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

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Abstract

The objective of this research is to investigate the impact that fund flows and management turnover have on the investment performance of actively managed equity mutual funds over time. Both fund flows and manager turnover have been identified in the literature as relevant factors that can 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 top past 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. For loser funds the combined effect on performance is equal to management fees. For winner funds it amounts to 60 percent of total fees. Including information about changes in fund management and fund flows into the mutual fund investment decision process would have yielded highly significant four-factor alphas of 3.12 to 4.44 percent per year before fees.

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1 Introduction

Although recent academic studies provide empirical evidence that equity mutual funds generate persistent performance in the short run (e.g. Bollen and Busse 2005), there is also overwhelming evidence that fund managers cannot persistently outperform an appropriate benchmark or index in the long run (e.g. Carhart 1997). The results that average performance of mutual funds is below zero based on investor returns (Malkiel 1995, Wermers 2000) and short run predictability is hard to exploit for the average investor are usually interpreted as a lack of investment skills. Thus, it seems irrational that the majority of investors are still willing to pay for the service of active management. French (2008), for example, calculates that, on average, 0.67 percent of total assets have been spent for active management in equities in the U.S. over the last 26 years. In 2006, this was equivalent to USD 101.8 billion or 0.77 percent of GDP. In addition, the share of mutual funds in total costs spent for active management in equities rose from 0.11 percent in 1980 to 0.32 percent in 2006 as a result of the increase in assets under management. Therefore, the benefit to the investor is usually negative because the expenses are often higher than pre expense alphas. These findings question the quality of asset managers and the contribution of active management in the mutual fund industry and one usual suggestion for the investor is to follow a passive investment strategy. Because many mutual funds are managed by highly sophisticated experts, these results are puzzling. However, the important question why performance persistence disappears over longer horizons and if this indeed indicates a lack of investment skill still remains an unsolved issue.

It seems that Berk and Green (2004) resolve this apparent paradox by demonstrating that even in the presence of skilled fund managers, with decreasing returns to scale, expected excess returns will be close to zero, because fund inflows and outflows chase past performance, and cause expected returns to converge to their equilibrium values. In addition, Khorana (2001) finds that management turnover also hinders future fund performance. In a sample of replaced fund managers, he finds underperforming funds subsequently improve their performance post-replacement, and outperforming funds have a decline in post-replacement performance. From this research it would appear that either fund flows or management turnover may negatively impact performance persistence. The important question of our research is to empirically analyze which of these factors is more important in explaining mean reversion in mutual fund performance and how these two factors interact. The active investor may benefit from our analysis by including this knowledge in the investment decision process. Our empirical findings suggest that taking the impact of management turnover and fund flows on performance into account can improve the abnormal performance of winner funds by an amount equal to 60 percent of total fees. Similarly at loser funds, the same mechanisms acting as internal and external governance have a positive impact on performance that is equal to the total amount of fees. Thus, asking why winner fund performance does not persist and how loser funds can be brought back to the mean might help to

solve the above paradox.

The contribution of this paper is to analyze the effect of fund flows and managerial turnover on performance persistence separately as well as jointly and to investigate whether future performance is more sensitive to changes in fund flows or to management turnover. We provide empirical evidence that managerial turnover is as important as fund flows in influencing performance persistence. Our findings on fund flows confirm previous results of Berk and Green (2004), Alexander, Cici and Gibson (2007) and Berk and Tonks (2007). In addition, we extend the work of Khorana (2001) on managerial turnover by relating changes in fund managers directly to performance persistence of these funds. We are able to compare the economic significance of both fund flows and managerial turnover effects separately but also analyze their interaction. Loser funds during the previous period benefit more from a replacement of their manager than from funds outflows, i.e. fund withdrawals of investors. Most importantly, both channels reinforce each other. In contrast, for past winner funds both channels interact at the downside but not at the upside.

The obligation to offer daily redemption and creation, one of the cornerstones of the open-ended structure of mutual funds, can be viewed as a corporate governance mechanism in the mutual fund industry that controls fund managers but that also imposes direct and indirect costs on current fund investors. According to Berk and Green (2004), inflows into previously outperforming funds reduce their potential to outperform in the next period as a result of decreasing returns to scale in active management. Combined with the practice of investors chasing past returns, this might explain the lack of performance persistence among good fund managers as reported in the literature. The incentives for investment management companies to soft-close their funds in this situation are limited as fee income is usually linearly related to fund size. Nevertheless, continuous trading in mutual funds offers an easy mechanism for investors to exercise external governance over underperforming managers. Withdrawals from underperforming funds seem, at first, to harm managers, but at the same time this offers them the opportunity to improve performance again by concentrating on a smaller number of sure winners. Fund flows are therefore an important mechanism that can negatively impact performance persistence for both outperformers and underperformers.

We argue in this paper that managerial turnover provides an additional explanation for the lack of performance persistence. Current studies on fund performance implicitly assume that that there is no difference between the fund and the fund manager.[1] This is clearly not the case as fund

[1]One notable exception is Baks (2003).

managers move between funds and enter or exit the mutual fund industry for various reasons.[2] At the top end, highly skilled fund managers have the incentive to maximize their salary. But, in contrast with the predictions of Berk and Green (2004), this does not happen at their current fund. Rather the star fund managers are drawn away by other funds. If investment performance depends on managerial skill, then the funds previously managed by these managers cease to outperform the market. At the other extreme, the managers of badly performing funds might be sacked by the fund management company. From the perspective of Berk and Green (2004), their fees are essentially reduced to zero. If effective internal governance mechanisms exist, then this should result in the replacement of underperforming managers by new managers with expected higher skills. The new manager will almost always change the investment strategy resulting in an improved performance. Consequently, the withdrawal of funds by investors and the replacement of a badly performing fund manager by the fund management company are usually perceived as two alternative control mechanisms in delegated fund management that may help to end a period of generating inferior investment returns. However, both corporate governance mechanisms may be exercised simultaneously. Whether this interaction between internal and external control will result in a weaker or stronger effect is at the core of our empirical analysis.

Thus, the objective of this study is to shed further light on the determinants of performance persistence and, specifically, to quantify the impact of managerial turnover and fund flows on performance both in the cross-section of our data set and over time. We apply a ranked portfolio test to compare the performance of different fund groups and a pooled regression to assess the change in performance over time. The focus of our analysis is on extreme outperformers and underperformers in the top and bottom deciles of funds, respectively, which allows us to analyze differences between extremely good and bad managers. We also provide new evidence on the performance persistence of actively managed U.S. equity mutual funds by employing new statistical methodologies, such as the Bayesian estimation. Furthermore, compared to other recent studies that investigate performance predictability by using improved estimation methods, we improve the predictability by incorporating additional economic information into the fund selection process (Busse and Irvine 2006, Huij and Verbeek 2007).

Our results provide empirical evidence that, at one extreme, excessive inflows into winner funds have a strong negative impact on their performance but that, at the other extreme, loser funds do not benefit from outflows to the same degree. Specifically, the performance of top decile 10 funds with high inflows deteriorates in the subsequent year by -1.44 to -1.80 percent compared to winner funds that did not experience extreme inflows. Over time, the performance of middling

[2]Indeed, it has already been suggested by Hendricks, Patel and Zeckhauser (1993, p. 102) that "superior analysts get bid away once they build a track record." Similarly, Tonks (2005, p. 1940) argues that "over time these individuals [fund managers] move between jobs, so that over longer horizons, the persistence in fund-management-house performance weakens."

funds decreases by -2.53 to -3.39 percent in the subsequent year compared with the previous year, following a one standard deviation increase in fund flows. The reduction for top decile 10 funds is even higher with -3.63 to -5.15 percent. Funds that invest in narrow or illiquid markets also suffer from extreme inflows and the negative impact is stronger for these funds compared to funds with broad investment perspectives. Bottom decile 1 funds that benefit from a one standard deviation increase in outflows earn between 1.00 to 3.27 percent higher risk-adjusted returns compared with the previous year which is not significantly higher than for middling funds. Furthermore, the performance differential between loser funds with high or low outflows is not statistically significant, suggesting that investors are reluctant to exercise external governance by withdrawing money from underperforming funds. There are different explanations for this behavior.

In contrast, managerial turnover has an important impact on performance persistence for both past winner and loser funds. On the one hand, losing an outperforming manager subsequently results in a -1.32 to -2.04 percent lower performance compared with winner funds that kept their star manager. Over time, if a manager of a winner fund leaves, the fund suffers from a reduction in performance by -0.50 to -0.82 percent compared with the previous year. This result seems to indicate that some managerial skill exists. Therefore, it is essential for the success of fund families to attract and retain skilled and successful managers. On the other hand, the replacement of an underperforming manager increases fund performance by 0.96 to 1.68 percent during the following year compared with previously underperforming funds that kept the same manager. Over time, a change in management leads to an increase in fund performance of the average fund by 0.48 percent in the year following the manager's replacement. This figure increases to 1.00 to 1.03 percent if the fund belongs to a larger family. If a fund manager with inferior performance is replaced, the improvement in performance is 0.47 to 0.51 percent larger than that of the average fund (0.95 to 0.99 percent). This finding underscores the importance and the impact of internal governance mechanisms in the mutual fund industry.

When focusing on the impact of the interaction effects of both control mechanisms, we find on one hand, that incorporating the information of fund flows and managerial turnover into the investment decision making process improves the performance by 0.72 to 0.84 percent per year. This equals 60% of the impact that fees have on the performance of winner funds. Following this investment strategy would have yielded highly significantly positive four-factor alphas of 3.12 to 4.44 percent per year before fees.[3] On the other hand, exercising simultaneously internal and external governance mechanisms among loser funds would have resulted in an improved

[3]This strategy involves a long position in winner funds that do not have higher than median inflows an no change in management. Adding a short position in loser funds without managerial turnover and lower than median outflows increases the alpha to 5.04 to 6.36 percent after fees or 4.68 to 6.24 percent before fees. Note that institutional investors often pay very low fees trough institutional share classes or individual fee arrangements.

performance of 1.56 to 2.04 percent per year compared to less governed funds. This effect is even slightly higher than the performance drag resulting from management fees. Consequently, investors would have benefited more from good governance than they would have gained from waiving the management fees of loser funds. Thus, a combination of external and internal governance seems to be the most effective tool to recuperate good and persistent mutual fund performance. Interestingly, the interaction effects among loser funds turn out to be even stronger than for winner funds.

Both managerial turnover and fund flows are important means for investors, investment management companies and regulators as they contain valuable information about the expected future fund performance. Investors should include information on both in their investment decision. Fund management companies should recognize the effect of stars in their fund management teams: if returns depend too much on a single manager, this becomes a risk factor for the investment company as well as for its investors. Fund management companies also play an important role in exercising internal governance. Regulators should be concerned about the possibility of negative side effects of their regulatory restrictions and the appropriateness of open-end fund constructions for eventually illiquid asset classes. Furthermore, it is questionable if funds used for retirement savings necessarily require the daily redemption feature or if its benefits are outweighed by the possibly higher performance of funds with restricted redemptions. As the share of U.S. equities held by mutual funds increased from 4.6 percent in 1980 to 32.4 percent in 2006 these aspects tend to become even more important (French 2008).

The rest of the paper proceeds as follows. The next section provides an overview of the literature on performance persistence, fund flows and manager changes. In the following section 3.1, we describe our data set and in section 3.2, we explain our methodology in more detail. Our results are discussed in section 4. General results on performance persistence based on different ranking methodologies are provided in section 4.1. Results for the ranked portfolio test taking account of fund flows are given in section 4.2, while results for the ranked portfolio test taking account of manager changes are given in section 4.3. Section 4.4 discusses the relative importance of both channels and analyzes the interaction effects. Section 4.5 performs a robustness check using a pooled regression approach. Section 5 finally concludes and presents an outlook to further research.

2 Literature Review

Performance Persistence There is overwhelming 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). Recent

underperformers continue to significantly underperform the benchmarks, whereas outperformers produce insignificantly higher returns than the benchmark, indicating that persistence is clustered around loser funds (Brown and Goetzmann 1995, Carhart 1997). Part of this is driven by higher fees. Winner funds merely happen by luck to hold last year's winner stocks (Carhart 1997). 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). The most recent studies focus on improved statistical methods. Using daily data and ranking based on risk-adjusted returns, Bollen and Busse (2005) document an economically and statistically significant outperformance of the top funds over quarterly periods. This outperformance vanishes over longer periods. Based on daily data, Busse and Irvine (2006) present evidence for the predictability of future fund performance by using the Bayesian methodology of Pastor and Stambaugh (2002). Huij and Verbeek (2007) employ an empirical Bayesian approach and find that statistically significant outperformance can be found among top funds even when monthly data is used. However, their results are not easy to exploit economically as they rebalance their portfolios on a monthly basis. Our study differs from these approaches in that it incorporates additional economic information about past fund flows and managerial turnover into the fund selection process in order to improve the identification of superior performers.

Brown and Goetzmann (1995) find that persistence is correlated across managers suggesting that persistence might be due to the adoption by fund managers of similar strategies that happen to outperform common benchmarks for a certain period. Neither the common risk-adjustment methodologies nor fund-style classifications seem to control sufficiently for this effect. Interestingly, restricting the analysis to funds with the same style causes the performance of the winner fund to deteriorate, confirming the importance of being in the right style at the right time (Huij and Verbeek 2007). Consequently, ranking based on risk-adjusted measures improves persistence compared with ranking based on raw returns (Elton, Gruber and Blake1996a, Bollen and Busse 2005).

External Governance and Fund Flows Open-end funds are obliged to report the daily net asset values (NAV) of their portfolios and to allow daily creations and redemptions at NAV, making fund shares usually very liquid. Thus, depending on a fund’s performance ranking investors have different incentives. On one hand, if a fund ranks among the top performers, investors have the incentive to quickly invest into this fund as performance persistence is very short lived (Bollen and Busse 2005). On the other hand, liquid fund shares allow for effective external governance. Indeed, empirical results show that investors' fund flows strongly respond to past performance (Sirri and Tufano 1998, Lynch and Musto 2003). However, poor performance is not followed by outflows to the same degree as one might have expected as superior performance is followed by inflows. However, a fund’s liquidity imposes costs on fund investors and prevents mutual funds from pursuing certain investment strategies.

In the short run, creations and redemptions of fund shares result 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). Thus, investment decisions might be affected by inflows or outflows that occur at inopportune times resulting in a poorer performance (Ferson and Schadt 1996). Moreover, a larger fund makes trading more expensive and difficult to hide. Other investors can easily front-run and exploit the information contained in the trading behavior of large funds. Furthermore, the choice of possible investment targets is constrained and restricted to liquid stocks. Good investment opportunities vanish as funds literally hit the capacity constraints on their best investment strategies. Consequently, daily liquidity requirements limit the potential to outperform if money chases the top performing funds.

Empirical results support the view that excessive fund flows reduce performance. Funds with more volatile daily flows tend to underperform their peers with less volatile flows (Rakowski 2003). Liquidity induced trades following excessive inflows or outflows significantly underperform discretionary trades based on superior information (Edelen 1999, Alexander, Cici and Gibson 2007). Analyzing hedge funds Naik, Ramadorai and Stromqvist (2007) report that capacity constraints exist in certain hedge fund styles – such as relative value, fixed income and emerging markets – especially if these strategies rely on the liquidity of the underlying markets. Redemption restrictions, such as lock-up and redemption notice periods, help to mitigate these problems (Aragon 2007). In contrast, performance persistence is stronger among closed-end funds and lasts for up to 36 months (Bers and Madura 2000). Note that the negative impact of inflows on performance can be interpreted as a lack of internal governance. Driven by the incentive to maximize fee income investment management companies allow funds to grow in size over and above the threshold that facilitates the generation of superior returns (Chen, Hong, Huang and Kubik 2004). A possible solution is to soft-close a fund which means that existing shareholders can still withdraw their money (and sometimes invest new money), but the fund is closed to new outside investors. For example, Fidelity decided to close the Magellan Fund to new investors in August 1997 as a consequence of high inflows and low relative returns in the previous three years. Performance based fees might be an instrument to align the interest of investment management companies with those of investors. However, in 1999 only 108 out of 6,716 mutual funds or 10.5 percent of total fund assets used performance fees (Elton, Gruber and Blake 2003).

On the other hand, the daily liquidity of mutual fund shares facilitates external governance. Investors do not have to rely on the investment management company or the fund board to take action after a period of unsatisfactory performance results; instead they can move their assets immediately to a fund with more potential. This governance mechanism is reinforced by the services of rating agencies, such as Morningstar and Lipper, media coverage and performance

rankings, as well as by the activities of sophisticated investors, such as funds of funds and wealth managers (DelGuercio and Tkac 2008). Placing restrictions on daily liquidity might, however, impose agency costs and gives underperforming managers the chance to survive longer in the industry (Anderson, Coleman, Gropper and Sunquist 1996). Indeed, if investors do not exercise external governance by withdrawing money, these funds can remain poor performers (Berk and Tonks 2007). This might be the result of investors falsely anticipating a strategy change by underperforming funds, a misplaced reliance on internal governance, or a disposition effect. There is evidence that in recent years, investors are beginning to react more quickly to past performance than previous studies documented (Goriaev Nijman and Werker 2008).

Internal Governance Mechanisms and Managerial Turnover Khorana, Servaes and Wedge (2007) suggest that there are four primary mechanisms to create the appropriate incentives for fund manager performance: compensation contract, dismissal, removal of the fund management company by the directors of the fund, and the "share ownership of the managers of the funds in the funds they oversee" (p. 183). Performance based compensation contracts and share ownership of the manager is only rarely used so far even though both are growing in importance (Elton, Gruber and Blake 2003, French 2008). 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.[4] In the U.S., fund boards should control the investment management company in the interest of the fund investors. In 2004, as a result of the fund scandals in 2003, 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.[5] However, this rule was rejected twice in federal appeals courts (SEC Remains Divided On Fund-Board Rule, *WSJ*, March 16, 2007). Fund boards, in general, do not fire the fund manager, but they can appoint another fund management company, although this rarely happens in practice. Investment advisors are insulated from direct SEC supervisory oversight altogether as this task is delegated to the board of directors (Haslem 2008).

It remains questionable whether these mechanisms are sufficient to incentivize the fund manager to generate superior returns and to replace him if he does not. Empirical results are still 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

[4]Note that keeping an existing manager with a good performance record can be seen as an equally important aspect of internal governance.

[5]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 are required.

to investors than large independent fund boards. The fund management company itself has an indirect incentive to control the fund manager's performance. Superior performance leads to high inflows and increases fee income which is usually based on the assets under management (Sirri and Tufano 1998, Lynch and Musto 2003). Consequently, several studies document an inverse relationship between fund performance and manager turnover (Khorana 1996, Chevalier and Ellison 1999, Gallagher and Nadarajah 2004).[6] 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 experience a change in fund manager, he reports an inverse relationship between the probability of managerial change and past performance. Past performance is measured either by portfolio returns or the growth in the fund's asset base. Promotions, i.e. the manager subsequently manages a larger fund, are positively and demotions, i.e. the fund manager subsequently manages a smaller fund, are negatively linked to past performance (Hu, Hall and Harvey 2000, Baks 2003).[7] Khorana (2001) goes on to examine the effect of the 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 1979 to 1991, he finds that underperforming funds subsequently improve post-replacement performance, and that the change in manager for outperforming funds results in a deterioration in post-replacement performance. Hence, managerial turnover acts as a curb on performance persistence. He also finds that manager turnover in underperforming funds is also preceded by decreases in net inflows into the fund.

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.[8] 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

[6]This inverse relationship between manager turnover and financial performance (Coughan and Schmidt 1985, Gilson 1989) or operating performance (Murphy and Zimmerman 1993) has also been documented for industrial companies. Furthermore, financial performance improves after manager replacement (Denis and Denis 1995).

[7]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 shown 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 Lynch1999, Carhart, Carpenter, Lynch and Musto2005).

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

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.[9]

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 comprises of 3,948 funds belonging to 672 fund families and having an average fund size of 899 million U.S. Dollar (table 2). 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.[10]

[Please insert **table 2** about here]

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

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

where 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 and 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, since there is no new cash. The portfolio 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 yet returned

[9] In a previous version of this paper we used single share classes and data up to the end of 2004. The results were qualitatively similar.

[10] 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.

to the same level. Furthermore, fund flow volatility increased over the sample period, especially after following the tech bubble (figure 1). This might be interpreted as a result of more sophisticated and performance-sensitive investors in mutual funds 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.[11] This variable gives the date of the last change in management 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). During our sample period, 6,446 manager changes occurred in our sample.[12] 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 follows closely the course of the market index (figure 1). The decrease at the end of the sample period results 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 managerial turnover in recent years, as well as the stronger performance sensitivity of fund flows indicated by their higher volatility suggest that manager changes and fund flows became even more important in explaining mutual fund persistence in recent years.

3.2 Methodology

In order to test our two hypotheses that managerial 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 fund flows and subgroups with and without a change in manager. Second, we perform a pooled regression of the change in performance over time on fund flows and managerial turnover in order to quantify the effects over time.

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

Ranked portfolio tests have been widely used in persistence studies, e.g. Carhart (1997), Carpenter and Lynch (1999) and Tonks (2005). This test involves the ranking of the funds into deciles based on their performance in the ranking 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 ranking period.[13] The intuition behind this is that we are interested in the different effects of managerial 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 decile from the subsequent ranking period. This procedure allows us to deal with the inherent endogeneity problem in the relation between managerial 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.

Ranking 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 rate on the risk-free asset) which have been used since the seminal work of Carhart (1997) (*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 just 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

[13]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.

increases the likelihood of ending up in the top decile, even if the manager has no skills.[14] 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*).[15] In order to deal with the time horizon question, we consider different but symmetric lengths for the ranking and evaluation periods. Specifically, we analyze short term persistence over three-month ranking and evaluation periods, mid-term persistence over one-year ranking and evaluation periods, and long-term persistence over two- and three- year ranking and evaluation periods.[16]

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 ranking 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.[17] Thus, the Bayesian adjustment 'shrinks' any extreme parameters towards a grand mean taking into account the cross-sectional distribution of 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) who attribute a higher skill measure to fund managers who produce their outperformance with a similar strategy as other skilled fund managers in comparison with managers who used a completely different strategy.

[14]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.

[15]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 did not change significantly, we present only results based on a raw return-sorting and a ranking using Carhart four-factor alphas.

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

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

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 to 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).[18] This results, for each decile, in a single time series of portfolio returns that could have been generated by following our trading strategy over the sample period (*portfolio approach*).[19] It is important to recognize that the composition of these portfolios changes significantly over time because after each ranking period new decile portfolios are formed.[20] 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, households 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 (equation 3) estimated during the evaluation period. 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 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:

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

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

We then move on one month at a time until we reach the end of the fund's return time series.[21] 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. Additionally, we analyze the moments of the whole panel of alphas for each decile (*panel approach*). Note that the difference between the mean of the alphas from the portfolio approach and the panel mean lies in the weighting of the time periods. In the portfolio approach, we take first the cross-sectional mean and then the time-series mean. This gives an equal weight to each month of our sample period irrespective of the number of funds that existed during that month. In contrast, 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. This accounts 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 fund flows and a managerial 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 managerial 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 the effects of fund flows and managerial turnover and of measuring their marginal impact.

[21] 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.

4 Empirical Results

4.1 Performance Persistence

First, we analyze whether the funds in our sample reveal performance persistence. We start by discussing the results for mid-term persistence based on a one-year ranking and evaluation period. Focusing first on the characteristics of the fund deciles, significant differences emerge from the results presented in table 3. There is a slightly higher managerial turnover among winner and loser funds, compared with funds with middling performance. This is consistent with our expectation that particularly bad managers are being sacked and extremely good managers have a higher likelihood of being recruited away by other investment management companies. Furthermore, decile 10 funds have high absolute and relative inflows and are relatively larger in size. Investors inflate the size of top funds by chasing good performers. Bottom funds, in general, experience outflows, indicating the functioning of external governance. Furthermore, funds are closed or merged at a higher rate of 5.00 to 5.30 percent in the bottom decile relative to the top decile, where the closure/merger rate is only 1.00 to 1.20 percent annually depending on the sorting mechanism (not reported in the tables). This result is consistent with the findings of previous studies (Brown and Goetzmann 1995, Elton, Gruber and Blake1996b). Higher fees tend to be associated with lower performance. However, there exists a U-shaped pattern with winner funds having slightly higher fees than funds in the middle of the distribution.

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

The performance of the decile portfolios increases almost monotonically from the bottom decile 1 to the top decile 10 (tables 4 and 5). Thus, bad funds remain bad and good funds remain good. Based on return-sorting, decile 10 funds offer raw returns in excess of the rate on the risk-free asset of 0.75 to 0.83 percent per month (9.00 to 9.96 percent annually). The average raw returns of decile 10 funds for the alpha-sorting are 0.67 to 0.77 percent per month (8.04 to 9.24 percent annually). However, risk-adjusted returns of decile 10 funds are insignificant at between -0.11 and 0.25 percent with return-sorting and between 0.07 and 0.18 percent with alpha-sorting. Only in the subperiod from 1996 to 1999 do top funds based on alpha-sorting continue to outperform their benchmark by a statistically significant alpha of 0.44 percent per month. In contrast, Huij and Verbeek (2007), using a very similar approach, document a significant abnormal risk-adjusted return of 0.26 percent per month for an earlier period from 1984 to 2003.[22] Decile 1 funds have excess raw returns of 0.17 to 0.28 percent per month (2.04 to 3.36 percent annually) with return-sorting and 0.36 to 0.45 percent per month (4.32 to 5.40 percent annually) with alpha-

[22]This difference might be driven by their longer sample period, the higher turnover of their decile portfolios as they use monthly rebalancing instead of annually rebalancing or their sample selection. Specifically, they do not combine all the share classes of one fund, but treat each share class as separately instead. Thus, if winner funds have several share classes, they get a higher weight in the equally weighted decile portfolios.

sorting. Risk-adjusted returns are negative yet insignificant between 0.03 and 0.37 percent with return-sorting and even statistically significantly negative at between -0.21 and -0.24 percent per month with alpha-sorting.

[Please insert **table 4** and **table 5** about here]

The spread in raw returns for a long position in decile 10 funds and a short position in decile 1 funds is on average between 0.55 and 0.57 percent per month (6.60 to 6.84 percent annually) with return-sorting. However, it is significantly positive only for the panel approach, not for the portfolio approach. These numbers are slightly lower than the results of Carhart (1997) who documents a return spread of 0.67 percent per month. Based on alpha-sorting, our results reveal slightly smaller return spreads of 0.30 to 0.32 percent monthly (3.60 to 3.84 percent annually). However, the average spread in risk-adjusted returns between winner and loser funds is even significantly positive for the OLS alphas of the concatenated time series at 0.31 percent per month and the panel approach at 0.39 percent per month, which is slightly higher than the 0.29 percent reported by Carhart (1997). Thus, we find significant performance persistence based on spread portfolios if we use the Bayesian four factor alphas for ranking. Investors can earn annually between 3.72 and 4.68 percent of risk-adjusted abnormal returns by buying decile 10 funds and shorting decile 1 funds. The median spread between decile 10 and decile 1, which is more important to small investors who can only buy one fund, is significantly positive in all four cases. The spread in raw returns is 0.45 or 0.30 percent for the return-sorting and alpha-sorting, respectively, whereas the spread in risk-adjusted returns is 0.62 or 0.39 percent per month for the return-sorting and alpha-sorting, respectively. Consequently, the funds in our sample show some signs of performance persistence especially based on an alpha-sorting.

An analysis of different subperiods indicates that persistence is stronger at the beginning of our sample period. In the subperiod from 1992 to 1995, the spread in raw returns between winner and loser funds based on the portfolio approach is significantly positive at 0.35 percent per month with alpha-sorting and significantly positive 0.51 percent with return-sorting. The corresponding rates for the OLS four-factor alpha model of the concatenated time series are 0.25 percent per month with both alpha- and return-sorting, although this is insignificant in the latter case. Even more striking, between 1996 and 1999, the return spread between decile 10 and decile 1 is 1.06 percent per month with both return- and alpha-sorting and the corresponding four-factor alphas are a significantly positive 0.62 percent with return-sorting and a significantly positive 0.95 percent with alpha-sorting. Thus, we find strong performance persistence before 1999 but no persistence afterwards. By visual inspection, these two periods coincide precisely with the different regimes for the fund flow volatility. Before 1999, fund flows are fairly stable, but after 1999 volatility increases significantly (figure 1). This confirms the importance of fund flows for performance persistence.

In order to gain a first insight into the duration of performance persistence in our sample we analyze the survival rates of funds in the top and bottom deciles.[23] If fund performance were independently and identically distributed (*iid*) over time, we would expect that ten percent of the funds remain in the same decile in the following year. However, in all but two years, this fraction is higher for decile 10 funds indicating a positive relationship between past and future performance. The average share of top funds that survive a second year and third year in decile 10 is 15.69 percent and 2.61 percent, respectively, both significantly higher than the expected numbers based on *iid* performance. However, after three years, persistence fades away as survival rates are no longer significantly higher than expected. A very similar picture emerges for decile 1 funds where again significantly more funds survive in year two (15.70 percent) and three (1.85 percent) than expected under *iid* performance, before persistence again vanishes for horizons longer than three years. Recall that one manager-fund combination on average lasts for 4 years which might explain why persistence starts to fade away around this period.

If we compare different lengths for the ranking and evaluation periods, we find a stronger indication that persistence is a short-lived phenomenon which is consistent with the findings of the previous literature (Bollen and Busse 2005). This conclusion is independent of the combination of ranking and evaluation methodologies we use. For example, the four-factor alphas of the portfolio approach based on return-sorting are significantly positive at 0.80 percent per month for three-month ranking and evaluation periods, decrease to an insignificant 0.56 percent for 12-month periods and finally become negative and insignificant at -0.25 percent for 24 months.

In the following sections, we concentrate on the results for the 12-months ranking and evaluation periods, since this is the length of time with the strongest signs of performance persistence for which results for both return-sorting and alpha-sorting are available. Furthermore, we conjecture that alpha-sorting is a superior technique for separating investment skill from luck than return-sorting. First, this is based on theoretical arguments: the Bayesian four-factor alphas adjust for risk and investment style and correct for any potentially extreme impact of luck or an omitted factor on performance by shrinking the alphas towards a grand mean.[24] Second, empirical observations support our conjecture. With return-sorting, a clear U-shaped pattern emerges for the 90 percent decile and an inverted U-shape for the 10 percent decile of risk-adjusted returns in the evaluation period (panel (a) of table 5). Thus, both the loser and winner deciles of funds have a large cross-sectional dispersion in alphas within their decile, whereas funds in deciles 3 to 8 lie much closer together. We interpret this as evidence of luck having a significant impact on performance in both the top and bottom deciles. If we compare the rankings based on Bayesian four-factor alphas, the U-shape pattern is much less pronounced (panel (b) of table 5) indicating

[23]Rankings are based on Bayesian four-factor alphas but the results for return-sorting are very similar.
[24] We thank Hendrik Scholz for pointing out the latter argument.

that the deciles are more homogenous and thus more likely to be driven by differences in skill rather than luck.

4.2 Fund Flows

In this section, we present the results from a first ranking of the funds into deciles based on either raw returns or Bayesian four-factor alphas over the preceding 12 months. In a second step, we subdivide decile 1 and decile 10 funds into those with higher relative fund flows than the median fund flows for the respective decile during the previous 12 months (high flows) and those with lower than median fund flows (low flows). Rebalancing of the decile portfolios occurs every January.

Loser funds Our results for bottom decile 1 funds lend only weak empirical support to the hypothesis of Berk and Green (2004). They argue that fund flows are the mechanism that leads to mean reversion in performance. Specifically, investors should withdraw money from badly performing funds. This would give fund managers the opportunity to reorganize their portfolios. As expected, the average raw returns of bottom funds with lower inflows, i.e. higher outflows, are higher than the raw returns of bottom funds with higher inflows, i.e. lower outflows (table 6). However, the spread in raw returns between these two groups is significantly positive at 0.11 percent per month only for the panel approach based on alpha-sorting, but insignificantly positive for the other three measures. Risk-adjusted returns from the four factor model are, however, more in line with the hypothesis of Berk and Green (2004) (8). Bottom funds that benefit from outflows have average risk-adjusted returns that are statistically indistinguishable from zero in five out of six cases, whereas the alphas of bottom funds that do not benefit from outflows are significantly negative between -0.25 and -0.42 percent per month in five out of six cases. However, the spread between these two groups is again significantly positive only for the panel approach: the average is 0.12 to 0.13 percent per month, while the median is 0.07 to 0.08 percent. Despite these return differences, there is only weak support in our data set for the Berk and Green (2004) hypothesis for bottom funds. A possible explanation is that a large fraction of investors are reluctant to withdraw money from underperforming funds as suggested by Berk and Tonks (2007). There is therefore no incentive for the poorly performing fund managers to reorganize 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 still a significant fraction of borrowers is reluctant to refinance due to various reasons. The latter do not seem to behave rationally in an economic sense. This behavior of mutual fund investors, however, is also consistent with the disposition effect in that investors are hesitant to realize losses and therefore stay invested until the fund price increases to the price level at which the investor bought the fund.

Winner funds Our results clearly show that top funds suffer from the impact of large inflows in the medium and long run, lending strong support to our hypothesis as well as being consistent with the model of Berk and Green (2004) (table 6 and 7). However the results depend strongly on the length of the ranking and evaluation period. In short-term ranking and evaluation over three months, which is possible only with return-sorting, excessive fund flows into decile 10 funds have a positive impact on future performance (not reported in tables). The spread between winner funds with low inflows and winner funds with high inflows is highly significant between -0.14 and -0.16 percent in raw returns and -0.11 and -0.17 percent in alphas.[25] This result might be due to a short-run momentum effect which is not accounted for by our momentum factor which is based on the previous 12 months' returns. Additionally, funds might drive up the share prices of their own portfolios if they invest a large fraction of these excessive inflows in stocks they already hold. This price effect might be temporary rather than persistent but still boosts fund performance in the short run. For a 12-month ranking and evaluation period, this picture reverses. Based on return-sorting, the spread portfolio long in winner funds with low inflows and short in winner funds with high inflows yields positive average raw returns between 0.06 and 0.07 percent per month and alphas between 0.05 and 0.09 percent per month. However, none of these numbers is statistically significant. Based on alpha-sorting, the spread portfolio has higher average raw returns of 0.11 to 0.12 percent per month which translate into alphas of 0.12 to 0.15 percent, the latter being significant in three out of five cases. These results are similar to the negative contribution of liquidity-induced trading on alpha of 0.12 percent per month identified by Edelen (1999). Our results also show that the positive OLS alpha for top decile 10 funds of 0.07 percent can be divided into a positive alpha for top funds with low flows of 0.13 percent and a negative alpha for top funds with high flows of -0.03 percent. Focusing on long term persistence for 24-months ranking and evaluation periods, the negative impact of fund flows becomes even more evident (not reported in tables). The average returns on the spread portfolio are highly significantly positive at between 0.13 and 0.16 percent per month, independent of the sorting mechanism used. Four-factor alphas are also highly significant in five out of six cases at between 0.10 and 0.17 percent per month. Thus, what helps the fund manager in the short term to push up his own prices has a highly negative effect in the long run. Our results strongly suggest the importance of putting in place mechanisms that shelter funds from excessive flows or reduce the costs that result from these flows.

[Please insert **table 6** and **table 7** about here]

Summarizing the results for fund flows, we conclude that external governance at loser funds does not seem to have a large impact on the performance reversal of these funds. As empirical studies on the performance-flow relationship suggest, investors are still reluctant to sell underperforming

[25]Note that the OLS alpha based on the concatenated time series is not statistically significant for the whole period, but only for the 1996 to 1999 subperiod.

funds at the same rate as they buy outperforming funds (Sirri and Tufano 1998, Lynch and Musto 2003). Thus, we document only weak signs of a positive impact of outflows on fund performance for loser funds. Fund flows can therefore only to a certain degree explain the observed persistence among bottom decile 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. In the short run, superior performers benefit from inflows, but in the medium to long run, excessive inflows harm positive performance persistence. This is especially true for fund managers who end up in the top decile as a result of superior investment skills (alpha-sorting) as compared to investment style or just luck (return-sorting). The highest risk-adjusted alpha, a significant 0.40 percent per month or 4.80 percent per year, can be earned by a long position in top funds with low inflows and a short position in bottom funds with low outflows: this is almost a third higher than the risk-adjusted return from applying the long decile 10 and short decile 1 strategy which disregards information on past fund flows. Thus, fund flows convey important information about future fund performance. We now turn over attention to managerial turnover.

To check for the robustness of our findings, we repeat our analysis but sort funds into quintiles. The results are presented in panel (b) of table 8. They verify that our results are not driven by a sorting into deciles. Thus, both for winner and loser funds the results of the previous section are confirmed. Similarly, one might suspect that differences in fees between funds with higher or lower than median fund flows affect our results. For example, investors might prefer winner funds with lower fees or loser funds with a higher degree of governance that might have lower fees as a result of this governance. Thus, we repeat our analysis using gross of management fee returns. Panel (c) reveals that none of this seems to be the case. Our basic results remain unchanged whether we look at before or after fee performance.

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

4.3 Managerial Turnover

In this section, we present the results from a first ranking of the funds into deciles based on either raw returns or Bayesian four-factor alphas over the preceding 12 months. In a second step, we subdivide decile 1 and decile 10 funds into funds that experienced a manager change during the previous 12 months (denoted ‘with manager change’) and those that did not (denoted ‘without manager change’). Rebalancing of the decile portfolios occurs every January.

Loser funds Our hypothesis that bottom funds that sack their fund manager can improve performance in the following year compared with bottom funds that stick to their presumably unskilled manager is strongly supported by our findings. This becomes even more obvious for

alpha-sorting. Specifically, based on return-sorting, the average return spread is significant at 0.09 percent, based on the portfolio approach, and even higher although insignificant at 0.14 percent, based on the panel approach (table 9). The difference in medians is highly significant at 0.20 percent per month. For alpha-sorting (which captures the effect of skill on performance), the return spread between bottom funds with and without managerial turnover is highly significant at 0.10 to 0.16 percent per month or 1.20 to 1.92 percent per year. The risk-adjusted returns, based on the four-factor model, lend even more support to our hypothesis (table 10). Based on return-sorting, decile 1 funds without a change in management continue to underperform by -0.09 to -0.38 percent per month on average, which is statistically significant in two out of the three measures. Based on alpha-sorting, all three measures are significantly negative with values between -0.24 and -0.26 percent per month. In contrast, decile 1 funds that replaced their manager still generate negative alphas, but these are statistically indistinguishable from zero. There is a significant alpha spread between bottom funds with and without manager change of 0.08 to 0.14 percent per month or 0.96 to 1.68 percent per year. Consequently, managerial turnover is an important control mechanism that has a statistically and economically significant impact on fund performance. Furthermore, we find evidence that the persistent underperformance of decile 1 funds, which has also been documented by Carhart (1997), can be attributed completely to funds that do not apply internal governance (based on alpha-sorting).

Winner funds Turning to winner funds, a change in management has an important negative impact on fund performance. Decile 10 funds that lose their skilled manager underperform winner funds that can keep their manager by 0.09 (portfolio approach) or 0.13 percent (panel approach) on average, the former being statistically significant (based on alpha-sorting). The difference in risk-adjusted returns is highly significant at 0.11 to 0.17 percent per month or 1.32 to 2.04 percent per year on average.[26] However, managerial turnover does not seem to have a similar impact on the performance of decile 10 funds based on return-sorting. This is not very surprising, since a large fraction of the funds presumably end up in the top decile due to luck rather than skill and the return-sorting mechanism is not able to differentiate between these two. Consequently, the turnover of managers is less important, because luck itself does not seem to be very persistent. In summary, our results highlight the importance of retaining skilled fund managers, for example, by linking their pay more closely to performance. The OLS alpha of decile 10 funds of 0.07 percent per months stems completely from top funds without managerial turnover (0.10 percent), whereas top funds with a change in management display a negative alpha (-0.02). However, the lack of performance persistence among decile 10 funds cannot be explained by managerial turnover alone, since even winner funds that keep their manager do not show persistent outperformance.

[26] This relationship is strongest for the subperiod 2000 to 2003.

[Please insert **table 9** and **table 10** about here]

Consistent with our hypotheses, the performance of decile 1 funds with a manager change is significantly higher than the performance of decile 1 funds without a manager change. Moreover, the performance of decile 10 funds without a manager change is significantly higher than the performance of decile 10 funds with a manager change. Thus, manager changes have a negative impact on the performance of top decile funds but a positive impact on the performance of bottom decile funds. Our results indicate that the replacement of an underperforming manager improves subsequent returns, confirming the importance of effective internal governance. At the other extreme, losing a star manager reduces performance. Looking at persistence, bad performance is more persistent at loser funds that kept their bad manager and superior performance is more persistent at good funds that kept their skilled manager. Both results confirm our expectations and highlight the finding that managerial turnover is at least as important as fund flows in explaining mutual fund performance. This result confirms that a number of fund management companies are unable to keep their talented managers. Baks (2003) finds some persistence by tracking individual managers instead of funds. Consequently, fund management companies need to improve their internal governance in order to retain skilled managers. A stronger alignment of performance and salary similar to the hedge fund industry might be necessary. At the same time, investors should pay close attention to the career paths of individual managers amongst different funds.

Similar to the robustness check in the previous section we investigate the impact of sorting into quintiles instead of deciles on our results. The results presented in panel (b) of table 11 confirm the same economic relation between managerial turnover and fund performance for quintile portfolios. Similarly, analyzing alphas before fees only shifts our results parallel upwards. However, the relative relation between funds with and without a change in management remains the same and our conclusions are not altered based on the gross of management fee results.

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

4.4 Comparison and Interaction of Fund Flows and Managerial Turnover

In the previous section, we have provided empirical evidence that managerial turnover and fund flows individually have a statistically and economically significant impact on mutual fund performance. In this section our aim is to compare the importance of both governance mechanisms and to focus our attention on potential interaction effects.[27] That is, we perform a double sorting simultaneously on both channels. This results in four subgroups of the winner and

[27] All of the following results are based on rankings and evaluations using four-factor alphas.

loser fund portfolios, respectively. These subgroups are: funds with managerial turnover and lower than median funds flows (w lo), funds with managerial turnover and higher than median fund flows (w hi), funds without managerial turnover and lower than median fund flows (w/o lo) and funds without managerial turnover and higher than median fund flows (w/o hi).

The composition of these subgroups reveals distinct differences indicating that each channel has an independent impact on fund performance. Table 12 shows the fraction of fund-months in the subgroups of decile 10 and decile 1 with high and low fund flows and with and without managerial turnover.[28] It is clear 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 managerial turnover are almost equally distributed between the groups with high and low fund flows. 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 at the same time, virtually the same as the rate for decile 10 funds in aggregate (20.11 percent). The results for decile 1 funds are similar. Of the 49.85 percent of loser funds with high outflows, 11.86 percent experience a change in management. Thus, the share of funds with managerial turnover within the outflow group is 23.79 percent which is very close to the average rate of 22.00 percent across all decile 1 funds. Similarly, from the group with a change in management, 53.38 percent have outflows at the same time, whereas 49.85 of all decile 1 funds have outflows. Thus, fund flows and managerial turnover both seem to have an independent impact on performance which is not a spurious result driven by the other channel. We now analyze the relative importance and interaction effects of both channels.

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

Loser funds Recall from above that loser funds tend to continuously underperform the four-factor benchmark by significant -0.21 to -0.24 percent per month. Effective internal and external governance leads to an improvement of the investment results. We now turn to the question which of these channels is more important. The subgroup of loser funds with lower than median fund flows has negative alphas between insignificant -0.14 and significant -0.21 percent, an improvement in performance compared to the average loser fund of between 0.03 and 0.07 percent per month. In contrast, replacing an underperforming manager has a stronger positive impact on performance. It improves the performance by 0.05 to 0.11 percent per month resulting in alphas for loser funds with managerial turnover of between -0.10 to -0.19 percent per month which are insignificantly different from zero. The same conclusions can be drawn from a comparison of the spread between loser funds with and without managerial turnover and loser

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

funds with lower than median and higher than median fund flows. The spread resulting from internal governance, i.e. managerial turnover, is on average 0.08 to 0.14 percent monthly (0.96 to 1.68 percent per year) and significant in all cases. It is at the same time economically meaningful because it is equivalent to about one third of the spread between decile 10 and decile 1 funds. On the other hand, external governance via outflows does not have the same impact. The spread between loser funds with high outflows and loser funds with low outflows is only between 0.06 and 0.12 percent per month (0.72 and 1.44 percent per year) on average but statistically significant only for the panel approach.[29] Thus, it seems fair to conclude that managerial turnover is more relevant in explaining mean reversion of loser fund performance than fund flows.

Similar conclusions emerge from analyzing one channel while keeping the effect of the other channel constant (tables 13 and 14 and figure 2). In order to analyze the marginal impact of internal governance we compare the performance of loser funds with and without managerial (with higher than median and lower than median fund flows) turnover within the fund flow (managerial turnover) subgroups. In all cases, loser funds with managerial turnover have higher alphas than funds without managerial turnover and funds with lower than median fund flows in all cases have higher alphas than funds with higher than median fund flows. Thus, the effect of both channels is robust and there is always a marginal improvement in performance when one of the governance mechanisms is applied. The marginal impact of managerial turnover when we keep the impact of fund flows constant is significant in four out of six cases. However, comparing the results for the managerial turnover channel within the fund flow subgroup shows that the spread in the lower than median fund flow environment (1 w lo – 1 w/o lo) is larger than the spread in the higher than median fund flow environment (1 w hi – 1 w/o hi). This result indicates that the new manager can more successfully turn around the fund if at the same time he has outflows that give him the opportunity to reorganize the portfolio. The impact of fund flows on performance becomes statistically insignificant in five out of six cases once we control for the impact of managerial turnover on performance. These results underline that for loser funds the internal governance mechanism via a replacement of the manager is more important and has a marginal impact on performance that goes beyond the impact of funds flows. Market based external governance in contrast leads only to a smaller improvement in performance. If the manager has already been replaced, external governance can only provide a small and in most cases insignificant additional performance improvement.

[Please insert **tables 13** and **14** and **figure 2** about here]

[29]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.

If internal and external governance mechanisms reinforce each other we would expect that loser funds with managerial turnover and lower than median fund flows yield the highest performance among all loser funds. Indeed, this is what our empirical results suggest. Loser funds with managerial turnover and lower than median fund flows have alphas between -0.04 and -0.11 percent per month which are statistically insignificant from zero. This is an improvement compared to the average loser funds of between 0.13 and 0.17 percent per month (figure 2). Also compared to the individual effects of internal and external governance from the single sorting there exists a large improvement in performance. The alphas of funds experiencing internal and external governance are on average 0.08 to 0.10 percent higher than the alphas of loser funds with external governance alone and still 0.05 to 0.08 percent higher than the alphas of loser funds with managerial turnover. Thus, it seems that both governance channels reinforce each other. This is supported by the fact that the largest and in all cases highly significant spread of between 0.17 and 0.24 percent can be earned by the extreme combination of our double sorting subgroups, i.e. a long position in loser funds with a change in management and high outflows and a short position in loser funds that stick to their manager and do not benefit from outflows. Comparing the combined effect of both governance mechanisms and the performance drag resulting from management fees shows that the performance improvement of efficient governance is even slightly higher than the effect that management fees have on mutual fund performance. Thus, investors of loser funds benefit more from governance than they would benefit if fund companies waived their management fees. Loser funds that benefit from both governance mechanisms even generate positive alphas before fees of between 0.03 and 0.09 percent per month. Thus, persistent undeperformance of loser funds can be explained by their fees as suggested by Carhart (1997) but also to the same degree by the lack of efficient governance among many of these loser funds.[30] All of these results are robust when using quintiles instead of deciles and do not change based on gross fee performance.

Winner funds Winner funds yield insignificant alphas of 0.07 to 0.18 percent per month subsequent to the ranking year. Part of these low performance results can be explained by excessive inflows due to investors chasing past returns and by a change in the fund management as shown in the previous section. An empirical investigation into the relative magnitude of both effects reveals that fund flows are slightly more important based on the results from the single sorting. Restricting the investment to winner funds which do not suffer from excessive inflows results in four-factor alphas of between 0.13 and 0.23 percent which is slightly higher than the alphas from restricting the investment to winner funds without managerial turnover (0.10 to 0.21 percent per month). Thus, avoiding funds with large inflows improves performance by 0.03 to 0.06 percent while avoiding funds with a change in management improves performance by 0.02 to 0.03 percent. A comparison of the spread portfolios for the single sorting results in similar

[30]Only 11.86 percent of all loser funds benefit from a combination of both governance mechanisms (table 12).

conclusions although both channels are almost perfectly equal. The spread between winner funds with lower than median and higher than median fund flows amounts to 0.12 to 0.15 percent per month, significant in two out of three cases. The spread between winner funds that kept their star manager and those that lost their manager is significant at 0.11 to 0.17 percent. Judged on the individual effects both channels seem to be more or less equally important in explaining mean reversion of superior fund performance with a weak indication of a higher impact for fund flows. Consequently, the hypothesis concerning diseconomies of scale in active management by Berk and Green (2004) seems to be supported by our data. However, we find empirical evidence that managerial turnover is an equally important mechanism that prevents funds from delivering persistent outperformance.[31]

Keeping again one channel constant while analyzing the effects of the other channel provides a deeper understanding of the relative importance of both channels (tables 13 and 15 and figure 3). In all cases, funds without managerial turnover have higher alphas than funds with managerial turnover and funds that do not suffer from high inflows have superior performance compared to funds that receive high inflows. Within the fund flow subgroups, the impact of managerial turnover on fund performance is between 0.06 and 0.19 percent per month yet significant only in two out of six cases at the 10 percent level (10 w/o lo – 10 w lo and 10 w/o hi – 10 w hi). A slightly stronger result arises from an analysis within the managerial turnover subgroups (10 w lo – 1 w hi and 10 w/o lo – 1 w/o hi). The marginal performance improvement for funds with lower than median inflows compared to funds with higher than median inflows is between 0.05 and 0.20 percent per month and significant in half of the six cases at the 5 percent level. Specifically, if we already choose only winner funds that do not suffer from high inflows, the performance improvement of an additional restriction to funds without managerial turnover is significant only in one case at the 10 percent level. In contrast, if we only analyze funds without a change in management we can improve the performance by 0.12 to 0.14 percent (significant in two out of three cases) if we restrict ourselves to funds with lower than median inflows. However, compared to the results at loser funds, it seems that both channels do not reinforce each other to a large degree at winner funds. If the investment is already restricted to funds with lower than median inflows there is only a small additional contribution of the second mechanism.

[Please insert **table 15** and **figure 3** about here]

If we employ the previous results to develop an investment strategy to outperform the four-factor benchmark we should invest into winner funds without managerial turnover that have lower than median fund flows. That is, compared to other recent studies on performance predictability such

[31]Note that we do not even have to assume decreasing returns to scale for this latter mechanism. Only different skill levels and the mobility of fund managers between different funds or even outside the mutual fund industry are required.

as Busse and Irvine (2006), we incorporate additional information into the prediction of managerial skill. However, even combining both selection criteria does not yield significantly positive performance. Nevertheless, the alphas of the low inflow and no manager change subgroup are clearly larger at 0.14 to 0.25 percent than the alphas of average winner funds at 0.07 to 0.18 percent per month. The double sorting also yields 0.04 percent higher alphas than a single sorting only based on managerial turnover and 0.01 to 0.04 percent higher alphas than a single sorting only based on fund flows. However, the combined effect is smaller than the contribution of the combined effect we observed for loser funds. Looking at the downside, there seems to be some reinforcement at work. Funds that suffer from high inflows have 0.08 to 0.10 percent lower performance results than average winner funds. Winner funds that lost their star manager suffer from a performance decrease of between 0.09 to 0.14 percent per month. However, if both channels are at work at the same time, performance decreases by 0.16 to 0.19 percent. This leads to a highly significant spread for the extreme combination based on a double sorting, i.e. long in winner funds without managerial turnover and low inflows and short in winner funds with managerial turnover and high inflows (10 w/o lo – 10 w hi), of between 0.22 and 0.26 percent. Thus, even if investors can only gain to a smaller degree from a combination of both effects on the upside, they are well advised to avoid winner funds that suffer from a change in management and at the same time have high inflows as the alphas of the latter are between -0.12 and 0.03 percent per month.

Analyzing the performance of winner funds gross of management fees reveals that even before fees the alphas of winner funds are insignificant in the evaluation period at 0.19 to 0.30 percent. This indicates that investors can earn an equivalent of 60% of management fees if they apply our double sorting. Before fees both of our sorting mechanisms yield significantly positive abnormal performance. Winner funds that do not suffer from inflows or managerial turnover outperform the market before costs by highly significant 0.26 to 0.37 percent per month (3.12 to 4.44 percent per year). Thus, some institutional investors who pay only marginal annual fees through institutional share classes or individual fee arrangements might be able to significantly outperform the market if they apply our double sorting mechanism. The results again are robust to using quintiles instead of deciles and do not change if we analyze gross of fee performance.

4.5 Pooled Regression

To analyze the marginal effects in more detail, we perform a pooled regression of the change in annualized Bayesian four-factor alphas between adjacent years on fund flows, managerial turnover and a set of control variables documented in the literature to have an impact on performance.[32] These controls are the fund size, fund fees, fund age and the turnover ratio.[33]

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

Since 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. 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 managerial turnover and the decile 10 and decile 1 dummy. Our second model analyzes in addition 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. The third model additionally 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 last year is higher than the 70 percent quantile. Model 4 additionally analyzes the interaction between the managerial turnover and fund flow channel. Specifically, we include a dummy for winner funds that have higher than median fund flows and a change in management and a dummy for loser funds that have lower than median fund flows and a change in management.

We measure the change in performance from the previous year to this year. 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. Most of the coefficients turn out to be insignificant as expected. The signs indicate that small and young funds with low costs can improve their performance over time, compared with old and large funds with high expense ratios. 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-driven 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). Funds that invest in narrow markets, such as small-cap and sector funds, have similar raw returns but higher alphas compared with large and

[33]Chen, Hong, Huang and Kubik (2004) and Cremers and Petajisto (2007) show a negative effect of fund size on performance, Carhart (1997) documents a negative effect of 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) and Chen, Jegadeesh and Wermers (2000) find a positive relationship.

mid-cap funds. The decile 1 and decile 10 dummies are both highly significant and indicate that loser funds improve their risk-adjusted returns between 3.17 and 3.25 percent in the following year. The alphas of decile 10 funds deteriorate by 3.09 to 3.36 percent in the year after they left decile 10. Current fund flows have a significantly positive impact on raw returns and the performance is consistent with our findings of a positive short term impact in section 4.3.[34]

[Please insert **table 16** about here]

Fund performance declines significantly following past inflows. A one standard deviation increase in cumulated fund flows during the previous year decreases four-factor alphas by -2.53 to -3.39 percent the following year. If the fund belongs to the winner fund group during the previous year, it suffers even more from excessive inflows. Alphas decrease between -3.63 to -5.15 percent, following a one standard deviation increase in fund flows. This result is statistically and economically significant. Also consistent with our expectation is the observation that the negative effect of inflows on performance is stronger if the fund operates in narrow markets. Specifically, a one standard deviation increase in previous-year inflows decreases the alphas of small-cap and sector funds significantly by an additional -2.70 to -2.72 percent compared with average large and mid-cap funds.

Based on the pooled regression results, the hypothesis of Berk and Green (2004) that loser funds can benefit from outflows due to decreasing returns to scale in active management also receives only limited empirical support. The improvement in alphas for decile 1 funds is not significantly different than the impact of fund flows on average funds. It turns out to be even significantly smaller than the improvement of the average fund at 1.00 to 1.34 percent once we control for the combined effect of narrow markets and fund flows. Still, all fund groups can gain from outflows as suggested by Berk and Green (2004). This result might be explained by the decreasing sensitivity of fund flows to performance as a fund's performance ranking decreases (Sirri and Tufano 1998, Lynch and Musto 2003). Consequently, fund flows have a marginal impact on fund performance that is independent of managerial turnover.

A change in management generally improves subsequent performance. Decile 1 funds benefit more than average funds and decile 10 funds suffer if the manager leaves. Specifically, a change in management improves the average fund's alpha in the subsequent year by a significant 0.48 percent based on models 1 and 2. This effect is completely picked up by the interaction between a change in management and the dummy for a large fund family in model 3. The aggregate effect of managerial turnover among funds of large fund families is significantly (at 10 percent) positive at 1.00 to 1.03 percent. Thus, we can confirm the hypothesis of Gervais, Lynch and Musto (2005)

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

for our sample that the replacement of a manager of a large fund family contains more information. If a top manager of a decile 10 fund leaves, that fund's alphas subsequently decrease by -0.50 to -0.65 percent, although this is insignificant (models 1 and 2). Model 3 shows a decrease of even -0.82 percent. However, focusing on the interaction term between fund flows and managerial turnover in model 4 the results indicate that this effect is clearly driven by a reinforcement of both channels. Specifically, the coefficient for winner funds with managerial turnover is even positive while the interaction term shows that the alpha of winner funds with a change in management and simultaneously higher than median fund flows deteriorates by highly significant 3.04 percent. Bottom funds that replaced their manager can improve their alphas by 0.95 to 0.99 percent in the following year (models 1 and 2). However, these numbers are not statistically significantly higher than the performance improvement among average funds as documented above. This effect is picked up to a large degree by the large family interaction term in model 3. Model 4 reveals again, that the interaction between fund flows and managerial turnover is driving this result. A change in the management of a loser fund even has a significantly negative average effect on alpha in model 4. However, if the change in management is accompanied by high outflows, the improvement in performance is highly significant at 3.35 percent. These results confirm the conclusions from the ranked portfolio tests in section 4.2 and show that decile 10 funds suffer from a change in management, whereas the average fund (and decile 1 funds in particular) benefit. However, the results for the managerial turnover channel at the bottom funds seem to be slightly weaker than the results based on the ranked portfolio tests in section 4.2. Thus, managerial turnover seems to be a better predictor for performance differences across funds than for a change in performance over time. In general, our results confirm that managerial turnover affects performance independently from fund flows but also suggest that both channels are interlinked to a large degree.

In summary, the pooled regression results confirm our previous findings from the ranked portfolio test. Fund inflows reduce performance on average and especially for winner funds and funds investing in narrow markets. Loser funds can gain from outflows, even though the magnitude of the performance improvement is lower than for the average fund. Managerial turnover, on average, improves fund performance in the subsequent year which is especially true for large fund families. If a top manager leaves a decile 10 fund, this has a negative impact on fund performance. However, the replacement of a bottom fund manager does not improve the performance of this fund to a larger degree than for an average fund. Our analysis confirms that both channels, fund flows and managerial turnover, have a significant marginal impact on fund performance. Furthermore, the interaction effects confirm our conclusions from the previous section and turn out to be even stronger for the pooled regression results.

5 Conclusion and Outlook

In this study, we have analyzed the impact of fund flows and managerial 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 wipe out performance persistence. Similarly, the same mechanism operating in the context of outflows gives loser funds the possibility to regain performance. Following Khorana (2001) we have argued that managerial turnover results in a similar effect and provides a complementary mechanism to fund flows. Outperforming managers may leave winner funds to increase their salary elsewhere. The previously outperforming funds left behind cannot generate the same positive performance post-departure and as a result no performance persistence will be found in winner funds that lose their manager. Similarly among losing funds, the replacement of an underperforming manager with a better one serves as an internal governance mechanism, and subsequent performance post-departure, should improve. The new manager is also likely to generate mediocre returns (star fund managers are not attracted to funds in the bottom decile) and again no persistence among loser funds can be observed if their manager is replaced.

Our empirical results based on a set of 3,948 U.S. equity mutual funds support these conjectures. Keeping a star manager leads to 1.32 to 2.04 percent higher risk-adjusted returns in the following year in comparison with winner funds that lose their manager. Over time, losing a winner fund manager reduces performance by -0.50 to -0.82 percent in the year after the manager left. At the other extreme, replacing an underperforming manager increases subsequent risk-adjusted returns by 0.96 to 1.68 percent compared with loser funds that stick with their manager. Over time, this internal governance mechanism results in an increase in performance of 0.95 to0.99 percent. Consistent with Berk and Green (2004), excessive inflows into top funds harm subsequent performance by -1.44 to -1.80 percent annually compared with funds with lower than median inflows. Somewhat surprisingly, bottom funds do not gain from outflows to the same degree as winner funds suffer from inflows based on the ranked portfolio test. Still, the performance of loser funds increases by 1.00 to 3.27 percent in the year following a one standard deviation increase in outflows. The somewhat stronger results of the managerial turnover channel indicate that this channel might be even more important in explaining the observed lack of performance persistence than the channel operating via fund flows. This is especially evident for exercising governance at under-performing funds in the bottom decile.

Furthermore, we show that both, funds flows and managerial turnover, have an independent marginal impact on fund performance and do not depend on one another. If both channels act simultaneously they reinforce each other especially as governance mechanisms at previously losing funds. If internal governance via managerial turnover and external governance via outflows are exercised at the same time among loser funds this leads to a performance

improvement of 1.56 to 2.04 percent in alphas which is even slightly higher than the total amount of management fees paid by investors for these funds. Carhart (1997) argues that higher fees at loser funds leads to stronger performance persistence in the bottom decile compared to the top decile. However, our results suggest that a lack of governance among loser funds can also explain this observation. For example, both governance mechanisms are applied to only 11.86 percent of all loser funds (table 12). Thus, we cannot expect a large performance improvement for the majority of the loser funds. For winner funds our results show that at least some funds are able to outperform the market. However, these funds become victims of their own success. Large amounts of money flows into these funds offer the fund manager the opportunity and offers him the incentive to quit his job in response to lucrative offers elsewhere. We conclude that it is not solely a lack of managerial skill that prevents persistent out-performance, but that the incentives resulting from a top position in performance rankings also play a significant role in this relationship. If we follow an investment strategy that invests in previous winners but at the same time avoids funds that grow in size due to large inflows or suffer from a change in management the resulting alphas are between 1.68 and 3.00 percent per year, yet insignificant. Before fees, these alphas are even highly significant at 3.12 to 4.44 percent. Adding a short position in funds with higher than median fund flows and no change in management, results in a spread portfolio that yields an alpha of 5.04 to 6.36 percent after fees. These findings highlight the importance of acquiring additional information for a successful prediction of future investment results of mutual funds that go beyond an estimation of pure investment skills.

Furthermore, out results highlight the importance of the regulatory and operational environments for performance. Even though internal governance mechanisms are not well developed, the indirect performance incentives of the investment management company seem to be strong enough to effectively punish poor fund managers. However, the reluctance of investors of loser funds to withdraw their money still seems to be puzzling. Nevertheless, at the top end, fund management companies are not able to keep good fund managers. One way to tie a fund manager more strongly to a fund is to link his compensation directly to performance. This would give managers a direct performance incentive. Currently, a high position in a performance ranking might seduce top fund managers to maximize their salary by maximizing funds size, which subsequently will hurt performance, or to even leave the fund and accept a better paid job from another fund company or outside the industry. Some other studies have already 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). A look at the hedge fund industry, which typically combines asymmetric performance fees with personal stakes by the fund manager, might prove beneficial for mutual funds as well.

Furthermore, our results question the absolute benefit of the open-ended fund structure for investors. Even though it gives investors a high degree of flexibility at the same time it imposes

costs in the form of lower performance. These costs are hard to measure but our results suggest they might be economically significant. Two conclusions emerge from this. First, funds need to invest more of their resources in measures that allow more efficient handling of fund flows including tools for managing large liquidity-driven orders. Second, it might be sensible to develop fund shares with restricted liquidity for the benefit of long-term profits. As mutual funds are more and more competing with life-insurance policies and similar long-term products for retirement saving, investors might not require the daily liquidity feature. Lockup periods and redemption notice periods can be used as well as a closing of the fund once it reaches its capacity constraints.

Moreover, our study does not directly address the risk associated with the liquidity service of open-ended funds. As investment strategies become more focused and new asset classes are packaged into open-end fund structures, these risks can be severe if the liquidity of fund shares does not match the liquidity of the underlying assets. For example, some German open-ended real-estate funds had to be closed at the end of 2005 in response to heavy outflows. The liquidity of the fund shares was much higher than the liquidity of the underlying real-estate assets. The same can happen when the liquidity of initially liquid markets dries up as a result of a market crash which happened to asset-backed-security funds at the end of 2007. One possible way to shelter the fund from extreme flows, while at the same time preserving daily liquidity, is an exchange listing of fund shares. However, as long as standard creation and redemption mechanisms still exist, the net surplus or deficit in demand during one trading day must be traded directly with the mutual fund company. Consequently, net daily fund flow is not reduced compared with the case without exchange trading. Thus, exchange trading in combination with restrictions of creation and redemption might be necessary to efficiently shelter the fund from excessive flows. However, in this case, it cannot be guaranteed that the fund shares trade close to their NAV at all times. Fund investors with an immediate demand for liquidity services bear the cost of this liquidity by themselves if they sell (buy) fund shares at the exchange below (above) their current NAV. Under the current regulatory environment without a significant volume of exchange trading of mutual fund shares, these costs are spread among all fund investors (Zitzewitz 2006). Finally, our results provide an explanation for the trend to separate alpha and beta sources.[35] Mutual funds are supposed to deliver both, a diversified exposure to market risk and at the same time to add some alpha. Eventually, 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 alpha at hedge funds that are more flexible to generate diversified market exposure through low-cost products such as index funds and exchange traded funds.

[35]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 on 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. [36] 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 keep 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 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 1. 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.

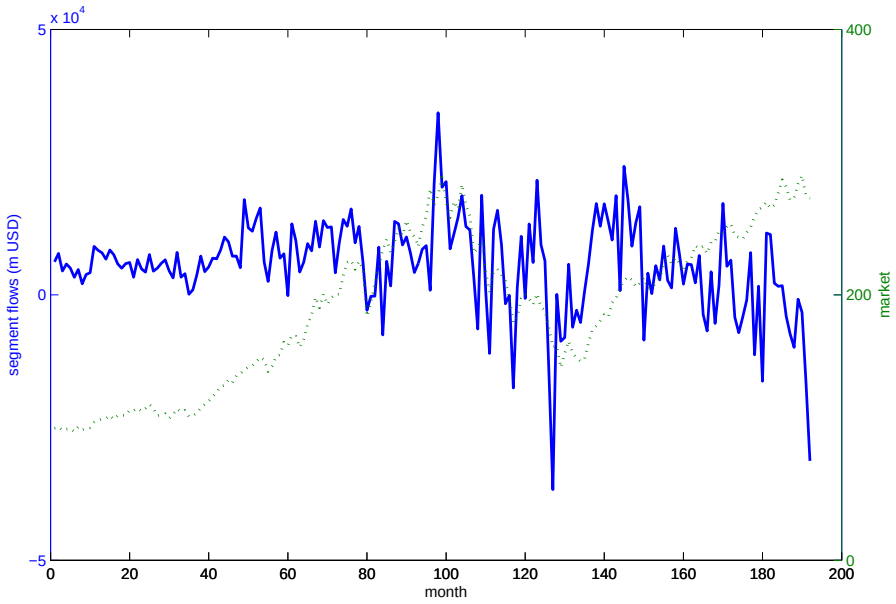
[Please insert **table 1** about here]

[36] 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 months 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

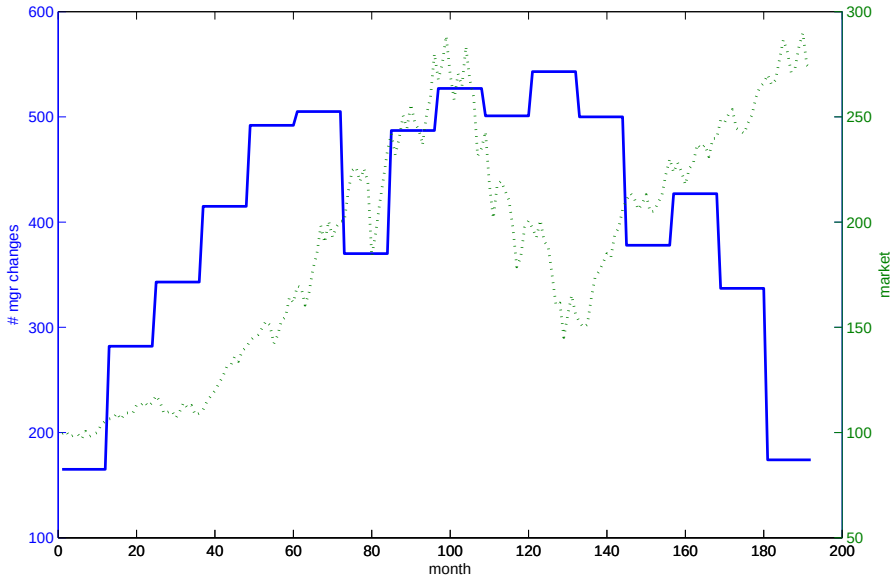


Figure 2: Average alphas for loser funds and loser fund subgroups

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.

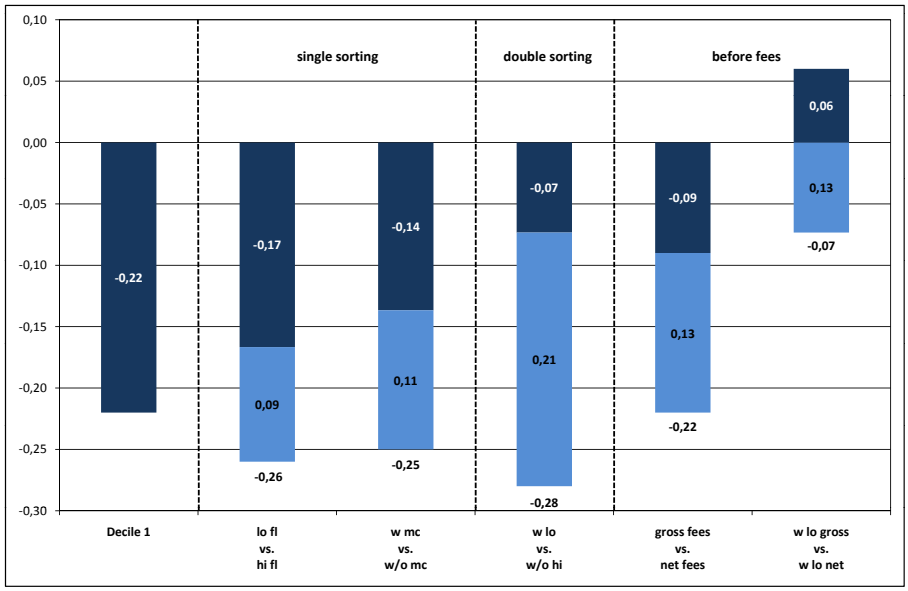


Figure 3: Average alphas for winner funds and winner fund subgroups

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.

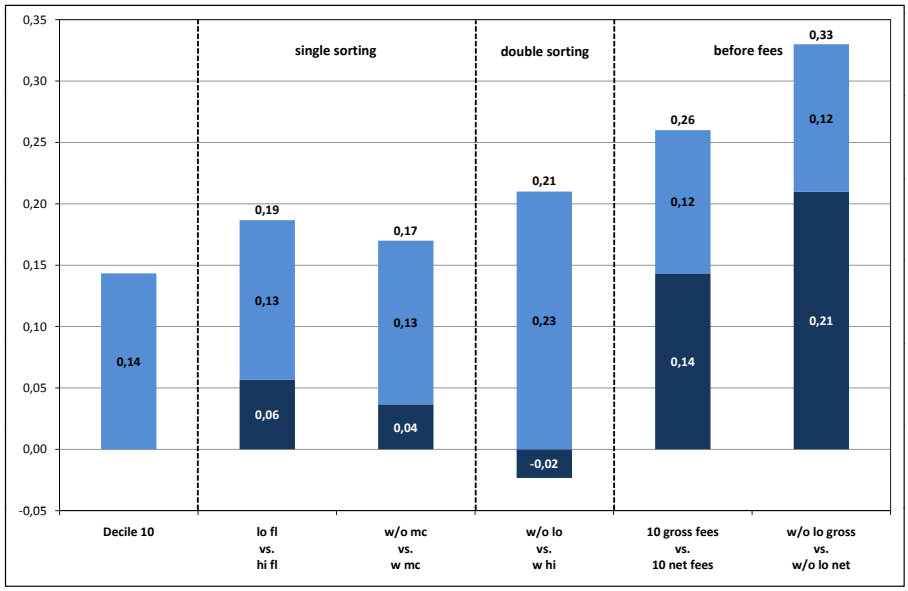


Table 1: Classification of investment objectives

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 that 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.

Table 2: Descriptive Statistics of fund sample

This table presents descriptive statistics for 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 gives the number of months in the respective period. The second row gives monthly (arithmetic) mean excess raw returns in percent. The third row gives average fees. The fourth row gives the mean fund size in million U. S. Dollar. The fifth row gives monthly mean absolute fund flows in million U. S. Dollar. The sixths row gives the number of funds in existence. The seventh row gives 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 3: Descriptive statistics of decile portfolios (12 months)

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 column reports the number of manager changes per fund; columns two and three report the mean and median of fund size (in m USD), respectively; columns four and five report the mean and median of absolute fund flows (in m USD), respectively; columns six and seven report the mean and median of relative fund flows, respectively; and column eight reports the average fees (in percent). ***, ** 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.

(a) Sorting based on returns

	mc/funds	size		absolute flows		relative flows		fees
		mean	median	mean	median	mean	median	mean
1 (loser)	0.21	461.84	77.27	−5.19	−0.55	0.02	−0.01	2.00
2	0.23	838.24	129.60	−8.56	−0.64	0.00	−0.01	1.71
3	0.21	898.82	144.50	−4.72	−0.39	0.04	−0.01	1.63
4	0.20	1,128.40	160.65	−3.48	−0.29	0.03	−0.00	1.57
5	0.20	1,137.85	172.70	0.61	−0.08	0.01	−0.00	1.54
6	0.20	1,283.33	182.70	2.56	−0.01	0.08	−0.00	1.52
7	0.19	1,139.48	195.20	4.01	0.05	0.01	0.00	1.55
8	0.18	1,196.28	196.04	7.84	0.20	0.02	0.00	1.56
9	0.19	1,282.99	193.95	13.17	0.59	0.55	0.01	1.57
10 (winner)	0.22	1,029.92	217.65	17.22	1.20	0.04	0.01	1.69
10 − 1	–	568.08***	140.37***	22.41***	1.75***	0.02*	0.02***	−0.31***

(b) Sorting based on Bayesian four-factor alphas

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

Table 4: Returns of decile portfolios (12 months)

This table presents the raw returns (in excess of the rate on the risk-free asset) 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 the standard deviation, respectively, of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*portfolio* approach); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, of the panel of the monthly returns of all funds that belong to the respective decile portfolio (*panel* approach). ***, ** 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.

(a) Sorting based on returns

	portfolio		panel			
	mean	std	mean	median	perc_{10}	perc_{90}
1 (loser)	0.28	5.22	0.17	0.45	−7.21	7.25
2	0.42	4.32	0.30	0.56	−5.80	6.17
3	0.47	4.03	0.38	0.62	−5.40	5.87
4	0.46	3.95	0.36	0.66	−5.32	5.77
5	0.50	3.84	0.40	0.69	−5.07	5.67
6	0.56	3.78	0.46	0.76	−4.93	5.69
7	0.65	3.89	0.57	0.79	−4.91	5.81
8	0.71	4.07	0.62	0.89	−5.02	6.11
9	1.02	5.56	1.00	0.90	−5.27	6.38
10 (winner)	0.83	5.58	0.75	0.89	−6.28	7.34
10 − 1	0.55	5.19	0.57^{***}	0.45^{***}	–	–

(b) Sorting based on Bayesian four-factor alphas

	portfolio		panel			
	mean	std	mean	median	perc_{10}	perc_{90}
1 (loser)	0.45	4.20	0.36	0.64	−6.08	6.54
2	0.52	4.11	0.42	0.66	−5.63	6.19
3	0.49	3.96	0.40	0.67	−5.33	5.92
4	0.53	3.89	0.44	0.68	−5.14	5.93
5	0.57	3.95	0.48	0.73	−5.10	5.86
6	0.53	3.82	0.45	0.70	−5.04	5.77
7	0.52	3.87	0.42	0.70	−5.16	5.87
8	0.59	4.02	0.49	0.74	−5.31	6.09
9	0.94	5.56	0.90	0.79	−5.61	6.50
10 (winner)	0.77	5.31	0.67	0.85	−6.14	7.07
10 − 1	0.32	3.19	0.30^{***}	0.21^{***}	–	–

Table 5: Four-factor alphas of decile portfolios (12 months

This table presents the performance based on a Carhart (1997) four-factor model 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 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); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, 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. For the concatenated time series (first column) we compute inferences using a conventional t-test on the regression coefficients of an OLS regression with White's heteroscedasticity-consistent standard errors. For the time series portfolio Bayesian alphas (second column) we apply a t-test on the time series of the portfolio alphas. For the means of the panel of Bayesian alphas (third column) we apply a conventional t-test to the individual fund alphas of each decile portfolio and a two-sample t-test to the spread portfolios. For the medians of the panel (fourth column) we apply a Wilcoxon signed rank test to the individual fund alphas of each decile portfolio and a Mann-Whitney U-test to the spread portfolios.

(a) Sorting based on returns

	concatenated	portfolio	panel			
	α^{OLS}	α^B mean	α^B mean	α^B median	α^B perc$_{10}$	α^B perc$_{90}$
1 (loser)	-0.08	-0.34	-0.37	-0.35^{***}	-5.43	4.75
2	-0.08	-0.21	-0.25	-0.29^{***}	-3.63	3.21
3	-0.08	-0.15	-0.16	-0.24^{***}	-3.14	2.87
4	-0.14^{*}	-0.17^{**}	-0.18^{**}	-0.23^{***}	-2.87	2.62
5	-0.10^{**}	-0.10^{*}	-0.12^{*}	-0.17^{***}	-2.67	2.46
6	-0.09^{**}	-0.04	-0.05	-0.11^{***}	-2.54	2.45
7	-0.08^{**}	0.05	0.06	-0.05^{**}	-2.60	2.65
8	-0.05	0.11	0.12	0.01^{***}	-2.65	2.84
9	0.16	0.17	0.18	0.10^{***}	-2.98	3.27
10 (winner)	-0.11	0.23	0.25	0.15^{***}	-4.38	4.56
$10-1$	-0.02	0.56	0.62^{***}	0.51^{***}	–	–

(b) Sorting based on Bayesian four-factor alphas

	concatenated	portfolio	panel			
	α^{OLS}	α^B mean	α^B mean	α^B median	α^B perc$_{10}$	α^B perc$_{90}$
1 (loser)	-0.24^{**}	-0.21^{**}	-0.21^{**}	-0.19^{***}	-3.95	3.49
2	-0.16^{*}	-0.11	-0.11	-0.15^{***}	-3.28	3.13
3	-0.14^{**}	-0.13^{**}	-0.14^{**}	-0.15^{***}	-3.10	2.84
4	-0.11^{*}	-0.08	-0.08	-0.13^{***}	-2.97	2.83
5	-0.09^{*}	-0.05	-0.05	-0.11^{***}	-2.92	2.79
6	-0.10^{**}	-0.08^{*}	-0.08^{*}	-0.13^{***}	-2.89	2.75
7	-0.11^{*}	-0.08	-0.08	-0.14^{***}	-2.98	2.87
8	-0.05	0.00	-0.00	-0.10^{***}	-3.10	3.11
9	0.24	0.08	0.08	-0.07^{**}	-3.20	3.33
10 (winner)	0.07	0.18	0.18	0.01^{***}	-3.68	4.10
$10-1$	0.31^{*}	0.39	0.39^{***}	0.20^{***}	–	–

Table 6: Returns of subgroups based on fund flows (12 months)

This table presents the raw returns (in excess of the rate on the risk-free asset) for the following pairs of portfolios and the resulting spread portfolios: decile portfolio 10 (winner) and 1 (loser), decile 1 funds with lower than median fund flows (1 lo fl) and with higher than median fund flows (1 hi fl), decile 10 funds with lower than median fund flows (10 lo fl) and with higher than median fund flows (10 hi fl). The first two columns report the mean and the standard deviation, respectively, of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*portfolio* approach); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, of the panel of the monthly returns of all funds that belong to the respective decile portfolio (*panel* approach). ***, ** 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.

(a) Sorting based on returns

	portfolio		panel			
	mean	std	mean	median	perc_{10}	perc_{90}
10 (winner)	0.83	5.58	0.75	0.89	−6.28	7.34
1 (loser)	0.28	5.22	0.17	0.45	−7.21	7.25
10 − 1	0.55	5.19	0.57***	0.45***	–	–
1 lo fl	0.33	5.00	0.24	0.42	−6.94	7.21
1 hi fl	0.25	5.46	0.14	0.49	−7.30	7.29
1 lo fl − 1 hi fl	0.09	1.05	0.10	−0.07***	–	–
10 lo fl	0.85	5.48	0.75	0.90	−6.16	7.16
10 hi fl	0.78	5.70	0.69	0.88	−6.39	7.41
10 lo fl − 10 hi fl	0.07	0.71	0.06	0.02***	–	–

(b) Sorting based on Bayesian four-factor alphas

	portfolio		panel			
	mean	std	mean	median	perc_{10}	perc_{90}
10 (winner)	0.77	5.31	0.67	0.85	−6.14	7.07
1 (loser)	0.45	4.20	0.36	0.64	−6.08	6.54
10 − 1	0.32	3.19	0.30***	0.21***	–	–
1 lo fl	0.50	4.03	0.43	0.66	−5.86	6.53
1 hi fl	0.41	4.37	0.32	0.63	−6.24	6.51
1 lo fl − 1 hi fl	0.08	0.87	0.11*	0.03***	–	–
10 lo fl	0.81	5.01	0.70	0.86	−5.96	6.92
10 hi fl	0.69	5.56	0.59	0.83	−6.25	7.07
10 lo fl − 10 hi fl	0.12*	0.93	0.11	0.03***	–	–

Table 7: Four-factor Bayesian alphas of subgroups based on fund flows (12 months)

This table presents the performance based on a Carhart (1997) four-factor model for the following pairs of portfolios and the resulting spread portfolios: decile portfolio 10 (winner) and 1 (loser), decile 1 funds with lower than median fund flows (1 lo fl) and with higher than median fund flows (1 hi fl), decile 10 funds with lower than median fund flows (10 lo fl) and with higher than median fund flows (10 hi fl). 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); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, 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. For the concatenated time series (first column) we compute inferences using a conventional t-test on the regression coefficients of an OLS regression with White's heteroscedasticity-consistent standard errors. For the time series portfolio Bayesian alphas (second column) we apply a t-test on the time series of the portfolio alphas. For the means of the panel of Bayesian alphas (third column) we apply a conventional t-test to the individual fund alphas of each decile portfolio and a two-sample t-test to the spread portfolios. For the medians of the panel (fourth column) we apply a Wilcoxon signed rank test to the individual fund alphas of each decile portfolio and a Mann-Whitney U-test to the spread portfolios.

(a) Sorting based on returns

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc_{10}	α^{B} perc_{90}
10 (winner)	-0.11	0.23	0.25	0.15^{***}	-4.38	4.56
1 (loser)	-0.08	-0.34	-0.37	-0.35^{***}	-5.43	4.75
10 − 1	-0.02	0.56	0.62^{***}	0.51^{***}	–	–
1 lo fl	-0.09	-0.27	-0.30	-0.32^{***}	-5.15	4.68
1 hi fl	-0.07	-0.39^{*}	-0.42^{*}	-0.39^{***}	-5.63	4.84
1 lo fl − 1 hi fl	-0.03	0.12	0.13^{**}	0.07^{***}	–	–
10 lo fl	-0.10	0.25	0.27	0.16^{***}	-4.29	4.49
10 hi fl	-0.15	0.16	0.18	0.13^{***}	-4.52	4.57
10 lo fl − 10 hi fl	0.05	0.09	0.09	0.03^{***}	–	–

(b) Sorting based on Bayesian four-factor alphas

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc_{10}	α^{B} perc_{90}
10 (winner)	0.07	0.18	0.18	0.01^{***}	-3.68	4.10
1 (loser)	-0.24^{**}	-0.21^{**}	-0.21^{**}	-0.19^{***}	-3.95	3.49
10 − 1	0.31^{*}	0.39	0.39^{***}	0.20^{***}	–	–
1 lo fl	-0.21^{**}	-0.15	-0.14	-0.15^{***}	-3.92	3.71
1 hi fl	-0.27^{**}	-0.25^{**}	-0.26^{**}	-0.23^{***}	-3.93	3.25
1 lo fl − 1 hi fl	0.06	0.09	0.12^{***}	0.08^{***}	–	–
10 lo fl	0.13	0.22	0.21	0.02^{***}	-3.52	3.98
10 hi fl	-0.03	0.10	0.10	-0.02	-3.85	4.10
10 lo fl − 10 hi fl	0.15^{***}	0.12	0.12^{**}	0.04^{***}	–	–

Table 8: Four-factor Bayesian alphas of subgroups based on fund flows (12 months)

This table presents in panel (a) Carhart (1997) four-factor alphas for the following pairs of portfolios and the resulting spread portfolios: decile portfolio 10 (winner) and 1 (loser), decile 1 funds with lower than median fund flows (1 lo fl) and with higher than median fund flows (1 hi fl), decile 10 funds with lower than median fund flows (10 lo fl) and with higher than median fund flows (10 hi fl). Panel (b) reports the corresponding results for quintile portfolios instead of decile portfolios and panel (c) reports the corresponding results for decile portfolios gross of management fees. The sorting is based on Bayesian four-factor alphas over the previous year. 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); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, 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.

(a) Deciles, after fees

	concatenated	portfolio	panel			
	α^{OLS}	α^B mean	α^B mean	α^B median	α^B perc$_{10}$	α^B perc$_{90}$
10 (winner)	0.07	0.18	0.18	0.01^{***}	-3.68	4.10
1 (loser)	-0.24^{**}	-0.21^{**}	-0.21^{**}	-0.19^{***}	-3.95	3.49
10 − 1	0.31^{*}	0.39	0.39^{***}	0.20^{***}	–	–
1 lo fl	-0.21^{**}	-0.15	-0.14	-0.15^{***}	-3.92	3.71
1 hi fl	-0.27^{**}	-0.25^{**}	-0.26^{**}	-0.23^{***}	-3.93	3.25
1 lo fl − 1 hi fl	0.06	0.09	0.12^{***}	0.08^{***}	–	–
10 lo fl	0.13	0.22	0.21	0.02^{***}	-3.52	3.98
10 hi fl	-0.03	0.10	0.10	-0.02	-3.85	4.10
10 lo fl − 10 hi fl	0.15^{***}	0.12	0.12^{**}	0.04^{***}	–	–

(b) Quintiles, after fees

	concatenated	portfolio	panel			
	α^{OLS}	α^B mean	α^B mean	α^B median	α^B perc$_{10}$	α^B perc$_{90}$
Q5 (winner)	0.15	0.13	0.13	-0.03	-3.44	3.74
Q1 (loser)	-0.20^{**}	-0.16^{*}	-0.16^{*}	-0.17^{***}	-3.60	3.31
Q5 − Q1	0.35^{**}	0.29	0.29^{***}	0.14^{***}	–	–
Q1 lo fl	-0.20^{**}	-0.12	-0.11	-0.14^{***}	-3.66	3.53
Q1 hi fl	-0.21^{**}	-0.19^{**}	-0.20^{**}	-0.20^{***}	-3.54	3.08
Q1 lo fl − Q1 hi fl	0.01	0.07	0.09^{***}	0.05^{***}	–	–
Q5 lo fl	0.34	0.19^{*}	0.19^{*}	-0.03	-3.22	3.63
Q5 hi fl	-0.04	0.05	0.05	-0.05	-3.63	3.75
Q5 lo fl − Q5 hi fl	0.37	0.14	0.14^{***}	0.02^{***}	–	–

(c) Deciles, before fees

	concatenated	portfolio	panel			
	α^{OLS}	α^B mean	α^B mean	α^B median	α^B perc$_{10}$	α^B perc$_{90}$
10 (winner)	0.19	0.29	0.30	0.12^{***}	-3.61	4.29
1 (loser)	-0.11	-0.08	-0.08	-0.07^{***}	-3.75	3.58
10 − 1	0.30	0.38	0.38^{***}	0.19^{***}	–	–
1 lo fl	-0.09	-0.03	-0.01	-0.03	-3.78	3.82
1 hi fl	-0.13	-0.12	-0.13	-0.10^{***}	-3.66	3.31
1 lo fl − 1 hi fl	0.04	0.09	0.12^{***}	0.07^{***}	–	–
10 lo fl	0.24^{**}	0.34^{**}	0.34^{**}	0.13^{***}	-3.46	4.17
10 hi fl	0.09	0.21	0.21	0.09^{***}	-3.76	4.25
10 lo fl − 10 hi fl	0.16^{***}	0.13^{*}	0.13^{**}	0.04^{***}	–	–

Table 9: Returns of subgroups based on managerial turnover (12 months)

This table presents the raw returns (in excess of the rate on the risk-free asset) for the following pairs of portfolios and the resulting spread portfolios: decile portfolio 10 (winner) and 1 (loser), decile 1 funds with manager change (1 w mc) and without manager change (1 w/o mc), decile 10 funds without manager change (10 w/o mc) and with manager change (10 w mc). The first two columns report the mean and the standard deviation, respectively, of a concatenated time series of decile portfolio returns following the methodology of Carhart (1997) (*portfolio* approach); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, of the panel of the monthly returns of all funds that belong to the respective decile portfolio (*panel* approach). ***, ** 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.

(a) Sorting based on returns

	portfolio		panel			
	mean	std	mean	median	perc_{10}	perc_{90}
10 (winner)	0.83	5.58	0.75	0.89	−6.28	7.34
1 (loser)	0.28	5.22	0.17	0.45	−7.21	7.25
10 − 1	0.55	5.19	0.57***	0.45***	–	–
1 w mc	0.36	5.33	0.28	0.61	−7.38	7.90
1 w/o mc	0.27	5.19	0.15	0.40	−7.16	7.08
1 w − 1 w/o	0.09*	0.63	0.14	0.20***	–	–
10 w/o mc	0.83	5.55	0.75	0.89	−6.19	7.27
10 w mc	0.88	5.75	0.73	0.91	−6.73	7.60
10 w/o − 10 w	−0.05	0.72	0.02	−0.02***	–	–

(b) Sorting based on Bayesian four-factor alphas

	portfolio		panel			
	mean	std	mean	median	perc_{10}	perc_{90}
10 (winner)	0.77	5.31	0.67	0.85	−6.14	7.07
1 (loser)	0.45	4.20	0.36	0.64	−6.08	6.54
10 − 1	0.32	3.19	0.30***	0.21***	–	–
1 w mc	0.52	4.32	0.49	0.77	−6.19	6.98
1 w/o mc	0.42	4.17	0.33	0.61	−6.06	6.43
1 w − 1 w/o	0.10***	0.53	0.15**	0.16***	–	–
10 w/o mc	0.79	5.25	0.69	0.86	−5.99	7.00
10 w mc	0.70	5.55	0.56	0.82	−6.76	7.38
10 w/o − 10 w	0.09*	0.65	0.13	0.04***	–	–

Table 10: Four-factor Bayesian alphas of subgroups based on managerial turnover (12 months)

This table presents the performance based on a Carhart (1997) four-factor model for the following pairs of portfolios and the resulting spread portfolios: decile portfolio 10 (winner) and 1 (loser), decile 1 funds with manager change (1 w mc) and without manager change (1 w/o mc), decile 10 funds without manager change (10 w/o mc) and with manager change (10 w mc). 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); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, 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. For the concatenated time series (first column) we compute inferences using a conventional t-test on the regression coefficients of an OLS regression with White's heteroscedasticity-consistent standard errors. For the time series portfolio Bayesian alphas (second column) we apply a t-test on the time series of the portfolio alphas. For the means of the panel of Bayesian alphas (third column) we apply a conventional t-test to the individual fund alphas of each decile portfolio and a two-sample t-test to the spread portfolios. For the medians of the panel (fourth column) we apply a Wilcoxon signed rank test to the individual fund alphas of each decile portfolio and a Mann-Whitney U-test to the spread portfolios.

(a) Sorting based on returns

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc_{10}	α^{B} perc_{90}
10 (winner)	−0.11	0.23	0.25	0.15***	−4.38	4.56
1 (loser)	−0.08	−0.34	−0.37	−0.35***	−5.43	4.75
10 − 1	−0.02	0.56	0.62***	0.51***	–	–
1 w mc	−0.03	−0.26	−0.34	−0.34***	−5.29	4.95
1 w/o mc	−0.09	−0.35*	−0.38*	−0.36***	−5.46	4.70
1 w − 1 w/o	0.06	0.09*	0.05	0.02***	–	–
10 w/o mc	−0.11	0.22	0.25	0.15***	−4.31	4.53
10 w mc	−0.09	0.24	0.23	0.16***	−4.65	4.68
10 w/o − 10 w	−0.02	−0.01	0.03	−0.01***	–	–

(b) Sorting based on Bayesian four-factor alphas

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc_{10}	α^{B} perc_{90}
10 (winner)	0.07	0.18	0.18	0.01***	−3.68	4.10
1 (loser)	−0.24**	−0.21**	−0.21**	−0.19***	−3.95	3.49
10 − 1	0.31*	0.39	0.39***	0.20***	–	–
1 w mc	−0.19	−0.12	−0.10	−0.17***	−3.77	3.69
1 w/o mc	−0.26**	−0.24**	−0.24**	−0.20***	−4.01	3.45
1 w − 1 w/o	0.08*	0.11***	0.14***	0.03***	–	–
10 w/o mc	0.10	0.20	0.21	0.03***	−3.59	4.09
10 w mc	−0.02	0.09	0.04	−0.08*	−4.10	4.19
10 w/o − 10 w	0.12**	0.11**	0.17**	0.12***	–	–

Table 11: Four-factor Bayesian alphas of subgroups based on managerial turnover (12 months)

This table presents in panel (a) Carhart (1997) four-factor alphas for the following pairs of portfolios and the resulting spread portfolios: decile portfolio 10 (winner) and 1 (loser), decile 1 funds with manager change (1 w mc) and without manager change (1 w/o mc), decile 10 funds without manager change (10 w/o mc) and with manager change (10 w mc). Panel (b) reports the corresponding results for quintile portfolios instead of decile portfolios and panel (c) reports the corresponding results for decile portfolios gross of management fees. The sorting is based on Bayesian four-factor alphas over the previous year. 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); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, 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.

(a) Deciles, after fees

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc$_{10}$	α^{B} perc$_{90}$
10 (winner)	0.07	0.18	0.18	0.01***	−3.68	4.10
1 (loser)	−0.24**	−0.21**	−0.21**	−0.19***	−3.95	3.49
10 − 1	0.31*	0.39	0.39***	0.20***	–	–
1 w mc	−0.19	−0.12	−0.10	−0.17***	−3.77	3.69
1 w/o mc	−0.26**	−0.24**	−0.24**	−0.20***	−4.01	3.45
1 w − 1 w/o	0.08*	0.11***	0.14***	0.03***	–	–
10 w/o mc	0.10	0.20	0.21	0.03***	−3.59	4.09
10 w mc	−0.02	0.09	0.04	−0.08*	−4.10	4.19
10 w/o − 10 w	0.12**	0.11**	0.17**	0.12***	–	–

(b) Quintiles, after fees

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc$_{10}$	α^{B} perc$_{90}$
Q5 (winner)	0.15	0.13	0.13	−0.03	−3.44	3.74
Q1 (loser)	−0.20**	−0.16*	−0.16*	−0.17***	−3.60	3.31
Q5 − Q1	0.35**	0.29	0.29***	0.14***	–	–
Q1 w mc	−0.13	−0.08	−0.07	−0.13***	−3.46	3.42
Q1 w/o mc	−0.22**	−0.18**	−0.18**	−0.18***	−3.65	3.28
Q1 w − Q1 w/o	0.08**	0.10***	0.12***	0.05***	–	–
Q5 w/o mc	0.19	0.15	0.15	−0.02**	−3.36	3.70
Q5 w mc	−0.02	0.07	0.03	−0.10***	−3.77	3.86
Q5 w/o − Q5 w	0.21	0.08	0.12***	0.08***	–	–

(c) Deciles, before fees

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc$_{10}$	α^{B} perc$_{90}$
10 (winner)	0.19	0.29	0.30	0.12***	−3.61	4.29
1 (loser)	−0.11	−0.08	−0.08	−0.07***	−3.75	3.58
10 − 1	0.30	0.38	0.38***	0.19***	–	–
1 w mc	−0.06	0.00	0.02	−0.04	−3.58	3.73
1 w/o mc	−0.13	−0.11	−0.11	−0.08***	−3.80	3.54
1 w − 1 w/o	0.08*	0.11***	0.14***	0.04***	–	–
10 w/o mc	0.21*	0.32*	0.33*	0.15***	−3.51	4.26
10 w mc	0.10	0.23	0.18	0.03*	−3.97	4.43
10 w/o − 10 w	0.11**	0.09*	0.15**	0.12***	–	–

Table 12: Overlap 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 (lo fl) and high fund flow (hi fl) subgroup and in the manager change (w mc) and no manager change (w/o mc) subgroup, respectively, based on the total number of fund months on our sample. Ranking into deciles is based on Bayesian four-factor alphas during the previous year.

Share of funds in subgroups

	(a) decile 10 funds				(b) decile 1 funds		
	10 w mc	10 w/o mc	sum		1 w mc	1 w/o mc	sum
10 lo fl	10.07	39.79	49.86	1 lo fl	11.86	37.99	49.85
10 hi fl	10.03	40.10	50.14	1 hi fl	10.14	40.01	50.15
sum	20.11	79.89	100.00	sum	22.00	78.00	100.00

Table 13: Four-factor Bayesian alphas of subgroups based on a double sorting (12 months)

This table presents in panel (a) Carhart (1997) four-factor alphas for subgroups of decile 10 (winner) and decile 1 (loser) funds based on a double sorting on managerial turnover and fund flows: without manager change and higher than median fund flows (w/o hi), without manager change and lower than median fund flows (w/o lo), with manager change and higher than median fund flows (w hi), and with manager change and lower than median fund flows (w lo). Panel (b) reports the corresponding results for quintile portfolios instead of decile portfolios and panel (c) reports the corresponding results for decile portfolios gross of management fees. The sorting is based on Bayesian four-factor alphas over the previous year. 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); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, 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.

(a) Deciles, after fees

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc_{10}	α^{B} perc_{90}
1 w/o hi	-0.28^{**}	-0.28^{***}	-0.28^{***}	-0.23^{***}	-3.97	3.18
1 w/o lo	-0.24^{**}	-0.18^{*}	-0.17^{*}	-0.16^{***}	-3.99	3.65
1 w hi	-0.24^{*}	-0.16	-0.16	-0.22^{***}	-3.71	3.46
1 w lo	-0.11	-0.07	-0.04	-0.13^{**}	-3.81	3.90
10 w hi	-0.12	0.03	0.02	-0.13^{*}	-4.15	4.14
10 w lo	0.08	0.15	0.06	-0.05	-4.08	4.25
10 w/o hi	0.01	0.12	0.12	0.01	-3.77	4.09
10 w/o lo	0.14	0.24	0.25	0.04^{***}	-3.39	3.95

(b) Quintiles, after fees

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc_{10}	α^{B} perc_{90}
Q1 w/o hi	-0.21^{**}	-0.20^{**}	-0.21^{**}	-0.20^{***}	-3.56	3.05
Q1 w/o lo	-0.24^{**}	-0.16^{*}	-0.16^{*}	-0.17^{***}	-3.75	3.49
Q1 w hi	-0.19^{*}	-0.15^{*}	-0.17^{*}	-0.18^{***}	-3.47	3.22
Q1 w lo	-0.08	-0.00	0.03	-0.08^{*}	-3.43	3.66
Q5 w hi	-0.14	-0.03	-0.04	-0.15^{***}	-3.88	3.79
Q5 w lo	0.09	0.16	0.09	-0.06	-3.65	3.92
Q5 w/o hi	-0.01	0.08	0.07	-0.03	-3.56	3.74
Q5 w/o lo	0.38	0.21^{*}	0.21^{*}	-0.02^{**}	-3.13	3.59

(c) Deciles, before fees

	concatenated	portfolio	panel			
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median	α^{B} perc_{10}	α^{B} perc_{90}
1 w/o hi	-0.13	-0.14	-0.15	-0.10^{***}	-3.71	3.26
1 w/o lo	-0.13	-0.06	-0.05	-0.04^{*}	-3.83	3.75
1 w hi	-0.13	-0.05	-0.05	-0.09	-3.47	3.47
1 w lo	0.03	0.06	0.09	0.02	-3.65	3.95
10 w hi	-0.00	0.16	0.14	-0.03	-4.04	4.41
10 w lo	0.21	0.29	0.21	0.07^{*}	-3.96	4.47
10 w/o hi	0.12	0.23	0.23	0.12^{***}	-3.70	4.23
10 w/o lo	0.26^{***}	0.36^{**}	0.37^{**}	0.15^{***}	-3.33	4.12

Table 14: Four-factor Bayesian alphas of spread portfolios of loser fund subgroups based on a double sorting (12 months)

This table presents in panel (a) Carhart (1997) four-factor alphas for spread portfolios of decile 1 (loser) funds based on a double sorting on managerial turnover and fund flows: without manager change and higher than median fund flows (w/o hi), without manager change and lower than median fund flows (w/o lo), with manager change and higher than median fund flows (w hi), and with manager change and lower than median fund flows (w lo). Panel (b) reports the corresponding results for quintile portfolios instead of decile portfolios and panel (c) reports the corresponding results for decile portfolios gross of management fees. The sorting is based on Bayesian four-factor alphas over the previous year. 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); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, 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.

(a) Deciles, after fees

	concatenated	portfolio	panel	
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median
1 w/o hi − 1 w/o lo	−0.04	−0.10	−0.12**	−0.07***
1 w/o hi − 1 w hi	−0.04	−0.12**	−0.12*	−0.01***
1 w/o hi − 1 w lo	−0.17**	−0.21***	−0.24***	−0.10***
1 w/o lo − 1 w hi	0.00	−0.02	−0.01	0.06***
1 w/o lo − 1 w lo	−0.13**	−0.10	−0.13*	−0.04***
1 w hi − 1 w lo	−0.13	−0.09	−0.12	−0.09***

(b) Quintiles, after fees

	concatenated	portfolio	panel	
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median
Q1 w/o hi − Q1 w/o lo	0.03	−0.05	−0.06*	−0.03***
Q1 w/o hi − Q1 w hi	−0.02	−0.05	−0.04	−0.02***
Q1 w/o hi − Q1 w lo	−0.13**	−0.20***	−0.24***	−0.12***
Q1 w/o lo − Q1 w hi	−0.05	−0.00	0.01	0.01***
Q1 w/o lo − Q1 w lo	−0.15***	−0.15***	−0.18***	−0.09***
Q1 w hi − Q1 w lo	−0.10*	−0.15**	−0.19***	−0.10***

(c) Deciles, before fees

	concatenated	portfolio	panel	
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median
1 w/o hi − 1 w/o lo	−0.01	−0.08	−0.10**	−0.06***
1 w/o hi − 1 w hi	−0.00	−0.09*	−0.10	−0.01***
1 w/o hi − 1 w lo	−0.17**	−0.20***	−0.24***	−0.12***
1 w/o lo − 1 w hi	0.01	−0.01	−0.00	0.04***
1 w/o lo − 1 w lo	−0.16**	−0.12*	−0.14**	−0.06***
1 w hi − 1 w lo	−0.16**	−0.11	−0.14	−0.10***

Table 15: Four-factor Bayesian alphas of spread portfolios of winner fund subgroups based on a double sorting (12 months)

This table presents in panel (a) Carhart (1997) four-factor alphas for spread portfolios of decile 10 (winner) funds based on a double sorting on managerial turnover and fund flows: without manager change and higher than median fund flows (w/o hi), without manager change and lower than median fund flows (w/o lo), with manager change and higher than median fund flows (w hi), and with manager change and lower than median fund flows (w lo). Panel (b) reports the corresponding results for quintile portfolios instead of decile portfolios and panel (c) reports the corresponding results for decile portfolios gross of management fees. The sorting is based on Bayesian four-factor alphas over the previous year. 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); columns three to six report the mean, median, 10 percent quantile and 90 percent quantile, respectively, 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.

(a) Deciles, after fees

	concatenated	portfolio	panel	
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median
10 w/o lo − 10 w/o hi	0.14^{**}	0.12	0.13^{**}	0.04^{***}
10 w/o lo − 10 w lo	0.06	0.09	0.19^{*}	0.10^{***}
10 w/o lo − 10 w hi	0.26^{***}	0.22^{**}	0.23^{**}	0.18^{***}
10 w/o hi − 10 w lo	−0.07	−0.03	0.05	0.06^{***}
10 w/o hi − 10 w hi	0.13^{*}	0.09	0.10	0.14^{***}
10 w lo − 10 w hi	0.20^{**}	0.13	0.05	0.08^{***}

(b) Quintiles, after fees

	concatenated	portfolio	panel	
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median
Q5 w/o lo − Q5 w/o hi	0.39	0.13	0.14^{***}	0.00^{***}
Q5 w/o lo − Q5 w lo	0.29	0.05	0.12	0.03^{***}
Q5 w/o lo − Q5 w hi	0.51^{*}	0.23^{*}	0.25^{***}	0.13^{***}
Q5 w/o hi − Q5 w lo	-0.10^{*}	−0.08	−0.03	0.03^{***}
Q5 w/o hi − Q5 w hi	0.13^{**}	0.10	0.11^{*}	0.13^{***}
Q5 w lo − Q5 w hi	0.23^{***}	0.18^{*}	0.13	0.10^{***}

(c) Deciles, before fees

	concatenated	portfolio	panel	
	α^{OLS}	α^{B} mean	α^{B} mean	α^{B} median
10 w/o lo − 10 w/o hi	0.14^{**}	0.13	0.14^{**}	0.03^{***}
10 w/o lo − 10 w lo	0.04	0.07	0.16^{*}	0.07^{***}
10 w/o lo − 10 w hi	0.26^{***}	0.20^{**}	0.23^{**}	0.17^{***}
10 w/o hi − 10 w lo	−0.09	−0.06	0.02	0.05^{***}
10 w/o hi − 10 w hi	0.12^{*}	0.07	0.09	0.15^{***}
10 w lo − 10 w hi	0.22^{**}	0.13	0.07	0.10^{***}

Table 16: 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 year and this year. The explanatory variables of model 1 are fund size (m USD), fees (percent), fund age and turnover 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 last 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. Ranking into deciles is based on Bayesian four-factor alphas over the previous year.

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	0.80^{**}	0.01	0.53	0.10	0.55^{*}	0.09	0.58^{*}	0.07
TNA (m USD)	-0.08	0.14	-0.07	0.18	-0.08	0.14	-0.08	0.15
fees (%)	-0.16	0.35	-0.14	0.39	-0.15	0.38	-0.16	0.34
age ($\cdot 100$)	-1.93^{**}	0.03	-1.59^{*}	0.08	-1.58^{*}	0.08	-1.69^{*}	0.06
turnover	0.38^{***}	0.00	0.41^{***}	0.00	0.41^{***}	0.00	0.41^{***}	0.00
dec1_{t-1}	3.25^{***}	0.00	3.18^{***}	0.00	3.18^{***}	0.00	3.17^{***}	0.00
dec10_{t-1}	-3.09^{***}	0.00	-3.26^{***}	0.00	-3.26^{***}	0.00	-3.36^{***}	0.00
flows_{t}	0.59^{***}	0.00	0.52^{***}	0.00	0.52^{***}	0.00	0.53^{***}	0.00
flows_{t-1}	-2.37^{***}	0.00	-1.77^{***}	0.00	-1.77^{***}	0.00	-1.77^{***}	0.00
$\text{flows}_{t-1}\cdot \text{dec10}_{t-1}$	-1.23^{***}	0.00	-0.94^{***}	0.00	-0.94^{***}	0.00	-0.77^{***}	0.00
$\text{flows}_{t-1}\cdot \text{dec1}_{t-1}$	0.08	0.84	0.83^{**}	0.05	0.84^{**}	0.04	1.07^{**}	0.01
mgr_ch_{t-1}	0.48^{*}	0.10	0.48^{*}	0.10	0.14	0.68	0.16	0.63
$\text{mgr\_ch}_{t-1}\cdot \text{dec10}_{t-1}$	-1.13	0.19	-0.98	0.25	-0.96	0.26	1.14	0.31
$\text{mgr\_ch}_{t-1}\cdot \text{dec1}_{t-1}$	0.51	0.58	0.47	0.61	0.48	0.59	-2.86^{**}	0.02
style	–	–	0.62^{**}	0.01	0.60^{**}	0.02	0.59^{**}	0.02
$\text{flows}_{t-1}\cdot$ SC/SEC	–	–	-1.89^{***}	0.00	-1.89^{***}	0.00	-1.90^{***}	0.00
$\text{mgr\_ch}_{t-1}\cdot$ lfam	–	–	–	–	0.89^{*}	0.06	0.84^{*}	0.08
$\text{mgr\_ch}_{t-1}\cdot \text{hi fl}_{t-1}\cdot \text{dec10}_{t-1}$	–	–	–	–	–	–	-4.34^{***}	0.00
$\text{mgr\_ch}_{t-1}\cdot \text{lo fl}_{t-1}\cdot \text{dec1}_{t-1}$	–	–	–	–	–	–	6.05^{***}	0.00
Nobs	21,318	–	21,318	–	21,318	–	21,318	–
R^2	0.05	–	0.05	–	0.05	–	0.05	–