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Profitability of reversal strategies: A modified version of the Carhart model in China[☆]

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ABSTRACT

This paper shows that buying stocks that have performed poorly and selling stocks that have performed well in the past generates positive returns in the Chinese stock market. Profits from reversal strategies cannot be explained by systematic risk and fundamental factors. Testing the Fama-French three-factor model and reversal strategies in multiple formation periods, we find that the price-to-earnings ratio explains the stock returns better than book-to-market ratio does, and investors benefit more from short-term reversal strategies than medium-term momentum strategies. Substituting the book-to-market factor and momentum factor for the price-to-earnings ratio factor and reversal factor, we propose a modified Carhart model. Our findings deepen understanding on the link between Chinese stock returns and their historical performance.

1. Introduction

Voluminous studies demonstrate that buying well-performing stocks and selling stocks performed poorly in the past can gain riskless profits in developed markets (Asness et al., 2013; Rouwenhorst, 1998). However, this phenomenon, termed the momentum effect, is less pronounced in many emerging markets (Chui et al., 2010). Due to high transaction costs and low information efficiency, emerging stock markets have more market frictions. The Chinese stock market is the largest emerging markets in the world. As noted by the Financial Times, retail investors hold 90% of Chinese A-share stocks, and the average holding period is only two months because of extremely high turnover. Most Chinese retail investors are not well trained, and they have to bear expensive costs because of frequent trading. Thus, market frictions and irrational investments lead to stock return autocorrelations and predictability (Xue and Zhang, 2017). Given the above, this paper aims to address two questions. First, how do historical returns impact expected returns? Second, what is the best way to construct

investment strategies and asset pricing models based on historical performance in China?

Investors' reaction to past performance depends on the time interval and country. In America, individual stock returns exhibit a short-term reversal effect within a few days or weeks, a medium-term momentum effect in 3 months to 1 year, and a long-term reversal effect within 3–5 years. In developed markets, institutional investors account for a great proportion of stock investors. They pursue value investment and hold winners for a long period. Hence, the momentum effect motivates traders to construct investment strategies and attracts a great deal of attentions in various ways (Fama and French, 2012; Gong et al., 2015; Grinblatt and Moskowitz, 1999; He and Li, 2015; Jegadeesh and Titman, 2001; Lewellen, 2002; Novy-Marx, 2012; Rouwenhorst, 1998; Wu and Mazouz, 2016; Vidal et al., 2015; Vidal-García et al., 2016).

The momentum effect was first selected as a pricing factor by Carhart (1997). He argues that well-performing funds have consistently good performance and shows that the “buying winners and

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selling losers” strategies have significantly positive returns. Carhart constructs a momentum strategy by buying the top 30% well-performing funds and selling the bottom 30% funds. He incorporates this pricing factor into the Fama-French three-factor model (Fama and French, 1993). The Carhart four-factor model works well in explaining the impact of historical performance in developed markets, which cannot be captured by the CAPM and Fama-French three-factor model (Fama and French, 1996; Grundy and Martin, 2001).

Compared with developed markets, the momentum effect is not significant in Asian emerging markets, such as China and Korea (Chui et al., 2010). So far, there is still no agreement on whether the momentum effect is significant in Chinese stock returns. Wang (2004) and Wu (2011) show that stock returns only exhibit the reversal effect. Dividing subsamples by trading volume, Wang and Chin (2004) argue that high volume intensifies the short-term reversal effect. In contrast, Kang et al. (2002) and Naughton et al. (2008) find a significant middle-term momentum effect. Pan et al. (2013) sort groups of winners and losers by return intervals instead of percentiles and find a pervasive momentum effect within a one-year formation period. Lee et al. (2012) investigate momentum effects under different firm performance levels for Chinese real estate stocks. Xue and Zhang (2017) show that stock return autocorrelations depend on market state. The results are different because the existing literature employs different periods. We should use more investment strategies to re-examine the impact of historical performance in a wider period.

In this paper, we examine the impact of historical performance on current stock returns and construct a new pricing model to capture the impact of historical performance. Using the sample of A-share stocks listed in the Shanghai Stock Exchange and Shenzhen Stock Exchange from 1992 to 2015, we construct winners-minus-losers portfolios with a formation period varying from 1 week to 250 weeks and then test the zero-investment portfolio returns in the next week. This paper finds that buying poorly-performing stocks in the past and selling well-performing stocks in the past can gain riskless profits. Specifically, super-short term reversal effects over several weeks and long term reversal effects in the neighborhood of a 3-year formation period are more significant. We find that the reversal effect cannot be captured by the Fama-French three-factor model, and the short-term reversal factor constructed in this paper make a significantly marginal contribution to the explanatory power of stock returns. The long-term reversal effect can also be captured by the short-term reversal factor. Additionally, we use the price-to-earnings ratio instead of the book-to-market ratio of the Fama-French three-factor model in the proposed model. Combining the market risk premium, size, price-to-earnings ratio, and reversal factor, we propose a new four-factor pricing model in the Chinese stock market. The proposed pricing model can be regarded as a modified version of the Carhart model. Our model passes out of sample tests, Gibbons-Ross-Shanken F-statistics (Gibbons et al., 1989, GRS hereafter), and subsample tests for most portfolios. Our findings deepen understanding on the link between Chinese stock returns and their historical performance, and provide alternative investment strategies for investors.

The empirical findings in this paper have the following contributions to the existing literature. First, because the systematic risk level is very high and investors prefer to trade speculatively and frequently rather than hold a well-performing stock for a long period in China, we might expect the country-level model to out-perform regional or global level models. Figuring out that the popular 1-year momentum factor is not suitable for the Chinese stock market, we address the Carhart four-factor model by proposing a new pricing factor that can capture a super-short and long-term reversal effect. Second, unlike developed markets, Chinese investors pay more attention to the price-to-earnings ratio than to the book-to-market ratio. Thus, the book-to-market effect is not significant in China's stock market. To better explain the stock returns, we incorporate the price-to-earnings factor into the pricing

model instead of the book-to-market ratio factor.¹ Third, this paper enlarges the sample interval and tests the momentum strategies with a wider range of formation period and then confirms a pervasive reversal effect in China. We propose an alternative investment strategy based on the reversal effect. One can gain profits by buying losers and selling winners.

The remainder of this paper is organized as follows. Section 2 reports the term structure of momentum factors. In Section 3, we show the time series regression results. The robustness and other relevant issues are considered in Section 4. Section 5 concludes.

2. Term structure of momentum factors

The two stock exchanges, Shanghai Stock Exchange (SHSE) and Shenzhen Stock Exchange (SZSE) in China, began to operate in 1990 and 1991, respectively. Listed shares are divided into two types, A-shares and B-shares, available for domestic and foreign investors, respectively. Due to a small number of stocks and volatile prices during the early years, the sample period starts from 1992 to construct momentum strategies. Because of the need for five year of historical data when testing zero-investment portfolio returns with different formation periods, the sample period in the regression part is from January 1997 to December 2015. In this paper, the data cover the period from January 1992 to December 2015, and include weekly stock returns of SHSE and SZSE A-shares in the SinoFin economic and financial database. To exclude initial price anomalies after an IPO, we delete the initial six-month returns of each stock. We also delete stocks with negative net assets per share. Weekly stock returns are adjusted for dividends and selected on Wednesday.

To form the portfolios, we sort our sample firms on prior J days' returns. The prior J days' return breakpoints are the 30th and 70th of the prior J days' performance. Formation periods and holding periods are 1, 2, 3, 4, 6, 9, 12 days, including 49 J-K strategies. We also report the results of summary statistics for weekly and monthly J-K strategies. Daily (weekly, monthly) returns are winsorized each day (week, month) at the 0.5% and 99.5% levels. As shown in Table 1, except the daily 1-1 strategy and a few J-K strategies, stock returns exhibit a pervasive reversal effect and no significant momentum effect. Following He and Zhou (2006) and sorting the whole sample into two subsamples of 1997–2005 and 2006–2015, we find that the reversal effect is more significant during the 2006–2015 and bull market period.²

As Lo and Wang (2006) point out, the sample size is not enough for monthly data, it will lack an economic explanation for daily data. Pan et al. (2013) argue that Chinese stock prices fluctuate rapidly due to frequent and speculative trading. Thus, it is reasonable to select weekly data in the Chinese stock market. Following the method of Carhart (1997), we construct momentum factors with a 1-week holding period and a formation period from 1 week to 250 weeks. Due to the high trading frequency and low bid-ask spread, we do not incorporate lags between holding weeks and formation weeks. In each week of sample intervals, we calculate past J-week ($J=1, 2, \dots, 250$) returns of individual stocks, and define winners and losers as the top and bottom 30% of performance in a formation period. Portfolio returns are equally-weighted results. The $i-1$ strategy and its return series are denoted as WML (i).³ Weekly returns are winsorized each week at the 0.5% and 99.5% levels.

Fig. 1 shows the performance of winner-minus-loser strategies from the past 1-week to 250-week formation periods from 1997 to 2015. In the sample of winner-minus-loser strategies with no lags, stock returns perform a reversal effect, which is especially significant in the short

¹ Pan and Xu (2011) and Tian et al. (2014) also show that HML does not work well in China. Pan and Xu (2011) show that the price-to-earnings ratio has a higher explanatory power than the book-to-market ratio does.

² We do not report the result here. Detailed results can be obtained from the author.

³ If WML (i) is positive, stock returns show momentum effect. If it is negative, stock returns show reversal effect.

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