Why is Persistent Mutual Fund Performance so Difficult to Achieve? The Impact of Fund Flows and Manager Turnover

Wolfgang Bessler, David Blake, Peter Lückoff and Ian Tonks[1]

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Abstract

The objective of this research is to jointly investigate the impact that fund flows and manager turnover have on the investment performance of actively managed equity mutual funds. Both fund flows and manager turnover have been identified in the literature as relevant factors that significantly affect performance persistence. We analyze which of these factors has a stronger impact and how they interact. Using a sample of 3,948 U.S. equity mutual funds for the period from 1992 to 2007, our results support the notion that both mechanisms impact performance predictability over both the cross-section and time. The future performance of past top performing funds strongly suffers from both the departure of skilled fund managers and even more from excessive inflows. The future performance of past loser funds benefits from a replacement of their unskilled or unlucky managers, but does not benefit from cash outflows to the same degree. Furthermore, we provide empirical evidence that both factors have a marginal and mutually independent impact on performance and document a strong interaction between both variables. Including information on fund flows and changes in fund management in the mutual fund investment decision process would have yielded highly significant spreads in four-factor alphas of 3.12 for winner funds and 2.04 percent for loser funds per year.

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[1] Wolfgang Bessler, Justus-Liebig-University Giessen, Center for Finance and Banking, Wolfgang.Bessler @wirtschaft.uni-giessen.de; David Blake, Cass Business School, The Pensions Institute, D.Blake@city.ac.uk; Peter Lückoff, Justus-Liebig-University Giessen, Center for Finance and Banking, Peter.Lueckoff@wirtschaft.uni-giessen.de; Ian Tonks, University of Exeter, Xfi Centre for Finance and Investment, I.Tonks@exeter.ac.uk. Part of this research was undertaken while Peter Lueckoff was a visiting research fellow at Xfi Centre for Finance and Investment, University of Exeter. He gratefully acknowledges financial support from the German Academic Exchange Service (DAAD). We thank Wolfgang Drobetz, Alexandra Niessen, Lee M. Dunham, Iwan Meier, Harald Lohre, Jerry T. Parwada, Guillermo Baquero and participants at Campus for Finance, 2009, Centre for Financial Research Cologne, 2009, Financial Services Authority, German Finance Association, 2008, Midwest Finance Association, 2009, RSM conference on professional asset management, 2009, and the University of Exeter for helpful comments. Errors remain the responsibility of the authors.

1 Introduction

There is overwhelming evidence that fund managers cannot persistently outperform appropriate benchmarks after fees in the long run (Carhart 1997, Pastor and Stambaugh 2002). Yet, a number of recent studies provide empirical support for the proposition that equity mutual funds can generate persistent performance in the short run (Bollen and Busse, 2005), implying that fund managers have some investment skills. In this paper we investigate why performance persistence disappears over longer horizons and what happens to these short-run investment skills. Berk and Green (2004) offer a solution to this apparent paradox by demonstrating that, even in the presence of skilled fund managers expected excess returns will be close to zero, if there are decreasing returns to scale, because fund inflows and outflows chase past performance and this causes expected returns to converge to their equilibrium values. In addition, Khorana (2001) examines the effect of manager turnover on future fund performance, and, for a sample of funds with manager changes, finds that underperforming funds subsequently improve their performance post replacement, while outperforming funds experience a decline in post-replacement performance. These studies therefore suggest two possible reasons for the elimination of performance persistence: fund flows or manager turnover. Both "equilibrating mechanisms" (Berk and Green 2004, p. 1271) might help to explain mean reversion in mutual fund returns. Thus, analyzing one of these mechanisms without accounting for the other mechanism might not reveal the interaction and may possibly bias the results.

The objective of our research is to investigate which of these equilibrating mechanisms is more important in explaining mean reversion in mutual fund performance, how both mechanisms interact and if they can be employed to predict future fund performance. This sheds light on important questions such as whether fund investors can earn abnormal returns in certain winner funds and what governance mechanisms work at loser funds. For this we analyze the effect of fund flows and manager turnover on performance persistence for all actively managed U.S. equity mutual funds over the period from 1992 to 2007. The approach taken is to evaluate the performance of decile-portfolios formed on the basis of previous performance, concentrating on the winner (top decile) and loser (bottom decile) portfolios. We split these winner and loser portfolios into subgroups based on fund flows and manager turnover, and examine the contribution of these alternative equilibrating mechanisms on performance. Our results are robust to alternative performance measures and portfolio formation methods. Moreover, we employ new Bayesian estimation methodologies to measure performance persistence (Busse and Irvine 2006, Huij and Verbeek 2007). In addition to the ranked portfolio approach, we examine the effects of fund flows and manager turnover on future performance using a pooled regression framework.

We provide empirical evidence that manager turnover is as important as fund flows in reducing performance persistence. Our findings on fund flows support the theoretical predictions of Berk and Green (2004) that inflows have a negative effect on the subsequent performance for

winner funds but that outflows have only a marginal positive effect on loser funds, as confirmed in Berk and Tonks (2007) for loser funds. Thus, the equilibrium mechanism is different for winner and loser portfolios. Specifically, the annualized performance of top decile funds with high inflows suffers in the subsequent year by about -1.80 per cent compared with winner funds that did not experience extreme inflows. In contrast, the performance differential between loser funds with high and low outflows is generally smaller. We also find that manager turnover has a significant impact on performance persistence for both past winner and loser funds. Losing a top-decile outperforming manager results in a -1.44 per cent lower subsequent annualized performance compared with winner funds that kept their star manager. The replacement of a bottom-decile underperforming manager increases annualized fund performance by 0.96 per cent in the year after the replacement compared with previously underperforming funds that kept the same manager.

When we allow for interaction between the two equilibrating mechanisms, we find that both mechanisms have incremental explanatory power and interact strongly. The impact of fund outflows and manager turnover on the winner portfolios reduces annualized performance by 3.12 per cent. In contrast the joint effect of the two governance channels increases the annualized performance for the loser portfolios by 2.04 per cent. The implication of our work is that both fund flows and manager turnover contain valuable information for investors and investment management companies because they influence expected future fund performance. However, a long only investment strategy in winner funds conditional on both equilibrating mechanisms does not generate significantly positive alphas after fees. In contrast, before-fee alphas turn out to be highly significant indicating that most of the proceeds from real investment skill are retained by investment management companies. For loser funds, the results on the fund flow channel seem slightly weaker than the manager change channel. However, there might still be an important role for fund flows in the governance of loser funds: the threat of potential outflows of investors might be an important incentive for fund management companies to closely monitor the performance of their managers and sack bad managers. These results are also supported by the pooled regression and are robust to variations in the portfolio formation.

The rest of the paper proceeds as follows. The next section provides an overview of the literature and our hypotheses. In the following section 3, we describe our data set and explain our methodology in more detail. Our results are discussed in section 4. We first analyze funds flows, manager changes and their interaction separately for winner and loser funds before we perform a robustness check using a pooled regression approach. Section 5 finally concludes and presents an outlook to further research.

2 Equilibrating Mechanisms and Mutual Fund Performance Persistence

There is overwhelming empirical evidence that mutual fund performance persists in the short run, but not in the long run, once survivorship bias is taken into account (Hendricks, Patel

and Zeckhauser 1993, Elton, Gruber and Blake 1996b). Especially some recent studies point towards the predictability of short-term fund performance using improved statistical methods (Busse and Irvine 2006, Huij and Verbeek 2007). Based on net of fee returns received by investors, outperformers eventually produce insignificantly higher returns than the benchmark. The traditional explanations for this are management fees and a lack of management skill. Many winner funds merely happen by luck to hold last year's winner stocks: this is the short-term momentum effect identified by Carhart (1997). In addition, performance persistence seems to be strongest among young funds, small-cap growth funds and no-load funds (Blake and Timmermann 1998, Huij and Verbeek 2007). Recent underperformers, however, continue to significantly underperform the benchmarks, indicating that persistence is clustered around loser funds (Brown and Goetzmann 1995, Carhart 1997). However, it remains an open question in the literature so far why persistent positive fund performance is so difficult to achieve and why it strongly reverts to the mean. Our study contributes to the literature by examining two alternative explanations for the disappearance of persistent performance: fund flows and manager turnover. We also add new results on the persistence of performance using the improved statistical methods employed in a recent study by Huij and Verbeek (2007) building upon a Bayesian approach in combination with a holding period of one year.

The negative impact of these two equilibrating mechanisms results from conflicts of interest in delegated portfolio management. The incentives of investors and fund managers strongly depend on the relative performance ranking of the fund. Information on fund performance is readily available from rating agencies such as Morningstar and Lipper, media coverage and performance rankings. In the case of a superior recent performance and a high rating, empirical evidence shows that investors respond strongly to these positive signals by investing additional funds and thus increasing the asset size of winner funds (Sirri and Tufano 1998, Lynch and Musto 2003, DelGuercio and Tkac 2008). As the compensation of fund managers usually is linked to the fund size, fund growth is in the interest of fee-maximizing fund managers.[2] However, decreasing returns to scale in active management deteriorate the future performance of these funds (Berk and Green 2004)[3], making it difficult to deliver persistent outperformance. Thus, large net inflows are not in the interest of existing fund investors who try

[2]Here, we assume a positive relation between management fees and manager salary. However, this assumption is not relevant for our empirical results.

[3]There are a number of reasons why excessive fund flows might reduce mutual fund performance. In the short run, the creation or redemption of additional fund shares results in transaction costs such as commissions and market impact. In order to avoid these costs, fund managers often increase their cash holdings resulting in a cash drag on the fund's performance (Yan 2006). Investment decisions might be affected by fund flows that occur at inopportune times resulting in poorer performance (Ferson and Schadt 1996). Liquidity-motivated trades strongly underperform discretionary trades (Edelen 1999, Alexander, Cici and Gibson 2007). Trading is more expensive and difficult to hide in large funds: other investors can front-run and exploit the information contained in their trading behavior. Moreover, new investments of large funds are typically restricted to a small range of liquid stocks and good investment opportunities eventually vanish as funds hit the capacity constraints on their best investment strategies (Chen, Hong, Huang and Kubik 2004, Naik, Ramadorai and Stromqvist 2007). Thus, most of these studies seem to suggest that funds with excessive fund flows on average tend to underperform their peers.

to maximize risk-adjusted performance. In addition to maximizing fees by organic fund growth via inflows, fund managers with a proven track record might try to maximize their compensation by moving to a larger fund.[4] This is an additional equilibrating mechanism to the fund flows mechanism proposed by Berk and Green (2004). Indeed, empirical evidence suggests that promotions, i.e. the fund manager subsequently manages a larger fund, are positively linked to past performance (Hu, Hall and Harvey 2000, Baks 2003). Khorana (2001) examines the effect of a change in manager on a fund's subsequent performance. Using a sample of 393 domestic equity and bond fund managers that were replaced over the period from 1979 to 1991, he finds that the manager change for outperforming funds results in a deterioration in post-replacement performance. Thus, a good relative performance ranking of a mutual fund might result in high inflows or a change in management or in both. Empirical studies should, therefore, consider both equilibrating mechanisms simultaneously.

In the case of underperforming funds at low performance ranks, different incentives emerge for investors and the fund management company. Once a poorly performing fund has been identified, investors can move their assets to a fund with greater potential, a strategy followed by sophisticated investors, such as funds of funds and wealth managers (DelGuercio and Tkac 2008). Investors basically exercise market-based control and "fire" their portfolio manager. However, empirical evidence indicates that poor performance is not followed by outflows to the extent expected as many investors in poorly performing funds fail to withdraw their investments (Sirri and Tufano 1998, Lynch and Musto 2003). This might due to the fact that they anticipate either a strategy change or the firing of a poorly performing manager by the investment management company. A fund investor behavior according to the disposition effect is another possible explanation.[5] However, this investor behavior may be rational, because believing in efficient market mechanisms, the investor may assume that the two equilibrating or corporate governance mechanism discussed so far may improve the future performance. Furthermore, transaction costs such as loads and costs involved with gathering information about alternative funds might reduce the mobility of capital. The consequence is that the equilibrating mechanism is weak and the poor performance can persist (Berk and Tonks 2007). There is, however, recent evidence that investors are beginning to react more quickly to past performance than earlier studies have documented (Goriaev, Nijman and Werker 2008).

In addition to this market-based control mechanism an internal control of the portfolio manager by the investment management company should exist. Specifically, as investment management companies face the risk of significant outflows out of poorly performing funds, it might be in their interest to fire the managers of loser funds. Several studies document an inverse relationship between fund performance and manager turnover (Khorana 1996, Chevalier and

[4]In equilibrium, skilled funds managers maximize their salary according to Berk and Green (2004) as they manage larger funds than their unskilled peers.

[5]Investors are reluctant to realize losses and so stay invested until the fund price returns to the original purchase price (Shefrin and Statman, 1985).

Ellison 1999, Gallagher and Nadarajah 2004). Using a sample of 339 funds that replaced their managers over the period from 1979 to 1992, and a control group of 4,830 funds that did not, Khorana (1996) reports an inverse relationship between the probability of manager change and past performance. Moreover, demotions, i.e. the manager subsequently manages a smaller fund, are negatively linked to past performance (Hu, Hall and Harvey 2000, Baks 2003).[6] For underperforming funds Khorana (2001) documents that performance improves post-replacement. Hence, manager turnover does appear to place a curb on performance persistence. However, it remains unresolved if external and internal control mechanisms at loser funds are substitutes or complements. Specifically, investors might be reluctant to withdraw money from poorly performing funds in expectation of an internal manager replacement and a subsequent performance improvement. In contrast, fund management companies might fire poorly performing fund managers in order to prevent large outflows. Thus, it appears to be important to jointly analyze both equilibrating mechanisms.

Khorana, Servaes and Wedge (2007) suggest that there are three additional primary mechanisms to create the appropriate incentives for fund manager performance: compensation contract, removal of the fund management company by the directors of the fund, and the "share ownership of the manager of the funds in the funds they oversee" (Khorana, Servaes and Wedge 2007, p. 183). Performance-based compensation contracts and share ownership of the manager are still not common, even though both are growing in importance (Elton, Gruber and Blake 2003, French 2008). Future fund performance, at least, seems to be positively related to managerial ownership (Khorana, Servaes and Wedge 2007). Fund managers are employed by the investment management company which is legally independent of the mutual fund itself. Investors, therefore, do not have direct control over the decision to replace underperforming managers. However, with respect to the fund management company, control in the interest of fund investors is delegated to fund boards. In 2004, as a result of the fund scandals in 2003,[7] the SEC proposed a rule to increase the fraction of independent directors on fund boards to at least three quarters and required an independent chairman as well.[8] However, this rule was rejected

[6]However, rather than sacking an underperforming manager, investment companies might have an incentive to close or merge the losing fund and to open a new one as small and young funds are known to exhibit a higher flow sensitivity than large and old funds (Sawicki and Finn 2002). It has been documented that funds which disappear due to merger or death tend to have poor performance just prior to disappearance (Brown and Goetzmann 1995, Elton, Gruber and Blake1996b, Lunde, Timmermann and Blake 1999, Carpenter and Lynch 1999, Carhart, Carpenter, Lynch and Musto 2005).

[7]These scandals refer to rapid trading in mutual fund shares exploiting price deviations resulting from a calculation of the NAV based on stale prices due different time-zones of the fund shares and the underlying assets (market timing) or fund orders of some institutional investors being accepted after the official NAV calculation (Greene and Hodges 2002, Zitzewitz 2003, 2006).

[8]This was the last step in a sequence of reinforcements of this rule: The 1940 Investment Company Act required that a maximum of 60 percent of the directors were affiliated to the investment company. The 1970 Amendment broadened that definition by allowing a maximum of 60 percent of *interested* persons. This was replaced by the 2001 Amendment that required a majority of independent directors and, finally, since the 2004 Amendment three quarters of independent directors is required.

twice in federal appeals courts.[9] Fund boards, in general, do not fire the fund manager, but they can appoint another fund management company, although again this rarely happens in practice. Empirical evidence on the effectiveness of these incentive mechanisms – where they are used – is mixed. According to Ding and Wermers (2005), the size of the board and its independence increase the likelihood of replacing a poorly performing manager. In contrast, Kong and Tang (2008) argue that small unitary boards (i.e. one fund board oversees all funds of the family) are more beneficial to investors than large independent fund boards. However, we focus in our empirical analysis on fund flows and manager replacements as these mechanisms appear to be the relevant factors in explaining the dynamics of mutual fund performance and the observed mean reversion.

Building on the above findings, our data set allows us to investigate the following hypotheses about the effects of fund flows and manager turnover on performance persistence in mutual funds.

With respect of winner funds:

- Fund flows: Investors chase past performance and performance suffers from excessive inflows leading to stronger mean reversion for winner funds with higher net inflows.
- Manager turnover: A star fund manager is moving to another fund management house – either because he is unable to negotiate an acceptable compensation package related to the fee increase the fund management house generates due to the larger assets under management, or because he anticipates an inferior performance in the next period due to excessive inflows. Therefore, the performance may decline resulting in stronger mean reversion for winner funds with a change in management.

With respect of loser funds:

- Fund flows: Investors withdraw their money and performance improves as a result of a smaller asset base leading to stronger mean reversion for loser funds with lower net inflows, i.e. higher outflows (although this effect might be dampened by any investor inertia).
- Manager turnover: The fund management company fires an underperforming fund manager and performance improves under a newly appointed fund manager leading to stronger mean reversion for loser funds with a change in management.

The contribution of our paper is to jointly investigate the effects of both equilibrating mechanisms. If one of these mechanisms is analyzed without taking the other mechanism into account, the results might be biased. Furthermore, previous empirical studies on the impact of fund flows on performance did not directly address the role of fund flows as an equilibrating mechanism that dynamically explains the relation between past and future performance (i.e.

[9]SEC Remains Divided on Fund-Board Rule, *WSJ*, March 16, 2007.

performance persistence) over the longer term and did not explicitly consider the differences between winner funds and loser funds.

3 Data and Methodology

3.1 Data

The data on mutual funds and the benchmarks are obtained from the CRSP Survivorship Bias Free Mutual Fund Database from the University of Chicago. Our sample starts in 1992, the first year for which reliable information on manager changes is available, and it ends in 2007. In constructing our sample, we follow Pastor and Stambaugh (2002) as closely as possible.[10] Thus, we restrict ourselves to domestic equity mutual funds and exclude passive funds. In recent years, fund families started to offer different share classes in the same underlying portfolio, with the classes differing only in their expenses and minimum investment requirements (Zhao 2005). The share classes are managed by the same fund manager and fund flows at the share class level might cancel out at the portfolio level. However, the CRSP database treats each individual share class as a separate observation. Consequently, we combine all share classes of the same fund using a matching algorithm based on the portfolio number that matches share class characteristics with holdings information and the fund name.

These selection criteria generate a sample of 4,376 funds with a total of 11,798 share classes that existed at some time during the sample period from 1992 to 2007. These funds belong to 714 different fund families. However, we drop all observations prior to the IPO date given by CRSP and funds without names in order to account for a potential incubation bias (Evans 2007). Additionally, we drop funds that have fewer than 12 months of return observations during our sample period. The final sample consists of 3,948 funds belonging to 672 fund families and having an average fund size of 899 million USD (table 1). Fund size increased over the sample period, whereas average fees fell from 1.68 percent to 1.56 percent, as a result of economies of scale in direct expenses involved in asset management.[11]

[Please insert **table 1** about here]

Monthly fund flows are constructed from the change in total net assets adjusted for internal growth due to investment returns:

$$(1) \qquad flow_{it} = TNA_{it} - TNA_{it-1}\,(1 + r_{it})$$

[10] Details about the data selection are given in the appendix.

[11] Fees are calculated as the sum of the annual expense ratio and 1/7 of the sum of the front end and back end loads. See also French (2008) for an analysis of changes in the fee structure over time.

TNA_{it} refers to the total net assets of fund i at the end of period t and r_{it} is the return of fund i between t-1 and t, assuming that all distributions are reinvested net of fund expenses. Following the argument of Berk and Tonks (2007), absolute flows are scaled by $TNA_{it-1}(1+r_{it})$ in order to obtain relative flows:

$$(2) \qquad rel\_flow_{it} = \frac{TNA_{it} - TNA_{it-1}(1+r_{it})}{TNA_{it-1}(1+r_{it})}$$

If a fund merges with another one, we do not count the incoming assets as fund flows, because there is no additional cash to invest. Thus, the fund manager does not have the immediate problem of investing the inflows, but can adjust the portfolio weights gradually over time to minimize the performance impact. Fund flows significantly decreased after the tech bubble period and have not returned to the same level yet. Furthermore, fund flow volatility increased over the sample period, especially after the tech bubble (figure 1). A possible interpretation for this is that investors have become more sophisticated and performance-sensitive in recent years.

[Please insert **figure 1** about here]

To obtain information on manager changes, we focus on the variable `mgr_date` in the CRSP database, instead of using the specific names of the managers.[12] This variable provides the date of the last manager change as reported by the fund company. By using the `mgr_date` variable, we avoid any problems associated with different spellings of manager names. Furthermore, as the number of team-managed funds increased during recent years, the manager date variable has the advantage that fund management companies only report significant changes in management that might have an impact on performance (Massa, Reuter and Zitzewitz 2007). A total of 6,446 manager changes occurred during our sample period.[13] The number of funds and the number of manager changes peaked at the end of the tech bubble in 2000. On average, 19 percent of the fund managers are replaced each year which is consistent with the 14 percent to 18 percent reported by Ding and Wermers (2005) using a more detailed database on fund managers constructed from various sources. In combination with fund closures or mergers, this leads to an average duration of 47.26 months or almost four years for each manager-fund combination. The number of manager changes has decreased slightly in recent years (figure 1). The strong decrease during the last twelve months might result from a reporting lag but does not impact our results as we only use lagged manager changes in our analysis. Both, the higher level of manager turnover

[12]This variable has also been used by Lynch and Musto (2003) and Cooper, Gulen and Rau (2005).
[13]Note that the sample of Khorana (2001) who also analyzes the impact of manager turnover on performance contains only 393 funds.

as well as the stronger performance sensitivity of fund flows as indicated by their higher volatility suggest that manager changes and fund flows have become even more important in explaining the lack of mutual fund persistence in recent years.

3.2 Methodology

In order to test our two hypotheses that manager turnover weakens the relationship between past and future performance and that inflows (outflows) have a negative (positive) impact on the future performance of winner (loser) funds, we apply two different methodologies. First, we use ranked portfolio tests to compare the performance of funds in the cross section. Specifically, we compare subgroups with high and low net inflows and subgroups with and without a change in manager. Second, we perform a pooled regression of the change in performance over time on net inflows and manager turnover in order to quantify the effects over time.

Ranked portfolio tests have been widely used in persistence studies (Carhart 1997, Carpenter and Lynch 1999, and Tonks 2005). This test involves ranking the funds into deciles based on their performance in the formation period and the evaluation of their performance in the subsequent evaluation period. Based on the decile groupings of fund portfolios from the first sorting, we perform a second sorting of the top decile 10 and the bottom decile 1 funds based on manager changes or fund flows during the formation period.[14] The intuition behind this is that we are interested in the different effects of manager turnover and fund flows on good and bad managers. Specifically, we want to separate the effects of sacking an unskilled manager (i.e., internal governance) or withdrawing money from a bad manager (i.e., external governance) from the effects of a skilled manager leaving the fund or investors allocating large amounts of money to good managers. Thus, the first sorting based on past performance acts as a means of separating good from bad managers. We then analyze the performance of these subgroups of top and bottom deciles, as well as the performance of spread portfolios constructed from top and bottom deciles. This procedure allows us to deal with the inherent endogeneity problem in the relationship between manager turnover and performance and between fund flows and performance. Specifically, it replicates a real time trading strategy and measures the economic value of information on past manager changes and past fund flows.

Formation In order to employ the methodology outlined above, we face two decisions: first, the choice of which performance measure should be used to evaluate managerial skill and, second, the time horizon over which performance persistence should be analyzed. As these questions cannot be answered unambiguously from a theoretical perspective, we propose to apply several measures for ranking and evaluating funds. The first measure is raw returns (in excess of the return on the risk-free asset) which have been used since the seminal work of Carhart (1997)

[14]This methodology is similar to the one used for seasoned and unseasoned funds by Berk and Tonks (2007). However, their second sorting is based on the performance of the funds in the penultimate year.

(*return-sorting*). Raw returns have the advantage that they do not have to be estimated and that no assumptions about relevant risk factors have to be made. Additionally, investors seem to pay attention to past raw returns when allocating their money to mutual funds (Gruber 1996). However, ranking mutual funds based on raw returns might result in a noisy separation between skilled and unskilled fund managers. It is not only genuine investment skill that produces high returns compared with the peer group. For example, being a growth fund manager during periods when growth stocks outperform value stocks increases the likelihood of ending up in the top decile, even if the manager has no skills.[15] Alternatively, some managers might take on excessive risks and end up in the top decile by luck rather than by skill. To account for these issues, we follow Huij and Verbeek (2007) and apply a Bayesian version of the Carhart four-factor model to rank the funds into deciles (*alpha-sorting*).[16] In order to deal with the time horizon question, we consider different but symmetric lengths for the formation and evaluation periods. Specifically, we analyze short-term persistence over three-month formation and evaluation periods, medium-term persistence over one-year formation and evaluation periods, and long-term persistence over two- and three- year formation and evaluation periods.[17]

The Carhart four-factor model incorporates a size factor (*SMB*), a value factor (*HML*) and a momentum factor (*MOM*) in addition to the market proxy (er_{mt}) to explain fund returns and to account for different fund styles (Carhart 1997):

$$(3) \qquad er_{it} = \alpha_i + \beta_{1i} er_{mt} + \beta_{2i} SMB_t + \beta_{3i} HML_t + \beta_{4i} MOM_t + \varepsilon_{it}$$

Specifically, funds are ranked based on the alpha from equation (3) estimated over the whole formation period. In order to efficiently estimate a four-factor model over such a short horizon as one year, we apply a Bayesian adjustment (Huij and Verbeek 2007). This procedure involves the estimation of the Carhart model for each fund separately using OLS. We use the average of the parameters of all other funds during that period as the prior. The final alpha and beta parameters for each individual fund are then a weighted average of the OLS parameters and the average of the parameters of all other funds during that period, where the weights depend on the estimation efficiency of the OLS parameters.[18] Thus, the Bayesian adjustment 'shrinks' any extreme parameters towards a grand mean taking into account the cross-sectional distribution of

[15]This relies on the assumption that most managers do not systematically switch between a growth-oriented investment style and a value-oriented investment style over the cycle. If they switched styles successfully in a systematic manner, this clearly should be classified as real skill.

[16]Additionally, we employed the following measures for ranking: the Sharpe ratio, the Jensen one-factor alpha (Jensen 1968), the *t*-statistic of the Jensen one-factor alpha as suggested by Elton, Gruber and Blake (1996a) and a Bayesian version of the Jensen one-factor alpha. Additionally, we analyze the performance of non-equidistant quantiles using raw (excess) returns and the following cut-off points for our ten quantile groups: [5, 10, 20, 30, 50, 70, 80, 90, 95]. However, as our results do not change significantly, we present only results based on a raw return-sorting and a ranking using the Carhart four-factor alphas.

[17]Note that for the three-month ranking, we only use the return-sorting approach.

[18]Further technical details are given in Huij and Verbeek (2007).

the parameters. The intuition behind this approach is that it is less likely for a fund to generate high alphas if all other funds generate relatively low alphas during the same period. This argument is similar to the methodology of Cohen, Coval and Pastor (2005). They attribute a higher skill measure to fund managers who produce their outperformance with a similar strategy to other skilled fund managers in comparison with managers who used a completely different strategy. The later are classified as lucky rather than skilled. Consequently, the alpha-sorting based on Bayesian four-factor alphas accounts for a risk-adjustment of the performance measure used for the ranking, corrects for different investment styles and reduces the influence of high risk strategies on the ranking. We believe that in contrast with the raw return-sorting, the alpha-sorting provides a much more reliable separation of skilled and unskilled but lucky fund managers.

Evaluation To be consistent, the same performance measures we use for ranking funds into deciles are applied in the evaluation period. Specifically, following Carhart (1997), we construct a concatenated time series as the cross-sectional equally-weighted average of the raw returns of all funds that belong to one specific decile (or subgroup of funds).[19] For each decile this results in a single time series of portfolio returns that could have been generated by following our trading strategy over the sample period (*portfolio approach*).[20] It is important to recognize that the composition of these portfolios changes significantly over time because, after each formation period, new decile portfolios are formed.[21] In addition, the funds themselves change the composition of their portfolios over time. As an alternative, we consider the raw returns of the whole panel of funds that belong to a specific decile and report moments of their return distribution such as the mean and different quantiles (*panel approach*). Usually, retail investors are not able to follow a trading strategy implied by a ranked portfolio test as this involves holding a large number of funds. Thus, return moments of the panel of all funds that belong to a certain decile are more relevant for private investors than the results based on the concatenated time series.

We also apply risk-adjusted returns derived from the Carhart four-factor model estimated during the evaluation period according to equation (3). The advantage of this procedure is that it provides direct estimates of the economic significance of the factors in comparison with a benchmark. First, we use the time series of the decile portfolios to estimate the Carhart four-factor model over the whole sample period (*concatenated alphas*). However, the high turnover of the contents of this portfolio leads to a high degree of time-variability in the model parameters that an unconditional model does not account for (Elton, Gruber and Blake 1996a). This might severely bias the results (Bollen and Busse 2005). In order to deal with the time-variability of the parameters in the Carhart four-factor model, we apply a rolling window regression that can be

[19]If a fund drops out of the decile due to merger or closure, the portfolio weights are adjusted accordingly.
[20] This assumes that short sales in mutual funds are allowed for the spread portfolios.
[21]A strategy of buying decile 10 or decile 1 funds every year involves an annual turnover of about 84.31 percent and 84.30 percent, respectively.

interpreted as a non-parametric version of conditional performance evaluation models of Ferson and Schadt (1996). Specifically, we estimate the parameters from equation (3) for the Bayesian adjustment using a window of 24 months. For example, the alpha at time t = 13 of this window is the realized return at time t = 13 minus the expected return for that month:

$$(4) \qquad \begin{aligned} \alpha^{B}_{i,t=13} &= r_{i,t=13} - E(r_{i,t=13}) \\ &= r_{i,t=13} - \hat{\beta}_{1i} er_{m,t=13} + \hat{\beta}_{2i} SMB_{t=13} + \hat{\beta}_{3i} HML_{t=13} + \hat{\beta}_{4i} MOM_{t=13} \end{aligned}$$

We then move on one month at a time until we reach the end of the fund's return time series.[22] As the performance measurement in the evaluation period is ex-post by nature, this procedure does not suffer from a look-ahead bias. As a result, we obtain one alpha estimate for each fund and each month. Similar to the treatment above of raw returns, we construct a time series of decile portfolio alphas (and the alphas of the subgroups) for each decile as the cross-sectional equally-weighted average of the alphas of all funds that belong to a specific decile (*portfolio approach*):

$$(5) \qquad \alpha^{B}_{pt} = \frac{1}{n} \sum_{i=1}^{n} \alpha^{B}_{it}$$

In our tables, we present the time-series mean of these portfolio alphas over the sample period. This gives an equal weight to each month of our sample period as we take first the cross-sectional mean and then the time-series mean. However, as Loughran and Ritter (2000, p. 363) argue that "in general, tests that weight firms equally should have more power than tests that weight each time period equally", we additionally analyze the moments of the whole panel of alphas for each decile (*panel approach*). The mean from the panel approach gives equal weight to each fund and, as a result, less weight to earlier time periods when fewer funds existed, accounting for the increasing importance of mutual funds for investors in recent years.

Pooled regression In addition to the ranked portfolio test outlined above, we perform a pooled regression with the difference in annualized raw returns or performance between this year and the previous year as a dependent variable. These performance changes over time are then regressed on a set of control variables as well as net inflows and a manager turnover dummy. Following French (2008), we winsorize all variables at the 1 percent and 99 percent quantile to avoid any bias resulting from extreme outliers. This regression offers insights into the impact of fund flows and manager turnover on fund performance over time compared to the cross-sectional results of the ranked portfolio test. Furthermore, it provides us with the possibility of separating

[22]Elton, Gruber and Blake (1996a) use a similar approach, but estimate the model parameters at once over the whole life of the fund instead of using a rolling window.

the effects of fund flows and manager turnover and of measuring their marginal impact.

4 Empirical Results

4.1 Performance Persistence

We start the presentation of our results by the discussing the characteristics and performance of the fund deciles, based on a portfolio ranking formed on one-year past performance measured by Bayesian four-factor alphas (tables 2 and 3). It becomes immediately evident that the three top ranked fund deciles have significantly positive alphas in the formation year while the bottom four deciles highly significantly underperform the four-factor benchmark. As revealed by previous studies there exists a strong tendency for mean reversion in fund performance (Carhart 1997). Specifically, neither of the top ranked deciles continues to outperform in the evaluation year and only two lower ranked deciles continue to significantly underperform. The Bayesian portfolio alphas for winner funds are reduced from 0.88 percent to 0.18 percent per month while the same measure for loser funds reverts from -0.97 to -0.21 percent. However, the performance spread between decile 10 and decile 1 funds is in the range between 0.31 and 0.39 percent and significant for two performance measures (out of four), indicating weak signs of performance persistence. Overall, the tendency to mean revert seems to dominate the persistence in performance as is evidenced in figure 2. One important outcome is that the results for a formation based on Bayesian four factor alphas are more consistent than the formation based on raw returns. Thus, in the following we concentrate on the result from a formation based on Bayesian four-factor alphas.

Table 3 shows that the outperforming deciles, and in particular the winner decile 10 funds have high absolute and relative inflows and are relatively larger in size consistent with the notion that investors might add to the size of these funds by chasing past performance. The underperforming deciles, and especially the loser decile 1, experience outflows and have higher management fees. These high fees may explain why there is stronger evidence for performance persistence among poor performers (Carhart 1997). With respect to manager turnover, there is evidence that there is slightly higher manager turnover in both the winner and loser deciles relative to funds with average performance. Eventually this may be the result of loser fund managers being sacked and winner fund managers being poached away.

[Please insert **tables 2 and 3 and figure 2** about here]

Having established that the funds in the sample show some signs of performance persistence especially based on an alpha-sorting we now go on to examine how this persistence of winner and loser funds is affected by fund flows and manager turnover.

4.2 Winner Funds

This section discusses the results for funds that were ranked in the top decile based on previous year performance (table 4).[23] Our hypotheses suggest that winner funds strongly suffer from both, excessive inflows and the departure of the fund manager. According to Berk and Green (2004), active management suffers from decreasing returns to scale. Moreover, part of the previous outperformance might be attributed to the personal skills of the portfolio manager who has left the fund. These predictions are confirmed by our empirical results. Specifically, winner funds that suffer from high inflows yield low and in one case even negative alphas in the subsequent year based on the three different alpha measures used. Winner funds, in contrast, that have proven high levels of investment skill in the formation year but do not experience large inflows, have positive alphas in the range between 0.13 and 0.22 percent in the evaluation year. Thus, conditioning on fund flows yields a significant spread between winner funds with lower-than-median net inflows and higher-than-median net inflows of between 0.12 and 0.15 percent which is significant for two of the three alpha measures.[24] These results confirm the Berk and Green (2004) hypothesis for winner funds and are similar in magnitude to the negative contribution of liquidity-induced trading on alpha of 0.12 percent per month identified by Edelen (1999).[25]

[Please insert **table 4** about here]

Turning to winner funds with a change in management also supports our hypotheses. Manager turnover can serve as an equilibrating mechanism similar as fund flows. Decile 10 funds that lose their skilled manager yield alphas in the subsequent year which are close to zero or even negative and insignificant for all three measures. Winner funds that kept the same manager, in contrast, deliver abnormal returns in the range between 0.10 and 0.21 percent. This results in a spread between winner funds without and with a manager change of significant 0.11 to 0.17 percent, depending on the alpha measure employed. Conditioning on manager changes helps to identify winner funds that have a lower tendency to mean revert and, as a result, provide higher abnormal returns and stronger signs of persistence than funds with manager change. It is interesting to note that these numbers are similar to the number of the fund flow mechanism. Thus, fund flows and manager changes seem to have a similar performance impact individually.

[23]Repeating the same analysis with quintiles instead of deciles did not alter our results qualitatively.

[24]It is interesting to note that in results not presented here for short term effects, i.e. three month formation and evaluation periods, inflows into winner funds seem to have a positive impact on fund performance. This result might be due to winner fund managers upscaling their existing holdings as documented by Pollet and Wilson (2008) and, by doing so, driving up the prices of existing positions. However, over longer horizons this effect reverses.

[25]We repeat the analysis using the 80 percent quantile as breakpoint between winner funds with high or low net inflows. Funds in the high inflow subgroup, on average, more than double in size during the formation year. The performance of these funds is then reduced by additional 0.06 to 0.07 percent compared to the median breakpoint to insignificant -0.09 to 0.04 percent. The spread between winner funds with high net inflows and low inflows amounts to highly significant 0.15 to 0.18 percent indicating the importance of extreme inflows as equilibrating mechanism.

Even though the results when looking at both equilibrating mechanisms individually support our hypothesis, they cannot explain fully the lack of significant outperformance of winner funds in the evaluation period. Thus, we next consider their joint effects. To do this, we perform a double sort on both equilibrating mechanisms. This results in four subgroups: funds without manager turnover and lower-than-median net inflows (w/o lo), funds with manager turnover and lower-than-median net inflows (w lo), funds without manager turnover and higher-than-median net inflows (w/o hi) and funds with manager turnover and higher-than-median net inflows (w hi). Table 5 reports the alphas for winner decile subgroups conditioned on both mechanisms. It becomes evident that winner funds without large inflows and without a change in management clearly outperform the other decile 10 subgroups and the four-factor benchmark by 0.14 to 0.25 percent. However, the alphas of this strategy are still significant only for the panel approach. Winner funds that suffer from both equilibrating mechanisms yield alphas which are negative or very close to zero. Thus, the spread between these two subgroups, long in winner funds with lower-than-median net inflows and no change in management and short in winner funds with excessive inflows and manager turnover is highly significant between 0.22 and 0.26 percent, depending on the alpha measure employed.

[Please insert **table 5** about here]

Analyzing the interaction effects of both mechanisms reveals that if a winner fund already suffers from excessive inflows or a change in management then the other channel still has an additional negative impact on performance. Specifically, the alphas of winner funds with high inflows and manager change are still -0.07 to -0.09 percent lower than alphas of funds with only high inflows and still -0.02 to -0.10 percent lower than alphas of funds with only a change in management (compare tables 4 and 5). Furthermore, keeping the impact of one mechanism constant and conditioning on the other mechanism shows that equilibrating mechanisms exercise a marginal impact on performance. It appears that the impact of fund flows while keeping manager change constant is even stronger than the impact of manager change while keeping fund flows constant. Especially a change in management does not further decrease fund performance substantially if the fund already suffers from large inflows. This result indicates that the decreasing returns to scale in active management in the sense of Berk and Green (2004) appear to be at least partially independent of the fund manager (e.g. best ideas) and, instead, are related to the fund itself (e.g. trading efficiency).

According to Berk and Green (2004) and our hypotheses, the equilibrating mechanisms are closely related to the intentions of the winner fund managers to maximize their fees by increasing their assets under management either at the same fund (i.e. higher-than-median inflows) or by moving to another fund (i.e. manager change). Thus, it seems interesting to relate the results from above to different fee levels in the subgroups of winner funds. Specifically, we

repeat the same analysis from above using before-fee returns in order to calculate alphas (table 6). Our results do not change and we conclude therefore that winner fund managers do not maximize their fee income by actively adjusting the fee levels to their expected performance. The results suggest that winner funds with higher inflows have slightly lower fee levels which might also stem from a preference of investors for low fee funds. Winner funds without a change in management have lower fees. The pre-fee analysis yields some additional interesting insights. Even if the unconditional group of all decile 10 funds still cannot outperform the four-factor benchmark significantly, the two subgroups conditional on fund flows or manager changes do. The results for the former are slightly stronger with highly significant alphas between 0.24 and 0.34 percent before fees while the alphas of winner funds without manager change are significant only on the 10 percent level (1 percent for panel approach) between 0.21 and 0.33 percent before fees. A combined strategy conditioning on fund flows and manager changes even outperforms the four-factor model by highly significant 0.26 to 0.37 percent before fees. These results seem to imply that the equilibrating mechanisms can explain why the group of all winner funds is, on average, not able to produce significantly positive alphas even before fees while the fees help to explain why fund investors cannot earn significant abnormal returns even if they include both equilibrating mechanisms in their investment decision.

[Please insert **table 6** about here]

Figure 3 summarizes the results on winner funds and reports the average alphas of the three performance measures as well as the number of significant alphas in brackets.

[Please insert **figure 3** about here]

4.3 Loser funds

In this section, we present the results for loser funds, i.e. for the ten percent of all funds that ranked lowest based on previous year performance (table 7).[26] In this case, the equilibrating mechanisms can be interpreted as governance mechanisms. Based on our hypotheses, we would expect that the fund management company might sack underperforming fund managers. Furthermore, investors might individually come to the decision to "fire" their fund manager by withdrawing money from the fund. This serves as an incentive for fund management companies to closely monitor the performance of their fund managers in order to avoid losing market share. However, our results lend only weak empirical support for the market-based control according to the hypothesis of Berk and Green (2004). Conditioning on fund flows we cannot separate the loser decile into a subgroup that continues to outperform and a subgroup that reverts to the mean. The performance of loser funds that benefit from outflows is only slightly higher than the

[26]Repeating the same analysis with quintiles instead of deciles did not alter our results qualitatively.

performance of winner funds without significant outflows. The alpha spread between these two subgroups is between 0.06 and 0.12 percent and significant only for the panel approach.[27] A possible explanation for the weak support for the Berk and Green (2004) hypothesis for bottom funds is that a large fraction of investors are reluctant to withdraw money from underperforming funds (Berk and Tonks 2007). As empirical studies on the performance-flow relationship suggest, investors are still reluctant to sell underperforming funds at the same rate as they buy outperforming funds (Sirri and Tufano 1998, Lynch and Musto 2003). There is therefore no incentive for the poorly performing fund managers to change their portfolios and improve performance. Berk and Tonks (2007) compare this with the repayment behavior of mortgage borrowers. Some borrowers are sensitive to changes in the interest level and refinance their mortgage whenever it is beneficial, while a significant fraction of borrowers is reluctant to refinance. While not economically rational, this behavior is consistent with the disposition effect in that investors are hesitant to realize losses and so stay invested until the fund price returns to the original purchase price.[28] Another possible explanation for such a behavior is that the investor hopes for the equilibrating mechanisms to work and to benefit from them without further actions or costs.

[Please insert **table 7** about here]

Turning to manager changes, our hypothesis that bottom funds that sack their fund manager can improve their performance in the following year compared with bottom funds that stick with their presumably unskilled manager is strongly supported by our findings. While loser funds without manager turnover continue to underperform by -0.24 to -0.26 percent per month in the subsequent year, loser funds that replaced their manager have alphas between -0.10 and -0.19 percent which are insignificant in two out of three cases. This leads to a significant spread in alpha resulting from the exercise of internal governance mechanism of 0.08 to 0.14 percent. A new manager, therefore, may contribute to a stronger mean reversion of fund performance to neutral levels and may reduce poor performance persistence. All this suggests that manager turnover is an important control mechanism that has both a statistically and economically

[27]The difference between the panel and portfolio approaches lies in the weighting of different time periods, with the panel approach overweighting more recent time periods as a result of more funds coming into existence over time. This result suggests that the importance of external governance might have increased during recent years. This is consistent with the fact that a larger share of institutional investors are using mutual funds and with the findings of Goriaev, Nijman and Werker (2008) who show that more sophisticated investors respond more quickly to performance.

[28]We repeat the analysis by using the 20 percent quantile as breakpoint between loser funds with high or low net inflows. Funds in the low inflow subgroup have outflows between 14 and 39 percent of their total net assets on average during the formation year. The performance of loser funds benefiting from extreme outflows is then improved by additional 0.05 to 0.09 percent compared to the median breakpoint to insignificant -0.05 to -0.16 percent. However, the spread between loser funds with high outflows and low outflows is still significant only for one alpha measure between 0.09 and 0.19 percent indicating that even if investors are not reluctant to withdraw money we can only document weak support for the Berk and Green (2004) hypothesis.

significant impact on fund performance. Comparing the economic and statistical magnitude of both equilibrating mechanisms for loser funds strongly suggests that manager replacement are the more effective tool for governance than withdrawing money. However, as indicated above, the threat of money withdrawal strongly presses the fund management company on sacking underperforming managers.

Thus, it seems likely that both equilibrating mechanism are strongly linked among loser funds as both are governance mechanisms. Consequently, we next consider their interaction and dependency (table 8). Table 8 clearly reveals that loser funds benefit from both governance mechanisms at the same time and strongly revert to the mean. They do not show any signs of poor performance persistence. Specifically, all three alpha measures for this subgroup are insignificantly different from zero at between -0.04 to -0.11. Thus, the performance of the subgroup of decile 1 funds with manager change and high outflows even reverts to levels comparable to the unconditional performance of decile 7 funds (table 3). In contrast, loser funds without large outflows and without a change in management contribute largely to the observed persistent underperformance of the overall loser fund group. Their alphas are -0.28 and highly significant based on all three performance measures. Thus, conditioning on both equilibrating mechanisms results in a significant spread of -0.17 and -0.24 percent between the two extreme subgroups, i.e. long in loser funds without a change in management and below median outflows and short in loser funds that replaced their manager and benefited from above median outflows.

[Please insert **table 8** about here]

Comparing the results of tables 8 and 9 indicates that both governance mechanisms have a strong marginal impact on performance. If the manager of loser funds is already being replaced, additional outflows that are higher than median outflows improve subsequent alphas by 0.05 to 0.08 percent. Similarly, if a loser fund already experiences larger-than-median withdrawals, an additional replacement of the managers improves the subsequent performance by an additional 0.08 to 0.10 percent. This notion is supported by keeping one mechanism constant and conditioning only on the other mechanism. However, as already evident from the previous results, the internal governance mechanism seems to play a more important role among loser funds than external product-market based governance as is indicated by a larger spread for keeping fund flows while conditioning on manager change. The mechanisms at work for loser funds seem to be more closely related to the fund manager as a person than to the characteristics related to the fund size.

Because mutual funds facing a higher degree of internal and external governance charge lower fees, we repeat the above analysis with alphas calculated from raw returns gross of management fees (table 9). The results remain almost perfectly unchanged, indicating that the effect of the equilibrating mechanisms is independent of fund fees. It is further interesting to note

that loser funds benefiting from both governance mechanisms even yield positive yet insignificant alphas before fees of in the range of 0.03 to 0.09 percent. Thus, the combination of management fees and both equilibrating mechanisms can explain why some funds persistently underperform while others revert to neutral or even to a positive performance. The average underperformance of all loser funds is a result of their persistently higher fee levels as suggested by Carhart (1997). In addition, and to the same extent, this is also due to the lack of effective governance by many of the loser funds.[29]

In order to further understand the economic importance of both governance mechanisms we compare the performance improvement resulting from a fee waiver for loser funds as well as the combined effect of the governance mechanisms. In the unlikely event that the regulator stepped in and forced all bottom decile funds to pay back management fees to their investors, their performance would improve by 0.13 percent (decile 1 before fees minus decile 1 after fees). However, the joint exercise of internal and external governance mechanism improves performance by 0.14 to 0.17 percent depending on the alpha measure used (decile 1 without manager change and lower then median net inflows minus decile 1). Thus, the governance impact on performance is even stronger than the negative impact of fees on performance.

[Please insert **table 9** about here]

Figure 4 summarizes the results on loser funds and reports the average alphas of the three performance measures as well as the number of significant alphas in brackets.

[Please insert **figure 4** about here]

4.4 Interaction effects

Summarizing the results from the previous sections let us conclude that the dynamics of fund performance is strongly dominated by a mean reversion effect even though weak signs of persistence can be found. However, with respect to loser funds, we cannot strongly support the hypothesis of Berk and Green (2004), because withdrawals from these funds do not appear to be high enough to regain neutral performance. This might be due to performance insensitive investors in these funds. At the other extreme, fund flows play a major role in explaining persistence among winner funds which is consistent with the higher performance sensitivity of flows into these funds. However, excessive inflows significantly reduce positive performance persistence. Manager changes have a significant impact on both, performance persistence among winner funds and loser funds. In both cases, a change in management weakens the relation between past and future performance. Thus, manager changes are to the benefit of investors in

[29]Note that only 11.86 percent of all loser funds benefit from a combination of both governance mechanisms (table 10).

loser funds but to the disadvantage of investors in winner funds. Thus, past performance is only an indicator of future performance if the manager is not replaced and fund flows do not wipe out persistence.

So far, our results suggest that the interaction effects between both equilibrating mechanisms are rather low, especially for winner funds, and that fund flows and manager turnover affect performance persistence independently. Therefore, we now go on to analyze the composition of both subgroups of winner and loser portfolios. The results are presented in table 10. This also serves as an investigation of the feasibility of the investment strategies discussed. One might expect that the occurrence of both mechanisms is positively correlated. Surprisingly, the composition of the subgroups reveals distinct differences indicating that both mechanisms seem to be almost perfectly independent from each other. Table 10 shows the fraction of fund-months in the subgroups of decile 10 and decile 1 with higher-than-median and lower-than-median net inflows and with and without manager turnover.[30] It is apparent that our results are not driven by one mechanism alone as the composition of the different subgroups is comparable with the composition of the whole sample. Specifically, decile 10 funds with manager turnover are almost equally distributed between the groups with high and low net inflows. Almost exactly half (49.36 percent) of the funds that experience a departure of their star manager simultaneously suffer from high inflows. Similarly, 20.01 percent of funds with high inflows have a change in management in the same period, virtually identical to the rate for decile 10 funds in aggregate (20.11 percent). The results for decile 1 funds reveal a certain degree of dependency. Of the loser funds with high outflows, 11.86 percent experience a change in management while only 10.14 percent of loser funds with low outflows have a change in management. Thus, it seems that the likelihood for a change in management is higher if it is accompanied by high outflows. Similarly, from the group with a change in management, 53.38 percent (11.86/22.00) have outflows in the same period whereas 49.85 of all decile 1 funds have outflows. Thus, even though fund flows and manager turnover seem to be related both appear to have an independent effect on performance. It appears that this is not a spurious effect which is driven by the other mechanism.

[Please insert **table 10** about here]

Our findings that fund flows and manager turnover are largely independent are consistent with previous empirical studies on a causal link between fund flows and manager replacements. Even though negative asset growth rates increase the likelihood of being replaced, returns-based performance measures seem to dominate the asset growth measure in explaining the likelihood of a manager replacement (Khorana 1996). In addition, Hu, Hall, and Harvey (2000) show that after accounting for the difference between promotions and demotions the impact of fund flows on

[30]Note that the fraction of funds-months with lower (higher) than median net inflows is not exactly 50 percent as outflows seem to be associated with a higher number of fund closures or mergers.

manager replacements turns out to be insignificant.

4.5 Performance Changes over Time

In this section we perform a pooled regression of the change in annualized Bayesian four-factor alphas between adjacent years on net inflows, manager turnover and a set of control variables documented in the literature to have an impact on performance.[31] The aim is twofold: First, by controlling for other determinants of mutual fund performance identified in the literature we can measure the marginal impact of fund flows and manager change; second, it allows us to analyze the performance impact of both equilibrating mechanisms over time for each fund separately in contrast to comparing different funds in the cross-section as in the ranked portfolio tests of the previous sections. Furthermore, this section serves as robustness check. Specifically, we include the following controls into our analysis: fund size, fund fees, fund age and the portfolio turnover ratio.[32] Because there is a strong tendency for fund performance to revert to the mean, we add two dummy variables to our regression that indicate whether the fund is in decile 1 or decile 10. These dummies capture the mean reversion and assure that the other coefficients are not biased. The variables of interest are current and past fund flows as well as the manager change dummy. Additionally, we use an interaction term between fund flows and the decile 1 and decile 10 dummies in order to analyze the differences between funds flows on performance for top and bottom funds. Similarly, we use a manager-change dummy indicating whether the fund manager has been replaced during the previous year and again an interaction term between manager turnover and the decile 10 and decile 1 dummy. A second model additionally analyzes the impact of being a small-cap fund or a sector fund on performance and the marginal impact of fund flows on these two investment-style categories. We anticipate that capacity constraints are more prevalent in narrow and illiquid markets and, as a result, fund flows have a stronger impact on performance in these investment categories. A third model captures the interaction effect between a change in management and the fund being a member of a large fund family. Gervais, Lynch and Musto (2005) argue that the replacement of a manager of a large fund family reveals more information than the replacement of a manager of a small fund family. We assign a fund to the large family group if the number of funds offered by its fund family at the end of the previous year is higher than the 70 percent quantile. Model 4 analyzes the interaction between the manager turnover and fund-flow mechanisms. Specifically, we include a dummy for winner funds that have higher-than-median net inflows and a change in manager and a dummy for loser funds that

[31]Following French (2008) we winsorize all variables at the 1 percent and 99 percent quantile to avoid any bias resulting from extreme outliers.

[32]Chen, Hong, Huang and Kubik (2004) and Cremers and Petajisto (2007) find a negative effect of fund size on performance, Carhart (1997) documents a negative effect from fees, Huij and Verbeek (2007) and Karoui and Meier (2008) report an outperformance of young funds. Results on turnover are ambiguous. Elton, Gruber, Das and Hvlaka (1993) and Carhart (1997) find a negative relation, Wermers (2000) documents that turnover is not associated with fund performance and Dahlquist, Engstroem and Soederlind (2000) as well as Chen, Jegadeesh and Wermers (2000) find a positive relationship.

have lower-than-median net inflows, i.e. outflows, and a change in manager.

As we measure the change in performance between consecutive years a significant coefficient on one of the control variables would indicate a trend in performance over time rather than differences in the level of performance. As expected, the coefficients indicate that small, young funds with low costs can improve their performance over time, compared with old, large funds with high expense ratios. The impact of size is even significant. Turnover has a significantly positive impact on the change in fund performance in our sample. Funds with exceptionally high turnover in the previous year can improve their performance compared to low-turnover funds. A possible explanation is that the fund flow measures in our regression capture the negative effect of liquidity-motivated trading and, thus, the turnover ratio only captures the effect of discretionary trades based on superior information and therefore is highly significantly positive (Edelen 1999, Alexander, Cici and Gibson 2007). The decile 1 and decile 10 dummies are both highly significant and indicate that loser funds improve their risk-adjusted returns between 3.02 and 3.10 percent in the following year. The alphas of decile 10 funds deteriorate by 3.11 to 3.39 percent in the year after they have been ranked in decile 10. Thus, part of the extremely good or bad performance in the formation year can be explained by luck which results in a strong tendency for mean reversion. Current net inflows are significantly positively related to fund performance.[33] Funds that invest in narrow markets, such as small-cap and sector funds, can improve their alphas by 0.59 to 0.62 percent more than large and mid-cap funds.

[Please insert **table 11** about here]

Consistent with the hypothesis of Berk and Green (2004) we document a significant negative relation between relative net inflows and a subsequent change in performance. An increase in relative net inflows by one standard deviation during the previous year decreases four-factor alphas by -3.42 percent the following year on average for all funds. Controlling for the market segment of the fund reveals that performance decreases by -2.53 to -2.55 percent in general and by an additional -2.80 percent if the fund is a small-cap or sector fund. If the fund belongs to the winner fund group during the previous year, it suffers even more from excessive inflows. Alphas decrease between -3.52 to -5.05 percent, following a one standard deviation increase in relative net inflows. This result is statistically and economically significant. For the average fund, a change in management improves performance by insignificant 0.30 percent in the following year. However, if a manager of a decile 10 fund is replaced, performance subsequently deteriorates by -0.86 to -1.16 percent based on models 1 to 3. In model 4 this effect is completely captured by the interaction effect between a change in management and higher-than-median relative net inflows. Winner funds that lost their manager while, at the same time, having above

[33]Note that reverse causality cannot be excluded as a possible explanation, i.e., investors might allocate heavily to current winner funds.

median net inflows suffer from an aggregate performance deterioration due to the manager replacement of -3.25 percent.

For loser funds, the improvement in alphas following a one standard deviation increase in relative outflows is 3.60 percent which is only slightly larger than the general performance improvement for average performing funds (model 1).[34] These coefficients reveal that the performance of loser funds seems to be less sensitive to a change in net inflows of the same magnitude than the performance of winner funds. Combined with the positive skewness of relative net inflows this might explain why the fund flow channel has weaker explanatory power for loser funds than for winner funds.[35] Bottom funds that replaced their manager can improve their alphas by 0.99 to 1.34 percent in the following year (models 1 to 3). For large fund families this performance improvement is even 0.78 to 0.82 percent higher, which is weakly significant. This supports the predictions of Gervais, Lynch and Musto (2005) that the manager replacement in a large family contains more information. Model 4 reveals a strong interaction between both governance mechanisms. If loser funds sacked their manager while, at the same time, having above median outflows they experience an aggregate performance improvement due to the manager replacement of 3.95 percent.

Thus, our results strongly confirm the Berk and Green (2004) hypothesis for fund flows as a predictor of performance changes over time for winner and loser funds. The independent effect of manager changes is weaker. However, we can identify strong interaction effects suggesting that a change in management has a tremendous effect on performance in combination with fund flows. This result implies that fund flows are not only an important equilibrating mechanism in itself but also are an important trigger for the impact of manager change on performance.

5 Implications and Conclusion

In this study, we have analyzed the impact of fund flows and manager turnover on mutual fund performance. Berk and Green (2004) have argued that fund flows in combination with decreasing returns to scale erode the superior performance of winner funds and make performance persistence difficult to achieve. Similarly, the same mechanism operating in the opposite direction in the context of outflows provides loser funds with the opportunity to recover performance. Following Khorana (2001), we have argued that manager turnover provides an additional mechanism for influencing fund performance. Outperforming managers might leave winner funds to increase their remuneration elsewhere. The previously outperforming funds they leave behind cannot subsequently generate the same positive performance and consequently performance persistence disappears. Similarly for losing funds, the replacement of an underperforming manager with a better one serves as an internal governance mechanism, and

[34] Note that the interaction between the market segment and fund flows captures this effect in models 2 and 3.
[35] Note than relative net inflows have a lower bound of -100 percent while some funds have inflows of above 300 percent.

performance should improve subsequently. However, the new manager's returns are still likely to be fairly mediocre because star fund managers are not attracted to funds in the bottom decile and again we expect to find little evidence of performance persistence among loser funds which replace their manager. Rather, for both winner and loser funds, we are likely to find some reverting to the mean

Our empirical results based on a set of 3,948 U.S. equity mutual funds support these conjectures. Winner funds suffer from excessive inflows and the loss of their star manager. Specifically, conditioning on fund flows leads to a significant annualized spread in four-factor alphas of 1.44 to 1.80 percent between winner funds with high and low inflows. Similarly, conditioning on manager changes among winner funds generates significant annualized spreads between 1.32 to 2.04 percent. Combining the information on both equilibrating mechanisms results in a significant annualized spread in alphas of 2.64 to 3.12 percent between winner funds with lower-than-median inflows and no change in management and winner funds with higher-than-median inflows and a change in management. For loser funds we document a significant impact of manager replacements but not for fund flows. If the manager of a loser fund is replaced, the performance improves significantly by annualized 0.96 to 1.68 percent the following year compared to loser funds that keep their manager. The annualized performance improvement for loser funds that benefit from outflows is only 0.72 to 1.44 percent compared to loser funds without outflows. However, combining both mechanisms yields a significant annualized spread in alphas of 3.36 percent between loser funds with higher-than-median outflows and a change in management and loser funds with lower-than-median outflows and no manager replacement. The results for winner and loser funds are confirmed in the pooled regression framework. They are robust with respect to the impact of fees on performance and using alternative formation methods such as quintile instead of decile portfolios.

Thus, we have identified two mechanisms that contribute strongly to the mean reversion in mutual fund performance. Nevertheless, the results also indicate that most of the superior performance is extracted in the form of fees: pre-fee annualized alphas are statistically significant at 3.12 to 4.44 percent based on a long-only investment strategy conditional on both equilibrating mechanisms, while post-fee alphas are (largely) insignificant at 1.68 to 3.00 percent. Thus, long-only strategies are unlikely to be profitable for retail investors, while long-short strategies are not feasible for them. Furthermore, these results suggest that investment skills indeed exist but are eliminated to a large degree by a combination of both equilibrating mechanisms in the long run. The proceeds of these skills are retained to a large degree by investment management companies and portfolio managers in the form of fees.

With respect to loser funds we document that, based on the single sorting, manager replacements are more important than fund flows in explaining mean reversion but, at the same time, that strong interaction effects between both mechanisms exist. Thus, we cannot conclude that fund flows are not important as governance mechanism. Specifically, the risk of facing large

outflows might be an incentive for the investment management company to fire underperforming managers. The observed persistence of poorly performing funds in previous studies might be explained by the fact that both governance mechanisms only operate in 11.86 percent of all loser funds (table 10). Thus, we cannot expect a large performance improvement for the majority of the loser funds.

What are potential implications of our research findings? First of all, investors should pay close attention to fund flows and resulting changes in fund size as well as to the career paths of individual fund managers amongst different funds: "Past performance is only an indicator of future performance if the manager is not replaced and fund flows do not eliminate persistence." In this case, performance persistence is indeed difficult to achieve for the investor. Consequently, it seems important to require the disclosure of fund flows and manager changes to existing fund investors and in the prospectus. Furthermore, fund management companies need to retain skilled managers. A stronger alignment of performance with remuneration might be necessary. Some studies have questioned the usefulness of the restriction permitting only fulcrum fees in the U.S. which prevents the use of other types of performance fee contracts (Das and Sundaram 2002). Hedge fund industry practice, which typically combines asymmetric performance fees with personal stakes by the fund manager, might provide valuable lessons for the mutual fund industry as well. Especially after a fund has been soft-closed by the investment management company after a period of excessive inflows it might be appropriate to allow the fund to switch from size-based fees to performance fees. However, the principal message from our findings is that star fund managers will extract their rent of ability one way or another and that the nature of the inflows in the mutual fund industry is basically uncontrolled. On the loser side, it seems important to improve the independence of the fund board to make sure that bad managers are fired. This is especially important in light of the fact that the fund flows mechanisms is less effective at loser funds and that usually investors do not have the incentive to be the first to withdraw money at a loss. Finally, our results provide an explanation for the trend to separate alpha and beta sources.[36] Mutual funds are supposed to deliver both, a diversified exposure to market risk and at the same time a positive alpha. The regulatory and operational environments as well as the resulting incentives prevent them from being able to deliver both successfully at the same time. One logical consequence is to look for funds that are more flexible to generate diversified market exposure through low-cost products such as index funds and exchange traded funds.

[36]According to McKinsey's Institutional Investor U.S. Institute Asset Management Benchmarking Survey, the growth in assets under management in *higher alpha strategies* and in *cheap beta* strategies was significantly higher in 2004/2005 than that in *traditional actice/core* strategies.

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Appendix: Data Selection

In constructing our sample, we follow Pastor and Stambaugh (2002) as closely as possible. We select only domestic equity funds and exclude all funds not investing primarily in equities such as money market or bond funds. In addition, we exclude international funds, global funds, balanced funds, flexible funds, and funds of funds. As CRSP does not provide an indicator whether a fund is an active or passive fund, we further drop all funds containing terms in their name that commonly refer to passive vehicles. We require our funds to have at least 12 months of return data available to be included in our sample. Additionally, we drop all observations prior to the IPO date given by CRSP and funds without names in order to account for a potential incubation bias (Evans 2007). This selection results in 3,948 funds that existed at some time during our sample period from 1992 to 2007. These funds belong to 672 different fund families. Different share classes of the same fund have the same manager and that fund flows that occur between two different classes of the same fund might cancel out at the portfolio level. Hence, we combine all share classes that belong to the same fund and have the same underlying portfolio to one observation. We use a matching algorithm that combines information from the fund's name and the portfolio number variable (`crsp_portno`) given by CRSP. [37] Fund characteristics such as the investment objective or the first offer date are taken from the oldest share class, whereas quantitative information is either summed up, such as total net assets, or we take the weighted average over all share classes, such as returns and fees. If two share classes of the same funds have different manager change dates, we use the most recent date. We classify the funds in our sample into three groups: (1) Large and mid-cap funds (LMC), (2) small-cap funds (SC) and (3) sector funds (SEC). However, as we use the 2008 cut off of the CRSP mutual fund database, Lipper is the primary data source. As a consequence, ICDI classification codes, which have been used by Pastor and Stambaugh (2002) are no longer available and have been replaced by Lipper codes. Thus, we modify the selection criteria of Pastor and Stambaugh (2002) as follows. For our classification we use Lipper codes, Wiesenberger codes and Strategic Insight codes (priority is given in that order if different codes assign funds to different investment categories). Details are given in table 12. A fund is assigned to one of the three groups for the total sample period if it belonged to this group for at least 50 percent of the observations in our sample period. For example, if a fund has 72 months of data and belongs to the small-cap group for 12 months, but eventually changes to the large and mid-cap group for the remaining 60 months, it is assigned to the large and mid-cap group for the total of 72 months.

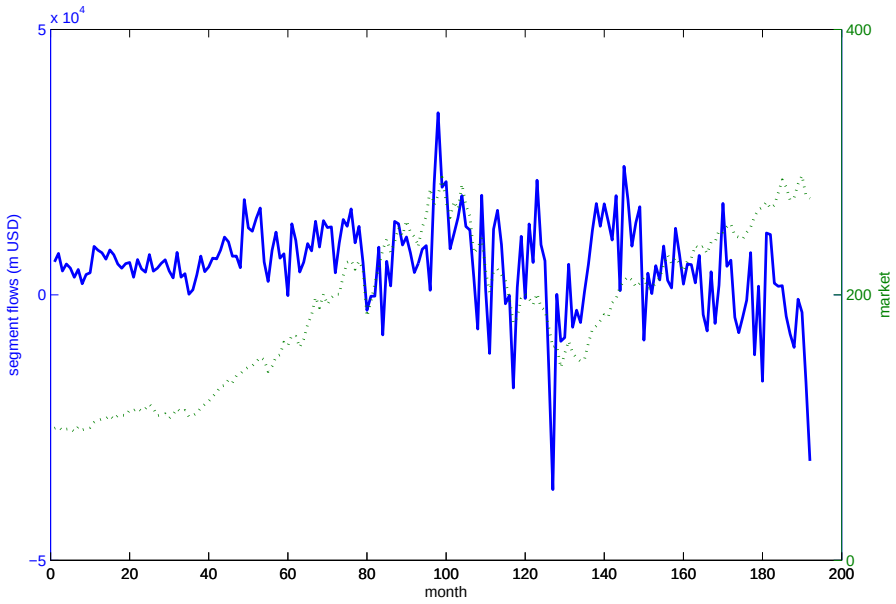
[Please insert **table 12** about here]

[37] A matching solely based on the portfolio number variable is not possible as this variable is available only from December 1998 onwards. Furthermore, some cases exist where the portfolio number variable is missing for some share classes of the same fund which would result in an incomplete matching.

Figure 1: Fund flows and number of manager changes

This figures presents in panel (a) the absolute fund flows in each month of the sample period as well as the rebased market index (dotted line). Panel (b) shows the number of manager changes in each month of the sample period as well as the rebased market index (dotted line).

(a) Fund Flows



(b) Number of manager changes

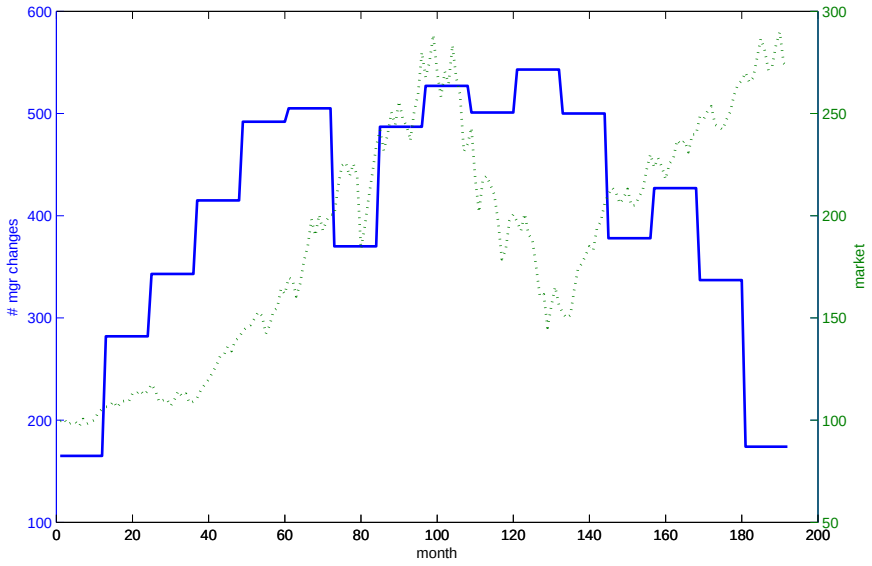


Figure 2: Portfolio alphas for decile portfolios

This figures presents the average monthly alphas of the decile portfolios based on the portfolio approach for the relative to the evaluation year (t). Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas.

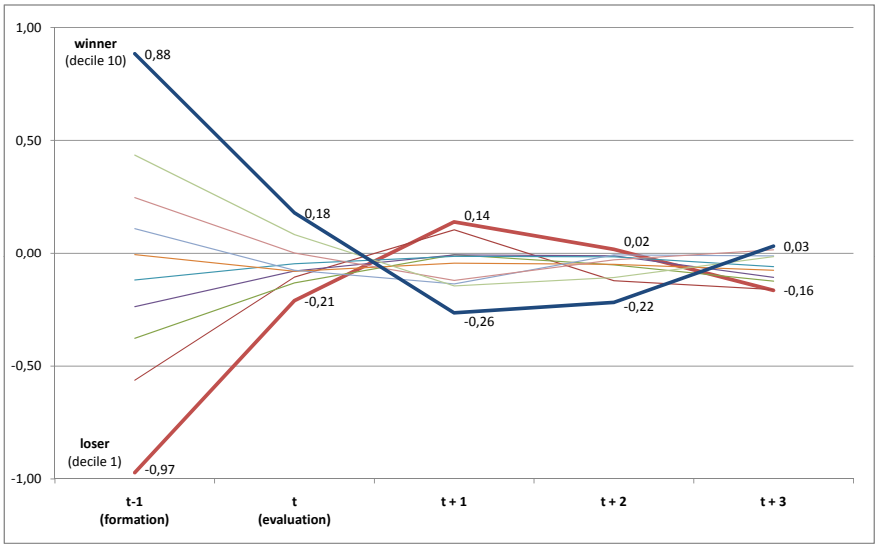


Figure 3: Average alphas for winner funds and winner fund subgroups

This figures presents the average of the alphas from the concatenated approach, the portfolio approach and the panel approach. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas. [3], [2] and [1] indicate if three, two or one of the individual alphas are statistically different from zero, respectively.

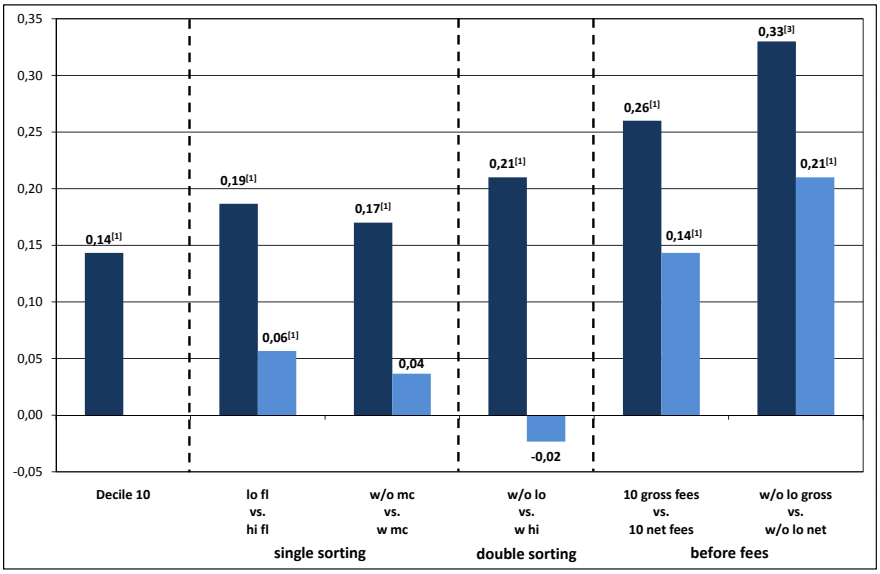


Figure 4: Average alphas for loser funds and loser fund subgroups

This figures presents the average of the alphas from the concatenated approach, the portfolio approach and the panel approach. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas. [3], [2] and [1] indicate if three, two or one of the individual alphas are statistically different from zero, respectively.

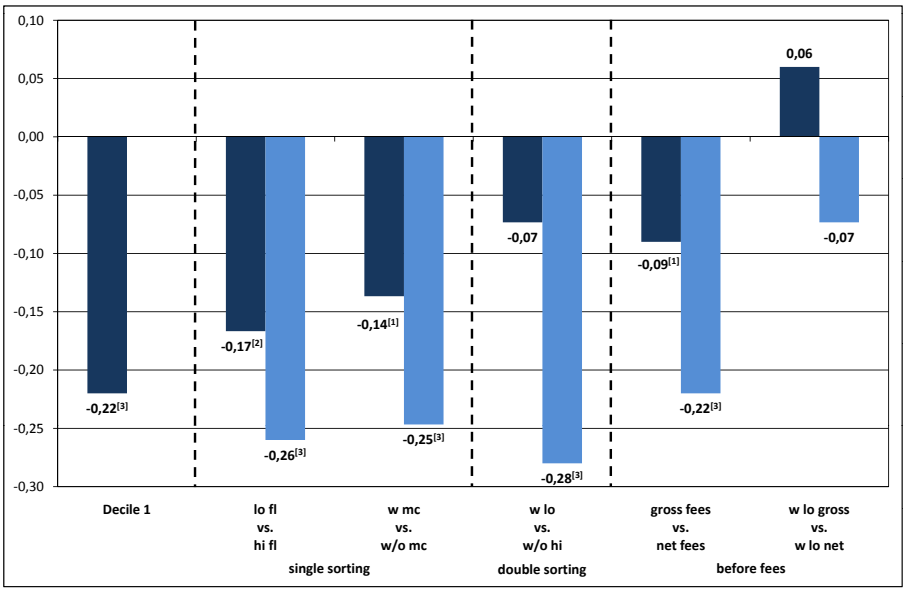


Table 1: Descriptive statistics for funds in sample

This table presents descriptive statistics on all 3,948 funds in the sample from 1992 to 2007. We restrict our sample to funds that have at least 12 months of available return data and information on the variable `mgr_date` in the CRSP database. The first row reports the number of months in the respective period. The second row reports monthly (arithmetic) mean raw returns in excess of the rate on the risk-free asset in percent. The third row reports average fees (in percent). The fourth row reports the mean fund size in millions USD. The fifth row reports monthly mean absolute fund flows in millions USD. The sixth row reports the number of funds in existence. The seventh row reports the number of manager changes that occurred during this period.

	1992–1995	1996–1999	2000–2003	2004–2007	Whole period
# months	48	48	48	48	192
returns	0.72	1.36	-0.29	0.62	0.51
fees	1.68	1.64	1.67	1.56	1.63
size	461.40	853.06	849.32	1178.74	899.28
flows	5.00	4.57	2.39	0.66	2.70
# funds	1,623	2,545	3,219	3,064	3,948
# man ch	1,205	1,854	2,071	1,316	6,446

Table 2: Descriptive statistics for decile portfolios

This table presents descriptive statistics for the decile portfolios 1 (loser) to 10 (winner) and a spread portfolio long in decile 10 funds and short in decile 1 funds. The first two columns report the mean and median of fund size in millions USD, respectively; column three reports the average fees in percent; columns four and five report the mean and median of absolute fund flows in millions USD, respectively; columns six and seven report the mean and median of relative fund flows in percent, respectively; and column eight reports the number of manager changes per fund. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. For differences in means, we apply a two-sample t-test, and, for differences in medians, we apply a Mann-Whitney-U-Test. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas.

	size		fees	absolute flows		relative flows		mc/fund
	mean	median	mean	mean	median	mean	median	
10 (winner)	1,059.17	180.00	1.67	14.45	0.50	0.55	0.01	0.21
9	1,115.10	184.00	1.59	8.48	0.12	0.03	0.00	0.21
8	1,333.25	193.47	1.55	6.35	0.06	0.02	0.00	0.18
7	1,179.21	181.60	1.55	4.62	−0.00	0.07	−0.00	0.19
6	1,176.30	170.40	1.54	1.85	−0.03	0.01	−0.00	0.18
5	962.69	170.50	1.60	1.32	−0.05	0.05	−0.00	0.21
4	1,027.58	162.85	1.63	−1.08	−0.13	0.01	−0.00	0.21
3	1,044.91	155.07	1.62	−4.26	−0.26	0.01	−0.00	0.21
2	839.51	144.45	1.70	−3.80	−0.35	0.04	−0.01	0.21
1 (loser)	673.54	100.10	1.88	−4.10	−0.52	0.01	−0.01	0.22
10 − 1	385.64***	79.90***	−0.21***	18.55***	1.02***	0.54	0.02***	–

Table 3: Returns and four-factor alphas of decile portfolios

This table presents the performance for the decile portfolios 10 (winner) to 1 (loser) and a spread portfolio long in decile 10 funds and short in decile 1 funds based on raw returns and a Carhart (1997) four-factor model. Panel (a) presents results for a sorting based on Bayesian four-factor alphas and panel (b) presents results for a sorting based on raw returns. The first column reports the performance based on the measure used for the formation of the decile portfolios, i. e. Bayesian four-factor alphas for panel (a) and raw returns for panel (b). The second and third columns report the average raw returns and the OLS alpha of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*concatenated* approach); column four reports the time series mean of the decile portfolio's Bayesian alphas computed as the cross-sectional mean of the individual alphas of all funds belonging to the respective decile in each time period (*portfolio* approach); column five reports the mean of the panel of the monthly Bayesian alphas of all funds belonging to the respective decile portfolio (*panel* approach). ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

(a) Sorting based on Bayesian four-factor alphas

	formation period	evaluation period			
	α Bayes	raw return	α *OLS*	α Bayes	
	portfolio	portfolio	concatenated	portfolio	panel
10 (winner)	0.88^{***}	0.77	0.07	0.18	0.18^{***}
9	0.43^{***}	0.94	0.24	0.08	0.08^{**}
8	0.25^{***}	0.59	−0.05	0.00	−0.00
7	0.11	0.52	-0.11^{*}	−0.08	-0.08^{***}
6	−0.01	0.53	-0.10^{**}	-0.08^{*}	-0.08^{***}
5	-0.12^{*}	0.57	-0.09^{*}	−0.05	−0.05
4	-0.24^{***}	0.53	-0.11^{*}	−0.08	-0.08^{***}
3	-0.38^{***}	0.49	-0.14^{**}	-0.13^{**}	-0.14^{***}
2	-0.56^{***}	0.52	-0.16^{*}	−0.11	-0.11^{***}
1 (loser)	-0.97^{***}	0.45	-0.24^{**}	-0.21^{**}	-0.21^{***}
10 − 1	–	0.32	0.31^{*}	0.39	0.39^{***}

(b) Sorting based on returns

	formation period	evaluation period			
	raw return	raw return	α *OLS*	α Bayes	
	portfolio	portfolio	concatenated	portfolio	panel
10 (winner)	2.36	0.83	−0.11	0.23	0.25^{***}
9	1.42	1.02	0.16	0.17	0.18^{***}
8	1.08	0.71	−0.05	0.11	0.12^{***}
7	0.84	0.65	-0.08^{**}	0.05	0.06^{*}
6	0.64	0.56	-0.09^{**}	−0.04	-0.05^{***}
5	0.45	0.50	-0.10^{**}	-0.10^{*}	-0.12^{***}
4	0.27	0.46	-0.14^{*}	-0.17^{**}	-0.18^{***}
3	0.04	0.47	−0.08	−0.15	-0.16^{***}
2	−0.25	0.42	−0.08	−0.21	-0.25^{***}
1 (loser)	−0.99	0.28	−0.08	−0.34	-0.37^{***}
10 − 1	–	0.55	−0.02	0.56	0.62^{***}

Table 4: Four-factor Bayesian alphas of winner fund subgroups based on single sorting on fund flows or management turnover

This table presents Carhart (1997) four-factor alphas for the following portfolios and the resulting spread portfolios: winner funds (10), winner funds with lower-than-median fund flows (10 low) and with higher-than-median fund flows (10 high), and winner funds without manager change (10 without) and with manager change (10 with). The first column reports the OLS estimate of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*concatenated* approach); column two reports the time series mean of the decile portfolio's Bayesian alphas computed as the cross-sectional mean of the individual alphas of all funds belonging to the respective decile in each time period (*portfolio* approach); column three reports the mean of the panel of the monthly Bayesian alphas of all funds belonging to the respective decile portfolio (*panel* approach). ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas. Column four reports the average of the three individual performance measures and $^{[3]}$, $^{[2]}$ and $^{[1]}$ indicate if three, two or one of the individual alphas are statistically different from zero, respectively.

	α *OLS*	α Bayes		average
	concatenated	portfolio	panel	
winner funds (unconditional)				
10	0.07	0.18	0.18^{***}	$0.14^{[1]}$
conditional on relative net inflows				
10 low	0.13	0.22	0.21^{***}	$0.19^{[1]}$
10 high	−0.03	0.10	0.10^{**}	$0.06^{[1]}$
10 low − 10 high	0.15^{***}	0.12	0.12^{**}	$0.13^{[2]}$
conditional on manager change				
10 without	0.10	0.20	0.21^{***}	$0.17^{[1]}$
10 with	−0.02	0.09	0.04	$0.04^{[1]}$
10 without − 10 with	0.12^{**}	0.11^{**}	0.17^{**}	$0.13^{[3]}$

Table 5: Four-factor Bayesian alphas of winner fund subgroups based on double sorting on fund flows and management turnover

This table presents Carhart (1997) four-factor alphas for the following portfolios and the resulting spread portfolios: winner funds (10), winner funds with lower-than-median fund flows and no change in management (10 without/low), winner funds with lower-than-median fund flows and a change in management (10 with/low), winner funds with higher-than-median fund flows and no change in management (10 without/high), and winner funds with higher-than-median fund flows and a change in management (10 with/high). The first column reports the OLS estimate of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*concatenated* approach); column two reports the time series mean of the decile portfolio's Bayesian alphas computed as the cross-sectional mean of the individual alphas of all funds belonging to the respective decile in each time period (*portfolio* approach); column three reports the mean of the panel of the monthly Bayesian alphas of all funds belonging to the respective decile portfolio (*panel* approach). ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas. Column four reports the average of the three individual performance measures and $^{[3]}$, $^{[2]}$ and $^{[1]}$ indicate if three, two or one of the individual alphas are statistically different from zero, respectively.

	α *OLS*	α Bayes		average
	concatenated	portfolio	panel	
winner funds (unconditional)				
10	0.07	0.18	0.18^{***}	$0.14^{[1]}$
conditional on relative net inflows and manager change simultaneously				
10 without/low	0.14	0.24	0.25^{***}	$0.21^{[1]}$
10 with/low	0.08	0.15	0.06	0.10
10 without/high	0.01	0.12	0.12^{***}	$0.08^{[1]}$
10 with/high	−0.12	0.03	0.02	−0.02
conditional on relative net inflows and manager change simultaneously (spread portfolios)				
10 without/low − 10 with/high	0.26^{***}	0.22^{**}	0.23^{**}	$0.24^{[3]}$
10 without/low − 10 without/high	0.14^{**}	0.12	0.13^{**}	$0.13^{[2]}$
10 without/low − 10 with/low	0.06	0.09	0.19^{*}	$0.11^{[1]}$
10 without/high − 10 with/low	−0.07	−0.03	0.05	−0.02
10 without/high − 10 with/high	0.13^{*}	0.09	0.10	$0.11^{[1]}$
10 with/low − 10 with/high	0.20^{**}	0.13	0.05	$0.13^{[1]}$

Table 6: Before-fee four-factor Bayesian alphas of winner fund subgroups based on single sorting on fund flows or management turnover

This table presents Carhart (1997) four-factor alphas before fees for the following portfolios and the resulting spread portfolios. Panel (a): winner funds (10), winner funds with lower-than-median fund flows (10 low) and with higher-than-median fund flows (10 high), and winner funds without manager change (10 without) and with manager change (10 with). Panel (b): winner funds with lower-than-median fund flows and no change in management (10 without/low), winner funds with lower-than-median fund flows and a change in management (10 with/low), winner funds with higher-than-median fund flows and no change in management (10 without/high), and winner funds with higher-than-median fund flows and a change in management (10 with/high). The first column reports the OLS estimate of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*concatenated* approach); column two reports the time series mean of the decile portfolio's Bayesian alphas computed as the cross-sectional mean of the individual alphas of all funds belonging to the respective decile in each time period (*portfolio* approach); column three reports the mean of the panel of the monthly Bayesian alphas of all funds belonging to the respective decile portfolio (*panel* approach). ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas. Column four reports the average of the three individual performance measures and $^{[3]}$, $^{[2]}$ and $^{[1]}$ indicate if three, two or one of the individual alphas are statistically different from zero, respectively.

(a) Single sorting on fund flows or managerial turnover

	α *OLS*	α Bayes		average
	concatenated	portfolio	panel	
winner funds (unconditional)				
10	0.19	0.29	0.30^{***}	$0.26^{[1]}$
conditional on relative net inflows				
10 low	0.24^{**}	0.34^{**}	0.34^{***}	$0.31^{[3]}$
10 high	0.09	0.21	0.21^{***}	$0.17^{[1]}$
10 low − 10 high	0.16^{***}	0.13^{*}	0.13^{**}	$0.14^{[3]}$
conditional on manager change				
10 without	0.21^{*}	0.32^{*}	0.33^{***}	$0.29^{[3]}$
10 with	0.10	0.23	0.18^{***}	$0.17^{[1]}$
10 without − 10 with	0.11^{**}	0.09^{*}	0.15^{**}	$0.12^{[3]}$

(b) Double sorting on fund flows and managerial turnover

	α *OLS*	α Bayes		average
	concatenated	portfolio	panel	
conditional on relative net inflows and manager change simultaneously				
10 without/low	0.26^{***}	0.36^{**}	0.37^{***}	$0.33^{[3]}$
10 with/low	0.21	0.29	0.21^{**}	$0.24^{[1]}$
10 without/high	0.12	0.23	0.23^{***}	$0.19^{[1]}$
10 with/high	−0.00	0.16	0.14	0.10
conditional on relative net inflows and manager change simultaneously (spread portfolios)				
10 without/low − 10 with/high	0.26^{***}	0.20^{**}	0.23^{**}	$0.23^{[3]}$
10 without/low − 10 without/high	0.14^{**}	0.13	0.14^{**}	$0.14^{[2]}$
10 without/low − 10 with/low	0.04	0.07	0.16^{*}	$0.09^{[1]}$
10 without/high − 10 with/low	−0.09	−0.06	0.02	−0.04
10 without/high − 10 with/high	0.12^{*}	0.07	0.09	$0.09^{[1]}$
10 with/low − 10 with/high	0.22^{**}	0.13	0.07	$0.14^{[1]}$

Table 7: Four-factor Bayesian alphas of loser fund subgroups based on single sorting on fund flows or management turnover

This table presents Carhart (1997) four-factor alphas for the following portfolios and the resulting spread portfolios: loser funds (1), loser funds with lower-than-median fund flows (1 low) and with higher-than-median fund flows (1 high), and loser funds with manager change (1 with) and without manager change (1 without). The first column reports the OLS estimate of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*concatenated* approach); column two reports the time series mean of the decile portfolio's Bayesian alphas computed as the cross-sectional mean of the individual alphas of all funds belonging to the respective decile in each time period (*portfolio* approach); column three reports the mean of the panel of the monthly Bayesian alphas of all funds belonging to the respective decile portfolio (*panel* approach). ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas. Column four reports the average of the three individual performance measures and $^{[3]}$, $^{[2]}$ and $^{[1]}$ indicate if three, two or one of the individual alphas are statistically different from zero, respectively.

	α *OLS*	α Bayes		average
	concatenated	portfolio	panel	
loser funds (unconditional)				
1	-0.24^{**}	-0.21^{**}	-0.21^{***}	$-0.22^{[3]}$
conditional on relative net inflows				
1 low	-0.21^{**}	-0.15	-0.14^{***}	$-0.17^{[2]}$
1 high	-0.27^{**}	-0.25^{**}	-0.26^{***}	$-0.26^{[3]}$
1 low − 1 high	0.06	0.09	0.12^{***}	$0.09^{[1]}$
conditional on manager change				
1 with	-0.19	-0.12	-0.10^{**}	$-0.14^{[1]}$
1 without	-0.26^{**}	-0.24^{**}	-0.24^{***}	$-0.25^{[3]}$
1 with − 1 without	0.08^{*}	0.11^{***}	0.14^{***}	$0.11^{[3]}$

Table 8: Four-factor Bayesian alphas of loser fund subgroups based on double sorting on fund flows and management turnover

This table presents Carhart (1997) four-factor alphas for the following portfolios and the resulting spread portfolios: loser funds (1), loser funds with lower-than-median fund flows and a change in management (1 with/low), loser funds with lower-than-median fund flows and no change in management (1 without/low), loser funds with higher-than-median fund flows and a change in management (1 with/high), and loser funds with higher-than-median fund flows and no change in management (1 without/high). The first column reports the OLS estimate of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*concatenated* approach); column two reports the time series mean of the decile portfolio's Bayesian alphas computed as the cross-sectional mean of the individual alphas of all funds belonging to the respective decile in each time period (*portfolio* approach); column three reports the mean of the panel of the monthly Bayesian alphas of all funds belonging to the respective decile portfolio (*panel* approach). ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas. Column four reports the average of the three individual performance measures and $^{[3]}$, $^{[2]}$ and $^{[1]}$ indicate if three, two or one of the individual alphas are statistically different from zero, respectively.

	α *OLS*	α Bayes		average
	concatenated	portfolio	panel	
loser funds (unconditional)				
1	-0.24^{**}	-0.21^{**}	-0.21^{***}	$-0.22^{[3]}$
conditional on relative net inflows and manager change simultaneously				
1 with/low	-0.11	-0.07	-0.04	-0.07
1 without/low	-0.24^{**}	-0.18^{*}	-0.17^{***}	$-0.20^{[3]}$
1 with/high	-0.24^{*}	-0.16	-0.16^{***}	$-0.19^{[2]}$
1 without/high	-0.28^{**}	-0.28^{***}	-0.28^{***}	$-0.28^{[3]}$
conditional on relative net inflows and manager change simultaneously (spread portfolios)				
1 without/high − 1 with/low	-0.17^{**}	-0.21^{***}	-0.24^{***}	$-0.21^{[3]}$
1 without/high − 1 without/low	-0.04	-0.10	-0.12^{**}	$-0.09^{[1]}$
1 without/high − 1 with/high	-0.04	-0.12^{**}	-0.12^{*}	$-0.09^{[2]}$
1 without/low − 1 with/high	0.00	-0.02	-0.01	-0.01
1 without/low − 1 with/low	-0.13^{**}	-0.10	-0.13^{*}	$-0.12^{[2]}$
1 with/high − 1 with/low	-0.13	-0.09	-0.12	-0.11

Table 9: Before-fee four-factor Bayesian alphas of loser fund subgroups based on single sorting on fund flows or management turnover

This table presents Carhart (1997) four-factor alphas before fees for the following portfolios and the resulting spread portfolios. Panel (a): loser funds (1), loser funds with lower-than-median fund flows (1 low) and with higher-than-median fund flows (1 high), and loser funds with manager change (1 with) and without manager change (1 without). Panel (b): loser funds with lower-than-median fund flows and a change in management (1 with/low), loser funds with lower-than-median fund flows and no change in management (1 without/low), loser funds with higher-than-median fund flows and a change in management (1 with/high), and loser funds with higher-than-median fund flows and no change in management (1 without/high). The first column reports the OLS estimate of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*concatenated* approach); column two reports the time series mean of the decile portfolio's Bayesian alphas computed as the cross-sectional mean of the individual alphas of all funds belonging to the respective decile in each time period (*portfolio* approach); column three reports the mean of the panel of the monthly Bayesian alphas of all funds belonging to the respective decile portfolio (*panel* approach). ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas. Column four reports the average of the three individual performance measures and $^{[3]}$, $^{[2]}$ and $^{[1]}$ indicate if three, two or one of the individual alphas are statistically different from zero, respectively.

(a) Single sorting on fund flows or managerial turnover

	α *OLS*	α Bayes		average
	concatenated	portfolio	panel	
loser funds (unconditional)				
1	−0.11	−0.08	−0.08***	−0.09$^{[1]}$
conditional on relative net inflows				
1 low	−0.09	−0.03	−0.01	−0.04
1 high	−0.13	−0.12	−0.13***	−0.13$^{[1]}$
1 low − 1 high	0.04	0.09	0.12***	0.08$^{[1]}$
conditional on manager change				
1 with	−0.06	0.00	0.02	−0.01
1 without	−0.13	−0.11	−0.11***	−0.12$^{[1]}$
1 with − 1 without	0.08*	0.11***	0.14***	0.11$^{[3]}$

(b) Double sorting on fund flows and managerial turnover

	α *OLS*	α Bayes		average
	concatenated	portfolio	panel	
conditional on relative net inflows and manager change simultaneously				
1 with/low	0.03	0.06	0.09	0.06
1 without/low	−0.13	−0.06	−0.05	−0.08
1 with/high	−0.13	−0.05	−0.05	−0.08
1 without/high	−0.13	−0.14	−0.15***	−0.14$^{[1]}$
conditional on relative net inflows and manager change simultaneously (spread portfolios)				
1 without/high − 1 with/low	−0.17**	−0.20***	−0.24***	−0.20$^{[3]}$
1 without/high − 1 without/low	−0.01	−0.08	−0.10**	−0.06$^{[1]}$
1 without/high − 1 with/high	−0.00	−0.09*	−0.10	−0.06$^{[1]}$
1 without/low − 1 with/high	0.01	−0.01	−0.00	−0.01
1 without/low − 1 with/low	−0.16**	−0.12*	−0.14**	−0.14$^{[3]}$
1 with/high − 1 with/low	−0.16**	−0.11	−0.14	−0.14$^{[1]}$

Table 10: Composition of fund flow and manager change subgroups

This table presents in panel (a) the share of decile 10 funds and in panel (b) the share of decile 1 funds in the low fund flow (low) and high fund flow (high) subgroup and in the manager change (with) and no manager change (without) subgroup, respectively, based on the total number of fund months on our sample. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas.

Share of funds in subgroups

	(a) decile 10 funds				(b) decile 1 funds		
	10 with	10 without	sum		1 with	1 without	sum
10 low	10.07	39.79	49.86	1 low	11.86	37.99	49.85
10 high	10.03	40.10	50.14	1 high	10.14	40.01	50.15
sum	20.11	79.89	100.00	sum	22.00	78.00	100.00

Table 11: Pooled regressions for change in fund performance

This table presents the results of a pooled panel regression for the change in annualized Bayesian four-factor alphas between the previous and current year. The explanatory variables of model 1 are fund size in billions USD, fees in percent, fund age in years and portfolio turnover in percent of total net assets at the end of the previous year, a dummy indicating whether the fund belonged to decile 1 during the previous year, a dummy indicating whether the fund belonged to decile 10 during the previous year, relative fund flows for the current year and the previous year, an interaction term between fund flows and the decile 10 dummy, an interaction term between fund flows and the decile 1 dummy, a dummy indicating whether the manager changed during the previous year, an interaction term between a change in management and the decile 10 dummy, and an interaction term between a change in management and the decile 1 dummy. Model 2 additionally contains a dummy indicating whether the fund is a small-cap or sector fund and an interaction term between fund flows and the investment style dummy. Model 3 additionally contains an interaction term between the manager change dummy and a dummy indicating whether the fund belongs to a large fund family. Model 4 additionally contains a dummy indicating whether the fund belonged to decile 10, had higher-than-median flows and a change in management at the same time during the previous year and a dummy indicating whether the fund belonged to decile 1, had lower-than-median flows and a change in management at the same time during the previous year The last two rows present the number of observations and the adjusted R^2. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas.

Annualized Bayesian four factor alphas (in percent)

	Model 1		Model 2		Model 3		Model 4	
	coeff.	p-val	coeff.	p-val	coeff.	p-val	coeff.	p-val
abs	0.38	0.25	0.11	0.75	0.13	0.71	0.16	0.64
TNA (bn USD)	-0.12^{**}	0.03	-0.11^{**}	0.05	-0.12^{**}	0.03	-0.11^{**}	0.04
fees (%)	−0.07	0.66	−0.06	0.73	−0.06	0.71	−0.08	0.66
age (·100)	-1.80^{*}	0.05	−1.46	0.11	−1.45	0.12	-1.56^{*}	0.09
turnover	0.34^{***}	0.00	0.37^{***}	0.00	0.37^{***}	0.00	0.37^{***}	0.00
dec1_{t-1}	3.10^{***}	0.00	3.03^{***}	0.00	3.03^{***}	0.00	3.02^{***}	0.00
dec10_{t-1}	-3.11^{***}	0.00	-3.29^{***}	0.00	-3.28^{***}	0.00	-3.39^{***}	0.00
flows_t	0.54^{***}	0.00	0.48^{***}	0.00	0.47^{***}	0.00	0.48^{***}	0.00
flows_{t-1}	-2.39^{***}	0.00	-1.77^{***}	0.00	-1.77^{***}	0.00	-1.78^{***}	0.00
$\text{flows}_{t-1}\cdot \text{dec10}_{t-1}$	-1.14^{***}	0.00	-0.83^{***}	0.00	-0.83^{***}	0.00	-0.68^{**}	0.01
$\text{flows}_{t-1}\cdot \text{dec1}_{t-1}$	−0.13	0.76	0.64	0.13	0.65	0.13	0.90^{**}	0.04
mgr_ch_{t-1}	0.30	0.32	0.30	0.32	−0.02	0.94	0.00	1.00
$\text{mgr\_ch}_{t-1}\cdot \text{dec10}_{t-1}$	−1.32	0.13	−1.16	0.19	−1.14	0.19	0.85	0.46
$\text{mgr\_ch}_{t-1}\cdot \text{dec1}_{t-1}$	1.04	0.27	0.99	0.29	1.01	0.28	-2.63^{**}	0.04
style	–	–	0.62^{**}	0.02	0.60^{**}	0.02	0.59^{**}	0.02
$\text{flows}_{t-1}\cdot$ SC/SEC	–	–	-1.96^{***}	0.00	-1.96^{***}	0.00	-1.96^{***}	0.00
$\text{mgr\_ch}_{t-1}\cdot$ lfam	–	–	–	–	0.84^{*}	0.09	0.78	0.11
$\text{mgr\_ch}_{t-1}\cdot$ hi $\text{fl}_{t-1}\cdot \text{dec10}_{t-1}$	–	–	–	–	–	–	-4.10^{***}	0.01
$\text{mgr\_ch}_{t-1}\cdot$ lo $\text{fl}_{t-1}\cdot \text{dec1}_{t-1}$	–	–	–	–	–	–	6.58^{***}	0.00
# observations	21,318	–	21,318	–	21,318	–	21,318	–
R^2	0.04	–	0.05	–	0.05	–	0.05	–

Table 12: Classification of investment objectives

This table presents the classification codes we have used to construct our sample. We use Lipper codes, Wiesenberger codes and Strategic Insight codes (priority is given in this order if different codes assign funds to different investment categories) in order to classify our funds into the following three groups: (1) Large- and mid-cap funds (LMC), (2) small-cap funds (SC) and (3) sector funds (SEC).

	Large- and mid-cap (LMC)	Small-cap (SC)	Sector (SEC)
Lipper	CA, EI, EIEI, G, GI, I, LCCE, LCGE, LCVE, MC, MCCE, MCGE, MCVE, MLCE, MLGE, MLVE	SCCE	FS, H, NR, S, SESE, TK, TL, UT
Wiesenberger	AGG, G, G-I, G-I-S, G-S, G-S-I, GCI, GRI, GRO, I-G, I-G-S, I-S, I-S-G, IEQ, ING, LTG, MCG, S-G, S-G-I, S-I-G, S-I, I*	SCG	ENR, FIN, HLT, TCH, UTL
Strategic Insight	AGG, GMC, GRI, GRO, ING	SCG	ENV, FIN, HLT, NTR, SEC, TEC, UTI

* Note that the Wiesenberger code I for income funds is not restricted to income equity funds but also contains income money market funds, income bond funds etc. Consequently we use a combination of Wiesenberger code I and policy code CS or I-S or Wiesenberger code I and an allocation to stocks of at least 50 percent as condition for funds to be included in our sample.