DO MUTUAL FUNDS HAVE DECREASING RETURNS TO SCALE?
EVIDENCE FROM FUND MERGERS

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Abstract

Using fund mergers as shocks to fund size, I analyze return-to-scale properties of mutual funds. The results show that acquiring funds experience performance deterioration after abnormal size increases due to mergers. Funds that have a larger shock in size at the time of mergers are more likely to experience worse declines in performance after the events. In the post-merger period, investors redeem their shares from the poorly performing acquiring funds, and both the declining performance and persistent capital outflows lead to decreases in size. As fund size decreases, performance tends to recover. These findings provide evidence that is consistent with mutual funds having decreasing returns to scale and more broadly with theoretical models of delegated portfolio, such as Berk and Green (2004).

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.

Empirical evidence on the relation between fund 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 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. Recent literature argues that manager skill is an omitted variable, which may be correlated with both fund size and performance. Thus, in order to examine the impact of size on performance, we need to identify the variations of size which are uncorrelated with manager skill, which is normally proxied by recent fund 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 different Morningstar ratings, which in turn yield discrete differences in fund size. They find that the impact of size on performance is not significant. Pástor, Stambaugh, and Taylor (2015) 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.

In this paper, I examine the size-performance relation in events associated with

¹Previous 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).

large shocks to fund size that are unrelated to prior performance – mutual fund mergers. I conduct two preliminary analyses to justify examining decreasing returns to scale in fund mergers. These analyses show that the likelihood of being an acquiring fund in a merger is not significantly related to past performance. This finding suggests that acquiring fund managers are not particularly skilled, which mitigates endogeneity concerns voiced in this literature. The results also show that the size change of acquiring funds resulting from 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. The large size changes facilitate a powerful test of the relation between size and future performance.

My main findings are as follows. First, acquiring funds experience performance deterioration after their size increases abnormally due to mergers. The annualized Carhart alpha (α^{c4}), which averages -0.29% over the four years before mergers, falls to -1.61% over the four years after the events. Similarly, the average annualized objective-adjusted return (OAR) of acquiring funds is insignificantly positive ($OAR = 0.42\%$) over the four years before mergers and becomes significantly negative ($OAR = -0.53\%$) over the four years after the events. Using each fund’s pre-event performance as a benchmark, I obtain the change in performance of acquiring funds. I find that not only performance declines after the events, but the change in performance that acquiring funds experience due to mergers is negative and significant ($\Delta\alpha^{c4} = -1.32\%$ and $\Delta OAR = -0.95\%$).

Second, funds that have a larger shock in size at the time of mergers are more likely to experience worse declines in performance after the events. Sorting funds into three groups according to their shock in size at the time of mergers, I find that funds with smaller shock in size experience a decrease in Carhart alpha of 0.89% . In contrast, funds having larger shock in size suffer a 2.44% decrease of Carhart alpha after the events. Using OAR as a measure of performance yields similar results. The change in OAR is -0.71% for funds with smaller shock in size, and is -2.23% for funds with larger shock in size. I also show that the relation between the shock in size and the change in performance is negative and significant after controlling for fund characteristics.

Third, investors redeem their shares from acquiring funds after mergers. The average objective-adjusted flow of acquiring funds, which is insignificantly different from zero

before mergers, becomes significantly negative after the events. The persistent outflows reinforce the declining post-merger performance and decrease average fund size during the four years after the events. The average objective-adjusted percentage change in size of acquiring funds is about -1% every month over the four years after mergers.

Fourth, the performance deterioration is a temporary phenomenon. Fund performance tends to recover as size decreases in the post-merger period. Comparing the pre-merger performance to the performance in the 5th and 6th year after mergers, I find that the change in performance is insignificant as measured by either the Carhart alpha ($\Delta\alpha^{c4} = -0.79\%$) or OAR ($\Delta OAR = -0.58\%$).

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 money flows into a fund. Fund flows continue until size reaches a point where the fund is no longer expected to either outperform or underperform in the future.

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 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 (2015) 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 $\tau = 1, \dots, T$, 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 managerial 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 after mergers and that shareholders of acquiring funds suffer worsening performance in the year following the events. 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.² 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 (2015)).

²See 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 (2015).

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 the sample period. Because the last TNA report month of target funds may not be the merger event month, I employ the following procedure to identify 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):

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

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 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.³ *Performance* is fund monthly returns. *Return Volatility* is the standard

³Appendix 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.

deviation of fund returns in the prior 12 months. *Age* is calculated in months. I obtain the value-weighted characteristics of a fund which has multiple share classes following Wermers (2000). Table 1 reports the time-series mean of the cross-sectional average characteristics. I first calculate the average characteristics 12 months before mergers for each acquiring and target fund. Then, I calculate the cross-sectional average characteristics of acquiring funds with the same merger month, of target funds with the same last report month, and of other funds every month in the sample period. Column (1)–(3) compare characteristics between acquiring and target funds for the period of 2000–2013.⁴ 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 (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. In particular, the performance of acquiring funds is not significantly different from the performance of other funds in a univariate setting. The difference in monthly returns between acquiring and other funds is 0.03%, with t -statistic of 0.08. This comparison implies that acquiring funds are average funds, which neither have superior past performance nor underperform before mergers.

⁴Elton, Gruber, and Blake (2001) document the omission bias of CRSP mutual fund database. The database reports detailed tables on the name and last report month of target funds. Yet, return data of some target funds are missing. CRSP does not report returns of the target funds included in this paper before 2000, and reports returns of about half of the target funds after 2000. In this paper, any test that requires target fund characteristics has a test period since 2000.

4 Methodologies and Findings

4.1 Preliminary Tests

4.1.1 Determinants of Being Acquiring Funds in Mergers

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. Therefore, in order to examine the impact of size on performance, we need to identify the variations in size that are uncorrelated with manager skill, which are normally proxied by recent fund performance. In this section, I examine whether the likelihood of being acquiring funds is related to their past performance to address the endogeneity issue.

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

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

where i refers to fund i , t indicates month t , and ν is year fixed effect. 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 characteristics of funds with the same investment objective. *Performance* is the objective-adjusted cumulative return computed over the prior

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

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

12 months. *Flow* and *Expense Ratio* are averaged over prior 12 months. *Return Volatility* is the standard deviation of fund returns in the prior 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 months and takes a value of zero otherwise. Fund characteristics over the prior 12 months 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.

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 a merger ($\beta_1 = 0.413$, $p\text{-value} = 0.32$, marginal effect = 0.010).⁸ This finding implies that the probability of being an acquiring fund is not correlated with manager skills. The results also show that larger and cheaper funds are more likely to be acquiring funds. Yet, the other fund characteristics, such as flow, family size, age, and return volatility, are not significantly correlated with the probability of being an acquiring fund in a merger.

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. I find that the relation between past fund performance and the probability of being an acquiring fund is insignificant for both within-family ($\beta_1 = 0.247$, $p\text{-value} =$

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

⁸I report the average marginal effect. The marginal effect of independent variable X for observation i is $ME(X)_i = P_i \times (1 - P_i) \times \hat{\beta}_x$, where P is the predicted probability of being an acquiring fund, and $\hat{\beta}_x$ is the parameter estimate for regressor X . The mean predicted probability of being acquiring funds in mergers is 0.025.

0.65, marginal effect = 0.004) and across-family ($\beta_1 = 0.570$, p -value = 0.37, marginal effect = 0.005) mergers. I also find that larger funds are more likely to acquire other funds within-family, and funds that charge a lower fee are more likely to acquire other funds in both within- and across-family mergers. Other fund characteristics, including flows, family size, age, and return volatility are not significantly related to the probability of being an acquiring fund in either within- or across-family mergers.⁹

To sum up, in this section, I show that the likelihood of being an acquiring fund is not related to past performance. This finding implies that the change in size due to mergers which acquiring funds experience is not correlated with manager skills. Thus, using mergers as shocks to fund size to test the size-performance relation alleviates the concern of the endogeneity fund size issue.

4.1.2 Abnormal Size Increase due to Mergers

In general, there are three sources of fund size change: 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 money inflows than poorly performing funds. Funds may also increase size by acquisitions. Yet, target investors could withdraw all money prior to a merger. Some shareholders of acquiring funds may also redeem their shares before the event. Thus, acquisitions do not necessarily lead to abnormal increases in size of acquiring funds.

This section explores whether acquiring funds experience abnormal size increase resulting from mergers. If acquiring funds experience abnormal size increase due to mergers, then using mergers as shocks to size enables me to do powerful tests examining the impact of size on performance. Abnormal size is the difference between a fund's

⁹I also use different measures for fund performance, including the objective-adjusted cumulative returns of past six months; the objective-adjusted average returns of past six and 12 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.

actual size (total net asset (TNA)) and its would-be size (denoted as $Size^*$) if there was no merger.

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

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

where i refers to fund i , t indicates month t , and ν is year fixed effect. The dependent variable is percentage change in size:

$$\Delta\%Size_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}}{TNA_{i,t-1}},^{10}\tag{4}$$

where $TNA_{i,t}$ is total net asset of fund i in month t . The independent variables are fund characteristics, which are lagged one period. *Performance* is the cumulative returns over the prior 12 months. *Return Volatility* is the standard deviation of returns over the prior 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 cumulative returns with standard deviation of returns. *Performance* $\times$ *Age* interacts 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 performance volatility is high, the relation between past performance volatility and

¹⁰The 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.

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 ($\beta_7 < 0$).

The second predictive regression model (Model (2)) includes two additional explanatory variables: *Performance* $\times$ *Return Decile* and *Spillover Effect*. *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 are 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.

These two explanatory variables are constructed based on the empirical findings of Sirri and Tufano (1998). The authors document an asymmetric flow-performance relation. Funds with superior recent performance enjoy disproportionately large new money inflows. They also document a “spillover effect.” If a fund performs extremely well, other funds in the same family experience increases in capital inflows as well. Their findings imply that the parameter estimate for the interaction term (β_8) is positive. Fund’s relative performance to other funds with the same investment objective positively affects the responsiveness of size change to performance. The parameter estimate for the dummy variable (β_9) is also positive. Funds from a family with star funds receive more inflows compared to other funds from a family without star funds.

I run a panel regression with year fixed effects using all domestic equity funds to obtain the coefficient estimates ($\hat{\beta}$) 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 ($\beta_1 = 0.113$, $t\text{-stat} = 7.76$).¹¹ Small ($\beta_3 = -0.002$, $t\text{-stat} = -9.36$), young ($\beta_4 = -0.004$, $t\text{-stat} = -5.84$), and cheaper ($\beta_5 = -0.612$, $t\text{-stat} = -7.06$) 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 ($\beta_6 = -0.140$, $t\text{-stat} = -3.10$). 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 ($\beta_7 = -0.016$, $t\text{-stat} = -5.81$). A given good return triggers more size increase if the fund's relative performance to its peer group is higher ($\beta_8 = 0.003$, $t\text{-stat} = 5.02$). The results provide evidence for the spillover effect ($\beta_9 = 0.016$, $t\text{-stat} = 8.65$). 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.¹²

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

$$E_{t-1} [\Delta \%Size_{i,t}] = \mathbf{X}_{i,t-1} \hat{\beta}, \quad (5)$$

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

$$Size_{i,t}^* = TNA_{i,t-1} \times (1 + E_{t-1} [\Delta \%Size_{i,t}]), \quad (6)$$

¹¹The marginal effect of *Performance* on $\Delta \%Size$ is $(0.113 - 0.153 \times Return\ Volatility - 0.016 \times Age)$ using predictive regression Model (1) and is $(0.093 - 0.14 \times Return\ Volatility - 0.016 \times Age + 0.003 \times Return\ Decile)$ 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 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), the marginal effect has a mean of 0.021 and standard deviation of 0.014. About 94% of all funds have a positive marginal effect of *Performance* on $\Delta \%Size$.

¹²I add four lags of flows to Model (2) and run a panel regression with year fixed effects. I find that the parameter estimates (magnitude and significance) of the independent variables which are included in Model (2) are similar to those obtained from estimating Model (2). The parameter estimates for the lagged flows are insignificant (untabulated). The results are available upon request.

and calculate the abnormal size at the time of mergers:

$$Abnormal\ Size_{i,t} = TNA_{i,t} - Size_{i,t}^*. \quad (7)$$

I test whether the abnormal size and the abnormal percentage change in size resulting from 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.

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 predictive regression Model (2) yields similar results. Acquiring funds experience an average of 52% (t -stat = 9.21) abnormal size increase resulting from 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.¹³

4.2 Deterioration of Fund Performance due to Mergers

I have shown that the likelihood of being an acquiring fund is unrelated to past performance, and thus testing the size-performance relation in fund mergers alleviates the concern of fund size being endogenous. Acquiring funds experience a positive shock in size at the time of mergers. Decreasing returns to scale implies that fund performance decreases as fund size increases. I test this implication by examining fund performance over the four years before and after mergers. In order to have fund characteristics four years before and after the events, I use mergers that occurred between 1995 and 2009 for the tests in this section.

¹³I also calculate the would-be size ($Size^*$) using returns in the merger event month and average flows over the four years before mergers. See Appendix A.1 and Table A4 for details.

4.2.1 Average Fund Performance around Mergers

I plot the cross-sectional average return decile of acquiring funds every month over the four years before and after mergers in Figure 2 (dotted line). The right vertical axis is the return decile. The horizontal axis is the time line of a merger. The numbers on the horizontal axis indicate months around mergers. 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. We observe that the average return decile fluctuates around 5.55 before mergers, and decreases to around 5.35 after the events. These patterns indicate that fund performance deteriorates after size increases abnormally resulting from mergers.

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:

$$R_{i,t}^e = \alpha_i^{c4} + \beta_i^{mkt} R_{m,t}^e + \beta_i^{smb} SMB_t + \beta_i^{hml} HML_t + \beta_i^{umd} UMD_t + \epsilon_{i,t}, \quad (8)$$

where the dependent variable is the excess return of fund i over the risk-free rate in month t , $R_{m,t}^e$ 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.¹⁴ The intercept of the model, α_i^{c4} , is the Carhart measure of abnormal returns of fund i .

I run the Carhart four-factor model for each fund using monthly returns over the four years before and after a merger while including seven event year dummies. I use the first year after a merger as the base year. The intercept of the regression model is the Carhart alpha for the base year. The Carhart alpha for the rest seven event

¹⁴The 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.

years is the sum of the intercept and the parameter estimate for the corresponding event year dummy. Estimating the Carhart alpha of eight event years in one regression model assumes that factor loadings of each fund are the same over these eight years. Next, I regress the Carhart alphas by event year on a constant and cluster by calendar year. Table 5 Column (1) and (2) report the annualized Carhart alpha in each event year and t -statistics. I find that the Carhart alpha of acquiring funds is not significantly different from zero in the pre-merger period. Yet, the Carhart alpha becomes significantly negative after the events. The annualized Carhart alpha, which is -0.42% (t -stat = -0.47) one year before mergers, decreases to -1.51% (t -stat = -3.29) one year after the events.¹⁵

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 performance of all funds with the same investment objective. I calculate monthly OAR of each fund over the four years before and after a merger. 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 5 report the test results. I find that the performance of acquiring funds, which is not significantly different from zero before mergers, becomes significantly negative after the events. The annualized OAR in the four years of the pre-merger period is 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, and it decreases to -0.54% (t -stat = -1.92) in the first year after mergers.

Next, I test whether the change in performance resulting from mergers is statistically significant. I benchmark each fund's own pre-event performance to calculate the change in performance:

$$\Delta\alpha_i^{c4} = \alpha_{i,t+1 \rightarrow t+48}^{c4} - \alpha_{i,t-48 \rightarrow t-1}^{c4}, \quad (9)$$

and

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

¹⁵As a robustness test, I use daily fund returns to run the Carhart model and find similar results. Results are available upon request.

where i indicates fund i , t refers to the merger event month, $t + 1 \rightarrow t + 48$ indicates the period from the first to the 48th month after a merger, and $t - 48 \rightarrow t - 1$ indicates the 48 months before the event.

I run the Carhart four-factor model for each fund using returns over the four years before and after a merger while including an event period dummy. The event period dummy takes a value of one if it is before a merger and zero after. Thus, the post-merger period is the base event period. The intercept of the regression is the post-merger Carhart alpha ($\alpha_{i,t+1 \rightarrow t+48}^{c4}$). The pre-merger Carhart alpha ($\alpha_{i,t-48 \rightarrow t-1}^{c4}$) is the sum of the intercept and the parameter estimate for the event period dummy. This empirical test assumes that factor loadings of each fund are the same before and after a merger. I regress $\alpha_{i,t-48 \rightarrow t-1}^{c4}$, $\alpha_{i,t+1 \rightarrow t+48}^{c4}$, and $\Delta\alpha_i^{c4}$ on a constant separately and cluster by calendar year. Table 6 Column (1) and (2) report the test results. The annualized Carhart alpha, which is -0.29% (t -stat = -0.80) before mergers, decreases to -1.61% (t -stat = -6.19) after the events. The change in Carhart alpha is negative and significant ($\Delta\alpha^{c4} = -1.32\%$, t -stat = -2.90).¹⁶

Similarly, I calculate the average pre-merger and post-merger OAR of each acquiring fund using four years of return data before and after a merger 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 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 events, 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 mergers is statistically significant.¹⁷

¹⁶As a robustness test, I redo the change in performance test using daily returns and find similar results. Results are available upon request.

¹⁷As a robustness check, I form calendar-time portfolios to examine the performance of acquiring funds around mergers. The calendar-time portfolio tests provide similar evidence of declining performance of acquiring funds resulting from mergers. See Appendix A.2 and Table A5 and A6 for details.

4.2.2 Subsample Analysis

Decreasing returns to scale implies that funds that experience larger shock in size at the time of mergers are more likely to experience worse performance after the events compared to funds with smaller shock in size. I test this implication using subsample analysis.

I sort acquiring funds into three groups according to their abnormal size at the time of mergers. I calculate the abnormal size of acquiring funds using the predictive regression Model (1) (Equation (3)–(7)) and keep funds with positive abnormal size.¹⁸ The abnormal size measures the shock in size that acquiring funds experience due to mergers. I use the breakpoints of the 30th percentile and the 70th percentile to sort funds into three groups. Group (I) includes funds that have abnormal size below the 30th percentile, Group (III) has funds with abnormal size above the 70th percentile, and Group (II) includes the rest funds. Panel A, B, and C of Table 7 report the test results for Group (I), (II), and (III), respectively.

I obtain the pre- and post-merger performance, and the change in performance for each group of funds using Equation (9) and (10) following Section 4.2.1. I test whether the change in performance of each group of funds is significantly negative. The results show that the post-merger performance of each group is significantly negative. The post-merger annualized Carhart alpha is -1.71% ($t\text{-stat} = -3.87$), -1.88% ($t\text{-stat} = -5.97$), and -1.52% ($t\text{-stat} = -4.36$) for Group (I), (II), and (III), respectively. Yet, the change in Carhart alpha is not significant for Group (I), but is significantly negative for Group (II) and (III). Moreover, the absolute magnitude of the change in Carhart alpha increases from Group (I) to Group (III). The change in Carhart alpha for Group (I) is -0.89% ($t\text{-stat} = -0.88$). In contrast, the change in Carhart alpha for Group (III) is -2.44% ($t\text{-stat} = -3.09$).

Using OAR to measure fund performance yields similar results. The change in OAR is negative but insignificant for Group (I), and is significantly negative for Group (II) and (III). The absolute magnitude of the change in performance of Group (I) is smaller than that of Group (III). The change in annualized OAR of Group (I) is -0.71% ($t\text{-stat} =$

¹⁸Using predictive regression Model (2) yields similar results. Results are available upon request.

−0.85), as compare to −2.23% (t -stat = −2.67) of Group (III). These findings show that funds experience larger shock in size are more likely to have worse declining performance after mergers.

4.2.3 Cross-Sectional Tests

I have shown that funds which experience larger shock in size at the time of mergers have worse performance after the events compared to funds having a smaller shock in size. In this section, I test the relation between the shock in size and the decline in performance that acquiring funds experience due to mergers using cross-sectional regressions:

$$(Change\ in\ Performance)_i = \beta_0 + \beta_1(Size\ Shock\ in\ Merger)_i + \nu + \varepsilon_i, \quad (11)$$

where i refers to fund i and ν is year fixed effect. The dependent variable is the change in performance of acquiring funds due to mergers. I use the change in Carhart alpha ($\Delta\alpha^{c4}$) and the change in OAR (ΔOAR) to measure *Change in Performance*, and $\Delta\alpha^{c4}$ and ΔOAR are obtained in Section 4.2.1. I calculate the abnormal size of acquiring funds at the time of mergers using the predictive regression Model (1) (Equation (3)–(7)). The abnormal size measures the shock in size that acquiring funds experience due to the events. The dependent variable, *Size Shock in Merger*, is the logarithm of abnormal size.

Table 8 Column (M1) and (M3) report the regression results. Model (M1) uses $\Delta\alpha^{c4}$ to measure the change in fund performance, and Model (M3) uses ΔOAR . I find that the parameter estimate for *Size Shock in Merger* is significantly negative for both Model (M1) ($\beta_1 = -0.03$, t -stat = −2.52) and Model (M3) ($\beta_1 = -0.02$, t -stat = −1.72). This finding implies that funds, which experience a larger shock in size at the time of mergers, are more likely to experience worse performance after the events.

Next, I include fund characteristics as control variables in the cross-sectional regression model. The included characteristics are *Return Volatility*, *Flow*, *Age*, and *Expense Ratio*. *Return Volatility* is the standard deviation of fund returns in the prior 12 months. *Flow* and *Expense Ratio* are averaged over prior 12 months. *Age* is the logarithm of fund

age. Column (M2) and (M4) report the results. Model (M2) uses $\Delta\alpha^{c4}$ as the dependent variable, and Model (M4) uses ΔOAR . The key finding is that the relation between the shock in size and change in performance that acquiring funds experience due to mergers is still negative and significant after controlling for fund characteristics. The parameter estimate for *Size Shock in Merger* is -0.03 (t -stat = -2.24) and -0.02 (t -stat = -1.52) for Model (M2) and (M4), respectively.

To sum up, in this section, I find that fund performance deteriorates after their size increases abnormally due to mergers. Funds which experience larger shock in size at the time of mergers are more likely to have worse declines in performance after the events. The change in performance is negatively and significantly correlated with the shock in size after controlling for fund characteristics. All these findings provide evidence that mutual funds have decreasing returns to scale.

4.3 Fund Flows and Changes in Fund Size around Mergers

4.3.1 Fund Flows

Previous empirical studies show that mutual fund investors chase past performance (Chevalier and Ellison (1997), Sirri and Tufano (1998), and Sapp and Tiwari (2004)). Berk and Green’s (2004) model explains that rational investors compete with each other to find skilled managers who can deliver positive alpha. Yet, investors do not observe manager skills and they take past performance as a signal of skills. Investors move their money into superior performing funds and redeem their shares from funds that perform poorly. I have shown that acquiring funds experience performance deterioration after abnormal size increases due to mergers. Investors are expected to move their money out of acquiring funds after the events as implied by Berk and Green’s model. I test this implication by examining flows of acquiring funds around mergers.

I plot the average monthly flow decile of acquiring funds among funds with the same investment objective over the four years before and after mergers in Figure 3. 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. Figure 3 shows 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 target funds. However, the average flow decile decreases to about 5.0 after mergers. This pattern implies that investors redeem their shares from acquiring funds after the events, which is consistent with the prediction of Berk and Green’s model.

Next, I use the objective-adjusted flows to test whether flows experienced by the acquiring funds around mergers are statistically significant. The objective-adjusted flow is the difference between fund flow and the average flow of all funds with the same investment objective. This measure implicitly accounts for sector, industry, or style-specific factors that may affect flows of funds with the same investment objective. I calculate the average objective-adjusted flow for each fund every year over the four years before and after a merger using monthly data. In each of these eight event years, I regress the objective-adjusted flows on a constant while clustering by calendar year.

Table 9 Column (1) and (2) report the regression results. The results show that the objective-adjusted flows of acquiring funds are not significantly different from zero before mergers and become significantly negative after the events. 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). The results 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.

4.3.2 Fund Size

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 $TNA_{i,t+1} > TNA_{i,t}$. When $R_{i,t+1} + Flow_{i,t+1} < 0$, size decreases and $TNA_{i,t+1} < TNA_{i,t}$. The deteriorated performance and persistent outflows that acquiring funds experience after mergers would lead to decreases in size in the post-merger period.

I plot the cross-sectional average size decile of acquiring funds every month over the four years before and after mergers in Figure 2 (solid line). The left vertical axis is the size decile. The horizontal axis is the time line of mergers. The numbers on the horizontal axis indicate months around mergers. A decile of 5.5 indicates the median size of all funds with the same investment objective. We observe 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. The average size decile climbs from 6.6 to 6.8 during the four years 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.

Next, I use the objective-adjusted percentage change in size to test whether size changes 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. This measure implicitly accounts for sector, industry, or style-specific factors that may affect size of funds with the same investment objective. I calculate the average monthly objective-adjusted percentage change in size for each fund every year over the four years before and after mergers. 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 9 Column (3) reports the cross-sectional average of the objective-adjusted

percentage change in size in each event year. Column (4) 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). The results also show that acquiring funds experience significant decreases in size after mergers. The monthly objective-adjusted percentage change in size is about -0.8% during the four years after mergers.¹⁹

4.3.3 Recovery of Fund Performance

I have shown that acquiring funds experience a positive shock in size resulting from mergers and that subsequently, their performance decreases and money flows out. The resulting decrease in size during the post-merger period facilitates a final test of decreasing returns to scale. If funds indeed exhibit decreasing returns to scale, the decline in fund size should be accompanied by a recovery in performance. In this section, I extend the window of the change in performance tests described in Section 4.2.1 to six years following the merger. This horizon choice is arbitrary, and the gradual post-merger decline in fund size implies the test is low in power. Thus, I interpret the results with a degree of caution. To obtain the Carhart four-factor alpha, I estimate the following regression model:

$$R_{i,t}^e = \alpha_i^{c4} + \beta_i^{mkt} R_{m,t}^e + \beta_i^{smb} SMB_t + \beta_i^{hml} HML_t + \beta_i^{umd} UMD_t + \nu_1 + \nu_2 + \epsilon_{i,t}, \quad (12)$$

¹⁹I calculate the raw fund flows of acquiring funds. The average monthly fund flow is about 0.8% over the four years before mergers, and the average monthly fund flow is about -0.1% over the four years after mergers. As shown in Table 9, the objective-adjusted fund flow is not significantly different from zero before mergers. This finding implies that the pre-event raw fund flow of acquiring funds is not significantly different from other funds with the same investment objective. Assuming the raw flow of the other funds does not change, then the -0.8% monthly objective-adjusted percentage change in size of acquiring funds after mergers is mainly due to the non-merger funds having a lot of inflows.

where ν_1 and ν_2 are two event period dummies, ν_1 takes a value of one if the return is within four years after a merger, and zero otherwise, and ν_2 takes a value of one if the return is in the 5th or 6th year after a merger, and zero otherwise. The pre-merger performance is the intercept of the model. Fund performance within four years after a merger is the sum of the intercept and ν_1 , and fund performance in the 5th and 6th year after the event is the sum of the intercept and ν_2 .

Table 10 reports the regression results. The sample period for the tests in this section is 1995–2007, and funds are required to have return data over the four years before and six years after mergers. Comparing fund performance four years before and after mergers, I find that fund performance declines after the events, and the change in performance is negative and significant. The change in the annualized Carhart alpha is -1.04% with t -statistic of -2.13 , and the change in the annualized OAR is -1.05% with t -statistic of -1.95 . Comparing fund performance four years before mergers and the performance in the 5th and 6th year after the events, I find evidence of performance recovery. The change in the annualized Carhart alpha is -0.87% with t -statistic of -1.30 , and the change in the annualized OAR is -0.72% with t -statistic of -1.24 .

The findings of Table 10 are consistent with an eventual recovery in fund performance. However, an alternative explanation is that poorly performing funds drop out of the sample, and the funds which stay alive more than four years after mergers may not experience performance deterioration right after the events. To rule out this alternative explanation, I only include funds which stay alive in the sample for more than four years after mergers and redo the change in performance tests.

Table 11 reports the test results using this alternate sample. The Carhart alpha, which is insignificant before mergers, becomes significantly negative over the four years after the events. The change in the annualized Carhart alpha is -0.96% with t -statistic of -1.83 . Using OAR as a measure of fund performance yields similar results. The change in the annualized OAR is also negative and significant ($\Delta OAR = -0.77\%$, t -stat = -1.90) over the four years before and after mergers. Comparing the pre-merger performance to the performance in the 5th and 6th year after mergers, I find that the change in performance is insignificant, as measured by either the Carhart alpha ($\Delta\alpha^{c4} = -0.79\%$,

$t\text{-stat} = -1.16$) or OAR ($\Delta OAR = -0.58\%$, $t\text{-stat} = -1.06$). These findings provide evidence that fund performance decreases as size increases due to mergers, and as size decreases in the post-merger period, fund performance tends to recover.

5 Robustness Tests

5.1 Value-Weighted Returns of Target and Acquiring Funds

Target funds have worse average performance than acquiring funds before mergers.²⁰ The relative poor performance of target funds may contribute to the declining performance of acquiring funds after the events. In this section, I redo the change in performance test using the value-weighted performance of target and acquiring funds as the pre-merger performance for the acquiring funds. Only the acquiring funds whose target funds having pre-merger information are included in the sample.

First, I calculate the value-weighted monthly returns of target and acquiring funds for each acquisition before the event, and use the value-weighted returns as the pre-merger monthly returns for the acquiring fund. I run the Carhart four-factor model for each fund using returns over the four years before and after a merger while including an event period dummy. The event period dummy takes a value of one if it is before mergers and zero after. Thus, the post-merger Carhart alpha is the intercept of the regression model, and the pre-merger Carhart alpha is the sum of the intercept and the parameter estimate for the event period dummy. I regress the pre- and post-merger Carhart alpha, and the change in Carhart alpha on a constant separately while clustering by calendar year. Table 12 Column (1) and (2) report the test results. The annualized Carhart alpha, which is -0.45% ($t\text{-stat} = -1.08$) before mergers, decreases to -1.85% ($t\text{-stat} = -4.20$) after the events. The decrease in Carhart alpha is statistically significant ($\Delta\alpha^{c4} = -1.40\%$, $t\text{-stat} = -2.40$).

Similarly, I calculate the value-weighted OAR using monthly OAR of target and acquiring funds before a merger, and obtain monthly OAR of each acquiring fund during

²⁰See Jayaraman, Khorana, and Nelling (2002), Zhao (2005), Ding (2006), and Table 1 of this paper.

the four years after the event. 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 12 report the test results. I find that the performance of acquiring funds is not significantly different from zero before mergers ($OAR = -0.39\%$, $t\text{-stat} = -1.30$), but becomes significantly negative after the events ($OAR = -0.72\%$, $t\text{-stat} = -2.34$). The change in OAR is -0.33% with t -statistic of -0.79 .

These results show that performance of acquiring funds becomes negative after mergers. The deterioration in performance that acquiring funds experience after their size increases abnormally cannot be explained only by the bad performance of target funds before mergers. Using the Carhart alpha to measure fund performance, I find not only that performance becomes negative after mergers, but the declining performance is statistically significant.

5.2 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 637 acquisitions in this sample for the period of 1995–2009.

I redo the change in performance test using this sample and report results in Table 13 Panel A. The results show that acquiring funds experience declines in performance after their size increases abnormally due to mergers. The annualized Carhart alpha, which is -0.37% ($t\text{-stat} = -0.90$) before mergers, becomes to -1.77% ($t\text{-stat} = -5.70$) after the events. The change in Carhart alpha is negative and significant ($\Delta\alpha^{c4} = -1.40\%$, $t\text{-stat} = -2.50$). Using OAR to measure fund performance yields similar results. The annualized OAR decrease by 1.20% ($t\text{-stat} = -1.96$) from 0.39% ($t\text{-stat} = 0.86$) before

mergers to -0.81% ($t\text{-stat} = -3.71$) after the events. These findings provide evidence that as fund size increases abnormally, performance deteriorates.

5.3 Changes of Investment Style

Some funds change their investment styles. 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. 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.²¹ There are 85 acquiring funds that change investment styles over the four years before or after mergers during the period of 1995–2009.

I redo the change in performance test using this sample and report results in Table 13 Panel B. The results show significant performance deterioration after mergers. The change of annualized Carhart alpha is -1.43% ($t\text{-stat} = -3.03$) and the change of OAR is -1.12% ($t\text{-stat} = -2.18$).

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 574 acquisitions in this sample. Using this sample for the change in performance test, I find consistent evidence of declining performance of acquiring funds after their size increases abnormally due to mergers (Table 13 Panel C). The annualized Carhart alpha and OAR are not significantly different from zero before mergers, and become significantly negative after the events. The declining performance is statistically significant as measured by the change in Carhart alpha ($\Delta\alpha^{c4} = -1.66\%$,

²¹Appendix Table A7 reports the CRSP investment objective codes for domestic equity funds. Appendix Table A8 reports the number of funds by investment objective every year in the sample period. Appendix Table A9 reports the number of acquiring funds by investment objective every year in the sample period.

$t\text{-stat} = -2.69\%$) and OAR ($\Delta OAR = -1.41\%$, $t\text{-stat} = -1.84\%$).

Overall, findings in this section provide consistent evidence that mutual funds have decreasing returns to scale. As fund size increases abnormally, fund performance declines, and the declining performance is statistically significant.

5.4 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.²² 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 acquiring fund one-year, two-year, three-year, and four-year before and after a merger. Next, I calculate changes in 12b-1 fee and turnover:

$$\Delta 12b1_i = \sum_{t=1}^{\tau} \frac{12b1_{i,t}}{\tau} - \sum_{t=-\tau}^{-1} \frac{12b1_{i,t}}{\tau}, \quad (13)$$

and

$$\Delta Turnover_i = \sum_{t=1}^{\tau} \frac{Turnover_{i,t}}{\tau} - \sum_{t=-\tau}^{-1} \frac{Turnover_{i,t}}{\tau}, \quad (14)$$

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 14 reports the test results. I find that the average 12b-1 fee charged by acquiring funds

²²CRSP reports fund turnover as the minimum of aggregated sales or aggregated purchases of securities divided by the average 12-month total net assets of a fund. Thus, turnover may not capture the redemptions by shareholders in the post-merger period.

significantly decreases after mergers. The $\Delta 12b1$ is -0.005% ($t\text{-stat} = -1.13$), -0.011% ($t\text{-stat} = -1.48$), -0.018% ($t\text{-stat} = -1.80$), and -0.023% ($t\text{-stat} = -1.99$) 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.

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 a merger is not significantly related to past performance. This finding implies that using fund mergers as shocks to fund size to analyze the return-to-scale property of mutual funds mitigates the concern of size being endogenous.

The results show that acquiring funds experience performance deterioration after their size increases abnormally due to mergers. Funds that experience larger shock in size at the time of mergers are more likely to have worse declines in performance after the events. The relation between the shock in size and the change in performance is negative and significant after controlling for fund characteristics. The results also show that acquiring funds have average fund flows before mergers but suffer persistent capital outflows after the events. 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. These empirical findings provide evidence that mutual funds have decreasing returns to scale.

My results also show that there is a delayed reaction of investors to the abnormal size increase and performance deterioration of acquiring funds. While these findings are empirically consistent with the asymmetric response of fund flows to performance docu-

mented by Gruber (1996), Chevalier and Ellison (1997), and Sirri and Tufano (1998),²³ the patterns are still puzzling. Future research should consider why it takes investors so long to understand the merger's negative implications for performance.

²³Gruber (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.

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 decile and return 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 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 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 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.

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 prior 12 months. 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. Table 1 reports the time-series mean of the cross-sectional average characteristics. I first calculate the average characteristics 12 months before mergers for each acquiring and target fund. Then, I calculate the cross-sectional average characteristics of acquiring funds with the same merger month, of target funds with the same last report month, and of other funds every month in the sample period. 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 results examining the probability of being an acquiring fund in mergers using a logistic regression model. The independent variables 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 characteristics implicitly account for sector, industry, or style-specific factors that may affect characteristics of funds with 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. *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.

	(1) All Mergers	(2) Marginal Effect	(3) Within-Family Mergers Regression Coefficient	(4) Marginal Effect	(5) Across-Family Mergers Regression Coefficient	(6) Marginal Effect
Performance	0.413 (0.32)	0.010	0.247 (0.65)	0.004	0.570 (0.37)	0.005
Flow	0.338 (0.59)	0.008	0.224 (0.75)	0.003	0.553 (0.63)	0.005
Size	0.044 (0.08)	0.001	0.075 (0.02)	0.001	-0.012 (0.77)	0.000
Expense Ratio	-0.309 (0.00)	-0.007	-0.250 (0.03)	-0.004	-0.390 (0.00)	-0.003
Number of Objectives in the Family	0.001 (0.36)	0.000	0.000 (0.90)	0.000	0.003 (0.19)	0.000
Return Volatility	2.296 (0.39)	0.055	-0.804 (0.82)	-0.012	6.376 (0.13)	0.057
Age	0.016 (0.81)	0.000	-0.021 (0.80)	0.000	-0.083 (0.42)	0.001
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 are fund characteristics, which are lagged one period. *Performance* is the cumulative return over the prior 12 months. *Return Volatility* is the standard deviation of returns over the prior 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 cumulative return with standard deviation of returns. *Performance* $\times$ *Age* interacts cumulative return 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 cumulative return 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.

	Model (1)	Model (2)
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 $\times$ Return Volatility	-0.153 (-3.38)	-0.140 (-3.10)
Performance $\times$ Age	-0.016 (-5.83)	-0.016 (-5.81)
Performance $\times$ 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): $E_{t-1} [\Delta\%Size_{i,t}] = \mathbf{X}_{i,t-1}\hat{\beta}$, where $\mathbf{X}_{i,t-1}$ refers to characteristics of fund i one month before the merger (period $t - 1$) and $\hat{\beta}$ is a vector of coefficient estimates of the predictive regression model. Next, I calculate $Size^*$ using the expected percentage change in size: $Size^*_{i,t} = TNA_{i,t-1} \times (1 + E_{t-1} [\Delta\%Size_{i,t}])$, and calculate the abnormal size at the time of mergers: $Abnormal\ Size_{i,t} = TNA_{i,t} - Size^*_{i,t}$. 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 mergers are significantly different from zero. t -statistics are in parentheses.

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

Table 5. Fund Performance around Mergers

Table 5 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. To obtain α^{c4} , I estimate the Carhart four-factor model (Equation 8). I run the Carhart four-factor model for each fund using monthly returns over the four years before and after a merger while including seven event year dummies. I use the first year after a merger as the base year. The intercept of the regression model is the Carhart alpha for the base year. The Carhart alpha for the rest seven event years is the sum of the intercept and the parameter estimate for the corresponding event year dummy. Next, I regress the Carhart alphas by event year on a constant and cluster by calendar year. Column (1) and (2) report the annualized Carhart alpha in each event year and t -statistics. 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 calculate monthly OAR of each fund during the four years before and after a merger. 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 α^{c4} (%)	t -statistics	Objective-Adjusted Return OAR (%)	t -statistics
$(t - 4)$ Year	0.15	(0.12)	0.89	(1.35)
$(t - 3)$ Year	-0.56	(-0.72)	-0.03	(-0.05)
$(t - 2)$ Year	-0.84	(-1.23)	-0.36	(-0.81)
$(t - 1)$ Year	-0.42	(-0.47)	0.78	(1.35)
$(t + 1)$ Year	-1.51	(-3.29)	-0.54	(-1.92)
$(t + 2)$ Year	-1.26	(-2.68)	-0.68	(-2.11)
$(t + 3)$ Year	-1.66	(-3.31)	-0.35	(-1.00)
$(t + 4)$ Year	-1.32	(-3.81)	0.12	(0.61)

Table 6. Change in Fund Performance due to Mergers

Table 6 reports fund performance around mergers and change 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)). I run the Carhart four-factor model for each fund using returns over the four years before and after a merger while including an event period dummy. The event period dummy takes a value of one if it is before a merger and zero after. Thus, the post-merger period is the base event period. The intercept of the regression is the post-merger Carhart alpha ($\alpha_{i,t+1 \rightarrow t+48}^{c4}$). The pre-merger Carhart alpha ($\alpha_{i,t-48 \rightarrow t-1}^{c4}$) is the sum of the intercept and the parameter estimate for the event period dummy. The change in Carhart alpha is $\Delta\alpha_i^{c4} = \alpha_{i,t+1 \rightarrow t+48}^{c4} - \alpha_{i,t-48 \rightarrow t-1}^{c4}$. I regress the pre- and post-merger Carhart alpha, and the change in Carhart alpha on a constant separately and cluster by calendar year. Column (1) and (2) report the test results. 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. Using four years of return data before and after mergers, I obtain the pre-merger OAR ($\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$) and the post-merger OAR ($\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$). The change in OAR is $\Delta OAR_i = \sum_{t=1}^{48} \frac{OAR_{i,t}}{48} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$. I regress the pre- and post-merger OAR and the change in OAR 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)	(2)	(3)	(4)
	Carhart Four-Factor Alpha α^{c4} (%)	Four-Factor Alpha $\Delta\alpha^{c4}$ (%)	Objective-Adjusted Returns OAR (%)	Returns ΔOAR (%)
4 Years before Mergers	-0.29 (-0.80)		0.42 (1.11)	
4 Years after Mergers	-1.61 (-6.19)	-1.32 (-2.90)	-0.53 (-4.53)	-0.95 (-2.19)

Table 7. Change in Fund Performance due to Mergers – Subsample Analysis

Table 7 reports fund performance around mergers and change in performance resulting from the events for three subsamples of funds. I sort acquiring funds into three groups according to their abnormal size at the time of mergers. I calculate the abnormal size of acquiring funds using the predictive regression model (1) (Equation (3)–(7)) and keep funds with positive abnormal size. The abnormal size measures the shock in size that acquiring funds experience due to mergers. I use the breakpoints of the 30th percentile and the 70th percentile to sort funds into three groups. Group (I) includes funds that have abnormal size below the 30th percentile, Group (III) has funds with abnormal size above the 70th percentile, and Group (II) includes the rest funds. Panel A reports the test results for Group (I), Panel B reports results for Group (II), and Panel C reports results for Group (III). 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)). I run the Carhart four-factor model for each fund using returns over the four years before and after a merger while including an event period dummy. The event period dummy takes a value of one if it is before a merger and zero after. Thus, the post-merger period is the base event period. The intercept of the regression is the post-merger Carhart alpha ($\alpha_{i,t+1 \rightarrow t+48}^{c4}$). The pre-merger Carhart alpha ($\alpha_{i,t-48 \rightarrow t-1}^{c4}$) is the sum of the intercept and the parameter estimate for the event period dummy. The change in Carhart alpha is $\Delta\alpha_i^{c4} = \alpha_{i,t+1 \rightarrow t+48}^{c4} - \alpha_{i,t-48 \rightarrow t-1}^{c4}$. I regress the pre- and post-merger Carhart alpha, and the change in Carhart alpha on a constant separately and cluster by calendar year. Column (1) and (2) report the test results. 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. Using four years of return data before and after mergers, I obtain the pre-merger OAR ($\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$) and the post-merger OAR ($\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$). The change in OAR is $\Delta OAR_i = \sum_{t=1}^{48} \frac{OAR_{i,t}}{48} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$. I regress the pre- and post-merger OAR and the change in OAR 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 α^{c4} (%)	(2) Four-Factor Alpha $\Delta\alpha^{c4}$ (%)	(3) Objective-Adjusted Returns OAR (%)	(4) Adjusted Returns ΔOAR (%)
<i>Panel A: Group (I)</i>				
4 Years before Mergers	−0.81 (−1.20)		−0.12 (−0.19)	
4 Years after Mergers	−1.71 (−3.87)	−0.89 (−0.88)	−0.83 (−1.92)	−0.71 (−0.85)
<i>Panel B: Group (II)</i>				
4 Years before Mergers	−0.26 (−0.54)		0.28 (0.80)	
4 Years after Mergers	−1.88 (−5.97)	−1.62 (−2.78)	−0.50 (−1.59)	−0.78 (−1.78)
<i>Panel C: Group (III)</i>				
4 Years before Mergers	0.92 (1.70)		1.64 (2.78)	
4 Years after Mergers	−1.52 (−4.36)	−2.44 (−3.09)	−0.59 (−1.75)	−2.23 (−2.67)

Table 8. Cross-Sectional Tests of the Size-Performance Relation

Table 8 reports coefficient estimates and t -statistics for cross-sectional regression models. These models examine the relation between the shock in size and the change in performance that acquiring funds experience due to mergers. The dependent variable is the change in performance that acquiring funds experience due to mergers. I use the Carhart four-factor model alpha (α^{c4}) and the objective-adjusted return (OAR) to measure fund performance. To obtain α^{c4} , I estimate the Carhart four-factor model (Equation (8)). I run the Carhart four-factor model for each fund using returns over the four years before and after a merger while including an event period dummy. The event period dummy takes a value of one if it is before a merger and zero after. Thus, the post-merger period is the base event period. The intercept of the regression is the post-merger Carhart alpha ($\alpha_{i,t+1 \rightarrow t+48}^{c4}$). The pre-merger Carhart alpha ($\alpha_{i,t-48 \rightarrow t-1}^{c4}$) is the sum of the intercept and the parameter estimate for the event period dummy. The change in Carhart alpha is $\Delta\alpha_i^{c4} = \alpha_{i,t+1 \rightarrow t+48}^{c4} - \alpha_{i,t-48 \rightarrow t-1}^{c4}$. 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. Using four years of return data before and after mergers, I obtain the pre-merger OAR ($\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$) and the post-merger OAR ($\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$). The change in OAR is $\Delta OAR_i = \sum_{t=1}^{48} \frac{OAR_{i,t}}{48} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$. The independent variable of interest is *Size Shock in Mergers*. I use the abnormal size of acquiring funds at the time of mergers to measure the shock in size. I obtain the abnormal size using the predictive regression Model (1) (Equation 3)–(7)). Column (M1) uses $\Delta\alpha^{c4}$ to measure change in fund performance, and Column (M3) uses ΔOAR . Next, I include fund characteristics as control variables in the cross-sectional regression model. The included characteristics are *Return Volatility*, *Flow*, *Age*, and *Expense Ratio*. *Return Volatility* is the standard deviation of fund returns in the prior 12 months. *Flow* and *Expense Ratio* are averaged over prior 12 months. *Age* is the logarithm of fund age. Column (M2) uses $\Delta\alpha^{c4}$ as the dependent variable, and Column (M4) uses ΔOAR . Year fixed effects are included. t -statistics are in parentheses.

	(M1)	(M2)	(M3)	(M4)
Size Shock in Mergers	-0.03 (-2.52)	-0.03 (-2.24)	-0.02 (-1.72)	-0.02 (-1.52)
Return Volatility		-8.85 (-7.22)		-6.16 (-4.48)
Flow		-0.02 (-0.12)		-0.06 (-0.34)
Age		0.02 (0.56)		0.03 (0.66)
Expense Ratio		9.54 (1.74)		3.70 (0.60)
Number of Observation	765	765	765	765
Adjusted R^2	0.0618	0.1210	0.0347	0.057
Year Fixed Effects	Yes	Yes	Yes	Yes

Table 9. Fund Flows and Size around Mergers

Table 9 reports the objective-adjusted flow and the objective-adjusted percentage change in size ($\Delta\%$ Size) of acquiring funds around mergers. The objective-adjusted flow is the difference between fund flow and the average flow of all funds with the same investment objective. 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. I calculate the average objective-adjusted flow of each acquiring fund over the four years before and after a merger using monthly data. In each of these eight event years, I regress the objective-adjusted flow 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 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. I report the regression results in Column (3) and (4). t -statistics are in parentheses.

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

**Table 10. Change in Fund Performance due to Mergers
– Six Years after Mergers**

Table 10 reports fund performance around mergers and changes in performance due to the events. The sample period is 1995–2007, and funds are required to have return data over the four years before and six years after 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. To obtain α^{c4} , I estimate the Carhart four-factor model:

$R_{i,t}^e = \alpha_i^{c4} + \beta_i^{mkt} R_{m,t}^e + \beta_i^{smb} SMB_t + \beta_i^{hml} HML_t + \beta_i^{umd} UMD_t + \nu_1 + \nu_2 + \epsilon_{i,t}$, where ν_1 and ν_2 are two event period dummies, ν_1 takes a value of one if the return is within four years after a merger, and zero otherwise, and ν_2 takes a value of one if the return is in the 5th or 6th year after a merger, and zero otherwise. The pre-merger performance is the intercept of the model. Fund performance within four years after a merger is the sum of the intercept and ν_1 , and fund performance in the 5th and 6th year after the event is the sum of the intercept and ν_2 . The change in Carhart alpha over the four years before and after mergers is ν_1 , and ν_2 is the change in Carhart alpha comparing returns four years before mergers and returns in the 5th and 6th year after the events. I run the Carhart four-factor model for each fund using returns over the four years before and six years after a merger. Next, I regress the pre- and post-merger Carhart alpha, and the changes in Carhart alpha on a constant separately and cluster by calendar year. Column (1) and (2) report the test results. 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. Using return data four years before and six years after mergers, I obtain the pre-merger OAR ($\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$) and two post-merger OAR ($\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$ and $\sum_{t=49}^{72} \frac{OAR_{i,t}}{24}$). The change in OAR over the four years before and after mergers is $\Delta OAR_i = \sum_{t=1}^{48} \frac{OAR_{i,t}}{48} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$, and the change in OAR comparing four years before and the 5th and 6th years after the events is $\Delta OAR_i = \sum_{t=49}^{72} \frac{OAR_{i,t}}{24} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$, I regress the pre- and post-merger OAR and the changes in OAR 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)	(2)	(3)	(4)
	Carhart Four-Factor Alpha α^{c4} (%)	Four-Factor Alpha $\Delta \alpha^{c4}$ (%)	Objective-Adjusted Returns OAR (%)	Returns ΔOAR (%)
4 Years before Mergers	−0.40 (−0.93)		0.45 (0.95)	
4 Years after Mergers	−1.44 (−4.68)	−1.04 (−2.13)	−0.59 (−4.16)	−1.05 (−1.95)
5 th and 6 th Years after Mergers	−0.81 (−1.90)	−0.87 (−1.30)	0.06 (0.25)	−0.72 (−1.24)

**Table 11. Change in Fund Performance due to Mergers
– Six Years after Mergers with Sample Restriction**

Table 11 reports fund performance around mergers and changes in performance due to the events. The sample period is 1995–2007. I only include funds which stay alive in the sample for more than four years after 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. To obtain α^{c4} , I estimate the Carhart four-factor model:

$R_{i,t}^e = \alpha_i^{c4} + \beta_i^{mkt} R_{m,t}^e + \beta_i^{smb} SMB_t + \beta_i^{hml} HML_t + \beta_i^{umd} UMD_t + \nu_1 + \nu_2 + \epsilon_{i,t}$, where ν_1 and ν_2 are two event period dummies, ν_1 takes a value of one if the return is within four years after a merger, and zero otherwise, and ν_2 takes a value of one if the return is in the 5th or 6th year after a merger, and zero otherwise. The pre-merger performance is the intercept of the model. Fund performance within four years after a merger is the sum of the intercept and ν_1 , and fund performance in the 5th and 6th year after the event is the sum of the intercept and ν_2 . The change in Carhart alpha over the four years before and after mergers is ν_1 , and ν_2 is the change in Carhart alpha comparing returns four years before mergers and returns in the 5th and 6th year after the events. I run the Carhart four-factor model for each fund using returns over the four years before and six years after a merger. Next, I regress the pre- and post-merger Carhart alpha, and the changes in Carhart alpha on a constant separately and cluster by calendar year. Column (1) and (2) report the test results. 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. Using return data four years before and six years after mergers, I obtain the pre-merger OAR ($\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$) and two post-merger OAR ($\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$ and $\sum_{t=49}^{72} \frac{OAR_{i,t}}{24}$). The change in OAR over the four years before and after mergers is $\Delta OAR_i = \sum_{t=1}^{48} \frac{OAR_{i,t}}{48} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$, and the change in OAR comparing four years before and the 5th and 6th years after the events is $\Delta OAR_i = \sum_{t=49}^{72} \frac{OAR_{i,t}}{24} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$, I regress the pre- and post-merger OAR and the changes in OAR 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)	(2)	(3)	(4)
	Carhart Four-Factor Alpha α^{c4} (%)	Four-Factor Alpha $\Delta \alpha^{c4}$ (%)	Objective-Adjusted Returns OAR (%)	Objective-Adjusted Returns ΔOAR (%)
4 Years before Mergers	0.02 (0.04)		0.69 (1.70)	
4 Years after Mergers	−0.94 (−3.37)	−0.96 (−1.83)	−0.07 (−0.61)	−0.77 (−1.90)
5 th and 6 th Years after Mergers	−0.78 (−1.76)	−0.79 (−1.16)	0.11 (0.51)	−0.58 (−1.06)

**Table 12. Change in Fund Performance due to Mergers
– Value-Weighted Returns of Target and Acquiring Funds**

Table 12 reports the results of a robustness test of change in performance. This test examines the change in performance of acquiring funds using the value-weighted performance of the target and acquiring funds before mergers as the pre-merger performance for the acquiring funds. Only the acquiring funds whose target funds having pre-merger information are included in the sample. I use the Carhart four-factor model alpha (α^{c4}) and the objective-adjusted return (OAR) to measure performance. To obtain α^{c4} , I first calculate the value-weighted monthly returns of target and acquiring funds for each acquisition before the event, and use the value-weighted returns as the pre-merger monthly returns for the acquiring fund. I run the Carhart four-factor model for each fund using returns over the four years before and after a merger while including an event period dummy. The event period dummy takes a value of one if it is before a merger and zero after. Thus, the intercept of the regression is the post-merger Carhart alpha ($\alpha_{i,t+1 \rightarrow t+48}^{c4}$), and the pre-merger Carhart alpha ($\alpha_{i,t-48 \rightarrow t-1}^{c4}$) is the sum of the intercept and the parameter estimate for the event period dummy. The change in Carhart alpha is $\Delta\alpha_i^{c4} = \alpha_{i,t+1 \rightarrow t+48}^{c4} - \alpha_{i,t-48 \rightarrow t-1}^{c4}$. I regress the pre- and post-merger Carhart alpha, and the change in Carhart alpha on a constant separately and cluster by calendar year. Column (1) and (2) report the test results. 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. Using four years of return data before and after mergers, I obtain the pre-merger OAR ($\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$) and the post-merger OAR ($\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$). The change in OAR is $\Delta OAR_i = \sum_{t=1}^{48} \frac{OAR_{i,t}}{48} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$. I regress the pre- and post-merger OAR and the change in OAR 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)	(2)	(3)	(4)
	Carhart Four-Factor Alpha α^{c4} (%)	Alpha $\Delta\alpha^{c4}$ (%)	Objective-Adjusted Returns OAR (%)	Returns ΔOAR (%)
4 Years before Mergers	−0.45 (−1.08)		−0.39 (−1.30)	
4 Years after Mergers	−1.85 (−4.20)	−1.40 (−2.40)	−0.72 (−2.34)	−0.33 (−0.79)

Table 13. Change in Fund Performance due to Mergers – Robustness Tests

Table 13 reports the results of three robustness tests of change in performance of acquiring funds due to mergers. In the first robustness test, 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. I report test results in Panel A. In the second robustness test, 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. Test results are in Panel B. In the third robustness test, I exclude acquisitions made by the same fund and acquisitions made by funds which change investment styles over the four years before and after mergers. Panel C reports the test results. The change in performance test examines whether fund performance significantly declines after mergers. I use the Carhart four-factor model alpha (α^{c4}) and the objective-adjusted return (OAR) to evaluate performance. To obtain α^{c4} , I estimate the Carhart four-factor model (Equation (8)). I run the Carhart four-factor model for each fund using returns over the four years before and after a merger while including an event period dummy. The event period dummy takes a value of one if it is before a merger and zero after. Thus, the post-merger period is the base event period. The intercept of the regression is the post-merger Carhart alpha ($\alpha_{i,t+1 \rightarrow t+48}^{c4}$). The pre-merger Carhart alpha ($\alpha_{i,t-48 \rightarrow t-1}^{c4}$) is the sum of the intercept and the parameter estimate for the event period dummy. The change in Carhart alpha is $\Delta\alpha_i^{c4} = \alpha_{i,t+1 \rightarrow t+48}^{c4} - \alpha_{i,t-48 \rightarrow t-1}^{c4}$. I regress the pre- and post-merger Carhart alpha, and the change in Carhart alpha on a constant separately and cluster by calendar year. Column (1) and (2) report the test results. 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. Using four years of return data before and after mergers, I obtain the pre-merger OAR ($\sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$) and the post-merger OAR ($\sum_{t=1}^{48} \frac{OAR_{i,t}}{48}$). The change in OAR is $\Delta OAR_i = \sum_{t=1}^{48} \frac{OAR_{i,t}}{48} - \sum_{t=-48}^{-1} \frac{OAR_{i,t}}{48}$. I regress the pre- and post-merger OAR and the change in OAR 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 α^{c4} (%)	(2) Alpha $\Delta\alpha^{c4}$ (%)	(3) Objective-Adjusted Returns OAR (%)	(4) Returns ΔOAR (%)
<i>Panel A: Control Multiple Acquisitions</i>				
4 Years before Mergers	−0.37 (−0.90)		0.39 (0.86)	
4 Years after Mergers	−1.77 (−5.70)	−1.40 (−2.50)	−0.81 (−3.71)	−1.20 (−1.96)
<i>Panel B: Control Style Change</i>				
4 Years before Mergers	−0.20 (−0.54)		0.52 (1.28)	
4 Years after Mergers	−1.63 (−5.89)	−1.43 (−3.03)	−0.60 (−3.73)	−1.12 (−2.18)
<i>Panel C: Control Multiple Acquisitions and Style Change</i>				
4 Years before Mergers	−0.18 (−0.44)		0.50 (0.95)	
4 Years after Mergers	−1.84 (−5.24)	−1.66 (−2.69)	−0.91 (−3.00)	−1.41 (−1.84)

Table 14. Changes in 12b-1 Fee and Turnover due to Mergers

Table 14 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 a merger. 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.

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

A Appendix

A.1 Abnormal Size of Acquiring Funds

In this section, I examine whether acquiring funds experience a significant shock in size at the time of mergers. I use abnormal size to measure the shock in size. Abnormal size is the difference between a fund's actual size (total net asset (TNA)) and its would-be size ($Size^*$) if there was no merger. I calculate $Size^*$ using two methods.

First, I assume that flow of acquiring funds is zero in the event month if there were no mergers:

$$Size_{i,t}^* = TNA_{i,t-1} \times (1 + R_{i,t}), \quad (15)$$

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.

Second, I use the event month return and the pre-event four-year average flow to calculate $Size^*$:

$$Size_{i,t}^* = TNA_{i,t-1} \times \left(1 + R_{i,t} + \sum_{t=-48}^{-1} \frac{Flow_{i,t}}{48} \right), \quad (16)$$

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.

Next, I exclude funds that experience changes in investment objective over the four

years before mergers to eliminate the impact of investment objective changes on flows (Cooper, Gulen, and Rau (2005)). 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 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 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 OAR 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 ($\alpha^{c4} = -1.01\%$, $t\text{-stat} = -1.05$) but becomes significantly negative after the events ($\alpha^{c4} = -3.23\%$, $t\text{-stat} = -3.44$). The annualized OAR, which is significantly positive one-year before mergers ($OAR = 1.29\%$, $t\text{-stat} = 1.74$), becomes negative and significant after the events ($OAR = -1.72\%$, $t\text{-stat}$

$= -2.21$). 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 the events.

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-weighted 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 OAR for both calendar-time portfolios in every calendar month. I regress the OAR 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 the events ($\alpha^{c4} = -1.86\%$, 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 change in performance is negative but insignificant.

Table A1. Cross-Sectional Distribution of Total Net Assets of Equity 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. 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 – Robustness Tests

Appendix Table A4 reports the abnormal size of acquiring funds in the merger event month. Abnormal size is the difference between a fund's actual size (total net asset (TNA)) and its would-be size ($Size^*$) if there was no merger. I calculate $Size^*$ using two methods. 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. Second, 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 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. Next, I exclude funds that experience changes in investment objective over the four years before mergers to eliminate the impact of investment objective changes on flows. The test results using this new sample are in Column (5) and (6). t -statistics are in parentheses.

Variables	(1) Mean	(2) Median	(3) Mean	(4) Median	(5) Mean	(6) Median
Abnormal Size (\$ Million)	159 (7.04)	32	125 (6.35)	24	129 (6.20)	24
Number of Observations	1,335		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 OAR 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	(1) Carhart α^{c4} (%)	(2) Four-Factor Alpha t -statistics	(3) Objective-Adjusted Return OAR (%)	(4) Return t -statistics
<i>Panel A: Value-Weighted Portfolio Returns</i>				
$(t - 4)$ 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)
<i>Panel B: Equal-Weighted Portfolio Returns</i>				
$(t - 4)$ 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 change 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-weighted 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 OAR 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) Carhart α^{c4} (%)	(2) Four-Factor Alpha $\Delta\alpha^{c4}$ (%)	(3) Objective-Adjusted Return OAR (%)	(4) Return ΔOAR (%)
<i>Panel A: Value-Weighted Portfolio Returns</i>				
4 Years before Mergers	−0.83 (−1.26)		0.13 (0.32)	
4 Years after Mergers	−1.86 (−3.44)	−1.03 (−1.15)	−0.52 (−1.32)	−0.66 (−1.15)
<i>Panel B: Equal-Weighted Portfolio Returns</i>				
4 Years before Mergers	−1.61 (−2.82)		−0.23 (−0.85)	
4 Years after Mergers	−1.91 (−3.10)	−0.29 (−0.33)	−0.78 (−2.52)	−0.55 (−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 by Investment Objective

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

Year	Cap-Based Funds (EDC)				Sector Funds (EDS)										Style Funds (EDY)						
	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 by Investment Objective

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

Year	Cap-Based Funds (EDC)				Sector Funds (EDS)										Style Funds (EDY)						
	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

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