

An Empirical Study on the Medium and Long Term Overreaction of the Growth Enterprise Market

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Abstract: This paper uses the "winner portfolio loser portfolio" model proposed by Jegadeesh and Titman in 1993 to measure the market efficiency of China's GEM from 2016 to 2021. The results show that the reverse arbitrage model of the sample consisting of 238 stocks in the GEM obviously violates the random walk model of stock prices in the empirical interval. The winner portfolio and loser portfolio based on the past price trend of stocks show statistically significant reverse effect returns and momentum effect returns respectively in the test period. Moreover, Fama French three factor model cannot explain the excess return obtained by arbitrage portfolio from the perspective of risk pricing. Based on the above conclusions, some conclusions and suggestions are put forward.

Keywords: Growth Enterprise Market; Overreaction; Momentum Effect; Three Factor Model

1. Journals Reviewed and Introduction

1.1 Journals Reviewed

De Bondt and Thaler (1985) ^[1] were the first scholars to study the phenomenon of overreaction. Barberis, Shleifer and Vishny (1998) ^[2] selected "conservative bias" and "representative principle bias" as the influencing factors to establish a BSV model. Recent studies on China's GEM market mainly include Zhang Chengbo (2021) ^[3] used the test methods of Jegadees and Titman in the research on momentum and contrarian effects of China's GEM market - the HS model analysis based on behavioral finance, and used the non overlapping sampling method to empirically test that the HS model also has some explanatory power in China's GEM market. Chen Lifan ^[4] found that China's stock market has a reversal effect under the two perspectives of information shock and historical rate of return by constructing "loser portfolio" and "winner portfolio"

1.2 Introduction

First of all, the basic function of capital market is to rationally allocate capital, the most valuable resource in modern economy, and the efficiency of resource allocation depends on the effectiveness of the market. so the efficient market hypothesis is one of the indispensable foundational theories in the modern financial theory system. But since the introduction of efficient market hypothesis was published, it has been widely questioned. in empirical research, January effect, scale effect, dividend puzzle, and closed-end fund discount puzzle. These financial anomalies also greatly discount the usefulness of efficient markets.

Finally, China's GEM market is still at the initial stage of development, and there are many deficiencies. It is more and more important to find out the irrational phenomena in China's GEM market and seek solutions.

2. Data and Research Methods

2.1 Data

This study has made the following improvements in the following aspects:

① The sample range is from January 2016 to December 2021.12. The data is relatively new, and the GEM has experienced a complete transition between bull and bear.

② In order to provide sufficient data for future model calculation and avoid autocorrelation bias of small samples, stocks suspended for more than one month during the period and GEM stocks listed after January 1, 2016 are excluded, and intermediate suspension and listed companies with negative returns are also excluded.

③ In order to test whether the excess return generated by the reversal strategy is generated by the time-varying risk premium, the article quotes French—Fama's three factor model. Risk coefficient through inspection β Value and excess return α Whether the value is close to zero is used to study and judge the relationship between excess return and risk caused by overreaction.

According to the above processing method, we can conclude that 238 stocks in the sample range meet the requirements. The data used in this paper are all from CSMAR, and the data analysis tools used are Excel and stata.

2.2 Research Methods

In order to make the research on the medium and long-term overreaction of China's GEM market more representative, we constructed the winner's portfolio, loser's portfolio and reverse arbitrage strategy (loser-winner) portfolio based on the monthly cumulative excess return of stocks according to the method of Jegadeesh and Titman (1995).

The excess return of each stock is calculated according to the six-month "formation period". The sample data of monthly excess return rate is divided into 10 formation period intervals on average from January 2016 to December 2020. Each formation period interval has 6 months. For example, January 2016 to June 2016 is the first formation period interval,By analogy, July 2020 to December 2020 is the tenth formation period interval. For each formation period interval, the next 1-12 months shall be the inspection period of the interval.

The last month of each formation period interval is represented by $t=0$, for example, June 2016, December 2016... December 2020. After doing this, $t=-5$ to $t=0$ represent the months in the formation period, and $t=1$ to $t=12$ represent the months in the inspection period. Results We got 10 winners' portfolios and 10 losers' portfolios, and each empirical interval (an interval consisting of a 6-month formation period and a test period of 12 months immediately following) includes a winner's portfolio and a loser's portfolio, so we also got 10 empirical intervals.

Finally,the top ten stocks with the highest return in the formation period form a group that we call the "winner portfolio", and the ten stocks with the lowest return form a group that we call the "loser portfolio". Once the portfolio is formed, it will be held for 1 to 12 months according to the size of the "inspection period". the return of the reverse arbitrage strategy portfolio in the test period, that is, the difference between the return of the "loser portfolio" and the "winner portfolio".

2.3 Data Processing Details

Considering that the GEM market had not been established for a long time, the paper believed that it was reasonable to use the market adjusted income method to calculate excess return.

Use the logarithmic method to calculate the return rate and market return rate of each stock.

$$\begin{aligned} R_{i,t} &= \ln(P_{i,t}) - \ln(P_{i,t-1}) \\ R_{m,t} &= \ln(P_{m,t}) - \ln(P_{m,t-1}) \quad (1) \end{aligned}$$

Including: P_i monthly composite index of GEM

P_m Represents the monthly closing price of individual shares

And calculate the excess return rate of each stock

$$\mu_{i,t} = R_{i,t} - R_{m,t} \quad (2)$$

① Cumulative excess yield in formation period

$$C\mu = \sum_{t=-5}^{t=0} \mu_{i,t} \quad (3)$$

② Average abnormal return of each month in the inspection period

$$AR_{W,n,t} = \frac{1}{10} \sum_{i=1}^{10} \mu_{w,n,i,t} \quad (4)$$

$$AR_{L,n,t} = \frac{1}{10} \sum_{i=1}^{10} \mu_{L,n,i,t} \quad (5)$$

Where: n=1, 2... 10 indicates the inspection period

W stands for winner portfolio

L represents loser combination

③ Cumulative average abnormal return CAR and $ACAR$ during the inspection period

$$CAR_{w,n,T} = \sum_{t=1}^T AR_{w,n,t}$$

$$CAR_{L,n,T} = \sum_{t=1}^T AR_{L,n,t} \quad (6)$$

Where: T=1,2..... 12 represents the length of each inspection period

Then average the winner's portfolio and loser's portfolio in 10 test intervals to measure the overreaction of the whole market

$$ACAR_{w,T} = \frac{1}{10} \sum_{n=1}^{10} CAR_{w,n,T}$$

$$ACAR_{L,T} = \frac{1}{10} \sum_{n=1}^{10} CAR_{L,n,T} \quad (7)$$

④ t_T statistic

According to the previous assumption that the stock market has overreaction, in the stage of $t > 0$, $ACAR_{w,T} < 0$, $ACAR_{L,T} > 0$ is true, that $ACAR_{L,T} - ACAR_{w,T} > 0$ is, it is true. Therefore, we construct statistics to test whether the results are significant.

$$t_T = (ACAR_{L,T} - ACAR_{w,T}) / \sqrt{2S_T^2 / N} \quad (8)$$

$$S_T^2 = \left[\sum_{n=1}^N (CAR_{w,n,T} - ACAR_{w,T})^2 + \sum_{n=1}^N (CAR_{L,n,T} - ACAR_{L,T})^2 \right] / 2(N-1) \quad (9)$$

Where, N represents the number of winner combinations or loser combinations, N=10

3. Empirical Test Results and Statistical Interpretation

The following is a T-test of the indicators constructed to determine the significance of the earnings of the winner's portfolio, the

loser's portfolio and the reverse arbitrage strategy.

Original hypothesis: Income performance of the portfolio of reverse arbitrage strategies in the test period $ACAR_{L,T} - ACAR_{w,T} \leq 0$ That is, there is no long-term overreaction

Alternative hypothesis: Income performance of the portfolio of reverse arbitrage strategies in the test period, $ACAR_{L,T} - ACAR_{w,T} > 0$ That is, there is a phenomenon of over reaction in the medium and long term.

3.1 Yield and T-statistics of Winner Portfolio, Loser Portfolio and Reverse Arbitrage Strategy Portfolio

Table 1 :ACAR and T statistics of three policy combinations in different test periods

Inspection period(t)	winner portfolio $ACAR_{w,T}$	Loser portfolio $ACAR_{L,T}$	Reverse arbitrage portfolio $ACAR_{L,T} - ACAR_{w,T}$	t_T Statistics of the return of reverse arbitrage portfolio
1	-0.045118	-0.05553	-0.01041	-0.41748
2	-0.043159	-0.03618	0.006984	0.28638
3	-0.072986	-0.01557	0.057414	2.341852**
4	-0.114465	-0.07066	0.0438	1.12875
5	-0.172953	-0.08639	0.086568	1.690451*
6	-0.19237	-0.12552	0.066849	1.284683*
7	-0.200395	-0.13435	0.066046	1.458064*
8	-0.201288	-0.13406	0.067231	1.378403*
9	-0.196402	-0.10342	0.092981	1.943928**
10	-0.256816	-0.13523	0.121581	2.085815**

Note: This table is prepared according to the calculation results. Among them

* means that the t_T statistics pass the 10% significance level test,

** means that the statistics pass the 5% t_T significance level test,

*** means that the statistics pass the 1% significance level test.

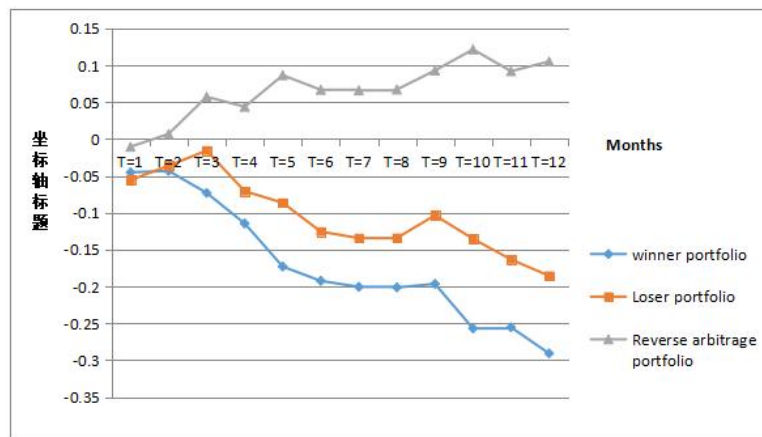


Figure 1 Average cumulative abnormal return rate of three strategy combinations under different test periods

3.2 Statistical interpretation of empirical results

As shown in Figure 1, in general, in the entire test period, the winning portfolio is $ACAR$ under the horizontal axis, indicating that the winning portfolio has experienced a stock price reversal in the test period, and the overreaction of the winning portfolio is significantly greater than that of the losing portfolio. The $ACAR$ curve of the loser portfolio as a whole is above the winner portfolio, which shows that the loser portfolio has better performance than the winner portfolio, but it is always below the abscissa, and the numerical returns continue to decline, which indicates that the loser portfolio has obvious momentum effect, showing that the loser is always losing. The reversal strategy portfolio has remained positive since the second month of the test period, and has increased significantly since then. In this case, the reversal strategy can outperform the market and is a better portfolio strategy than the buy and hold strategy. At the same time, the average cumulative abnormal return of the reversal strategy portfolio $ACAR_{L,T} - ACAR_{w,T}$ has passed the T test in most different test periods, and has a high degree of significance.

Specifically, the loser portfolio shows "the weak are always weak" in the one month test period. At this time, the average cumulative excess return of the winner portfolio is $ACAR_{w,T}$ higher than the $ACAR_{L,T}$. The average cumulative abnormal return of the constructed reversal strategy portfolio is negative during the one month test period. From the second month of the test period, the income performance of the winner's portfolio is significantly worse, and the income performance of the loser's portfolio is significantly stronger than that of the previous period. In the third month, the performance of both portfolios is the most significant, consistent with the characteristics of overreaction.

Finally, the $ACAR$ trend of the winner's portfolio and the loser's portfolio in the test period is roughly the same, and the change range of the winner's portfolio $ACAR_{w,T}$ is far greater than that of the loser's portfolio $ACAR_{L,T}$. It is shown in the figure as the size of the slope, which means that the income performance of both the winner's portfolio and the loser's portfolio is affected by the overall market trend. It shows that China's stock market has a large systematic risk, and all stocks have the obvious phenomenon of rising and falling at the same time. In addition, the reverse strategy portfolio constructed by buying loser portfolio and selling winner portfolio can obtain rich cumulative excess return. It can be preliminarily judged that the stock price overreaction in China's stock market exists within three months.

4. Reverse Arbitrage Return and Risk Premium Hypothesis

4.1 Theoretical Explanation

Chan (1988)^[5] believed that the risks of the winner's portfolio and the loser's portfolio are not constant. The asset value of the portfolio changes with the change of the stock price. After the risk factors are controlled, the excess return rate of the reversal strategy portfolio should be moderate. Li Anna^[6] used the FF three factor model and the four factor model containing momentum factors of different periods to regress the GEM portfolio, and found that the three factor model was not as strong as the four factor model in explaining portfolio returns. Fama and French (1993)^[7] proposed that the stock return rate can be explained by building a three factor model (namely, market factor, scale factor, book to market ratio factor), and believed that any portfolio or single stock would not be able to obtain excess returns after adjusting the three factor model. The following article will discuss the causes of the medium and long-term overreaction in the stock market through the Fama French three factor model, and test whether the medium and long-term overreaction in China's GEM market is mainly caused by changes in risk factors.

Use SMB 、 MRP 、 HML as the explanatory variables of the regression model, and use the cumulative excess return of the reverse arbitrage strategy portfolio constructed by the loser portfolio and the winner portfolio $CAR_{L,n,T} - CAR_{w,n,T}$ as the explanatory variables of the regression model. Therefore, the regression model constructed is:

$$CAR_{L,n,T} - CAR_{w,n,T} = \alpha_n + \beta_n MRP_t + S_n SMB_t + h_n HML_t + e_t \quad (10)$$

Table 2 Calculation Results of Regression Coefficients and t Statistics for Ten Test Periods

Coefficient ts and t statistics	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
β	-0.372 (-0.83)	0.634 (0.38)	0.287 (0.77)	-0.864 (-1.24)	0.058 (0.17)	0.377*** (4.69)	-0.307 (-0.98)	-0.649 (-1.58)	-1.447*** (-3.50)	0.267 (0.28)
S	-1.582 (-1.63)	-3.219 (-0.72)	0.402 (0.49)	1.667 (0.98)	0.082 (0.06)	0.485 (1.73)	-0.086 (-0.16)	0.705 (1.02)	-0.091 (-0.20)	0.077 (0.07)
h	-1.013 (-0.72)	-3.485 (-1.02)	-1.479 (-1.06)	0.542 (0.21)	-0.257 (-0.14)	1.476*** (4.26)	-0.833 (-1.04)	0.261 (0.14)	-1.820 (-1.61)	-0.466 (-0.34)
α	0.171*** (6.94)	0.137** (2.35)	0.013 (0.85)	0.083 (1.83)	0.084** (2.85)	-0.014** (-2.37)	0.018 (1.13)	0.043 (1.48)	0.247*** (10.43)	-0.093* (-2.29)
R^2	0.351	0.117	0.497	0.214	0.012	0.774	0.135	0.486	0.627	0.053

The in parentheses are t statistics

*** p<0.01, ** p<0.05, * p<0.1

From the figure, we can see that in the 10 test intervals discussed in this paper, although some regression coefficients are α significantly tested in the sixth and ninth test intervals, which can explain the cumulative R^2 excess return of the reverse arbitrage strategy to a certain extent, the constant items in the other six test intervals are significantly positive, and the goodness of fit is low, and a small number of empirical intervals that fail the significance test also have positive t statistics, The corresponding P value is also large. This shows that the three factor model has a low explanatory power for the portfolio income, and the medium and long-term overreaction in the market cannot be completely attributed to the change of risk factors, which confirms that the irrational behavior of investors ignored by traditional finance will also cause the market overreaction.

5. Summary and Outlook

5.1 Main Conclusions

First of all, China's GEM market has a mid - and long-term overreaction phenomenon with a monthly cycle, and the extra income realized by the difference between the excess cumulative average returns of the winner and loser portfolio in the test period cannot be fully explained by the traditional financial risk pricing theory, mainly because overreaction is also affected by the behavior bias of investors. From the perspective of psychological factors, psychological biases such as representational bias and conservative thinking mode will have an impact on investors' psychology when stock prices change [8].

Secondly, the empirical analysis made in this paper has similar conclusions with some foreign research results. With the extension of the formation period and the test period, the returns from the reverse arbitrage strategy composed of loser portfolio and winner portfolio show a more obvious positive correlation, and the significance level of returns is getting higher and higher. On the other hand, the loser portfolio has more obvious momentum effect than the winner portfolio, that is, the stocks falling in the formation period will continue to have a downward trend in the subsequent test period. In the medium and long term, the winner portfolio has an obvious reversal effect, that is, the stock price that rose in the early stage is likely to fall in the next few months. [9]

Finally, we test the relationship between overreaction and risk premium hypothesis by establishing a regression equation. The study found three risk coefficients in the three factor model β Basically zero, indicating that the reversal strategies in different test periods have excess returns that cannot be explained by time-varying risk premium in the medium and long term.

5.2 Outlook and Discussion

Based on the research results of behavioral finance theory, when making securities investment behavior, individual investors, as the main body of the capital market, should constantly reflect on their own investment philosophy and investment behavior, increase the number of rational investments, and avoid being driven by panic and greed to increase the volatility of the stock market price^[10]. In view of the reality of the immature securities market in China, small and medium-sized investors can adopt such strategies as reverse investment, centralized investment and cost averaging to strive for the highest excess return^[11]. On the other hand, as the supervisor of the capital market, the CSRC and policy makers need to recognize the negative impact of overreaction on the development of the resource allocation function of the capital market, and should speed up the reform of the trading mechanism of China's GEM market to maximize the effectiveness of capital pricing in the GEM market. We will strengthen and improve the market information disclosure mechanism, strengthen supervision, vigorously develop institutional investors, and strengthen investment knowledge training for small and medium-sized investors.^[12]

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