DOI: 10.1111/fima.12443

ORIGINAL ARTICLE

Financial Management | WILEY

Mutual fund performance and manager assets: The negative effect of outside holdings

Richard Evans[1] | **Javier Gil-Bazo**[2,3] | **Marc Lipson**[1]

[1]Darden School of Business, University of Virginia, Charlottesville, Virginia, USA

[2]UPF Barcelona School of Management, Universitat Pompeu Fabra, Barcelona, Spain

[3]Department of Economics and Business, Universitat Pompeu Fabra, Barcelona, Spain

Correspondence
Marc Lipson, Darden School of Business, University of Virginia, 100 Darden Blvd, Charlottesville, VA 22903, USA.
Email: mlipson@virginia.edu

Abstract

We explore the relation between fund performance and the assets managed by the fund's managers that are *outside* the fund. Controlling for fund size, we find a negative relation between performance and the size of fund managers' outside holdings, the number of other funds managed by a fund's managers, and the number of distinct fund categories managed by a fund's managers. This effect is driven by holdings that do not overlap with those held within the fund, and the effect's economic magnitude, while less than that of fund size, is comparable to that of fund family size and twice that of turnover. Endogeneity is addressed using fund mergers and recursive demeaning. Results suggest that manager responsibilities outside a fund significantly impact performance and that limited attention plays a role.

1 | INTRODUCTION

The existence of attention limits for decision-makers is well documented. Typical studies link unexpected shocks that increase attention demands to decreased performance. Less often acknowledged are attention limits that are implicit in the chosen structure of decision-maker engagements. In these settings, decision-makers and organizations jointly determine attention demands and would, therefore, be expected to avoid or mitigate negative attention effects. Whether there exists an attention effect on decision-making in these settings is, therefore, an open question whose answers might provide insight into the trade-offs being made. We explore this question in the context of mutual fund management and the decision by fund families to allocate additional funds to a fund manager. Our focus is not on the

manager, per se, but on the performance of a given fund with respect to the additional holdings managers oversee *outside* that fund.

Our examination of outside holdings extends the large literature looking at diseconomies related to mutual fund size. These diseconomies may arise either from the need to make larger trades or from limits to fund resources, such as manager attention. Such effects are of sufficient magnitude that empirical studies of performance inevitably include size controls. We note that these controls typically reflect inside holdings only, and our analysis essentially asks whether the size effect extends beyond the border of a given fund through its managers, particularly through the channel of attention limits. As with size, there are multiple ways a fund family could mitigate manager attention effects. For example, fund families could allocate funds to managers in a manner that mitigates or avoids attention drains; they could create incentives that change behaviors in a manner that offsets such effects; or they could provide compensating resources. The central purpose of this paper, therefore, is to explore whether an outside holdings diseconomy exists and to what extent.

We capture the effect of outside holdings with three different measures: the size of assets managed in other funds (external assets); the number of funds managed; and the number of distinct fund investment categories managed. These measures do not scale up with increases in a given fund's size and therefore allow us to capture the additional impact of outside holdings on fund performance. In panel regressions, we find that fund performance (after-fee four-factor alpha) is negatively related to these measures, even when controlling for the value of assets under management (AUM), fund turnover, fund flows, and the size of the fund family. These results are evident in a number of specifications in which we allow for manager, time, fund, fund family, and fund style fixed effects, as well as in a variety of specifications that consider alternate mechanisms.[1]

To assess the economic magnitude of the relation between fund performance and manager assets, we run panel regressions where dependent and explanatory variables are standardized at the fund level—reduced by the mean and scaled by the standard deviation of the variable's distribution within each fund. Based on the resulting standardized coefficients, we can evaluate the relative importance of explanatory variables on fund performance. Fund size, not surprisingly, has an economically substantial effect on performance. The effects of outside holdings are smaller, but comparable in size to the effect of fund family size (which reflects fund family efficiencies) and roughly twice the size of the effect of turnover (which is a direct measure of trading activity).

As noted, manager attention has been identified as a possible driver of fund diseconomies. To assess the degree to which the outside holdings effect might be related to attention, we conduct three sets of tests. First, outside holdings might include both holdings that overlap a fund's own holdings and holdings that do not overlap a fund's own holdings. Overlapping holdings should capture any effect due to, for example, price impact, while attention effects are more likely to be generated by holdings that are not overlapping. In a variety of tests, including one where we examine each individual security held by a fund, fund performance decreases only in the degree to which outside holdings *do not* overlap with the fund's holdings.

Second, we examine the effect on performance of *marginal* increases in the size of outside holdings. If the performance effect is driven by attention, then marginal increases in the size of the outside holdings, conditional on the existence of such holdings, should have a lesser impact on performance. For a fund's own holdings, there is a significant added decrease in performance for every additional increase in holdings. In fact, the effect is quite linear. In contrast, for outside holdings, the negative effect of additional increases in holdings is insignificant, except for the case where the size increase of outside holdings is in the largest of the categories we examine.[2] The pronounced lack of declines in

[1] Specifications include annual analyses (to address issues related to overlapping return observations), restricting our sample to funds with no more than three managers (to eliminate the effect of outliers), including variables that reflect the scope of assets (*R*-squared and industry concentration), including measures related to manager teams (to capture team-level economies), and using a six-factor alpha to measure performance. In unreported tests, we have also repeated our analyses using the benchmark-adjusted gross returns proposed by Berk and van Binsbergen (2015) and following the methodology of Berk et al. (2017) to aggregate benchmark-adjusted gross returns at the manager level. Results are similar both qualitatively and quantitatively to what we report using after-fee four-factor alphas.

[2] For example, partitioning holdings into quintiles, the added performance impact (alphas, in percent) for fund family assets being in quintiles 2–5 is −1.467, −1.495, −1.484, and −1.489, respectively, all significant. The analogous performance impact from outside assets is −0.178, +0.031, +0.033, and −0.395, respectively, with only the last being significant.

marginal performance across every size increase, and particularly how this pattern contrasts with the effect of a fund's own holdings, is consistent with an attention effect.

Third, we distinguish between funds that are managed within the fund family and those whose management is outsourced. Chen et al. (2013) document that outsourced funds (subadvised funds) substantially underperform other funds. They attribute this underperformance to difficulties incentivizing managers outside the fund family. Based on this work, we believe subadvised funds do not impose the same attention demands on managers as other funds within the fund family. We find that outside holdings that are in subadvised funds do not have a negative impact on fund performance.[3] Taken together, these three sets of results suggest that manager attention is a key mechanism by which outside holdings affect performance.[4]

We address endogeneity concerns in two ways. First, we use fund family mergers as an instrument for expansions in manager outside responsibilities. This setting has been used by McLemore (2019) to provide instrumented evidence on fund size diseconomies. When fund families merge, the newly combined family will typically reduce the number of managers, in part by reallocating acquired funds to existing managers. The merger is not likely to be driven by an expected future decline in performance of the funds in the acquiring fund family (though perhaps this would be the case for funds in the target family) and would be a valid instrument for a change in the holdings of existing managers. Establishing first that these mergers do affect (on average) the assets, number of funds, and number of investment categories of managers at the acquiring fund family, we instrument changes in manager responsibilities and confirm our results for funds in the acquiring family—the expansion of outside responsibilities negatively affects performance. Second, we use the recursive demeaning methodology proposed by Pástor et al. (2015), implemented as recommended by Zhu (2018). The results confirm that fund performance is negatively related to all three of our measures of manager assets.

Taken together, our results indicate an economically meaningful outside holdings effect that is not generated by overlapping securities. This expanded size effect is therefore likely driven by limits to manager attention rather than by correlated investing decisions across the funds a manager is managing. We note that a negative outside holdings effect does not imply that outside holdings are undesirable. For example, many studies document a negative relation between turnover and performance—but these papers do not conclude that trading is undesirable, just that the negative effects should be considered along with countervailing benefits. Furthermore, as Berk and van Binsbergen (2015) note, though excess returns are declining in fund family size, fund families benefit from fund size in ways that might offset any size effect. Similar considerations would apply to outside holdings.

The remainder of the paper is organized as follows. In the next section, we show how our results contribute to various strands of research. This is followed by a section describing our data with a focus on the relationships among managers, funds, and fund families. The rest of the paper is composed of sections presenting our results on the relation between outside holdings and fund and manager performance, evidence with respect to the driver of the outside holding effect, our analysis of mutual fund mergers as an instrument for expanded responsibilities, our analysis of performance using recursive demeaning, and a series of robustness tests.

2 | RELATED LITERATURE

Berk and Green (2004) provide a key insight into mutual fund management: investor flows responding to manager outperformance increase the size of the fund to the point where diseconomies of size eliminate, in equilibrium, that superior performance. Berk et al. (2017) apply the same reasoning to manager performance and suggest that fund

[3] We also find that if a fund itself is subadvised, there is less of an outside holding effect—consistent with fund managers devoting minimal attention to their subadvising duties.

[4] These results also provide some insight into why the economic effect of fund size is so much larger than the effect of outside holdings. Fund size will capture both implementation and information processing costs, whereas our results suggest that outside holding effects are driven largely by attention alone.

families will expand the responsibilities of better-performing managers until a similar equilibrium is reached.[5] Many studies have identified and explored possible sources of the underlying diseconomies that arise from fund growth.[6] These include, most prominently, price impact costs: larger funds execute larger position changes in individual assets.[7] Others have focused attention on countervailing benefits. These include, most notably, that increasing fund size increases the dollar value of performance, thus adding value to the fund.[8] Implicit in all this work is the notion that fund families will select an optimal level of scale and scope (both sources of diseconomies) that trades off recognized costs against recognized benefits. Our paper is most closely related to studies that have explored this trade-off in the context of manager attention.

Gupta-Mukherjee and Pareek (2020) explore the impact of manager attention limits that arise from investment allocations *within* a fund. They provide evidence that fund performance is attenuated when managers do not allocate their attention (as reflected in active positions) across assets in a manner that mirrors relative attention needs (as reflected in, e.g., asset volatility). This work extends Duan et al. (2009), who discuss stock characteristics, such as higher idiosyncratic risk, that dictate where managers should pay particular attention. Kacperczyk et al. (2005) show that funds with portfolios that are more concentrated within industries perform better than less-concentrated funds.[9] A similar point is made by Amihud and Goyenko (2013), who show that a lower *R*-squared in the time-series regression of fund excess returns on risk factors is associated with better fund performance, an effect they attribute to great selectivity on the part of managers.[10] Kacperczyk et al. (2016) build a model that explores attention allocation issues more broadly. These papers focus on choices within a fund—we document similar effects that arise due to a fund manager's outside holdings.

Related papers also include those that document how shocks to manager attention degrade performance. For example, Lu et al. (2016) document that managers who are distracted by negative life events earn lower alphas.[11] Schmidt (2019) shows that stocks that have earnings announcements distract institutional investors from trading in other stocks, and Gottesman and Morey (2006) explore cognitive ability and attention limits in mutual fund management. We show that these effects may exist in settings where fund families make organizational choices that may generate distraction.

Our results extend a growing body of work exploring the link between fund performance and decisions made at the fund family level with respect to the allocation of manager talent. Chen et al. (2004) explore both size and fund organization and note that even though fund returns are decreasing in fund size (and they provide evidence that this is related to the price impact of trading), fund returns are increasing in fund family size and are lower for team-managed funds. These latter two results suggest that organizational decisions are important, and, for example, fund families can offset diseconomies of scale with resources. Ample evidence suggests that fund families recognize and reward talent:

[5] Other papers examining manager allocation include Khorana (1996), Chevalier and Ellison (1999), Drazin and Rao (2002), Baer et al. (2011), Hoberg et al. (2018), and Fang et al. (2014).

[6] We should also note that a number of papers question whether the negative empirical relation between size and performance exists at the fund level (evidence at the industry level is rarely questioned). See, for example, Elton et al. (2012), Pástor et al. (2015), Phillips et al. (2018), and Ferreira et al. (2013). More recent studies, including Zhu (2018) and Pástor et al. (2022), have reaffirmed this negative effect at the fund level.

[7] Evidence is provided in Chen et al. (2004) and Yan (2008), among others. Wermers (2000), in contrast, notes that higher turnover is associated with better returns in actively managed funds, and Busse et al. (2020) find that larger funds, by trading less frequently and investing in relatively large and liquid companies, experience lower percentage transactions costs than smaller funds.

[8] Berk and van Binsbergen (2015) and Zhu (2018), building on Berk and Green (2004), model the problem of an asset management company that wants to maximize value added, that is, the product of before-fee alpha and fund assets. If alpha is a declining function of fund assets, the fund family faces a trade-off between higher quantity of AUM and lower before-fee alpha.

[9] In our robustness tests, we show that our results are unchanged when controlling for industry concentration.

[10] Huang et al. (2022), extending Sirri and Tufano (1998), make a similar point, though with a different mechanism. They argue that higher volatility of past performance decreases the flow–performance relation because volatility introduces noise in the process of inferring manager ability from returns. Cross-sectional results support this conclusion, as the effect is stronger for funds with more sophisticated investors (proxied, e.g., by low fees, as suggested by Evans and Fahlenbrach [2012]). In a similar vein, Jain and Wu (2000) and Obaid and Pukthuanthong (2021) explore how advertising draws attention to mutual fund past performance in the context of investor learning (an offset to attenuated attention).

[11] Similar arguments have been made in other contexts by Ferris et al. (2003), Fich and Shivdasani (2006), Field et al. (2013), and Li et al. (2011).

Khorana (1996), Chevalier and Ellison (1999), and Evans (2009) document that promotions (demotions) are related positively (negatively) to past performance; Hoberg et al. (2018) show that fund families reward performance in compensation decisions; Drazin and Rao (2002) show that top managers are allocated new funds; and Fang et al. (2014) show that managers are allocated to investment objectives where they are expected to perform best. We highlight an important consequence of the allocation of manager talent when managers manage more than one fund, which occurs more than 75% of the time in our sample. In that regard, our paper is similar to Wu et al. (2016), who also document declines in performance as managers are rewarded with expanded AUM. Their focus is on manager entrenchment, and they highlight the negative effects on performance of both fees and scale diseconomies (they explicitly mention that these might include attention effects). In one set of results foreshadowing our own conclusions, they show that manager performance in a closed-end fund is negatively related to assets managed in open-end funds. They do not explicitly focus on an outside holdings channel for performance, nor do they explore the mechanism driving such an effect.[12]

3 | DATA AND SUMMARY STATISTICS

Our data comprise the monthly observations in the Morningstar Direct mutual fund database from January 1993 to December 2018. We restrict our performance analysis to actively managed diversified domestic (U.S.) equity mutual funds. However, when measuring manager assets, we consider all funds under a manager's oversight, including non-U.S. funds, sector funds, and bond funds. While the Morningstar data are reported at a share class level, we aggregate all variables to a fund level, using the monthly share class total net assets to value weight all quantities.

Table 1 presents summary statistics on our sample. The sample includes about 11,000 funds and 19,000 managers. Funds often have multiple managers, while at the same time it is very common for managers to manage more than one fund. The number of asset management fund families is about 1000. Our sample is relatively balanced across three broad fund types: diversified domestic equity funds (the sample we focus on for our analysis of performance), other equity funds (including funds with non-U.S. equity holdings), and funds with nonequity holdings.

About 14,000 of the 19,000 managers manage only one fund type, though they may manage more than one fund within that type. The roughly 5000 managers who manage more than one fund type, by definition, manage more than one fund. As for fund families, in our sample, about a third exclusively offer diversified domestic equity funds and a third offer funds of all three fund types.

Table 2 presents summary statistics that describe the relationships among managers, funds, and fund families for the sample of funds whose performance we examine—diversified domestic equity funds. Observations are monthly and at the fund-manager level. We examine only funds that have at least 36 return observations; this results in about 1.6 million fund-manager-month observations (we have slightly fewer observations for some variables). In Panel A, we describe the relationships among funds, managers, and fund families, and we describe their sizes. Within our sample, the average number of managers in a fund is 5.3 with a median of 4 and a 99th percentile of 31. The average fund size is $2022 million. The distribution is skewed due to the existence of a number of large funds—the median is only 282 million, with a 75th and 99th percentile of $1094 million and $36,035 million, respectively. As for managers, the mean number of funds a manager manages is 5.8, and the mean dollar value of assets a manager manages (across all managed funds) is $11,495 million. Note that 303,062 observations (about 19% of our sample) are of managers who manage just one fund. As with the funds, the value of assets managed is skewed—the median value of assets managed

[12] Our paper is also related to research by Agarwal et al. (2023), who study changes in fund performance when managers switch from managing one fund to managing multiple funds. They document that the performance of incumbent funds declines while that of the acquired funds improves by a similar amount, which they interpret as consistent with the manager's effort and attention being diverted from the former to the latter. Our analysis is distinct in a number of ways from this study: we examine the level of outside holdings, which may change due to managers taking over new funds but also may be due to increased flows to those outside holdings; we look at the specific overlap in holdings to rule out price impact as a driver; we include two instrumental variable approaches to address endogeneity; and we include managers managing multiple funds.

TABLE 1 Number of funds, managers, and fund families.

Panel A: Funds	
Total	10,950
Diversified domestic equity funds	3,864
Other equity funds	2,660
Funds with nonequity holdings	4,426
Panel B: Managers	
Total	19,074
Only manage diversified domestic equity funds	4,529
Only manage other equity funds	3,855
Only manage funds with nonequity holdings	5,785
Only manage diversified domestic equity funds and other equity funds	1,439
Only manage diversified domestic equity funds and funds with nonequity holdings	1,163
Only manage other equity funds and funds with nonequity holdings	1,109
Manage all fund types	1,194
Panel C: Fund families	
Total	1,004
Only offer diversified domestic equity funds	319
Only offer other equity funds	111
Only offer funds with nonequity holdings	184
Only offer diversified domestic equity funds and other equity funds	74
Only offer diversified domestic equity funds and funds with nonequity holdings	108
Only offer other equity funds and funds with nonequity holdings	63
Offer all fund types	252

Note: This table reports the number of managers, funds, and fund families (firms or asset management companies) in our sample, covering the January 1996 to December 2018 period. Only funds with more than 36 monthly observations are included. We classify funds into three types: diversified domestic (U.S.) equity, other equity, and funds with nonequity holdings (balanced and nonequity funds). Our analyses of performance include only diversified domestic equity funds, though we include other funds when measuring manager assets. Panel A presents breakdowns by type of fund, Panel B by type of fund managed by managers, and Panel C by type of fund offered by fund families.

is $2026 million, with a 75th and 99th percentile of $7876 million and $207,632 million, respectively. As for fund families, the average number of funds in a fund family is 51 and the average number of managers is 77. On average, in our sample, a fund family manages $109,633 million in assets. Fund family size, like funds and manager assets, is also skewed—while the median fund family manages $19,962 million in assets, the 75th and 95th percentile fund families manage $72,598 million and $1,523,000 million, respectively.

Morningstar assigns funds into 137 different categories, based on the type of assets a fund invests in.[13] We will use these categories in later tests. In our sample, each manager manages, on average, about three categories. A large number manage only one category (including, of course, all the managers with just one fund). The median number is 2, and the 75th and 99th percentile values are 4 and 21, respectively. Fund families offer, on average, 24 categories. The median is similar at 22. As with size, the number of categories is skewed, with the 75th and 99th percentile values at 38 and 69, respectively.

[13] According to Morningstar, "While the investment objective stated in a fund's prospectus may or may not reflect how the fund actually invests, the Morningstar category is assigned based on the underlying securities in each portfolio."

TABLE 2 Summary statistics.

Panel A: Distribution of funds, managers, fund families, assets, and investment categories								
				Percentile				
Variable	Observations	Mean	SD	1st	25th	50th	75th	99th
Funds								
Managers per fund	1,595,002	5.3	5.9	1	2	4	6	31
Fund assets (USD Mill)	1,555,762	2022	9775	2	66	282	1094	36,035
Managers								
Funds per manager	1,595,002	5.8	8.1	1	2	4	7	46
Manager assets (USD Mill)	1,579,606	11,495	38,933	5	388	2026	7876	207,632
Number of categories	1,595,002	3.3	3.5	1	1	2	4	21
Fund families								
Funds per fund family	1,595,002	50.9	55.8	1	9	36	76	281
Managers per fund family	1,595,002	77.2	78.5	1	14	56	115	347
Family assets (USD Mill)	1,586,145	109,633	326,562	9	2236	19,962	72,598	1,523,065
Number of categories	1,595,002	23.8	17.9	1	7	22	38	69

Panel B: Fund and manager characteristics								
				Percentile				
Variable	Observations	Mean	SD	1st	25th	50th	75th	99th
Funds								
Fund age (years)	1,595,002	5.3	5.3	0.1	1.6	3.7	7.3	24.8
Fund turnover (%)	1,525,954	78.3	106.5	2.0	30.0	58.0	97.7	399.9
Fund expense ratio (%)	1,536,930	1.1	0.5	0.1	0.9	1.1	1.4	2.4
Fund monthly return (%)	1,594,974	0.7	5.0	−13.7	−1.8	1.1	3.5	12.2
Fund four-factor alpha (%)	1,339,879	−0.1	1.6	−4.6	−0.8	−0.1	0.6	4.7
Fund six-factor alpha (%)	1,339,879	−0.1	1.6	−4.6	−0.9	−0.1	0.6	4.5
Managers								
Manager tenure career (years)	1,595,002	9.5	7.0	0.3	4.1	8.2	13.6	30.5
Manager tenure fund (years)	1,595,002	9.3	5.8	0.9	4.7	7.9	12.9	23.0

Note: Panel A reports summary statistics from the joint distribution of managers, fund, fund families, and assets in the sample, covering the January 1996 to December 2018 period. Only funds with more than 36 monthly observations are included. Panel B reports summary statistics for fund, manager, and fund–manager pairs. Manager assets is the sum of the assets of all funds under a manager's control.

Table 2, Panel B, provides descriptive information on funds and managers. The average age of a fund is about 5 years. The funds turn over their assets a little under once a year (78%), though this varies greatly and is skewed—the 25th percentile is about a 30% turnover, while the 75th and 95th percentiles are 98% and 400%, respectively. Expense ratios average 1.1% of AUM. We know the year a manager first appears in the data set, so we can estimate the length of time a manager has been in this industry (manager tenure career). The average is 9.5 years. Some managers, of course, newly appear in the data (a career of 1 month, or about 10% of a year), while some have been managing for a long time (the 99th percentile is 31 years). The average length of time a manager has managed a given fund (manager tenure fund) in our sample is 9.3 years.

We measure performance using the Carhart (1997) four-factor alpha calculated using data made available by Kenneth French.[14] More specifically, we define performance in a given month as the abnormal return (alpha) relative to the four-factor factor model:

$$r_{it} = \alpha_{it} + \beta_{1i}MKT_t + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}UMD_t + \varepsilon_{it}, \quad (1)$$

where r_{it} is the period t return on fund i (in excess of the 1-month T-bill return); α_{it} is our performance measure; and the betas represent factor loadings for the value-weighted market return (MKT_t, in excess of the 1-month T-bill) and the zero-investment factor mimicking size (SMB_t), book-to-market (HML_t), and 1-year momentum (UMD_t) portfolios. Fund returns are net of expenses and transaction costs.[15] To estimate alpha, we first estimate factor loadings using a 3-year rolling window prior to month t, and then subtract the product of estimated loadings and factor realizations from the fund's excess return in that month. Our measure of risk-adjusted performance therefore includes both α_{it} and the error term ε_{it}.

The distribution of fund alphas is shown in Table 2, Panel B. The alphas are net of fees. The average fund loses 0.1% per month. Alphas appear to be symmetrically distributed—the median is equal to the mean, and the lowest decile of performers lose 4.6% while the best decile of performers earn 4.7%. Note that results are qualitatively similar if we use pre-fee alphas.

4 | MANAGER ASSETS AND FUND PERFORMANCE

This section presents our principal tests exploring whether manager assets affect fund performance. Measuring the impact on performance of a fund's manager assets separately from that of the fund's assets is challenging, since the dollar value of fund assets and the dollar value of manager assets are mechanically correlated for a given fund. We overcome this difficulty by creating three measures based on three characteristics that do not scale up mechanically with fund assets: external assets (the value of assets outside a given fund), the number of funds managed, and the number of Morningstar categories (henceforth called categories) managed. Our analyses focus on fund performance (fund observations), so we must define variables that account for the fact that any given fund may have multiple managers. These definitions are provided below for a given fund f that has n_f managers.

Mean external assets

The sum of AUM managed by all managers of fund f that are outside of fund f, where the AUM of an outside fund is divided by the number of managers of that fund. We compute the average across managers by dividing that sum by the number of managers of fund f and taking the log of 1 plus this average. For example, assume there are two managers of fund A, managers $A1$ and $A2$; assume manager $A1$ also manages fund B with three other managers and that manager $A2$ also manages fund C with one other manager. In this case, *mean external assets* for fund A would be equal to $\log(1 + ½\,(¼\,\text{AUM}_B + ½\,\text{AUM}_C))$.

Mean number of funds

The log of the average number of funds managed by the n_f managers of fund f. For the example above, mean number of funds would be equal to $\log(½\,(2 + 2))$.

[14] As a robustness test, in Section 6, we repeat our main regressions, replacing four-factor alpha with alpha based on the Fama and French (2015) five-factor model augmented with momentum.

[15] In some of our tests, we also use performance before expenses (gross alpha).

Mean number of categories

The log of the average number of categories spanned by each of the n_f managers of fund *f*. Assuming funds *A* and *B* are in the same category and fund *C* is in a different category, then for the example above, manager *A1* manages one category, manager *A2* manages two categories, and the mean number of categories would be equal to log(½ (1 + 2)).

Although we use only domestic diversified equity funds in all our analyses of performance, we calculate manager responsibilities using all funds under the manager's oversight, including nonequity and international funds.

Our unit of observation is a fund-month. The dependent variable, annual alpha of fund *f* in month *t*, is the sum of monthly alphas from month *t* to month *t* + 11.[16] The scope variables defined above are measured in month *t* − 1. As control variables, we include those employed in previous studies of fund performance: *Fund assets* (the log of fund AUM); *Fund family assets* (the log of total AUM across all the funds in the fund family); the reported *Turnover* and *Expense ratio* (both in percent); the *Annual flow* into the fund (the difference between current AUM and predicted AUM, divided by AUM 1 year previous, where predicted AUM is AUM 1 year previous, adjusted for the intervening return); an indicator as to whether a fund's share class has a sales *Load*; and *Fund age*, which is the number of years since fund inception. All controls are measured in month *t* − 1, except for *Annual flow*, which is the flow from month *t* − 12 to month *t* − 1.[17] Standard errors are clustered by both time and fund to correct for possible cross-sectional and time-series correlation.

Our principal results are presented in Table 3. The first column shows the estimated coefficients and standard errors of a regression of performance without any measure of manager assets (baseline: only fund assets are included), and the next six columns present the results with our three measures of manager assets included in the regression. For each measure of manager assets, we report results with time and fund fixed effects first, and then results without fund fixed effects but including two additional fund-level characteristics—*Load* and *Fund age*—and fixed effects for fund category and fund family. The inclusion of fund fixed effects controls for time-invariant determinants of fund performance at the fund level. We are therefore exploiting only variation within a given fund over time.

In all our specifications, and consistent with prior research, fund performance is negatively related to fund assets. Also as expected, given observations made by Pástor et al. (2015), the magnitude of the coefficient on fund assets drops when fund fixed effects are omitted. The coefficient on *Fund family assets*, in contrast, rises (and becomes significant) when fund fixed effects are omitted.[18] There are few statistically reliable relations between performance and other variables.[19] With respect to the goals of this paper, in every specification, there is a significantly negative relation between performance and our measures of manager assets—*Mean external assets*, *Mean number of funds*, and *Mean number of categories*.[20]

While Table 3 makes a strong case that manager assets are a statistically significant determinant of fund performance, we explore the economic significance of this relationship in Table 4. In that analysis, we standardize all our explanatory and dependent variables within a given fund by deducting the variables' (within-fund) mean and dividing

[16] In all our regressions, we cluster standard errors at the fund level (as well as the month level and manager level in some specifications) to account for potential serial correlation in errors due to the overlapping returns in our dependent variable that result from using both annual alphas and monthly observations (see, e.g., Thompson, 2011). In Section 6, we show that results are very similar if we run the regressions at the annual frequency to avoid overlapping returns.

[17] Flows are winsorized at the 1% and 99% levels.

[18] In unreported results, we find that when the specification includes neither fund fixed effects nor fund family fixed effects, the coefficient on fund family assets is positive and significant, which is consistent with the findings of Chen et al. (2004).

[19] Many studies document a negative relation between fees and performance. In unreported cross-sectional tests, we find this to be the case in our sample as well. The lack of significance in the presented results arises because we employ panel regressions that include either fund or fund family fixed effects, which suggests either that the negative relation documented in other studies is a feature observed only in the cross section or that in a time series the effect cannot be detected (possibly due to a lack of time-series variation within funds or fund families).

[20] Not surprisingly, our three measures of manager assets are highly correlated. We omit, therefore, a specification that includes all three variables together, as interpretation of those results is unclear. However, if it is of interest to the reader, in that model external asset and number of investment categories both remain significant. As in most studies, we employ logs of our size variables. The number of funds and investment objectives has a relatively small range (compared to AUM). Though the values are not restricted to whole units, given that funds are managed in teams, in a specification with indicators for various levels, our results are similar.

TABLE 3 Manager assets and fund performance.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Mean external assets		−0.023***	−0.023***				
		(0.009)	(0.007)				
Mean number of funds				−0.194**	−0.192***		
				(0.098)	(0.066)		
Mean number of categories						−0.372***	−0.336***
						(0.120)	(0.080)
Fund assets	−1.493***	−1.485***	−0.237***	−1.486***	−0.238***	−1.486***	−0.241***
	(0.084)	(0.084)	(0.036)	(0.083)	(0.036)	(0.083)	(0.036)
Fund family assets	−0.074	−0.061	−0.842***	−0.068	−0.848***	−0.064	−0.845***
	(0.121)	(0.120)	(0.110)	(0.121)	(0.110)	(0.121)	(0.110)
Turnover	0.000	0.000	−0.002**	0.000	−0.002**	0.000	−0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Expense ratio	0.220	0.218	−0.242	0.213	−0.253	0.214	−0.261
	(0.359)	(0.359)	(0.197)	(0.359)	(0.197)	(0.359)	(0.197)
Annual flow	0.032	0.030	0.099	0.030	0.098	0.028	0.097
	(0.068)	(0.068)	(0.067)	(0.068)	(0.067)	(0.068)	(0.067)
Load			−0.178		−0.179		−0.166
			(0.164)		(0.164)		(0.163)
Fund age			0.003		0.002		0.002
			(0.005)		(0.005)		(0.005)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	No	Yes	No	Yes	No
Category FE	No	No	Yes	No	Yes	No	Yes
Fund family FE	No	No	Yes	No	Yes	No	Yes
Observations	367,095	367,095	366,588	367,095	366,588	367,095	366,588
Adjusted *R*-squared (in %)	19.2	19.3	10.9	19.3	10.9	19.3	10.9

Note: This table reports estimated coefficients from the pooled OLS regression of annual fund four-factor alpha on manager, fund, and fund family characteristics. Standard errors are reported in parentheses. Annual four-factor alpha in a given year is defined as the sum of the fund's monthly alphas in that year, in percent units. *Mean external assets* is calculated for fund *f* by first computing, for each one of the fund's managers, their external assets as the sum of the assets of the funds under the manager's control divided by each fund's number of managers, excluding fund *f*, and then averaging across all managers in fund *f*, adding 1, and taking logs. *Mean number of funds* is calculated for fund *f* by first computing, for each one of the fund's managers, the total number of funds under their control, and then averaging across all managers in fund *f* and taking logs. *Mean number of categories* is calculated for fund *f* by first computing, for each one of the fund's managers, the total number of investment categories in which they manage funds, and then averaging across all managers in fund *f* and taking logs. *Fund assets* and *Fund family assets* correspond to the fund and its management company, respectively, and are in logs. *Turnover* and *Expense ratio* are in percent units. *Fund age* is the number of years since the fund's inception. *Load* is a dummy variable that equals 1 if one of the fund's share classes has sales loads. *Annual flow* is the relative annual growth in the fund's assets due to new money. For columns [3], [5], and [7], we omit fund fixed effects (FE) and include *Load*, *Fund age*, Category FE, and Fund family FE. All independent variables are lagged 1 month. Standard errors are clustered by fund and month. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 4 Manager assets and fund performance: Standardized variables.

	[1]	[2]	[3]
Mean external assets	−0.033***		
	(0.007)		
Mean number of funds		−0.0213***	
		(0.006)	
Mean number of categories			−0.022***
			(0.006)
Fund assets	−0.228***	−0.231***	−0.232***
	(0.011)	(0.011)	(0.011)
Fund family assets	−0.029***	−0.034***	−0.034***
	(0.010)	(0.010)	(0.010)
Turnover	0.011*	0.013*	0.013*
	(0.007)	(0.007)	(0.007)
Expense ratio	−0.004	−0.004	−0.005
	(0.007)	(0.007)	(0.007)
Annual flow	−0.001	−0.001	−0.000
	(0.007)	(0.007)	(0.007)
Absolute value of the ratio of outside holdings effect to indicated effect			
Fund assets	0.145	0.091	0.095
Fund family assets	1.138	0.618	0.647
Turnover	3.020	1.615	1.692
Observations	347,985	344,633	336,791
Adjusted *R*-squared (in %)	13.7	13.7	13.7

Note: This table reports estimated coefficients from the pooled OLS regression of annual fund four-factor alpha on manager, fund, and fund family characteristics. Standard errors are reported in parentheses. Annual four-factor alpha in a given year is defined as the sum of the fund's monthly alphas in that year, in percent units. Explanatory variables are defined as in Table 3, except that they have been standardized by subtracting the fund-level mean and dividing by the fund-level standard deviation. The three presented regressions include Category FE and Fund family FE—we do not include analyses with fund fixed effects since the variables are standardized at the fund level. All independent variables are lagged 1 month. Standard errors are clustered by fund and month. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All regressions have time fixed effects; odd numbered regressions have fund fixed effects; and even numbered regressions have category and fund family fixed effects.

by the variables' (within-fund) standard deviation.[21] The interpretation of the coefficients, therefore, is the expected change in fund performance scaled by performance variation for a one-standard-deviation increase in that fund's characteristics. Table 4 replicates Table 3 with these standardized variables, though we omit the regressions with fund fixed effects since the variables are already adjusted for fund levels. All measures of outside holdings, not surprisingly, remain significant.

A key point of Table 4 is to show how the outside holdings effect compares, in economic significance, to other effects typically acknowledged in fund analyses. The bottom section of the table shows the absolute value of the outside holdings standardized coefficients (three different measures) relative to fund size, the size of the fund family, and turnover

[21] Gormley and Matsa (2014) point out the limitations of two common approaches to controlling for unobserved heterogeneity (demeaning dependent variables with respect to a given group and adding the mean of the group as an explanatory variable) and identify better approaches, which we employ in this paper. We thank the referee for drawing attention to this work.

coefficients. We present absolute values to focus on relative economic significance. We find that the outside holdings effect is roughly one-tenth that of fund size. More importantly, we see that the effect of outside holdings is comparable to that of two explanatory variables often explored on their own and included in most performance studies: fund family size (the ratio of outside holdings to fund family size coefficients varies from 0.618 to 1.138) and turnover (the ratio of outside holdings to turnover coefficients varies from 1.615 to 3.020). The comparison to turnover is particularly striking, given that trading activity is often identified as an important driver of fund size effects more generally.

5 | ATTENTION VERSUS TRADING COSTS

As we note in the introduction, there are two likely drivers of the manager asset effect—trading costs (price impact) and attention. Any relation between outside holdings and performance that is driven by price impact would exist only to the extent that there is an overlap in holdings outside and within the fund. A first indicator that there is an effect beyond price impact, and therefore an important role for attention, is the significant relation between performance and *Number of categories*, since the mix of securities traded will not be the same in different investment categories.

To investigate the underlying mechanism, we supplement the evidence from *Number of categories* in two ways. First, we partition external assets and number of funds by the Morningstar investment categories. That is, we distinguish between manager assets in other funds with the same investment category and manager assets in other funds with a different investment category. This approach attempts to capture the overlap in the securities a fund is likely to trade, regardless of whether it is currently holding them. Of course, there will be some overlap in securities across categories, so this will not exactly equal the difference in holdings, though it does capture the relative mix of securities likely to be traded. Second, we directly measure the degree of overlap in holdings by looking at the individual stocks held by managers inside and outside a given fund. This more accurately measures the overlap with respect to assets held at a moment in time, but it does not capture the overlap in possible investments that may be traded. Moreover, stock holdings data are restricted to the subsample of all equity funds.[22]

Separately including size measures for inside and outside holdings should provide insight as to the existence of impact and attention effects. In particular, nonoverlapped outside holdings should exhibit little or no association with performance if the price impact of trades is the main mechanism underlying the negative relationship between fund performance and outside manager holdings. Conversely, overlapped outside holdings should have a lower association with fund performance if manager attention is the relevant mechanism. The specific partitions we employ are described as follows:

External assets same category

The average value of securities fund managers of a given fund are managing that are outside the fund but are in the same category as the given fund. For example, if a fund's managers are managing a U.S. Equity Large Value fund, we sum the market value of securities held in external funds that are also in the U.S. Equity Large Value category.

External assets other categories

The average value of securities fund managers of a given fund are managing that are outside the fund but are not in the same category.

Number of funds same category

The average number of funds managers of a given fund are managing that are in the same category as the given fund.

[22] We assume that the overlap between nonequity funds and the funds in our sample is zero.

Number of funds other categories

The average number of funds managers of a given fund are managing that are not in the same category as the given fund.

External overlapping securities

The average value of the securities fund managers of a given fund are managing both in the fund and in other funds. These are all stock holdings given we are examining equity funds.

External nonoverlapping securities

The average value of the securities fund managers of a given fund are managing in other funds that are not held in the given fund. This includes nonstock securities.

Our analysis is presented in Table 5. The analysis is at the fund level.[23] Any attention effect arises as a result of attention demands placed on the managers of the fund—which is why the above measures are averages across the managers in a given fund. For all three partitions (categories, number of funds, and actual holdings), the negative effects on performance are observed only to the degree the outside holdings do not overlap with a fund's inside holdings. The most direct evidence, of course, is in specification [3], where we look at each individual security held by a fund. It is also worth noting that in specification [2], we see a positive relation between overlapping funds and external funds. This is modest evidence that some economies of scale may exist. Overall, these results suggest that there is an effect of manager outside holdings that cannot be attributed to price impact and is consistent with attention limits.

Another way to explore the mechanism is to look at the marginal impact on performance of increasing sizes of internal and external assets. The *existence* of outside assets creates a drain on manager attention by requiring monitoring and decision-making—which is likely true regardless of the size of those outside assets. Conditional on the existence of some outside holdings, therefore, any effect on performance of increasing the size of outside holdings is likely due to price impact alone. Thus, if we include indicators for marginal increases in the size of assets, and the effect is driven largely by price impact, each incremental increase in size will still have an impact on performance. If the effect is driven largely by attention, then there will be a substantial initial effect, but less additional impact with increases in size.

Our analysis is presented in Table 6. In this table, we partition the size of assets (both within and outside the given fund) into three sets of incremental partitions: three groups (terciles), four groups (quartiles), and five groups (quintiles). The partitions for fund assets and outside assets are based on the distribution of each variable in the sample.

For assets within the fund, the marginal impact of additional asset size significantly decreases performance. In fact, the coefficients are not only significant in every partition but also similar in magnitude. This suggests that there is a large performance effect related to trading and, further, no economy of scale in that regard. As to external assets, we see that the indicator variable for *Mean external assets >0* has a statistically and economically significant negative impact on performance, which is consistent with our earlier results. However, in the various partitions, we observe a relation between added size and performance that is quite different from that of fund assets. In each case, there is an additional negative impact only from the largest additional size category and no significant impact from other categories. For example, when we look at quintiles, there is a significant negative impact from external assets and additional external assets greater than 80% of the size of assets. There is no impact from the other incremental increases in size. The contrast to fund assets is striking and once again is consistent with the notion that attention plays an important role in explaining the outside holding effect.

Subadvised funds are those funds where the fund family has hired managers outside the fund family to run the fund. Chen et al. (2013) document that outsourced funds (subadvised funds) substantially underperform other funds;

[23] We have run the analysis at the manager level and obtained qualitatively similar results. This suggests the attention effects we document are manifested not only at the fund level, but also at the individual manager level.

TABLE 5 Manager assets and fund performance: portfolio overlap.

	[1]	[2]	[3]
External assets same category	−0.001		
	(0.007)		
External assets other categories	−0.017**		
	(0.008)		
Number of funds same category		0.267*	
		(0.139)	
Number of funds other categories		−0.300***	
		(0.102)	
External overlapping securities			0.018
			(0.013)
External nonoverlapping securities			−0.031**
			(0.015)
Fund assets	−1.486***	−1.494***	−1.527***
	(0.084)	(0.083)	(0.085)
Fund family assets	−0.067	−0.065	−0.025
	(0.121)	(0.121)	(0.127)
Turnover	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
Expense ratio	0.214	0.219	0.105
	(0.359)	(0.359)	(0.405)
Annual flow	0.028	0.029	0.013
	(0.068)	(0.068)	(0.067)
Time FE	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes
Observations	365,916	365,916	331,504
Adjusted *R*-squared (in %)	19.3	19.3	19.6

Note: This table reports estimated coefficients from the pooled OLS regression of annual fund four-factor alpha on fund and firm characteristics including measures of portfolio overlap. Each observation corresponds to one fund in a given month. Standard errors are reported in parentheses. Annual four-factor alpha in a given year is defined as the sum of the fund's monthly alphas in that year, in percent units. *External assets same category* is the average value of the assets a fund's managers are managing that are in the same investment category as the fund but not in the fund. *External assets other category* is the average value of the assets a fund's managers are managing that are not in the same investment category as the fund and are not in the fund. *Number of funds same category* and *Number of funds other category* are the average number of other funds managers of the fund are managing in the same and different investment categories, respectively. *External overlapping securities* is the average of the total value of securities in other funds a fund's managers are managing that are also held in the fund. *External nonoverlapping securities* is the average of the total value of securities (including nonstock securities) in other funds a fund's managers are managing that are not held in the fund. Control variables (not reported) are the same as in Table 3. All specifications include time and fund fixed effects (FE). All independent variables are lagged 1 month. Standard errors are clustered by fund and month. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 6 Monotonicity of fund and outside holdings AUM effects.

	[1] Terciles	[2] Quartiles	[3] Quintiles
Fund assets			
Fund assets >33th percentile	−1.970***		
Fund assets >66th percentile	−1.765***		
Fund assets >25th percentile		−1.641***	
Fund assets >50th percentile		−1.633***	
Fund assets >75th percentile		−1.551***	
Fund assets >20th percentile			−1.467***
Fund assets >40th percentile			−1.495***
Fund assets >60th percentile			−1.484***
Fund assets >80th percentile			−1.489***
External assets			
Mean external assets >0	−0.397**	−0.392**	−0.329*
Mean external assets >33th percentile	−0.101		
Mean external assets >66th percentile	−0.276**		
Mean external assets >25th percentile		−0.063	
Mean external assets >50th percentile		−0.055	
Mean external assets >75th percentile		−0.397***	
Mean external assets >20th percentile			−0.178
Mean external assets >40th percentile			0.031
Mean external assets >60th percentile			0.033
Mean external assets >80th percentile			−0.395***
Observations	367,095	367,095	367,095
Adjusted *R*-squared (in %)	18.2	18.3	18.6

Note: This table reports estimated coefficients from the pooled OLS regression of annual fund four-factor alpha on manager, fund, and fund family characteristics, including indicator variables that equal 1 if asset size is above the corresponding quantile, based on *Fund assets* and *Mean external assets*, as defined in Table 3. Standard errors are omitted for brevity. Annual four-factor alpha in a given year is defined as the sum of the fund's monthly alphas in that year, in percent units. Control variables (not reported) are the same as in Table 3. All specifications include time and fund fixed effects. All independent variables are lagged 1 month. Standard errors are clustered by fund and month. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Abbreviation: AUM, assets under management.

they attribute this underperformance to difficulties incentivizing managers outside the fund family. These funds are therefore likely to be less important to managers who have other funds to manage. We exploit this possibility—that subadvised funds will draw less manager attention—in a set of tests presented in Table 7.

We adjust our previous definitions to distinguish between holdings in subadvised funds and holdings not in subadvised funds. Columns [1] to [3] replicate our central analyses (those labeled [2], [4], and [6] in Table 3) with these newly defined variables. We see that outside holdings in subadvised funds do not have a negative impact on performance. In contrast, holdings not in subadvised funds have a significant negative effect on performance. It is worth noting that the magnitude of the coefficients on non-subadvised holdings in specifications [2] and [3] is larger than that in the original specifications.

TABLE 7 Subadvised fund analysis.

	[1]	[2]	[3]	[4]	[5]	[6]
Mean external assets: sub	−0.005			−0.014		
	(0.008)			(0.011)		
Mean external assets: sub × Sub				0.024		
				(0.015)		
Mean external assets: non-sub	−0.026***			−0.046***		
	(0.008)			(0.012)		
Mean external assets: non-sub × Sub				0.042**		
				(0.016)		
Mean number of funds: sub		0.096			0.021	
		(0.121)			(0.174)	
Mean number of funds: sub × Sub					0.241	
					(0.232)	
Mean number of funds: non-sub		−0.465***			−0.687***	
		(0.147)			(0.226)	
Mean number of funds: non-sub × Sub					0.447	
					(0.300)	
Mean number of objectives: sub			−0.135			−0.306
			(0.143)			(0.196)
Mean number of objectives: sub × Sub						0.462*
						(0.278)
Mean number of objectives: non-sub			−0.586***			−0.846***
			(0.166)			(0.232)
Mean number of objectives: non-sub × Sub						0.581*
						(0.327)
Fund assets	−1.482***	−1.497***	−1.493***	−1.481***	−1.499***	−1.494***
	(0.083)	(0.083)	(0.083)	(0.082)	(0.083)	(0.083)
Fund family assets	−0.047	−0.063	−0.062	−0.037	−0.056	−0.054
	(0.120)	(0.121)	(0.121)	(0.120)	(0.121)	(0.121)
Turnover	0.000	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Expense ratio	0.200	0.218	0.215	0.200	0.217	0.214
	(0.364)	(0.359)	(0.359)	(0.363)	(0.359)	(0.359)
Annual flow	0.025	0.029	0.029	0.023	0.028	0.028
	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
Observations	364,195	367,095	367,095	364,195	367,095	367,095
Adjusted *R*-squared (in %)	19.2	19.3	19.3	19.3	19.3	19.3

Note: This table reports estimated coefficients from the pooled OLS regression of annual fund four-factor alpha on manager, fund, and fund family characteristics. Standard errors are reported in parentheses. Annual four-factor alpha in a given year is defined as the sum of the fund's monthly alphas in that year, in percent units. *Mean external assets* is calculated for fund *f* by first computing, for each one of the fund's managers, their external assets as the sum of the assets of the funds under the manager's

(Continues)

TABLE 7 (Continued)

control divided by each fund's number of managers, excluding fund *f*, and then averaging across all managers in fund *f*, adding 1, and taking logs. This is done separately for assets that are in subadvised funds (*sub*) and those that are not in subadvised funds (*non-sub*). *Mean number of funds* is calculated for fund *f* by first computing, for each one of the fund's managers, the total number of funds under their control, and then averaging across all managers in fund *f* and taking logs. This is done separately for assets that are in subadvised funds and those that are not in subadvised funds. *Mean number of categories* is calculated for fund *f* by first computing, for each one of the fund's managers, the total number of investment categories in which they manage funds, and then averaging across all managers in fund *f* and taking logs. This is done separately for assets that are in subadvised funds and those that are not in subadvised funds. The variable *Sub* indicates whether the fund whose performance is being studied is itself a subadvised fund. *Fund assets* and *Fund family assets* correspond to the fund and its management company, respectively, and are in logs. *Turnover* and *Expense ratio* are in percent units. All independent variables are lagged 1 month. All specifications in this table have time and fund fixed effects. Standard errors are clustered by fund and month. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

In columns [4] to [6], we recognize that the funds whose performance we are examining might, themselves, be subadvised. We include, therefore, interactions with an indicator *Sub* that identifies funds that are subadvised. The overall results are consistent with the first three columns—outside holdings in subadvised funds do not negatively impact performance. More interesting is that, when the effect for funds that are themselves subadvised is pulled out, the effect of outside holdings is (as in all our tests) still negative but of substantially larger magnitude. The coefficient on the interaction term is positive but lower in absolute magnitude. Thus, much of the negative effect is not observed for subadvised funds.

These results indicate that outside holdings in subadvised funds do not diminish fund performance and, further, that the outside holding effect we document in this paper is not a prominent feature for managers of subadvised firms. These results are consistent with a lack of manager attention to subadvised funds, which provides indirect confirmation of the results in Chen et al. (2013) and is consistent with their conjecture that managers of subadvised funds are not strongly motivated.

6 | ENDOGENEITY OF MANAGER ASSETS

One concern with our results is that neither fund assets nor the responsibilities of a fund's managers are exogenously determined. They are very likely determined by unobservable manager characteristics that may also drive performance. For instance, better managers will generate better fund performance that may attract fund flows (thereby increasing fund size). Similarly, better managers may see an expansion in their responsibilities (thereby increasing manager assets). Without being able to observe, and therefore control for, manager skill, the relation between fund performance and both fund size and manager assets will be positively biased.[24] While fund fixed effects account for the effect of time-invariant manager skill, as explained below, including fund fixed effects can generate a small-sample bias. In this section, we employ two different approaches to deal with such endogeneity concerns.

Our first approach is to use fund mergers as exogenous events that shock external assets, a setting also used by McLemore (2019) to examine decreasing returns to scale in the mutual fund industry. While the decision to acquire an investment adviser may be due, in part, to the skill of the mutual fund managers employed by the *target* investment adviser, it is plausibly exogenous to the skill of the managers employed by the *acquiring* investment adviser. At the same time, when investment categories of funds overlap between the two investment advisers, merging funds is a common practice.[25] It is plausible to think that managers from the acquiring firm who survive the merger are likely to see their responsibilities expanded. On the other hand, if two funds with common managers merge, the managers'

[24] Of course, this positive bias would not explain the results we document and would actually bias against our conclusions.

[25] Rand et al. (2002) point out that "Fund reorganizations frequently follow acquisitions of investment advisers. A variety of business objectives motivate mergers of funds following the acquisition of an investment adviser, most often combining fund complexes and otherwise eliminating duplicative products."

assets outside of the resulting fund decrease mechanically. Based on this reasoning, we use two variables to capture the shock to managers' assets due to mergers: *Fraction of managers in acquiring firm*, calculated as the fraction of the fund's managers who worked for the acquiring firm in a recent merger (last 3 or 5 years), and *Fund in acquiring firm*, an indicator variable that equals 1 if the fund's investment adviser recently acquired another firm.

To identify possible investment adviser mergers, we look at two different sources: first, the N-SAR filings that require investment company registrants to identify "Changes in control" (question 77.H), and second, the investment adviser registration statement (form ADV) that identifies "Control Persons" (item 10). We then search newspapers, magazines, industry periodicals, press releases, and other popular media sources to confirm the merger and identify the announcement date. The sample period from 1996 to 2018 includes 87 mergers where both the acquiring and target firms managed mutual funds.

The instrumental variable regression results are shown in Tables 8 and 9. Table 8 contains coefficient estimates from the first-stage regression of manager external assets on the instruments and the same control variables employed in previous regressions. All measures of external assets load positively and statistically significantly on *fraction of managers in acquiring firm*, which is consistent with managers who survive a merger seeing their responsibilities increased in the years following the merger. The coefficients on *fund in acquiring firm* are negative and statistically significant, which confirms that funds that survive a merger are likely to merge themselves, so their managers' outside holdings tend to decrease, other things equal. The Kleibergen–Paap rank Lagrange multiplier test rejects the null hypothesis of underidentification of the instruments, while the Cragg–Donald Wald *F*-test rejects the null of weak instruments, setting the maximum acceptable test size to 10%, as indicated in the Table 8 footnote containing the Stock and Yogo critical values.[26] The Kleibergen–Paap rank Wald test for weak instruments also rejects the null at the maximum 10% size for both specifications of the *mean number of funds*. For *mean external assets* and *mean number of categories*, however, it rejects only at the maximum size of 15% or 20%.

Table 9 contains the coefficient estimates from the second stage of the instrumental variable regression. Consistent with the previous results, the instrumented version of external assets is negative and statistically significantly related to fund performance. This is true, once again, for all three measures of manager assets. Results on other variables are similar to our earlier results.

Our second approach is based on Pástor et al. (2015) and Zhu (2018). In examining the relationship between fund size and performance, both Reuter and Zitzewitz (2021) and Pástor et al. (2015) argue that because fund size may be positively related to performance through manager skill, an omitted variable, the OLS regression of fund performance on size may yield a biased coefficient that underestimates the true magnitude of diseconomies related to size. Pástor et al. (2015) argue that including fund fixed effects fixes the omitted-variable bias but induces a negative bias in finite samples. The intuition is that unusually good fund performance increases fund assets in the same period, both mechanically and through flows, which in turn increases the sample mean of fund assets and reduces the demeaned value of fund assets. As a consequence, the innovation to the dependent variable is negatively correlated with the innovation to the independent variable in the regression with fixed effects, which negatively biases the coefficient on fund assets. Pástor et al. (2015) suggest recursive demeaning of fund size to create an instrument for size.

To study the causal effect of manager assets on performance, we apply the Pástor et al. (2015) approach, as improved upon in Zhu (2018). The analysis is shown in Table 10. In columns [1] to [3], recursively forward-demeaned *Mean external assets*, *Mean number of funds*, and *Mean number of categories* are instrumented with the corresponding recursively backward-demeaned variable. In columns [4] to [6], both forward-demeaned fund assets and measures of outside holdings are instrumented with backward-demeaned fund assets and outside holdings. In both cases, all three measures of manager assets remain statistically significant. The Kleibergen–Paap rank Lagrange multiplier test rejects the null of underidentification of the instruments, while the Kleibergen–Paap rank Wald and the Cragg–Donald Wald *F*-test both reject the null of weak instruments with a maximum size of 10%.

[26] This is the maximum tolerable rejection rate given a significance level of 5%.

TABLE 8 First-stage instrumental variables regressions.

	[1]	[2]	[3]	[4]	[5]	[6]
Instrumented variable:	*Mean external assets*		*Mean number of funds*		*Mean number of categories*	
Time window for instruments:	**3 years**	**5 years**	**3 years**	**5 years**	**3 years**	**5 years**
Fraction of managers in acquiring firm (instrument)	0.855***	0.814***	0.189***	0.169***	0.097***	0.093***
	(0.183)	(0.194)	(0.024)	(0.026)	(0.020)	(0.021)
Fund in acquiring firm (instrument)	−0.651**	−0.550**	−0.153***	−0.114***	−0.104***	−0.079***
	(0.260)	(0.270)	(0.029)	(0.029)	(0.025)	(0.024)
Fund assets	0.337***	0.336***	0.035***	0.035***	0.020***	0.020***
	(0.083)	(0.083)	(0.008)	(0.008)	(0.006)	(0.006)
Fund family assets	0.560***	0.560***	0.031**	0.031**	0.025**	0.025**
	(0.144)	(0.145)	(0.013)	(0.013)	(0.011)	(0.011)
Turnover	−0.001*	−0.001*	−0.000*	−0.000*	−0.000	−0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Expense ratio	−0.054	−0.049	−0.032	−0.031	−0.014	−0.013
	(0.241)	(0.242)	(0.023)	(0.023)	(0.018)	(0.018)
Annual flow	−0.104**	−0.103**	−0.011**	−0.011**	−0.010***	−0.010***
	(0.051)	(0.051)	(0.005)	(0.005)	(0.004)	(0.004)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	366,885	366,885	366,885	366,885	366,885	366,885
Adjusted *R*-squared (%)	65.6	65.6	78.2	78.2	76.0	76.0
Kleibergen–Paap rk LM statistic	19.31	16.31	45.95	35.99	22.13	17.72
(*p*-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Cragg–Donald Wald *F* statistic[a]	130.97	157.84	874.37	931.62	372.07	418.53
Kleibergen–Paap rk Wald *F* statistic[a]	10.88	8.87	30.84	21.87	12.25	9.67

Note: This table reports estimated coefficients from the first-stage regression of annual fund four-factor alpha on fund and fund family characteristics. Standard errors are reported in parentheses. In the first-stage regressions, the dependent variables are *Mean external assets* (columns [1] and [2]), *Mean number of funds* (columns [3] and [4]), and *Mean number of categories* (columns [5] and [6]), as defined in Table 3. The regressors include two instruments: *Fraction of managers in acquiring firm*, calculated as the fraction of the fund's managers who worked for the acquiring firm in a recent merger (last 3 or 5 years), and *Fund in acquiring firm*, an indicator variable that equals 1 if the fund's investment adviser recently acquired another firm. Control variables are defined as in Table 3. All independent variables are lagged 1 month. Standard errors are clustered by fund and month. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

[a]Stock–Yogo critical values for 10%, 15%, and 20% maximum instrumental variable size are 19.93, 11.59, and 8.75, respectively.

As Pástor et al. (2015) argue, fund fixed effects create a finite sample negative bias in the estimated coefficient on size. We observe this in our own tests—the coefficient on fund assets increases almost sevenfold when comparing our regressions without fund fixed effects (columns [3], [5], and [7] in Table 3) to those with fixed effects (columns [2], [4], and [6] in Table 3). We observe no comparable increase in the coefficient on the manager asset measures, which suggests the finite sample bias is small for our manager asset measures. Therefore, it is not surprising that our results hold when using the recursive demeaning approach.

TABLE 9 Second-stage instrumental variables regressions.

Time window for instruments:	[1] 3 years	[2] 5 years	[3] 3 years	[4] 5 years	[5] 3 years	[6] 5 years
Instrumented variables						
Mean external assets	−0.471*	−0.492**				
	(0.243)	(0.246)				
Mean number of funds			−2.093**	−2.370**		
			(1.046)	(1.131)		
Mean number of categories					−3.317*	−4.348**
					(1.959)	(2.076)
Fund assets	−1.335***	−1.328***	−1.419***	−1.410***	−1.428***	−1.408***
	(0.121)	(0.119)	(0.092)	(0.091)	(0.092)	(0.092)
Fund family assets	0.190	0.202	−0.008	0.001	0.010	0.036
	(0.198)	(0.198)	(0.129)	(0.129)	(0.136)	(0.139)
Turnover	−0.001	−0.001	−0.000	−0.000	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Expense ratio	0.201	0.200	0.160	0.151	0.181	0.166
	(0.376)	(0.378)	(0.366)	(0.367)	(0.364)	(0.366)
Annual flow	−0.017	−0.020	0.008	0.004	−0.003	−0.013
	(0.075)	(0.076)	(0.069)	(0.069)	(0.070)	(0.072)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	366,885	366,885	366,885	366,885	366,885	366,885
Adjusted *R*-squared (in %)	9.8	8.9	18.0	17.6	17.2	15.6

Note: This table reports estimated coefficients from the second-stage regression of annual fund four-factor alpha on manager, fund, and fund family characteristics. Standard errors are reported in parentheses. Annual four-factor alpha in a given year is defined as the sum of the fund's monthly alphas in that year, in percent units. All regressors are defined as in Table 3 and are lagged 1 month. Standard errors are clustered by fund and month. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

7 | ROBUSTNESS TESTS

In Table 11, we consider a variety of specifications to rule out alternative explanations. One reason manager assets may be negatively related to performance is that a manager with many funds under management will have to coordinate with many comanagers. To the extent that coordination is costly and detracts time from other tasks, this could result in poorer performance. Of course, interaction with other managers could also be beneficial to performance, as it enables dissemination and validation of ideas within the fund family.

To control for the potential costs and benefits of coordination, we compute, for each manager and month, the number of unique comanagers, meaning managers in the same funds as the given manager. To control for coordination *within* the fund, we also control for the number of managers of the fund in question. Both variables are expressed in logs.[27] In columns [1] to [3] of Panel A, we see that our manager asset coefficients are slightly increased, compared to our Table 3 results, and remain significant. We note that the coefficient on the number of managers in a fund is insignif-

[27] We add 1 to the number of comanagers before taking logs.

TABLE 10 Recursive demeaning regressions.

	[1]	[2]	[3]	[4]	[5]	[6]
Mean external assets	−0.075***			−0.068***		
	(0.018)			(0.017)		
Mean number of funds		−1.228***			−1.136***	
		(0.311)			(0.300)	
Mean number of categories			−0.829**			−0.777**
			(0.363)			(0.359)
Fund assets	−1.192***	−1.182***	−1.203***	−1.343***	−1.395***	−1.287***
	(0.079)	(0.080)	(0.079)	(0.255)	(0.255)	(0.251)
Fund family assets	0.005	0.043	−0.032	0.090	0.164	0.016
	(0.122)	(0.119)	(0.120)	(0.201)	(0.194)	(0.193)
Turnover	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Expense ratio	0.436	0.388	0.416	0.332	0.244	0.359
	(0.347)	(0.348)	(0.347)	(0.365)	(0.366)	(0.363)
Annual flow	0.116	0.097	0.119	0.134	0.123	0.130
	(0.083)	(0.081)	(0.082)	(0.084)	(0.083)	(0.083)
Observations	367,095	367,095	367,095	367,095	367,095	367,095
Adjusted *R*-squared (in %)	2.8	2.5	2.9	2.8	2.5	2.9
Kleibergen–Paap rk LM statistic (*p*-value)	161.288 (0.00)	168.998 (0.00)	170.793 (0.00)	113.584 (0.00)	114.985 (0.00)	115.120 (0.00)
Cragg–Donald Wald *F* statistic[a]	88000.00	37000.00	34000.00	8422.01	8335.11	8699.21
Kleibergen–Paap rk Wald *F* statistic[a]	287.68	202.31	194.52	62.27	62.87	63.50

Note: This table reports estimated coefficients from recursive-demeaning regressions of annual fund four-factor alpha on manager, fund, and fund family characteristics, following Zhu (2018). Standard errors are reported in parentheses. Annual four-factor alpha in a given year is defined as the sum of manager monthly alphas in that year, in percent units. All regressors are defined as in Table 3 and lagged 1 month. Both the dependent variable and the regressors are replaced in the regression equation by their recursively forward-demeaned values. In columns [1] to [3], the forward-demeaned measure of outside holdings is instrumented by the corresponding recursively backward-demeaned variable. In columns [4] to [6], both the forward-demeaned outside holdings measure and forward-demeaned fund assets are instrumented by backward-demeaned outside holdings and backward-demeaned fund assets. Standard errors are clustered by fund and month. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

[a]Stock–Yogo critical values for 10% maximum IV size are 19.93 for regressions [1] to [3] and 13.43 for regressions [4] to [6].

icant, though the coefficient on the number of comanagers is reliably positive. This suggests that having comanagers actually helps managers to manage the given fund.

It might be that managers who are more senior are more likely to have more responsibilities (more manager assets) and more likely to survive longer in our sample due to their better performance. In columns [4] to [6] of Table 11, Panel A, we control for manager tenure, defined as the number of years since the manager's first appearance in the sample. We control, specifically, for the mean tenure of the management team. Although the coefficient on tenure is negative and significant, there is little change in the magnitude of the coefficients on our manager asset variables, and they remain significant.

TABLE 11 Additional specifications.

Panel A: Number of managers, comanagers, and manager tenure						
	[1]	[2]	[3]	[4]	[5]	[6]
Mean external assets	−0.029***			−0.021**		
	(0.010)			(0.009)		
Mean number of funds		−0.386***			−0.171*	
		(0.134)			(0.098)	
Mean number of categories			−0.599***			−0.347***
			(0.151)			(0.119)
Number of managers in fund	−0.032	−0.072	−0.072			
	(0.110)	(0.112)	(0.111)			
Mean number of comanagers	0.128*	0.216**	0.238***			
	(0.073)	(0.093)	(0.085)			
Mean tenure				−0.025*	−0.025**	−0.024*
				(0.013)	(0.013)	(0.013)
Fund assets	−1.492***	−1.494***	−1.497***	−1.477***	−1.478***	−1.478***
	(0.084)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)
Fund family assets	−0.062	−0.068	−0.066	−0.068	−0.075	−0.071
	(0.121)	(0.121)	(0.121)	(0.120)	(0.121)	(0.121)
Turnover	0.000	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Expense ratio	0.224	0.216	0.222	0.236	0.232	0.231
	(0.359)	(0.359)	(0.359)	(0.360)	(0.360)	(0.359)
Annual flow	0.030	0.028	0.027	0.028	0.028	0.027
	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
Restricted sample	No	No	No	No	No	No
Alpha	Four-factor	Four-factor	Four-factor	Four-factor	Four-factor	Four-factor
Observations	367,095	367,095	367,095	367,095	367,095	367,095
Adjusted *R*-squared (in %)	19.3	19.3	19.3	19.3	19.3	19.3
Panel B: Industry concentration and *R*-squared						
	[7]	[8]	[9]	[10]	[11]	[12]
Mean external assets	−0.024***			−0.021**		
	(0.009)			(0.009)		
Mean number of funds		−0.244**			−0.191**	
		(0.099)			(0.097)	
Mean number of categories			−0.435***			−0.361***
			(0.123)			(0.119)
Industry Concentration Index	2.540*	2.540*	2.519*			
	(1.402)	(1.400)	(1.402)			
R-Squared				−5.774***	−5.822***	−5.797***
				(1.526)	(1.525)	(1.525)

(Continues)

TABLE 11 (Continued)

Panel B: Industry concentration and *R*-squared						
	[7]	[8]	[9]	[10]	[11]	[12]
Fund assets	−1.514***	−1.514***	−1.514***	−1.452***	−1.452***	−1.451***
	(0.086)	(0.086)	(0.086)	(0.082)	(0.082)	(0.082)
Fund family assets	−0.065	−0.073	−0.071	−0.044	−0.050	−0.047
	(0.125)	(0.126)	(0.126)	(0.120)	(0.120)	(0.120)
Turnover	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Expense ratio	0.234	0.226	0.227	0.129	0.123	0.125
	(0.384)	(0.384)	(0.384)	(0.367)	(0.367)	(0.366)
Annual flow	0.048	0.048	0.046	0.005	0.005	0.004
	(0.070)	(0.070)	(0.070)	(0.068)	(0.068)	(0.068)
Restricted sample	No	No	No	No	No	No
Alpha	Four-factor	Four-factor	Four-factor	Four-factor	Four-factor	Four-factor
Observations	344,577	344,577	344,577	367,095	367,095	367,095
Adjusted *R*-squared (in %)	19.3	19.3	19.3	19.4	19.4	19.4
Panel C: Restricted sample and six-factor alphas						
	[13]	[14]	[15]	[16]	[17]	[18]
Mean external assets	−0.023**			−0.020**		
	(0.010)			(0.009)		
Mean number of funds		−0.322***			−0.181*	
		(0.122)			(0.096)	
Mean number of categories			−0.543***			−0.369***
			(0.147)			(0.119)
Fund assets	−1.602***	−1.596***	−1.598***	−1.145***	−1.146***	−1.145***
	(0.102)	(0.102)	(0.101)	(0.074)	(0.074)	(0.073)
Fund family assets	−0.035	−0.043	−0.042	0.048	0.043	0.046
	(0.153)	(0.153)	(0.153)	(0.122)	(0.123)	(0.123)
Turnover	−0.000	−0.000	−0.000	0.001	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Expense ratio	0.225	0.217	0.222	−0.103	−0.107	−0.107
	(0.434)	(0.434)	(0.434)	(0.369)	(0.369)	(0.369)
Annual flow	0.005	0.004	0.002	0.210***	0.210***	0.209***
	(0.080)	(0.080)	(0.080)	(0.078)	(0.078)	(0.078)
Restricted sample	Yes	Yes	Yes	No	No	No
Alpha	Four-factor	Four-factor	Four-factor	Six-factor	Six-factor	Six-factor
Observations	274,448	274,448	274,448	367,095	367,095	367,095
Adjusted *R*-squared (in %)	20.4	20.4	20.4	18.0	18.0	18.0

(Continues)

TABLE 11 (Continued)

Panel D: Annual frequency and winsorized alphas						
	[19]	[20]	[21]	[22]	[23]	[24]
Mean external assets	−0.023**			−0.025***		
	(0.011)			(0.008)		
Mean number of funds		−0.249**			−0.205**	
		(0.119)			(0.094)	
Mean number of categories			−0.457***			−0.363***
			(0.159)			(0.114)
Fund assets	−1.465***	−1.464***	−1.464***	−1.442***	−1.443***	−1.443***
	(0.168)	(0.168)	(0.168)	(0.078)	(0.078)	(0.078)
Fund family assets	−0.041	−0.047	−0.041	−0.067	−0.074	−0.072
	(0.177)	(0.178)	(0.178)	(0.111)	(0.111)	(0.111)
Turnover	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Expense ratio	0.252	0.243	0.245	0.303	0.297	0.299
	(0.425)	(0.426)	(0.424)	(0.286)	(0.286)	(0.285)
Annual flow	0.024	0.025	0.023	0.042	0.042	0.041
	(0.188)	(0.187)	(0.188)	(0.062)	(0.062)	(0.062)
Frequency	Annual	Annual	Annual	Monthly	Monthly	Monthly
Winsorized alpha (0.1% of each tail)	No	No	No	Yes	Yes	Yes
Observations	31,638	31,638	31,638	366,491	366,491	366,491
Adjusted *R*-squared (in %)	13.9	13.9	14.0	19.2	19.2	19.2

Note: This table reports estimated coefficients from the pooled OLS regression of annual fund four-factor alpha on manager, fund, and fund family characteristics. Standard errors are reported in parentheses. Annual four-factor alpha in a given year is defined as the sum of the fund's monthly alphas in that year, in percent units. *Industry concentration index* is defined as the sum of the squared deviations of the value weights for each of the 10 different industries held by the mutual fund, relative to the industry weights of the total stock market. *Number of comanagers per manager* is the number of unique managers who comanage funds with the manager. *Number of managers per fund* is the number of managers managing the fund. *Tenure* is the number of years since the beginning of the manager's career (first appearance in the sample). *R-squared* is the *R*-squared of the time-series regression used to estimate factor loadings using the prior 3 years. All other regressors are defined as in Table 3. In columns [13] to [15], the sample includes only observations of fund *f* and manager *m* where fund *f* is managed by no more than three managers and manager *m* manages no more than three funds. In columns [16] to [18], the dependent variable is annual six-factor alpha. In columns [19] to [21], we repeat our analysis with annual (rather than monthly) observations. In columns [22] to [24], we winsorize our alphas at the 1% level. All regression specifications include time and fund fixed effects. All independent variables are lagged 1 month. Standard errors are clustered by fund and month. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Kacperczyk et al. (2005) show that funds with portfolios that are more concentrated within industries perform better than those that are less concentrated, and that the effect is driven by individual stock selection. To the extent that industry concentration is a choice that could affect the nature of manager assets, it could affect our results. For instance, managers of many funds could choose to hold portfolios that deviate less from the market portfolio, which is diversified across industries, in order to manage portfolios that are more homogeneous. Failure to control for industry concentration would in turn lead us to misestimate the effect of manager assets. To control for this possibility, we repeat our regressions, controlling also for Industry Concentration Index (ICI), as defined in Kacperczyk et al. (2005). In particular, the ICI at time *t* for a mutual fund is the sum of the squared deviations of the value weights for each

of the 10 different industries held by the mutual fund, $w_{j,t}$, relative to the industry weights of the total stock market, $\bar{w}_{j,t}$: $ICI_t = \sum_{j=1}^{10} (w_{j,t} - \bar{w}_{j,t})^2$. The results are shown in columns [7] to [9] of Table 11, Panel B. We see little change in the magnitude of the coefficients on our manager asset variables compared to Table 3, and they remain significant. In our analysis, the *Industry Concentration Index* is positive and significant at the 10% level in all three specifications.

Very similar to the point regarding industry concentration, prior studies have suggested that managers who pursue strategies that are more active are more likely to outperform their benchmarks (see Cremers & Petajisto, 2009). Amihud and Goyenko (2013) suggest that the *R*-squared of the regression of performance on factor loadings used to calculate the fund alpha (calculated over the prior 3 years) captures this effect. Specifications [10] to [12] in Table 11, Panel B, include this measure, *R-squared*, and, consistent with those papers, the coefficient is significant and negative. However, there is little change in the coefficients on our measures of manager assets.

As noted in Table 2, some managers manage many funds, and some funds are managed by many managers. This observation casts doubt on whether a single manager's decisions could have any impact on a given fund's performance when the manager is busy with many other funds or when the fund is being overseen by many other managers. To make sure our results are not driven by these outliers, in columns [13] to [15] of Table 11, Panel C, we restrict the sample to fund-manager observations where the fund has no more than three managers and the manager oversees no more than three funds. Despite the reduction in the sample size by almost 25%, our results are virtually unchanged.

In a final set of tests, we assess the robustness of our results to different measures of performance, the frequency of the analysis, and the influence of extreme observations. These tests use the baseline regressions presented in Table 3, columns [2], [4], and [6]. In columns [16] to [18] of Table 11, Panel C, we use the Fama and French (2015) five-factor model augmented with momentum. Our conclusions are unchanged. Our main analysis is based on monthly observations where the dependent variable is the alpha calculated as the average alpha over the prior 12 months. This means that our dependent variable abnormal return observations are overlapping. While time clustering should account for the potential serial correlation in errors induced by overlapping returns, in columns [19] to [21] of Table 11, Panel D, we repeat our analysis at the annual frequency, that is, using only observations at the first month of each year. While the sample size is greatly reduced, the results are unchanged. Finally, in columns [22] to [24], we winsorize alphas at the 1% level of each tail. Results are, again, unchanged.

8 | CONCLUSION

The difficulty that funds and managers face with respect to generating abnormal returns from active management has historically been framed as a question related to market efficiency. In this framing of the challenge, managers compete away profits by trading on their information. The larger the fund, the more impact they will have on markets, and the harder it will be to implement value-creating strategies. This is the typical argument for the negative relation between size and performance—a trading cost argument. Recent work on mutual funds has begun to explore alternative ways in which the organization of funds, and the compensation of fund managers, might affect fund and manager performance.

We contribute to this strand of literature by highlighting the potential effects on fund performance of manager assets outside the fund. In this regard, we extend the work of Berk et al. (2017), who, in turn, extend the work of Berk and Green (2004). In Berk and Green (2004), funds increase in size until they reach an equilibrium where outperformance is competed away. Berk et al. (2017) make a similar argument at the manager level—that managers are allocated additional funds *by asset management firms* until an analogous equilibrium is reached. The observation in Berk et al. (2017), combined with a variety of studies documenting the possibility of manager attention effects, suggests that any analysis of fund performance must recognize not only the assets in the fund, but also the assets managed by the managers of that fund. We conclude from our results that such a manager asset effect is economically and statistically relevant and, further, that this effect is driven, at least in part, by attention effects.

ACKNOWLEDGMENTS

We thank the following people for helpful comments and suggestions on this or an earlier related working paper: Tim Adam, Susan Christoffersen, Joe Chen, Steve Liu, and Martin Rohleder, as well as seminar participants at the Darden School of Business and the McIntire School of Commerce at the University of Virginia, University of Alabama, HEC Paris, and the Cologne Center for Research in Finance, and conference participants at the 2017 FMA European Conference, 2017 Spanish Finance Association, 2017 European Finance Association, 2017 ERMAS meetings, and the 2017 Financial Management Association Meetings.

REFERENCES

Agarwal, V., Ma, L., & Mullally, K. (2023). Managerial multitasking in the mutual fund industry. *Financial Analysts Journal*, *79*(2), 65–75.

Amihud, Y., & Goyenko, R. (2013). Mutual fund's R^2 as predictor of performance. *Review of Financial Studies*, *26*, 667–699.

Baer, M., Kempf, A., & Ruenzi, S. (2011). Is a team different from the sum of its parts? Evidence from mutual fund managers. *Review of Finance*, *15*, 359–396.

Berk, J. B., & Green, R. (2004). Mutual fund flows and performance in rational markets. *Journal of Political Economy*, *112*(6), 1269–1295.

Berk, J. B., & van Binsbergen, J. H. (2015). Measuring skill in the mutual fund industry. *Journal of Financial Economics*, *118*, 1–20.

Berk, J. B., van Binsbergen, J. H., & Liu, B. (2017). Matching capital and labor. *Journal of Finance*, *72*, 2467–2504.

Busse, J. A., Chordia, T., Jiang, L., & Tang, Y. (2020). Transaction costs, portfolio characteristics, and mutual fund performance. *Management Science*, *67*, 661–1328.

Carhart, M. M. (1997). On persistence in mutual fund performance. *Journal of Finance*, *52*, 57–82.

Chen, J., Hong, H., Huang, M., & Kubik, J. D. (2004). Does fund size erode mutual fund performance? The role of liquidity and organization. *American Economic Review*, *94*, 1276–1302.

Chen, J., Hong, H., Jiang, W., & Kubik, J. D. (2013). Outsourcing mutual fund management: Firm boundaries, incentives, and performance. *Journal of Finance*, *68*, 523–558.

Chevalier, J., & Ellison, G. (1999). Are some mutual fund managers better than others? Cross-sectional patterns in behavior and performance. *Journal of Finance*, *54*(3), 875–899.

Cremers, K. J. M., & Petajisto, A. (2009). How active is your fund manager? A new measure that predicts performance. *Review of Financial Studies*, *22*, 3329–3365.

Drazin, R., & Rao, H. (2002). Harnessing managerial knowledge to implement product-line extensions: How do mutual fund families allocate portfolio managers to old and new funds? *The Academy of Management Journal*, *45*, 609–619.

Duan, Y., Hu, G., & McLean, D. (2009). When is stock picking likely to be successful? Evidence from mutual funds. *Financial Analysts Journal*, *65*(2), 55–66.

Elton, E., Gruber, M., & Blake, C. (2012). Does mutual fund size matter? The relationship between size and performance. *The Review of Asset Pricing Studies*, *2*(1), 31–55.

Evans, R. (2009). *Does alpha really matter? Evidence from mutual fund incubation, termination and manager change*. Working paper.

Evans, R., & Fahlenbrach, R. (2012). Institutional investors and mutual fund governance: Evidence from retail-institutional fund twins. *The Review of Financial Studies*, *25*(12), 3530–3571.

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, *116*, 1–22.

Fang, J., Kempf, A., & Trapp, M. (2014). Fund manager allocation. *Journal of Financial Economics*, *111*(3), 661–674.

Ferreira, M. A., Keswani, A., Miguel, A. F., & Ramos, S. B. (2013). The determinants of mutual fund performance: A cross-country study. *Review of Finance*, *17*, 483–525.

Ferris, S. P., Jagannathan, M., & Pritchard, A. C. (2003). Too busy to mind the business? Monitoring by directors with multiple board appointments. *Journal of Finance*, *58*, 1087–1111.

Fich, E., & Shivdasani, A. (2006). Are busy boards effective monitors? *Journal of Finance*, *61*, 689–724.

Field, L., Lowry, M., & Mrktchyan, A. (2013). Are busy boards detrimental? *Journal of Financial Economics*, *109*(1), 63–82.

Gormley, T. A., & Matsa, D. A. (2014). Common errors: How to (and not to) control for unobserved heterogeneity. *Review of Financial Studies*, *27*, 617–661.

Gottesman, A., & Morey, M. (2006). Manager education and mutual fund performance. *Journal of Empirical Finance*, *13*, 145–182.

Gupta-Mukherjee, S., & Pareek, A. (2020). Limited attention and portfolio choice: The impact of attention allocation on mutual fund performance. *Financial Management*, *49*, 1083–1125.

Hoberg, G., Kumar, N., & Prabhala, N. (2018). Mutual fund competition, managerial skill, and alpha persistence. *Review of Financial Studies*, *31*, 1896–1929.

Huang, J., Wei, K., & Yan, H. (2022). Investor learning and mutual fund flows. *Financial Management*, *51*, 739–765.

Jain, P. C., & Wu, J. S. (2000). Truth in mutual fund advertising: Evidence on future performance and fund flows. *Journal of Finance*, *55*(2), 937–958.
Kacperczyk, M., Sialm, C., & Zheng, L. (2005). On the industry concentration of actively managed equity mutual funds. *Journal of Finance*, *60*, 1983–2011.
Kacperczyk, M., Van Nieuwerburgh, S., & Veldkamp, L. (2016). A rational theory of mutual funds' attention allocation. *Econometrica*, *84*(2), 571–626.
Khorana, A. (1996). Top management turnover: An empirical investigation of mutual fund managers. *Journal of Financial Economics*, *40*, 403–427.
Li, H., Zhang, X., & Zhao, R. (2011). Investing in talents: Manager characteristics and hedge fund performances. *Journal of Financial and Quantitative Analysis*, *46*, 59–82.
Lu, Y., Ray, S., & Teo, M. (2016). Limited attention, marital events and hedge funds. *Journal of Financial Economics*, *122*, 607–624.
McLemore, P. (2019). Do mutual funds have decreasing returns to scale? Evidence from fund mergers. *Journal of Financial and Quantitative Analysis*, *54*(4), 1683–1711.
Obaid, K., & Pukthuanthong, K. (2021). Informativeness of mutual fund advertisements: Does advertising communicate fund quality to investors? *Financial Management*, *50*, 203–236.
Pástor, L., Stambaugh, R., & Taylor, L. (2015). Scale and skill in active management. *Journal of Financial Economics*, *116*, 23–45.
Pástor, L., Stambaugh, R., Taylor, L., & Zhu, M. (2022). Diseconomies of scale in active management: Robust evidence. *Critical Finance Review*, *11*, 593–611.
Phillips, B., Pukthuanthong, K., & Rau, P. R. (2018). Size does not matter: Diseconomies of scale in the mutual fund industry revisited. *Journal of Banking & Finance*, *88*, 357–365.
Rand, J. S., King Jr., J. S., & Carty, M. C. (2002). Mergers and acquisitions of investment managers: Fund and board consolidation. *The Investment Lawyer*, *9*, 17–23.
Reuter, J., & Zitzewitz, E. (2021). How much does size erode mutual fund performance? A regression discontinuity approach. *Review of Finance*, *25*, 1395–1432.
Schmidt, D. (2019). Distracted institutional investors. *Journal of Financial and Quantitative Analysis*, *54*, 2453–2491.
Sirri, E. R., & Tufano, P. (1998). Costly search and mutual fund flows. *Journal of Finance*, *53*(5), 1589–1622.
Thompson, S. (2011). Simple formulas for standard errors that cluster by both firm and time. *Journal of Financial Economics*, *99*, 1–10.
Wermers, R. (2000). Mutual fund performance: An empirical decomposition into stock-picking talent, style, transactions costs, and expenses. *Journal of Finance*, *55*, 1655–1703.
Wu, Y., Wermers, R., & Zechner, J. (2016). Managerial rents vs. shareholder value in delegated portfolio management: The case of closed-end funds. *Review of Financial Studies*, *29*, 3428–3470.
Yan, X. (2008). Liquidity, investment style, and the relation between fund size and fund performance. *Journal of Financial and Quantitative Analysis*, *43*(3), 741–767.
Zhu, M. (2018). Informative fund size, managerial skill, and investor rationality. *Journal of Financial Economics*, *130*, 114–134.

How to cite this article: Evans, R., Gil-Bazo, J., & Lipson, M. (2024). Mutual fund performance and manager assets: The negative effect of outside holdings. *Financial Management*, 1–27.
https://doi.org/10.1111/fima.12443