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ARE THERE SEASONAL ANOMALIES IN A-SHARES?

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ABSTRACT

In this paper, the existence of cross-section seasonal anomalies was empirically tested by portfolio analysis and Fama-MacBeth regression. The results of the empirical analysis indicated that stocks that performed relatively well in the same calendar month in the past had significantly higher returns than other stocks in that future calendar month. This statistically significant correlation holds over a 10-year interval. Bull and Bear portfolios based on this market anomaly can achieve excess returns of over 70 basis points and this return is not fully explained by the common risk factors.

Keywords: Fama-MacBeth regression, Portfolio analysis, Seasonal anomalies, Stock returns

1. Introduction

Seasonal anomalies in stock returns cross-section, or simply seasonality in stock returns, is a market anomaly in which the returns of individual stocks or portfolios are associated with a particular month. Heston and Sadka (2008) were the first to investigate this issue. They find that stock returns exhibit a surprising seasonal oscillation pattern in the cross-section, i.e., the winning stock portfolio in a given month over the past 20 years still significantly outperforms the losing stock portfolio in the same month in the next k years (k=1,2,..., 20). Accordingly, they suggest that there are seasonal anomalies in the cross-section of stock returns in the U.S. stock market associated with a particular month, i.e., there is an inertia effect on returns at annual intervals. Keloharju et al. (2016) found that a long-short strategy based on cross-section seasonal anomalies (buying the maximum 10% while selling the minimum 10%) can yield an annualized return of 13%. Further studies have shown that cross-section seasonal anomalies also hold for assets such as bonds, digital currencies, etc. (Mikutowski et al., 2019; Zaremba, 2019; Long et al., 2020). Current research on the yield characteristics within "SameMonRet" is mainly focused on the US market (e.g., Heston and Sadka, 2008; Keloharju et al., 2016; Hirshlifer et al., 2020). In a study of non-U.S. markets, Heston and

Sadka (2010) use stock trading data from Canada, Japan, and 12 European countries to find that seasonal anomalies are also present in the stock markets of these countries.

Although this paper is not the first to study cross-section seasonal anomalies in the A-share market, the findings on the existence of cross-section seasonality are inconsistent; for example, Li et al. (2018) include the Chinese market in their study sample, but their study sample has a large amount of missing data. Therefore, their findings for the Chinese market may be problematic; domestic scholars based on the sample of the A-share market from 2002 to 2010 argue that cross-section seasonal anomalies do not exist in the A-share market, but their sample period is relatively short and their findings may also be biased. In contrast, Jansen et al. (2021) replicated 32 market anomalies using A-share data, which involved cross- section seasonal anomalies, and found that long-short strategies based on the average returns of the same calendar month in the past could all produce statistically significant returns.

In view of this, a method from Heston and Sadaka (2008, 2010) and Keloharju et al. (2016) is drawn by the author in this paper. Fama-MacBeth regression and portfolio analysis were used. It was found that cross-section seasonal anomalies exist in the A-share market. Among them, Bull and Bear portfolio based on the historical same month return within the last 10 years can produce a monthly return of 0.65% and this return is not fully explained by the common risk factors.

2. Research Design

2.1 Sample Selection

The individual stock and market trading data used in the empirical analysis of this paper are obtained from the Guotaian CSMAR China stock market trading database. A total of 3,803 stocks and 498,351 "stock-monthly" sample points are selected from January 1997 to December 2020 in the Shanghai and Shenzhen A-share markets. The sample for the next empirical analysis of this paper is listed companies that are still trading from January 2002 to December 2020, using these companies with a lag of 5 to 10 years, i.e., from 1997 to 2010, to examine the cyclical pattern of period returns. Part of the empirical analysis in this paper requires the use of historical stock returns over the past 10 years, and over 1,000 of the 3,803 stocks used in this paper have more than 10 years of historical trading in the sample period, alleviating concerns about the adequacy of the sample size.

2.2 Definition of Core Variables

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The core variable in this paper is "SameMonRet", which for each stock i and each month t is defined as the average of the monthly returns during the same calendar month over the past 10 years.

$$SameMonRet_{it}^{10yr} = \frac{1}{10}(ret_{i,t-12} + ret_{i,t-24}, + \cdots + ret_{i,t-120}) \qquad (1)$$

Where, $ret_{i,t}$ is the return of stock i in month t. In calculating the historical same month return, this paper requires at least 5 observations of the same month return over the past 10 years, as well as at least 5 years of historical trading data must be available.

In this paper, a series of control variables are also included in the analysis of the existence of seasonal anomalies, including: logarithmic stock market value (Ln (MV)), book to market ratio (B/M), price momentum (Momentum), price reversal (Reversal), turnover (Turnover) and return on total assets (ROA).

2.3 Descriptive Statistics

Table 1 presents the results of descriptive statistics for the main variables in this paper for the period 2002 to 2020. During the sample period of this paper, the mean value of monthly stock returns is 1.11% and the standard deviation is 13.33%, while the mean and standard deviation of the historical same month return indicator are 1.70% and 6.31%, respectively.

Table1.Descriptive statistics of the main variables

Var	obs.	mean	sd	p5	p25	median	p75	p95
ret(%)	329698	1.11	13.33	-19.08	-6.83	0.00	7.84	24.84
SameMonRet(%)	329698	1.70	6.31	-6.66	-1.80	1.44	4.81	10.50
ln(MV)	329698	3.32	1.27	1.28	2.43	3.31	4.11	5.53
B/M	329698	0.40	0.28	0.07	0.19	0.33	0.54	0.99
Reversal(%)	329698	1.03	13.50	-19.40	-6.98	-0.14	7.80	25.16
Momenturm(%)	329698	13.88	62.48	-47.44	-24.41	-2.85	31.84	134.60
ROA	329698	0.05	0.16	-0.19	0.02	0.06	0.12	0.25
Turnover(%)	329698	0.43	0.31	0.09	0.20	0.35	0.59	1.09

3. Empirical Analysis

3.1 Portfolio Analysis

In this paper, the existence of cross-sectional seasonal anomalies by using the standard empirical asset pricing research method is tested firstly, Fama and French's (1992,1993)

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portfolio analysis method. Specifically, the paper first sorts all sample stocks by historical same month return index at the beginning of each month. After sorting, the sample is divided into 10 groups according to quartiles, where group 1 is the group with the lowest historical same month return and group 10 is the group with the highest historical same month return. Secondly, this paper considers the stocks within each grouping as a portfolio, so as to calculate the portfolio returns of different portfolios in that month. Finally, this paper also constructs a costless arbitrage portfolio, i.e., buying stocks in the historical same month highest return group. Meanwhile, the stocks in the group is sold with the lowest historical same month returns and calculate the returns of the arbitrage portfolio in the current month and the next month. The portfolio returns are calculated using the market capitalization weighted average method and the equal-weighted average method, respectively. The portfolio was constructed from January 2006 to February 2020, and the portfolio was updated monthly. In addition, the original portfolio return and a series of risk-adjusted excess return metrics are used separately in this paper when assessing the size of the portfolio returns.

The results of the portfolio analysis are presented in Table 2. In this section, Panel A demonstrates the returns of each of the 10 historical same month return portfolios and the Bull and Bear portfolio. Each row shows the original return, the excess return adjusted by the CAPM model, the Fama and French (1993) three-factor model, the Carhart (1997) four-factor model, and the Fama and French (2015) five-factor model, respectively.

As can be seen from the results of Panel A in Table 2, the average return of each portfolio increases with the increase in historical same month returns. Taking the raw returns under the flow-weighted average, the monthly average returns gradually increase from 0.91% (t=1.41) in the lowest group of historical same month returns to 1.51% (t=2.31) in the highest group, and the difference between the monthly average returns of the highest and lowest groups is 0.60% with a t-value of 3.76, which is statistically significant at the 1% level. This result indicates that the monthly returns of individual stocks in the A-share market are positively correlated with their historical same month returns over the past 10 years. By buying stocks with the highest 10% historical same month returns and selling stocks with the lowest 10% historical same month returns in a Bull and Bear portfolio. This achieves an annualized monthly return of 7.44%. Meanwhile, the results in rows (2) to (5) show that the returns of the Bull and Bear portfolio are not fully explained by the common risk factors. The excess returns measured by either the CAPM model, the Fama-French three-factor model, the Carhart four-factor model or the Fama-French five-factor model are all significant.

It is worth pointing out that the above findings are one of the important contributions of this paper. This paper presents and validates for the first time a novel capital market anomaly in the Chinese A-share market. Cross-section seasonal anomalies, where the monthly return of a stock has a significant positive correlation with its historical return in the same calendar

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month over the past 10 years. The Bull and Bear portfolio based on this anomaly can achieve an annualized excess return of 7.44%.

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Table 2.Historical same month return and stock return: portfolio analysis

Historical same month return portfolio	(1)Low	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)High	H-L
Panel A. Weighted average of market capitalization in circulation											
(1) Raw	0.91	0.98	1.06	1.25	1.28	1.36	1.45	1.52	1.46	1.51	0.60
	(1.41)	(1.51)	(1.67)*	(1.93)*	(2.01)**	(2.10)**	(2.25)**	(2.35)**	(2.27)**	(2.31)**	(3.76)***
(2) CAPM-α	-0.15	-0.09	-0.00	0.17	0.21	0.28	0.37	0.44	0.38	0.43	0.58
	(-0.50)	(-0.32)	(-0.01)	(0.61)	(0.78)	(1.01)	(1.35)	(1.59)	(1.41)	(1.47)	(3.60)***
(3) FF3F-α	-0.37	-0.33	-0.22	-0.05	-0.00	0.06	0.14	0.23	0.18	0.24	0.60
	(-2.83)***	(-3.03)***	(-2.16)**	(-0.48)	(-0.05)	(0.65)	(1.48)	(2.38)**	(1.83)*	(2.02)**	(3.77)***
(4) FFC4F-α	-0.33	-0.30	-0.19	-0.03	0.01	0.08	0.17	0.25	0.22	0.26	0.59
	(-2.62)***	(-2.83)***	(-1.91)*	(-0.28)	(0.14)	(0.91)	(1.85)*	(2.72)***	(2.35)**	(2.23)**	(3.67)***
(5) FF5F-α	-0.25	-0.25	-0.08	0.10	0.04	0.13	0.24	0.33	0.28	0.34	0.59
	(-1.86)*	(-2.29)**	(-0.78)	(1.04)	(0.44)	(1.42)	(2.44)**	(3.37)***	(2.78)***	(2.86)***	(3.46)***
Panel B. Equal Weighted Average											
(1) Raw	0.45	0.78	0.78	0.92	1.10	0.93	1.33	1.31	1.30	1.27	0.81
	(0.77)	(1.34)	(1.32)	(1.58)	(1.85)*	(1.54)	(2.24)**	(2.19)**	(2.20)**	(2.13)**	(3.00)***
(2) CAPM-α	-0.58	-0.24	-0.27	-0.11	0.04	-0.14	0.28	0.25	0.26	0.23	0.81

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	(-2.86)***	(-1.24)	(-1.48)	(-0.61)	(0.23)	(-0.83)	(1.59)	(1.45)	(1.41)	(1.11)	(2.94)***
(3) FF3F-α	-0.68	-0.37	-0.35	-0.20	-0.05	-0.21	0.19	0.18	0.20	0.19	0.87
	(-3.89)***	(-2.49)**	(-2.43)**	(-1.50)	(-0.37)	(-1.48)	(1.24)	(1.34)	(1.31)	(1.11)	(3.25)***
(4) FFC4F-α	-0.64	-0.36	-0.35	-0.21	-0.05	-0.21	0.20	0.19	0.23	0.19	0.83
	(-3.72)***	(-2.44)**	(-2.40)**	(-1.53)	(-0.37)	(-1.47)	(1.35)	(1.44)	(1.52)	(1.08)	(3.10)***
(5) FF5F-α	-0.56	-0.32	-0.16	-0.04	-0.03	-0.09	0.31	0.31	0.26	0.24	0.80
	(-3.04)***	(-2.01)**	(-1.03)	(-0.31)	(-0.25)	(-0.62)	(1.97)*	(2.22)**	(1.57)	(1.30)	(2.81)***

Note: All returns are in percentages, t-values are in parentheses, and *, **, and *** represent 10%, 5%, and 1% significance levels, respectively.

3.2 Fama-MacBeth regression

In order to further verify the existence of cross-section seasonal anomalies, this paper retests the relationship between historical same month returns and current stock returns using the Fama-MacBeth regression, and the regression model is as follows.

$$Ret_{i,t} = \alpha + \beta SameMonRet_{i,t} + \gamma Controls_{i,t-1} + \varepsilon_{i,t+1} \qquad (2)$$

Table 3 shows the results of the Fama-MacBeth regression of model (2). In column (1), this paper only includes the historical same month return indicator as the independent variable; In column (2), stock market value and book to market ratio are added as control variables; In column (3), price reversal, price momentum, return on total assets and turnover are added. Under different model settings, the regression coefficients of historical same month return SameMonRet are all positive and all statistically significant at the 1% level. In terms of economic significance, the results in column (1) indicate that, without controlling for other variables, the historical same month return over the past 10 years for each standard deviation increase in SameMonRet (6.31%), the stock's return in the coming month will increase by 23bp. Using the Fama-MacBeth regression method and the portfolio approach, it conclude that there is indeed a "cross-sectional seasonality" anomaly in the Chinese A-share market.

In addition, for the control variables, the results in Table 3 show that stock market value (ln(MV)), price reversal (Reversal) and abnormal turnover rate (Turnover) are negatively related to stock return, and book to market ratio (BM) is positively related to stock return. This indicates that there are significant small market capitalization anomalies, short-term price reversal, turnover rate anomalies and value anomalies in our country.

Table 3.Historical same month return and stock return: Fama-MacBeth regression

	(1) ret	(2) ret	(3) ret
SameMonRet	0.049	0.034	0.035
	(4.52)***	(4.07)***	(4.51)***
Ln(MV)		-0.003	-0.004
		(-2.03)**	(-3.08)***
B/M		0.007	0.003
		(1.97)**	(0.82)
Reversal			-0.052
			(-7.21)***
Momentum			0.035

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			(1.23)
ROA			0.008
			(1.13)
Turnover			-0.080
			(-7.91)***
_cons	0.011	0.014	0.025
	(1.52)	(1.75)*	(2.82)***
N	329698	329698	329698
Avg. R^2	0.003	0.050	0.094

Note: t-values based on Newey-West (1987) standard errors are in parentheses, and *, **, and *** represent 10%, 5%, and 1% significance levels, respectively.

4. Conclusion

In this paper, the existence of cross-section seasonal anomalies was empirically tested by portfolio analysis and Fama-MacBeth regression using individual stock trading data of China's A-share market from 1997 to 2020. The results of the empirical analysis indicated that stocks that performed relatively well in the same calendar month in the past had significantly higher returns than other stocks in that future calendar month. This statistically significant correlation holds over a 10-year interval. Bull and Bear portfolios based on this market anomaly can achieve excess returns of over 70 basis points.

Unlike previous studies on seasonal anomalies, which mainly use stock market indices to test for differences in returns over time (e.g., the January effect) or to test for cross-sectional correlations between historical and future stock returns over a continuous interval (e.g., the momentum effect), this paper focuses on individual stock cross-sectional anomalies. Seasonal anomalies are market anomalies in which the returns of individual stocks or portfolios are correlated with a particular calendar month. The topic of cross-section seasonal anomalies has only gradually gained attention from scholars in the last 15 years, and studies on the cross-section correlation between individual stock returns and historical returns in a specific calendar month are rare and mainly focused on developed country capital markets. A small number of studies based on the A-share market argue that cross-section seasonal anomalies do not exist, but these studies generally suffer from sample bias, for example, Li et al. (2018) have a sample from the Datastream database (Datastream International) with a sample interval is 1997-2013, but the number of Chinese listed companies in the sample is only 250, which is much lower than the number of A-share listed companies in the same period. Based on the individual stock trading data of Chinese A-share market from 1997 to 2020, this paper finds for the first time the existence of cross-section seasonal anomalies in developing countries' stock markets, which provides new empirical evidence for the study of cross-section seasonal anomalies and avoids the Data Snooping caused by concentrating on western stock markets. This provides new empirical evidence for the study of cross-sectional seasonal anomalies and avoids the problem of Data Snooping caused by concentrating on Western stock markets, and also provides a new idea for the subsequent study of market anomalies in A-shares.

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