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The Impact and Interaction of Fund Flows and Manager Changes

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Abstract

This paper investigates the reasons for the lack of long-term persistence in the investment performance of actively managed equity mutual funds. We document that the responses of investors, fund managers, and investment management companies to past performance have an important impact on future performance. Conditioning on fund flows and manager changes allows us to predict future performance of both past outperforming (winner) and past underperforming (loser) funds. Recent winner funds, experiencing neither high inflows nor the departure of a skilled fund manager, outperform by 3.60 percentage points based on risk-adjusted returns in the following year, relative to winner funds suffering from both effects. We also find that the performance of the worst performing funds experiencing both the replacement of the fund manager (internal governance) and high outflows (external governance) enjoy a subsequent increase in performance of 2.40 percentage points in the following year, relative to loser funds not experiencing these effects. Among loser funds, in particular, both mechanisms appear to interact strongly.

JEL Classification: G28, G29, G32.
Keywords: Mutual Funds, Performance Persistence, Fund Flows, Manager Turnover.

1 Introduction

It is now widely recognized that equity mutual fund performance does not persist in the long run, although there is evidence for short-run persistence among both winner and loser funds.[2] Berk and Green (2004) argue that, if there are decreasing returns to scale in active management and investors react to past performance, the asset base managed by a portfolio manager adjusts to her individual skill level, driving away previous out- or underperformance. Their model implies that fund flows is one key mechanism that prevents persistent outperformance, but also removes persistent underperformance.

Large money inflows into recent winners usually reduce future performance through transaction costs and distorted trading decisions, as reported by Edelen (1999) and Alexander, Cici and Gibson (2007). However, these studies also report that outflows are as harmful for future performance as inflows, a finding that is incompatible with Berk and Green (2004)'s claim that underperforming funds benefit from withdrawals. Chen et al. (2004) report that small funds outperform large funds, an outcome that is consistent with decreasing returns to scale in fund management. However, they do not relate their results to past fund flows. We extend this analysis and ask whether the response of fund flows to past performance is large enough to explain the mean reversion in performance of both winner and loser funds.

It is not only outside investors who react to past performance. Both the portfolio manager and the investment management company (IMC) might also react: an alternative mechanism to explain mean reversion in fund performance is manager changes (Khorana, 1996, 2001). A successful fund manager can increase her compensation by switching to another fund, while the IMC can replace a poorly performing manager. Dangl, Wu and Zechner (2008) develop a model in which poorly performing managers are subject to both "external governance" from investors withdrawing funds and "internal

[2] See, e.g., Carhart (1997), Bollen and Busse (2005), Huij and Verbeek (2007).

governance" associated with the termination of their contracts. It is important to analyze both mechanisms jointly.

The objective of our research is to investigate how far fund flows and manager changes act as "equilibrating mechanisms" (as defined by Berk and Green, 2004, p. 1271) to explain mean reversion in mutual fund returns and, if so, how both mechanisms interact. We analyze these effects for a CRSP sample of 3,946 actively managed U.S. equity mutual funds over the period from 1992 to 2007. The performance of decile portfolios formed on the basis of past performance is evaluated, concentrating on the winner (top-decile) and loser (bottom-decile) portfolios. These winner and loser portfolios are split into subgroups based on fund flows and manager changes, and we examine the contribution of these alternative equilibrating mechanisms on performance.

We provide empirical evidence that fund flows and manager changes are important mechanisms for weakening performance persistence, both individually and in combination. The average four-factor alpha of winner funds that receive high inflows is reduced by an average of 2.52 percentage points in the following year compared with winner funds that do not experience extreme inflows. We also find that manager changes have a significant impact on the performance persistence of past winner funds. Losing a top-decile manager results in a 1.44 percentage points lower performance in the following year compared with winner funds that keep their star manager. Moreover, we find that both mechanisms help to predict future performance, allowing us to identify those winner funds that continue to significantly outperform a four-factor benchmark. Winner funds not experiencing these mechanisms – having relatively low net inflows and no change in manager – outperform those winner funds suffering both effects simultaneously, with a spread of 3.60 percentage points in the following year. This is approximately equal to the sum of the separate effects, indicating that the effects, in the case of winner funds, are additive and neither magnify nor offset each other. These results are not driven by differences in fee levels and hold on a gross management fee basis.

Our results for losing funds are different. We find that the more important equilibrating mechanism is internal (manager replacement) rather than external governance (outflows) which conflicts with the predictions of the Berk and Green (2004) model for loser funds. We find that, even though loser-fund raw returns benefit from withdrawals, alpha improves only by an insignificant 1.08 percentage points relative to funds without outflows, implying outflows do not allow the existing managers to improve their performance from managing a smaller asset base. Manager changes, on the other hand, play an important role in the governance of loser funds both separately and in combination with fund flows. Firing an underperforming manager significantly improves loser-fund performance by an average of 0.96 percentage points in the following year relative to loser funds that keep the same manager. More significantly, internal and external governance mechanisms strongly reinforce each other and are more effective if applied simultaneously. The combined positive effect of 2.40 percentage points higher performance compared with funds not benefiting from either governance mechanism is larger than the sum of the individual effects. This finding indicates that outflows cannot improve performance on their own, but that outflows strongly contribute to performance reversals and, hence, to mean reversion if the manager is also replaced. Our results support the conjecture in Dangl, Wu and Zechner (2008) that it is important to control for manager changes when analyzing the role of external governance (fund flows).

The rest of the paper proceeds as follows. The next section presents a review of the literature and our hypotheses. In section 3, we describe our data set and explain our research methodology. Our results are discussed in section 4: we first analyze funds flows, manager changes and their interaction separately for winner and loser funds before we perform a robustness check using a pooled regression approach. Section 5 concludes and draws implications.

2 Literature Review and Hypotheses

There is overwhelming empirical evidence that superior mutual fund performance does not persist in the long run, once survivorship bias is taken into account (Hendricks, Patel and Zeckhauser, 1993; Elton, Gruber and Blake, 1996a, 1996b; Carhart, 1997; Pastor and Stambaugh, 2002). For outperformers, the traditional explanations for this phenomenon are the size of management fees and other costs, the absence of genuine management skill, and the momentum effect in individual stock returns spilling over into the subsequent evaluation period of fund performance (Carhart, 1997). By contrast, although some underperformers do improve their performance, the majority continue to underperform significantly their benchmarks, indicating that any persistence is clustered around loser funds (Brown and Goetzmann, 1995; Carhart, 1997). Recent studies, however, point towards the persistence and predictability of short-term fund performance (Bollen and Busse, 2005; Busse and Irvine, 2006; Huij and Verbeek, 2007). These studies challenge the traditional explanations for a lack of performance persistence. Fees are fairly stable and cannot explain why persistence exists in the short run, but vanishes over longer horizons.

Berk and Green (2004) argue that mutual fund market equilibrium is attained through fund flows. Several studies show that investors respond to recent superior performance and ratings by investing additional funds and thus increasing the asset size of winner funds.[3] Berk and Green's argument relies on there being decreasing returns to scale in active fund management. Chen et al. (2004) and Yan (2008) provide evidence that transaction costs are positively correlated with fund size and the degree of illiquidity of the investment strategy. New investments of large funds are typically restricted to a limited range of liquid stocks and good investment opportunities eventually vanish as funds hit the capacity constraints on their investment strategies. Pollet and Wilson (2008) show that, rather than generate more "best ideas", fund managers instead tend to scale up existing holdings as a response to inflows. Edelen (1999) and Alexander, Cici and Gibson (2007) argue that excessive fund flows encourage liquidity-

[3] See, e.g., Sirri and Tufano (1998), Lynch and Musto (2003), DelGuercio and Tkac (2008) and Goriaev, Nijman and Werker (2008).

motivated, rather than valuation-motivated, investments and induce immediate transaction costs, both of which are detrimental to fund performance in the short run.[4]

Consistent with the Berk and Green hypothesis of decreasing returns to scale, Chen et al. (2004) document that small funds significantly outperform large funds. However, differences in fund sizes are the result of both differences in the inflows accumulated throughout a fund's full history since inception (external growth) and differential performance (internal growth) and so will only be of indirect relevance for testing the Berk and Green hypothesis. By contrast, our analysis directly investigates the role of investors' responses to past performance and the importance of fund flows as an equilibrating mechanism. We extend the study of Chen et al. (2004), first, by considering differences in capacity constraints between winner funds and loser funds and, second, by allowing for capacity constraints relative to initial fund size, but at different levels of absolute fund size. This accounts for the possibility that capacity constraints differ across funds depending on their investment strategy.

Fund growth is a relevant objective for fee-maximizing IMCs because management fees are usually a percentage of assets under management (AUM). Large net inflows do not benefit existing investors, however. To minimize the negative impact of inflows, while simultaneously increasing the compensation to successful managers, some funds might close to new investors in an attempt to preserve their superior performance and then increase fees. Empirical evidence, however, suggests that this does not tend to prevent a subsequent significant deterioration in alpha (Bris et al., 2007). Star fund managers can extract a larger share of the higher fee income by either moving to a larger fund within the same organization or to another IMC altogether if they are unable to negotiate an acceptable compensation

[4] The "smart money effect" also analyzes the predictive content of fund flows (Gruber, 1996; Zheng, 1999). The reasoning is that sophisticated investors can predict manager skill and, in turn, their fund flows predict future performance. In this case, inflows are subsequently followed by outperformance, whereas outflows are followed by underperformance. The empirical evidence is inconclusive about the existence of a smart money effect, after controlling for the momentum effect (Sapp and Tiwari, 2004; Keswani and Stolin, 2008). Our study differs from this literature in that we first condition on past performance as a proxy for skills and then use the predictive power of conditioning on fund flows in a second step.

package related to the higher fee income received by the IMC.[5] Moreover, a successful manager anticipating that she will not be able to repeat her outstanding performance in the future, mey decide to use her current favorable track record to find a higher paid job with a new IMC. In this case, the decision to stay or to leave will be the result of the manager's own assessment of her investment skill. Empirical evidence indicates that promotions, with a successful fund manager subsequently managing a larger fund, are positively linked to past performance (Hu, Hall and Harvey, 2000; Baks, 2006). In any case, a winner fund that loses its star manager will need to hire a new manager, presumably with lower skills. Therefore, we would expect fund performance to deteriorate after the hiring of a new manager. Using a sample of 393 domestic equity and bond fund managers that were replaced over the period from 1979 to 1991, Khorana (2001) finds that a manager change in outperforming funds results in a deterioration in post-replacement performance from 1.9 percent in the pre-replacement period to 0.4 percent in the third year. It appears manager changes can act as an additional curb on performance persistence to that arising from fund flows.

Building on these arguments, our data set allows us to investigate the following hypotheses and questions about the joint effects of fund flows and manager changes on performance persistence in outperforming equity mutual funds:

- Fund flows: Investors chase past performance and future performance suffers from high inflows, leading to stronger mean reversion for winner funds with higher net inflows.
- Manager changes: A fund manager who leaves a winner fund is replaced with a less skilled manager, resulting in reduced performance and stronger mean reversion for winner funds with a change in manager.

[5] Anecdotal evidence suggests that some mutual fund managers have increased their personal wealth by quitting their job as an employee in the mutual fund and setting up a hedge fund, such as Jeffrey N. Vinik, the former manager of Fidelity's Magellan fund, in 1996.

- Which effect has the bigger impact on eliminating performance persistence? Are both effects in combination additive, magnifying or offsetting?

In terms of Berk and Green (2004), for those winner funds that need to replace a departing fund manager, the fund size is now too large relative to the skill level of this new manager. These funds should subsequently underperform compared with winner funds without a manager change. Thus, an increase in fund size relative to managerial skill is the underlying factor causing both equilibrating mechanisms to lower performance.

In addition to the long-term effect through an increased fund size, the fund-flow channel also captures the negative short-term effect of liquidity-induced transactions on performance, which is absent in the case of a fund-size adjustment through manager change. We would, therefore, expect the fund-flow channel to act as a stronger curb on performance. On the other hand, the departure of a star fund manager might have a more negative impact on performance than the transactions costs associated with increased fund flows. So which effect has the larger impact will be an empirical issue.We would expect the combination of high inflows and manager changes to result in even more pronounced mean reversion. But it will also be an empirical issue whether the combined negative impact of inflows and manager changes on performance is simply the sum of the individual effects or whether the two effects are reinforcing or offsetting.

In the case of underperforming (i.e., loser) funds, Dangl, Wu and Zechner (2008) consider alternative strategies for investors and the IMC. Once a fund has been identified as poorly performing, investors could choose to move their assets to a fund with greater potential: in other words, investors could exercise external governance and vote-by-feet. Yet, empirical evidence indicates that many investors in poorly performing funds fail to withdraw their investments (Sirri and Tufano, 1998; Lynch and Musto, 2003). This could be because they anticipate a strategy change by the incumbent manager, or

the firing of a poorly performing manager, or because of a disposition effect.[6] Transaction costs and the costs involved in gathering information about alternative funds will further reduce the mobility of capital. The consequence is that the fund-flow equilibrating mechanism is weak in underperforming funds and poor performance may persist, at least in the short term (Carhart, 1997; Berk and Tonks, 2007). Large outflows, in particular, result in liquidity-motivated transactions which distort fund performance in the short term and impose an even stronger cost on loser funds than they do on winner funds. Coval and Stafford (2007) find that the performance of loser funds in distress and experiencing large outflows, hence making their trades predictable by others, deteriorates even more. These short-term liquidity-induced trading effects work in the opposite direction to the long-term effects on returns from decreasing returns to scale and this makes it more difficult for the performance of loser funds to return to the mean.[7] Consequently, the fund-flow channel will be weaker among losers than winner funds.

Several studies also document an inverse relationship between fund performance and manager changes (Khorana, 1996; Chevalier and Ellison, 1999b; Gallagher and Nadarajah, 2004). Moreover, demotions – the manager subsequently manages a smaller fund – are negatively linked to past performance (Hu, Hall and Harvey, 2000; Baks, 2006).[8] For underperforming funds, Khorana (2001) documents that performance improves post replacement, with abnormal performance improving from -2.40 percent in the year before replacement to 0.50 percent in the third year after replacement. Hence, manager changes also appear to place a curb on (poor) performance persistence.

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

[7] Note that in case of winner funds, the short-term effects of liquidity-induced trading and the long-term effects of decreasing returns to scale both operate in the same direction, magnifying the negative impact of inflows on winner-fund performance.

[8] However, rather than sacking an underperforming manager, IMCs might have an incentive to close or merge the losing fund and instead open a new fund, as small and young funds are known to exhibit a higher flow sensitivity than large and old funds (Sawicki and Finn, 2002). It has also 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 Blake, 1996b; Lunde, Timmermann and Blake, 1999; Carpenter and Lynch, 1999; Carhart et al. 2002).

We will investigate the following hypotheses and questions about the effects of fund flows and manager changes on performance persistence in underperforming equity mutual funds:

- Fund flows: Investors withdraw their money and performance improves as a result of a smaller asset base, since managers can concentrate on the most profitable investment opportunities and this leads to stronger mean reversion for loser funds with higher outflows, although this effect might be dampened by any investor inertia and by the costs of rearranging portfolios.
- Manager changes: The IMC fires an underperforming fund manager and performance improves under a newly appointed fund manager, leading to stronger mean reversion for loser funds with a change in manager.
- Which effect has the bigger impact on eliminating performance persistence? Are both effects in combination additive, magnifying or offsetting?

Loser funds which replace their underperforming manager with a presumably better manager should subsequently outperform loser funds without a manager change. We would expect loser funds to benefit more from a manager replacement than from outflows. This is because the fund-flow channel involves transaction costs arising from the forced sales of assets. While the new manager will almost certainly change the asset composition of the fund, this can be done gradually without a market impact. On the other hand, significant fund outflows will lead to a quicker and more radical restructuring of the portfolio and consequently a faster return to normal performance. So again it is an empirical matter about which effect dominates. The question of how both mechanisms interact is also an empirical one. They are likely to be reinforcing when both mechanisms occur simultaneously, such as where an IMC fires a poorly performing fund manager in an attempt to stem outflows.[9] But their effects would be neutralized in the case where investors fail to withdraw money from poorly performing funds in

[9] In the case of corporations, Parrino, Sias and Starks (2003) provide empirical evidence that a reduction in institutional ownership increases the likelihood of forced CEO turnover.

anticipation of a manager change, but the IMCs delays firing the poorly performing fund manager because outflows did not materialize.

3 Data and Research Methodology

3.1 Data

The data on mutual funds and the benchmarks are obtained from CRSP. Our sample starts in 1992, the first year for which reliable information on manager changes becomes available, and it ends in 2007. In constructing our sample, we follow Pastor and Stambaugh (2002) as closely as possible and select only actively managed domestic equity funds.[10] We aggregate all share classes of the same fund and 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, 2010). Our final sample consists of 3,946 funds that existed at some time during the period from 1992 to 2007 for at least 12 consecutive months. These funds have an average fund size of 899 million USD (Table 1). Fund size increased over the sample period, whereas average fees fell from 1.68 percent to 1.56 percent, as a result of economies of scale in direct expenses involved in asset management.[11]

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

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

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

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

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

argument of Berk and Tonks (2007), absolute flows are scaled by $TNA_{it-1}(1+r_{it})$ in order to obtain relative flows.[12] On average, each fund received 2.70 million USD net inflows per month.

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.[13] This variable provides the date of the last manager change as reported by the IMC. 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 IMCs only report significant changes in manager that might have an impact on performance (Massa, Reuter and Zitzewitz, 2010). A total of 6,492 manager changes occurred during our sample period. On average, 19 percent of the fund managers are replaced each year which is consistent with other studies.[14]

3.2 Research Methodology

We use both ranked portfolio tests (Carhart, 1997; Carpenter and Lynch, 1999; Tonks, 2005) and pooled regressions to investigate the hypotheses in Section 2.

Ranked portfolio tests Funds are first ranked into decile portfolios based on their previous-year performance.[15] Then, a second sorting of the top-decile-10 and the bottom-decile-1 funds is carried

[12] If a fund merges with another one, we do not count the incoming assets as fund flows, because there is no additional cash to invest. Thus, the fund manager does not face the immediate problem of investing the inflows, but can adjust the portfolio weights gradually over time to minimize the performance impact.

[13] This variable has also been used by Lynch and Musto (2003) and Cooper, Gulen and Rau (2005). In theory, it shows the date that the manager leaves. However, for around 80 percent of observations, this is always the first of January. For the years 1992 and 1993, the variable is evenly distributed over different months. We conclude from this that the variable can only be used as an indicator of the year in which there was a manager change. One implication of this is that our data set is not sufficiently granular to investigate the impact of timing differences between fund flows and manager changes on subsequent fund performance. In other words, we are unable to test whether fund flows pre-date and hence possibly 'cause' a manager change or vice versa. We are only able to indicate that there were changes in fund flows as well as a manager change within the same year and then assess what effect these had on a fund's subsequent performance.

[14] Chevalier and Ellison (1999a) report 18 percent and Ding and Wermers (2006) report 14 to 18 percent using a more detailed database on fund managers constructed from various sources.

[15] Repeating the same analysis for winner and loser funds with quintiles instead of deciles did not alter our results qualitatively.

out.[16] Specifically, we form subgroups of the winner and loser deciles based on a single sorting on fund flows (high net inflows / low net inflows) or manager change (with manager change / without manager change), respectively (Figure 1). Furthermore, as we are interested in the interaction effects between both mechanisms, we form subgroups of the winner and loser decile based on a double sorting on fund flows and manager change simultaneously (high with / high without / low with / low without). The first sorting, based on past performance, separates good from bad managers, since we are interested in whether the same mechanisms that prevent persistent outperformance of skilled managers can also explain why badly performing managers regress towards the mean. We aim to separate the effects of a skilled manager leaving the fund or investors allocating large amounts of money to good managers from the effects of sacking an unskilled manager (i.e., internal governance) or investors withdrawing money from a bad manager (i.e., external governance). We then analyze the performance of these subgroups of top and bottom deciles, as well as the performance of spread portfolios to compare alternative investment strategies.

In Berk and Green (2004), active management suffers from decreasing returns to scale, but it is an empirical question whether these capacity constraints are absolute or relative. Absolute capacity constraints arise once a certain threshold of absolute fund size is exceeded and depend on absolute fund flows. Relative capacity constraints differ across investment strategies and arise after the fund receives a certain level of inflows relative to the initial fund size. We analyze both absolute and relative net inflows, but in the presentation of our results we concentrate on absolute flows and only discuss relative flows when there are additional insights.

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

[16] 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.

Formation The formation of decile portfolios is created by the first sorting and, to do this, we need to measure the alpha of each fund in the previous year. Specifically, funds are ranked based on alphas from a Carhart (1997) four-factor model estimated over the previous 12 months (the formation period). This model incorporates the Fama-French (1993) size (*SMB*) and value (*HML*) factors and the Carhart momentum factor (*MOM*) in addition to the market excess return (er_{mt}) to explain fund excess returns and account for different fund styles:

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

In order to efficiently estimate a four-factor model over such a short horizon, we apply a Bayesian adjustment (Huij and Verbeek, 2007). This procedure involves the estimation of the Carhart model for each fund separately using OLS. Then the averages of the parameters of all other funds during the same period are used as priors. The final alpha and beta parameters for each individual fund are obtained as weighted averages of the OLS parameters and the prior, 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.[18] The intuition behind this Bayesian adjustment is that it is less likely that a fund will genuinely generate high alphas if all other funds generate relatively low alphas during the same period.[19] Using a similar argument, Cohen, Coval and Pastor (2005) attribute a higher skill level to fund managers who produce their outperformance with a similar strategy to other skilled fund managers in comparison with managers who used a completely different strategy. The latter are classified as lucky rather than skilled.

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[17] Further technical details are given in Huij and Verbeek (2007).
[18] This also reduces a potential market-climate-bias of the alpha due to omitted risk factors. We thank Hendrik Scholz for pointing this out.
[19] Moreover, as the betas of the underlying stocks change randomly over time, funds with similar holdings should be affected by these fluctuations to a similar degree.

Evaluation In the evaluation period, we investigate the investment performance of the deciles and decile subgroups. Funds that drop out of the portfolios due to merger or closure remain in the decile until their last month of operation and then the portfolio weights are readjusted accordingly to avoid any look-ahead bias.[20,21] We used three models to evaluate performance. The first is the four-factor Carhart model as specified in equation (2). The second is a five-factor model that adds a mean reversion factor[22] to the Carhart model: if winner funds hold on to winner stocks for another one or two years, these winner stocks might eventually experience mean reversion in returns (De Bondt and Thaler, 1985, 1987). The third is a five-factor model that adds a liquidity factor[23] to the Carhart model on the grounds that fund flows might also affect portfolio liquidity. We also analyzed performance based on raw returns as an additional robustness test in case a potentially omitted factor in the model used for formation and evaluation biases the results. However, we only present the four-factor model results and comment on the other specifications if they provide additional insights.

Pooled regressions We also perform a pooled regression with the difference in annualized performance between the evaluation year and the formation year as the dependent variable. These performance changes over time are then regressed on a set of control variables, including net inflows and a manager change dummy. This regression offers insights into the impact of fund flows and manager changes on fund performance over time. Furthermore, it provides us with the opportunity not only of

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[20] Carhart (1997) defines look-ahead bias as the bias that results from eliminating funds from the sample that fail to survive a minimum period of time after the ranking period.

[21] Assuming, in case of a merger, that all investors of the acquired funds subsequently hold the acquiring funds by "following the money" does not alter our conclusions (the evidence for this is not reported but available from the authors on request).

[22] This factor is based on six value-weighted portfolios formed on the size and prior returns of all NYSE, AMEX and NASDAQ stocks. A stock is classified as big (small) if its market capitalization is higher (lower) than the median of all NYSE firms. Past returns are measured over the previous four years lagged by one year, where "high returns" means higher than the 70th percentile and "low returns" means lower than the 30th percentile. The mean reversion factor is then the average of the low-prior-return portfolios minus the high-prior-return portfolios in both size groups. We thank Kenneth French for providing these data on his website.

[23] We thank Lubos Pastor for providing these data on his website.

separating the effects of fund flows and manager changes, but also of measuring their marginal impact and their interaction with other fund characteristics.

4 Empirical Results

4.1 Ranked Portfolio Tests

We begin the presentation of our results by discussing the characteristics and performance of the fund deciles. The three top-ranked fund deciles have significantly positive alphas in the formation year, while the bottom five deciles significantly underperform the four-factor benchmark (Table 2). The spread between the top and bottom decile is a significant 1.86 percentage points per month. We find some evidence of mean reversion in fund performance in both winner and loser funds, particularly the former. In the evaluation period, the alphas of the three highest deciles are insignificantly different from zero, while the bottom three deciles continue to significantly underperform, although their performance levels improve considerably in comparison with the formation period. The monthly performance of winner funds decreases by an average of 0.81 percentage points between the formation and evaluation periods to 0.07 percent in the evaluation period. Loser-fund performance improves from -0.97 to -0.24 percent per month between the formation and evaluation periods, a change of 0.73 percentage points. The spread between winner and loser funds is reduced to 0.32 percentage points in the evaluation period: since this spread is just statistically significant, we conclude that there is still some degree of performance persistence after one year. A similar pattern of mean reversion emerges for raw returns (Figure 2).

[Please insert **Table 2** and **Figure 2** about here]

This residual spread of 0.32 percentage points per month can partly be attributed to higher fees and to potentially higher transaction costs arising from the higher turnover of decile-1 funds compared with decile-10 funds: see Table 3.[24] This table shows that the outperforming deciles, in particular, the

[24] Indeed, gross of management fees, the spread between winner and loser funds shrinks to an insignificant 0.28 percentage points (these results are not reported, but are available from the authors on request).

winner-decile-10 funds, have high net inflows, consistent with investors chasing past performance. These winner funds have inflows of 14.52 million USD per month in the evaluation period, but they also experienced high inflows in the formation period, with mean absolute inflows of 10.71 million USD per month. This suggests that some investors – the more sophisticated ones – have quicker reaction times than others. Decile-10 funds are amongst the second smallest size groups during the formation period, with an average size of 757.58 million USD. This is consistent with the results of Chen et al. (2004) that only small funds are able to beat the benchmark.[25] However, as a result of inflows and capital appreciation, winner funds grow to an average size of 1,059.93 million USD in the evaluation period which is larger than the average of the funds in any of the bottom five performing deciles. Loser funds, by contrast, experience only modest average outflows of 1.23 million USD in the formation period and only slightly larger outflows of 4.05 million USD in the evaluation period, indicating some form of investor inertia. The average size of loser funds remains virtually unchanged between the formation period (at 684.31 million USD) and the evaluation period (at 673.59 million USD).

Comparing the fund flows of median winner and loser funds, instead of average funds, reveals that fund flow levels are roughly equal and opposite between winner and loser funds, especially in the evaluation period. This suggests that the asymmetric flow response to positive and negative performance documented in the previous literature might be driven by extreme inflows into a small number of winner funds.[26]

Having established that performance persistence is mean reverting amongst both winner funds and loser funds, we now investigate how fund flows and manager changes influence this.

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

[25] The fact that decile-1-loser funds are also the smallest funds indicates that being a small fund is not sufficient to beat the benchmark.

[26] Indeed, recent studies document that investors are now more likely to respond to bad performance by withdrawing money (O'Neal, 2004; Ivković and Weisbenner, 2009).

4.2 Winner Funds

The effect of fund flows Winner funds are separated by our second sorting into a subgroup with low absolute net inflows, averaging -4.50 million USD per month during the formation period, and a subgroup with high absolute net inflows, averaging 25.78 million USD per month (Table 4). The fraction of managers leaving winner funds is similar for both subgroups.

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

In terms of investment performance, winner funds which suffer from high absolute net inflows generate negative, though insignificant monthly alphas, of -0.05 percent in the evaluation year (Table 5). Winner funds which do not experience large absolute inflows have higher, though still insignificant, alphas in the evaluation year of 0.16 percent. The spread between the two subgroups conditioned on absolute net inflows is a significant 0.21 percentage points. Moreover, comparing the degree of mean reversion, defined as the difference in alphas between the formation and the evaluation period, reveals that the performance of the high-inflow subgroup moves towards the mean by -0.99 percentage points, while the low-inflow subgroup moves by only -0.67 percentage points. Figure 3 shows that conditioning on fund flows helps to predict both differences in future performance and in the degree of mean reversion. More extreme inflows lead to even stronger results.[27] We therefore have clear evidence indicating that fund flows explain the lack of performance persistence among winner funds, confirming the Berk and Green (2004) hypothesis.

[Please insert **Table 5** and **Figure 3** about here]

[27] We repeated the analysis by defining high-inflow funds as those with net inflows exceeding the 80th percentile and low-inflow funds as those with net inflows below the 20th decile (instead of using the median as the split point). Funds in the high-inflow subgroup, on average, experience net inflows of 57.63 million USD compared with -10.79 million USD net inflows for the low-inflow subgroup. The performance of high-inflow funds is reduced to an insignificant -0.17 percent (compared with -0.05 percent for the median split point). The spread between winner funds with low net inflows and high inflows amounts to a highly significant 0.30 percent, indicating the importance of extreme inflows as an equilibrating mechanism.

Winner funds with low absolute net inflows have an average size of 507.53 million USD which is only about half the size of winner funds with high absolute net inflows (1041.47 million USD). Thus, part of the difference in performance might be explained by differences in size rather than flows.[28] To test this, we analyze the results from a second sorting based on relative fund flows. The two subgroups are now closer in size and the low-relative-inflow subgroup is actually larger (816.61 versus 733.99 million USD). However, the basic conclusions remain the same: the low-net-inflow subgroup outperforms the high-net-inflow subgroup by a significant 0.16 percentage points per month. Both, absolute and relative capacity constraints seem to matter for winner funds.

Bris et al. (2007) report that funds which close to new investors after a period of superior performance switch from average four-factor alphas of 0.96 percent per month to 0.15 percent, a significant decrease of 0.81 percentage points. They interpret this result as evidence against their good stewardship hypothesis which postulates that fund closures are intended to sustain good performance. By contrast, our results indicate that funds sheltered from inflows significantly outperform those experiencing inflows in the subsequent year. Thus, even though mean reversion in performance is present in all funds, the closure of a successful fund to new inflows can still make an important contribution to sustaining their superior performance (at least for another year).

The effect of manager changes We find evidence supporting the hypothesis relating to manager changes. Winner-decile-10 funds that lose their skilled manager generate an insignificant average monthly alpha of -0.02 percent. By contrast, winner funds that keep the same manager deliver positive, although still insignificant, alphas of 0.10 percent (see Figure 3). The spread of 0.12 percentage points, however, is statistically significant.[29] The degree of mean reversion is also higher at -0.89

[28] Note, however, that funds in the two smallest size groups of Chen et al. (2004) have an average fund size of only 4.7 and 22.2 million USD, respectively, indicating that sorting on absolute fund flows leads to quite different results from sorting on fund size.

[29] Note that this figure might underestimate the true impact of manager turnover on performance because we cannot observe either the reason for a manager change or the quality of the new manager. For example, some skilled managers

percentage points in the case where the manager changes, compared with -0.79 percentage points for the subgroup without a manager change. Thus, manager change can also partly explain mean reversion among winner funds. But the magnitude of the manager-change channel in inducing mean reversion is slightly smaller than that for the inflow channel, consistent with the hypothesis in Section 2 above.

Interaction effects To examine the joint effect of fund flows and manager changes, we perform a double sort on both equilibrating mechanisms resulting in four subgroups. Table 6 reports the alphas for winner-decile subgroups conditioned on both mechanisms and the resulting spread portfolios. Winner funds experiencing neither inflows nor a manager change (weakly) significantly outperform the four-factor benchmark by 0.18 percentage points per month. This corresponds to a mean reversion of only -0.65 percentage points per month. By contrast, winner funds suffering from both high inflows and a manager change generate negative, although, insignificant alphas of -0.12 percent per month, a degree of mean reversion of -1.02 percentage points per month. The statistically significant spread of 0.30 percentage points per month[30] is only slightly lower than the sum of the individual effects.[31] These results indicate that, in the case of winner funds, the two effects are additive and neither magnify nor offset each other in combination.

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

The double sorting also allows us to analyze marginal effects. The occurrence of a manager change seems to be independent of fund flows, since, on average, 22 percent of managers change each year in both subgroups with high and low net inflows (Table 4). The difference in fund flows between

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might simply retire and be replaced by a new younger successor in the normal course of events and the IMCs of successful funds might be able to attract an above-average replacement in such circumstances.

[30] This is the evaluation-period alpha on the "10 low without – 10 high with" spread portfolio (Table 6).

[31] The sum of the individual effects is 0.33 and is given by the sum of the evaluation-period alpha of 0.21 on the "10 low – 10 high" spread portfolio (using absolute net inflows) and the evaluation-period alpha of 0.12 on the "10 without – 10 with" spread portfolio (see Table 5). Figure 3 shows this graphically: 0.30 is the absolute sum of the first and fourth columns in the double-sorting segment of the "alpha" panel; 0.21 is the absolute sum of the two columns in the single-sorting-by-flows segment of the "alpha" panel; and 0.12 is the absolute sum of the two columns in the single-sorting-by-manager-change segment of the "alpha" panel.

winner funds without and those with a manager change is statistically significant but economically small at 4.49 million USD. As both mechanisms appear to be independent of each other, we would expect that controlling for one mechanism would not alter the impact of the other. This is indeed the case. Irrespective of whether the manager changes or not, fund flows have a significantly negative impact on performance of between 0.21 and 0.22 percentage points per month.[32] When there is a manager change, alpha declines to an insignificant 0.07 percent for the low-inflow subgroup and to an equally insignificant 0.09 percent for the high-inflow subgroup.[33] Comparing the subgroups "10 low with" and "10 high without" allows a comparison of the strength of both mechanisms. The statistically significant monthly spread of 0.13 percentage points again confirms that, among winner funds, fund flows is a more important equilibrium mechanism than manager change. Figure 3 also reveals a monotonic decrease in alphas between the two extreme subgroups, with fund flows again having the stronger impact on performance than manager changes.

To summarize, the results for winner funds lend strong support to the hypothesis of Berk and Green (2004) that fund flows is a key mechanism bringing active mutual fund outperformance back into equilibrium where expected abnormal returns are zero. However, another equilibrating mechanism, manager changes also contribute to this effect. As expected, winner funds subject to both mechanisms simultaneously experience the largest performance deterioration. Conditioning on both mechanisms explains 37 percent[34] of the unconditional mean reversion of winner funds. Fund flows are, however, a more important equilibrating mechanism than manager changes. Nevertheless, the two effects are additive.

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[32] This result is based on a comparison of the "10 low without" and "10 high without" subgroups and a comparison of the "10 low with" and "10 high with" subgroups, respectively.

[33] In unreported results, we find that, for the high-relative-net-inflow subgroup, the spread between funds without and with a manager change is a significant 0.15 percentage points per month.

[34] This is the ratio of the evaluation-period alpha of 0.30 on the "10 low without – 10 high with" spread portfolio (Table 6) to the absolute degree of mean reversion of 0.81 on winner funds between the formation and evaluation periods (Table 2).

4.3 Loser funds

The effect of fund flows The second sorting on absolute net inflows divides loser funds into a subgroup with low net inflows, experiencing average monthly net inflows of -10.72 million USD, and a subgroup with high net inflows of 8.15 million USD (Table 7). The low-net-inflow funds are larger than the high-net-inflow funds during the formation period, 792.06 million USD compared with 593.03 million USD. This difference is evened out by subsequent differences in fund flows, resulting in a difference in size of only 20.62 million USD in the evaluation period. There are no notable differences in characteristics between the subgroups with and without a manager change.

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

Conditioning on absolute fund flows, we find that loser funds with outflows have significant 0.12 percentage points per month higher raw returns in the evaluation period than loser funds with inflows, revealing the impact of external governance (Table 8). However, comparing raw returns with four-factor and five-factor alphas reveals that this spread is partly explained by differences in risk exposures: loser funds with outflows appear to hold on to both momentum loser stocks, which continue to underperform, and long-term winner stocks, which exhibit mean reversion, to a much smaller extent than loser funds without significant outflows, i.e., manager inertia is much more prevalent in the latter case.[35] Further, Figure 4 shows that the alphas of loser funds that benefit from outflows are only slightly higher than the alphas of loser funds without significant outflows and both subgroups continue to significantly underperform.[36] Consequently, the predictions of Berk and Green (2004) on the fund-flow mechanism operating amongst loser funds do not find strong support in our data.

[Please insert **Table 8** and **Figure 4** about here]

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[35] These results are not reported in the tables but are available from the authors on request.
[36] The results for the sorting on relative net inflows are similar though slightly weaker and not significant, implying that absolute changes in fund size are more relevant in improving loser-fund performance.

A standard explanation for the weak support for the Berk and Green (2004) hypothesis for loser funds is that a large fraction of investors are reluctant to withdraw money (Berk and Tonks, 2007). Indeed, the difference in average fund flows between the low- and high-fund-flow subgroups of loser funds is only about two-thirds as large as the same difference for winner funds (18.87 million USD versus 30.28 million USD).[37] Therefore, the external incentive for poorly performing fund managers to change their portfolios and improve performance is not a powerful one.[38] This behavior is consistent with the disposition effect, whereby investors are hesitant to realize losses and so stay invested in the hope that the fund price eventually returns to the original purchase price. Investors perhaps hope that the equilibrating mechanisms will work without them having to incur any additional effort or costs. In the presence of transaction costs and some degree of mean reversion, few investors will be willing to be early sellers. But, our results show that staying invested in loser funds is a sub-optimal strategy, since performance remains negative, while investors could alternatively earn 0.18 percent abnormal monthly returns by switching to previous-year winner funds with lower inflows and no manager change, an additional return likely to be sufficient to cover switching costs.

To test whether a stronger response by investors would improve loser-fund performance even more, we repeat the above analysis, but focus only on loser funds being in the highest or lowest net-inflow quintiles instead of using the median as a split point. The general conclusion remains the same.[39] Thus, even if investors do withdraw significant amounts of money from loser funds, we find little support for the Berk and Green (2004) hypothesis. The reason seems to be a failure of the manager to

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[37] Median differences are not reported in the tables but reveal a similar picture.

[38] Berk and Tonks (2007) compare this with the repayment behavior of mortgage borrowers. Some borrowers are sensitive to changes in the interest rate and refinance their mortgage whenever it is beneficial, while a significant proportion is reluctant to refinance.

[39] Specifically, we repeat the analysis defining high-inflow funds as those with net inflows exceeding the 80th percentile and low-inflow funds as those with net inflows below the 20th decile. Funds in the low-absolute-inflow subgroup have net inflows of -23.27 million USD, on average, during the formation year (compared with only -10.72 million USD when the median is used as the split point). However, the performance of the subgroup of loser funds with more extreme absolute outflows remains significantly negative at -0.18 percent per month and the spread between low and high net inflows increases to 0.14 percentage points, although this is still insignificant.

take appropriate actions, rather than the reluctance of fund investors to withdraw money. In addition, the higher transaction costs associated with forced asset sales is likely to contribute to the weak performance reversal after outflows. Moreover, this implies that the underperformance of loser funds is explained by a lack of good ideas, rather than the level of average transaction costs, because the latter should be reduced after a decrease in fund size.

The effect of manager changes Turning to manager changes, our hypothesis that bottom funds which sack their fund manager can improve their performance in the following year compared with bottom funds which stick with their presumably unskilled manager is strongly supported by our findings. While loser funds without a change of manager continue to significantly underperform by -0.26 percent per month in the subsequent year, loser funds that replace their manager have insignificant alphas of -0.18 percent per month (see Figure 4). This leads to a significant spread in alpha of 0.08 percentage points per month due to the exercise of internal governance and implies that internal governance is effective among loser funds.[40] The spread in raw returns is even larger – a highly significant 0.11 percent. A new manager, therefore, might contribute to stronger mean reversion of fund performance towards equilibrium levels by selling off loser stocks and realigning the portfolio. This evidence suggests that manager changes are an important equilibrating mechanism that has both a statistically and economically significant impact on fund performance.

Interaction effects An IMC might fire an underperforming manager to avoid the risk of investors withdrawing funds. Table 9 investigates the interaction and dependency between the two equilibrating mechanisms and fund performance. A comparison of the characteristics of the subgroups reveals that the internal and external governance mechanisms interact positively: funds with outflows have a higher fraction of manager changes than funds with positive net inflows and funds with a manager change have larger outflows than funds without (Table 7). If internal and external governance

[40] Again, this figure might underestimate the true effect of forced manager turnover on performance, because not all manager changes are performance related.

were independent of each other, we would expect their combined impact on fund performance to be the sum of the individual effects. However, funds that benefit from both mechanisms have insignificant alphas of -0.09 percent per month in the evaluation period. This corresponds to an impressive degree of mean reversion of 0.90 percentage points per month. Funds without either form of governance mechanism continue to significantly underperform by -0.29 percent per month, regressing to the mean by only 0.67 percentage points per month. The spread between both subgroups is a highly significant 0.20 percentage points per month[41] which is larger than the sum of the individual effects.[42] This implies that the internal and external governance mechanisms are magnified when they operate jointly in loser funds, as can be seen from an examination of Figure 4.[43]

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

Turning to marginal effects, within the subgroup of funds with outflows, those with a manager change have a significant 0.15 percentage points higher average alpha than those without a manager change, while the difference for the funds without outflows is close to zero. Fund managers who stay on do not seem to use the outflows to reorganize their portfolio, but merely to scale down existing investments. Again, an explanation for this behavior could be a disposition effect among loser-fund managers. Even more interestingly, within the group of loser funds with a manager change, those funds that experience large absolute outflows have alphas that are significantly higher by 0.18 percentage points per month than those without outflows. Thus, the poor effectiveness of the fund-flow channel based on the single sorting is almost entirely explained by the subgroup without a manager change.

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[41] This is the evaluation-period alpha on the "1 low with – 1 high without" spread portfolio (Table 9).

[42] The sum of the individual effects is 0.17 and is given by the sum of the evaluation-period alpha of 0.09 on the "1 low – 1 high" spread portfolio (using absolute net inflows) and the evaluation-period alpha of 0.08 on the "1 with – 1 without" spread portfolio (see Table 8). Figure 4 shows this graphically: 0.20 is the difference between the first and fourth columns in the double-sorting segment of the "alpha" panel; 0.09 is the difference between the two columns in the single-sorting-by-flows segment of the "alpha" panel; and 0.08 is the absolute sum of the two columns in the single-sorting-by-manager-change segment of the "alpha" panel.

[43] Note, however, that on average less than 12 percent of all loser funds benefit from a combination of both governance mechanisms, explaining why studies not conditioning on fund flows and manager changes report, on average, persistent underperformance (differences due to rounding).

In summary, we do not find much support for the Berk and Green (2004) hypothesis for loser funds when considering fund flows as the sole equilibrating mechanism. However, manager changes both separately and jointly with outflows play an important role in the governance process, leading to a significant improvement in the performance of loser funds. Applying internal and external governance at the same time not only brings performance levels back to equilibrium (-0.09) in the evaluation period, but also explains 27 percent[44] of the unconditional mean reversion among loser funds. Manager changes are a much more effective governance tool than withdrawing money, especially when transactions cost associated with the latter are taken into account, and, when used in combination, the effects are magnified.

4.4 Impact of fees

The evidence we have presented above in the case of winner funds is consistent with efforts by winner-fund managers to maximize their fees by increasing their AUM either at the same fund (i.e., higher-than-median inflows) or by moving to another fund (i.e., manager change), as discussed in Section 2. But winner-fund managers might also strategically adjust fee levels to past performance. By contrast, loser funds experiencing a high degree of both internal and external governance might charge lower fees to reflect their lower skills.[45] To investigate this, we repeated the above analysis using pre-fee returns.[46] However, our conclusions based on either single or double sorting on fund flows and manager changes do not change in the case of either winner or loser funds.

We conclude that winner-fund managers do not attempt to maximize their fee income by actively adjusting the fee levels to their expected performance and that the benefits of outflows and manager

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[44] This is the ratio of the evaluation-period alpha of 0.20 on the "1 low with – 1 high without" spread portfolio (Table 9) to the absolute degree of mean reversion of 0.73 on loser funds between the formation and evaluation periods (Table 2).
[45] In addition to fees, cross-sectional differences in trading costs might explain part of the spreads between the different deciles and decile subgroups. However, even though we have information on portfolio turnover, we do not know the differences in the levels of transaction costs and these might be large across funds depending on the investment style, especially with respect to a small cap tilt. Thus, the data does not allow us to control for cross-sectional differences in total trading costs. However, we control for differences in turnover in our regression tests.
[46] The results are not reported in tables, but available from the authors on request.

changes among loser funds are not related to differences in fees. This demonstrates that the performance impact of the equilibrating mechanisms documented in the previous section is robust to potential differences in fee levels. Furthermore, based on a comparison of gross and net returns and the magnitude of the performance impact of both equilibrating mechanisms, we conclude that the equilibrating mechanisms are more relevant in explaining below-average performance than the impact of fees.

4.5 Regression Analysis

Model specification In this section, we examine the output from a pooled regression of the change in annualized Bayesian four-factor alphas between the formation and evaluation periods on relative net inflows, manager changes and a set of other control variables documented in the literature as having an impact on performance.[47] We focus on relative flows in this section because they are more comparable across funds. The aims are threefold: first, by controlling for other determinants of mutual fund performance, we are able to measure the marginal impact of fund flows and manager changes, as well as the interaction with other control variables; second, it allows us to analyze the performance impact of both equilibrating mechanisms over time (i.e., whether they lead to mean reversion), in contrast with the cross-sectional results in the previous sections using ranked portfolio tests; and third, it serves as a robustness check.

In our first model, we include the following additional control variables: fund size (total net assets), fund fees, fund age and the portfolio turnover ratio.[48] [49] Because there is a strong tendency for the extremes in fund performance to revert to the mean, we add to our regression two dummy variables

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[47] Following French (2008), we winsorize all variables at the 1st and 99th percentile to avoid any bias resulting from extreme outliers.

[48] The portfolio turnover ratio is defined as the minimum of aggregated sales and aggregated purchases of securities, divided by the average 12-month total net assets of the fund. It measures the fraction of the portfolio traded over the previous 12 months.

[49] Chen et al. (2004) and Cremers and Petajisto (2009) find a negative effect of fund size on performance; Carhart (1997) documents a negative effect from fees; Huij and Verbeek (2007) and Karoui and Meier (2009) report an outperformance of young funds. Results on turnover are ambiguous. Elton et al. (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.

that indicate whether a fund is currently in decile 10 or decile 1 based on previous-year performance. These dummies capture the pure mean reversion effect and ensure that the other coefficients are not biased. The key variables of interest are net inflows and the manager change dummy. We also include an interaction term between fund flows and the decile-10 and decile-1 dummies in order to analyze the differential effects of fund flows on performance in the top and bottom funds. Similarly, we use a manager-change dummy indicating whether the fund manager has been replaced during the previous year and an interaction term between manager change and the decile-10 and decile-1 dummies.

In a second model, we analyze the impact of being a small-cap or a sector fund on performance and the marginal impact of fund flows on winner and loser funds that belong to these two investment-style categories. We anticipate that capacity constraints are more prevalent in narrow and illiquid markets and, as a result, fund flows have a stronger impact on performance in these investment categories. A third model investigates the interaction effect between a change in the manager of a winner or loser fund and the fund being a member of a large fund family. Gervais, Lynch and Musto (2005) argue that the replacement of an underperforming manager in a large fund family reveals more information than the replacement of a manager in a small fund family. We assign a fund to the large-family group if the number of funds offered by its fund family at the end of the previous year is higher than the 70th percentile. A fourth model assesses the interaction between the manager-change and fund-flow mechanisms. Specifically, we include a dummy for winner funds that have higher-than-median net inflows and a change in manager and a dummy for loser funds that have lower-than-median net inflows (i.e., high net outflows) and a change in manager.[50]

Empirical Results As we measure the change in performance between consecutive years, a significant coefficient on one of the control variables would indicate that there was a trend in

[50] In an additional unreported regression, we included year dummies into the analysis. However, as the alphas are already adjusted for general market movements, our results are not qualitatively different. Furthermore, using Newey-West standard errors does not alter our conclusions. These results are available from the authors on request.

performance over time. An examination of the first four regressors in Table 10 indicates that, across all models, only fund size (as measured by total net assets) is statistically significant. The decile-1 and decile-10 dummies are both highly significant and indicate that loser funds improve their alphas by between 7.93 and 7.94 percentage points in the following year, depending on the model, while the alphas of winner funds deteriorate by between 8.21 and 8.31 percentage points in the following year, before conditioning on any other variable. These findings indicating strong mean reversion are consistent with the results of the portfolio tests.

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

In line with the hypothesis of Berk and Green (2004), we document a significant negative relationship between relative net inflows and subsequent performance. A one percent increase in relative net inflows during the previous year decreases four-factor alphas for all funds by 1.06 percentage points on average in the following year. Model 1 reveals that the decrease becomes 1.48 percentage points for winner funds which confirms the results of the ranked portfolio test. Controlling for a fund's market segment shows that performance decreases by an additional 0.86 percentage points if the winner fund is a small-cap or sector fund and receives high inflows (Models 2-4). This supports the notion that capacity constraints are partly driven by transaction costs.

A manager change does not have a significant impact on the average fund, but if the manager of a winner-decile-10 fund changes, performance subsequently deteriorates by a significant 1.15 to 1.30 percentage points in the following year, according to Models 1-3. The more sophisticated Model 4 shows that the effect operates through fund flows: winner funds that lose their manager, while also experiencing above-median net inflows, experience an average deterioration in performance of 2.29 percentage points in the following year. If the star manager of a large fund family leaves, the effect is not significantly different from the case in which the manager of a small fund family leaves, implying that

not even large fund families have access to the fund management skills that would prevent the deterioration in performance following the loss of a talented manager.

For loser funds, the improvement in alpha following an increase in relative outflows is not significantly different from the general performance improvement for average-performing funds (Model 1), implying that the performance of loser funds is less sensitive to a change in net flows of the same magnitude than the performance of winner funds. Further, being a small-cap or sector fund has little effect on the relationship between outflows and subsequent performance (Model 2). The improvement in performance following a manager change, although positive, is insignificant for a typical loser fund, according to Models 1 and 2. However, the more sophisticated Models 3 and 4 reveal that replacing an underperforming manager in a fund belonging to a large fund family improves performance significantly by an additional 2.71 to 2.92 percentage points in the following year. This result supports the predictions of Gervais, Lynch and Musto (2005) that manager replacement in a large family contains more information, particularly if it is associated with an underperforming manager. Model 4 additionally shows a strong interaction between the two equilibrating mechanisms: if loser funds sack their manager, while also experiencing above-median outflows, they experience an aggregate performance improvement of 3.00 percentage points the following year – although this is attenuated by a deterioration of 1.80 percentage points as a result of the pure effect of a change in manager in a bottom-performing fund. This supports the findings from the ranked portfolio tests

Thus, the results in this section strongly confirm the Berk and Green (2004) hypothesis for fund flows as a predictor of mean reversion in performance over time for winner funds (and, indeed, the average fund), but not for loser funds. The effect of manager change is driven by the interaction with high net inflows for winner funds, and by the interactions with outflows and fund family size for loser funds. These interaction effects suggest that a change in manager has a magnified impact on performance in combination with fund flows, again reinforcing the evidence from the ranked portfolio tests. What is clear from all four models that, by itself, a change in manager has no effect on

performance: it is only in combination with fund flows (and, additionally, in the case of loser funds, with fund family size) that a change in manager has an impact. By contrast, relative fund flows have an independent (negative) impact on performance.

5 Conclusions and Implications

We have examined the role of fund flows and manager changes in explaining the lack of persistence in mutual fund performance. Using a CRSP sample of 3,946 actively managed U.S. equity mutual funds over the period from 1992 to 2007, we find that around 37 percent of the mean reversion in winner funds and 27 percent of the mean reversion in loser funds can be explained by these two equilibrating mechanisms. They are much more important in explaining below-average performance than, say, the impact of fees.

In the case of winner funds, we provide support for the Berk and Green (2004) hypothesis that inflows of new money have a large impact on inducing mean reversion, and are more important than manager changes. Both methods combined can explain a spread in risk-adjusted performance of 0.30 percent per month (3.60 percent per year). On the other hand, the impact of fund flows on performance is much weaker in the case of loser funds. Manager replacement is a more effective equilibrating mechanism than fund outflows, especially when transactions costs associated with the latter are taken into account. Indeed, the weak results for fund flows based on the single sorting of the data are almost entirely due to the subgroup without a manager change. In contrast, fund flows and manager changes acting together complement each other in the case of loser funds. When both governance mechanisms operate jointly, risk-adjusted performance of loser funds improves by 0.20 percent per month (2.40 percent per year) compared to the subgroup of loser funds without any governance. This is greater than the sum of the individual effects.

What are the potential implications of these findings? First of all, investors should pay close attention to fund flows and the resulting changes in fund size, as well as to the career paths of individual

fund managers amongst different funds: our results show that past performance is only an indicator of future performance if the manager is not replaced and fund flows do not eliminate the persistence. It would be valuable for investors if IMCs were required to publish information on fund flows on a regular basis and on manager changes immediately.

Second, IMCs should make their best efforts to retain skilled managers. While this is an obvious statement to make, it implies that a stronger alignment of performance with remuneration might be necessary to avoid the high turnover of talented managers. Das and Sundaram (2002) have questioned the usefulness of US restrictions permitting only fulcrum fees as performance-related fee contracts. Hedge fund industry practice, which typically combines asymmetric performance fees with personal stakes by the fund manager, provides valuable lessons for the mutual fund industry. After a fund has been soft-closed by the IMC after a period of excessive inflows, it might be appropriate to allow the fund to switch from size-based fees to performance-based fees. Nohel, Wang and Zheng (2010) discuss the implications of allowing side-by-side management of hedge funds and mutual funds by the same manager as a way of retaining star fund managers. This privilege is usually only granted to the best performing managers and any agency conflicts do not seem to reduce mutual fund performance. Still, any improvement in the rewards to star fund managers will be at the expense of investors, again making it difficult for investors to benefit from any performance persistence. An important message from our findings is that star fund managers extract their skill-rents one way or another, even if that means changing jobs.

Finally, with respect to loser funds, the IMC needs to respond more promptly in the face of poor performance. Since losing fund managers seem to be incapable of extricating themselves from their losing positions, the IMC needs to replace them much sooner than hitherto: the fund-flow mechanism is much less effective at loser funds if not accompanied by a change in the fund manager.

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Appendix: Data Selection

In constructing our sample, we follow Pastor and Stambaugh (2002) and select only domestic equity funds. We exclude international funds, global funds, balanced funds, flexible funds, and funds of funds. 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 2010). This results in 3,948 funds that existed at some time during our sample period from 1992 to 2007. Different share classes of the same fund have the same manager and fund flows of individual share classes might cancel out at the portfolio level. Hence, we combine all share classes that belong to the same fund and have the same underlying portfolio to one observation. We use a matching algorithm that combines information from the fund's name and the portfolio number variable given by CRSP.[51] Fund characteristics such as the investment objective or the first offer date are taken from the oldest share class, whereas quantitative information is either summed up, such as total net assets, or we take the weighted average over all share classes, such as returns and fees. If two share classes of the same funds have different manager change dates, we use the most recent date. We classify the funds in our sample into three groups: (1) Large and mid-cap funds (LMC), (2) small-cap funds (SC) and (3) sector funds (SEC). Because ICDI classification codes are no longer available in the 2008 cut off of the CRSP mutual fund database, 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 are not consistent). Details are given in Table 11. 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.

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

[51] A matching solely based on the portfolio number variable is not possible, as this variable is available only from December 1998 onwards.

Figure 1: Portfolio formation

This figure presents the methodology we apply to construct the subgroup portfolios. Funds are first sorted into deciles based on their performance in the formation period. Then, the winner (decile 10) and loser (decile 1) funds are further divided into: (a) a low-net-inflow (high-net-inflow) subgroup if the net inflows in the formation period are lower (higher) than the median net inflows of the decile which the funds belong to (we use either absolute net inflows or relative net inflows and present the results for both); (b) a without (with) manager-change subgroup if the manager remained the same (changed) during the formation period; and (c) into four subgroups combining the criteria in (a) and (b) in a double sorting mechanism.

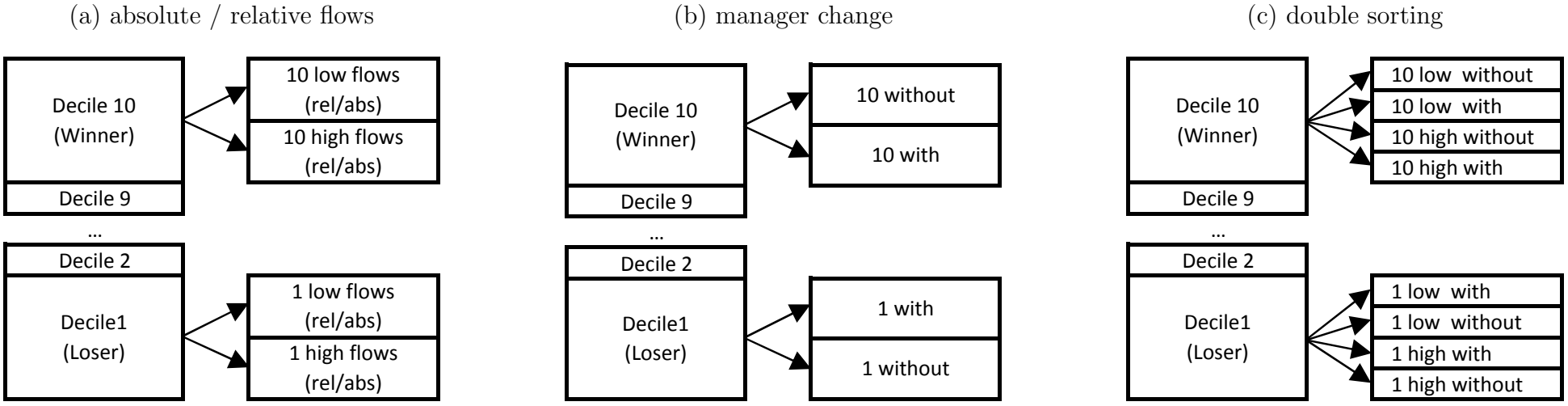

Figure 2: Mean reversion of fund performance

This figure presents the average monthly raw returns of the decile portfolios relative to the evaluation year (t). Portfolios are formed based on previous-year Bayesian four-factor alphas.

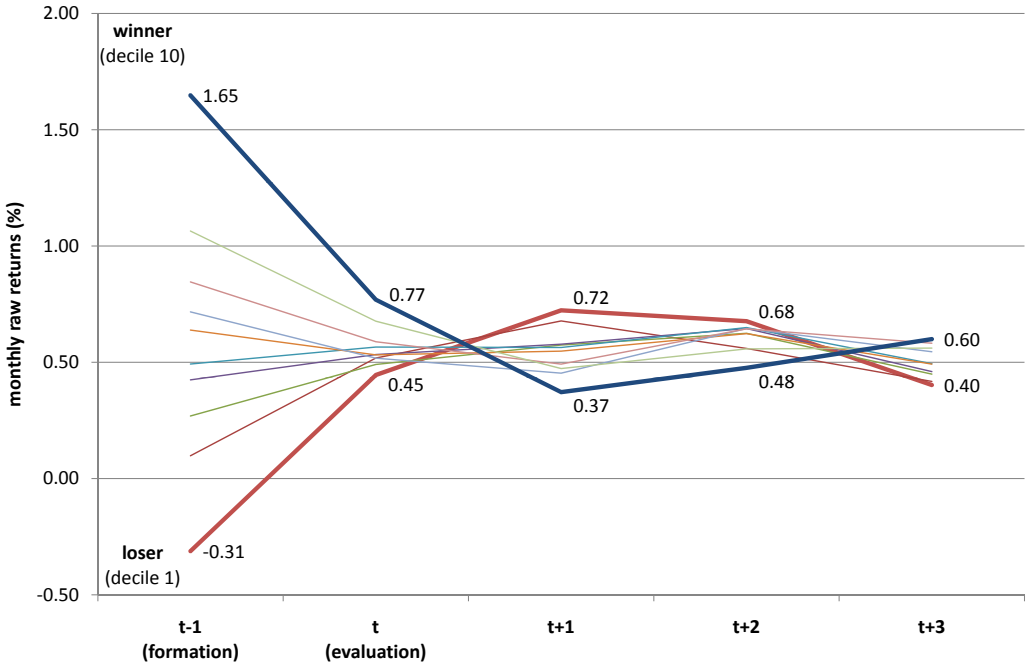

Figure 3: Average four-factor alphas for winner funds and winner-fund subgroups

This figure presents the four-factor alphas for winner funds and winner-fund subgroups based on a single sorting and also a double sorting on absolute fund flows and / or manager change. The top panel presents the level of performance (four-factor alpha) in the evaluation period and the bottom panel presents the change in performance between the formation and evaluation periods (Δ alpha). Funds are assigned to the high-net-inflow (high) or low-net-inflow (low) subgroup based on whether their net inflows during the formation period are higher or lower than the median net inflows of all other funds in the same decile. Funds are assigned to the manager-change (with) or no-manager-change (without) subgroup based on whether their fund manager changed during the formation period. Portfolios are formed based on previous-year Bayesian four-factor alphas. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

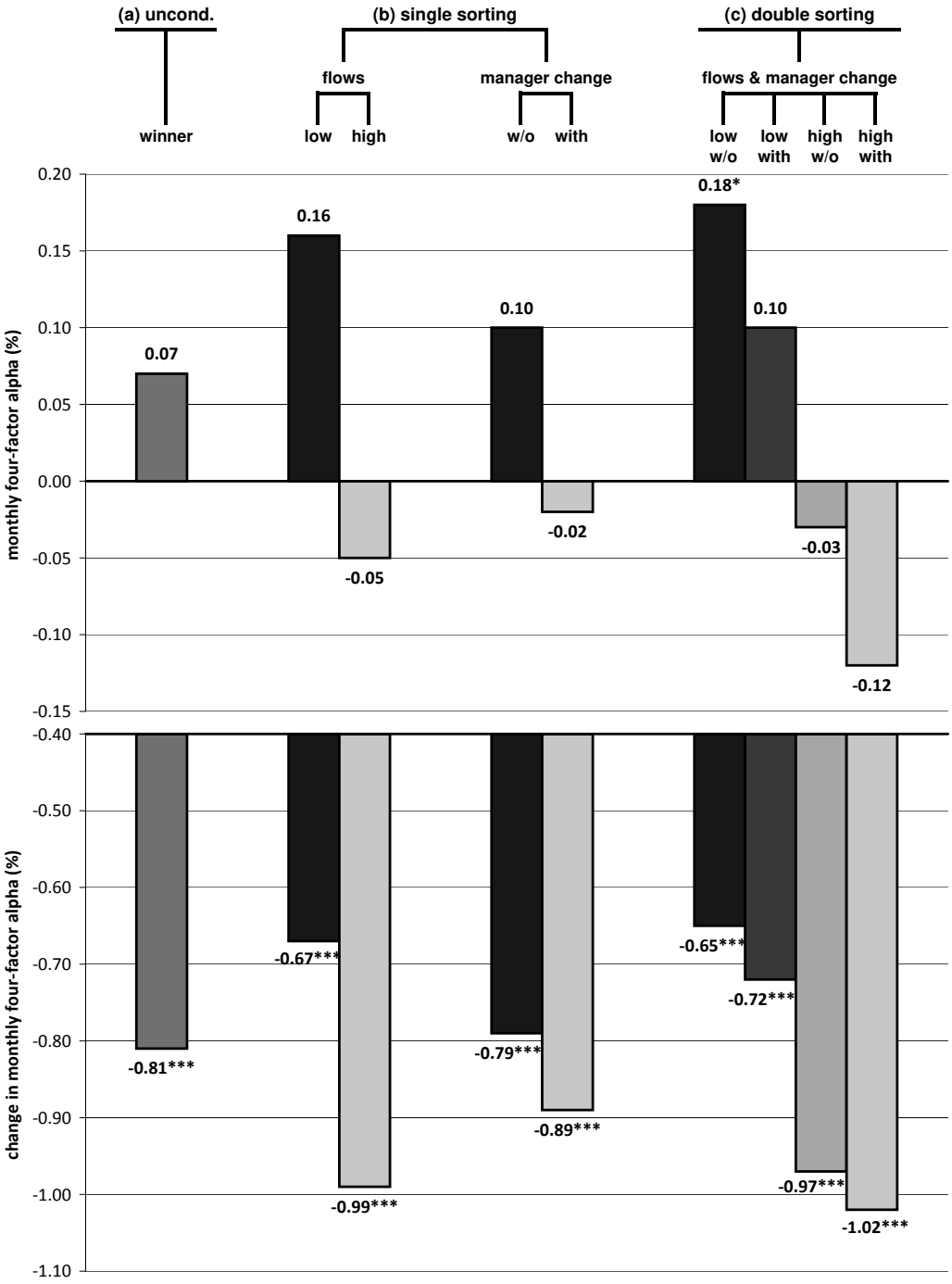

Figure 4: Average four-factor alphas for loser funds and loser-fund subgroups

This figure presents the four-factor alphas for loser funds and loser-fund subgroups based on a single sorting and also a double sorting on absolute fund flows and / or manager change. See the note to figure 3 for more explanation.

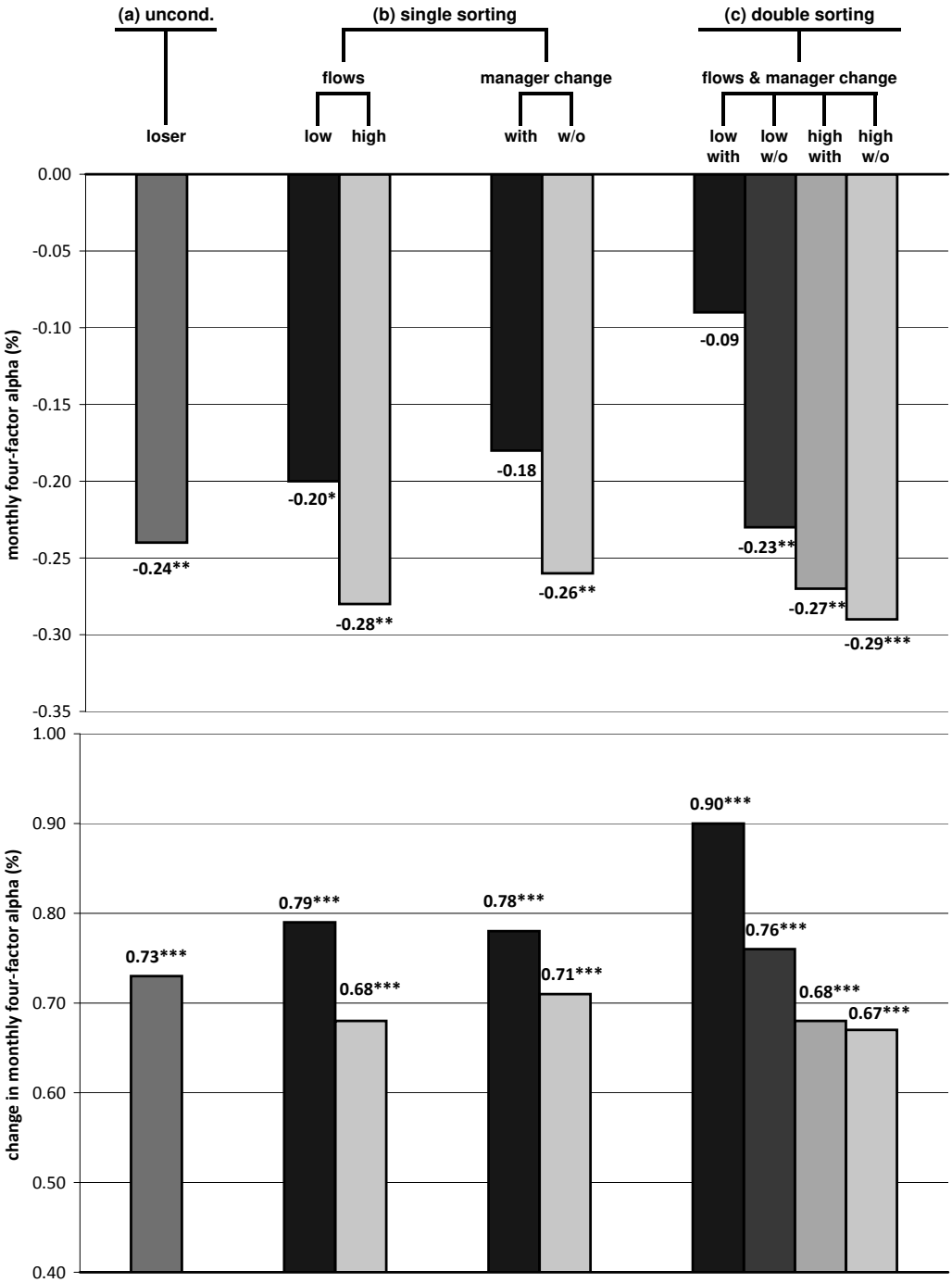

Table 1: Characteristics of funds in sample

This table presents the characteristics of the sample of funds for 48-month subperiods and for the whole period 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. Row (1) reports the number of months in the respective period; row (2) reports monthly (arithmetic) mean raw returns in excess of the rate on the risk-free asset in percent; row (3) reports the average portfolio turnover in percent; row (4) reports average fees in percent; row (5) reports the average age of the funds in years; row (6) reports the mean fund size in million USD; row (7) reports monthly mean absolute fund flows in million USD; row (8) reports the number of funds in existence; and row (9) reports the number of manager changes that occurred during this period.

	subperiods				whole period
	1992–1995	1996–1999	2000–2003	2004–2007	
# months	48	48	48	48	192
returns	0.72	1.36	-0.29	0.53	0.48
turnover	83.16	110.18	140.16	102.25	113.35
fees	1.68	1.64	1.67	1.56	1.63
age	11.72	9.91	9.81	11.99	10.80
size	461.42	853.36	849.27	1178.46	899.26
flows	4.99	4.56	2.36	0.71	2.70
# funds	1,622	2,628	3,286	3,312	3,946
# man ch	1,218	1,868	2,073	1,333	6,492

Table 2: Performance of decile portfolios

This table presents different performance measures for the decile portfolios 10 (winner) to 1 (loser) and a spread portfolio long in decile-10 funds and short in decile-1 funds. Columns (1) and (2) report raw returns and Bayesian four-factor alphas in the formation period; columns (3) and (4) report raw returns and four-factor alphas in the evaluation period; column (5) presents the change in performance between the formation and evaluation periods (Δ alpha). ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

	formation period		evaluation period		differences
	raw return	4-factor α	raw return	4-factor α	Δ 4-factor α
10 (winner)	1.65	0.88^{***}	0.77	0.07	-0.81^{***}
9	1.07	0.43^{***}	0.68	0.01	-0.43^{***}
8	0.85	0.25^{***}	0.59	-0.05	-0.29^{***}
7	0.72	0.11	0.52	-0.11^{**}	-0.22^{***}
6	0.64	-0.01	0.53	-0.10^{**}	-0.10^{***}
5	0.50	-0.12^{*}	0.57	-0.09^{*}	0.03
4	0.42	-0.24^{***}	0.53	-0.11	0.13^{***}
3	0.27	-0.38^{***}	0.49	-0.14^{**}	0.24^{***}
2	0.10	-0.56^{***}	0.52	-0.16^{*}	0.40^{***}
1 (loser)	-0.31	-0.97^{***}	0.45	-0.24^{**}	0.73^{***}
10 − 1	1.96^{***}	1.86^{***}	0.32	0.32^{*}	–

Table 3: Characteristics of decile portfolios

This table presents the characteristics of the decile portfolios 10 (winner) to 1 (loser) and a spread portfolio long in decile-10 funds and short in decile-1 funds. Panel (a) gives the results for the formation period and panel (b) for the evaluation period. Columns (1) and (2) report the mean and median of fund size in million USD, respectively; column (3) reports the average fund age in years; column (4) reports the average fees in percent; column (5) reports the average portfolio turnover in percent; columns (6) and (7) report the mean and median of absolute net inflows in million USD, respectively; and column (8) reports the number of manager changes per fund. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. For differences in means, we apply a two-sample t-test, and, for differences in medians, we apply a Mann-Whitney-U-Test.

(a) Formation period

	size		fund age	fees	turnover	absolute flows		mc/fund
	mean	median	mean	mean	mean	mean	median	
10 (winner)	757.58	109.70	9.58	1.69	1.24	10.71	0.42	0.21
9	891.03	136.00	11.10	1.61	1.10	6.24	0.16	0.20
8	1127.44	149.40	11.39	1.56	1.01	5.41	0.10	0.21
7	1015.31	151.80	11.26	1.55	0.94	4.23	0.06	0.19
6	1032.41	145.69	11.72	1.55	0.96	3.12	0.02	0.21
5	863.43	143.70	11.55	1.60	1.00	2.68	0.03	0.21
4	951.42	143.09	11.34	1.62	1.03	1.22	−0.01	0.21
3	1009.47	144.05	11.64	1.64	1.12	−0.30	−0.05	0.23
2	820.64	136.90	11.41	1.69	1.21	−0.47	−0.10	0.23
1 (loser)	684.31	104.60	10.45	1.88	1.63	−1.23	−0.26	0.23
10 − 1	73.27**	5.10***	−0.86***	−0.19***	−0.40***	11.94***	0.68***	–

(b) Evaluation period

	size		fund age	fees	turnover	absolute flows		mc/fund
	mean	median	mean	mean	mean	mean	median	
10 (winner)	1059.93	180.06	10.58	1.67	1.16	14.52	0.50	0.20
9	1118.03	184.13	12.10	1.59	1.04	8.41	0.12	0.21
8	1329.14	192.50	12.39	1.55	0.95	6.35	0.06	0.18
7	1181.07	182.70	12.26	1.55	0.89	4.43	−0.01	0.19
6	1177.34	169.60	12.72	1.54	0.94	1.90	−0.03	0.18
5	968.96	170.40	12.55	1.60	0.97	1.45	−0.05	0.20
4	1022.96	163.50	12.34	1.63	0.97	−1.13	−0.13	0.21
3	1041.18	154.60	12.64	1.62	1.12	−4.21	−0.26	0.21
2	838.86	144.20	12.41	1.70	1.18	−3.77	−0.35	0.21
1 (loser)	673.59	100.30	11.45	1.88	1.57	−4.05	−0.53	0.21
10 − 1	386.33***	79.76***	−0.86***	−0.21***	−0.41***	18.58***	1.02***	–

Table 4: Characteristics of winner-fund subgroups

This table presents the characteristics for the winner-fund subgroups and the resulting spread portfolios based on a single sorting on absolute fund flows, on relative fund flows and on manager change. Funds are assigned to the high-net-inflow (high) or low-net-inflow (low) subgroup based on whether their net inflows during the formation period are higher or lower than the median net inflows of all other funds in the same decile. Funds are assigned to the manager-change (with) or no-manager-change (without) subgroup based on whether their fund manager changed during the formation period. Columns (1) and (2) report the average fund size in million USD in the formation and evaluation periods, respectively; column (3) reports average absolute net inflows in million USD in the formation period; and column (4) reports the number of manager changes per fund in the formation period. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. For differences in means, we apply a two-sample t-test.

	formation period			evaluation period
	abs. flows	mc/fund	size	size
conditional on absolute net inflows (median split point)				
10 low	−4.50	0.22	507.53	561.27
10 high	25.78	0.22	1041.47	1596.60
10 low − 10 high	−30.28***	–	−533.95***	−1035.33***
conditional on relative net inflows (median split point)				
10 low	−1.10	0.22	816.61	965.45
10 high	22.40	0.22	733.99	1199.03
10 low − 10 high	−23.50***	–	82.62**	−233.59***
conditional on manager change (without / with)				
10 without	11.59	0.00	785.35	1106.94
10 with	7.10	1.00	643.56	866.76
10 without − 10 with	4.49***	–	141.79***	240.18***

Table 5: Performance of winner-fund subgroups (single sorting)

This table presents different performance measures for the winner-fund subgroups and the resulting spread portfolios based on a single sorting on absolute fund flows, on relative fund flows and on manager change. Funds are assigned to the high-net-inflow (high) or low-net-inflow (low) subgroup based on whether their net inflows during the formation period are higher or lower than the median net inflows of all other funds in the same decile. Funds are assigned to the manager-change (with) or no-manager-change (without) subgroup based on whether their fund manager changed during the formation period. Column (1) reports Bayesian four-factor alphas in the formation period; columns (2) and (3) report raw returns and four-factor alphas in the evaluation period; column (4) presents the change in performance between the formation and evaluation periods (Δ alpha). ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively. White's heteroscedasticity-consistent standard errors are used for the regression coefficients.

	formation period	evaluation period		difference
	4-factor α	raw return	4-factor α	Δ 4-factor α
conditional on absolute net inflows (median split point)				
10 low	0.83^{***}	0.84	0.16	-0.67^{***}
10 high	0.94^{***}	0.66	-0.05	-0.99^{***}
10 low − 10 high	-0.11	0.17^{**}	0.21^{***}	–
conditional on relative net inflows (median split point)				
10 low	0.82^{***}	0.81	0.13	-0.69^{***}
10 high	0.94^{***}	0.69	-0.03	-0.97^{***}
10 low − 10 high	-0.12	0.12^{*}	0.16^{***}	–
conditional on manager change (without / with)				
10 without	0.89^{***}	0.79	0.10	-0.79^{***}
10 with	0.87^{***}	0.70	-0.02	-0.89^{***}
10 without − 10 with	0.02	0.09^{*}	0.12^{**}	–

Table 6: Performance of winner-fund subgroups (double sorting)

This table presents different performance measures for the winner-fund subgroups and the resulting spread portfolios based on a double sorting on absolute fund flows and manager change simultaneously. See the note to table 5 for more explanation.

	formation period	evaluation period		difference
	4-factor α	raw return	4-factor α	Δ 4-factor α
conditional on absolute net inflows and manager change				
10 low without	0.83^{***}	0.85	0.18^{*}	-0.65^{***}
10 low with	0.83^{***}	0.80	0.10	-0.72^{***}
10 high without	0.94^{***}	0.69	-0.03	-0.97^{***}
10 high with	0.90^{***}	0.63	-0.12	-1.02^{***}
spread portfolios				
10 low without − 10 high with	-0.08	0.23^{*}	0.30^{***}	–
10 low without − 10 high without	-0.12	0.17^{*}	0.21^{***}	–
10 low without − 10 low with	0.00	0.05	0.07	–
10 low with − 10 high without	-0.12	0.12	0.13^{*}	–
10 low with − 10 high with	-0.08	0.18^{*}	0.22^{**}	–
10 high without − 10 high with	0.04	0.06	0.09	–

Table 7: Characteristics of loser-fund subgroups

This table presents the characteristics for the loser-fund subgroups and the resulting spread portfolios based on a single sorting on a single-sorting on absolute fund flows, on relative fund flows and on manager change. See the note to table 4 for more explanation.

	formation period			evaluation period
	abs. flows	mc/fund	size	size
conditional on absolute net inflows (median split point)				
1 low	-10.72	0.26	792.06	674.15
1 high	8.15	0.21	593.03	694.77
1 low − 1 high	-18.87^{***}	–	199.04^{***}	-20.62
conditional on relative net inflows (median split point)				
1 low	-9.66	0.25	560.40	481.26
1 high	7.09	0.22	823.60	879.86
1 low − 1 high	-16.75^{***}	–	-263.20^{***}	-398.60^{***}
conditional on manager change (with / without)				
1 with	-3.31	1.00	623.84	619.84
1 without	-0.65	0.00	700.88	688.60
1 with − 1 without	-2.66^{***}	–	-77.04^{*}	-68.76

Table 8: Performance of loser-fund subgroups (single sorting)

This table presents different performance measures for the loser-fund subgroups and the resulting spread portfolios based on a single-sorting on absolute fund flows, on relative fund flows and on manager change. See the note to table 5 for more explanation.

	formation period	evaluation period		difference
	4-factor α	raw return	4-factor α	Δ 4-factor α
conditional on absolute net inflows (median split point)				
1 low	-0.99^{***}	0.51	-0.20^{*}	0.79^{***}
1 high	-0.96^{***}	0.40	-0.28^{**}	0.68^{***}
1 low − 1 high	−0.03	0.12^{**}	0.09	–
conditional on relative net inflows (median split point)				
1 low	-0.99^{***}	0.50	-0.21^{**}	0.78^{***}
1 high	-0.95^{***}	0.41	-0.27^{**}	0.68^{***}
1 low − 1 high	−0.04	0.09	0.06	–
conditional on manager change (with / without)				
1 with	-0.97^{***}	0.52	−0.18	0.78^{***}
1 without	-0.97^{***}	0.42	-0.26^{**}	0.71^{***}
1 with − 1 without	0.01	0.11^{***}	0.08^{*}	–

Table 9: Performance of loser-fund subgroups (double sorting)

This table presents different performance measures for the loser-fund subgroups and the resulting spread portfolios based on a double sorting on absolute fund flows or manager change simultaneously. See the note to table 5 for more explanation.

	formation period	evaluation period		difference
	4-factor α	raw return	4-factor α	Δ 4-factor α
conditional on absolute net inflows and manager change				
1 low with	-0.98^{***}	0.61	−0.09	0.90^{***}
1 low without	-0.99^{***}	0.48	-0.23^{**}	0.76^{***}
1 high with	-0.95^{***}	0.44	-0.27^{**}	0.68^{***}
1 high without	-0.96^{***}	0.38	-0.29^{***}	0.67^{***}
spread portfolios				
1 low with − 1 high without	−0.02	0.23^{***}	0.20^{***}	–
1 low with − 1 high with	−0.03	0.17^{*}	0.18^{**}	–
1 low with − 1 low without	0.01	0.13^{*}	0.15^{**}	–
1 low without − 1 high without	−0.02	0.11^{*}	0.06	–
1 low without − 1 high with	−0.04	0.04	0.04	–
1 high with − 1 high without	0.02	0.06	0.02	–

Table 10: Pooled regressions for change in fund performance

This table presents the results of a pooled regression for the change in annualized Bayesian four-factor alphas between the formation and evaluation years. The explanatory variables of model 1 are total net assets (TNA) in billion USD, fees in percent, fund age in years and portfolio turnover in the previous year, two dummies that indicate whether the fund is currently in decile 10 or decile 1 based on previous year performance, respectively, relative fund flows for previous year, an interaction term between fund flows and the decile-10 and decile-1 dummy, respectively, a dummy indicating whether the manager changed during the previous year, an interaction term between a manager change and the decile-10 and decile-1 dummy, respectively. Model 2 additionally contains a dummy indicating whether the fund is a small-cap or sector fund (SC/SEC) and an interaction term between fund flows into small-cap or sector funds and the decile-10 and decile-1 dummy, respectively. Model 3 additionally contains an interaction term indicating whether the manager change among decile-10 and decile-1 funds, respectively, occurred in a large fund family. Model 4 additionally contains a dummy indicating whether the fund was ranked into decile 10, had higher-than-median flows and a manager change during the previous year and a dummy indicating whether the fund was ranked into decile 1, had lower-than-median flows and a manager change during the previous year. The last two rows present the number of observations and the adjusted R^2. Funds are ranked into deciles based on their previous-year Bayesian four-factor alphas. Following French (2008), we winsorize all variables at the 1^{th} and 99^{th} percentile to avoid any bias resulting from extreme outliers.

	Model 1		Model 2		Model 3		Model 4	
	coeff.	p-val	coeff.	p-val	coeff.	p-val	coeff.	p-val
constant	0.37^{*}	0.06	0.36^{*}	0.08	0.36^{*}	0.07	0.37^{*}	0.06
TNA_{t-1} (bn USD)	-0.13^{***}	0.00	-0.13^{***}	0.00	-0.13^{***}	0.00	-0.13^{***}	0.00
fees_{t-1} (%)	-0.09	0.38	-0.08	0.44	-0.08	0.43	-0.08	0.43
age_{t-1} ($\cdot 100$)	-0.52	0.34	-0.52	0.35	-0.53	0.34	-0.60	0.28
turnover_{t-1}	-0.02	0.75	-0.01	0.81	-0.01	0.83	-0.01	0.82
dec10_t	-8.21^{***}	0.00	-8.25^{***}	0.00	-8.25^{***}	0.00	-8.31^{***}	0.00
dec1_t	7.94^{***}	0.00	7.94^{***}	0.00	7.94^{***}	0.00	7.93^{***}	0.00
flows_{t-1}	-1.06^{***}	0.00	-1.06^{***}	0.00	-1.06^{***}	0.00	-1.06^{***}	0.00
$\text{flows}_{t-1} \cdot \text{dec10}_t$	-0.42^{***}	0.00	0.05	0.78	0.05	0.78	0.12	0.51
$\text{flows}_{t-1} \cdot \text{dec1}_t$	-0.15	0.55	0.08	0.82	0.10	0.77	0.21	0.55
style SC/SEC	–	–	-0.02	0.90	-0.02	0.87	-0.03	0.83
$\text{flows}_{t-1} \cdot \text{SC/SEC} \cdot \text{dec10}_t$	–	–	-0.86^{***}	0.00	-0.86^{***}	0.00	-0.86^{***}	0.00
$\text{flows}_{t-1} \cdot \text{SC/SEC} \cdot \text{dec1}_t$	–	–	-0.46	0.34	-0.52	0.28	-0.45	0.34
mgr_ch_{t-1}	0.15	0.41	0.15	0.42	0.15	0.42	0.15	0.41
$\text{mgr\_ch}_{t-1} \cdot \text{dec10}_t$	-1.21^{**}	0.02	-1.15^{**}	0.03	-1.30^{**}	0.04	-0.22	0.78
$\text{mgr\_ch}_{t-1} \cdot \text{dec1}_t$	0.76	0.16	0.78	0.15	-0.43	0.52	-1.80^{**}	0.02
$\text{mgr\_ch}_{t-1} \cdot \text{lfam} \cdot \text{dec10}_t$	–	–	–	–	0.41	0.66	0.41	0.66
$\text{mgr\_ch}_{t-1} \cdot \text{lfam} \cdot \text{dec1}_t$	–	–	–	–	2.92^{***}	0.00	2.71^{***}	0.00
$\text{mgr\_ch}_{t-1} \cdot \text{hi fl}_{t-1} \cdot \text{dec10}_t$	–	–	–	–	–	–	-2.29^{**}	0.01
$\text{mgr\_ch}_{t-1} \cdot \text{lo fl}_{t-1} \cdot \text{dec1}_t$	–	–	–	–	–	–	3.00^{***}	0.00
# observations (fund-years)	21,403		21,403		21,403		21,403	
R^2	0.15		0.15		0.15		0.15	

Table 11: Classification of investment objectives

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

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

* Note that 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.