolio returns are all negative but not significant, and the reversal returns decrease with the growth of the formation period, and the significance gradually weakens, indicating a weak reversal effect in the short term. For investment portfolios with a holding period of one month, it is not possible to determine whether there is a momentum effect or a reversal effect, nor can clear patterns be observed.

4.2 Fama-MacBeth Regression Analysis

Portfolio analysis cannot determine whether a portfolio with a holding period of 1 month has momentum effects. In order to further investigate whether a portfolio with a holding period of 1 month will experience a reversal, Fama-MacBeth regression is used to determine the relationship between its returns and the formation period returns.

Scholars have pointed out that there is a short-term reversal effect, where winners who performed better in the previous month will have lower returns in the next month, while losers who performed worse in the previous month will have higher returns in the next month. Therefore, this article also considers adding the previous month's returns as the control variable. In addition, the control variables also include the monthly turnover rate, the number of individual shares traded per month (100 million shares), the monthly trading amount of individual shares (100 million yuan) and the total market value of individual shares per month (100 million yuan). In order to avoid the regression coefficient being too small, the natural logarithm is taken for the monthly trading amount of individual shares and the total market value of individual shares per month.

Firstly, all samples were regressed using Python. The regression coefficients and t-values are shown in Table 2, where $r_{j,2}$ represent the formation period returns and lag_r1 represents the revenue from the previous month. From Table 2, it can be seen that the coefficients of returns with a formation period of 3 and 6 months are negative, indicating that stocks that have performed better in the past J months have lower returns in t month, while stocks that have performed worse in the past J months have higher returns in t month, but with weaker significance, indicating a reversal effect in the medium to short term. The coefficient of last month's returns was significantly negative, indicating a short-term reversal in the stock market. When all control variables are added, the absolute values of the coefficients forming the period return and the previous month return become larger, and the significance also increases significantly, indicating that after controlling for other characteristics of the stock, the reversal effect will be significantly enhanced. It is worth noting that the regression model used in this article is not used for pricing, and even if there is a significant intercept term, it does not affect the analysis of momentum effects in this article.

Table 2. Regression results of all samples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
intercept	0.0180 (2.5837)	-0.0570 (-4.4124)	0.0155 (2.7175)	-0.0549 (-4.0536)	0.0131 (2.3634)	-0.0636 (-5.3872)	0.0142 (2.5076)	-0.0756 (-8.2584)
$r_{3,2}$	-0.0187 (-1.6020)	-0.0721 (-2.1070)						
$r_{6,2}$			-0.0025 (-0.5905)	-0.0313 (-5.2853)				
$r_{9,2}$					0.0011 (0.3432)	-0.0227 (-4.0443)		
$r_{12,2}$							0.0006 (0.1954)	-0.0144 (-1.7395)
lag_r1	-0.0521 (-2.7501)	-0.1646 (-5.2758)	-0.0416 (-2.6273)	-0.1397 (-5.1772)	-0.0420 (-2.4373)	-0.1730 (-5.8596)	-0.0457 (-2.5519)	-0.1767 (-3.9219)
turnover		0.0625 (2.3466)		0.0448 (1.2935)		0.0584 (1.8933)		0.0938 (18.4465)
volume		-0.0698 (-0.6307)		0.0190 (0.6356)		-0.0882 (-1.0856)		-0.0339 (-1.3890)
ln_trd		0.0106 (2.3225)		0.0097 (2.7214)		0.0183 (2.2111)		0.0253 (1.4082)
ln_size		0.0120 (6.6061)		0.0094 (3.1874)		0.0099 (3.4210)		0.0101 (2.5519)

Considering that the presence of reversal effects in all samples may be due to the influence of samples from other groups, in order to further explore whether the combination of winners and losers also has reversal effects, regression was conducted using samples from the combination of winners and losers, and the results are shown in Table 3. The regression results of the winner and loser investment portfolios are similar to those of all samples, and there is also a reversal effect in the short to medium term. After adding all control variables, the coefficients become larger and more significant, and there is also a significant reversal effect in the long term. In most cases, the coefficients of the past J-month returns and the previous month returns of the winner and loser

combinations are more significant than the coefficients of all samples, indicating a stronger reversal effect in the two extreme combinations.

Table 3. Regression results of winner and loser samples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
intercep	0.0219	-0.0730	0.0166	-0.0842	0.0134	-0.0882	0.0111	-0.0838
t	(2.3183)	-4.5924	(2.8396)	(-9.4726)	(2.2453)	(-10.3606)	(1.5372)	(-10.4817)
r3,2	-0.0133	-0.0420						
	(-1.2634)	(-4.6879)						
r6,2			-0.0039	-0.0284				
			(-0.9056)	(-6.1156)				
r9,2					0.0005	-0.0197		
					(0.1546)	(-5.6948)		
r12,2							0.0037	-0.0202
							(1.1175)	(-6.6091)
lag_r1	-0.0454	-0.1050	-0.0447	-0.0959	-0.0357	-0.1106	-0.0634	-0.1153
	(-1.4714)	(-6.8783)	(-2.6382)	(-4.8906)	(-2.2138)	(-6.7665)	(-2.6828)	(-7.3463)
turnover		0.0805		0.0879		0.0898		0.0911
		(14.8770)		(13.6133)		(15.9151)		(16.2206)
volume		-0.0055		-0.0444		-0.0198		-0.0072
		(-0.3785)		(-1.6840)		(-2.6413)		(-0.8878)
ln_trd		0.0078		0.0033		0.0041		0.0047
		(1.6568)		(1.4381)		(1.6134)		(1.7272)
ln_size		0.0140		0.0184		0.0184		0.0175
		(4.2120)		(7.8528)		(8.9674)		(9.6453)

4.3 Analysis of Samples From Different Periods

Many scholars have conducted research on the momentum effect in China's stock market, but their conclusions obtained from selecting different periods and stock samples are not entirely the same. In order to verify whether the reversal effect of investment portfolios with a holding period of one month exists for a long time, this article also analyzes samples from different periods, mainly divided into periods before and after the equity split reform and different market states.

4.3.1 Before and after the equity split reform

China implemented the split share structure reform in May 2005, therefore, the sample interval selected before the split share structure reform was from May 1991 to April 2005. Considering that investors need some time to absorb and adapt to this reform, the transition period will be one year after the implementation, during which some listed companies have completed the share reform. Therefore, the sample range selected after the split share structure reform is from May 2006 to April 2022.

The sample regression results before the equity split reform are shown in Table 4, which are similar to the results for all periods. After adding all control variables, the coefficient of the formation period return and the coefficient of the previous month return become larger and more significant. From the regression results, it can be seen that before the equity split reform, the combination with a formation

period of 6 months, 9 months, and 12 months had a significant reversal effect, while the short-term reversal effect of 3 months was relatively weak.

Table 4. Sample regression results before the equity split reform

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
intercept	0.0154 (0.9761)	-0.0647 (- 3.1686)	0.0087 (0.8405)	-0.0633 (- 4.2485)	0.0100 (0.8993)	-0.0845 (- 4.8475)	-0.0161 (- 0.9573)	-0.0663 (- 5.1565)
r3,2	-0.0177 (- 0.8896)	-0.0294 (- 1.2325)						
r6,2			0.0010 (0.1032)	-0.0384 (- 2.7383)				
r9,2					0.0044 (0.6865)	-0.0215 (- 2.6855)		
r12,2							0.0341 (1.3422)	-0.0214 (- 2.8137)
lag_r1	-0.0246 (- 0.4821)	-0.1018 (- 2.7115)	-0.0487 (- 1.2122)	-0.1441 (- 3.7218)	-0.0121 (- 0.2582)	-0.1253 (- 3.4339)	-0.1776 (- 1.4829)	-0.1307 (- 3.9888)
turnover		0.1019 (8.4852)		0.0914 (7.2943)		0.1023 (9.6070)		0.1019 (8.3705)
volume		-0.0087 (- 0.4793)		-0.0304 (- 2.2204)		-0.0399 (- 2.6551)		-0.0178 (- 1.3484)
ln_trd		0.0232 (3.3872)		0.0170 (2.9836)		0.0183 (3.6590)		0.0210 (2.8010)
ln_size		0.0094 (2.3318)		0.0062 (1.2335)		0.0117 (3.0367)		0.0077 (1.8809)

After the equity split reform, the investment portfolio not only has a significant reversal effect in the medium to long term, but also has a strong reversal effect in the short term. Even without adding other control variables, its reversal effect has improved. The reversal effect after the split share reform is even stronger than that of the entire period, possibly because the samples from all periods are affected by the samples before the split share reform, which weakens its reversal effect. Therefore, the use of reverse strategies after the split share reform seems more profitable.

Table 5. Sample regression results after the equity split reform

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
intercep	0.0157	-0.0838	0.0159	-0.0882	0.0126	-0.0925	0.0105	-0.0969
t	(2.1735)	(-7.7094)	(2.1531)	(-8.4756)	(1.7993)	(-8.6427)	(1.5167)	(-9.0310)
r3,2	-0.0142	-0.0378						
	(-2.5870)	(-8.3479)						
r6,2			-0.0063	-0.0263				
			(-1.6552)	(-8.7520)				
r9,2					-0.0031	-0.0212		
					(-0.9865)	(-7.9245)		
r12,2							-0.0034	-0.0208
							(-1.2046)	(-9.0662)
lag_r1	-0.0361	-0.0992	-0.0361	-0.0955	-0.0375	-0.0966	-0.0433	-0.1042
	(-4.2836)	(-13.668)	(-4.2895)	(-12.565)	(-4.4953)	(-12.9189)	(-4.9400)	(-14.1363)
turnover		0.0609		0.0661		0.0700		0.0720
		(18.0906)		(19.8811)		(21.3930)		(20.7248)
		)		)		)		)
volume		0.0002		0.0002		-0.0001		-0.0009
		(0.5246)		(0.5786)		(-0.0799)		(-2.7481)
ln_trd		-0.0016		-0.0044		-0.0046		-0.0036
		(-0.8561)		(-2.3267)		(-2.3492)		(-2.0279)
ln_size		0.0171		0.0197		0.0200		0.0208
		(7.8363)		(9.4513)		(9.1997)		(9.7434)

4.3.2 Bull market, bear market, and volatile market

China's stock market has also experienced brief bull and bear markets multiple times, and many investors are concerned about what strategies to adopt in bull or bear markets to achieve higher returns. This article also tests whether there is still a reversal effect in bull, bear, and volatile markets. The K-line chart of the Shanghai Composite Index since the establishment of the stock market in China is shown in Figure 1. The Shanghai Composite Index reached 998 points on June 6, 2005, and then skyrocketed, reaching a historical high of 6124 points on October 16, 2007. There is no doubt that China's stock market has ushered in a major bull market in this short period. Afterwards, there was a bear market for a year, dropping from 6124 points to 1664 points on October 28, 2008. On August 28, 2012, the Shanghai Composite Index was at 2052 points, and on July 21, 2014, it was at 2054 points, which was a volatile period.



Fig. 1 K-line chart of the Shanghai Composite Index

The time interval for the bull market was selected from June 2005 to September 2007, and the sample regression results for this period are shown in Table 6. When no other control variables are added, only the coefficient of the investment portfolio with a formation period of 9 months is positive, and neither the momentum effect nor the reversal effect is significant. Although the degree of significance increased after adding control variables, only investment portfolios with a formation period of 12 months had a significant reversal effect. The coefficient of returns last month was still significantly negative, and short-term reversals still exist during bull markets, indicating the universality of short-term reversals. Therefore, adopting a short-term reverse strategy during a bull market may yield higher returns.

Table 6. Sample regression results during the bull market period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
intercept	0.0897 (3.87001)	-0.0671 (-1.7763)	0.1089 (4.3135)	-0.0564 (-1.3269)	0.1060 (3.7853)	-0.0957 (-1.8587)	0.1036 (3.1855)	-0.1021 (-2.0659)
r3,2	-0.0063 (-0.3197)	-0.0121 (-0.9343)						
r6,2			-0.0160 (-0.7994)	-0.0205 (-1.3703)				
r9,2					0.0077 (0.5481)	-0.0052 (-0.5430)		
r12,2							-0.0083 (-0.9486)	-0.0153 (-2.8573)
lagr1	-0.0331 (-0.9188)	-0.0841 (-3.4166)	-0.0259 (-0.6260)	-0.0747 (-2.6020)	-0.0119 (-0.2922)	-0.0634 (-2.2067)	-0.0283 (-0.8801)	-0.0694 (-2.9029)
turnover		0.1067 (7.2157)		0.1043 (6.5518)		0.1306 (6.5069)		0.1254 (6.9330)
volume		-0.0034 (-2.1015)		-0.0043 (-2.7825)		-0.0058 (-3.4588)		-0.0030 (-1.4591)
ln_trd		-0.0245 (-4.0744)		-0.0249 (-3.0791)		-0.0334 (-4.5822)		-0.0335 (-4.7525)
ln_size		0.0458 (6.1665)		0.0495 (5.1400)		0.0600 (5.4958)		0.0595 (5.8847)

The time interval for the bear market was selected from November 2007 to October 2008, and the regression results are shown in Table 7. Due to the short interval selected for the bear market, it is not possible to construct an investment portfolio with a formation period of 12 months. Therefore, Table 7 only presents the regression coefficients and t-values for investment portfolios with formation periods of 3, 6, and 9 months. From the regression results, it can be seen that although there was a reversal after adding control variables, none of them were significant, and the return coefficient of the previous month was also not significant, indicating that there was neither momentum effect nor reversal effect in a bear market. This phenomenon may also be caused by the short bear market

interval selected in this article, with a small sample size, which makes it impossible to obtain clear patterns.

Table 7. Sample regression results during the bear market period

	(1)	(2)	(3)	(4)	(5)	(6)
intercept	-0.1284 (-3.3441)	-0.2533 (-4.2581)	-0.1564 (-3.2219)	-0.2821 (-4.0888)	-0.2079 (-3.9227)	-0.3911 (-11.1750)
r3,2	0.0048 (0.2207)	-0.0115 (-0.8913)				
r6,2			0.0033 (0.1981)	-0.0105 (-0.6416)		
r9,2					-0.0186 (-1.1848)	-0.0178 (-1.2854)
lagr1	-0.0954 (-1.5601)	-0.1340 (-2.2870)	-0.0687 (-1.1394)	-0.0980 (-1.4948)	0.0183 (0.2880)	-0.0205 (-0.2151)
turnover		0.1079 (8.8141)		0.0927 (18.3249)		0.1092 (12.8888)
volume		0.0003 (0.1645)		0.0002 (0.0962)		-0.0011 (-0.2738)
ln_trd		-0.0283 (-4.7216)		-0.0412 (-7.3437)		-0.0463 (-4.5993)
ln_size		0.0357 (4.0779)		0.0434 (5.4408)		0.0605 (12.3155)

The time interval for the volatile market was selected from September 2012 to July 2014, and the regression results are shown in Table 8. From the results in the table, it can be seen that after adding control variables, only the coefficient and significance of the investment portfolio with a formation period of 3 months have increased, and the coefficient of last month's return is also significantly negative, indicating that there is only a short-term reversal effect in volatile markets. Therefore, in volatile markets, investors can adopt short-term reverse strategies to obtain higher excess returns.

Table 8. Sample regression results during the volatile market period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
intercept	0.0321 (1.9608)	-0.0135 (-0.5835)	0.0141 (0.7977)	-0.0355 (-1.3894)	0.0105 (0.5655)	-0.0340 (-1.2144)	0.0173 (1.3105)	-0.0244 (-1.3518)
r3,2	-0.0067 (-0.3571)	-0.0414 (-2.7675)						
r6,2			0.0184 (1.1386)	-0.0102 (-0.8395)				
r9,2					0.0123 (0.6912)	-0.0098 (-0.7159)		
r12,2							0.0095 (0.5062)	-0.0132 (-0.9387)
lagr1	-0.0434 (-1.9776)	-0.1210 (-5.4241)	-0.0318 (-1.3203)	-0.1018 (-4.3027)	-0.0435 (-1.6066)	-0.1084 (-4.2688)	-0.0688 (-3.0567)	-0.1384 (-5.7889)
turnover		0.0585 (8.8310)		0.0633 (9.1428)		0.0639 (7.6784)		0.0655 (8.1330)
volume		0.0001 (0.0985)		0.0005 (0.3834)		0.0003 (0.2236)		0.0005 (0.3357)
ln_trd		0.0069 (1.9997)		0.0019 (0.5615)		0.0030 (0.8892)		0.0042 (1.0911)
ln_size		0.0011 (0.2668)		0.0053 (1.3910)		0.0039 (0.8747)		0.0029 (0.7638)

Based on the empirical analysis of the above three markets, it can be seen that the momentum and reversal effects of the Shanghai and Shenzhen stock markets vary under different market conditions. In a bull market, there are short-term and long-term reversals; In a bear market, there is neither momentum effect nor reversal effect, and investors may need to look for other investment strategies; In an oscillating market, there is a short-term reversal effect. This empirical result has a clear guiding role for actual investors in the Shanghai and Shenzhen stock markets, and investors can choose corresponding strategies based on the market trends in reality.

5. Conclusions and Recommendations

5.1 Conclusions

Through empirical research and analysis in this article, the following conclusions can be drawn:

Firstly, according to portfolio analysis, the momentum and reversal effects in the A-share market seem to be only related to the holding period. There is a strong momentum effect in the medium to long term, with a formation period of 6 months and a holding period of 9 months. The zero investment portfolio has the highest monthly return of 7.12%. There is a weak reversal effect in the short term, and the reversal returns decrease with the growth of the formation period, and the significance gradually weakens.

Secondly, for investment portfolios with a holding period of one month, there is no momentum effect in the A-share market, and there is a significant reversal effect in the short to medium term. In addition to the reversal effect in the short to medium term, winners and losers also experience a reversal in the long term. Taking the split share structure reform as the dividing point, winners and losers only have mid-term and long-term reversals before the reform, and there will also be short-term reversals after the reform. In addition, winners and losers have short-term and long-term reversals during bull markets, while bear markets have neither momentum nor reversal effects, while volatile markets only have short-term reversals.

5.2 Investment Advice

Investors can use investment portfolios constructed based on returns from the past 3, 6, 9, and 12 months, and this momentum strategy achieves significant excess returns in the medium to long term (6-12 months). The proportion of systemic risk in the Chinese stock market to the total risk is very high, and the systemic risk is very large. In the short term, in terms of reversal strategy and momentum strategy alone, the probability of success of reversal strategy is relatively high, and the expected excess returns are very considerable. The probability of momentum strategy failure is very high, at least for investors who cannot affect stock prices, momentum strategy or "chasing up and killing down" is the worst strategy.

Accurately grasping market trends can help investors gain greater returns. In bull markets, short-term reverse strategies can be adopted for reverse operations. In bear markets, momentum strategies and reverse strategies cannot achieve significant excess returns. Investors need to find other strategies. In volatile markets, investors can adopt short-term reverse strategies to obtain higher excess returns.

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