Forthcoming, *Research in International Business and Finance*

Performance Persistence in Chinese Securities Investment Funds

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December 2016

Abstract:
This study examines the performance persistence of Chinese equity securities investment funds during the period between May 2003 and May 2014. We apply the recursive portfolio formation methodology of Carhart (1997). The results from sorting funds either by past 4-factor alphas or by t-statistics of past alphas suggest that the top ranked decile portfolio yields statistically and economically significant forwarding looking alphas. In respect of past decile loser funds, there is no evidence that underperformance among Chinese loser funds persists. In addition, we apply the recursive portfolio formation methodology for alternative 'smaller' portfolios of a fixed size and find that almost all the smaller portfolios of past winning funds produce positive and statistically significant forward looking alphas. Hence an active portfolio strategy for the Chinese securities investment fund industry of selecting a small number of past outperforming funds may earn positive abnormal returns after the deduction of management fees.

Keywords: Chinese funds, fund performance, persistence.

JEL Classification: G11, G12.

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1. Introduction

This study evaluates the performance persistence of open-end securities investment funds investing in Chinese domestic equity over the period May 2003 to May 2014. A data set of 419 funds is examined that represents almost the entire Chinese domestic equity securities investment fund industry at the end of the sample period. Fund performance persistence, which is a crucial issue examining whether abnormal performance can be predicted and for how long it persists, is well documented in the mutual fund performance literature. Persistence tests may be characterised as either tests of 'statistical predictability' or 'economic predictability'. The former focus on the average association between the relative performance ordering of funds in two consecutive periods and are usually examined by rank correlations, regressions or contingency tables. The latter concentrate on economic value, i.e., whether the degree of persistence represents an exploitable strategy for an investor. These are commonly based on recursively rebalancing and holding a portfolio of past winning funds and evaluating whether such a strategy yields an abnormal return.

The evidence from tests based on statistical predictability is quite mixed. Hendricks, Patel and Zeckhauser (1993), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995) document that US mutual fund performance persists over short-term periods from one to three years, i.e., the 'hot hand effect'. The evidence in Grinblatt and Titman (1992) and Elton, Gruber, Das and Hlavka (1993) supports the existence of long-term (five to ten years in their study) statistical predictability of mutual fund returns and they attribute this to skilled or informed fund managers. However, findings from more recent studies suggest that positive abnormal performance is more difficult to predict but some predictability is identified when a portfolio of past winners is re-balanced frequently (at least once quarterly) with the performance horizon not longer than about one year (Wermers (1997), Carhart (1997), Blake and Morey (2000)). In terms of the literature regarding UK mutual and pension funds, strong evidence that past losers continue to underperform is found while past

outperformers are not likely to deliver future positive risk-adjusted returns (Blake and Timmermann (1998), Quigley and Sinquefield (2000), Allen and Tan (1999), Blake, Lehmann and Timmermann (1999), Fletcher and Forbes (2002), Tonks (2004) Cuthbertson, Nitzsche and O'Sullivan (2008)).

In terms of 'economic significance', studies of the US mutual fund industry point to the existence of one-year persistence among past winning funds (Carhart (1997), Chen, Jegadeesh and Wermers (2000), Wermers (2003)). However, this persistent outperformance is attributed to one-year momentum in stock returns - Jegadeesh and Titman (1993) rather than persistent good stock selection ability (Carhart (1997), Chen et al. (2000)). Cuthbertson et al. (2008) examine the economic predictability of UK mutual fund returns and find less evidence that past winners produce future positive risk-adjusted performance compared to US equity funds. Similar to the US, past loser funds in the UK market are more likely to continue to underperform.

This paper proceeds as follows. Section 2 provides a brief review of the existing literature on fund performance and persistence. Section 3 describes the Chinese data set. The persistence test methodology and empirical results are presented in section 4 and 5 respectively. Section 6 concludes.

2. Literature Review

Performance and Persistence among US Mutual Funds

Grinblatt and Timan (1992) is one of the earliest studies on performance persistence among US equity mutual funds. The study investigates whether the source of persistence found in their study lies in a momentum effect in stock returns or in persistent stock selection ability on the part of the fund by applying a simple persistence testing methodology. The paper first examines persistence among US mutual funds from 1974 to 1984 by splitting the sample period into two 5-year

sub-periods, estimating α_{i}[1], i.e., abnormal performance, for each fund in each sub-period and implementing a cross-sectional regression of abnormal performance from the second sub-period on those in the first sub-period. The t-statistic from the above cross-sectional regression test is positive and significant, which shows evidence of positive and significant persistence. In addition, the authors repeat the above process with a control sample of 109 passive funds which are constructed to exhibit various characteristics based on firm size, past returns, beta, dividend yield, interest rate sensitivity and co-skewness with the CRSP market index. These funds are rebalanced 'mechanically' monthly and do not involve stock selectivity. Their findings indicate significant predictability in abnormal performance among active funds but no evidence of persistence for the control sample.

Another important test of statistical predictability among US mutual funds is that of Malkiel (1995). This study uses contingency tables to examine performance persistence over the sample period from 1971-1991. Sorting funds into 'winners' and 'losers' based on the raw returns and risk-adjusted returns based on median ranking each quarter, Malkiel (1995) finds considerable patterns of persistence during the period of 1972-1981 but not during the 1980s - this paper records that an investment strategy based on persistence would have provided a significant excess return relative to the Standard and Poor's, during 1970s, while no considerable excess returns based on the persistence strategies would have been earned during 1980s. These findings imply that short-term anomalies do not represent long-run exploitable investment strategies and hence it is important to examine sufficiently long sample periods when evaluating fund performance.

An important, comprehensive and widely-cited contribution to the literature on fund performance persistence testing both statistical and economic predictability is the Carhart (1997) study. Carhart (1997) carries out the recursive portfolio formation

[1] α_i is the intercept in a regression against eight factor portfolios, see Grinblatt and Timan (1992).

procedure (similar to Hendricks et al. (1993)) on his survivor bias free database of US mutual funds from 1963-1993. The author sorts funds into equally-weighted deciles, based on one-year raw returns, holds the decile portfolios for one year and then rebalances them. The procedure is repeated recursively to generate holding period returns for each decile. In the case of each decile Carhart first estimates the CAPM and finds that the CAPM betas of the top and bottom deciles are virtually identical. This indicates that the resulting CAPM alphas produce as much dispersion as the raw returns – pointing to the inadequacy of the CAPM to explain the cross-section of fund returns.

Carhart (1997) goes on to measure performance of the decile portfolios using a 4-factor model. In contrast to the CAPM, the 4-factor model explains much of the spread and pattern in these portfolios, with the size factor (SMB) and momentum factor (PR1YR) explaining most of the variation in returns. The top decile portfolios, with sensitivity to the size factor, appear to hold more small stocks than the bottom deciles. The momentum risk factor is suggested to explain half of the spread between the top and bottom decile portfolios. However, the four-factor alphas are negative for all portfolios and are statistically significant for decile 3-10 (where decile 1 represents the top ranked portfolio). This implies that underperformance tends to persist while there is negative (inverse) persistence in the top two deciles based on a risk-adjusted return. In addition, the results do not support the existence of skilled or informed mutual fund managers.

A similar recursive portfolio formation methodology in Bollen and Busse (2002) proposes to examine persistence in post-ranking abnormal returns, using daily data and quarterly formation and evaluation periods. Their findings suggest that persistence disappears for holding periods longer than one quarter and outperformance can be observed only when funds are examined several times per year.

However, Carhart (1997) reveals a potential risk of using unconditional (constant parameter) models to estimate risk-adjusted performance as there is high turnover in the composition of the top and bottom decile portfolios over time.

Carhart (1997) also tests the persistence of one-year mutual fund ranking by applying a contingency table approach. The results indicate that last year's winners frequently become next year's losers while there is an 80% annual turnover in the composition of the top-rank decile portfolio. However, the author demonstrates that whatever performance persistence might exist, it is short lived, as the returns on the decile portfolios quickly converge in each of the next five years after formation, where portfolios are not reformed annually.

Chen et al. (2000) pick up the same question of persistence and momentum. They define winning and losing mutual funds as the top and bottom quintiles of funds ranked quarterly by past one-year raw returns and examine the future returns of winners and losers between 1975 and 1995. Their paper records that stocks currently held by winners yield higher future returns than the stocks of losing funds. In addition, winning funds continue to outperform losing funds based on raw returns and risk-adjusted returns for the subsequent two quarters and the subsequent one quarter respectively.

In addition, the Chen et al. (2000) study draws some other interesting conclusions related to persistence and momentum. First, there is little evidence that the stocks most widely held by the mutual fund industry outperform the stocks least widely held but relatively strong evidence that newly bought stocks tend to outperform newly sold stocks. These findings are true of both winning and losing funds and are true of various stock characteristics such as market capitalization (size) and book-to-market equity ratio (value). Second, stocks held passively from prior periods exhibit a tendency of underperforming those actively traded. However, due to the reduction of returns caused by substantial transaction costs, actively-managed

funds do not show significant better stock picking abilities than less-frequent trading funds. Third, the performance of growth funds is more likely to persist than income funds at the level of raw returns.

In a further examination of performance persistence, Elton et al. (1996) find evidence in support of persistence by applying a recursive portfolio formation approach based on a survivor bias free sample of equity mutual funds from 1977 to 1993. The authors sort funds into decile portfolios and evaluate the performance of the decile portfolios over three-year formation and one-year evaluation periods. The empirical evidence suggests that portfolios based on optimal weights do yield a significantly higher return relative to equal-weighted portfolios.

Christopherson, Ferson and Glassman (1998) runs cross-sectional regressions of future fund excess returns on a past performance measure of abnormal returns to test persistence:

$$r_i(t, t+\tau) = \gamma_{0,t,\tau} + \gamma_{1,t,\tau}(\alpha_{i,t}) + \mu_i(t, t+\tau), i = 1,2, \dots, n \qquad [1]$$

where $r_i(t, t+\tau)$ is the compounded excess return from period t to $t+\tau$ earned by manager i. τ represents the return horizon and is examined for values τ = 1, 3, 6, 12, 24 and 36. The regressor, $\alpha_{i,t}$, is a measure of return estimated up to month t. $\mu_i(t, t+\tau)$ is the regression disturbance term. The authors employ a number of performance measures including conditional and unconditional alpha measures. Under the null hypothesis of no persistence, $\gamma_{1,t,\tau} = 0$.

A number of caveats are reported by Christopherson et al. (1998) which include that the regressions fail to account for differences in the risk of future returns and hence if the forward looking alphas are related to risk due to a misspecification in the model then persistence in the expected compensation for risk may be reflected by

evidence of persistence in performance. Christopherson et al. also demonstrate that persistence based on past alpha in equation [1] estimated by conditional performance models appears to be stronger than by unconditional models. Finally, consistent with the papers on the US fund industry discussed above, Christopherson et al. report strong evidence of persistent poor performance relative to outperformance persistence.

Overall, among the studies of the US mutual fund industry there is evidence in support of short-term persistence in positive risk-adjusted returns. Moreover most studies reach a consistent conclusion that there is strong evidence of persistent underperformance relative to outperformance. These findings regarding US mutual fund performance and persistence are well explored. This question is underexplored with respect to the Chinese securities investment fund industry. This literature is discussed next. Table 1 provides a summary of the main findings from US studies.

[Table 1 here]

Performance and Persistence among Chinese Securities Investment Funds

Existing literature on the Chinese securities investment fund industry mostly focuses on the statistical predictability of fund returns. One of the earliest studies on performance persistence based on Chinese fund data is that of Ni, Xiao and Wu (2002), which examines short-term performance persistence among 22 closed-end securities investment funds during the period from October 1999 – November 2001. The authors measure abnormal performance of each fund using the single-factor model and the Fama and French 3-factor (1992) model and replicate the methodology of Grinblatt and Timan (1992) as discussed above to test for persistence. Based on the results of cross-sectional regressions, the study concludes that fund outperformance appears to revert to underperform during the whole sample. Wu, Chen and Lei (2003) test persistence among 15 Chinese closed-end securities investment funds by applying the same approach as in Christopherson et al. (1998) as discussed above and report no

significant evidence of persistence in the short-run (1-3 months). However, Wu, Wang and Li (2003) do find evidence of persistence on Chinese closed-end securities investment fund performance in a mid- (6 months) to long- (over 1 year) run.

Xiao and Yang (2005) examine performance and persistence among 38 open-end securities investment funds during the period between 2003 and 2004 applying the contingency table approach of Goetzmann and Ibbotson (1994) and the Christopherson et al. (1998) approach. The authors first rank raw returns into winners and losers by median ranking each month, every other month, each quarter, every other quarter, every three quarters and every four quarters and confirm the existence of performance persistence in the short-term (1-3 months). However, they show that the evidence of persistence is weakened during a longer period (2-4 quarters). The study demonstrates that the evidence of persistence is lessened using Jensen's (1968) alpha to measure the fund performance, which is due to the relatively large volatility of Chinese equity returns. Xiao and Yang (2005) also present the methodology of Christopherson et al. (1998) using Jensen's risk-adjusted measure of return to test persistence in both the short term and medium term. The results from cross-sectional regressions of future fund excess returns on a past performance measure of abnormal returns fail to reject the null hypothesis that the past value of alphas cannot be used to predict future return (at the 5% significance level) with regard to both the short (1-3 months) and medium run (6 months). Zhang and Wu (2010) examine performance persistence among 28 closed-end and 28 open-end securities investment funds from 2005 to 2009 using the same approaches as in Xiao and Yang (2005) and report that performance tends not to persist in the short, mid and long-term, while they find evidence that past winners tend to revert to underperform in a long period of time (over 1 year).

Wang, Shan and Huang (2012) examine persistence in fund performance by using the recursive portfolio formation procedure as in the Carhart (1997) study and others. Funds are ranked into quintile portfolios based on raw returns over the past

one year, rebalanced quarterly, semi-annually and annually and evaluated by the alpha from the Fama and French 3-factor model. The positive forward looking alphas from all the quintile portfolios further suggest that past winners continue to outperform in the future, while past losers also tend to perform well in the future. However, the spreads in monthly forward looking abnormal return between the best and the worst portfolio are 0.48%, 0.33% and 0.14% respectively by estimating the alpha quarterly, semi-annually and annually. The spread is diminishing as the length of the holding period increases, which indicates that the persistent outperformance of the top quintile portfolio tends to be relatively short-lived.

Peng (2010) investigates whether there is evidence that poor performance persists among 162 Chinese open-end securities investment funds between 2006 and 2008 by implementing a contingency table test – differing from the methodology of Xiao and Yang (2005) and others. The author ranks funds by Jensen's alpha and sorts into 3 groups: winners, mid-ranking funds and losers based on two different rules. The first rule is that funds are divided into these three groups equally, i.e., each group consists of one-third of the funds. The other rule is that the top and bottom 25% of funds constitute the winner and loser group respectively, while the remaining funds are defined as mid-ranking funds. Based on the contingency table tests, the author finds evidence of persistence in the mid-term (6 months) which is due mainly to repeat past losers rather than repeat past winners by following both of the two ranking rules. This is an indication of more evidence of persistence in underperformance. However, the methodology of Peng (2010) restricts his analysis to funds which survive for more than one year, and it may induce a slight look-ahead bias in the conclusions.

Chen and Nie (2009) carry out a number of methods such as the methodology in the Christopherson et al. (1998) study, rank correlations, regressions and contingency tables. They rank funds by Jensen's alpha to test performance persistence on the whole Chinese open-end securities investment fund industry. The authors find that the

results are different based on different persistence test methodologies and different evaluation and holding periods. For example, there is less evidence of persistence based on a short-term evaluation period (1 month) than based on a mid-term evaluation period (6 months), while performance persistence is more significant by rank correlation and regression tests than by the Christopherson et al. (1998) methodology and by contingency tables. However, overall the empirical evidence from the Chen and Nie (2009) study does support the existence of persistence in Chinese securities investment fund performance, while the evidence of persistence is weakened as the holding period extends.

The results from Chinese studies with respect to performance persistence are mixed compared with the relatively consistent conclusions from US studies. Moreover, most Chinese studies are concentrated on statistical predictability rather than economic predictability and a considerable portion of studies examine closed end funds.

In this study, we contribute to the debate on performance persistence in the Chinese fund market in the following ways: First, we construct a momentum risk factor in the Chinese securities investment fund market and evaluate performance persistence based on the Carhart (1997) 4-factor model. Second, we examine persistence not only based on tests of statistical predictability but also based on tests of economic predictability. Third, we are the first to apply the recursive portfolio formation methodology of Carhart (1997) for alternative ‘smaller’ portfolios of a fixed size. Fourth, this paper is more comprehensive in terms of the sample length and sample size as earlier studies on the performance persistence of Chinese securities investment funds are based on relatively few funds and relatively short sample periods (see Table 2). Finally, weekly fund performance is examined in this study while most existing literature on the Chinese fund industry evaluates fund performance using monthly data. Compared to mature fund markets, e.g., US and UK, the history of the Chinese fund industry is short and hence the number of monthly observations is small.

Therefore, assessing fund performance based on weekly data is more accurate and robust.

Table 2 provides an overall summary of findings among studies on performance persistence of Chinese securities investment funds.

[Table 2 here]

3. Data Description

The history of the Chinese securities investment fund industry is short compared to that of developed fund industries such as the US and the UK. The first Chinese securities investment fund was issued in October 1991. However, only closed-end funds existed in the Chinese market over the period of 1991-2001. The Chinese open-end securities investment fund industry was established in December 2001 and has been developing very fast since 2003. During the last decade (2004-2014), as a newer and less developed industry, it has grown much faster (total net asset value increased by almost 1,400%) than developed fund industries such as the US (total net asset value only doubled). This significant development is one of the motivations for studying the Chinese fund market. By May 2014 the total net asset value of the Chinese securities investment fund industry was ￥45,374.30 billion (＄6,796.63 billion). However, only ￥495.54 billion (＄74.23 billion) was managed globally (outside of China), while ￥44,878.76 (＄6,722.40 billion) was under management within China, i.e., investing in Chinese domestic assets. Table 3 summarizes the historical data of the industry in China.

[Table 3 Here]

The Asset Management Association of China classifies Chinese securities

investment funds into the following five categories: (i) equity funds, (at least 60%[2] of the fund is invested in Chinese domestic equity); (ii) commingled funds, which are invested in stock, money and bond market; (iii) bond funds, (at least 80% of the fund is invested in the Chinese bond market); (iv) money market funds, which are invested in the Chinese money market; and (v) QDII (Qualified Domestic Institutional Investors) funds, which are invested in global assets.

This study examines 419 Chinese open-end domestic equity funds during an 11-year sample period from 2003 to 2014. Compared with most previous studies on the Chinese fund industry, the fund data set in our study is comprehensive in terms of the number of funds in our sample and the sample period length. In addition, the fund data set includes both surviving funds (414) and non-surviving funds (5). A non-surviving fund is defined as one which has existed for some time during the sample period but has not survived throughout the entire sample. Funds may close due to mergers or takeovers or may have been forced to close due to bad performance. This latter situation may impart a survivorship bias in findings.

The securities investment fund returns are measured weekly rather than monthly from May 2003 to May 2014 in order to increase the number of observations due to relatively short history of the Chinese fund industry. Fund returns data have been taken from the Morningstar Database.

This study uses the HuShen 300 Index (the Shanghai Stock Exchange and Shenzhen Stock Exchange largest 300 Stock Index) as a proxy for the market portfolio. This is the most comprehensive Chinese stock index. Weekly data of the index is taken from the RESSET Database[3]. The HuShen 300 Index is measured as a

[2] The Asset Management Association of China published a new definition of Chinese equity securities investment funds in 2015. By the new definition, Chinese equity securities investment funds have at least 80% of the fund capital invested in Chinese domestic equity. However, this study examines the performance of Chinese equity securities investment funds during the period from 2002-2014. Hence old definitions and classifications apply.

[3] The RESSET Database is one of the most authoritative databases reporting Chinese financial data.. It provides professional Chinese financial data to over 500 large financial institutions (e.g., China International Capital

value-weighted mean of the largest 300 common stocks which comprise around 60% of the market capitalization of the Shanghai Stock Exchange and Shenzhen Stock Exchange.

The risk factor portfolio to model the size premium, SMB, is measured as the difference between the weekly returns on a portfolio of small cap stocks and the weekly returns on a portfolio of large cap stocks. Weekly returns are taken from the RESSET Database. The portfolio of small (large) cap stocks is comprised of the lowest (largest) 30% stocks by market capitalization in the Chinese equity market.

The risk factor portfolio to capture the value effect, HML, is calculated as the difference between the weekly returns on a portfolio of value stocks (the highest 30% of stocks by book-to-market ratio) and the weekly returns on a portfolio of growth stocks (the lowest 30% of stocks by book-to-market ratio). Weekly data of the value risk variable is sourced from the RESSET Database. This incorporates a measure for reinvested dividends.

We construct the benchmark risk factor portfolio for the momentum effect, MOM, ourselves. Weekly returns on all 2,037 Chinese stocks listed on both the Shanghai stock exchange and the Shenzhen stock exchange are collected individually from DATASTREAM. Each week all stocks are ranked by their cumulative returns over the past 11 weeks (ranking period). Equal-weighted portfolios of the top 30% of the stocks and the bottom 30% of the stocks are then constructed and held for one week (holding period). The momentum variable, MOM, is calculated as the difference between the return on the portfolio of past winners and the return on the portfolio of past losers in the holding period.

In this study, the Chinese Central Bank Bill rate taken from the RESSET

Corporation Limited, CITIC Securities, etc.) and works with many universities including Tsinghua University, Beijing University and the Massachusetts Institute of Technology. The RESSET database has also been used in academic literature, e.g., Calomiris, Fisman and Wang (2010).

Database is used as a proxy for the risk-free interest rate.

4. Persistence Testing Methodology

Persistence tests may be characterised as either tests of statistical predictability or economic predictability. The former ranks funds over some sample period and measures the associations between the relative orderings of funds in both pre-sort and post-sort periods, where the performance metrics could differ between the ranking and evaluation periods. Correlations, regressions or contingency tables are usually used to measure the relationship between the past and the future rankings. These approaches, however, do not necessarily identify exploitable strategies for investors. For example, all of the post-sort decile alphas may be insignificant or negative even though past and future rankings are strongly correlated. Similarly, strong correlations could be primarily attributable to repeating past losers rather than repeating past winners. Finally, (Spearman) rank correlations treat each points in the ranking equally and lack power against the hypothesis that performance predictability is concentrated in the tails of fund performance. We address this issue by testing the *ex-ante* performance of smaller portfolios of funds.

Even though the above approaches are commonly-used to test statistical predictability, investors are more interested in economic value, i.e., whether the degree of persistence represents an exploitable investment strategy. Therefore, this study applies the recursive portfolio formation approach of Carhart (1997). The primary advantage of using such a method is that it directly assesses the economic significance of persistence in addition to the statistical predictability. The Carhart (1997) procedure is described as follows:

Funds are ranked according to measures of historical performance at time *t* based on a backward looking evaluation period. For example, funds may be ranked by past one-year raw returns. Fractile portfolios, e.g., deciles, are then constructed and held over the next n months. A sequence of n monthly forward looking returns is obtained.

Fractile portfolios are rebalanced every n months and a sequence of forward looking monthly returns for each fractile portfolio over the whole period is observed: $R_i^f(t,T)$, where t= t+1, …, T.

The economic value of performance persistence is examined using the sequence of forward looking concatenated returns, i.e., $R_i^f(t,T)$. Alternative performance attribution models or other performance statistics are estimated using $R_i^f(t,T)$ and post-sort alphas or forward looking alphas are then produced. A significant and positive value of forward looking alphas indicates evidence of positive and economically significant persistence. Results are presented for the 4-factor model (Carhart (1997)):

$$r_{i,t}^f = \alpha_i^f + \beta_{1i} r_{m,t} + \beta_{2i} SMB_t + \beta_{3i} HML_t + \beta_{4i} MOM_t + \varepsilon_{i,t} \qquad [2]$$

The excess return on forward looking portfolios is expressed as $r_{i,t}^f = R_i^f - r$. $r_{m,t}$ denotes the excess return on the market portfolio. As illustrated in Section 3, SMB_t, HML_t and MOM_t are the risk factor portfolios to capture the size, value and momentum effects respectively. A positive and significant value of forward looking alphas of past winners indicates evidence of positive and economically significant persistence.

The forward-looking returns, $R_i^f(t,T)$, are based on either sorting on the funds' past 52-week four-factor alpha or on the t-alpha from the 4-factor model. In this study, the portfolios are equally weighted. This study also examines alternative rebalancing periods of 4, 13, 26 and 52 weeks. In addition to analyzing decile portfolios, this study also sorts funds either by past 4-factor alphas or t-alphas using alternative 'smaller' portfolios of a fixed number of funds ranging from 1 to 10 of past winners and past losers. As smaller portfolios may involve more possible non-normality in idiosyncratic risks (particular for the extreme rails of the performance distribution), this study also calculates bootstrap p-values of alphas for the alternative smaller

portfolios of funds.

4. Empirical Results of Persistence Tests

In this section, the study uses all 419 actively managed Chinese equity securities investment funds which exist for some or all of the sample period. Funds are ranked either by past alphas from the Carhart 4-factor model or by t-statistics of past alphas. Persistence tests results for alternative 'formation/holding' horizons of 52/52, 52/26, 52/13 and 52/4 weeks are reported.

Table 4 presents the 'forwarding looking' decile alphas and t-statistics of alphas from the 4-factor model where funds are sorted by past one-year alphas (Panel A) or past one-year t-alphas (Panel B). Although persistence results obtained using the Fama and French three factor model are broadly similar to results based on the 4-factor model, the momentum risk factor is statistically significant for most of the decile portfolios. Hence this study presents results for the 4-factor model. In particular, in more frequent rebalancing, the momentum risk factor is found to be more statistically significant. In addition, the statistical significance of the momentum variable is stronger for the extreme winner and loser deciles, e.g., the first and the tenth decile portfolios.

[Table 4 here]

According to the results presented in Table 4 Panel A, all the decile portfolios have positive forward looking alphas regardless of their past one-year performance. Only top ranked decile portfolios (i.e., Decile 1 and 2), however, reveal positive and statistically significant alphas under the alternative rebalancing periods less than 52 weeks. For example, based on a 52 week ranking period and a 26 week holding period, the forward looking alpha of Decile 1 is 0.254 with a t-statistic of1.819, while when rebalancing annually (i.e., when holding period is 52 weeks), the forwarding looking alpha of Decile 1 is 0.222 with a t-statistic of 1.607 – it is statistically insignificant.

Although past losers reverse to perform well, forward looking alphas of bottom deciles as well as most of the mid-ranked portfolios are shown to be statistically insignificant under all the alternative holding periods. Broadly similar conclusions are reached when funds are sorted by t-alpha (Table 4, Panel B). For example, when ranked by t-alphas, the highest decile shows positive and statistically significant forward looking alphas lying between 0.27% weekly (13.78% p.a.) and 0.34% weekly (17.47% p.a.). In the case of the lowest decile, when sorted by t-alpha, the forward looking alphas range between 0.06% (2.91% p.a.) and 0.16% (8.32% p.a.) – but all are statistically insignificant. However, there are some differences in Decile 2 as when sorting by past t-alphas, Decile 2 produces positive but insignificant forward looking alphas based on formation/holding horizons of 52/52, 52/26.

When sorting funds on t-alphas, the spread of forward looking alphas between the top and bottom decile portfolio is 0.25%, 0.28%, 0.22% and 0.11% weekly for alternative 'ranking/holding' horizons of 52/4, 52/13, 52/26 and 52/52 respectively. Sorting on past alphas gives qualitatively similar results that the spread of forward looking alphas between past winners and losers is generally diminishing as the length of rebalancing period increases, which indicates outperformance tends to persist in the relatively short run, e.g., for 1 month or 1 quarter. This conclusion is broadly consistent with the persistence conclusion researched in Wang et al. (2012). US studies on performance persistence also find some evidence in support of the existence of positive persistence among past winning funds (Carhart (1997), Chen, Jegadeesh and Wermers (2000) and Wermers (2003)), particularly when a portfolio of past outperformers is rebalanced frequently, e.g., monthly or quarterly, (Wermers (1997), Carhart (1997), Blake and Morey (2000)). UK studies, however, find little evidence that past decile outperforming funds provide future positive abnormal performance (Cuthbertson et al. (2008) and Quigley and Sinquefield (1999)). With respect to the bottom ranked funds, however, quite different conclusions are researched in the US and UK studies where it is evident that past loser funds continue to underperform, while we find that past underperforming Chinese funds tend to

produce positive but insignificant future risk-adjusted returns.

The data set employed in this study containing over 400 funds implies that the top decile portfolio consists of over 40 funds. Hence the top decile may fail to identify (a small number of) genuine repeat outperforming funds as there is a very wide spread in past alphas or t-alphas. Therefore, this study applies the above analysis for alternative 'smaller' portfolios of a fixed size from among the past winners and among the past losers. This may produce more useful investment strategies for investors in practice but smaller portfolios may involve more non-normality in idiosyncratic risk. Hence it is necessary to calculate bootstrap p-values for the alternative smaller portfolios (which are presented throughout.) For many investments, smaller portfolios of a fixed number of funds (throughout the whole investment horizon) are likely to be a more exploitable investment strategy in practice.

Table 5 reports the alphas and bootstrap p-values for the Carhart 4-factor model when ranking funds by t-alphas using alternative smaller portfolios of a fixed size ranging from 1 to 10 funds. It is clear that almost all the smaller portfolios of past winning funds produce positive and statistically significant forward looking alphas ranging from 0.23% (11.96% p.a.) to 0.37% (19.24% p.a.). In addition, the forward looking alphas tend to be larger the more frequent the rebalancing. In terms of the bottom ranked funds, this study finds that although most of the smaller portfolios formed from the worst 1 to 10 funds possess positive forward looking alphas, none of them are statistically significant for all the alternative ranking/rebalancing periods (Table 6).

[Table 5 and 6 here]

5. Conclusion

This study examines both the statistical as well as economic significance of

performance persistence among a large and long sample of Chinese equity securities investment funds between May 2003 and May 2014. Ranking funds based on either past 4-factor alphas or on t-statistics of past alphas, the study finds strong evidence that the top decile of past winner funds continues to perform well in terms of future 4-factor alpha and this positive risk-adjusted performance tends to be more significant the more frequent the rebalancing. We find that persistence tends to be relatively short-lived. The further examination on performance persistence of 'smaller' portfolios of past outperformers in this study suggests that the top ranked 1 to 10 funds (by past t-alphas) produce significant and large future 4-factor alphas under the alternative holding horizons from 1 month to 1 year. Cuthbertson, Nitzsche and O'Sullivan (2006) also finds evidence that when rebalancing quarterly or monthly, the portfolios of up to around 5 funds yield some statistically and economically significant 4-factor alphas.

With respect to underperforming funds, although past decile loser funds are likely to reverse to perform well in terms of their future 4-factor alphas, this outperformance is not statistically significant under all the alternative formation/holding periods. Hence an active portfolio strategy for the Chinese securities investment fund industry of selecting a small number of past winner funds may earn positive abnormal returns (after management fees but before the deduction of transaction costs of the actively-managed investment strategy).

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Table 1: Summary of Studies of US Equity Mutual Fund Performance

Study	Period	Type of Funds	Risk Adjusted	Controls Transactions	Controls for	Performance Persistence
Grinblatt and Titman (1992)	1975-1984	279 US mutual funds	Yes	Yes	No	Yes, strongest evidence is among underperformers
Hendricks et al. (1993)	1975-1988	US equity mutual funds	Only in evaluation	Net of management	Yes	Yes, strongest evidence is among underperformers
Volkman and Wohar (1995)	1980-1989	322 US mutual funds	Yes	Yes	Yes	Yes
Goetzmann and Ibbotson (1994)	1976-1988	728 US mutual funds	Yes	No	No	Yes
Malkiel (1995)	1971-1991	All US equity mutual funds	Yes	Yes	Yes	Yes, during the 1970s. Not 1980s
Elton et al. (1996)	1977-1993	188 US equity mutual funds	Yes	Yes	Yes	Yes
Carhart (1997)	1963-1993	All US equity mutual funds	Yes	Yes	Yes	Yes, among poor funds. No, among top funds
Christopherson et al. (1998)	1979-1990	273 US equity pension funds	Yes	Net of trading costs	No	Yes, concentrated among poor performers
Fletcher (1999)	1985-1996	85 UK-American unit trusts	Yes	Net of management fee	Yes	No
Chen et al. (1998)	1975-1995	US equity funds	Yes	No, Uses gross returns	Yes	Yes, due to momentum effects. No, when risk adjusted.

Table 2: Summary of Studies of Chinese Equity Securities Investment Fund Performance

Study	Period	Type of Funds	Risk Adjusted	Controls Transactions Costs	Controls for Survivorship Bias	Performance Persistence
Ni, Xiao and Wu (2002)	1999-2001	22 closed-end securities investment	Yes	Yes	No	No, it points to reversals
Wu, Chen and Lei (2003a)	1999-2001	15 closed-end securities investment	Yes	Yes	No	Yes, in a mid- to long-run. No, during short term.
Xiao and Yang (2005)	2003-2004	38 open-end securities investment funds	Yes	Yes	No	Yes, in a short- to mid- run based on raw returns. No, when risk adjusted.
Li, Fang and Yu (2006)	2001-2005	171 equity and hybrid securities investment	No	Yes	No	Only a few funds' (less than 10%) performance tends to persistent.
Li, Chen and Mao (2007b)	2005-2006	30 open-end securities investment funds	No	Yes	No	Yes, within a mid-term (with in a semi-annual)
Tang and Yu (2008)	1999-2008	All equity and hybrid securities investment funds	No	Yes	Yes	Yes, in long term. No, in short to medium term. Stronger persistence among top performers.
Chen and Nie (2009)	2004 -2008	54 open-end securities investment funds	Yes	Yes	No	Yes, in short term
Zhang and Wu (2010)	2005-2009	28 close- and 28 open –end securities investment funds	Yes	Yes	No	No, it point to reversals in some time periods
Peng (2010)	2006-2008	162 open-end securities investment funds	Yes	Yes	No	Yes, among poor performers in a mid-term
Wang and Huang (2012	2005-2009	All securities investment funds	Yes	Yes	Yes	Yes, but short-lived.

Table 3. Breakdown of Historical Data of Chinese Securities Investment Fund Industry

Year	No. of Funds	No. of Closed-end Funds	No. of Open-end Funds	No. of Fund Companies	Total Net Asset Value of Fund Industry (billion)
1998	5	5	0	5	￥103.64
1999	19	19	0	10	¥ 484.16
2000	33	33	0	10	¥ 845.91
2001	51	48	3	14	¥ 818.10
2002	67	54	13	17	¥ 1,112.92
2003	104	54	50	25	¥ 1,572.74
2004	161	54	107	37	¥ 3,246.40
2005	222	54	168	47	¥ 4,607.48
2006	321	53	268	52	¥ 8,552.71
2007	366	35	331	57	￥32,853.28
2008	474	33	441	59	¥ 19,427.37
2009	621	33	588	60	¥ 26,829.61
2010	785	31	754	60	¥ 25,275.43
2011	835	31	804	71	¥ 21,918.40
2012	1124	31	1093	77	￥28,661.00
2013	1474	30	1444	85	¥ 30,020.71
2014.05	1607	30	1577	96	¥ 39,241.00

Table 4: Persistence Results – Decile Portfolios

Table 4 Panel A presents persistence results for decile portfolios formed on past 4-factor alphas for alternative formation and holding periods as indicated. Alpha (% per week) and t-alpha the forward looking decile portfolios are represented.

	Panel A							
Decile Portfolios	**Portfolios formation period and holding period**							
	52 weeks formation 52 weeks holding		52 weeks formation 26 weeks holding		52 weeks formation 13 weeks holding		52 weeks formation 4 weeks holding	
	alpha	t-alpha	alpha	t-alpha	alpha	t-alpha	alpha	t-alpha
1	0.222	1.607	0.254	1.819	0.242	1.739	0.290	2.093
2	0.240	1.716	0.254	1.811	0.247	1.741	0.237	1.699
3	0.135	0.965	0.176	1.261	0.186	1.338	0.227	1.647
4	0.236	1.656	0.186	1.348	0.241	1.743	0.214	1.562
5	0.169	1.266	0.157	1.222	0.146	1.150	0.183	1.442
6	0.154	1.088	0.178	1.286	0.172	1.279	0.171	1.264
7	0.169	1.346	0.153	1.178	0.189	1.433	0.136	1.046
8	0.158	1.241	0.131	1.002	0.130	0.985	0.174	1.326
9	0.175	1.293	0.126	0.969	0.114	0.879	0.143	1.083
10	0.121	0.874	0.104	0.791	0.098	0.745	0.117	0.851

Table 4 Panel B presents persistence results for decile portfolios formed on past t-alphas for alternative formation and holding periods as indicated. Alpha (% per week) and t-alpha of the forward looking decile portfolios are represented.

	Panel B							
Decile Portfolios	**Portfolios formation period and holding period**							
	52 weeks formation 52 weeks holding		52 weeks formation 26 weeks holding		52 weeks formation 13 weeks holding		52 weeks formation 4 weeks holding	
	alpha	t-alpha	alpha	t-alpha	alpha	t-alpha	alpha	t-alpha
1	0.265	1.953	0.326	2.324	0.336	2.420	0.328	2.426
2	0.201	1.442	0.214	1.528	0.234	1.666	0.256	1.860
3	0.159	1.161	0.186	1.353	0.195	1.425	0.225	1.647
4	0.221	1.564	0.198	1.433	0.228	1.651	0.188	1.355
5	0.157	1.167	0.146	1.130	0.172	1.311	0.158	1.229
6	0.152	1.111	0.138	1.019	0.163	1.201	0.187	1.373
7	0.160	1.295	0.186	1.471	0.186	1.420	0.144	1.097
8	0.101	0.750	0.083	0.607	0.132	0.975	0.138	1.026
9	0.207	1.526	0.135	1.005	0.127	0.952	0.125	0.948
10	0.160	1.183	0.107	0.826	0.056	0.437	0.081	0.623

Table 5: Persistence Results – Alternative Size Portfolios (Past Winners)

Table 5 presents persistence results for 'smaller' portfolios of past winners formed on t-statistics of past 4-factor alphas for alternative formation and holding periods as indicated. Alpha (% per week) and t-alpha of the forward looking portfolios are reported.

Portfolio Size	**Portfolios formation period and holding period**											
	52 weeks formation 52 weeks holding			52 weeks formation 26 weeks holding			52 weeks formation 13 weeks holding			52 weeks formation 4 weeks holding		
	alpha	t-alpha	p-values	alpha	t-alpha	p-values	alpha	t-alpha	p-values	alpha	t-alpha	p-values
1	0.240	1.589	0.057	0.290	1.951	0.022	0.260	1.776	0.035	0.350	2.405	0.012
2	0.270	2.006	0.018	0.280	2.021	0.019	0.270	1.943	0.021	0.370	2.553	0.008
3	0.260	1.911	0.025	0.280	2.021	0.017	0.280	2.054	0.018	0.360	2.576	0.007
4	0.280	2.040	0.017	0.300	2.143	0.013	0.280	1.994	0.022	0.350	2.498	0.011
5	0.280	2.114	0.018	0.320	2.311	0.011	0.300	2.192	0.014	0.340	2.483	0.011
6	0.260	1.945	0.023	0.290	2.119	0.017	0.290	2.160	0.014	0.330	2.420	0.012
7	0.250	1.866	0.026	0.270	1.947	0.022	0.270	1.981	0.023	0.320	2.370	0.014
8	0.240	1.772	0.032	0.260	1.908	0.025	0.270	2.011	0.023	0.320	2.345	0.014
9	0.230	1.738	0.033	0.250	1.851	0.028	0.250	1.879	0.024	0.290	2.190	0.020
10	0.230	1.771	0.031	0.260	1.908	0.022	0.260	1.923	0.023	0.290	2.197	0.019

Table 6: Persistence Results – Alternative Size Portfolios (Past Losers)

Table 6 presents persistence results for 'smaller' portfolios of past losers formed on t-statistics of past 4-factor alphas for alternative formation and holding periods as indicated. Alpha (% per week) and t-alpha of the forward looking portfolios are reported.

Portfolio Size	**Portfolios formation period and holding period**											
	52 weeks formation 52 weeks holding			52 weeks formation 26 weeks holding			52 weeks formation 13 weeks holding			52 weeks formation 4 weeks holding		
	alpha	t-alpha	p-values	alpha	t-alpha	p-values	alpha	t-alpha	p-values	alpha	t-alpha	p-values
1	-0.020	-0.128	0.556	-0.020	-0.113	0.543	-0.070	-0.437	0.687	-0.080	-0.522	0.706
2	-0.010	-0.054	0.530	-0.030	-0.230	0.597	-0.040	-0.248	0.610	0.000	0.024	0.514
3	0.040	0.282	0.393	0.040	0.267	0.395	0.010	0.090	0.456	0.080	0.531	0.317
4	0.060	0.434	0.339	0.060	0.448	0.323	0.040	0.283	0.385	0.080	0.585	0.299
5	0.070	0.561	0.289	0.080	0.615	0.264	0.070	0.485	0.314	0.100	0.673	0.268
6	0.070	0.525	0.297	0.070	0.515	0.300	0.060	0.440	0.332	0.080	0.564	0.301
7	0.090	0.673	0.247	0.080	0.626	0.256	0.070	0.478	0.322	0.080	0.602	0.288
8	0.100	0.754	0.206	0.090	0.633	0.248	0.070	0.532	0.292	0.080	0.597	0.289
9	0.100	0.735	0.214	0.090	0.642	0.248	0.070	0.543	0.292	0.080	0.579	0.292
10	0.090	0.715	0.217	0.090	0.657	0.244	0.080	0.573	0.281	0.080	0.598	0.287