Do Mutual Funds Have Decreasing Returns to Scale? Evidence from Fund Mergers *

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Abstract

This paper investigates whether mutual funds have decreasing returns to scale. The results show that acquiring funds experience performance deterioration after abnormal size increases due to mergers. The declining performance, however, is a temporary phenomenon. Fund size decreases in the post-merger period resulting from the combination of poor performance and abnormal outflows. As the abnormal size of acquiring funds decreases, fund performance tends to recover. These findings provide evidence that is consistent with mutual funds having decreasing returns to scale.

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1 Introduction

Do mutual funds exhibit decreasing returns to scale? The answer to this question is important, as it has implications for researchers, investors, and fund managers. Berk and Green's (2004) theoretical model, which provides a rational explanation for the observed fund flow-performance puzzle, relies on the key assumption of decreasing returns to scale.[1] In practice, decreasing returns to scale implies investors should consider fund size when they make investment decisions. Likewise, fund management companies should consider fund size when they determine whether and when to close funds to new investment. This paper examines the size-performance relation in fund mergers and provides evidence that is consistent with decreasing returns to scale.

Empirical evidence on the relation between size and performance is mixed. Chen, Hong, Huang, and Kubik (2004), Edelen, Evans, and Kadlec (2007), and Yan (2008) document a significantly negative relation between fund size and performance. They show that liquidity and trading costs are the underlying factors driving the adverse effect of size on performance. However, these findings are challenged by the endogeneity of fund size. Manager skill is an omitted variable, which may be correlated with both fund size and performance. Reuter and Zitzewitz (2013) address the endogeneity of fund size by examining the size-performance relation in a natural experiment setting, where small differences in mutual fund returns cause discrete changes in Morningstar ratings. The changes in Morningstar ratings yield discrete differences in fund size, which are nearly unrelated to fund performance. They find that the impact of size on performance is not significant. Pástor, Stambaugh, and Taylor (2014) address the omitted-variable bias by including fund fixed effects to account for heterogeneity in managerial skills. They find an insignificant but negative relation between fund size and performance. Responding to the endogeneity issue, Phillips, Pukthuanthong, and Rau (2014) use instrumental variables that are correlated with size but unrelated to recent performance. They find little evidence that fund size directly affects performance.

While Reuter and Zitzewitz (2013), Pástor, Stambaugh, and Taylor (2014), and

[1] Previous studies show that fund performance is neither persistent nor predictable, but mutual fund investors chase past performance. This phenomenon is referred to as the fund flow-performance puzzle. See Chevalier and Ellison (1997), Sirri and Tufano (1998), and Sapp and Tiwari (2004).

Phillips, Pukthuanthong, and Rau (2014) address the potential endogeneity of fund size, these empirical tests may lack power as they only capture relatively small changes in fund size. In this paper, I alleviate both concerns of endogeneity and power of tests by analyzing events associated with large shocks to fund size that are unrelated to prior performance – mutual fund mergers. My empirical results show that the likelihood of being an acquiring fund in mergers is not significantly related to past performance. Thus, examining the fund size-performance relation in mergers is not subject to the endogenous size issue. The results also show that the size change of acquiring funds resulting from the mergers is statistically and economically significant. The acquiring funds experience an average of 50% (a median of 8%) abnormal increase in size due to mergers.

My main findings are as follows. First, acquiring funds experience performance deterioration after their size increases abnormally due to mergers. The average return decile of acquiring funds relative to other funds with the same investment objective is about 5.55 before mergers, but drops to about 5.35 after mergers. The annualized Carhart alpha (α^{c4}), which averages -0.68% (t-stat $= -2.16$) over the four years before mergers, falls to -1.33% (t-stat $= -4.69$) over the four years after mergers. The average annualized objective-adjusted return (OAR) of acquiring funds is positive (but not significant) four years before mergers (OAR $= 0.42\%$, t-stat $= 1.11$) and becomes significantly negative four years after mergers (OAR $= -0.53\%$, t-stat $= -4.53$). Using each fund's pre-event performance as a benchmark, I find that the change in performance of acquiring funds is negative and significant ($\Delta\alpha^{c4} = -0.65\%$, t-stat $= -1.54$ and ΔOAR $= -0.95\%$, t-stat $= -2.19$). These findings provide evidence that supports mutual funds having decreasing returns to scale.

Second, acquiring funds that experience positive size shocks resulting from the mergers lose assets under management in the post-merger period. That is, investors redeem their shares from the acquiring funds after mergers. The average flow decile of acquiring funds, which fluctuates around the median level of 5.5 before mergers, decreases to about 5.0 after mergers. The average objective-adjusted flows of acquiring funds, which are insignificantly different from zero before mergers, become significantly negative after the events. Combined with the declining post-merger performance, the persistent outflows

lead to decreases in size after the merger events.

Third, the worsening performance is a temporary phenomenon. Fund performance tends to recover as size decreases in the post-merger period. The average performance decile of acquiring funds tends to recover to the pre-merger level of 5.55 by the end of the fourth year after mergers. The magnitude and significance of the Carhart alpha decrease in the fourth year after mergers and the OAR becomes insignificant two years after the events. I sort acquiring funds into subsamples according to their abnormal size at the end of each year in the post-merger period. I find that funds with smaller abnormal size in the subsample formation year experience performance recovery in the year after subsample formation. In contrast, the performance of funds which have larger abnormal size deteriorates in the following year. These findings also provide evidence that is consistent with decreasing returns to scale.

My paper is related to Jayaraman, Khorana, and Nelling (2002), who use data from 1994 to 1997 to study the determinants of being acquired in fund mergers and the impact of mergers on shareholders' wealth. They provide evidence that acquiring funds experience performance deterioration and capital outflows in the year following mergers. I consider a much longer sample period (1991 to 2013) and extend the test window to four years before and after mergers. Importantly, I show the declining performance is a temporary phenomenon and that fund size decreases in the post-merger period resulting from the combination of poor performance and persistent abnormal outflows.

Overall, my results are consistent with the model of Berk and Green (2004). In their model, rational investors compete with each other to find skilled managers who can deliver positive alpha. Since managerial skills are not observable to investors, investors take superior past performance as a signal of skill. Investors move their money into superior performing funds and move their money out of funds that perform poorly. Thus, we observe fund flows chasing performance. However, due to decreasing returns to scale, fund performance deteriorates as capital flows into a fund. Fund flows continue until fund size reaches a point where the fund is no longer expected to either outperform or underperform in the future. My results also show that there is a delayed reaction of investors to the abnormal size increase and performance deterioration of acquiring

funds. These findings are consistent with the asymmetric response of fund flows to performance documented by Gruber (1996), Chevalier and Ellison (1997), and Sirri and Tufano (1998).[2]

The remainder of the paper is organized as follows. Section 2 reviews the literature. Section 3 describes the data. Section 4 introduces methodologies and presents empirical findings. Section 5 contains the robustness tests. Section 6 concludes.

2 Literature Review

This paper contributes to three strands of literature. A first set analyzes whether mutual funds have decreasing returns to scale. A second set examines fund flow-performance relation. A third set studies the determinants and influence of fund mergers.

2.1 Decreasing Returns to Scale

Early empirical studies provide evidence that is consistent with decreasing returns to scale. Chen, Hong, Huang, and Kubik (2004) first document a negative relation between fund size and performance. They find that small-cap funds exhibit a stronger adverse effect of size on performance. Since small-cap funds are more likely to have illiquid holdings, the authors argue that fund size erodes performance because of liquidity. Yan (2008) measures liquidity using bid-ask spread and market impact and documents similar results. He finds that funds which hold less liquid portfolios and which have high liquidity demand, such as growth funds and high-turnover funds, have a stronger negative relation between size and performance. Edelen, Evans, and Kadlec (2007) examine the role of trading costs as a source of decreasing returns to scale. They regress fund returns on both relative trade size and fund size, finding that relative trade size subsumes fund size in the regression. The authors conclude that trading cost is a major source of

[2]Gruber (1996), Chevalier and Ellison (1997), and Sirri and Tufano (1998) show that funds with superior recent performance enjoy disproportionately large new money inflows, while funds with poor performance suffer smaller outflows.

diseconomies of scale. Pollet and Wilson (2008) examine the response of mutual funds to asset growth. The authors argue that if mutual funds do not have decreasing returns to scale, then managers should simply scale up their few best investment ideas as asset under management increases. Yet, they find that large funds and small-cap funds diversify their portfolios as their size increases. These findings support liquidity cost as an explanation for diminishing returns to scale. However, Elton, Gruber, and Blake (2012) show an insignificant relation between size and performance by examining samples of increasingly larger funds. They explain that the reduction of expense ratio outweighs the effect of decreasing returns to scale as a fund increases in size.

Recent literature questions the documented negative relation between fund size and performance. Size is not randomly assigned to funds. Manager skill is an omitted variable, which may be correlated with both size and performance. Reuter and Zitzewitz (2013) argue that in order to examine whether size erodes performance, we need to identify the variation in fund size that is uncorrelated with manager skill. They observe that funds with past returns above a Morningstar rating threshold are more likely to receive inflows than funds with past returns immediately below the threshold. Exploiting this fact, Reuter and Zitzewitz (2013) use a regression discontinuity approach to address the endogeneity of fund size. Specifically, they use a reduced-form regression model in which the dependent variable is fund return in period $t + 1$ and the independent variable of interest is a dummy variable that indicates whether fund return is above the threshold in period t. The authors find that the magnitude of diseconomies of scale is not strong enough to be significant.

Pástor, Stambaugh, and Taylor (2014) address the endogeneity of fund size by including fund fixed effects to account for heterogeneity in managerial skills while fixing a lookahead bias. Including fixed effects is equivalent to running a demeaned model. The authors argue that including fund fixed effects will downward bias the coefficient estimate for the demeaned size. A fund's full-sample time-series mean of size is subtracted to compute the demeaned size. Thus, the demeaned size of fund i in period t depends on all time-series observations, including observations after period t. The authors define this demeaned size as forward-demeaned size. A higher return in period $t + \tau$, where

$\tau = 1, ..., T$, increases the time-series mean of fund size, which decreases the forward-demeaned size in period t. Thus, the forward-demeaned size of fund i in period t is negatively correlated with the innovation of size after period t, which in turn is positively correlated with the error term. The positive correlation between innovation in size and the error term is the source for the downward biased coefficient estimate for the forward-demeaned size (Stambaugh (1999)). To avoid this mechanical negative bias, the authors calculate the demeaned size using only the observations of fund i prior to period t. They define this demeaned size as backward-demeaned size. The authors use the backward-demeaned size as an instrumental variable. They first regress the forward-demeaned size on the backward-demeaned size and then regress demeaned returns on the fitted values from the first-stage regression. They find an insignificant but negative relation between size and performance.

Responding to the endogeneity concern, Phillips, Pukthuanthong, and Rau (2014) use stale performance chasing to identify a set of instrumental variables and re-examine the size-performance relation. The intuition of stale performance chasing is the following. Investors increase asset allocations to the funds which experience improvement in holding period return. One source of this improvement is dropping a stale negative end-return from the horizon of the holding period return calculation. Such improvement is not related to recent fund performance. To obtain instrumental variables, they regress fund flows on last period return ($R_{i,t-1}$) and returns at the end of one-, three-, or five-year holding period return horizon ($R_{i,t-\tau}$, where $\tau = 13, 37, 61$). The authors argue that the parameter estimates for $R_{i,t-\tau}$ are correlated with size but are unrelated to recent performance and use them as instrumental variables. They find little evidence that size directly affects performance.

2.2 Flow-Performance Relation

Previous studies examining the fund flow-performance relation aim to explain why investors place money with mutual funds despite fund performance being neither persistent nor superior to passive strategies. Berk and Green (2004) argue that investors infer man-

agerial skills from past returns and rationally move their money across funds. Berk and Green (2004) assume that mutual funds have decreasing returns to scale. Performance decreases as a fund receives capital inflows. Empirical studies document an asymmetric response of fund flows to performance. Gruber (1996), Chevalier and Ellison (1997), and Sirri and Tufano (1998) show that funds with superior recent performance enjoy disproportionately large new money inflows, while funds with poor performance suffer smaller outflows. Sirri and Tufano (1998) examine the impact of search cost on fund flows. They find that funds belonging to a larger family and receiving more media attention are more likely to have lower search costs and thus grow more rapidly than other funds.

Some studies examine whether mutual fund investors are able to predict future fund performance. Gruber (1996) finds some evidence that new flows gain positive alpha. Zheng (1999) builds on Gruber (1996) and shows the "smart money" effect. She finds that funds with positive flows outperform those with negative flows and that the smart money effect is a short-lived phenomenon. Sapp and Tiwari (2004) re-examine whether mutual fund investors are able to predict fund performance and find that the Carhart alpha is the same for funds with positive and negative flows. They conclude that the smart money effect is completely explained by a momentum factor.

2.3 Mutual Fund Mergers

Previous studies examine the determinants of being acquired in fund mergers. Jayaraman, Khorana, and Nelling (2002), Zhao (2005), and Ding (2006) find that poor performance of target funds is a main reason for within-family mergers. A defunct fund with higher management fees or 12b-1 fees is more likely to be merged within-family (English, Demiralp, and Dukes (2011)). Khorana, Wedge, and Tufano (2007) find that across-family mergers are more likely when the target board has a larger percentage of independent directors but less likely when boards are paid higher than average.

Some studies shed light on the subsequent wealth impact of mergers on shareholders. Jayaraman, Khorana, and Nelling (2002) provide evidence that investors of target funds realize significant benefits in terms of reduced fees and improved performance af-

ter mergers and that shareholders of acquiring funds suffer worsening performance in the year following mergers. Namvar and Phillips (2013) show that similarities of management objectives between merger funds positively affect post-merger performance.

3 Data

I collect data from the CRSP survivor-bias-free mutual fund database. CRSP provides fund monthly total net asset (TNA) data since 1991. The sample period for this study is 1991–2013. Following previous studies, this paper is restricted to diversified U.S. equity mutual funds.[3] I remove the first three years of return data for all funds to eliminate the incubation bias (Evans (2010)). I also exclude the funds with TNA less than $15 million to eliminate the upward bias in their reported returns (Elton, Gruber, and Blake (2001); Chen, Hong, Huang, and Kubik (2004); Yan (2008); and Pástor, Stambaugh, and Taylor (2014)).

I identify a merger if the delist code is M in the last report month of a fund. Mergers among share classes of the same fund are excluded. There are 1,335 acquisitions in my sample. Because the last TNA report month of target funds may not be the merger event month, I employ the following procedure to identity the merger event month (See Lou (2012)). I match a target fund to its acquiring fund from one month before its last report month to three months after. I then designate the month in which the acquiring fund has the largest flow as the event month. Fund flow is calculated following Sirri and Tufano (1998):

$$Flow_{i,t} = \frac{TNA_{i,t} - (1 + R_{i,t}) \times TNA_{i,t-1}}{TNA_{i,t-1}}, \tag{1}$$

where $Flow_{i,t}$, $TNA_{i,t}$, and $R_{i,t}$ are flow, total net asset, and return of fund i in month t.

Figure 1 plots the number of mergers every year from 1991 to 2013. I count the number of mergers from the perspective of acquiring funds. A merger event in which an acquiring fund acquires multiple funds at the same time is counted as one merger in

[3]See Chen, Hong, Huang, and Kubik (2004); Edelen, Evans, and Kadlec (2007); Pollet and Wilson (2008); Yan (2008); Phillips, Pukthuanthong, and Rau (2014); and Pástor, Stambaugh, and Taylor (2014).

this study. The number of mergers increases from seven in 1991 to beyond 50 in the early 2000s, reaches a high of 162 in 2009, and decreases to 45 in 2013. CRSP provides identifiers of fund family since December 1999. I count the number of acquiring families, target families, and total families that have domestic equity funds for the period of 2000–2013. On average there are about 55 families involved in mergers of domestic equity funds every year, which account for about 11% of all families that have domestic equity funds (untabulated results).

Table 1 reports characteristics of acquiring funds, target funds, and other funds that are not involved in mergers. I use fund-month observations to calculate characteristics of each fund group. Only months which have characteristics of both comparing fund groups are included in the calculation. Characteristics of interest include size, performance, return volatility, expense ratio, age, and flow. *Size* is measured as the TNA in million dollars.[4] *Performance* is fund monthly returns. *Return Volatility* is the standard deviation of fund returns in the past 12 months (including the current month). *Age* is calculated in months. I calculate the value-weighted characteristics of a fund which has multiple share classes following Wermers (2000). To compare characteristics between acquiring funds and target funds and between acquiring funds and other funds, I do the following calculations. First, I calculate the average characteristics 12 months before mergers for each acquiring and target fund. Second, I calculate the cross-sectional average characteristics of acquiring funds with the same merger month and the cross-sectional average characteristics of target funds with the same last report month. Third, I calculate the cross-sectional average characteristics of other funds every month in the sample period. These calculations yield time series of characteristics for acquiring, target, and other funds, respectively. Column (1)–(3) compare characteristics between acquiring and target funds for the period of 2000–2013. Column (4)–(6) compare characteristics between acquiring and other funds during the sample period of 1991–2013. t-statistics are in parentheses.

I find that acquiring funds are larger (t-stat = 8.88), older (t-stat = 2.18), cheaper

[4]Appendix Table A1 reports the cross-sectional distribution of total net assets of all equity funds for the period of 1991–2013. Appendix Table A2 reports the cross-sectional distribution of total net assets of acquiring funds for the period of 1991–2013. Appendix Table A3 reports the cross-sectional distribution of total net assets of target funds for the period of 2000–2013.

(t-stat = -6.92), and experience greater flows (t-stat = 7.41) than target funds. Compared to other funds that are not involved in mergers, acquiring funds are smaller (t-stat = -3.93) and charge a higher fee (t-stat = 3.22). The other characteristics of acquiring funds are not significantly different from the other funds. For example, the performance of acquiring funds is not significantly different from the performance of other funds in a univariate setting. The performance difference between acquiring and other funds is 0.03%, with t-statistic of 0.08.

4 Methodologies and Findings

4.1 Preliminary Tests

Decreasing returns to scale implies that increases in size negatively affect future fund performance. Yet, size is not randomly assigned to funds. Manager skill is an omitted variable, which may be correlated with both size and performance. Previous studies examining the size-performance relation either fail to address the potential endogeneity of size or only capture small changes in size. To justify testing the size-performance relation in fund mergers, I conduct two preliminary analyses which examine whether the likelihood of being acquiring funds is related to their past performance and whether acquiring funds experience an abnormal size increase due to mergers. The abnormal size increase is defined as the difference between the actual size of acquiring funds after mergers and their would-be size if there were no mergers. I test the relation between past performance and the probability of being acquiring funds in Section 4.1.1 and investigate whether mergers result in economically meaningful shocks to the size of acquiring funds in Section 4.1.2.

4.1.1 Determinants of being Acquiring Funds in Mergers

I test the relation between past performance and the probability of being an acquiring fund in mergers using the following logistic regression specification:[5]

$$\begin{aligned} Probability\ (Acquiring\ Fund)_{i,t} = \beta_0 + \beta_1(Performance)_{i,t-1} + \beta_2(Flow)_{i,t-1} \\ +\beta_3(Size)_{i,t-1} + \beta_4(Expense\ Ratio)_{i,t-1} \\ +\beta_5(Number\ of\ Objectives\ in\ the\ Family)_{i,t-1} \\ +\beta_6(Age)_{i,t-1} + \beta_7(Return\ Volatility)_{i,t-1}, \end{aligned} \tag{2}$$

where i refers to fund i and t indicates month t. The independent variables are fund characteristics. *Performance*, *Flows*, *Expense Ratio*, and *Return Volatility* are objective-adjusted fund characteristics following previous studies.[6] An objective-adjusted characteristic is the difference between fund characteristic and the average characteristic of all funds with the same investment objective. These objective-adjusted measures of fund characteristics implicitly account for sector, industry, or style-specific factors that may affect fund characteristics for the same investment objective. *Performance* is the objective-adjusted cumulative return. Cumulative returns are calculated over the past 12 months. *Flow* and *Expense Ratio* are averaged over past 12 months. *Return Volatility* is the standard deviation of fund returns in the past 12 months. *Size* is the logarithm of total net asset of a fund. *Number of Objectives in the Family* is a measure of fund family size.[7] *Age* is the logarithm of fund age in months.

I use annual observations to run the logistic regression model. Following Jayaraman, Khorana, and Nelling (2002), I form the dependent and independent variables every year in June. The dependent variable takes on a value of one if a fund acquires other funds in the subsequent 12-month period and takes a value of zero otherwise. Fund characteristics over the past 12-month period (including the current month) are used to construct the

[5] Jayaraman, Khorana, and Nelling (2002) use this model to examine the determinants of being a target fund in mergers.

[6] See Jayaraman, Khorana, and Nelling (2002); Zhao (2005); Ding (2006); Khorana, Wedge, and Tufano (2007); and English, Demiralp, and Dukes (2011).

[7] CRSP provides identifiers of fund family since December 1999. The sample period used to study the determinants of mergers is 2000–2013.

independent variables. For instance, in June 2000, the dependent variable takes on a value of one if a fund acquires other funds in the subsequent 12-month period of July 2000 to June 2001. Fund characteristic data over July 1999 to June 2000 are used to construct the independent variables.

Table 2 Column (1) reports the regression coefficients and Column (2) reports the marginal effects for all mergers. The key finding is that past performance is not significantly related to the probability of being an acquiring fund in mergers ($\beta_1 = 0.413$, p-value = 0.32, marginal effect = 0.010). This finding verifies the use of fund mergers as a shock to fund size to test the size-performance relation. The results show that fund flows ($\beta_2 = 0.338$, p-value = 0.59, marginal effect = 0.008), family size ($\beta_5 = 0.001$, p-value = 0.36, marginal effect = 0.000), return volatility ($\beta_6 = 2.296$, p-value = 0.39, marginal effect = 0.055), and age ($\beta_7 = 0.016$, p-value = 0.81, marginal effect = 0.000) are not significantly related to the probability of acquisition. I find that larger ($\beta_3 = 0.044$, p-value = 0.08, marginal effect = 0.001) and cheaper ($\beta_4 = -0.309$, p-value = 0.00, marginal effect = -0.007) funds are more likely to acquire other funds.

There are two types of fund mergers. A within-family merger refers to the combination of two funds within the same fund family. An across-family merger involves the combination of two funds from different fund families. Column (3) and (4) report the results for within-family mergers. Column (5) and (6) report the results for across-family mergers. The key finding is that the relation between past fund performance and the probability of being an acquiring fund is insignificant for both within-family ($\beta_1 = 0.247$, p-value = 0.65, marginal effect = 0.004) and across-family ($\beta_1 = 0.570$, p-value = 0.37, marginal effect = 0.005) mergers. I find that larger funds ($\beta_3 = 0.075$, p-value = 0.02, marginal effect = 0.001) are more likely to acquire other funds within-family. Funds that charge a lower fee are more likely to acquire other funds in both within-family ($\beta_4 = -0.250$, p-value = 0.03, marginal effect = -0.004) and across-family ($\beta_4 = -0.039$, p-value = 0.00, marginal effect = -0.003) mergers. Fund flows, age, return volatility, and fund family size are not significantly related to the probability of being an acquiring fund in either within-family or across-family mergers.[8]

[8]I also use different measures for fund performance, including (but not limited to) the objective-adjusted cumulative returns of past six months; the objective-adjusted average returns of past six and 12

Overall, I find that the likelihood of being an acquiring fund in mergers is not related to past performance. This finding verifies that testing the relation between size and performance in mergers is not subject to the endogenous fund size issue.

4.1.2 Abnormal Size Increase due to Mergers

There are three sources of fund size change in general: returns, flows, and acquisitions. Funds which have superior past performance grow in size, and funds that receive capital inflows also experience size growth. Capital inflows and fund performance are related. Funds with better performance are more likely to attract new capital inflows than poorly performing funds. Funds can also increase size through acquisitions. Yet, target investors could withdraw all money prior to the merger. Some shareholders of acquiring funds may also redeem their shares before the event. Thus, acquisitions may not lead to significant increases in size of acquiring funds. This section explores whether acquiring funds experience an abnormal size increase resulting from the mergers. The abnormal size is the difference between fund actual size (total net asset (TNA)) and its would-be size (denoted as $Size^*$) if there were no mergers. I use two predictive regression models to obtain $Size^*$.

I build two predictive regression models based on previous theoretical work and empirical findings. The first predictive regression model (Model (1)) is constructed based on the theoretical model of Berk and Green (2004):

$$\begin{aligned}\Delta\%Size_{i,t} = \beta_0 + \beta_1(Performance)_{i,t-1} + \beta_2(Return\ Volatility)_{i,t-1} \\ +\beta_3(Size)_{i,t-1} + \beta_4(Age)_{i,t-1} + \beta_5(Expense\ Ratio)_{i,t-1} \\ +\beta_6(Performance \times Return\ Volatility)_{i,t-1} \\ +\beta_7(Performance \times Age)_{i,t-1},\end{aligned} \tag{3}$$

where i refers to fund i and t indicates month t. The dependent variable is percentage

months; the Capital Asset Pricing Model alpha (Sharpe (1964) and Lintner (1965)); the Fama–French three-factor alpha (Fama and French (1993)); and the Carhart four-factor alpha (Carhart (1997)). All these measures of performance yield similar results (unreported) that the probability of being an acquiring fund in mergers is not related to past performance.

change in size:

$$\Delta\%Size_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}}{TNA_{i,t-1}},^{9} \tag{4}$$

where $TNA_{i,t}$ is total net asset of fund i in month t. The independent variables of Model (1) are fund characteristics, which are lagged one period. *Performance* is the cumulative returns over the past 12 months. *Return Volatility* is the standard deviation of returns over the past 12 months. *Size* is the logarithm of fund TNA. *Age* is the logarithm of fund age in months. *Expense Ratio* is fund expense ratio. *Performance* $\times$ *Return Volatility* interacts fund cumulative returns with standard deviation of past returns. *Performance* $\times$ *Age* interacts the cumulative returns with the logarithm of fund age in months.

In line with the prediction of Berk and Green's (2004) model, these fund characteristics affect changes in size in an intuitive way. Size increases as a fund experiences superior performance ($\beta_1 > 0$). Because it is hard for investors to learn managerial skills when past performance volatility is high, the relation between past performance volatility and future flows is negative ($\beta_2 < 0$). Large and old funds are less likely to attract new capital inflows as their managers may have already used their best investment ideas (Pollet and Wilson (2008)). The expected future abnormal returns of these funds are relatively lower than the promising young and small funds ($\beta_3 < 0$ and $\beta_4 < 0$). Funds become less attractive to investors as their fees increase ($\beta_5 < 0$). Some fund characteristics may affect the responsiveness of size change to performance. As performance volatility increases, investors learn less from returns about managerial skills. Thus, volatility negatively impacts the responsiveness of size change to a given return ($\beta_6 < 0$). As fund age increases, investors have more information about managerial skills. The impact of age on the responsiveness of size change to the next return is also negative ($\beta_7 < 0$).

Sirri and Tufano (1998) document an asymmetric flow-performance relation. Funds with superior recent performance enjoy disproportionately large new money inflows. The

[9]The percentage change in fund size in period t is the sum of fund flow and return in period t: $\Delta\%Size_{i,t} = Flow_{i,t} + Return_{i,t}$. An alternative methodology is to model fund flows and returns separately. My main goal of using predictive regression models is to obtain the would-be size of acquiring funds (denoted as $Size^*$) if there were no mergers. Berk and Green (2004) provide a theoretical model between percentage change in fund size and fund characteristics. Since their model directly serves the purpose of obtaining the would-be size ($Size^*$) of acquiring funds, I model percentage change in size rather than modelling flows and returns separately in this paper.

asymmetric flow-performance relation implies that fund's relative performance to other funds with the same investment objective positively affects the responsiveness of size change to performance. Sirri and Tufano also document a "spillover effect." If a fund performs extremely well, other funds in the same family experience increases in capital inflows as well. Following Sirri and Tufano (1998), I add two independent variables to the second predictive regression model (Model (2)):

$$\begin{aligned}\Delta\%Size_{i,t} = \beta_0 + \beta_1(Performance)_{i,t-1} + \beta_2(Return\ Volatility)_{i,t-1} \\ +\beta_3(Size)_{i,t-1} + \beta_4(Age)_{i,t-1} + \beta_5(Expense\ Ratio)_{i,t-1} \\ +\beta_6(Performance \times Return\ Volatility)_{i,t-1} \\ +\beta_7(Performance \times Age)_{i,t-1} \\ +\beta_8(Performance \times Return\ Decile)_{i,t-1} \\ +\beta_9(Spillover\ Effect)_{i,t-1},\end{aligned} \tag{5}$$

where *Performance* × *Return Decile* interacts the cumulative returns with fund return decile. I calculate the return decile for each equity fund among funds with the same investment objective. *Spillover Effect* is a dummy variable which takes a value of one if funds from a family which has star funds and takes a value of zero otherwise. A star fund has performance in the top five percent of all funds with the same investment objective. The findings of Sirri and Tufano (1998) imply that holding other fund characteristics the same, return decile positively impacts the responsiveness of size change to performance ($\beta_8 > 0$). Funds from a family with star funds receive more inflows compared to other funds from a family without star funds ($\beta_9 > 0$).

I run a panel regression with year fixed effects using all domestic equity funds to obtain the coefficient estimates ($\widehat{\beta}$) for each model. Table 3 reports the regression results. The results are consistent with the theoretical model predictions and previous empirical findings. I use the regression results for Model (2) to explain the findings. I find that fund size change is positively related to performance ($\beta_1 = 0.113$, t-stat $= 7.76$).[10] Small ($\beta_3 =$

[10]The marginal effects of $Performance$ on $\Delta\%Size$ are $(0.113 - 0.153 \times Return\ Volatility - 0.016 \times Age)$ using predictive regression Model (1) and $(0.093 - 0.14 \times Return\ Volatility - 0.016 \times Age + 0.003 \times Return\ Decile)$ using predictive regression Model (2). I calculate the marginal effect of $Performance$ on $\Delta\%Size$ for each equity fund for each model. I find that the mean marginal effect is 0.026 with standard

-0.002, t-stat $= -9.36$), young ($\beta_4 = -0.004$, t-stat $= -5.84$), and cheaper ($\beta_5 = -0.612$, t-stat $= -7.06$) funds are more likely to increase in size. I also find that performance volatility negatively impacts the responsiveness of size change to a given return ($\beta_6 = -0.140$, t-stat $= -3.10$). When volatility of past returns is high, investors learn less about managers' ability from returns. As fund age increases, investors have more information about fund performance and are less responsive to recent performance ($\beta_7 = -0.016$, t-stat $= -5.81$). A given good return triggers more size increase if the fund's relative performance to its peer group is higher ($\beta_8 = 0.003$, t-stat $= 5.02$). The results provide evidence for the spillover effect ($\beta_9 = 0.016$, t-stat $= 8.65$). Funds experience increases in capital inflows if there are star funds in the same family. I also add four lags of flows to Model (2) to control for the persistence in investment flows following Ferson and Kim (2012) and Lou (2012) and find similar results.[11]

After obtaining the coefficient estimates, I calculate the expected percentage change in size in the merger event month (period t):

$$E_{t-1}\left[\Delta\%Size_{i,t}\right] = \mathbf{X}_{i,t-1}\widehat{\beta}, \tag{6}$$

where $\mathbf{X}_{i,t-1}$ refers to characteristics of fund i one month before the merger (period $t-1$) and $\widehat{\beta}$ is a vector of coefficient estimates of the predictive regression model. Next, I calculate $Size^*$ in the merger month using the expected percentage change in size:

$$Size^*_{i,t} = TNA_{i,t-1} \times \left(1 + E_{t-1}\left[\Delta\%Size_{i,t}\right]\right). \tag{7}$$

I test whether the abnormal size and the abnormal percentage change in size resulting from the mergers are significantly different from zero. The abnormal percentage change in size due to mergers is the difference between the actual percentage change in size and the expected percentage change in size calculated using the predictive regression models.

deviation of 0.011 using predictive regression Model (1). About 98% of all funds have a positive marginal effect of $Performance$ on $\Delta\%Size$. Using predictive regression Model (2), marginal effects have a mean of 0.021 and standard deviation of 0.014. About 94% of all funds have a positive marginal effect of $Performance$ on $\Delta\%Size$.

[11] I add four lags of flows to Model (2) and run a panel regression with year fixed effects. The results are available upon request.

Table 4 reports the test results. I find that the mean abnormal percentage increase in size that acquiring funds experience due to mergers is 49% (t-stat = 9.21) and the median is 8%. The mean abnormal size of acquiring funds in the merger event month is \$144 million (t-stat = 10.01) and the median is \$27 million. Using the predictive regression Model (2) yields similar results. Acquiring funds experience an average of 52% (t-stat = 9.21) abnormal size increase resulting from the mergers and the average abnormal size in the merger event month is \$151 million (t-stat = 9.23). These findings show that mergers result in statistically significant and economically meaningful shocks to fund size.[12]

4.2 Size-Performance Relation

I have shown that acquiring funds experience abnormal size increases resulting from the mergers and that the likelihood of being an acquiring fund is unrelated to past performance. These preliminary test results justify examining the size-performance relation in fund mergers. In this section, I test this relation by studying the changes in fund size and performance around mergers.

4.2.1 Changes in Fund Size around Mergers

I examine the changes in fund size over the four years before and after mergers. In order to have fund characteristics four years before and after the event, I use mergers that occurred between 1995 and 2009 for the tests in this section.

First, I use size deciles to compare the relative size of acquiring funds to all funds with the same investment objective. A decile of 5.5 indicates the median size of all funds with the same investment objective. I calculate the monthly size decile of each acquiring fund over the four years before and after a merger. In each event month of these eight years, I calculate the cross-sectional average size decile and plot them in Figure 2 (solid line). The left vertical axis is the size decile. The horizontal axis is the time line of

[12] I also calculate the would-be size ($Size^*$) using returns in the merger event month and pre-event average flows. See Appendix A.1 and Table A4 for details.

mergers. The numbers on the horizontal axis indicate months around mergers. I find that during the four years before mergers, acquiring funds increase in size. The average size decile climbs from 6.6 to 6.8 before mergers, and reaches above 7.0 due to the event, as indicated by the spike in the event month (0). In the post-merger period, acquiring funds persistently lose assets under management in comparison to other funds with the same investment objective. The average size decile decreases from above 7.0 to below 6.9 by the end of the fourth year after mergers. Overall, Figure 2 provides evidence that acquiring funds grow in size before mergers, experience a positive shock in size resulting from the event, and lose assets under management in the post-merger period.

Both returns and flows can contribute to changes in size: $TNA_{i,t+1} = TNA_{i,t} \times (1 + R_{i,t+1} + Flow_{i,t+1})$, where $TNA_{i,t+1}$, $R_{i,t+1}$, and $Flow_{i,t+1}$ are the total net asset, return, and flow of fund i in period $t + 1$, respectively. When $R_{i,t+1} + Flow_{i,t+1} > 0$, size increases and $TNA_{i,t+1} > TNA_{i,t}$. The increases in size before mergers may be caused by either positive returns, capital inflows, or both. When $R_{i,t+1} + Flow_{i,t+1} < 0$, size decreases and $TNA_{i,t+1} < TNA_{i,t}$. Decrease in size after mergers may be caused by either negative returns, fund outflows, or both. Flows are directed by investments and redemptions made by fund shareholders. Next, I test whether investment behaviors exhibited by fund shareholders contribute to the size changes of acquiring funds around mergers.

Figure 3 plots the average monthly flow deciles of acquiring funds among funds with the same investment objective over the four years before and after mergers. Flow deciles provide information about the relative flows of acquiring funds compared to all funds with the same investment objective. The vertical axis is the flow decile. The numbers on the horizontal axis indicate event months of a merger. I find that during the four years before mergers, the average flow decile of acquiring funds fluctuates around the median level of 5.5. The spike in the event month (0) indicates the acquired assets from the target funds. However, the average flow decile decreases to about 5.0 after mergers. These findings indicate that acquiring funds attract capital inflows before mergers, which contribute to the pre-merger growth in size. They also indicate that acquiring funds experience persistent capital outflows after mergers, which lead to the post-merger decreases in size.

Next, I use the objective-adjusted percentage change in size and the objective-adjusted flows to test whether size changes and flows experienced by the acquiring funds around mergers are statistically significant. The objective-adjusted percentage change in size is the difference between a fund's percentage change in size and the average percentage change in size of all funds with the same investment objective. The objective-adjusted flow is the difference between fund flow and the average flow of all funds with the same investment objective. These two objective-adjusted measures implicitly account for sector, industry, or style-specific factors that may affect size changes and flows of funds with the same investment objective.

I calculate the average objective-adjusted percentage change in size for each fund every year over the four years before and after mergers using monthly data. In each of these eight event years, I regress the objective-adjusted percentage change in size on a constant while clustering by calendar year. Table 5 Column (1) reports the cross-sectional average of the objective-adjusted percentage change in size in each event year. Column (2) reports the t-statistics. I find that acquiring funds do not have different size changes from other funds with the same investment objective before mergers. The significant positive value in the fourth year before mergers is due to acquisitions made by the same fund within four years. Some funds make multiple acquisitions in their life cycle. In the robustness test, I exclude mergers if there are less than four years between two consecutive acquisitions made by the same fund and rerun this test. I find that the objective-adjusted percentage change in size in the fourth year before mergers is 0.16% with t-statistic of 1.24 (untabulated results). Results in Table 5 also show that acquiring funds experience decreases in size after mergers. The objective-adjusted percentage change in size is negative and significant in the four years after mergers.

Similarly, I calculate the average objective-adjusted flow for each fund over the four years before and after mergers using monthly data. In each of these eight event years, I regress the objective-adjusted flows on a constant while clustering by calendar year. I report the regression results in Column (3) and (4). I find that the objective-adjusted flows of acquiring funds are not significantly different from zero before mergers and become significantly negative after mergers. The significant average objective-adjusted flow in

the fourth year before mergers is due to some funds making multiple acquisitions within four years. Using the sample which excludes acquisitions made by the same fund within four years, the objective-adjusted flow in the fourth year before mergers is 0.06% with t-statistic of 0.63 (untabulated results). Results in Column (3) and (4) also show that acquiring funds experience persistent and significant capital outflows after mergers. The average objective-adjusted flows every year over the four years after mergers are -0.60% (t-stat $= -3.32$), -0.46% (t-stat $= -2.44$), -1.13% (t-stat $= -7.87$), and -1.04% (t-stat $= -6.28$), respectively. These findings provide evidence that acquiring funds receive about average flows before mergers and that investors of acquiring funds redeem their shares after the events. These redemptions by investors contribute to the decreases in size of acquiring funds in the post-merger period.

4.2.2 Deterioration of Fund Performance due to Mergers

I have shown that acquiring funds experience a positive shock in size at the time of mergers. Decreasing returns to scale implies that fund performance will decrease as fund size increases. I test this implication by examining fund performance around mergers.

Consistent with previous size and flow tests, I first examine fund performance around mergers using return deciles. Return deciles provide information about the relative performance of acquiring funds compared to all funds with the same investment objective. A decile of 5.5 indicates the median performance of all funds with the same investment objective. In each event month over the four years before and after mergers, I calculate the cross-sectional average return decile of acquiring funds and plot them in Figure 2 (dotted line). The right vertical axis is the return decile. I find that the pre-merger average return decile fluctuates around 5.55. The average return decile decreases to around 5.35 after mergers and tends to recover to 5.55 by end of the fourth year. These findings indicate that fund performance deteriorates after size increases abnormally resulting from the mergers. Yet, the declining performance of acquiring funds seem to be a temporary phenomenon. As size decreases in the post-merger period, performance tends to recover.

Next, I use the Carhart four-factor model alpha (Carhart (1997)) and the objective-adjusted return (OAR) to evaluate performance of acquiring funds around mergers. The Carhart four-factor model adjusts for size, value, and momentum in fund returns. To obtain the Carhart four-factor alpha, I estimate the following regression:

$$R^e_{i,t} = \alpha^{c4}_i + \beta^{mkt}_i R^e_{m,t} + \beta^{smb}_i SMB_t + \beta^{hml}_i HML_t + \beta^{umd}_i UMD_t + \epsilon_{i,t}, \tag{8}$$

where the dependent variable is the excess return of fund i over the risk-free rate in month t, $R^e_{m,t}$ is the excess return of the market portfolio over the risk-free rate in month t, *SMB* is the return difference between small and large capitalization stocks, *HML* is the return difference between high and low book-to-market stocks, and *UMD* is the return difference between stocks with high and low past returns.[13] The intercept of the model, α^{c4}_i, is the Carhart measure of abnormal returns of fund i.

I first use each fund's monthly returns every year over the four years before and after mergers to run the Carhart four-factor model. I obtain the Carhart alpha of each fund in each year. Next, I regress the Carhart alphas obtained in the first step on a constant and cluster by calendar year. Table 6 Column (1) and (2) report the intercept and t-statistics. I find that the Carhart alpha of acquiring funds are not significantly different from zero in the pre-merger period, except for the second year before the event. The annualized Carhart alpha, which is -1.02% (t-stat $= -1.01$) one year before mergers, decreases to -1.37% (t-stat $= -2.54$) one year after mergers. The Carhart alpha remains negative and significant in the following three years.[14]

The relatively poor performance of target funds may contribute to the decreases in performance of acquiring funds directly after mergers. Yet, the further performance deterioration cannot be fully explained by the poor performance of target funds. The

[13]The market, size, value, and momentum factor returns and the risk-free rate are from Kenneth French's website at http://mba.tuck.dartmouth.edu/page/faculty/ken.french/. I thank Kenneth French for making data available.

[14]As a robustness check, I run the Carhart four-factor model for each fund using returns over the four years before and after mergers while including event year dummies. I calculate the Carhart alpha of each fund every year of these eight event years and test whether the Carhart alpha is significantly different from zero. I find similar results that acquiring funds' Carhart alpha is not significantly different from zero before mergers, but becomes significantly negative after the events. Results are available upon request.

results show that in the third year after mergers, the annualized Carhart alpha further decreases to -1.75% (t-stat $= -3.21$). Decreasing returns to scale provides an alternative but not exclusive explanation. Previous studies find that liquidity cost is the underlying factor that drives mutual funds having decreasing returns to scale (See Chen, Hong, Huang, and Kubik (2004); Edelen, Evans, and Kadlec (2007); Pollet and Wilson (2008); and Yan (2008)). I have shown that shareholders of acquiring funds redeem their shares after mergers, which may be due to the initial decrease in performance. These redemptions lead to liquidity-motivated trading, which further depresses fund performance (Edelen (1999)). Fund managers may actively reorganize fund holdings after mergers. Post-merger portfolio reorganization will also trigger liquidity cost, resulting in worsening fund performance.

A second measure of fund performance is the OAR. The OAR is the difference between fund return and the average return of all funds with the same investment objective. The OAR measures fund performance relative to other funds in its peer group and implicitly adjusts for sector, industry, or style-specific factors that may affect the performance of all funds with the same investment objective. I calculate monthly OAR of each fund during the four years before and after mergers. In each of these eight event years, I calculate the average OAR for each fund and regress them on a constant while clustering by calendar year. Column (3) and (4) of Table 6 report the test results. I find that the performance of acquiring funds is not significantly different from zero before mergers. The annualized OARs in the four years of the pre-merger period are 0.89% (t-stat $= 1.35$), -0.03% (t-stat $= -0.05$), -0.36% (t-stat $= -0.81$), and 0.78% (t-stat $=$ 1.35), respectively. However, the annualized OAR decreases to -0.54% (t-stat $= -1.92$) in the first year after mergers and further deteriorates to -0.68% (t-stat $= -2.11$) in the following year. These results provide evidence that acquiring funds experience performance deterioration resulting from the merger. Yet, the results also show that the OAR becomes insignificant in the third and fourth year after the event. This finding indicates that the performance of acquiring funds only temporarily deteriorates due to the merger and tends to recover two years after the event.

Next, I test whether the change in performance resulting from the merger is statis-

tically significant. I benchmark each fund's own pre-event performance to calculate the change in performance:

$$\Delta\alpha_i^{c4} = \alpha_{i,t+1\to t+48}^{c4} - \alpha_{i,t-48\to t-1}^{c4}, \tag{9}$$

and

$$\Delta OAR_i = \sum_{t=1}^{48} \frac{OAR_{i,t}}{48} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}, \tag{10}$$

where i indicates fund i, t refers to the merger event month, $t+1 \to t+48$ indicates the period from the first to the 48^{th} month after the merger, and $t-48 \to t-1$ indicates the 48 months before the event. I obtain the pre-merger Carhart alpha for each acquiring fund ($\alpha_{i,t-48\to t-1}^{c4}$) by running the Carhart four-factor model using fund returns four years before the event. The post-merger Carhart alpha for each acquiring fund ($\alpha_{i,t+1\to t+48}^{c4}$) is obtained using fund returns four years after the event. I regress $\alpha_{i,t-48\to t-1}^{c4}$, $\alpha_{i,t+1\to t+48}^{c4}$, and $\Delta\alpha_i^{c4}$ on a constant separately and cluster by year. Table 7 Column (1) and (2) report the test results. Similarly, I calculate the average pre-merger and post-merger OAR of each acquiring fund using four years of return data before and after mergers to obtain $\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$ and $\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$. I regress $\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$, $\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$, and ΔOAR_i on a constant separately and cluster by year. Column (3) and (4) report the test results. The key finding is that the performance of acquiring funds decreases significantly after mergers. The annualized Carhart alpha, which is -0.68% (t-stat $= -2.16$) before mergers, becomes -1.33% (t-stat $= -4.69$) after mergers. The change in Carhart alpha is negative and statistically significant ($\Delta\alpha^{c4} = -0.65\%$, t-stat $= -1.54$). I find that the annualized OAR of acquiring funds is not significantly different from zero before mergers ($\sum_{t=-48}^{-1} \frac{OAR_t}{48} = 0.42\%$, t-stat $= 1.11$), decreases significantly by 0.95% (t-stat $= -2.19$) due to the event, and becomes negative in the post-merger period ($\sum_{t=1}^{48} \frac{OAR_t}{48} = -0.53\%$, t-stat $= -4.53$). These findings not only show that fund performance deteriorates after mergers but also provide evidence that the decrease in performance that acquiring funds experience resulting from the mergers is statistically significant.[15]

Overall, the findings in this section provide evidence that mutual funds have de-

[15]I also form calendar-time portfolios to examine the performance of acquiring funds around mergers. The calendar-time portfolio tests provide evidence of declining performance of acquiring funds resulting from the mergers. See Appendix A.2 and Table A5 and A6 for details.

creasing returns to scale. Acquiring funds experience performance deterioration after their size increases abnormally due to mergers.

4.2.3 Recovery of Fund Performance after Mergers

I have shown that acquiring funds experience a positive shock in size resulting from the mergers and that subsequently, their performance decreases and money flows out. Both the declining performance and persistent capital outflows lead to decreases in size in the post-merger period. Decreasing returns to scale implies that as fund size decreases, performance increases. Figure 2 shows that the average performance decile of acquiring funds tends to recover to the pre-merger level of 5.55 by the end of the fourth year after mergers. The results in Table 6 show that the magnitude and significance of the Carhart alpha decrease in the fourth year after mergers ($\alpha^{c4} = -0.84\%$, t-stat $= -1.59$) and that the OAR becomes insignificant two years after the events ($OAR = -0.35\%$, t-stat $= -1.00$ and $OAR = 0.12\%$, t-stat $= 0.61$). These findings indicate that fund performance tends to recover as size decreases in the post-merger period. In this section, I further investigate the recovery of fund performance using subsample analysis.

I sort acquiring funds into three groups according to their abnormal size at the end of each year after mergers. I calculate the abnormal size of acquiring funds using the predictive regression Model (1) and (2) (Equation (3) and (5) in Section 4.1.2).[16] The first group includes funds with negative abnormal size. I calculate the median abnormal size of funds with positive abnormal size. Funds with positive abnormal size less than the median belong to the second group, and the third group has funds with abnormal size larger than the median. I benchmark each fund's own pre-event performance to calculate the change in performance.

Specifically, at the end of the first year after mergers, I sort acquiring funds into three groups. For each fund, I use four years of monthly returns before mergers to obtain

[16] I test whether the abnormal size of all funds is significantly different from zero using the predictive regression model (1) and (2). I calculate the abnormal size of each fund every month. I obtain the cross-sectional average abnormal size in each month and regress them on a constant. I regress the cross-sectional average of the abnormal size on a constant. I find that the cross-sectional average of abnormal size is insignificantly different from zero.

the pre-merger Carhart alpha ($\alpha^{c4}_{i,t-48\to t-1}$) and OAR ($\sum_{t=-48}^{-1}\frac{OAR_{i,t}}{48}$), where i refers to fund i and t indicates the merger event month. I use monthly returns in the second year after the merger to obtain the post-merger Carhart alpha ($\alpha^{c4}_{i,t+13\to t+24}$) and OAR ($\sum_{t=13}^{24}\frac{OAR_{i,t}}{12}$). Next, benchmarking each fund's own pre-event performance, I calculate the change in Carhart alpha ($\Delta\alpha^{c4}_i = \alpha^{c4}_{i,t+13\to t+24} - \alpha^{c4}_{i,t-48\to t-1}$) and the change in OAR ($\Delta OAR_i = \sum_{t=13}^{24}\frac{OAR_{i,t}}{12} - \sum_{t=-48}^{-1}\frac{OAR_{i,t}}{48}$). For each group of funds, I regress the $\Delta\alpha^{c4}_i$ and ΔOAR_i on a constant separately and cluster by calendar year. Table 8 reports the test results.

Decreasing returns to scale implies that performance of funds in the second group with smaller abnormal size at the end of the first year will recover in the next year. Thus, the change in performance of these funds is insignificant ($\Delta\alpha^{c4} = 0$, $\Delta OAR = 0$). In contrast, the performance of funds which have larger positive abnormal size at the end of the first year after mergers will deteriorate in the next year. The difference between the pre-merger performance and performance in the second year after mergers is negative ($\Delta\alpha^{c4} < 0$, $\Delta OAR < 0$). The test results provide evidence that supports these implications. Using the predictive regression Model (1), I find that the change in performance of funds with smaller positive abnormal size is 1.40% (t-stat = 1.95) as measured by the annualized Carhart alpha and is -0.09% (t-stat = -0.09) as measured by the annualized OAR. In contrast, funds with larger abnormal size at the end of the first year have declining performance in the following year ($\Delta\alpha^{c4} = -1.61\%$, t-stat = -1.31 and $\Delta OAR = -1.14\%$, t-stat = -2.66). Using the predictive regression Model (2), I find that the performance of funds with smaller abnormal size tends to recover ($\Delta\alpha^{c4} = 0.09\%$, t-stat = 1.19 and $\Delta OAR = -0.36\%$, t-stat = -0.37). In contrast, funds with larger abnormal size experience decreases in performance in the following year ($\Delta\alpha^{c4} = -1.39\%$, t-stat = -1.17 and $\Delta OAR = -1.01\%$, t-stat = -1.89).

I do the same analysis at the end of the second and third year after mergers. The results provide stronger evidence of decreasing returns to scale. Funds which have larger abnormal size in the group formation period experience worsening performance in the following year. For example, funds which have larger abnormal size at the end of the second year after mergers have the annualized $\Delta\alpha^{c4}$ of -1.96% (t-stat = -2.56)

using the predictive regression Model (1) and of -2.00% (t-stat $= -2.50$) using the predictive regression Model (2). The annualized ΔOAR of these funds is -1.89% (t-stat $= -1.85$) and -1.83% (t-stat $= -1.85$) using the predictive regression Model (1) and (2), respectively. In contrast, performance of funds with smaller abnormal size in the group formation period tends to recover in the following year. The $\Delta\alpha^{c4}$ and ΔOAR of these funds are insignificant in all tests.

Overall, I have shown that acquiring funds are neither superior funds nor poorly performing funds before mergers. Compared to others funds with the same investment objective, acquiring funds receive the medium level of flows and steadily grow in size during the pre-merger period. However, these funds experience performance deterioration after their size increases abnormally resulting from the mergers. Facing the declining performance, shareholders redeem their shares after mergers. My findings of post-merger capital outflows of acquiring funds are consistent with the model prediction of Berk and Green (2004). Berk and Green argue that fund flows chase performance because managerial skills are not directly observable and rational investors use past performance as proxies for skills. Their model predicts that money will flow out of acquiring funds due to their declining performance after mergers. Both worsening returns and persistent capital outflows lead to decreases in size in the post-merger period. As fund size decreases, performance tends to recover. These results provide evidence that supports decreasing returns to scale.

5 Robustness

5.1 Value-Weighted Returns of Target and Acquiring Funds

Target funds have worse average performance than acquiring funds before mergers.[17] The relative poor performance of target funds may contribute to the declining performance of acquiring funds after the events. In this section, I calculate the value-weighted monthly returns of target funds and acquiring funds before mergers, and use these value-weighted

[17]See Jayaraman, Khorana, and Nelling (2002), Zhao (2005), Ding (2006), and Table 1 of this paper.

returns to obtain the Carhart alpha for each acquiring fund every year over the four years before the events. I use monthly returns of each acquiring fund to obtain its Carhart alpha every year over the four years after the events. CRSP mutual fund database does not report returns of target funds before 2000, and reports returns of about half of the target funds after 2000. In this section, the sample period is 2000–2009. Only the acquiring funds whose target funds have pre-merger information are included in the sample.

I regress the Carhart alphas of acquiring funds on a constant and cluster by calendar year. Table 9 Column (1) and (2) report regression intercepts and t-statistics. I find that the Carhart alphas of acquiring funds are not significantly different from zero in the pre-merger period, but become significantly negative after the events. The annualized Carhart alpha, which is -0.67% (t-stat $= -0.67$) one year before mergers, decreases to -1.93% (t-stat $= -3.59$) one year after mergers. The Carhart alpha remains negative and significant in the following three years. These findings provide evidence of decreasing returns to scale. Fund performance deteriorates after size increases abnormally due to the mergers.

Similarly, I calculate the monthly OAR of target and acquiring funds separately before mergers, then calculate their value-weighted OARs. I calculate monthly OAR of each acquiring fund during the four years after mergers. In each of these eight event years, I obtain the average OAR for each acquiring fund and regress them on a constant while clustering by calendar year. Column (3) and (4) of Table 9 report the test results. I find that the performance of acquiring funds is not significantly different from zero before mergers. The annualized OAR, which is -0.20% (t-stat $= -0.45$) one year before mergers, decreases to -0.72% (t-stat $= -2.34$) one year after the events. The OAR becomes insignificant in the following two years and significantly positive in the fourth year. These findings indicate the recovery of performance in the post-merger period.

5.2 12b-1 Fee and Turnover Tests

An alternative explanation for the declining post-merger performance is increased 12b-1 fee or increased fund turnover after mergers.[18] English, Demiralp, and Dukes (2011) find that target funds tend to have high 12b-1 fee. Acquiring funds may adopt some of the fee settings of the target funds after mergers. Acquiring funds may advertise the newly merged fund to attract inflows (Barber, Odean, and Zheng (2005)), which increases their 12b-1 fee and decreases fund net returns after mergers. Acquiring funds may experience higher post-merger turnover, as investors redeem their shares and managers reorganize portfolio holdings, which increases operation costs and reduces fund net returns. In this section, I test whether acquiring funds increase their 12b-1 fee and turnover after mergers.

I calculate the average of 12b-1 fee and turnover for each fund one-year, two-year, three-year, and four-year before and after mergers. Next, I calculate changes in 12b-1 fee and turnover:

$$\Delta 12b1_i = \sum_{t=1}^{\tau} \frac{12b1_{i,t}}{\tau} - \sum_{t=-\tau}^{-1} \frac{12b1_{i,t}}{\tau}, \tag{11}$$

and

$$\Delta Turnover_i = \sum_{t=1}^{\tau} \frac{Turnover_{i,t}}{\tau} - \sum_{t=-\tau}^{-1} \frac{Turnover_{i,t}}{\tau}, \tag{12}$$

where i refers to fund i, t indicates the merger event month, and $\tau = 12, 24, 36, 48$. I regress $\Delta 12b1_i$ and $\Delta Turnover_i$ on a constant separately and cluster by year. Table 10 reports the test results. I find that the average 12b-1 fee charged by acquiring funds significantly decreases after mergers. The $\Delta 12b1$ are -0.005% (t-stat $= -1.13$), -0.011% (t-stat $= -1.48$), -0.018% (t-stat $= -1.80$), and -0.023% (t-stat $= -1.99$) using one-year, two-year, three-year, and four-year average values, respectively. I find that the $\Delta Turnover$ is not significant in all tests. These findings imply that the declining performance of acquiring funds after mergers is not related to either increased 12b-1 fee or increased turnover.

[18] CRSP reports fund turnover as the minimum of aggregated sales or aggregated purchases of securities divided by the average 12-month total net assets of the fund. Thus, turnover may not capture the redemptions by shareholders in the post-merger period.

5.3 Multiple Acquisitions in Life Cycle

Some funds acquire multiple times in their life cycle. As a robustness check, I exclude mergers if there is less than four years between two consecutive acquisitions made by the same fund, because fund characteristics are double counted for these two acquisitions. For example, Evergreen Core Equity Fund of Evergreen Investments acquired Wachovia Personal Equity Fund in March 2002 and acquired Evergreen Tax Strategic Equity Fund in May 2003. Acquiring fund returns between these two acquisitions are classified as post-merger performance for the first acquisition and as pre-merger performance for the second acquisition. There are 868 acquisitions in this sample. I test the size-performance relation using this new sample. The findings show that acquiring funds experience an abnormal size increase due to mergers and subsequent performance deterioration after mergers. The declining performance, however, is a temporary phenomenon. Performance tends to recover as fund size decreases.

5.4 Changes in of Investment Style

Cooper, Gulen, and Rau (2005) find that funds which change their names to reflect current hot investment styles experience abnormal capital inflows. As a robustness check, I remove acquiring funds which experience changes in fund style over the four years before or after mergers to control the effect of style change on flows. There are 107 acquiring funds that change investment styles over the four years before or after mergers during the period of 1991–2013. I identify a style change using the CRSP fund objective identifier (*crsp_obj_cd*), which combines Strategic Insight, Wiesenberger, and Lipper objective codes into a unique style code for each fund. CRSP fund objective identifier consists four letters. I define a style change as any changes in either the third or the fourth letter of this objective code.[19] I rerun the tests using this sample which controls for changes of investment style and find evidence that is consistent with mutual funds having decreasing

[19]Appendix Table A7 reports the CRSP investment objective codes for domestic equity funds. Appendix Table A8 reports the number of funds within each investment objective every year in the sample period. Appendix Table A9 reports the number of acquiring funds within each investment objective every year in the sample period.

returns to scale.

Next, I construct a sample which excludes acquisitions made by the same fund and acquisitions made by funds which change investment styles over the four years before and after mergers. There are 789 acquisitions in this sample. Using this sample, I also find that mutual funds have decreasing returns to scale.[20]

6 Conclusion

This paper examines whether mutual funds have decreasing returns to scale. I study the size-performance relation in fund mergers, where acquiring funds experience an abnormal increase in size. I show that the probability of being an acquiring fund in mergers is not significantly related to past performance. This finding verifies that examining the size-performance relation in mergers is not subject to the endogenous fund size issue.

The results show that acquiring funds experience performance deterioration after their size increases abnormally due to mergers. Acquiring funds have median-level fund flows before mergers but suffer persistent capital outflows after mergers. Both the declining performance and persistent capital outflows lead to decreases in size in the post-merger period. As fund size decreases, performance tends to recover. The worsening post-merger performance of acquiring funds is therefore a temporary phenomenon. The empirical findings of this paper provide evidence that mutual funds have decreasing returns to scale.

[20]The results of robustness tests are available upon request.

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Table 1. Compare Fund Characteristics: Acquiring, Target, and Other Funds

Table 1 reports characteristics of acquiring funds, target funds, and other funds that are not involved in mergers. I use fund-month observations to calculate characteristics of each fund group. Only months which have characteristics of both comparing fund groups are included in the calculation. Characteristics of interest include size, performance, return volatility, expense ratio, age, and flows. Size is measured as the total net asset (TNA) in million dollars. Performance is fund monthly returns. Return volatility is the standard deviation of fund returns in the past 12 months (including the current month). Age is calculated in months. Flow is calculated as: $Flow_{i,t} = \frac{TNA_{i,t}-(1+R_{i,t})\times TNA_{i,t-1}}{TNA_{i,t-1}}$, where $Flow_{i,t}$, $TNA_{i,t}$, and $R_{i,t}$ are flow, total net asset, and return of fund i in month t. I calculate the value-weighted characteristics of a fund which has multiple share classes. To compare characteristics between acquiring funds and target funds and between acquiring funds and other funds, I do the following calculations. First, I calculate the average characteristics 12 months before mergers for each acquiring and target fund. Second, I calculate the cross-sectional average characteristics of acquiring funds with the same merger month and the cross-sectional average characteristics of the target funds with the same last report month. Third, I calculate the cross-sectional average characteristics of the other funds every month in the sample period. These calculations yield time series of characteristics for acquiring funds, target funds, and other funds, respectively. Column (1)–(3) compare characteristics between acquiring and target funds for the period of 2000–2013. Column (4)–(6) compare characteristics between acquiring and other funds during the sample period of 1991–2013. t-statistics are in parentheses.

Fund Characteristics	(1)	(2)	(3)	(4)	(5)	(6)
	2000–2013			1991–2013		
	Acquiring Funds	Target Funds	t-statistics	Acquiring Funds	Other Funds	t-statistics
Size ($ Million)	1,200	261	(8.88)	948	1,355	(−3.93)
Performance (%)	0.58	0.44	(1.79)	0.80	0.77	(0.08)
Return Volatility(%)	4.96	5.04	(−1.34)	4.70	4.77	(−0.44)
Expense Ratio (%)	1.24	1.37	(−6.92)	1.26	1.20	(3.22)
Age (Months)	170	151	(2.18)	176	172	(0.60)
Flow (%)	0.44	−1.60	(7.41)	1.03	0.41	(1.23)

Table 2. Determinants of being Acquiring Funds in Mergers

Table 2 reports the test resulsts examining the probability of being an acquiring fund in mergers using a logistic regression model. The independent variables are fund characteristics. *Performance*, *Flows*, *Expense Ratio*, and *Return Volatility* are objective-adjusted fund characteristics. An objective-adjusted characteristic is the difference between fund characteristic and the average characteristic of all funds with the same investment objective. These objective-adjusted measures of fund characteristics implicitly account for sector, industry, or style-specific factors that may affect fund characteristics for the same investment objective. *Performance* is the objective-adjusted cumulative return. Cumulative returns are calculated over the past 12 months. *Flow* and *Expense Ratio* are averaged over past 12 months. *Return Volatility* is the standard deviation of fund returns in the past 12 months. *Size* is the logarithm of total net asset of a fund. *Number of Objectives in the Family* is a measure of fund family size. *Age* is the logarithm of fund age in months. I use annual observations to run the logistic regression model. I form the dependent and independent variables every year in June. The dependent variable takes on a value of one if a fund acquires other funds in the subsequent 12-month period and takes a value of zero otherwise. Fund characteristics over the past 12-month period (including the current month) are used to construct the independent variables. For instance, in June 2000, the dependent variable takes on a value of one if a fund acquires other funds in the subsequent 12-month period of July 2000 to June 2001. Fund characteristic data over July 1999 to June 2000 are used to construct the independent variables. Column (1) reports the regression coefficients and Column (2) reports the marginal effects for all mergers. There are two types of fund mergers. A within-family merger refers to the combination of two funds within the same fund family. An across-family merger involves the combination of two funds from different fund families. Column (3) and (4) report the results for within-family mergers. Column (5) and (6) report the results for across-family mergers. Numbers in parentheses are p-values.

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
	All Mergers		Within-Family Mergers		Across-Family Mergers	
	Regression Coefficient	Marginal Effect	Regression Coefficient	Marginal Effect	Regression Coefficient	Marginal Effect
Intercept	−4.164		−5.297		−4.576	
	(0.00)		(0.00)		(0.00)	
Performance	0.413	0.010	0.247	0.004	0.570	0.005
	(0.32)		(0.65)		(0.37)	
Flow	0.338	0.008	0.224	0.003	0.553	0.005
	(0.59)		(0.75)		(0.63)	
Size	0.044	0.001	0.075	0.001	−0.012	0.000
	(0.08)		(0.02)		(0.77)	
Expense Ratio	−0.309	−0.007	−0.250	−0.004	−0.390	−0.003
	(0.00)		(0.03)		(0.00)	
Number of Objectives in the Family	0.001	0.000	0.000	0.000	0.003	0.000
	(0.36)		(0.90)		(0.19)	
Return Volatility	2.296	0.055	−0.804	−0.012	6.376	0.057
	(0.39)		(0.82)		(0.13)	
Age	0.016	0.000	−0.021	0.000	−0.083	0.001
	(0.81)		(0.80)		(0.42)	
Number of Acquiring Funds	786		500		286	
Number of Observations	31,879		31,879		31,879	
Year Fixed Effect	Yes		Yes		Yes	

Table 3. Predictive Regression Models for Percentage Changes in Fund Size

Table 3 reports coefficient estimates and t-statistics for two predictive regression models. The first predictive regression model (Model (1)) is constructed based on the theoretical model of Berk and Green (2004). The dependent variable is percentage change in size: $\Delta\%Size_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}}{TNA_{i,t-1}}$, where $TNA_{i,t}$ is total net asset of fund i in month t. The independent variables of Model (1) are fund characteristics, which are lagged one period. *Performance* is the cumulative returns over the past 12 months. *Return Volatility* is the standard deviation of returns over the past 12 months. *Size* is the logarithm of fund TNA. *Age* is the logarithm of fund age in months. *Expense Ratio* is the expense ratio. *Performance* $\times$ *Return Volatility* interacts fund cumulative returns with standard deviation of past returns. *Performance* $\times$ *Age* interacts the cumulative returns with the logarithm of fund age in months. The second predictive regression model (Model (2)) adds two more independent variables following Sirri and Tufano (1998). *Performance* $\times$ *Return Decile* interacts the cumulative returns with fund return decile. I calculate the return decile for each equity fund among funds with the same investment objective. *Spillover Effect* is a dummy variable which takes a value of one if funds from a family which has star funds and takes a value of zero otherwise. A star fund has performance in the top five percent of all funds with the same investment objective. I run a panel regression of each model with year fixed effects using all domestic equity funds. t-statistics are in parentheses.

Independent Variables	Model (1)	Model (2)
Intercept	0.066 (11.05)	0.068 (11.42)
Performance	0.113 (7.76)	0.093 (6.19)
Return Volatility	0.021 (1.02)	−0.016 (−0.77)
Size	−0.003 (−9.48)	−0.002 (−9.36)
Age	−0.004 (−5.79)	−0.004 (−5.84)
Expense Ratio	−0.567 (−6.54)	−0.612 (−7.06)
Performance × Return Volatility	−0.153 (−3.38)	−0.140 (−3.10)
Performance × Age	−0.016 (−5.83)	−0.016 (−5.81)
Performance × Return Decile		0.003 (5.02)
Spillover Effect		0.016 (8.65)
Number of Observations	408, 126	408, 126
Adjusted R^2 (%)	0.68	0.71
Year Fixed Effect	Yes	Yes

Table 4. Abnormal Size of Acquiring Funds

Table 4 reports the abnormal size and abnormal percentage change in size of acquiring funds due to mergers. The abnormal size is the difference between fund actual size (total net asset (TNA)) and its would-be size (denoted as $Size^*$) if there were no mergers. I use two predictive regression models to obtain $Size^*$. I calculate the expected percentage change in size in the merger event month (period t): $E_{t-1}\left[\Delta\%Size_{i,t}\right] = \mathbf{X}_{i,t-1}\widehat{\beta}$, where $\mathbf{X}_{i,t-1}$ refers to characteristics of fund i one month before the merger (period $t-1$) and $\widehat{\beta}$ is a vector of coefficient estimates of the predictive regression model. Next, I calculate $Size^*$ using the expected percentage change in size: $Size^*_{i,t} = TNA_{i,t-1} \times (1 + E_{t-1}\left[\Delta\%Size_{i,t}\right])$. The abnormal percentage change in size due to mergers is the difference between fund actual percentage change in size and the expected percentage change in size calculated using the predictive regression models. I test whether the abnormal size and the abnormal percentage change in size resulting from the mergers are significantly different from zero. t-statistics are in parentheses.

Variables	Predictive Regression Model			
	Model (1)		Model (2)	
	Mean	Median	Mean	Median
Abnormal Size ($ Million)	144	27	151	27
	(10.01)		(9.23)	
Abnormal Δ% Size	49%	8%	52%	8%
	(9.21)		(8.65)	
Number of Observations	1,333		1,333	

Table 5. Fund Size and Flows around Mergers

Table 5 reports the objective-adjusted percentage change in size (Δ% Size) and the objective-adjusted flows of acquiring funds around mergers. The objective-adjusted percentage change in size is the difference between percentage change in size and the average percentage change in size of all funds with the same investment objective. The objective-adjusted flow is the difference between fund flow and the average flow of all funds with the same investment objective. These two objective-adjusted measures implicitly account for sector, industry, or style-specific factors that may affect size change and flows for the same investment objective. I calculate the average objective-adjusted percentage change in size of each acquiring fund every year over the four years before and after mergers using monthly data. In each of these eight event years, I regress the objective-adjusted percentage change in size on a constant while clustering by calendar year. Column (1) reports the intercept and Column (2) reports the t-statistics. Similarly, I calculate the average objective-adjusted flow of each acquiring fund over the four years before and after mergers using monthly data. In each of these eight event years, I regress the objective-adjusted flows on a constant while clustering by calendar year. I report the regression results in Column (3) and (4). t-statistics are in parentheses.

Year	(1) Objective-Adjusted Δ% Size	(2)	(3) Objective-Adjusted Flow	(4)
	Estimate (%)	t-statistics	Estimate (%)	t-statistics
$(t-4)$ Year	0.64	(2.30)	0.57	(2.08)
$(t-3)$ Year	0.25	(0.95)	0.25	(0.93)
$(t-2)$ Year	0.45	(1.24)	0.47	(1.35)
$(t-1)$ Year	0.17	(0.56)	0.11	(0.37)
$(t+1)$ Year	−0.63	(−3.40)	−0.60	(−3.32)
$(t+2)$ Year	−0.50	(−2.57)	−0.46	(−2.44)
$(t+3)$ Year	−1.15	(−7.96)	−1.13	(−7.87)
$(t+4)$ Year	−1.01	(−6.16)	−1.04	(−6.28)

Table 6. Fund Performance around Mergers

Table 6 reports fund performance around mergers. I use the Carhart four-factor model alpha (α^{c4}) and the objective-adjusted return (OAR) to evaluate performance of acquiring funds around mergers. The Carhart four-factor model adjusts for size, value, and momentum in fund returns. To obtain α^{c4}, I estimate the Carhart four-factor model (Equation 8). The dependent variable is the excess return of fund over the risk-free rate. The independent variables include R_m^e, *SMB*, *HML*, and *UMD*, where R_m^e is the excess return of the market portfolio over the risk-free rate, *SMB* is the return difference between small and large capitalization stocks, *HML* is the return difference between high and low book-to-market stocks, and *UMD* is the return difference between stocks with high and low past returns. The intercept of the model is the Carhart alpha. I first use each fund's monthly returns every year over the four years before and after mergers to run the Carhart four-factor model. I obtain the Carhart alpha of each fund in each year. Next, I regress the Carhart alphas obtained in the first step on a constant and cluster by calendar year. I report the intercept and t-statistics in Column (1) and (2). A second measure of fund performance is the OAR. The OAR is the difference between fund return and the average return of all funds with the same investment objective. The OAR measures fund performance relative to other funds in its peer group and implicitly adjusts for sector, industry, or style-specific factors that may affect the performance of all funds with the same investment objective. I calculate monthly OAR of each fund during the four years before and after mergers. In each of these eight event years, I calculate the average OAR for each fund and regress them on a constant while clustering by calendar year. I report the test results in Column (3) and (4). The reported α^{c4} and OAR are annualized values. t-statistics are in parentheses.

Year	(1)	(2)	(3)	(4)
	Carhart Four-Factor Alpha		Objective-Adjusted Return	
	α^{c4} (%)	t-statistics	OAR (%)	t-statistics
$(t-4)$ Year	0.38	(0.30)	0.89	(1.35)
$(t-3)$ Year	−0.03	(−0.44)	−0.03	(−0.05)
$(t-2)$ Year	−1.12	(−1.83)	−0.36	(−0.81)
$(t-1)$ Year	−1.02	(−1.01)	0.78	(1.35)
$(t+1)$ Year	−1.37	(−2.54)	−0.54	(−1.92)
$(t+2)$ Year	−0.90	(−1.75)	−0.68	(−2.11)
$(t+3)$ Year	−1.75	(−3.21)	−0.35	(−1.00)
$(t+4)$ Year	−0.84	(−1.59)	0.12	(0.61)

Table 7. Change in Fund Performance due to Mergers

Table 7 reports fund performance around mergers and changes in performance resulting from the events. I use the Carhart four-factor model alpha (α^{c4}) and the objective-adjusted return (OAR) to evaluate performance of acquiring funds around mergers. To obtain α^{c4}, I estimate the Carhart four-factor model (Equation 8). The dependent variable is the excess return of fund over the risk-free rate. The independent variables include R_m^e, *SMB*, *HML*, and *UMD*, where R_m^e is the excess return of the market portfolio over the risk-free rate, *SMB* is the return difference between small and large capitalization stocks, *HML* is the return difference between high and low book-to-market stocks, and *UMD* is the return difference between stocks with high and low past returns. The intercept of the model is the Carhart alpha. A second measure of fund performance is the OAR. The OAR is the difference between fund return and the average return of all funds with the same investment objective. I test whether the changes in performance resulting from the mergers is statistically significant. I benchmark each fund's own pre-event performance to calculate the change in performance: $\Delta\alpha_i^{c4} = \alpha_{i,t+1\to t+48}^{c4} - \alpha_{i,t-48\to t-1}^{c4}$, and $\Delta OAR_i = \sum_{t=1}^{48} \frac{OAR_{i,t}}{48} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$, where i indicates fund i, t refers to the merger event month, and $t+1 \to t+48$ indicates the period from the first month after the merger to the 48^{th} month after the event. I obtain the pre-merger Carhart alpha for each fund ($\alpha_{i,t-48\to t-1}^{c4}$) by running the Carhart four-factor model using fund returns four years before the event. The post-merger Carhart alpha for each fund ($\alpha_{i,t+1\to t+48}^{c4}$) is obtained using fund returns four years after the event. I regress $\alpha_{i,t-48\to t-1}^{c4}$, $\alpha_{i,t+1\to t+48}^{c4}$, and $\Delta\alpha_i^{c4}$ on a constant separately and cluster by year. I report the test results in Column (1) and (2). Similarly, I calculate the average pre-merger and post-merger OAR of each fund using four years of return data before and after mergers to obtain $\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$ and $\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$. I regress $\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$, $\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$, and ΔOAR_i on a constant separately and cluster by year. Column (3) and (4) report the test results. The reported α^{c4}, $\Delta\alpha^{c4}$, OAR, and ΔOAR are annualized values. t-statistics are in parentheses.

Year	(1) Carhart Four-Factor Alpha	(2)	(3) Objective-Adjusted Returns	(4)
	α^{c4} (%)	$\Delta\alpha^{c4}$ (%)	OAR (%)	ΔOAR (%)
4 Years before Mergers	−0.68		0.42	
	(−2.16)		(1.11)	
4 Years after Mergers	−1.33	−0.65	−0.53	−0.95
	(−4.69)	(−1.54)	(−4.53)	(−2.19)

Table 8. Fund Performance after Mergers: Subsample Analysis

Table 8 reports test results of examining the recovery of fund performance using subsample analysis. I use the Carhart four-factor model alpha (α^{c4}) and the objective-adjusted return (OAR) to evaluate performance of acquiring funds around mergers. To obtain α^{c4}, I estimate the Carhart four-factor model. The dependent variable is the excess return of fund over the risk-free rate. The independent variables include R_m^e, *SMB*, *HML*, and *UMD*, where R_m^e is the excess return of the market portfolio over the risk-free rate, *SMB* is the return difference between small and large capitalization stocks, *HML* is the return difference between high and low book-to-market stocks, and *UMD* is the return difference between stocks with high and low past returns. The intercept of the model is the Carhart alpha. A second measure of fund performance is the OAR. The OAR is the difference between fund return and the average return of all funds with the same investment objective. I sort the acquiring funds into three groups according to their abnormal size. I calculate the abnormal size of acquiring funds at the end of the first year after mergers using the predictive regression Model (1) and (2) (Equation (3) and (5) in Section 4.1.2). The first group includes funds with negative abnormal size. I calculate the median abnormal size of funds with positive abnormal size. Funds with positive abnormal size less than the median belong to the second group, and the third group has funds with abnormal size larger than the median. I benchmark each fund's own pre-event performance to calculate the change in performance. Specifically, at the end of the first year after mergers, I sort acquiring funds into three groups. For each fund, I use four years of monthly returns before mergers to obtain the pre-merger Carhart alpha ($\alpha^{c4}_{i,t-48\to t-1}$) and OAR ($\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$), where i refers to fund i and t indicates the merger event month. I use monthly returns in the second year after the merger to obtain the post-merger Carhart alpha ($\alpha^{c4}_{i,t+13\to t+24}$) and OAR ($\sum_{t=13}^{24} \frac{OAR_{i,t}}{12}$). Next, benchmarking each fund's own pre-event performance, I calculate the change in Carhart alpha ($\Delta\alpha_i^{c4} = \alpha^{c4}_{i,t+13\to t+24} - \alpha^{c4}_{i,t-48\to t-1}$) and the change in OAR ($\Delta OAR_i = \sum_{t=13}^{24} \frac{OAR_{i,t}}{12} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$). For each group of funds, I regress the $\Delta\alpha_i^{c4}$ and ΔOAR_i on a constant separately and cluster by calendar year. I do the same analysis at the end of the second and third year after mergers. The $\Delta\alpha^{c4}$ and ΔOAR are annualized values. t-statistics are in parentheses.

Year	Funds with Negative Abnormal Size	Funds with Smaller Positive Abnormal Size	Funds with Larger Positive Abnormal Size
Panel A1: $\Delta\alpha^{c4}$ (%) (Predictive Regression Model (1))			
2^{nd} Year after Merger	−0.02	1.40	−1.61
	(−0.03)	(1.95)	(−1.31)
3^{rd} Year after Merger	−1.38	0.04	−1.96
	(−1.80)	(0.06)	(−2.56)
4^{th} Year after Merger	−0.14	−0.62	−0.89
	(−0.23)	(−0.44)	(−0.83)
Panel A2: ΔOAR (%) (Predictive Regression Model (1))			
2^{nd} Year after Merger	−0.81	−0.09	−1.14
	(−1.14)	(−0.09)	(−2.66)
3^{rd} Year after Merger	−0.66	−0.15	−1.89
	(−1.43)	(−0.12)	(−1.85)
4^{th} Year after Merger	−0.16	0.06	−1.00
	(−0.44)	(0.66)	(−1.56)
Panel B1: $\Delta\alpha^{c4}$ (%) (Predictive Regression Model (2))			
2^{nd} Year after Merger	0.05	0.09	−1.39
	(0.07)	(1.19)	(−1.17)
3^{rd} Year after Merger	−1.37	0.03	−2.00
	(−1.76)	(0.04)	(−2.50)
4^{th} Year after Merger	−0.09	−0.05	−1.08
	(−0.13)	(−0.05)	(−1.44)
Panel B2: ΔOAR (%) (Predictive Regression Model (2))			
2^{nd} Year after Merger	−0.77	−0.36	−1.01
	(−1.08)	(−0.37)	(−1.89)
3^{rd} Year after Merger	−0.67	−0.13	−1.83
	(−1.45)	(−0.10)	(−1.85)
4^{th} Year after Merger	0.05	0.24	−1.52
	(0.10)	(0.23)	(−3.02)

Table 9. Fund Performance around Mergers: Using Value-Weighted Returns of Target and Acquiring Funds

Table 9 reports fund performance around mergers. I use the Carhart four-factor model alpha (α^{c4}) and the objective-adjusted return (OAR) to evaluate performance of acquiring funds around mergers. The Carhart four-factor model adjusts for size, value, and momentum in fund returns. To obtain α^{c4}, I estimate the Carhart four-factor model (Equation 8). The dependent variable is the excess return of fund over the risk-free rate. The independent variables include R^e_m, *SMB*, *HML*, and *UMD*, where R^e_m is the excess return of the market portfolio over the risk-free rate, *SMB* is the return difference between small and large capitalization stocks, *HML* is the return difference between high and low book-to-market stocks, and *UMD* is the return difference between stocks with high and low past returns. The intercept of the model is the Carhart alpha. I calculate the value-weighted monthly returns of target funds and acquiring funds before mergers, and use these value-weighted returns to obtain the Carhart alpha for each acquiring fund every year over the four years before the events. I use monthly returns of each acquiring fund to obtain its Carhart alpha every year over the four years after the events. CRSP mutual fund database does not report returns of target funds before 2000, and reports returns of about half of the target funds after 2000. In this section, the sample period is 2000–2009. Only the acquiring funds whose target funds have pre-merger information are included in the sample. I regress the Carhart alphas of acquiring funds on a constant and cluster by calendar year. Column (1) and (2) report regression intercepts and t-statistics. Similarly, I calculate the monthly OAR of target and acquiring funds separately before mergers, then calculate their value-weighted OARs. I calculate monthly OAR of each acquiring fund during the four years after mergers. In each of these eight event years, I obtain the average OAR for each acquiring fund and regress them on a constant while clustering by calendar year. Column (3) and (4) report the test results. The reported α^{c4} and OAR are annualized values. t-statistics are in parentheses.

Year	(1) Carhart Four-Factor Alpha	(2)	(3) Objective-Adjusted Return	(4)
	α^{c4} (%)	t-statistics	OAR (%)	t-statistics
$(t-4)$ Year	−0.25	(−0.16)	0.68	(0.61)
$(t-3)$ Year	−0.47	(−0.66)	−1.45	(−1.77)
$(t-2)$ Year	−0.90	(−1.13)	−1.09	(−1.34)
$(t-1)$ Year	−0.67	(−0.67)	−0.20	(−0.45)
$(t+1)$ Year	−1.93	(−3.59)	−0.72	(−2.34)
$(t+2)$ Year	−0.83	(−1.77)	0.15	(0.45)
$(t+3)$ Year	−1.57	(−2.44)	−0.34	(−0.91)
$(t+4)$ Year	−0.73	(−1.69)	0.50	(2.21)

Table 10. Changes in 12b-1 Fee and Turnover due to Mergers

Table 10 reports changes in 12b-1 fee and turnover of acquiring funds due to mergers. I calculate the average 12b-1 fee and turnover for each fund one-year, two-year, three-year, and four-year before and after mergers. Next, I calculate the changes in 12b-1 fee and turnover: $\Delta 12b1_i = \sum_{t=1}^{\tau} \frac{12b1_{i,t}}{\tau} - \sum_{t=-\tau}^{-1} \frac{12b1_{i,t}}{\tau}$, and $\Delta Turnover_i = \sum_{t=1}^{\tau} \frac{Turnover_{i,t}}{\tau} - \sum_{t=-\tau}^{-1} \frac{Turnover_{i,t}}{\tau}$, where i refers to fund i, t indicates the merger event month, and $\tau = 12, 24, 36, 48$. I regress $\Delta 12b1_i$ and $\Delta Turnover_i$ on a constant separately and cluster by year. t-statistics are in parentheses.

Variables	One-Year Average	Two-Year Average	Three-Year Average	Four-Year Average
Δ 12b1 (%)	-0.005	-0.011	-0.018	-0.023
	(-1.13)	(-1.48)	(-1.80)	(-1.99)
Δ Turnover (%)	-0.377	0.284	-1.249	-2.217
	(-0.31)	(0.25)	(-0.88)	(-1.35)
Number of Observations	753	767	777	784

Figure 1. Number of Mergers

Figure 1 plots the number of mergers every year from 1991 to 2013. I count the number of mergers from the perspective of acquiring funds. A merger event in which an acquiring fund acquires multiple funds at the same time is counted as one merger in this study.

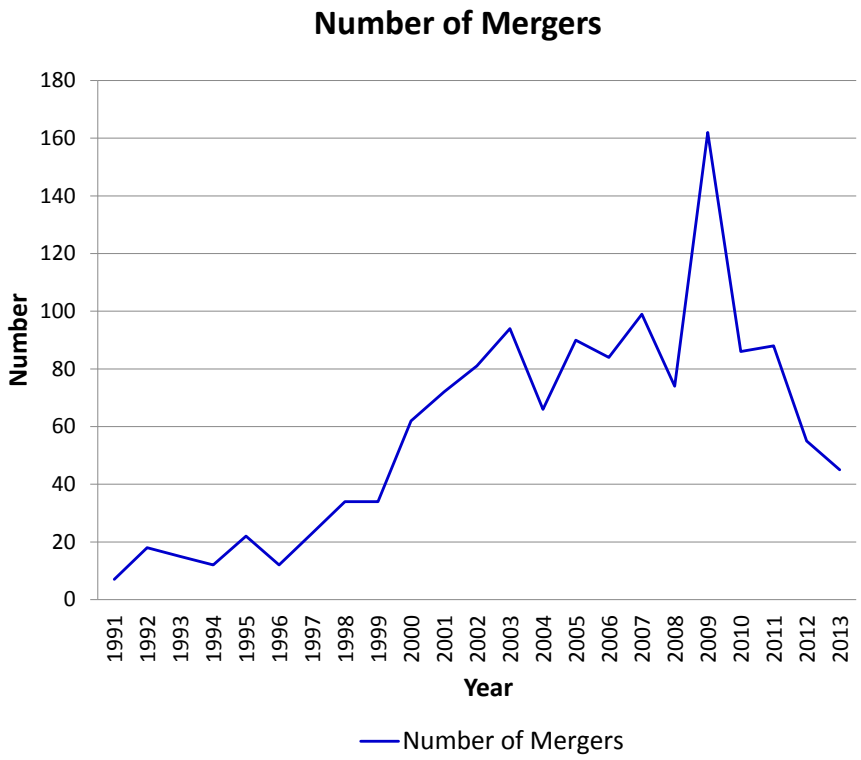


Figure 2. Size-Performance Relation: Size Decile and Return Decile

Figure 2 plots monthly average size decile and average return decile of acquiring funds over the four years before and after mergers. I calculate monthly size deciles and return deciles of each acquiring fund over the four years before and after mergers. In each event month of these eight years, I calculate the cross-sectional average size decile and average return decile and plot them against time. The horizontal axis is the time line of mergers, and the numbers indicate months around mergers. The left vertical axis is the size decile. The right vertical axis is the return decile. The solid line plots the average size decile of acquiring funds. The dotted line plots the average return decile of acquiring funds.

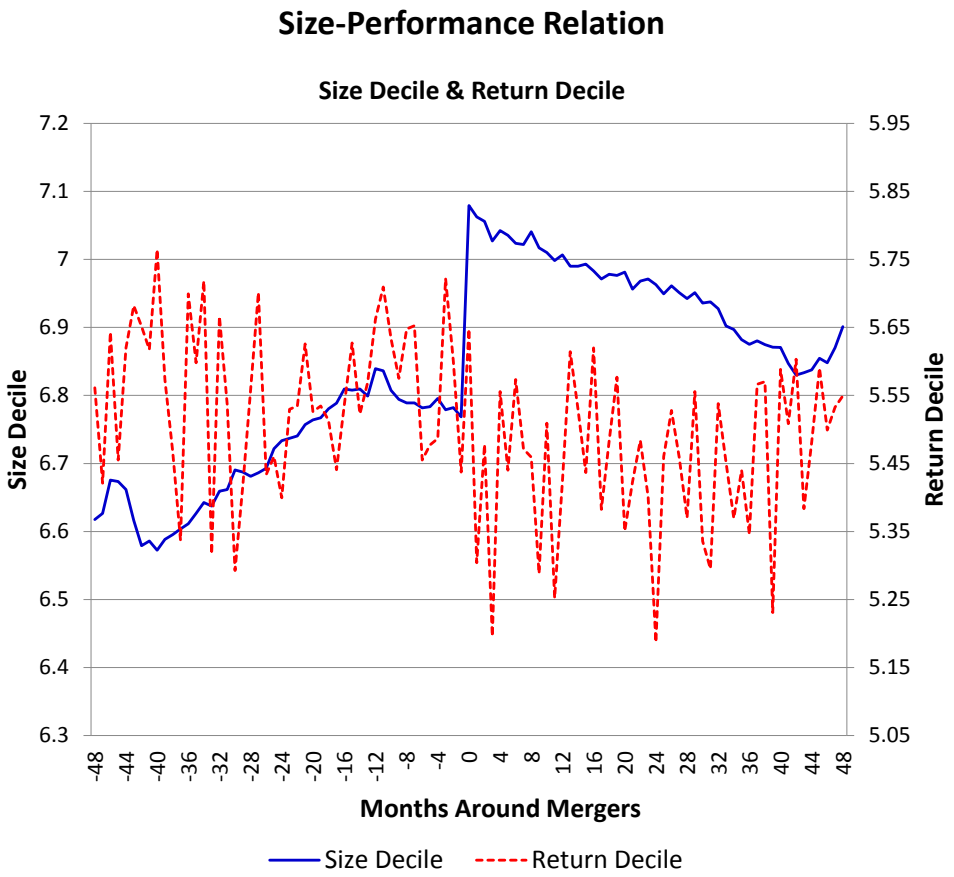
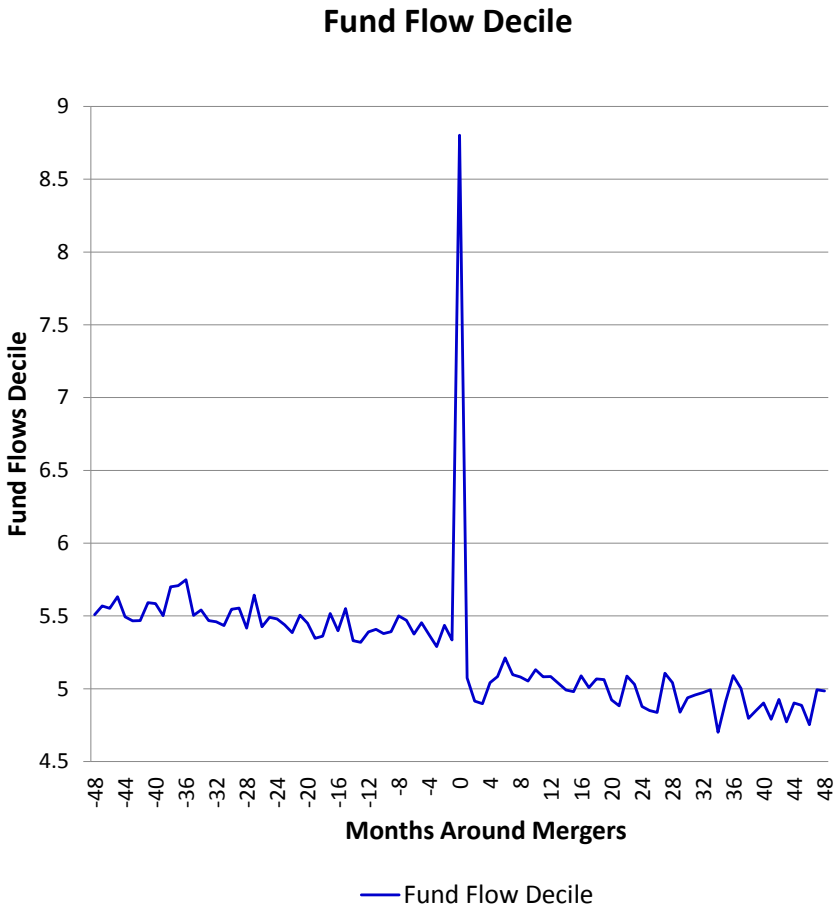


Figure 3. Fund Flow Decile around Mergers

Figure 3 plots monthly average flow decile of acquiring funds over the four years before and after mergers. I calculate monthly flow deciles of each acquiring fund over the four years before and after mergers. In each event month of these eight years, I calculate the cross-sectional average flow decile of acquiring funds and plot them against time. The horizontal axis is the time line of mergers, and the numbers indicate months around mergers. The vertical axis is fund flow decile.



A Appendix

A.1 Abnormal Size of Acquiring Funds

I define the abnormal size of an acquiring fund at the time of merger as the difference between its actual size and the would-be size ($Size^*$) if there was no merger. In this section, I use returns of the merger event month and pre-event average flows to calculate $Size^*$. First, I assume that flow of acquiring funds is zero in the event month if there were no mergers:

$$Size^*_{i,t} = TNA_{i,t-1} \times (1 + R_{i,t}), \tag{13}$$

where $R_{i,t}$ and $Size^*_{i,t}$ are return and the would-be size of fund i in the merger event month, and $TNA_{i,t-1}$ is size of fund i one month before the event. I calculate the abnormal size of each acquiring fund and regress them on a constant while clustering by calendar year. Appendix Table A4 Column (1) and (2) report results. The average abnormal size of acquiring funds is \$159 million (t-stat = 7.04) and the median is \$32 million in the merger event month. Next, I use the event month return and the pre-event four-year average flow to calculate $Size^*$:

$$Size^*_{i,t} = TNA_{i,t-1} \times \left(1 + R_{i,t} + \sum_{t=-48}^{-1} \frac{Flow_{i,t}}{48}\right), \tag{14}$$

where $\sum_{t=-48}^{-1} \frac{Flow_{i,t}}{48}$ is the average flow of fund i over the the four years before the event. I exclude mergers if there is less than four years between two consecutive acquisitions made by the same fund, because flows from a previous merger in consecutive acquisitions are not typical flows that funds would expect to receive in the future without a merger. I calculate the abnormal size of each acquiring fund and regress them on a constant while clustering by calendar year. Column (3) and (4) report results. The average abnormal size of acquiring funds is \$125 million (t-stat = 6.35) and the median is \$24 million in the merger event month. To eliminate the impact of investment objective changes on flows (See Cooper, Gulen, and Rau (2005)), I exclude funds that experience changes in investment objective over the four years before mergers. Using this new sample yields

similar results (Column (5) and (6)). Overall, I find that acquiring funds experience a positive shock in size resulting from the mergers. The average abnormal size at the time of merger is statistically significant and economic meaningful.

A.2 Calendar-Time Portfolio Tests

I examine performance of the acquiring funds around mergers using a calendar-time portfolio approach. In each calendar month, I form value-weighted and equal-weighted portfolios of all sample funds that acquired other funds in the previous year. Portfolios are re-balanced monthly. In this way, I obtain time-series returns for this post-merger first year calendar-time portfolio. Similarly, I construct a post-merger second year portfolio, a post-merger third year portfolio, a post-merger fourth year portfolio, and corresponding four pre-merger calendar-time portfolios. Following Mitchell and Stafford (2000), I exclude multiple observations on the same fund that occur within four years of the initial observation.

I run time-series regressions on each calendar-time portfolio using the Carhart four-factor model and report the Carhart alpha (α^{c4}) in Appendix Table A5 Column (1) and (2). Panel A reports the results using value-weighted portfolio returns, and Panel B reports the results using equal-weighted returns. I also calculate the value-weighted and equal-weighted objective-adjusted returns (OAR) for all eight calendar-time portfolios in each calendar month. I regress the OARs of each calendar-time portfolio on a constant and report the intercept and t-statistics in Column (3) and (4).

The results provide evidence of performance deterioration of acquiring funds after mergers. Using value-weighted portfolio returns, the annualized Carhart alpha is insignificantly different from zero one-year before mergers ($\alpha^{c4} = -1.01\%$, t-stat $= -1.05$) but becomes significantly negative after mergers ($\alpha^{c4} = -3.23\%$, t-stat $= -3.44$). The annualized OAR, which is significantly positive one-year before mergers (OAR $= 1.29\%$, t-stat $= 1.74$), becomes negative and significant after mergers (OAR $= -1.72\%$, t-stat $= -2.21$). Both the Carhart alpha and the OAR become insignificant in the following three years. Using equal-weighted portfolio returns, I find that the annualized Carhart alpha

is significantly negative around mergers. The annualized OAR is 0.24% (t-stat = 0.56) one year before mergers and becomes −1.25% (t-stat = −2.52) one year after mergers. The OAR is still significantly negative in the second year after mergers and becomes insignificant in the following two years.

Next, I form one pre-merger and one post-merger calendar-time portfolios to examine whether the change in performance is statistically significant. In each calendar month, I form value-weighted and equal-weighted portfolios of all sample funds that acquired other funds within the previous four years. Portfolios are re-balanced monthly. In this way, I obtain time-series returns for this post-merger calendar-time portfolio. Similarly, I construct a pre-merger calendar-time portfolio. In each calendar month, I form value-weighed and equal-weighted portfolios of all sample funds that will acquire other funds within the next four years. I run time-series regressions on each portfolio using the Carhart four-factor model and report the Carhart alpha in Appendix Table A6 Column (1) and (2). Panel A reports the results using value-weighted portfolio returns, and Panel B reports the results using equal-weighted returns. I also calculate the value-weighted and equal-weighted OARs for both calendar-time portfolios in every calendar month. I regress the OARs of each portfolio on a constant and report the results in Column (3) and (4). The t-statistics for the change in Carhart alpha and the change in OAR are obtained using the difference in mean test.

The results provide evidence of performance deterioration of acquiring funds after mergers. Using value-weighted portfolio returns, the annualized Carhart alpha is insignificantly different from zero before mergers ($\alpha^{c4} = -0.83\%$, t-stat = −1.26) but becomes significantly negative after mergers ($\alpha^{c4} = -1.86\%$, t-stat = −3.44). The annualized OAR is insignificant before and after mergers. Using equal-weighted portfolio returns, I find that the annualized Carhart alpha decreases from −1.61% (t-stat = −2.82) before mergers to −1.91% (t-stat = −3.13) after mergers. The annualized OAR, which is insignificant before mergers (OAR = −0.23%, t-stat = −0.85), becomes significantly negative after mergers (OAR = −0.78%, t-stat = −2.52). Yet, the changes in performance is negative but insignificant.

Table A1. Cross-Sectional Distribution of Total Net Assets of Equity Mutual Funds (1991–2013)

Appendix Table A1 reports the cross-sectional distribution of total net assets (TNA) of equity mutual funds for the period of 1991–2013. I remove the first three years of return data to eliminate the incubation bias. I also exclude the funds with TNA less than $15 million to eliminate the upward bias in their reported returns. I calculate annual average TNA of each fund using monthly data. TNAs are in $ million. P_i is the i^{th} percentile of the TNA distribution, where $i = 5, 25, 50, 75,$ and 95.

Year	Number of Funds	Mean	Standard Deviation	Maximum	Minimum	P5	P25	P50	P75	P95
1991	471	543	1,221	17,474	16	25	66	170	563	2,193
1992	535	599	1,421	20,781	16	24	67	180	557	2,428
1993	597	733	1,847	27,651	15	25	81	220	614	3,055
1994	639	782	2,102	34,978	15	29	86	213	629	3,130
1995	728	923	2,565	46,746	16	31	91	246	753	3,710
1996	889	1,087	3,097	54,294	15	28	92	257	797	4,302
1997	1,081	1,252	3,739	58,611	15	26	84	285	904	5,032
1998	1,296	1,407	4,498	71,357	16	26	84	274	959	5,560
1999	1,474	1,551	5,417	94,201	15	23	76	246	934	6,243
2000	1,662	1,631	5,672	102,105	15	22	71	246	969	6,397
2001	1,813	1,249	4,414	82,547	15	20	63	214	772	4,788
2002	1,907	1,016	3,633	65,794	15	19	57	184	646	3,944
2003	2,040	984	3,569	65,613	15	21	63	188	612	3,878
2004	2,248	1,172	4,581	98,598	15	20	64	201	721	4,368
2005	2,286	1,301	5,262	105,273	15	20	70	224	818	4,708
2006	2,328	1,457	6,085	147,349	15	21	73	252	899	5,058
2007	2,346	1,642	6,975	183,354	15	23	79	273	995	6,079
2008	2,420	1,330	5,782	165,913	15	20	65	226	830	4,885
2009	2,284	1,086	4,719	129,382	15	23	65	197	710	3,838
2010	2,284	1,335	5,711	141,905	15	23	77	254	923	4,622
2011	2,348	1,476	6,197	143,268	15	23	80	275	1,042	5,092
2012	2,332	1,569	6,629	171,662	15	23	77	287	1,123	5,780
2013	2,375	1,905	8,150	230,117	15	25	92	349	1,338	7,149

Table A2. Cross-Sectional Distribution of Total Net Assets of Acquiring Funds (1991–2013)

Appendix Table A2 reports the cross-sectional distribution of total net assets (TNA) of acquiring funds for the period of 1991–2013. I remove the first three years of return data to eliminate the incubation bias. I also exclude the funds with TNA less than $15 million to eliminate the upward bias in their reported returns. I collect TNA of acquiring funds one month before the merger event month. TNAs are in $ million. P_i is the i^{th} percentile of the TNA distribution, where $i = 5, 25, 50, 75$, and 95.

Year	Number of Funds	Mean	Standard Deviation	Maximum	Minimum	P5	P25	P50	P75	P95
1991	7	698	624	1,663	72	72	251	438	1,489	1,663
1992	18	394	561	1,745	19	19	62	155	395	1,745
1993	15	253	187	679	18	18	90	221	401	679
1994	12	619	463	1,708	16	16	263	614	758	1,708
1995	22	304	424	1,961	26	34	82	182	317	862
1996	12	279	208	751	52	52	134	216	390	751
1997	23	696	997	4,868	45	58	118	504	682	1,479
1998	34	630	806	4,081	19	20	126	358	756	2,096
1999	34	533	589	2,045	36	38	117	348	661	2,011
2000	62	1,257	3,575	26,799	21	39	87	328	1,260	3,760
2001	72	883	2,920	21,595	17	24	91	237	446	2,150
2002	81	769	976	7,193	17	36	152	481	1,121	1,995
2003	94	1,352	2,835	19,734	20	33	136	361	1,246	7,148
2004	66	963	2,412	16,906	19	29	87	231	648	4,027
2005	90	886	1,194	6,379	18	31	132	459	1,102	3,338
2006	84	1,899	2,892	15,287	18	58	215	849	2,244	7,879
2007	99	1,144	1,677	8,020	17	47	170	480	1,335	5,770
2008	74	1,839	2,432	11,408	34	47	255	964	2,600	8,821
2009	162	724	1,871	19,213	21	31	107	218	627	3,107
2010	86	603	1,591	12,624	16	21	61	155	482	2,220
2011	88	1,892	4,551	38,128	25	58	224	646	1,491	8,136
2012	55	909	1,381	6,521	27	39	91	239	1,375	4,392
2013	45	805	1,143	5,301	25	37	118	304	907	2,945

Table A3. Cross-Sectional Distribution of Total Net Assets of Target Funds (2000–2013)

Appendix Table A3 reports the cross-sectional distribution of total net assets (TNA) of target funds for the period of 2000–2013. CRSP reports TNA of target funds since 2000. I remove the first three years of return data to eliminate the incubation bias. I also exclude the funds with TNA less than $15 million to eliminate the upward bias in the fund's reported returns. I collect TNA of target funds in their last report month. TNAs are in $ million. P_i is the i^{th} percentile of the TNA distribution, where $i = 5, 25, 50, 75$, and 95.

Year	Number of Funds	Mean	Standard Deviation	Maximum	Minimum	P5	P25	P50	P75	P95
2000	38	95	106	547	18	18	28	58	152	299
2001	41	114	157	738	16	18	23	42	127	404
2002	57	116	128	525	17	19	31	61	135	415
2003	57	119	148	656	16	17	26	62	140	500
2004	46	177	299	1,462	16	19	34	68	176	845
2005	75	252	395	1,892	17	20	46	112	249	912
2006	56	494	909	5,508	15	19	78	180	391	2,303
2007	61	204	270	1,291	15	17	45	96	228	856
2008	68	361	859	4,406	15	18	35	76	268	1,441
2009	111	289	1,174	11,795	15	16	27	60	137	1,072
2010	76	216	394	2,704	16	21	43	85	201	1,050
2011	89	305	483	3,656	17	26	68	143	355	1,245
2012	53	194	224	1,016	15	24	44	102	216	683
2013	46	460	630	2,485	16	17	67	165	714	2,355

Table A4. Abnormal Size of Acquiring Funds

Appendix Table A4 reports the abnormal size of acquiring funds in the merger event month. I define the abnormal size of an acquiring fund at the time of merger as the difference between its actual size and the would-be size ($Size^*$) if there was no merger. First, I assume that flow of acquiring funds is zero in the event month if there were no mergers: $Size^*_{i,t} = TNA_{i,t-1} \times (1 + R_{i,t})$, where $R_{i,t}$ and $Size^*_{i,t}$ are return and the would-be size of fund i in the merger event month, and $TNA_{i,t-1}$ is size of fund i one month before the event. I calculate the abnormal size of each acquiring fund and regress them on a constant while clustering by calendar year. Column (1) and (2) report results. Next I use the event month return and the pre-event four-year average flow to calculate $Size^*$: $Size^*_{i,t} = TNA_{i,t-1} \times \left(1 + R_{i,t} + \sum_{t=-48}^{-1} \frac{Flow_{i,t}}{48}\right)$, where $\sum_{t=-48}^{-1} \frac{Flow_{i,t}}{48}$ is the average flow of fund i over the four years before the event. I exclude mergers if there is less than four years between two consecutive acquisitions made by the same fund, because flows from a previous merger in consecutive acquisitions are not typical flows that funds would expect to receive in the future without a merger. I calculate the abnormal size of each acquiring fund and regress them on a constant while clustering by calendar year. Column (3) and (4) report results. To eliminate the impact of investment objective changes on flows, I exclude funds that experience changes in investment objective over the four years before mergers. Column (5) and (6) report results using this sample. t-statistics are in parentheses.

Variables	(1) Mean	(2) Median	(3) Mean	(4) Median	(5) Mean	(6) Median
Abnormal Size ($ Million)	159	32	125	24	129	24
		(7.04)		(6.35)		(6.20)
Number of Observations		1,338		870		791

Table A5. Fund Performance around Mergers – Calendar-Time Portfolio Approach

Appendix Table A5 reports fund performance around mergers. I examine performance of acquiring funds around mergers using a calendar-time portfolio approach. In each calendar month, I form value-weighted and equal-weighted portfolios of all sample funds that acquired other funds in the previous year. Portfolios are re-balanced monthly. In this way, I obtain time-series returns for this post-merger first year calendar-time portfolio. Similarly, I construct a post-merger second year portfolio, a post-merger third year portfolio, a post-merger fourth year portfolio, and corresponding four pre-merger calendar-time portfolios. I exclude multiple observations on the same fund that occur within four years of the initial observation. I run time-series regressions on each calendar-time portfolio using the Carhart four-factor model and report the Carhart alpha (α^{c4}) in Column (1) and (2). Panel A reports the results using value-weighted portfolio returns, and Panel B reports the results using equal-weighted returns. I also calculate the value-weighted and equal-weighted objective-adjusted returns (OAR) for all eight calendar-time portfolios in each calendar month. I regress the OARs of each calendar-time portfolio on a constant and report the intercept and t-statistics in Column (3) and (4). The reported α^{c4} and OAR are annualized values. t-statistics are in parentheses.

Year around Mergers	(1) Carhart Four-Factor Alpha α^{c4} (%)	(2) Carhart Four-Factor Alpha t-statistics	(3) Objective-Adjusted Return OAR (%)	(4) Objective-Adjusted Return t-statistics
Panel A: Value-Weighted Portfolio Returns				
$(t-4)$ Year	1.64	(1.01)	1.13	(1.35)
$(t-3)$ Year	−2.00	(−1.89)	0.29	(0.37)
$(t-2)$ Year	−3.09	(−2.81)	−2.31	(−2.74)
$(t-1)$ Year	−1.01	(−1.05)	1.29	(1.74)
$(t+1)$ Year	−3.23	(−3.44)	−1.72	(−2.21)
$(t+2)$ Year	−1.23	(−1.50)	−0.49	(−0.75)
$(t+3)$ Year	0.13	(0.16)	1.25	(1.53)
$(t+4)$ Year	−0.78	(−1.01)	−0.24	(−0.37)
Panel B: Equal-Weighted Portfolio Returns				
$(t-4)$ Year	0.33	(0.28)	0.81	(1.40)
$(t-3)$ Year	−2.56	(−2.91)	0.12	(0.26)
$(t-2)$ Year	−3.44	(−4.36)	−1.15	(−3.00)
$(t-1)$ Year	−1.71	(−2.07)	0.24	(0.56)
$(t+1)$ Year	−2.24	(−2.40)	−1.25	(−2.52)
$(t+2)$ Year	−2.08	(−2.36)	−1.38	(−2.60)
$(t+3)$ Year	−1.18	(−1.48)	0.46	(0.68)
$(t+4)$ Year	−0.60	(−0.83)	−0.12	(−0.22)

Table A6. Changes in Fund Performance due to Mergers – Calendar-Time Portfolio Approach

Appendix Table A6 reports fund performance around mergers and the changes in performance due to mergers. I examine performance of acquiring funds around mergers using a calendar-time portfolio approach. In each calendar month, I form value-weighted and equal-weighted portfolios of all sample funds that acquired other funds within the previous four years. Portfolios are re-balanced monthly. In this way, I obtain time-series returns for this post-merger calendar-time portfolio. Similarly, I construct a pre-merger calendar-time portfolio. In each calendar month, I form value-weighed and equal-weighted portfolios of all sample funds that will acquire other funds within the next four years. I run time-series regressions on each portfolio using the Carhart four-factor model and report the Carhart alpha (α^{c4}) in Column (1) and (2). Panel A reports the results using value-weighted portfolio returns, and Panel B reports the results using equal-weighted returns. I also calculate the value-weighted and equal-weighted objective-adjusted returns (OAR) for both calendar-time portfolios in every calendar month. I regress the OARs of each portfolio on a constant and report the results in Column (3) and (4). The t-statistics for the change in Carhart alpha ($\Delta\alpha^{c4}$) and the change in OAR (ΔOAR) are obtained using the difference in mean test. The reported α^{c4}, $\Delta\alpha^{c4}$, OAR, and ΔOAR are annualized values. t-statistics are in parentheses.

Year	(1)	(2)	(3)	(4)
	Carhart Four-Factor Alpha		Objective-Adjusted Returns	
	α^{c4} (%)	$\Delta\alpha^{c4}$ (%)	OAR (%)	ΔOAR (%)
Panel A: Value-Weighted Portfolio Returns				
4 Years before Mergers	−0.83		0.13	
	(−1.26)		(0.32)	
4 Years after Mergers	−1.86	−1.03	−0.52	−0.66
	(−3.44)	(−1.15)	(−1.32)	(−1.15)
Panel B: Equal-Weighted Portfolio Returns				
4 Years before Mergers	−1.61		−0.23	
	(−2.82)		(−0.85)	
4 Years after Mergers	−1.91	−0.29	−0.78	−0.55
	(−3.10)	(−0.33)	(−2.52)	(−1.34)

Table A7. CRSP Investment Objective Code

Appendix Table A7 lists the investment objectives of domestic equity funds defined by CRSP. The CRSP objective code combines Strategic Insight, Wiesenberger, and Lipper objective codes into an unique objective code for each fund. The CRSP objective code has four letters.

1^{st} Letter	2^{nd} Letter	3^{rd} Letter	4^{th} Letter
Equity (E)	Domestic (D)	Cap-based (C)	Micro Cap (I) Large Cap (L) Mid Cap (M) Small Cap (S)
		Sector (S)	Telecom (A) Commodities (C) Financial (F) Gold (G) Health (H) Industrials (I) Materials (M) Natural Resources (N) Real Estate (R) Consumer Services (S) Technology (T) Utilities (U)
		Style (Y)	Growth and Income (B) Growth (G) Hedged (H) Income (I) Short (S)

Table A8. Number of Funds within Each Investment Objective

Appendix Table A8 reports the number of funds within each investment objective every year for the period of 1991–2013.

Year	Cap-Based Funds (DEC)				Sector Funds (DES)												Style Funds (DEY)				
	CI	CL	CM	CS	SA	SC	SF	SG	SH	SI	SM	SN	SR	SS	ST	SU	YB	YG	YH	YI	YS
1991	0	0	0	32	0	0	5	16	6	0	0	9	0	0	11	10	122	244	0	25	0
1992	0	0	0	62	0	0	8	18	6	0	0	10	0	0	11	13	192	282	0	30	0
1993	0	0	0	83	0	0	10	19	7	0	0	12	4	0	15	15	197	268	0	2	0
1994	0	0	17	87	0	0	11	21	6	0	0	14	3	0	13	11	198	276	0	1	0
1995	0	0	25	100	0	0	11	21	8	0	0	16	3	0	12	18	230	270	0	1	0
1996	0	0	39	131	0	0	11	21	10	0	0	21	4	0	13	22	275	333	0	1	0
1997	0	0	64	177	0	0	11	24	9	0	0	23	13	0	17	32	329	403	0	0	0
1998	9	31	114	233	6	0	13	23	10	0	0	22	21	0	19	37	407	484	0	75	0
1999	15	38	135	243	7	0	17	20	13	0	0	21	27	0	27	37	326	480	0	85	0
2000	23	43	170	285	7	0	22	14	18	0	0	19	29	0	38	34	354	522	0	89	0
2001	29	50	184	311	8	0	27	15	23	0	0	20	42	0	43	31	371	580	0	88	0
2002	33	53	187	331	8	0	32	19	28	0	0	23	50	0	51	27	383	606	0	87	0
2003	32	64	197	351	6	0	33	19	36	0	0	22	57	0	70	25	382	678	0	80	0
2004	34	71	225	385	6	0	35	20	45	0	0	25	61	0	90	21	398	762	0	78	0
2005	37	67	240	383	6	0	34	20	51	0	0	26	64	0	83	21	398	785	0	74	0
2006	38	63	253	406	8	0	34	21	47	0	0	26	68	0	81	23	395	796	17	71	6
2007	39	60	257	412	8	0	35	19	44	0	0	28	75	0	77	22	379	790	28	76	10
2008	41	62	267	422	8	6	32	22	44	10	4	34	72	6	72	23	376	796	47	84	11
2009	33	57	275	396	5	5	19	25	25	9	4	15	56	6	37	23	366	785	49	87	19
2010	30	48	257	388	5	8	21	26	25	9	6	16	56	7	35	20	376	793	65	86	24
2011	30	45	250	371	6	10	21	26	27	7	6	16	55	7	40	18	415	816	103	80	20
2012	29	44	235	361	6	11	19	25	21	7	5	15	54	10	34	16	418	789	152	79	14
2013	26	41	224	360	6	13	20	25	20	9	5	15	54	10	33	16	456	777	183	83	11

Table A9. Number of Acquiring Funds within Each Investment Objective

Appendix Table A9 reports the number of acquiring funds within each investment objective every year for the period of 1991–2013.

Year	Cap-Based Funds (DEC)				Sector Funds (DES)												Style Funds (DEY)				
	CI	CL	CM	CS	SA	SC	SF	SG	SH	SI	SM	SN	SR	SS	ST	SU	YB	YG	YH	YI	YS
1991	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	2	1	0	1	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	11	0	2	0
1993	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	6	8	0	0	0
1994	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	4	4	0	0	0
1995	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	2	8	9	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	7	0	0	0
1997	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	11	7	0	0	0
1998	0	0	3	4	1	0	0	1	0	0	0	0	0	0	0	0	12	12	0	2	0
1999	0	1	3	7	0	0	0	0	0	0	0	0	2	0	0	1	11	9	0	1	0
2000	0	2	3	8	0	0	1	0	1	0	0	2	0	0	1	2	20	18	0	4	0
2001	0	2	9	9	0	0	0	2	0	0	0	0	5	0	0	1	12	22	0	6	0
2002	0	2	4	8	1	0	2	0	0	0	0	0	1	0	5	2	21	34	0	3	0
2003	0	2	12	12	0	0	1	0	1	0	0	1	0	0	9	0	14	40	0	4	0
2004	0	3	4	9	0	0	0	0	0	0	0	0	0	0	3	0	7	25	0	2	0
2005	2	4	12	14	0	0	1	0	3	0	0	2	2	0	4	0	21	35	0	5	0
2006	2	3	9	12	0	0	0	1	1	0	0	0	0	0	1	1	13	29	0	4	0
2007	2	2	11	11	0	0	1	0	1	0	0	0	3	0	4	1	26	36	1	6	0
2008	1	1	8	9	0	0	0	0	2	0	0	0	2	0	7	1	13	29	0	4	0
2009	2	3	21	33	0	0	0	0	0	0	1	0	1	0	2	0	31	54	3	5	0
2010	2	4	19	16	0	0	1	0	0	0	0	0	1	0	1	1	11	31	0	3	0
2011	1	2	12	13	0	0	0	0	1	0	0	1	2	0	1	1	15	35	1	5	0
2012	2	3	8	5	0	0	0	0	0	0	0	0	1	0	1	0	8	23	0	4	0
2013	0	1	13	4	0	0	0	0	0	0	0	0	0	0	1	0	9	16	0	3	0