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Managerial Investment in Mutual Funds

Abigail S. Hornstein and James Hounsell*

ABSTRACT

The SEC requires mutual fund portfolio managers to disclose annually their level of investments in self-managed funds. We examine whether skin in the game serves to align managerial and investor interests using a hand-collected panel dataset of managerial investment at nearly 800 no load mutual funds from 2006 to 2009. We believe we are the first to explore the time series variation in mutual fund managerial investments. Managerial investment fluctuates markedly from year to year and fund returns are significantly lower when managers invest more in their funds. Expense fees are significantly higher when managers invest more but there is no relationship between management fees and managerial investment levels. These results contrast sharply with the conventional wisdom and suggest that either managerial investment suffers from an omitted variable problem or that other mechanisms may be used more effectively to align managerial and investor interests.

* Abigail S. Hornstein, Wesleyan University, Middletown, CT; ahornstein@wesleyan.edu, corresponding author. James Hounsell, Centerview Partners, New York.

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1. Introduction

"A portfolio manager's ownership in a fund provides a direct indication of his or her alignment with the interests of shareholders in that fund," argued the U.S. Securities and Exchange Commission (SEC) in 2004.[1] In March 2005, the SEC mandated that funds begin annual disclosure of portfolio managers' ownership stakes in their own funds within the Statement of Additional Information (SAI) section of each fund's annual report. Such disclosures would supplement the mandatory frequent, comprehensive disclosure of funds' investment activities for each reporting period (typically quarterly), including listings of the funds' holdings as of a particular date, information on the fund's board of directors, and information on portfolio managers.

When the SEC proposed this disclosure requirement, some fund managers argued that information on levels of managerial investment would be a noisy, non-informative signal that investors might have difficulty understanding. For example, a manager might not invest in the mutual fund she managed because it was not aligned with her personal financial interests. Alternatively, a manager's level of ownership might fluctuate due to personal financial considerations and not reflect a change in beliefs regarding the long-term expectations for the fund. If the SEC's hypothesis of long-term incentive alignment is correct, then managerial investment levels would generally be non-decreasing across time and there should be a positive relationship between fund performance and the level of managerial ownership. In this light, Khorana et al. (2007), Evans (2008), and Fu and Wedge (2011) assume that managerial ownership is flat or rising over time and use a single cross-section of managerial ownership data from end-2004 to explain varying aspects of fund performance.

[1] This is from the SEC Rule S7-12-04, "Disclosure Regarding Portfolio Managers of Registered Management Investment Companies."

There have been few studies to date of the relationship between mutual fund performance and managerial ownership. Both Khorana et al. (2007) and Evans (2008) find that fund performance is strongly positively related to ownership stakes, with Khorana et al. reporting that each additional basis point of managerial ownership is associated with a three basis point increase in fund performance. Similarly, industry research has also found a positive relationship. For example, a July 2009 study by Morningstar shows that managers with more than $1 million invested in their own funds beat 58% of peers, on average, over the previous five years while funds with no manager investment outperformed only 46% of their peers. In related work, Chen et al. (2008) and Cremers et al. (2009) have looked at the relationship between mutual fund performance and directors' ownership. They have found that such investments are associated with reduced agency problems and higher performance.

On the other hand, Kumlin and Puttonen (2009) reported no significant relationship between manager ownership and mutual fund performance in Norway. Furthermore, when Kumlin and Puttonen controlled for portfolio manager ownership as a percentage of taxable wealth, they found a negative relationship between portfolio manager ownership and fund performance. Kumlin and Puttonen produced the only published study that has used panel data on managerial ownership stakes, and that used ownership stakes to explain future performance.[2] In a complementary study Fahlenbrach and Stulz (2011) found that U.S. banks with CEOs whose incentives were better aligned with their shareholders achieved worse performance than their peers. It is thus unclear whether skin in the game consistently or succesfully serves to align managerial and shareholder incentives.

[2] Khorana et al. (2007) and Evans (2008) both assumed that managerial investment would be non-decreasing over time and thus used investment levels to explain contemporaneous and past returns. If their assumption was correct, this would have biased against their finding significant results.

The level of portfolio manager ownership may also be predictive of manager behavior. Evans (2008) finds an inverse relationship between manager ownership and portfolio turnover. This result is fairly intuitive: excessive turnover raises administrative costs, and managers invested in their own funds, feeling the effects of those administrative costs, should be less likely to tolerate them. In related work, Fu and Wedge (2011) find an inverse relationship between the level of mutual fund manager ownership and a fund's propensity to exhibit a disposition effect.

We inject nuance into these results through use of a panel dataset detailing managerial ownership at nearly 800 no load mutual funds across a four year period. We focus on no load mutual funds as these have attracted the largest volume of net cash inflows in recent years (ICI). Much of the increase in inflows into no load funds is due to the expansion of employer-sponsored retirement plans during the last decade. First, our panel data reveals that managerial investment levels fluctuate considerably across time, which is contrary to the SEC's hypothesis and a key assumption of Khorana et al. (2007), Evans (2008), and Fu and Wedge (2011) but is consistent with the findings of Kumlin and Puttonen (2009). There is tremendous inter-temporal variation in the levels of managerial ownership, which suggests that fund managers may view their investment stake not as a signal of managerial incentive alignment so much as an asset within their own personal diversified portfolios, or a co-investment. This interpretation is consistent with Dimmock et al. (2011) who point out that managerial investment in the overarching investment management firm may be consistent with the incentive alignment theory while co-investment in an individual mutual fund might hold no such informational content.

Second, we reveal that fund performance is significantly weaker when managers own a higher share of the firm, and this is true across multiple years and across both single-manager and team-managed funds. As Kacperczyk et al. (2011) show that managerial skill may be time-

varying, managers with better track records may sell their investments to lock in gains, thus causing year-end ownership data to be downward biased and simultaneously generating the observed result that fund performance is lower when managerial investment is higher. Our results are also consistent with Berk and Green (2004)'s argument that the lack of persistence in mutual fund performance does not indicate that managers lack investing skill or that markets are efficient. Rather, it simply indicates that capital is supplied competitively, driving down returns. Third, we explore the relationship between expense and management fees and ownership levels. This step is necessary as some investors, particularly in no load funds, may be less cognizant of the fees imposed by the fund or the fund family.

Finally, we look at determinants of a manager's ownership level. While most studies to date have found that higher levels of manager ownership are correlated with superior performance, the causal relationship between manager ownership and fund performance has not been settled. It is possible that a manager with a substantial stake in her own fund is incentivized to achieve better performance. On the other hand, it is possible that better past performance spurs managers to invest more money in their own funds, consistent with Berk and Green's (2004) hypothesis that better past performance attracts greater inflows. The causal relationship between ownership and performance is difficult to discern but can be clarified somewhat by regressing performance against lagged ownership.

Section 2 discusses institutional determinants of managerial investment, and Section 3 presents our data. The methodology is discussed in Section 4. We report our results in Section 5, and conclude in Section 6.

2. Managerial investment

There is no systematic database detailing the flexibility individual managers have to decide whether, and how much, to invest in the funds they personally manage, and/or in other funds within the same mutual fund family. There appear to be three general corporate approaches to regulating how managers invest their own funds (Braham, 2010). First, some mutual fund families (e.g., Fairholme Capital Management) require their fund managers to co-invest in their funds. Another fund family, Royce & Associates, has minimum co-investment requirements for their managers, ranging from $250,000 for assistant managers to $1 million for solo lead managers. The anecdotal evidence suggests that smaller and younger funds tend to have strict co-investment requirements or expectations. Second, some mutual fund families (e.g., Southeastern Asset Management) prohibit employees or their spouses from owning individual stocks or other mutual funds. Thus, by default, employees can only invest in family funds or cash. These two approaches share a common belief that managers are most effective when their interests are fully, and visibly, aligned with those of shareholders. Finally, most fund families, however, have no such policies as they recognize that each manager may have idiosyncratic variation in current and long-term investing needs and preferences, and thus an individual may simultaneously be an appropriate fund manager and have no monies tied up in the fund. For example, tax-exempt state funds might be managed by residents of other states, or lifecycle funds might be overseen by individuals of different ages.

It is also possible that an individual manager might oversee several funds simultaneously, and hold investments in some but not all of these funds. A 2003 survey of portfolio managers found that the median number of portfolios managed by each manager is 20 (Farnsworth and Taylor, 2006). When a single manager oversees multiple funds, the manager's aggregate

investment levels may become a proxy for whether the manager's interests are aligned with those of the fund family, but not signal a particular alliance with a specific individual fund. The SEC requirement only mandates that managers disclose their ownership in funds they manage, and thus may not capture indirect incentive alignment via investments in other funds within the fund family. Thus, the available data may represent a downward biased measure of the extent to which managers' personal interests correlate positively with those of the fund family.

Basic principles of portfolio diversification call for portfolio managers to reduce or avoid personal exposure to the funds they manage, given that their salaries and employment are already linked to the performance of these funds. For example, Evans (2008) reports that 90% of the managers in her sample have some compensation, typically an annual bonus, tied to fund returns. Farnsworth and Taylor (2006) report that managers receive an average of 45% of total compensation in the form of an annual bonus, and that the size of this bonus is usually determined largely by fund performance. Furthermore, there are frequently incentives for managers with certain personal characteristics to avoid investing in some types of funds. For example, one would expect young mutual fund managers to avoid investing their own money in bond funds. At the same time, however, it is possible that managers may maintain a stake in their own funds as a signaling mechanism to current and prospective investors who might otherwise be wary of investing in a fund that the portfolio manager avoids investing in. In contrast with managers of corporations, the fact that even the most heavily invested manager generally owns well under 1% of the fund's total assets under management precludes the possibility that managers may increase their ownership stake in order to entrench themselves.

It is in this light, that the management ownership data may be best interpreted as being just one component of individual compensation. If this rationale is correct, then any empirical

analysis that includes managerial investment levels but not details on all components of the individual's total compensation and portfolio may suffer from omitted variable bias. This angle is explored further in Section 5.1 as the compensation data are not available. Some larger funds indirectly encourage managerial investments by paying out bonuses, at least partially, in fund shares that vest over multiple years (e.g., Janus where shares vest over four years). In instances where the fund pays out bonuses in fund shares, the question of interest would then be how much *additional* funds did the manager place into the fund? That is, we would want to decompose the manager's investments into forced and voluntary investments, with the incentive alignment hypothesis being tested through the impact of voluntary investments. However, the decomposition of managerial investment stakes into these two bins is not available.

The CFA Institute used to conduct an annual compensation survey of portfolio managers but last conducted it in 2007, and are no longer willing to share this data. As a result, the latest available data regarding portfolio manager compensation is from the CFA Institute's 2005 study as reported in Khorana et al. (2007) and as obtained from payscale.com in 2012. Khorana et al. (2007) report that the CFA Institute and Russell Reynolds Associate 2005 study found that the median total compensation of U.S. CFA members who serve as portfolio managers ranges from $176,000-$310,000 with the bonus accounting for 12-40% of the total compensation. The payscale.com data suggest that portfolio managers receive base salaries of $47,000-$168,000 with total compensation ranging from $48,000-$264,000. While these two sets of data may represent dissimilar samples from the universe of portfolio managers, they yield complementary intepretations: the larger managerial investment bins correspond to multiple years of income for many managers.

3. Data

As no load mutual funds may attract more footloose investors, investors may expect additional assurances that the managers are sympathetic to their concerns, and thus increase the signaling value of a managerial co-investment. We therefore examine the approximately 800 mutual funds listed in the May 2009 "Value Line No-Load Fund Advisor Mutual Fund Directory", and we later backfilled in prior years' data for these funds. This data set was selected primarily because it presents a large listing of U.S. mutual funds with similar characteristics in one easily-accessible online directory, and thus represents a group of funds that presumably are of greater interest to representative investors. We matched all the funds listed in Value Line's directory with data from CRSP, Morningstar, and fund filings with the SEC.

First, all fund and fund family characteristics were obtained from the CRSP Survivor-Bias-Free US Mutual Fund Database. Second, as CRSP listed either a single manager's name or indicated that a fund was team-managed, we obtained a list of manager names from Morningstar for all funds that were managed by two or more individuals. Finally, data for each fund on the level of each manager's ownership stake, number of directors, number of insiders on board, as well as data on whether the CEO is on the board or the CEO is the Chairman was hand-collected from Semi-Annual N-CSRS (Certified Shareholder Report) and 485 BPOS (Prospectus) filings.

The SEC requires all firms to make an annual disclosure of managerial ownership at year-end in their annual Statement of Additional Information. Managerial ownership for each fund is reported as lying within one of the following bands: $0; $1-$10,000; $10,001-$50,000; $50,001-$100,000; $100,001-$500,000; $500,001-$1,000,000; and over $1,000,000. These bands are not evenly spaced and, additionally, there may be a significant difference in ownership within a single band; e.g., a fund manager who owns $500,001 and a manager who owns

$1,000,000 are both reported within the same band. Furthermore, for managers with over $1,000,000 invested, it is impossible to determine by how much their investment exceeds $1,000,000. We therefore followed the Khorana et al. (2007) process of assuming a representative value at the mean of each band, or of $1,000,001 for the top bin.

Fund managers are required to disclose their year-end levels of investment in the funds. This may not necessarily be representative of their true level of investment. For example, managers may engage in window dressing whereby they increase their level of reported investment towards the end of the calendar year. Alternatively, a manager who expects to be paid an annual bonus in fund shares may decrease their investment in the fund in order to avoid having personal investments be overly concentrated in the fund. The results of the 2005 CFA salary survey suggest that the average manager who has invested in their fund has effectively tied up two or more years' worth of total compensation. That may lead to an overly concentrated investment portfolio that is not optimal for the manager. As we do not know the idiosyncratic motivation behind each manager's decision to invest or not in their own fund, we simply acknowledge that the reported levels may not be consistent with the true level of investment in the funds over the span of the entire calendar year. Nonetheless, in the absence of more complete reporting throughout the year, this data remains the best available way to measure managerial investments in mutual funds.

The managerial ownership distribution is relatively bifurcated. Of the 1,720 observations in the sample, 21.0% are fund-year observations in which the average managerial ownership stake is zero and 23.2% represent average manager ownership stakes of over $1,000,000. An average of 1.8 managers oversee each fund, and these funds have average total managerial

ownership stakes of $664,000 constituting 0.001% of assets under management.[3] Farnsworth and Taylor (2006) report that each manager oversees a median of 20 funds.

We find that the average ownership stake is higher in dollar terms and lower as percent of assets under management than has been previously reported by others. For example, Evans (2008) reports that her sample of 237 domestic equity funds included 22 with zero managerial investment, 27% with managerial investments of $100,000 or less, 24% with investments of $100,001-$500,000, 6% with investments of $500,001-$1,000,000 and 22% with investments of more than $1 million; we find these bins constitute 21%, 14%, 24%, 6% and 22% respectively. Thus, our allocations into the three most common bins – no investment, moderate investment ($100,001-$500,000) and high investment ($1,000,001 or more) – are very similar. On the other hand, Khorana et al. (2007) report that 57% of the 1,406 mutual funds in their sample had zero managerial investment in 2004. Khorana et al. surveyed the widest and most diverse swath of the mutual fund universe, including both sole and multiple manager funds, funds with and without loads, and funds with varied styles. Thus, the gap between Khorana et al.'s and Evans' samples probably reflects the selection criterion, while the similarities between Evans' sample and our own suggests that broad patterns may have remained stable over this period. That is, managers often do not invest but if they do invest, they either invest a moderate sum ($100,001-$500,000) or a lot (more than $1 million).

The estimated average ownership stake may be higher in our dataset for two reasons. First, general equity market participation rose throughout the last decade and was generally higher in all years in our sample (2006-2009) than at the start of the decade. Second, we

[3] This would suggest that the average manager would have total fund family investments of approximately $7.4 million if they had similar investment levels in each fund they managed, assuming that each fund had 1.8 mnaagers. If a manager had total annual compensation of $310,000 – the highest level reported in the CFA survey – then such an investment stake would represent nearly 24 years of total compensation.

examine only no load funds, which offer all investors easy entry and exit conditions, and this characteristic may be particularly appealing to fund managers whose total compensation may be more closely linked to aggregate market conditions. Summary statistics are reported in Table 1 Panel A. Panel B of Table 1 reports the mean values of all variables broken out by level of ownership stakes. This table shows that there are substantial differences in fund performance and governance across ranges of ownership stakes, and supports the hypothesis that these differences may be related to ownership stakes.

4. Methodology

To examine the impact on fund characteristics of fund manager investment in the fund, we estimate three sets of models in which the dependent variables are fund returns, expense fees, and management fees, respectively. We are therefore able to assess the direct impact on performance through returns, and indirectly through fees. As mutual funds are popularly thought of as being diversified portfolios, we use buy-and-hold returns that are estimated per calendar year. This approach may be especially well suited for examination of cross-sectional variation in fund performance (Falhlenbrach and Stulz, 2011). Fund returns are estimated both in raw nominal terms and as excess of the Lipper-objective style average. When estimating excess returns we use data on all CRSP funds and thus our reported average estimated excess return is not precisely zero in the sample studied herein. Because the error terms may be clustered across funds within a family to reflect the impact of family characteristics such as managerial investment policies discussed in Section 2, all error terms are clustered at the fund family level.

The focal independent variable in all models, ownership, is operationalized in three different ways. First, it may be the case that the nominal dollar value of the holdings influences

managerial behavior. Thus, we include the estimated dollar value of the ownership stake lagged one year as an independent variable. Second, a large managerial investment may constitute a small percent of assets under management, or the converse might hold depending on fund characteristics. We therefore next include as an independent variable the estimated lagged dollar value of the ownership stake as a percent of assets under management in that fund that year to capture the magnitude of the managerial investments. Third, all of our estimates of the value of managerial ownership may be biased due to the fact that we must estimate these values as the midpoints of unevenly sized bands. We therefore next operationalize the ownership variable as a dummy for managerial non-ownership. Thus, this dummy takes the value of 1 any time the average managerial investment in the fund is $0.

The basic construction of the first model to examine variation in annual fund returns is

$$Returns_{i,t} = \beta_0 + \beta_1 Ownership_{i,t-1} + \beta_2 Expense\ ratio_{i,t} + \beta_3 Fund\ age_{i,t} + \beta_4 Fund\ size_{i,t-1} + \beta_5 Board\ size_{i,t} + \beta_6 Board\ independence_{i,t} + \beta_7 Fund\ family\ size_{i,t} + Year\ FE + Objective\ FE + \varepsilon_{i,t}. \quad [1]$$

This model is estimated separately with the returns measured in nominal and excess terms. Our baseline model is as represented above. Next, two additional independent variables are included in an expanded model to capture CEO effects – whether the CEO sits on the board and whether the CEO is chair of the board. These variables are included to allow exploration of whether the CEO's immediate presence affects fund behavior. Then the baseline model is estimated separately for solo managed and team-managed funds, and by year. Thus the model is estimated seven times for nominal returns and an additional seven times for excess returns.

The second and third models are constructed analogously to explain expense and management fees. Ownership stakes, returns, and fund size are lagged while all other independent variables are estimated contemporaneously with the dependent variable, using

$$Fees_{i,t} = \beta_0 + \beta_1 Ownership_{i,t-1} + \beta_2 Returns_{i,t-1} + \beta_3 Fund\ age_{i,t} + \beta_4 Fund\ size_{i,t-1} + \beta_5 Board\ size_{i,t} + \beta_6 Board\ independence_{i,t} + \beta_7 Fund\ family\ size_{i,t} + Year\ FE + Objective\ FE + \varepsilon_{i,t}. \quad [2]$$

Finally, we explore possible determinants of managerial ownership stakes. This round of analysis is particularly tricky as we do not have access to managerial employment contracts which may state that managers are required to invest in funds that they oversee. Moreover, given that many managers oversee simultaneously multiple funds, even if such contracts exist, we might still see non-investment in some of their funds. To the extent that such considerations may pertain, this means that this particular model framework is particularly likely to have an omitted variable problem. Nonetheless, in the absence of such information, we estimate this model:

$$Ownership_{i,t} = \beta_0 + \beta_1 Returns_{i,t-1} + \beta_2 Expense\ fees_{i,t} + \beta_3 Fund\ age_{i,t} + \beta_4 Fund\ size_{i,t-1} + \beta_5 Board\ size_{i,t} + \beta_6 Board\ independence_{i,t} + \beta_7 Fund\ family\ size_{i,t} + Year\ FE + Objective\ FE + \varepsilon_{i,t}. \quad [3]$$

When estimating this model managerial ownership is measured only as the total managerial investment in the fund divided by total assets in the fund in that same year.

Year and objective fixed effects are included in all regressions to control for unobserved characteristics that affected all funds in a given year or in a given segment of the mutual fund universe. Each manager presumably seeks to optimize individual portfolio returns at all times. Accordingly, the manager must first ascertain whether the fund's style is appropriate for their own portfolio at that time. This alone may suggest that certain types of funds may attract varying levels of managerial investment and that there might also be time variation in these levels. Secondly, the importance of managerial effort and incentive alignment may not be constant across all types of funds, with the importance presumably highest in actively managed

equity funds where the intrinsic risks are greater. All results reported herein are robust to the exclusion of these fixed effects.

5. Results

In this section we examine the relationship between mutual fund performance, measured as either nominal or style-adjusted returns, and lagged managerial ownership. This permits identification of whether managerial ownership fulfills the incentive alignment goal identified by the SEC as a rationale for the mandatory disclosure of managerial ownership. Next we examine whether expense or management fees are affected by managerial ownership. Finally, we explore the determinants of managerial ownership levels.

5.1. Performance and ownership

We estimate three main versions of equation [1] to capture different aspects of managerial ownership: the dollar level, the proportion of fund assets, and non-investment. All three versions yield complementary explanations of the variation in nominal returns (Table 2): fund performance is strongly and significantly lower when the fund managers invest in their funds. This result is strikingly at odds with those of Khorana et al. (2007) and Evans (2008) and yet fully consistent with those of Kumlin and Puttonen (2009). If a fund manager's investment increases by $1 million – as occurred in some fund-years – then Panel A of Table 2 reveals that the mutual fund's nominal return would decrease by 0.11-0.18 basis points or by 5.6-9.3%. The average managerial investment position accounts for 0.001% of assets under management, or 0.002% if funds with zero managerial investments are excluded, and an increase of 0.001% would be associated with a 0.014-0.048 basis point decline in nominal returns (Panel B of Table

2). On the other hand, fund returns are neither higher or lower when managers do not invest in their funds (Panel C of Table 2).

These results suggest several questions that merit further investigation. First, why are these results so different from those of Khorana et al. (2007) and Evans (2008)? Second, are there meaningful differences between single and team managed funds? Third, one of the years we examine, 2008, was characterized by significantly greater equity market volatility than the other years in our dataset. Could this alone drive the results? These questions are now addressed sequentially.

First, Evans (2008) uses ownership stakes from end-2004 to explain fund performance in prior years, 2001-2004, on the thesis that ownership would be non-decreasing. Evans reports (footnote 16) that when 2004 ownership data is used to explain only returns from 2004, the results lose significance. Evans' approach is not dissimilar from that of Khorana et al. (2007) who estimate abnormal returns over 2003-05 and use the coefficients on the intercept and a 2005 dummy to calculate abnormal returns for 2005. Thus, the simple act of managerial ownership only to explain fund performance in *subsequent* years might help explain why our results differ from the prior literature, and may also reflect the added value of using panel data vs. a single cross-section. Alternatively, we use different sub-sets of the mutual fund universe. That said, Khorana et al. included two dummy variables for front end loads and back end loads, and these variables were statistically insignificant in estimations using objective-adjusted returns, as are used herein. This suggests that the type of mutual fund may not be driving the difference in results. On the other hand, no load funds generally experience higher volumes of net inflows due to the lack of speed bumps or tolls that might deter hot money (ICI). Accordingly, our results

might be interpreted as a potential extreme case of how managerial investments might fluctuate across time in response to both managerial and fund characteristics.

Second, considerable nuance emerges when examining results for single vs. team-managed funds and individual years. First, the impact of managerial ownership may be more meaningful when a fund has a solo manager, who may feel a greater need to align incentives. Evans (2008) therefore examined only single manager funds. Alternatively, when there are two or more managers, peer pressure may result in average managerial ownership rising. Single managed funds are examined in column 5 and team managed funds are examined in column 6. Our approach is consistent with that of Khorana et al. (2007) who pooled all funds and then conducted separate analyses of solo and team managed funds.

When examining the sheer level of investments (Panel A), the distinction between single and team managed funds is insignificant as managerial investment is insignificant in each regression. However, when managerial investment is scaled by fund size to ascertain the magnitude of managerial influence over the fund (Panel B), the effect is consistently negative and highly significant in both specifications. Intriguingly, the magnitude of the effect is slightly larger in the funds with solo managers, which may reflect some sort of idiosyncratic managerial effect.

Third, perhaps the years we examine (2006-2010) are fundamentally different from the years they examine (2001-2005). To that end, we engage in several robustness tests, which are presented in Columns 7-9 of each panel of Table 2. The 2008 results, reported in column 8, appear to be different from the other years, which is consistent with the sharp gyrations in the world-wide equity markets in that calendar year. Managerial ownership exerts a much larger negative effect on fund returns in that year, which would be consistent with managerial loss

aversion (see Panels A and B). This result is at odds with Fu and Wedge (2011) who report that managerial ownership at the end of 2004 is associated with a reduced disposition effect during the period 2002-2004.

Next, complementary evidence is obtained from an examination of the impact of managerial non-investment. If managerial investment is consistently associated with lower fund performance, than managerial non-investment should be associated with insignificantly different or stronger fund performance. Panel C reveals that this is the case.

The managerial ownership data must now be hand collected. As that is a very labor-intensive process, we began by collecting only the most recent data for the funds that were listed in a 2009 Value Line report. Because we later expanded the dataset backwards, that injects a survival bias into the dataset. We therefore find it interesting that even among the funds that survived until at least 2009, there is a strong, consistent negative relationship between performance and managerial ownership. In other words, this bias would argue against our finding such strong results, and suggests that managerial ownership may be a very expensive activity that investors should shy away from.

When the dependent variable is excess returns, the story becomes much more nuanced (Table 3). It is no longer unambiguously detrimental for managers to invest in their funds but, when there is a significant effect, it remains negative. Moreover, the circumstances under which this result is obtained are slightly different, suggesting that the results obtained from regressions with nominal fund returns are not spurious. If managerial investment is measured in dollars (panel A), there is limited evidence that it may be associated with lower fund performance (models 2 and 4) and the impact is greater than observed earlier in Table 2. However, when managerial investment is scaled by fund size (panel B), managerial investment is consistently

negatively and strongly significantly associated with fund performance. This result is obtained in six of the nine models shown, suggesting it is a persistent relationship. Interestingly, team managed funds displayed a significant negative relationship between fund performance and managerial ownership when returns are in nominal terms but not when adjusted for fund objective. Also, in Table 2 Panel B there was a negative relationship between managerial investment and fund performance only in calendar year 2008 while Table 3 Panel B shows that the single year effect is present only in calendar year 2009. This suggests that the deleterious impact of managerial ownership on fund performance is persistent across time.

The negative correlation of fund performance and managerial ownership suggests there may be an omitted variable bias. Perhaps, skin in the game works precisely as predicted by theory, but only when total compensation is observed. If the unobservable part of the package is negatively correlated with the observable part then the estimated sign of the coefficient on ownership would flip. This situation could occur if managers' wealth becomes more tied to fund performance through unobservable mechanisms such as bonuses and then they try to reduce their investment to avoid having too much personal and human capital concentrated in the fund. This story strongly parallels the findings of Fahlenbrach and Stulz (2011) that banks with CEOs whose incentives were better aligned with shareholder interests achieved similar or worse performance than their peers.

The interpretation of the control variables is largely as expected. Expense ratios are fairly strongly associated with higher nominal returns (Table 2) but insignificantly related to excess returns (Table 3). Older funds do appear to have slightly lower returns, both nominal and style-adjusted, and this is sometimes offset by the impact of fund size. While older funds tend to be larger funds, these two variables are not overly correlated in this sample (correlation = 0.22).

A number of studies have found an inverse relation between performance and fund size (e.g., Yan, 2008, and Adams et al., 2009), and we find an inconsistent relationship between performance and fund size with the fund size variable flipping in sign and generally being statistically insignificant. We find that nominal fund performance is weakly positively related to family size but that excess fund performance, a fund's key objective, is not significantly related to fund family size. This is consistent with a number of studies that have shown no decline in performance as the size of the fund family increases (e.g., Chen et al., 2004, and Pollett and Wilson, 2008).

Larger boards are often associated with slightly lower returns. Mutual fund boards are only charged with deciding whether or not to renew the fund adviser contracts, so this result may suggest that the larger board size makes it harder for members to reach consensus decisions regarding managerial tenure. While several studies have found evidence of better performance by funds with more independent boards (e.g., Wermers and Ding, 2005), board independence is statistically insignificant in all regressions. This is probably an artifact of the SEC ruling that took effect in 2006 requiring that boards be at least 75% independent in the hopes that it would mitigate conflicts of interest and improve fund performance. Our result is consistent with several studies of the mutual fund industry that have also shown no relationship between board independence and performance (e.g., Ferris and Yan, 2007).

Most studies of mutual fund performance do not include characteristics of CEOs such as whether the CEO sits on the board of directors or CEO duality whereby the CEO is also chair of the board. This may stem from the fact that these variables are often perfectly, or nearly perfectly, correlated. However, this is not the case in our dataset. Accordingly, we include these two variables in Models 3 and 4 to test the hypothesis that CEOs may be particularly inclined to

invest in their own funds, or they may set family or fund-specific policies that mandate non-zero managerial investment. These two variables are statistically insignificant in all tests, which suggests that the impact of managerial investment stems from managerial or fund characteristics, and not those of the CEO.

5.2. Fees

Rational investors want to maximize their returns while minimizing associated costs such as expense and management fees. To that extent, we therefore estimate equation [2] where fees could be implemented as expense fees (Table 4) or management fees (Table 5). The focal independent variable is total managerial ownership as a percentage of funds under management. Fund returns in the prior year are included as a control variable, with Panel A reporting results using nominal returns and Panel B reporting results using excess returns.

Managerial ownership is insignificantly associated with both types of fees in all specifications except in calendar year 2009. In 2009 managerial ownership was consistently associated with higher expense and management fees. This is tricky to understand as management fees fell throughout the period under examination for the firms in the dataset while expense fees fell from 1.03 basis points in 2006 to 1.01 basis points in 2007 and 2008 before rising to 1.05 basis points in 2009. Thus, the impact of managerial ownership does not appear to stem entirely from the higher value of the expense ratio in that year.

Higher fees appear to be strongly associated with prior year fund performance in most models. Older funds, larger funds, and funds that belong to larger fund families tend to charge lower fees. More independent boards are strongly associated with lower management fees but appear to have no impact on expense fees. This appears to be strongly consistent with the fact that boards' sole responsibility is to decide whether to continue or terminate the management

company's contract. Expense fees are higher when the CEO sits on the board but this effect is fully offset when the CEO is also chair of the board. Thus, in the roughly 1/3 of funds where the CEO is chair, the CEO's presence is associated with lower fees while in the roughly 1/3 of funds where the CEO is on the board but is not the chair, the CEO's presence is associated with higher fees. The CEO's presence appears to have no effect on management fees.

5.3 Determinants of managerial investment

We now estimate equation [3] using two different measures of the dependent variable, managerial ownership. In Panel A managerial ownership is measured in dollars, while in Panel B the ownership level is scaled by the fund size. Since the dollar value of managerial ownership for an individual manager can take only one of six values corresponding to the six different bins established by the SEC, this equation ought to be estimated by multinomial logit for single manager funds when ownership is measured in dollars. However, nearly half the funds in the dataset have more than one manager. In these funds, the value of managerial ownership can assume many more levels as each manager may have different levels of ownership. Accordingly, our use of OLS to estimate equation [3] may cause the standard errors to be over-estimated and thus biases against our finding statistical significance.

The dollar amount of managerial investment appears to be weakly higher for funds that have higher expense fees, which may suggest a managerial sense of obligation to signal an alignment of interests. That is, managers may believe that if they are going to charge investors more, they must appear to share the concerns of these investors. The level of ownership is strongly significantly higher at older and larger funds but is not affected by family size. This

may reflect a survival bias as well as the possibility that the managers of these funds have also had longer employment tenures.[4]

In Panel B we present results from estimation where managerial ownership is expressed as a percentage of assets under management. In these tests we find that managerial ownership is slightly lower in funds with higher nominal returns but insignificantly affected by excess returns. This suggests that managers may invest more when it appears their fund is out-performing but before they learn how their competitors have done as well. Again, managers do appear to invest significantly more when expense fees are higher. Fund size is strongly negatively associated with the level of managerial ownership when past returns are measured in nominal terms but is strongly positive when returns are measured in excess terms. This suggests that managerial incentive alignment may be occurring, and that it is easiest for managers to do this when they have more assets available to invest. It is unclear whether this suggests that the managers believe they've picked more winners or is simply a scale effect whereby the larger fund size means that the managers can hold a more diversified portfolio, and the managers find this appealing for personal gain.

6. Conclusion

We make two contributions to the literature. First, the nascent literature on managerial investment in mutual funds has used only cross-sectional data and presumed that the investment levels would be non-decreasing in time. By creating a panel dataset spanning four years we are able to document that there is considerable year-to-year variation in the level of managerial investment. This then suggests that the earlier work may merit further examination. Second, we

[4] In robustness tests not reported herein the variables total and average managerial tenure were also included. Neither variable was statistically significant in tests.

then revisit the question of how mutual funds are affected by managerial investments. We find that fund performance is significantly lower when managers co-invest in the funds, and that this result is robust across multiple specifications. Expense and management fees are insignificantly affected by managerial ownership.

The observed relationship between portfolio manager ownership and fund performance and fees is inconsistent with the hypothesis that more skin in the game increases the alignment of fund managers' interests with those of their shareholders. It also suggests that, leaving aside questions of privacy, the SEC disclosure requirements may be valuable to the investment community because they carry predictive power regarding fund performance even if the directionality is precisely the opposite of what they had expected.

The results reported herein also strongly parallel those of the broad empirical literature on the relationship between managerial ownership and firm performance. While most studies have found a positive relationship indicating managerial alignment at low ownership levels, most have also found that the relationship is non-monotonic (e.g., Morck et al., 1988; McConnell and Servaes, 1990). On the other hand, Demsetz and Villalonga (2001) find no relationship between managerial ownership and firm performance.

While we document a strong relationship between performance and managerial ownership, we do not determine the direction of causality. It is unclear whether better intra-year fund performance causes managers to decrease their year-end ownership stake and, presumably, diversify their investments, consistent with the idea that some managers have greater skills (Chevalier and Ellison, 1999) and Kacperczyk et al. (2011)'s finding that the top managers are able to time their purchases and sales to lock in gains and minimize losses. Alternatively, on the contrary, managerial over-confidence may lead managers to invest more in their funds and then

refrain from selling stocks. Fu and Wedge (2011) argue find that managerial investments are associated with a reduced disposition effect using a cross-section of ownership data from 2004. We hope these questions can be addressed in future research.

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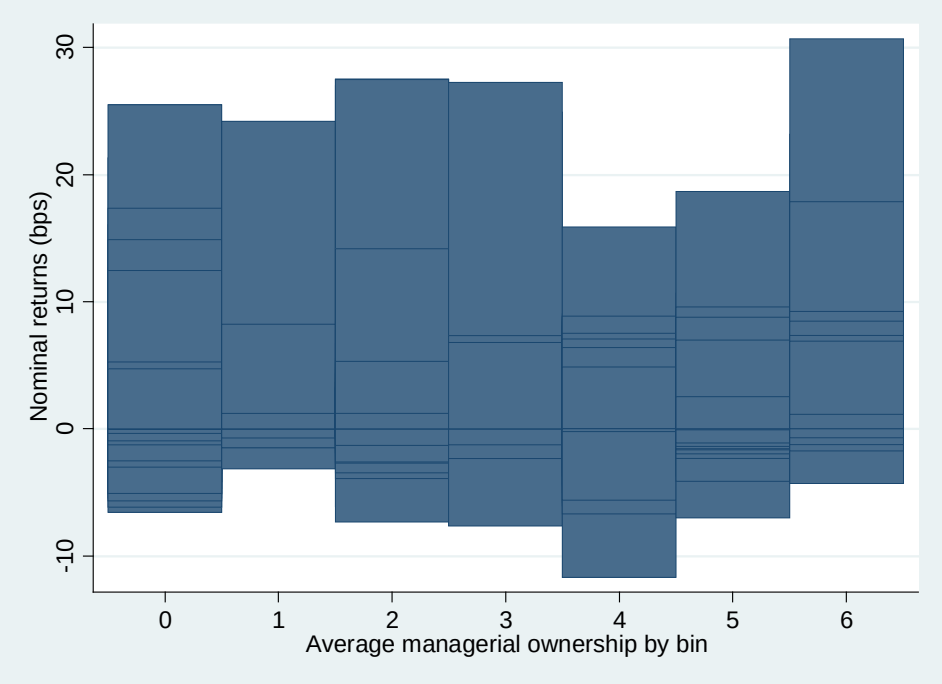
Graph 1: Nominal fund returns vs. managerial ownership



Graph 2: Excess fund returns vs. managerial ownership

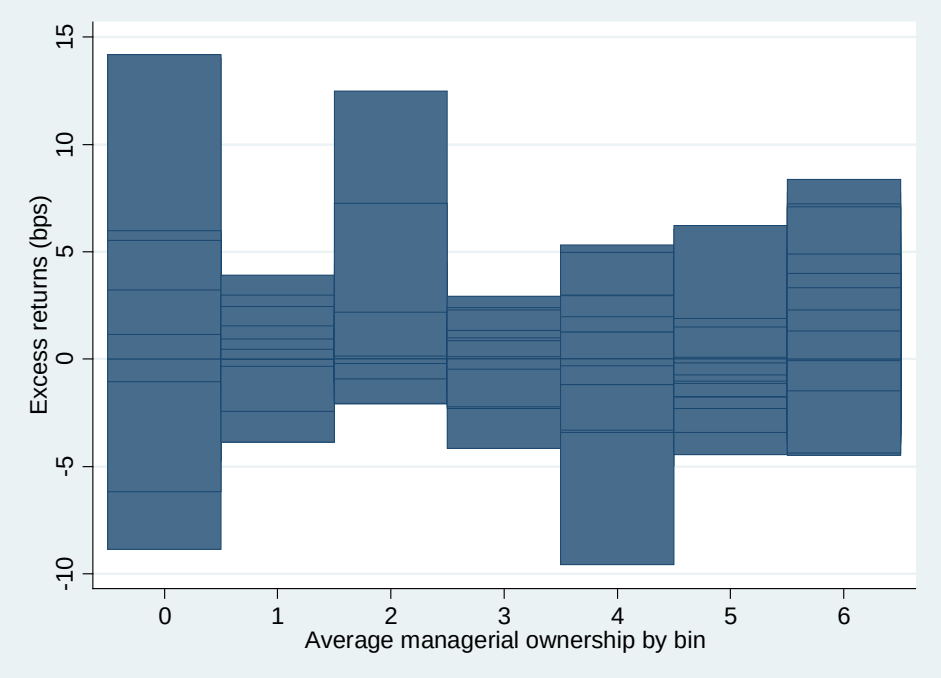


Table 1. Summary Statistics

Panel A: All data

Variable	Definition	Mean	S.D.	Min	Max	Obs
Total ownership	Total amount invested in fund by all managers; US$ mn. Values recorded using method described in the text.	0.664	0.836	0	5.750	1720
Total ownership as percent	Total amount invested in fund by all managers divided by total assets under management as obtained from CRSP.	0.001	0.006	0	0.166	1719
Average total ownership	Total ownership divided by total number of managers.	0.418	0.395	0	1.000001	1720
Number of managers	Number of managers at the firm as listed in the fund's filing with the SEC.	1.881	1.233	1	7	1641
% of funds where managers have $0 investments	Fraction of all observations where total ownership is $0.	0.210	0.408	0	1	1720
Nominal returns	Nominal year-on-year returns reported by fund as recorded in CRSP; measured in basis points.	1.988	3.509	-11.679	30.677	1719
Excess returns	Style-adjusted excess returns using Lipper style classifications as recorded in CRSP; measured in basis points.	0.174	1.691	-9.585	14.196	1719
Expense ratio	Expense ratio as recorded in CRSP; measured in basis points.	1.025	0.406	0	2.97	1718
Management fees	Management fees as recorded in CRSP; measured in basis points.	68.798	28.885	0	202.9	1718
Fund age	Years since fund was first opened to investors.	20.040	15.594	0	85	1720
Fund size	Log of average total net assets under management; US$ mn as reported in CRSP.	7.579	1.483	1.619	12.119	1572
Board size	Number of individuals on board of directors.	2.108	0.337	1.099	2.773	1660
Board independence	Fraction of directors who are independent	0.769	0.206	0.226	1	1550
Fund family size	Log of total average total net assets under management by fund family; US$ mn as reported in CRSP.	10.567	2.123	1.903	13.842	1720
CEO on board	Dummy for whether the CEO sits on the board	0.635	0.482	0	1	1644
CEO is chairman	Dummy for whether the CEO also chairs the board	0.387	0.487	0	1	1644

Panel B: Means of key variables by level of ownership

Variable	Bin 0: $0	Bin 1: $1-$10,000	Bin 2: $10,001-$50,000	Bin 3: $50,001-$100,000	Bin 4: $100,001-$500,000	Bin 5: $500,001-$1,000,000	Bin 6: $1,000,001+
# of observations	362	39	114	85	444	278	398
Number of managers	1.765	2.026	1.939	1.741	2.077	2.496	1.204
Nominal returns	2.004	2.281	2.319	2.207	1.681	2.107	2.060
Excess returns	0.202	0.155	0.333	-0.007	0.078	0.141	0.274
Expense ratio	0.985	0.927	0.928	0.992	1.050	1.087	1.035
Management fees	63.955	53.503	56.968	68.412	71.042	71.678	73.659
Fund age	16.660	14.897	18.430	23.824	20.881	23.496	19.920
Fund size	7.187	6.673	7.291	7.403	7.464	8.065	7.912
Board size	2.080	2.108	2.214	2.153	2.121	2.080	2.099
Board independence	0.761	0.851	0.781	0.747	0.750	0.795	0.771
Fund family size	10.673	10.410	11.122	10.647	10.476	10.302	10.596
CEO board	0.544	0.605	0.645	0.718	0.651	0.645	0.673
CEO chair	0.356	0.211	0.421	0.388	0.406	0.322	0.448

Table 2. The impact of managerial investment on nominal fund returns. Year and fund objective fixed effects and a constant term are included in all regressions; standard errors are in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

Panel A: Managerial investment is measured in dollar terms.

	1	2	3	4	5	6	7
	Baseline	Complete	1 Manager	Team Managed	2007	2008	2009
Lagged total ownership	-0.096	-0.112*	-0.096	-0.014	0.019	-0.209*	-0.127
	(0.062)	(0.065)	(0.212)	(0.081)	(0.114)	(0.124)	(0.098)
Expense ratio	-0.012	-0.021	-0.103	0.132	0.474	-0.116	-0.010
	(0.161)	(0.160)	(0.333)	(0.214)	(0.386)	(0.387)	(0.277)
Fund age	-0.004	-0.004	-0.004	-0.006	0.015**	-0.021**	-0.002
	(0.004)	(0.004)	(0.006)	(0.005)	(0.006)	(0.009)	(0.004)
Lagged fund size	0.104**	0.104**	0.212***	0.027	-0.130**	0.436***	0.064
	(0.049)	(0.050)	(0.071)	(0.078)	(0.060)	(0.102)	(0.063)
Board size	-0.559**	-0.578**	-0.168	-0.635	-0.307	-1.217***	-0.170
	(0.251)	(0.252)	(0.338)	(0.400)	(0.508)	(0.457)	(0.346)
Board independence	0.005	-0.111	0.265	-0.056	-0.587	0.981	-0.110
	(0.319)	(0.336)	(0.471)	(0.444)	(0.563)	(0.643)	(0.437)
Fund family size	0.037	0.043	-0.029	0.043	0.007	-0.001	0.104
	(0.041)	(0.043)	(0.060)	(0.055)	(0.093)	(0.074)	(0.063)
CEO on board		-0.207					
		(0.223)					
CEO is chairman		0.034					
		(0.150)					
R^2	0.360	0.359	0.333	0.418	0.559	0.846	0.745
N	976	967	536	440	304	311	361

Panel B: Managerial investment as percent of total assets under management

	1	2	3	4	5	6	7
	Baseline	Complete	1 Manager	Team Managed	2007	2008	2009
Lagged total ownership	-14.07*	-14.42*	-8.044	-19.17	5.703	-50.76	-15.09
	(7.409)	(7.484)	(15.30)	(13.29)	(16.68)	(46.98)	(14.87)
Expense ratio	-0.017	-0.024	-0.124	0.138	0.471	-0.077	-0.032
	(0.162)	(0.162)	(0.312)	(0.210)	(0.381)	(0.387)	(0.276)
Fund age	-0.005	-0.004	-0.004	-0.006	0.015**	-0.022**	-0.002
	(0.004)	(0.004)	(0.006)	(0.005)	(0.006)	(0.010)	(0.004)
Lagged fund size	0.065	0.062	0.196***	-0.000006	-0.120*	0.324***	0.014
	(0.047)	(0.048)	(0.068)	(0.067)	(0.072)	(0.105)	(0.070)
Board size	-0.551**	-0.560**					
	(0.248)	(0.248)					
Board independence	-0.007	-0.092					
	(0.315)	(0.332)					
Fund family size	0.044	0.049	-0.026	0.049	0.006	0.023	0.114*
	(0.040)	(0.043)	(0.059)	(0.055)	(0.095)	(0.075)	(0.064)
CEO on board		-0.187					
		(0.224)					
CEO is chairman		0.051					
		(0.151)					
R^2	0.360	0.358	0.333	0.418	0.559	0.847	0.744
N	976	967	536	440	304	311	361

Panel C: Managerial non-investment.

	1	2	3	4	5	6	7
	Baseline	Complete	1 Manager	Team Managed	2007	2008	2009
Lagged total ownership	-0.177	-0.196	-0.019	-0.526	-0.665	0.106	0.031
	(0.334)	(0.337)	(0.437)	(0.457)	(0.424)	(0.346)	(0.222)
Expense ratio	-0.058	-0.071	-0.149	0.142	0.461	-0.157	-0.049
	(0.171)	(0.171)	(0.338)	(0.218)	(0.380)	(0.400)	(0.279)
Fund age	-0.005	-0.005	-0.004	-0.009*	0.014**	-0.022**	-0.002
	(0.004)	(0.004)	(0.006)	(0.005)	(0.006)	(0.010)	(0.004)
Lagged fund size	0.075*	0.071	0.202***	0.012	-0.155**	0.387***	0.031
	(0.044)	(0.045)	(0.070)	(0.066)	(0.066)	(0.097)	(0.066)
Board size	-0.547**	-0.558**	-0.161	-0.640	-0.361	-1.192**	-0.151
	(0.249)	(0.249)	(0.334)	(0.390)	(0.511)	(0.461)	(0.346)
Board independence	-0.035	-0.137	0.288	-0.159	-0.667	0.899	-0.161
	(0.320)	(0.335)	(0.461)	(0.456)	(0.571)	(0.650)	(0.451)
Fund family size	0.041	0.046	-0.028	0.043	0.017	0.010	0.109*
	(0.040)	(0.042)	(0.059)	(0.055)	(0.094)	(0.073)	(0.064)
CEO on board		-0.194					
		(0.227)					
CEO is chairman		0.035					
		(0.152)					
R^2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	0.360	0.358	0.333	0.420	0.570	0.846	0.744

Table 3. The impact of managerial investment on style-adjusted excess fund returns. Year and fund objective fixed effects and a constant term are included in all regressions; standard errors are in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

Panel A: Managerial investment is measured in dollar terms.

	1	2	3	4	5	6	7
	Baseline	Complete	1 Manager	Team Managed	2007	2008	2009
Lagged total ownership	-0.125**	-0.138**	-0.115	-0.066	0.019	-0.209*	-0.127
	(0.060)	(0.063)	(0.197)	(0.081)	(0.114)	(0.124)	(0.098)
Expense ratio	0.051	0.056	-0.165	0.261	0.474	-0.116	-0.010
	(0.145)	(0.145)	(0.290)	(0.202)	(0.386)	(0.387)	(0.277)
Fund age	-0.003	-0.003	-0.002	-0.007	0.015**	-0.021**	-0.002
	(0.004)	(0.004)	(0.006)	(0.005)	(0.006)	(0.009)	(0.004)
Lagged fund size	0.119***	0.120**	0.191***	0.096	-0.130**	0.436***	0.064
	(0.045)	(0.046)	(0.066)	(0.073)	(0.060)	(0.102)	(0.063)
Board size	-0.537**	-0.554**	0.113	-0.853**	-0.307	-1.217***	-0.170
	(0.226)	(0.226)	(0.315)	(0.399)	(0.508)	(0.457)	(0.346)
Board independence	0.049	-0.008	0.271	-0.194	-0.587	0.981	-0.110
	(0.322)	(0.322)	(0.533)	(0.425)	(0.563)	(0.643)	(0.437)
Fund family size	0.031	0.032	-0.061	0.047	0.007	-0.001	0.104
	(0.036)	(0.037)	(0.052)	(0.049)	(0.093)	(0.074)	(0.063)
CEO on board		-0.190					
		(0.216)					
CEO is chairman		0.093					
		(0.129)					
R^2	0.109	0.112	0.137	0.124	0.223	0.317	0.146
N	976	967	536	440	304	311	361

Panel B: Managerial investment as percent of total assets under management

	1	2	3	4	5	6	7
	Baseline	Complete	1 Manager	Team Managed	2007	2008	2009
Lagged total ownership	-18.80**	-19.67**	-7.564	-25.99**	5.703	-50.76	-15.09
	(7.790)	(7.734)	(13.28)	(9.992)	(16.68)	(46.98)	(14.87)
Expense ratio	0.046	0.056	-0.195	0.264	0.471	-0.077	-0.032
	(0.144)	(0.147)	(0.264)	(0.197)	(0.381)	(0.387)	(0.276)
Fund age	-0.004	-0.004	-0.002	-0.008*	0.015**	-0.022**	-0.002
	(0.004)	(0.004)	(0.006)	(0.005)	(0.006)	(0.010)	(0.004)
Lagged fund size	0.067	0.066	0.173***	0.040	-0.120*	0.324***	0.014
	(0.043)	(0.044)	(0.063)	(0.056)	(0.072)	(0.105)	(0.069)
Board size	-0.527**	-0.533**					
	(0.224)	(0.223)					
Board independence	0.034	0.020					
	(0.318)	(0.316)					
Fund family size	0.041	0.039	-0.058	0.058	0.006	0.023	0.114*
	(0.035)	(0.036)	(0.052)	(0.047)	(0.095)	(0.075)	(0.064)
CEO on board		-0.166					
		(0.216)					
CEO is chairman		0.116					
		(0.130)					
R^2	0.108	0.110	0.137	0.126	0.224	0.319	0.143
N	976	967	536	440	304	311	361

Panel C: Managerial non-investment.

	1	2	3	4	5	6	7
	Baseline	Complete	1 Manager	Team Managed	2007	2008	
Lagged total ownership	-0.060	-0.073	0.067	-0.331	-0.665	0.106	
	(0.199)	(0.198)	(0.234)	(0.239)	(0.424)	(0.346)	
Expense ratio	0.011	0.014	-0.189	0.261	0.461	-0.157	
	(0.148)	(0.150)	(0.263)	(0.202)	(0.380)	(0.400)	
Fund age	-0.004	-0.004	-0.002	-0.010**	0.014**	-0.022**	
	(0.004)	(0.004)	(0.006)	(0.005)	(0.006)	(0.010)	
Lagged fund size	0.086**	0.084**	0.182***	0.064	-0.155**	0.387***	
	(0.040)	(0.042)	(0.063)	(0.056)	(0.066)	(0.097)	
Board size	-0.523**	-0.529**	0.116	-0.838**	-0.361	-1.192**	
	(0.226)	(0.226)	(0.310)	(0.392)	(0.511)	(0.461)	
Board independence	-0.0003	-0.030	0.279	-0.297	-0.667	0.899	
	(0.321)	(0.321)	(0.521)	(0.423)	(0.571)	(0.650)	
Fund family size	0.037	0.036	-0.059	0.051	0.017	0.010	
	(0.035)	(0.036)	(0.052)	(0.047)	(0.094)	(0.073)	
CEO on board		-0.162					
		(0.217)					
CEO is chairman		0.095					
		(0.132)					
R^2	0.106	0.109	0.137	0.127	0.243	0.313	
N	976	967	536	440	304	311	

Table 4. The impact on expense fees of total managerial ownership. Year and fund objective fixed effects and a constant term are included in all regressions; standard errors are in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

Panel A: Returns are expressed in nominal terms.

	Baseline	Complete	1 Manager	Team Managed	2007	2008	2009
Total ownership	0.046	0.043	0.170**	0.017	0.040	0.043	0.053
	(0.035)	(0.036)	(0.079)	(0.040)	(0.038)	(0.039)	(0.037)
Lagged returns	-0.0006	-0.001	-0.005**	0.006	-0.017	0.022	-0.010
	(0.002)	(0.001)	(0.002)	(0.004)	(0.020)	(0.018)	(0.008)
Fund age	-0.003*	-0.003*	-0.002	-0.004	-0.003**	-0.0032*	-0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Lagged fund size	-0.009	-0.012	-0.017	0.0005	-0.009	-0.004	-0.010
	(0.013)	(0.013)	(0.015)	(0.021)	(0.016)	(0.014)	(0.015)
Board size	0.273**	0.272**	0.346***	0.236	0.294*	0.299**	0.223*
	(0.127)	(0.104)	(0.116)	(0.194)	(0.149)	(0.138)	(0.126)
Board independence	0.066	-0.009	0.080	0.140	0.067	0.044	0.101
	(0.117)	(0.129)	(0.118)	(0.227)	(0.128)	(0.121)	(0.129)
Fund family size	-0.099***	-0.085***	-0.096***	-0.096***	-0.099***	-0.098***	-0.098***
	(0.020)	(0.020)	(0.021)	(0.034)	(0.023)	(0.021)	(0.019)
CEO on board		0.102**					
		(0.051)					
CEO is chairman		-0.184**					
		(0.080)					
R^2	0.439	0.462	0.572	0.451	0.467	0.454	0.439
N	975	966	535	440	303	311	361

Panel B: Returns are estimated as the excess of average return for the investment objective style.

	Baseline	Complete	1 Manager	Team Managed	2007	2008	2009
Total ownership	0.046	0.043	0.172**	0.017	0.040	0.043	0.053
	(0.035)	(0.036)	(0.079)	(0.040)	(0.038)	(0.039)	(0.037)
Lagged returns	-0.001	-0.003	-0.012**	0.010	-0.021	0.022	-0.009
	(0.005)	(0.005)	(0.006)	(0.010)	(0.022)	(0.018)	(0.009)
Fund age	-0.003*	-0.003*	-0.002	-0.004	-0.003**	-0.003*	-0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Lagged fund size	-0.009	-0.012	-0.016	0.001	-0.009	-0.004	-0.010
	(0.013)	(0.013)	(0.015)	(0.021)	(0.016)	(0.014)	(0.015)
Board size	0.273**	0.270**	0.343***	0.241	0.293*	0.299**	0.224*
	(0.128)	(0.104)	(0.116)	(0.198)	(0.149)	(0.137)	(0.126)
Board independence	0.066	-0.010	0.081	0.140	0.064	0.044	0.100
	(0.117)	(0.129)	(0.117)	(0.228)	(0.129)	(0.121)	(0.129)
Fund family size	-0.099***	-0.085***	-0.096***	-0.096***	-0.099***	-0.098***	-0.098***
	(0.020)	(0.020)	(0.021)	(0.035)	(0.023)	(0.021)	(0.019)
CEO on board		0.102**					
		(0.051)					
CEO is chairman		-0.185**					
		(0.080)					
R^2	0.439	0.463	0.573	0.451	0.467	0.453	0.439
N	975	966	535	440	303	311	361

Table 5. The impact on management fees of total managerial ownership. Year and fund objective fixed effects and a constant term are included in all regressions; standard errors are in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

Panel A: Returns are expressed in nominal terms.

	Baseline	Complete	1 Manager	Team Managed	2007	2008	2009
Total ownership	3.075	2.154	11.00**	3.693	1.998	2.497	4.692*
	(2.303)	(1.913)	(5.117)	(2.413)	(2.442)	(2.518)	(2.504)
Lagged returns	0.245	0.257*	-0.138	0.659**	-0.202	1.669**	0.185
	(0.156)	(0.153)	(0.121)	(0.261)	(1.401)	(0.736)	(0.601)
Fund age	-0.060	-0.043	-0.103	-0.060	-0.068	-0.054	-0.072
	(0.101)	(0.099)	(0.121)	(0.158)	(0.111)	(0.116)	(0.101)
Lagged fund size	-1.093	-1.120	0.274	-1.877	-0.755	-1.160	-1.195
	(0.823)	(0.804)	(1.105)	(1.220)	(0.918)	(0.963)	(0.966)
Board size	7.565	6.726	13.26**	5.231	8.301	9.031	5.677
	(5.579)	(5.117)	(6.127)	(8.091)	(6.802)	(6.420)	(5.299)
Board independence	-19.83***	-23.48***	-9.240	-27.15***	-20.19***	-22.41***	-16.80***
	(6.153)	(6.997)	(6.880)	(10.29)	(6.652)	(7.170)	(6.257)
Fund family size	-7.813***	-7.197***	-7.358***	-8.604***	-8.167***	-7.780***	-7.484***
	(0.987)	(1.018)	(1.003)	(1.325)	(1.128)	(1.110)	(0.980)
CEO on board		4.447					
		(3.135)					
CEO is chairman		-6.947					
		(4.262)					
R^2	0.585	0.598	0.677	0.612	0.616	0.596	0.580
N	975	966	535	440	303	311	361

Panel B: Returns are estimated as the excess of average return for the investment objective style.

	Baseline	Complete	1 Manager	Team Managed	2007	2008	2009
Total ownership	3.081	2.158	10.98**	3.701	2.007	2.491	4.699*
	(2.303)	(1.908)	(5.118)	(2.415)	(2.437)	(2.517)	(2.501)
Lagged returns	0.629*	0.648*	-0.130	1.330**	-0.341	1.671**	0.271
	(0.364)	(0.356)	(0.297)	(0.607)	(1.393)	(0.730)	(0.609)
Fund age	-0.059	-0.042	-0.102	-0.057	-0.068	-0.054	-0.070
	(0.101)	(0.098)	(0.121)	(0.157)	(0.111)	(0.116)	(0.101)
Lagged fund size	-1.120	-1.144	0.270	-1.870	-0.757	-1.161	-1.218
	(0.818)	(0.799)	(1.102)	(1.204)	(0.919)	(0.963)	(0.964)
Board size	7.854	7.016	13.28**	6.026	8.291	9.020	5.826
	(5.584)	(5.107)	(6.114)	(8.219)	(6.793)	(6.418)	(5.301)
Board independence	-19.77***	-23.34***	-9.257	-26.98**	-20.29***	-22.41***	-16.88***
	(6.134)	(6.949)	(6.889)	(10.36)	(6.654)	(7.166)	(6.238)
Fund family size	-7.818***	-7.213***	-7.360***	-8.674***	-8.171***	-7.781***	-7.493***
	(0.986)	(1.019)	(1.003)	(1.334)	(1.124)	(1.110)	(0.982)
CEO on board		4.452					
		(3.104)					
CEO is chairman		-6.833					
		(4.247)					
R^2	0.586	0.599	0.677	0.614	0.616	0.596	0.580
N	975	966	535	440	303	311	361

Table 6. Determinants of the total managerial investment in a fund expressed as a percentage of fund size. Year and fund objective fixed effects and a constant term are included in all regressions; standard errors are in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

Panel A: Level of managerial ownership (US$mn)

	Nominal returns		Excess returns	
	Baseline	Full	Baseline	Full
Lagged returns	0.00297	0.00338	-0.0000646	-0.0000570
	(0.00413)	(0.00377)	(0.0000467)	(0.0000444)
Expense fees	0.274*	0.254	0.00180***	0.00204**
	(0.160)	(0.170)	(0.000662)	(0.000861)
Fund age	0.00702*	0.00737*	0.00000956	0.00000917
	(0.00397)	(0.00396)	(0.0000129)	(0.0000134)
Lagged fund size	0.251***	0.239***	-0.00115***	-0.00113***
	(0.0851)	(0.0788)	(0.000439)	(0.000415)
Board size	-0.114	-0.182	-0.000376	-0.000408
	(0.215)	(0.215)	(0.000673)	(0.000697)
Board independence	0.379	0.107	0.00190	0.00238
	(0.394)	(0.268)	(0.00136)	(0.00196)
Family size	-0.0460	-0.0233	0.000299*	0.000241
	(0.0333)	(0.0425)	(0.000170)	(0.000161)
CEO on board		-0.228		-0.000477
		(0.202)		(0.000437)
CEO is chairman		-0.0334		0.00101
		(0.178)		(0.00112)
R^2	0.292	0.303	0.239	0.245
N	975	966	975	966

Panel B: Level of managerial ownership (percent of assets under management)

	Nominal returns		Excess returns	
	Baseline	Full	Baseline	Full
Lagged returns	-0.0000229	-0.0000210	0.00168	0.00327
	(0.0000170)	(0.0000158)	(0.0109)	(0.0101)
Expense fees	0.00180***	0.00204**	0.274*	0.254
	(0.000663)	(0.000861)	(0.160)	(0.171)
Fund age	0.00000971	0.00000930	0.00701*	0.00737*
	(0.0000130)	(0.0000135)	(0.00397)	(0.00395)
Lagged fund size	-0.00116***	-0.00113***	0.251***	0.239***
	(0.000439)	(0.000416)	(0.0852)	(0.0790)
Board size	-0.000344	-0.000382	-0.116	-0.182
	(0.000678)	(0.000699)	(0.215)	(0.216)
Board independence	0.00190	0.00239	0.379	0.107
	(0.00136)	(0.00197)	(0.394)	(0.268)
Family size	0.000298*	0.000240	-0.0459	-0.0232
	(0.000169)	(0.000160)	(0.0333)	(0.0425)
CEO on board		-0.000477		-0.228
		(0.000437)		(0.202)
CEO is chairman		0.00102		-0.0332
		(0.00112)		(0.178)
R^2	0.238	0.245	0.292	0.303
N	975	966	975	966