Managerial Investment in Mutual Funds

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ABSTRACT

The SEC requires mutual fund managers to disclose annually investments in self-managed funds. We examine whether such investments align managerial and investor interests using a hand-collected panel dataset at nearly 400 no load funds. We believe we are the first to document and examine the time series variation in these investments. Managerial investment fluctuates markedly within funds, contrary to prior researchers' assumptions that the levels would be non-decreasing, and is not systematically related to fund characteristics. Fund returns are higher for solo-managed funds with managerial investment. On the other hand, team-managed funds have lower excess returns and management fees when managers invest more in the fund. These results suggest that managerial investment does not signal interest alignment but is rather an idiosyncratic personal decision.

Keywords: mutual funds, managerial ownership, fund governance, fund performance
JEL codes: G29, G32

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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] Thus, as of 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. These annual disclosures have garnered little subsequent public attention, with the *Wall Street Journal*, for example, publishing just one article on this topic – buried on an inside page, no less – in calendar year 2011 (Jaffe, 2011).

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. Nonetheless, 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

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

ownership is flat or rising over time and use a single cross-section of managerial ownership data to explain varying aspects of past, contemporaneous and future fund performance.

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 in excess of the fund's objective ("excess returns" or "objective-adjusted returns"). 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 (Braham, 2010). 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, which is consistent with the fact that director turnover is minimal, and thus directors may have greater long-term interest alignment.[2] However, as managerial tenure is often shorter than director tenure, it is unclear whether managers would behave similarly to directors.

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

[2] The SEC mandates disclosure of director ownership according to several bands, none of which are the same as the levels of the bands for disclosure of managerial ownership. For example, the top band for directors' ownership is more than $100,000 while the top band for managerial ownership is $1,000,000. This sort of complication makes it tricky to directly compare the literature on director ownership with that of managerial ownership. Moreover, Cremers et al. (2009) and Chen et al. (2008) use director ownership data from 2001 and 2002-03, respectively, with both periods preceding the SEC requirement that managerial investments be disclosed.

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 data on overall managerial wealth. In a related, 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 due perhaps to actual corporate performance that was below prior expectations. These studies both lay the groundwork for questioning whether skin in the game can align managerial and shareholder incentives over the long-term and highlight the need for using panel data on managerial ownership in such analysis.

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.

Now that managers have been required for many years to disclose their investments it is appropriate to re-examine the question of whether managerial investments are related to fund performance. Moreover, the Khorana et al. (2007) and Evans (2008) results both used a single year of data on managerial investments as that was all that was available at the time of their studies. It is now possible to examine how managerial investments fluctuate over time, and exploit the time series dimensionality of both fund characteristics and managerial investments.

We use a panel dataset detailing managerial ownership at nearly 400 no load mutual funds across 2006-2009. No load mutual funds have attracted the largest volume of net cash inflows in recent years (ICI), due in large part to the expansion of employer-sponsored

retirement plans during the last decade. We find that the average managerial investment stake is valued at $750,000 with the average mutual fund holding $1.5 billion in assets, which suggests that an alignment of interest story as laid out by Khorana et al. (2007) and Evans (2008) may not fully explain why managers invest in their mutual funds, and thus complicates the interpretation of a mutual fund manager's decision to invest in a self-managed fund.

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). The tremendous inter-temporal variation in the levels of managerial ownership suggests that fund managers may view their investment stake as an asset within their own personal diversified portfolios, or a co-investment, and not as a signal of managerial incentive alignment. This interpretation is consistent with Dimmock et al. (2011) who point out that managerial investment in the overarching investment management firm supports the incentive alignment theory while co-investment in an individual mutual fund might hold no such informational content. We then examine the determinants of managerial investments, and find that fund characteristics carry little explanatory power.

Second, we reveal that fund performance is insignificantly affected by the dollar level of a manager's investments. However, fund performance is significantly higher when solo managers own a higher share of the firm and the opposite is true among team-managed funds. This suggests that managerial investments may be interpreted by investors as a meaningful signal only when the manager can be clearly identified, as is the case at solo managed funds. 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 as funds receive more net inflows than can be invested at comparable yields.

Third, we explore the relationship between fund fees and ownership levels. This step is necessary as some investors may be less cognizant of the fees imposed by the fund or the fund family even while higher longer-term returns are associated with lower fees (Gruber, 1996). We find that both expense and management fees are generally unrelated to the level of managerial investment. However, team-managed funds have lower management fees when managerial investments are higher, which is consistent with an alignment of interests hypothesis.

Finally, we look at whether investors believe that managerial investment signals greater incentive alignment by exploring whether net asset inflows are related to the level of managerial investment. We find minimal evidence to support such a link, with the link positive when managerial investment is measured in dollars but negative when the investment is scaled by firm size. This suggests that investors want their managers to have an explicit vested interest in the fund's performance but they worry about the manager being overly cautious when they are entrenched in the fund. This result is counter-intuitive from a corporate governance perspective but yet is consistent with the literature on labor contracts. When labor contracts inefficiently reward performance and effort, individuals adjust their efforts and time allocations as they perceive to be optimal (e.g., Dewatripont, 1989; Holmstrom, 1983; Topel and Welch, 1986).

Section 2 discusses theoretical determinants of managerial investment. The data are described in Section 3. The empirical analysis of managerial investment is reported in Section 4. The theoretical performance implications of managerial investments are discussed in Section 5, and reported in Section 6. The relationship between fees and managerial investment is reported

in Section 7, while Section 8 examines the relationship between new asset inflows and managerial investment. Finally, we conclude in Section 9.

2. Managerial investments

There are five overarching theories that explain why a manager may invest in a self-managed fund: the employment, information, governance, personal considerations, and overconfidence. These five theories are now explored and their implications presented. After this theoretical overview, we discuss the process by which the managerial investment data is observed and the potential drawbacks associated with this data.

2.1. Theoretical explanations

First, some mutual fund families have one of two broad sets of policies governing managerial investment (Braham, 2010). The first type of policy is a strict co-investment requirement or expectations. For example, Fairholme Capital Management requires fund managers to co-invest in their funds while 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 co-investment requirements or expectations. The second broad policy is that 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. This theory thus supports the convergence of interest hypothesis, and suggests that fund performance would be increasing in the level of managerial investment. However, inasmuch as the managers

may instead regard such investments as being a fixed cost of continued employment, there may be no relationship between fund performance and the magnitude of such investments.

Second, a fund family may think that investors believe that manager's investments convey meaningful information and thus the level of managerial investments serves as a means of advertising for the fund. In this case, the level of a manager's investments may not be determined by the past performance or fees of a fund. However, if the fund family correctly identified how investors would react to the disclosures, we would expect fund performance and net asset inflows to consistently be higher when managerial investments are higher. The relationship between expense and management fees and managerial investment would be ambiguous as the managers themselves might prefer lower fees while the fund family might believe the advertising would reel in a new class of investors who are less sensitive to such fees.

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 (Dimmock et al., 2011). 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 versus with those of the fund itself. Given that the manager is hired by the fund advisory company it may be prudent for the manager to align their interests with those of the

overarching family while fund-specific investments may be less informative internal signals. Thus, analysis of the relationship between fund characteristics and managerial investments should include fund family fixed effects to capture the impact of family policy.

On the other hand, most fund families have no systematic policies governing managerial investment. This is often because 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. Thus, it is appropriate to explore the other theories for why a manager might invest in their own fund.

Third, the governance view, as espoused by the SEC in 2004, argues that managerial ownership may directly affect fund performance by incentive alignment whereby managers with more skin in the game invest more astutely, consistent with a reduction in agency costs (e.g., Jensen and Meckling, 1976; Mahoney, 2004). A manager's investments would therefore be related to past and future performance, and would be associated with a lower fee structure.

Fourth, personal career and financial considerations may be the sole determinants of a manager's investments in a self-managed fund. These lead to complementary but not identical predictions governing the determinants of a manager's investments and the long-term implications thereof. If managerial career concerns (i.e., job security) are sufficient to induce incentive alignment, then managerial investment in a mutual fund may carry little informational content to fund investors. If managerial investment is consistent with the incentive alignment theory there would be a positive relationship between fund returns and managerial ownership level and ownership levels would be non-decreasing. On the other hand, if the incentive alignment theory doesn't hold, there would be insignificant relationships between fund returns

and managerial ownership and between fund inflows and managerial ownership while ownership levels would follow no clear pattern over time.

Alternatively, personal financial considerations may suggest it would be inappropriate for a fund manager to invest in a particular 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. Moreover, managers often oversee simultaneously multiple funds which may have high degrees of overlap (e.g., domestic, international and purely foreign funds focusing on a specific industry), and thus it may be unrealistic for a manager to personally invest in each fund.

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 or for a manager to put all of their money into a sector-specific fund. 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. Thus, while the literature on managerial ownership in corporations suggests that low and high levels of managerial investment can cause an incentive alignment benefit or an entrenchment problem respectively (e.g., Morck et al., 1988), only the former may be relevant in the mutual fund context.

Finally, management ownership data may be 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 wealth may suffer from omitted variable bias. However, such data are not available and thus this potential problem is unavoidable. 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. This would be consistent with the literature on CEO overconfidence (e.g., Malmendier and Tate, 2005).

The governance, personal considerations, and overconfidence theories suggest that the level of investments reflects the personal unobservable characteristics of the managers of a mutual fund. As most mutual funds are team managed, it is therefore appropriate to include management team fixed effects in empirical analysis. When solo-managed funds are analyzed separately, such fixed effects can be interpreted more cleanly as managerial fixed effects.

2.2. Disclosures of managerial investment data

There is no 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. Thus, the data on managerial investments must be compiled manually from annual fund disclosures. 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. The variance in size and level of these bins leads to the use of two empirical approaches. First, we adopt the Khorana et al. (2007) process of assuming a representative value at the mean of each band, and of $1,000,001 for the top bin. Second, dummy variables are used to denote ownership levels within each bin.

While fund managers are required to disclose their year-end levels of investment in the funds, the disclosed levels 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 at the average level obtained in this dataset 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 the idiosyncratic motivation behind each manager's decision to invest or not in their own fund is not known, 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 CFA Institute used to conduct an annual compensation survey of portfolio managers but last conducted it in 2007, and is 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 complemented by data 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 interpretations: the larger managerial investment bins correspond to multiple years of income for many managers.

3. Data

The dataset is based on the list of approximately 800 mutual funds from the May 2009 "Value Line No-Load Fund Advisor Mutual Fund Directory". This data set was selected 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. Moreover, Value Line targets longer-term investors and thus it is appropriate for us to consider the longer-term returns associated with investments in these funds. We include only the equity funds for which managerial ownership data could be obtained for at least two years. The funds listed in Value Line's directory are matched with data from CRSP, Morningstar, and fund filings with the SEC. The resultant dataset includes 1,081 observations on 439 mutual funds, with 354-372 funds present in each year. This dataset represents roughly 5% of the CRSP universe in a given year.

3.1. Data source

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.[3] Separate analysis is conducted of solo and team-managed funds as solo managers may derive greater personal benefits from the informational value of signaling the level of their investment in the fund. Finally, data for each fund on the level of each manager's ownership stake, number of directors, and number of insiders on the board was hand-collected from Semi-Annual N-CSRS (Certified Shareholder Report) and 485 BPOS (Prospectus) filings.

Each of the studies on the relationship between fund performance and insider ownership shares a common limitation: sample size. As the data on managerial or director ownership must be hand-collected, each set of authors chose a sub-set of the mutual fund universe to analyze. Most of these studies end up with samples of roughly 400 mutual funds in a single year, or

[3] When manager information could not be obtained from Morningstar, the names were found from the SEC filings.

roughly 5% of the CRSP universe. For example, Evans (2008) analyzes solo-managed domestic equity mutual funds. Similarly, Chen et al. (2008) and Cremers et al. (2009) restrict their sample to the mutual funds that belonged to the largest mutual fund families as of a particular date or had listed toll-free customer service phone numbers within Morningstar. At the other extreme, Khorana et al. (2007) examined the broadest sample yet with coverage of all mutual funds, except money market funds, that filed annual reports between March and December 2005. They ended up with a sample of 1,406 funds in a single year, or roughly 20% of the CRSP universe.

Despite the vast differences in their sample sizes, all of these studies reached similar conclusions: fund performance is higher when motivated individuals – managers or directors – own shares in the fund. Thus, as these studies used insider ownership data from different points in time, it appears that the sub-samples analyzed in each study exhibit similar behavior across time. Moreover, Khorana et al.'s extensive results show that front-end and back-end load dummies are consistently statistically insignificant in most tests. While Khorana et al. report that a single manager dummy variable is always statistically insignificant, they also present separate analysis of solo-managed and team-managed funds that shows large differences in the impact on fund performance of managerial ownership and of the full vector of control variables.

A key distinction of the dataset used herein is that it was collected from an investor's perspective: focusing exclusively on funds listed in the Value Line survey, which is well-known to be extensively referenced by investors. This approach is in contrast to the standard academic approach of analyzing funds if and only if they have a specific characteristic, often an endogenous one, such as management by a large fund family or a narrow investment mandate (e.g., the Lipper fund objective code). In theory these two approaches should be complementary, and, at times, overlap. Thus, while one could critique our approach for not covering the entirety

of the CRSP universe, the studies that are most comparable to this one also did not do so. Moreover, the descriptive statistics presented in Table 1 suggest that the dataset used herein is similar to those of the related studies. For example, the average fund size in this dataset is $1.5 bn over 2006-2009 versus $1.41 bn in 2005 in Khorana et al. (2007) and $1.2 bn in 2001-2004 in Chen et al. (2008).

3.2. Managerial ownership

Khorana et al. (2007) and Evans (2008) greatly aided the profession by creating a baseline analysis of how mutual fund performance is related to managerial investment using managerial investment data collected in 2005. Now that it is possible to analyze multiple years of data on managerial investment, the nature of managerial investment can be re-examined. First, both sets of authors assumed that managerial investment would be non-decreasing across time due to a convergence of interests. However, we are able to document that managerial investment in fact varies markedly from year-to-year. As is shown in Panel A of Table 1, roughly one-third of all managerial investment stakes change in any given calendar year. The average ownership stake is measured as $414,000 in 2006, $412,000 in 2007, $417,000 in 2008, and $439,000 in 2009. Due to a large decrease in assets under management in 2008, a poor market year, managerial investment was worth 0.002% of fund size in 2008 versus 0.001% in all other years.

[INSERT TABLE 1 HERE]

Second, the managerial ownership distribution is relatively bifurcated as shown in Panel B of Table 1. Of the 1,048 observations in the dataset, 14.9% are fund-year observations in which the average managerial ownership stake is zero and 24.3% represent average manager ownership stakes of over $1,000,000. All empirical tests of the impact of managerial ownership are conducted with and without the inclusion of the funds managed by non-investors in order to

more carefully identify the impact of the level of a manager's investments. An average of 1.9 managers oversees each fund, and these funds have average total managerial ownership stakes of $750,000 constituting 0.001% of assets under management as the average fund size is $1.5 bn. Farnsworth and Taylor (2006) report that each manager oversees a median of 20 funds.[4] Panel B of Table 1 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. The range of fund performance within each band of managerial ownership is quite wide, as is shown in Graph 1.

[INSERT GRAPH 1 HERE]

Finally, 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 (Table 1). Khorana et al. (2007) report that 57% of the 1,406 mutual funds in their sample had zero managerial investment in 2004. Meanwhile, 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. In this dataset, the same bins constitute 15%, 14%, 28%, 19% and 24%, respectively. Using 2004 ownership data, Khorana et al. (2007) 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 while Evans (2008) surveyed solo-managed domestic equity funds. Our ownership data span 2006-09 and includes only no load equity funds.

[4] This would suggest that the average manager would have total fund family investments of approximately $4.8 million if they had similar investment levels in each fund they managed, assuming that each fund had 1.9 managers. 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 15.4 years of total compensation.

The sample of funds analyzed by Khorana et al. (2007) included both solo and team managed funds while Evans (2008) restricted her sample to include only solo managed funds. In that light, we report in the last columns of Panel C (Table 1) the means of each variable conditioned on whether the fund is solo or team managed, and the t-test of the means. These data confirm that there are meaningful differences between solo and team managed funds. Most notably, managerial ownership stakes are significantly higher in solo managed funds, averaging $487,000, than in team managed funds, where they average $414,000. On the other hand, managers have zero dollars invested in self-managed funds that are solo managed vs. 11% of team managed funds. Thus, managers appear less likely to invest in solo-managed funds, but if they invest, they invest more.

The estimated average ownership stake may be higher in this dataset for three reasons. First, general equity market participation rose throughout the last decade and was generally higher in all years in our sample than earlier in the decade. Second, we 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. Third, to the extent that mandatory disclosure of managerial investments has influenced subsequent managerial investment behavior, there may be a latent upward trend to managerial investment throughout the period. Summary statistics are reported in Table 1 Panel C.

3.3. Variable construction

Buy-and-hold returns for fund *i* are estimated per calendar year by compounding monthly returns from CRSP (MRET) over the entire year as:

$$\text{Annual Return}_{i,t} = \prod_{m=1}^{12}\left(1 + \text{monthly return}_{i,t,m}\right) - 1, \qquad [1]$$

where monthly $\text{return}_{\text{i,t,m}}$ is the return of fund *i* in month *m* of year *t*. The monthly fund returns are first calculated as changes in monthly net asset values (TNA), including reinvested dividends from one period to the next.[5] This approach may be especially well suited for examination of cross-sectional variation in fund performance (Fahlenbrach and Stulz, 2011).

Excess fund returns are estimated relative to the Lipper-objective style average. As data on all CRSP funds is used even if the fund itself is not included in our sample of managerial ownership, the reported average estimated excess return is not precisely zero in the sample studied herein. We thus estimate the excess return of fund *i* in Lipper objective class *j* as

$$Excess\ Return_{i,t} = \text{Annual Return}_t - \overline{\text{Annual Return}_{J,t}}. \quad [2]$$

As excess returns are thus estimated relative to the average return for a fund objective, our regression models include interactive year-fund objective fixed effects.

Similarly, net annual inflows per calendar year are estimated using December data on net asset values (total net assets or TNA) as

$$Inflows_t = TNA_t - TNA_{t-12}. \quad [3]$$

4. Do managers invest in their own funds?

First, we explore determinants of managerial ownership stakes. If managers chase past performance, than managerial investment should be highest in firms that have out-performed previously. On the other hand, if managers believe their investments serve as advertising for the firm, then they might invest more in under-performing funds to signal that they personally

[5] Net asset values are net of all management expenses and 12b-fees.

believe in the fund's strategy. These suggest alternative expectations for the nature of the relationship between the level of managerial investment and past performance. In a similar light, the impact of expense fees is also ambiguous as managers may feel a need to invest more to justify the imposition of higher fees while they may also wish to invest less to avoid higher fees.

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 funds. To the extent that such considerations may pertain, this particular model framework may have an omitted variable problem. On the other hand, mandatory investment policies are presumably coordinated at the fund family level, and thus fund family fixed effects are included in the empirical model,

$$Ownership_{i,t} = \beta_0 + \beta_1 Excess\ returns_{i,t-1} + \beta_2 Expense\ fees_{i,t} + \beta_3 Fund\ age_{i,t} + \beta_4 Fund\ size_{i,t-1} + \beta_5 Board\ size_{i,t} + \beta_6 Board\ independence_{i,t} + \beta_7 Fund\ family\ size_{i,t} + Year \times Objective\ FE + Fund\ family\ FE + Management\ team\ FE + \varepsilon_{i,t}. \quad [4]$$

Interactive year-fund objective fixed effects are included in all regressions to control for unobserved characteristics that affect a given segment of the mutual fund universe in a particular year.[6] 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. Moreover, when the fund invests in less liquid or more opaque assets, investors will want

[6] We thank a referee for pointing out that using separate year and objective fixed effects could introduce a look-ahead bias due to the use of future data.

the fund to adopt stricter corporate governance measures as a signaling device as it may be harder for investors to understand the fund's disclosures. Thus managerial investment may carry greater informational content in some industries (Demsetz and Lehn, 1985) or types of mutual funds. Finally, 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. There may also be a sorting mechanism whereby different types of managers oversee certain types of funds or whereby certain types of managers consistently adopt policies on investments in their own funds. Thus, management team fixed effects are also included in the empirical model.[7]

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.

We now estimate equation [4] using two different measures of the dependent variable, managerial ownership. Each measure is multiplied by 1,000 to enable easier interpretation of the estimated coefficients. 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 could 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 [4] may cause the standard errors to be over-estimated and thus biases against our finding statistical significance.

[7] When we report separate analysis of solo managed funds, these management team fixed effects can be interpreted as manager fixed effects.

Managerial investment appears to be unrelated to the fund's past performance and most identifiable firm characteristics. Results are qualitatively similar whether managerial ownership is measured as a dollar amount (Columns 1-3) or as a percent of assets under management (Columns 4-6).Three variables appear to predict the level of managerial investment in a fund. First, higher managerial investment is associated with higher expense fees among solo-managed funds and with lower expense fees among team-managed funds. This suggests that solo managers may believe that if they are going to charge investors more, they must appear to share the concerns of these investors. On the other hand, that team managers invest more when expense fees are lower suggests a belief that self-investments should fit personal portfolio considerations. Second, managers of team-managed funds appear to invest less money when the board of directors is larger, while solo managers invest more money when there are more independent directors on the board. These results suggest that managers are very cognizant of how they are monitored, and invest more money in the fund when they feel the monitoring is more intense. The level of ownership is insignificantly higher at older or larger funds and is also not affected by family size. This suggests the absence of survival bias as well as the possibility that the managers of these funds have also had longer employment tenures.[8]

[INSERT TABLE 2 HERE]

5. The impact of managerial ownership

The various measures of managerial ownership may be associated systematically with fund performance, types and levels of associated fees, and asset inflows. Depending on the

[8] In robustness tests not reported herein the variables total and average managerial tenure were also included separately. Neither variable was statistically significant in tests. Manager age is not used in empirical analysis as it is not disclosed in the annual Statements of Additional Information and is also not available from CRSP.

nature of how managers perceive their own investments and how investors respond to the disclosures of these investments, it is unclear a priori whether managerial investment would be systematically positively or negatively related to each type of fund characteristic, and thus we investigate these relationships. 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 the observed year-end ownership data to be downward biased. We therefore use lagged ownership levels in empirical analysis.[9]

First, the basic model to examine variation in annual fund returns in excess of the Lipper fund objective is

$$Excess\ returns_{i,t} = \beta_0 + \beta_1 Ownership_{i,t-1} + \beta_2 Expense\ ratio_{i,t} + \beta_3 Fund\ age_{i,t} + \beta_4 Fund\ size_{i,t-1} + \beta_5 Board\ size_{i,t} + \beta_6 Board\ independence_{i,t} + \beta_7 Fund\ family\ size_{i,t} + Year \times Objective\ FE + Fund\ family\ FE + Management\ team\ FE + \varepsilon_{i,t}. \quad [5]$$

The model is also estimated separately for solo managed and team-managed funds, and with the exclusion of all fund-year observations with zero reported managerial ownership. Thus, each model is estimated six times for each means of operationalizing the value of managerial ownership. A positive estimated coefficient for the focal variable of interest, managerial ownership, could be interpreted as performance-chasing behavior.

To identify the impact on fund performance of a manager's investments, the focal independent variable, ownership, is operationalized in four different ways. First, it may be the case that the nominal dollar value of the holdings influences managerial behavior. Thus, the estimated dollar value of the ownership stake lagged one year is used as an independent variable. Second, a large managerial investment may constitute a small percent of assets under

[9] Qualitatively similar results are obtained if contemporaneous ownership levels are used instead.

management, or the converse might hold depending on fund characteristics. The estimated lagged dollar value of the ownership stake is therefore scaled as a percent of assets under management in the fund that year to capture the magnitude of the managerial investments. These two separate methods of estimating managerial ownership stake are used as it is possible that a mutual fund manager's investment may grow at a different rate from that of the fund. Third, all of the value of managerial ownership may be biased due to the fact that these values are estimated as the midpoints of unevenly sized bands. We therefore instead use dummy values for each bin. Finally, a dummy for managerial non-ownership is used to test a complementary theory: if managerial investment has an impact, then does managerial non-investment have the opposite effect? This dummy variable takes the value of 1 any time the average managerial investment in the fund is $0.

All models include interactive year-fund objective fixed effects to control for the fund's competitive environment, fund family fixed effects to capture management policy structures, and management team fixed effects to capture individual managerial characteristics. Errors are clustered at the fund family level to reflect potential coordination of policies within each family.

The third and fourth models are constructed analogously to explain expense and management fees. Some fund families (e.g., Vanguard) explicitly use low fees as a marketing tool. Gruber (1996) also reports that longer-term fund performance is higher when a fund has lower fees. Ownership stakes, returns, and fund size are lagged while all other independent variables are estimated contemporaneously with the dependent variable, using

$$Fees_{i,t} = \beta_0 + \beta_1 Ownership_{i,t-1} + \beta_2 Excess\ returns_{i,t-1} + \beta_3 Fund\ age_{i,t} + \beta_4 Fund\ size_{i,t-1} + \beta_5 Board\ size_{i,t} + \beta_6 Board\ independence_{i,t} + \beta_7 Fund\ family\ size_{i,t} + Year \times Objective\ FE + Fund\ family\ FE + Management\ team\ FE + \varepsilon_{i,t}. \quad [6]$$

Rational investors want to maximize their returns while minimizing associated costs such as expense and management fees. Some mutual funds also use low fees as a marketing strategy (e.g., Vanguard). Moreover, given that fund performance is often not persistent, lower fees should lead to higher long-term returns (Gruber, 1996). Both expense and management fees are significantly higher at funds with no managerial investment (1.071 and 69.412 basis points vs. 0.976 and 68.261 basis points, respectively), with the difference in expense fees highly statistically significant (p-value 0.000).[10] We therefore estimate equation [6] where fees could be implemented as expense fees or management fees, with the focal independent variable is being managerial ownership as a percentage of funds under management. Fund returns in the prior year are included as a control variable.

Finally, we look at total net asset inflows. Mutual fund manager compensation has a sizeable variable component in which managers are rewarded for fund performance and that could be construed as fund returns, which is the investing public's common definition of performance, or as total revenue generated for the fund advisory company, the fees collected on assets under management. Moreover, even while the fund advisory company may enjoy economies of scale from managing larger funds, existing investors may find new asset inflows cause managers to invest in less profitable investments, thus driving down returns for all investors. It is thus unclear whether net asset inflows should be positively or negatively related to the level of managerial investment in the fund. We examine this relationship using

[10] A table with t-tests of the means for funds with and without managerial investment is not included in Table 1 for space considerations. It can be included easily upon request. If this table were included, one would see that there are statistically significant differences between these two groups with funds that have managerial investment reporting higher expense fees (p-value 0.000), higher management fees (0.000), older funds (0.000), larger funds (0.000) from larger families (0.000), and these funds are more likely to be index funds (0.000) or international (0.001) with more managers (0.067). There appear to be no statistically significant differences between these funds with regards to excess fund performance, board size and board independence.

$$Inflows_{i,t} = \beta_0 + \beta_1 Ownership_{i,t-1} + \beta_2 Excess\ returns_{i,t-1} + \beta_3 Expense\ fees_{i,t} + \beta_4 Fund\ age_{i,t} + \beta_5 Fund\ size_{i,t-1} + \beta_6 Board\ size_{i,t} + \beta_7 Board\ independence_{i,t} + \beta_8 Fund\ family\ size_{i,t} + Year \times Objective\ FE + Fund\ family\ FE + Management\ team\ FE + \varepsilon_{i,t}. \quad [7]$$

6. Fund performance and managerial investment

In this section we examine the relationship between mutual fund performance and managerial ownership through estimation of equation [5]. 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. We examine both the aggregate data set and several meaningful sub-sections of the data such as by fund type. To explore the informational content of the relationship between performance and managerial ownership, we also conduct separate examinations of funds where managerial ownership stakes changed. As there is considerable heterogeneity among types of mutual funds, the dataset is also divided by fund type to examine whether the relationship between fund performance and managerial ownership is consistent. Next, the impact of managerial ownership on expense and management fees is explored to test for other means by which managers could signal that they share investors' perspectives and interests.

6.1. Managerial ownership

In Table 3 we examine the broad relationship between mutual fund performance and managerial ownership. When managerial investments are recorded in dollar levels, there is no evident relationship between fund performance and the level of managerial investment (Columns 1-6). However, when managerial investments are scaled by assets under management (Columns 7-12), we observe that fund performance is higher when managers invest more in solo managed funds and when managers invest less in team managed funds. This result is less robust but still

present when non-investor managers are excluded from the sample. 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. 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.

Our results suggest that when a fund is solo managed, the level of investment can serve as an informational signal for investors, which is consistent with Evans (2008) and the alignment of interests hypothesis. Evans reports (footnote 16) that the positive relationship between fund performance and managerial investment is identified only when managerial investments are lagged, not contemporaneous. However, while we lag managerial ownership by one year in all results reported herein, all results are similar when we use contemporaneous levels of managerial ownership. That the opposite result is obtained for team managed funds suggests the impact of managerial investment depends upon managers believing their individual efforts can be identified and rewarded by investors. This result contrasts sharply with the earlier findings of Khorana et al. (2007) that fund performance and managerial investments were positively related among both solo and team-managed funds. On the other hand, the negative coefficient on managerial ownership in team managed funds is consistent with the findings of Kumlin and Puttonen (2009).

[INSERT TABLE 3 HERE]

Khorana et al. (2007) used an approach that is similar to ours and yet obtained different results. It is possible that this reflects the fact that we analyze 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.

Finally, perhaps the years examined herein (2006-2009) are fundamentally different from the years examined by Khorana et al. and Evans, 2001-2005. To that end, we conduct a year by year analysis and that shows that managerial ownership exerts a much larger negative effect on fund returns in 2008, which would be consistent with managerial loss aversion and the global downturn that year.[11]

To begin reconciling these results with those reported previously by Khorana et al. (2007) and Evans (2008), we first attempt to identify whether there is a non-linearity to the relationship between fund performance and managerial ownership by examining the separate impact of each level of managerial investment. The advantage of this procedure is that no assumptions are needed regarding the true level of an individual manager's ownership stake. It is also possible that managers believe investors make asset allocation decisions based on the disclosure of managerial investments. If that is the case then fund managers may game the system by investing at or near the bounds of a range, particularly at the lower bound. We therefore use a set of dummy variables to denote each interval of disclosed managerial investment.

This set of results, reported in Table 4, reveals that there is no consistent relationship between fund performance and managerial investment unless non-owners are excluded from the

[11] These results are available upon request, and are not included here for space considerations.

sample (Columns 4-6). When the analysis is restricted to include only funds where managerial investment is positive, it emerges that there is a positive impact on performance from low levels of managerial investment when a fund is solo managed (Column 5) but no additional benefit from higher levels of managerial investment. Neither Khorana et al. (2007) or Evans (2008) excluded non-investors from their analysis and thus the first three columns suggest that their results may not have persisted into more recent years. The results obtained are consistent with those reported in Table 3, and they strongly suggest that higher levels of managerial investment may be performance-chasing, mandated by fund employment policies, or, perhaps, suggest managerial adoption of more conservative investment strategies upon investing personal funds in the mutual fund.

[INSERT TABLE 4 HERE]

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. Table 5 reveals that this is the case, with fund performance not affected by the manager's decision to not investing in the fund.

[INSERT TABLE 5 HERE]

The managerial ownership data must 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 the dataset was later expanded backwards, a survival bias was injected into the dataset. We therefore find it interesting that even among the funds that survived until at least 2009, there is no consistent positive relationship between performance and

managerial ownership. In other words, the survivorship bias would argue against our finding such strong results, particularly if managerial ownership did indeed affect fund performance.

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 generally insignificantly related to excess returns. Older funds do appear to have slightly lower returns 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 other studies have reported no decline in performance as the size of the fund family increases (e.g., Chen et al., 2004, and Pollet and Wilson, 2008). We find that fund performance is positively related to fund and fund family sizes.

Mutual fund boards have limited responsibilities, chiefly relating to the continuity and terms of fund adviser contracts. Thus, the finding that larger boards are often associated with slightly lower returns may suggest that the larger board size makes it harder for members to

reach consensus decisions regarding managerial tenure. While Ding and Wermers (2009) found evidence of better performance by funds with more independent boards, Ferris and Yan (2007) found no relationship between board independence and performance. We find limited evidence that fund performance is slightly lower for funds with more independent boards.

All results are robust to the exclusion of funds where managerial tenure is less than two years. This threshold was chosen in order to ensure managers would have disclosed ownership levels at least twice, thus permitting identification of how managers changed their levels of investment.[12]

6.2. Changes in managerial ownership levels

The broad literature on insider ownership in corporations suggest that changes in levels of insider ownership may be informative of insiders' expectations for subsequent corporate performance as insider sales could reflect advance knowledge of relevant information. Alternatively, such ownership changes might simply reflect personal financial considerations. In the standard corporate setting, insider transactions must be reported within a narrow time frame measured in days whereas in the mutual fund setting, insider transactions are not reported per se – just the aggregate level of ownership is reported once annually. Nonetheless, in an attempt to capture the informational flavor of insider sales, three dummy variables are now created. The first is called "change" and takes the value of 1 if a manager changed the level of ownership in a fund in a given year, and the next two variables, "increase" and "decrease" take the value of 1 if and only if the level of managerial ownership in a given year increased or decreased, respectively. We now conduct two further rounds of analyses. First, the dummy variable for

[12] These results are available upon request.

change of ownership level is included in the regression model, and then this variable is replaced separately with dummies for increased or decreased ownership levels.[13]

The new baseline results, reported in Table 6, again reveal that fund performance is higher when a solo team manager invests more (Column 5) and lower when total ownership is higher at team managed funds (Column 6). Moreover, we now find that changes in the level of ownership are not associated with performance, which is contrary to what is reported in the literature on insider purchases and sales at corporations. Thus, we now investigate the related question of whether increases and decreases in the level of managerial investment cause symmetric or asymmetric changes in fund performance?

[INSERT TABLE 6 HERE]

These questions are addressed by separate analyses in which a dummy variable for increase or decrease in managerial investment are added to the estimation equation (Table 7). Using corporate data, Lakonishok and Lee (2001) and Jeng et al. (2003) report that insider purchases are informative of subsequent performance while insider sales are not. This suggests that the "increase" dummy would have a positive and statistically significant coefficient, and the "decrease" dummy would be statistically insignificant. We find no support for this hypothesis with the "increase" and "decrease" dummies statistically insignificant for all specifications. These results suggest that in general the level of managerial investment impacts fund returns, but not the stability of the level of investment. Thus, the general result based on corporate performance may not carry over wholesale into the mutual fund universe.

[INSERT TABLE 7 HERE]

[13] We also conducted separate sub-sample analyses of funds where managerial investment increased or decreased. These results are similar to those included in the paper and are therefore not reported herein, but are available upon request.

6.3. Fund type

Certain types of funds (e.g., index funds) have very narrow mandates and thus managers may have less discretion with regard to asset selection and portfolio turnover. On the other hand, some fund objectives are sufficiently broad (e.g., equity or international) that the scope for managerial impact is substantially higher. Finally, the failure rate for mutual funds varies markedly by fund type (Bogle, 2005) and the "window dressing" and market timing scandals have occurred primarily in small caps funds. We therefore use the Lipper fund objective codes to sub-divide the dataset into more homogenous clusters of funds for this round of analysis. Three types of funds are now analyzed separately: non-index, international or global, and domestic funds. All results are reported in Table 8 with managerial investment measured in levels (Columns 1-3) and as a percent of assets under management (Columns 4-6).

[INSERT TABLE 8 HERE]

First, as our dataset contains no non-equity funds we do not report separate results for equity funds. Thus, we begin with Panel A in which non-index funds are analyzed. This round of analysis provides additional support for the earlier finding that performance is higher at solo managed funds with self-investments (Column 5) and lower at team-managed funds with higher investments (Column 6). This set of results is almost the same as our baseline results reported in Table 3 as equity and non-index funds dominate the overall sample.

Roughly 80% of the funds in the sample include non-domestic assets and thus two further sub-sample analyses are reported in Panels B and C. Panel B reveals that international funds that have higher managerial ownership achieve higher performance when solo managed (Column 5) but not when team managed (Column 6). The purely domestic funds account for 18.4% of the funds in the dataset, and appear to have a different relationship between performance and

managerial investment (Panel C). Purely domestic funds appear to have no consistent relationship between fund performance and the level of managerial investment. Intriguingly, Columns 2 and 5 can be compared most directly to the results of Khorana et al. (2007) and Evans (2008). Khorana et al. (2007) reported in their Table 3 Panel C this sub-sample analysis on domestic funds that were solo-managed and Evans (2008) studied only domestic equity funds. Both studies found the opposite relationship between fund performance and managerial investment. Thus, the difference in results may reflect aggregate market changes such as an increase in team managed and international funds in the last decade (ICI, 2011). Accordingly, those managers who are responsible for purely domestic mutual funds in the more recent years may differ from those who were managers in the earlier years examined by Khorana et al. (2007) and Evans (2008).

6.4. Dynamic panel estimation

The results reported above were all obtained through OLS estimation of the model specified in equation [5]. One potential concern is that the independent variables may be endogenous and that there may also be serial correlation. Flannery and Hankins (2013) examine the impact of such econometric concerns on estimations using corporate finance data. They report that it is generally most efficient to use fixed effects with OLS estimation but that dynamic panel estimation techniques may sometimes be preferable. In that light we also replicate all models analyzed above using Arellano Bond estimation and obtain qualitatively similar results.

6.5. Time series variation in managerial ownership

All results reported above reflected use of the full panel dataset using observations spanning 2006-2009. Separate analyses were also conducted on a year-by-year basis, and are largely consistent with the results obtained using the full panel. These results are available from

the authors upon request. The results obtained using cross-sections shared two commonalities. First, most relationships reported above were preserved, albeit with slightly reduced statistical significance. Second, 2008 was consistently different from the other years, as might be expected given the extent of the financial crisis that year.

7. Fees

The types and levels of fees associated with a mutual fund may be affected by the level of managerial investment. If managerial investments lead the managers to identify with the investors, then fees would be lower at funds with higher managerial investments. On the other hand, if managers believe that their investments serve as advertising for the firm, then they may feel greater freedom to charge higher fees at funds where they have invested higher amounts of money. The results reveal that expense fees are insignificantly associated with the level of managerial investment (Panel A), and that management fees are generally also insignificantly associated with the level of managerial investment (Panel B). A strong exception to this rule is that management fees are significantly lower at some team managed funds (Panel B Column 6). However, we need to caution that a one standard deviation increase in the level of managerial investment, which would raise the level by 0.007% of assets under management, would be associated with a 2.27 basis point decrease in management fees. As the average management fee is nearly 69 basis points with a standard deviation of 28 basis points, this decrease is not economically large. Nonetheless, this result suggests that having multiple managers may be a disciplining technique that ensures lower average costs for all investors. Higher fees appear to be inconsistently associated with prior year fund performance. More independent boards are strongly associated with higher expense fees and lower management 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. To the extent that larger fund families are more likely to have team managed funds (such as are analyzed in our Columns 3 and 6), these results are consistent with those of Cremers et al. (2009) who report that fees are higher at funds with low levels of director ownership.

[INSERT TABLE 9 HERE]

8. New asset inflows

Jeng et al. (2003) and Lakonishok and Lee (2001) find that insider purchases predict future returns. Mutual fund managerial compensation may have both a fixed and a variable component, with the variable component reflecting some combination of fund performance and fund size (i.e., assets under management). We therefore examine how net fund inflows are affected by managerial investment in the fund after controlling for relevant factors, particularly past performance of the fund using equation [7]. This examination, reported in Table 10, is motivated by the finding that funds with more assets under management have lower returns as new asset inflows are often performance chasing (e.g., Berk and Green, 2004).

[INSERT TABLE 10 HERE]

New asset inflows appear to be generally unrelated to managerial investments, with the focal variable statistically insignificant in 10 of 12 empirical specifications. There is limited evidence suggesting managerial investment affects fund inflows in solo managed funds. We find that inflows are higher when the dollar level of managerial investments is higher (Column 5) but this is only true when managerial investments account for a smaller fraction of fund size

(Column 11). Thus, it appears that investors are drawn to certain types of funds on the basis of fund characteristics (e.g., objective) and known attributes of the manager (e.g., past track record).

9. Conclusion

We make two contributions to the literature. First, the nascent literature on managerial investment in mutual funds has thus far 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 in the univariate statistics that there is considerable year-to-year variation in the level of managerial investment. Second, in our multivariate analysis we then revisit the question of how mutual funds are affected by managerial investments. We find that fund performance is higher when solo managers invest in their own funds and significantly lower when team managers co-invest in the funds, and that this result is robust across multiple specifications. Expense and management fees and net asset inflows are generally unrelated to the level of managerial investment. This suggests that managerial investment in a fund may be orthogonal to the interests of retail investors, particularly longer-term investors.

The observed relationship between portfolio manager ownership and fund characteristics is inconsistent with the hypothesis that more skin in the game increases the alignment of fund managers' interests with those of their shareholders. The results reported herein suggest that managerial investment may be an inefficient marketing tool for a fund, and, from the individual manager's perspective, such an investment may be performance-chasing. Leaving aside questions of privacy, the SEC disclosure requirements may thus be valuable to the investment community because the level of managerial investment does appear to carry predictive power

regarding fund performance and fees even if the directionality is the opposite of what the SEC 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, many have also found that the relationship is non-monotonic (e.g., Morck et al., 1988; McConnell and Servaes, 1990). It is thus notable that the levels of reported managerial ownership are substantially higher in our 2006-09 dataset than in the 2005 data used by Khorana et al. (2007) and Evans (2008). 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 (e.g., Malmendier and Tate, 2005).

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Graph 1: Excess fund returns vs. managerial ownership

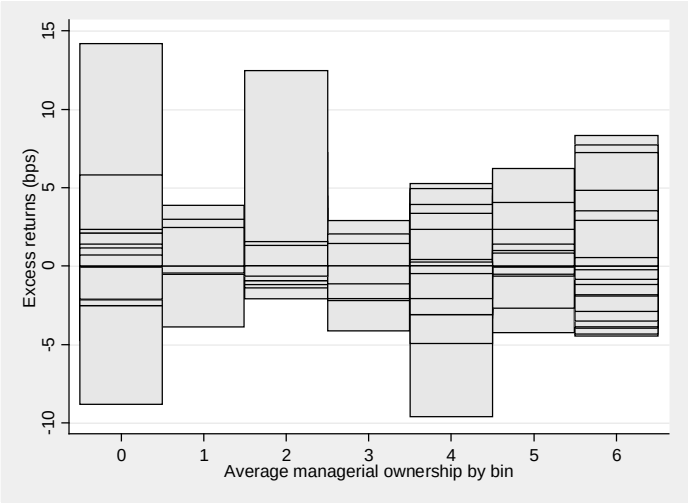

Table 1. Summary Statistics

Panel A: Inter-temporal variation in fund characteristics

Variable	Definition	2006	2007	2008	2009
# of observations		369	392	379	372
Number of managers	Number of managers at the firm as listed in the fund's filing with the SEC.	1.859	1.860	1.876	1.836
Total ownership	Total amount invested in fund by all managers; US$ mn. Values recorded using method described in the text.	0.737	0.726	0.739	0.781
Total ownership as percent	Total amount invested in fund by all managers divided by total assets under management as obtained from CRSP.	0.001	0.001	0.002	0.001
Average total ownership	Total ownership divided by total number of managers.	0.414	0.412	0.417	0.439
% of funds where managers have $0 investments	Fraction of all observations where total ownership is $0.	0.165	0.166	0.161	0.169
Change in level of ownership	Dummy variable to indicate whether the average ownership changed from the prior year		0.380	0.370	0.375
Increase in level of ownership	Dummy variable to indicate whether the average ownership increased from the prior year		0.210	0.146	0.218
Decrease in level of ownership	Dummy variable to indicate whether the average ownership decreased from the prior year		0.170	0.223	0.156
Excess returns	Style-adjusted excess returns using Lipper style classifications as recorded in CRSP; measured in basis points.	0.073	0.278	0.367	-0.068
Expense ratio	Expense ratio as recorded in CRSP; measured in basis points.	1.016	1.010	1.012	1.041
Management fees	Management fees as recorded in CRSP; measured in basis points.	68.844	69.120	69.262	68.839
Fund age	Years since fund was first opened to investors.	18.799	19.564	20.441	21.874
Fund size	Log of average total net assets under management; US$ mn as reported in CRSP.	7.303	7.458	7.332	7.125
Board size	Number of individuals on board of directors.	2.124	2.108	2.112	2.121
Board independence	Fraction of directors who are independent	0.779	0.781	0.778	0.780
Fund family size	Log of total average total net assets under management by fund family; US$ mn as reported in CRSP.	10.606	10.738	10.583	10.374
Index	Dummy variable to indicate index fund	0	0	0.053	0.056
International	Dummy variable to indicate global or international fund	0.846	0.847	0.818	0.812

Panel B: Variation in fund characteristics based on level of managerial 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	161	25	71	60	299	202	263
Number of managers	1.702	2.120	1.859	1.717	2.040	2.510	1.273
Excess returns	0.192	0.368	0.428	-0.063	0.106	0.159	0.373
Expense ratio	0.920	0.990	0.877	0.979	1.054	1.086	1.043
Management fees	60.839	59.84	52.806	68.012	71.004	71.700	74.257
Fund age	16.391	12.800	17.239	24.750	22.110	24.134	20.722
Fund size	6.980	6.182	6.737	7.219	7.179	7.654	7.710
Board size	2.109	2.152	2.249	2.159	2.121	2.087	2.089
Board independence	0.782	0.891	0.790	0.781	0.757	0.807	0.761
Fund family size	10.918	10.314	11.243	10.588	10.551	10.304	10.538
Index	0.143	0.040	0.113	0.050	0.013	0.000	0.008
International	0.720	0.960	0.859	0.800	0.773	0.886	0.886

Panel C: All data

Variable	Mean	S.D.	Min	Max	Obs	Solo-managed funds	Team-managed funds	T-test of the means
Number of managers	1.865	1.224	1	6	1078	1.000	2.879	0.000***
Total ownership	0.774	0.864	0	5.750	1048	0.479	1.128	0.000***
Total ownership as percent	0.001	0.007	0	0.166	1048	0.001	0.002	0.009***
Average total ownership	0.454	0.389	0	1.000001	1081	0.487	0.414	0.002***
% of funds where managers have $0 investments	0.149	0.356	0	1	1081	0.179	0.114	0.003***
Excess returns	0.211	1.847	-9.585	14.196	1081	0.284	0.126	0.161
Expense ratio	1.020	0.389	0.09	2.65	1081	0.976	1.071	0.000***
Management fees	68.792	28.231	0	202.9	1081	68.261	69.412	0.504
Fund age	20.910	15.805	1	85	1081	20.146	21.802	0.086*
Fund size	7.317	1.515	1.823	11.406	1081	7.363	7.264	0.286
Board size	2.116	0.335	1.099	2.773	1081	2.134	2.091	0.023**
Board independence	0.778	0.207	0.226	1	1081	0.735	0.828	0.000***
Fund family size	10.598	2.160	4.704	13.842	1081	11.012	10.116	0.000***
Index	0.038	0.191	0	1	1081	0.046	0.028	0.116
International	0.825	0.380	0	1	1081	0.811	0.842	0.186

Table 2. Determinants of managerial investment in a fund. In this table managerial investment is measured as the mid-point of each range, and the minimum value for the top range. Managerial ownership is measured in dollar levels in Columns 1-3 and as percent of assets under management in Columns 4-6. Year-fund objective, fund family and managing team fixed effects are included in all regressions. Standard errors are clustered by fund family and are reported in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

	Level			Percent of assets		
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Lagged returns	5.417	7.610	6.527	0.055	-0.019	0.150
	(6.971)	(9.338)	(13.81)	(0.103)	(0.027)	(0.238)
Expense fees	181.8	217.6	187.3	-0.271	0.979**	-9.021**
	(180.5)	(196.0)	(437.8)	(1.073)	(0.439)	(4.469)
Fund age	11.15	7.560	22.29	0.045	-0.0004	0.120
	(11.67)	(8.355)	(28.30)	(0.037)	(0.008)	(0.125)
Lagged fund size	-33.29	-38.33	7.555	-1.080	-0.207	-3.932
	(71.70)	(97.66)	(117.8)	(0.821)	(0.126)	(3.091)
Board size	2,018	2,078	-4,186***	5.342	3.042	8.708
	(1,979)	(2,509)	(1,518)	(5.530)	(2.864)	(27.45)
Board independence	3,225	3,340	75,228	13.54**	17.89***	-673.6
	(2,864)	(3,587)	(57,033)	(6.352)	(4.253)	(827.3)
Family size	-5.667	112.7	-89.46	-0.695	-0.199	-1.030
	(62.15)	(107.1)	(93.91)	(0.490)	(0.380)	(0.902)
Intercept	-6,114	-9,268	-69,419	-9.051	-18.80	703.5
	(5,564)	(9,022)	(55,654)	(12.40)	(11.36)	(808.0)
Adjusted R^2	0.942	0.826	0.949	0.918	0.991	0.901
N	1078	594	484	1078	594	484

Table 3. Fund performance and managerial investment. Managerial investment is measured as the minimum value for the top range and as the mid-point of all other ranges. Managerial ownership is measured in dollar levels in Columns 1-6 and as percent of assets under management in Columns 7-12. Year-fund objective, fund family and managing team fixed effects are included in all regressions. Standard errors are clustered by fund family and are reported in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

	Levels						Percent of assets					
	All funds			Exclude non-owners			All funds			Exclude non-owners		
	1	2	3	4	5	6	7	8	9	10	11	12
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Lagged total ownership	0.074	-0.300	0.022	0.046	-0.569	-0.066	-32.26	63.70**	-106.7***	-40.41	55.22	-109.3***
	(0.323)	(0.586)	(0.570)	(0.354)	(0.747)	(0.639)	(66.97)	(28.59)	(22.51)	(65.29)	(38.82)	(23.43)
Expense ratio	0.574	0.403	0.180	-0.537	-0.705	-0.400	0.507	0.484	-0.219	-0.621	-0.574	-0.914
	(1.262)	(1.264)	(2.985)	(1.233)	(1.240)	(3.235)	(1.298)	(1.244)	(3.160)	(1.241)	(1.286)	(3.440)
Fund age	0.006	0.0006	-0.013	-0.003	0.0002	-0.052	0.009	-0.008	-3.04e-05	0.002	-0.006	-0.051**
	(0.024)	(0.050)	(0.023)	(0.043)	(0.070)	(0.052)	(0.024)	(0.050)	(0.024)	(0.043)	(0.071)	(0.022)
Lagged fund size	0.020	-0.093	0.202	-0.079	-0.303	0.150	-0.072	0.094	-0.191	-0.254	-0.066	-0.303
	(0.241)	(0.353)	(0.509)	(0.335)	(0.533)	(0.582)	(0.253)	(0.348)	(0.371)	(0.371)	(0.567)	(0.416)
Board size	-2.513	-0.949	0.019	-0.125	3.073	0.870	-1.806	-2.916*	0.853	1.265	-0.532	3.422
	(1.697)	(3.270)	(9.471)	(2.832)	(6.368)	(10.79)	(1.323)	(1.612)	(7.543)	(3.108)	(3.891)	(8.842)
Board independence	-5.167	-3.425	-413.7*	-5.207	-1.660	9.435	-4.366	-6.055**	-478.9**	-3.933	-6.030	12.13
	(3.788)	(4.825)	(216.5)	(4.844)	(8.174)	(30.96)	(3.422)	(2.603)	(198.4)	(5.098)	(4.566)	(28.45)
Fund family size	-1.076*	-1.125	-1.092	-1.218*	-0.818	-1.248	-1.056*	-1.221	-1.032	-1.152*	-0.951	-1.133
	(0.575)	(0.936)	(0.822)	(0.673)	(0.929)	(1.422)	(0.562)	(0.916)	(0.779)	(0.654)	(0.886)	(1.353)
Intercept	13.21*	16.32	417.4**	13.05	3.960	-3.921	11.94*	23.48**	483.9**	10.63	16.62	-7.303
	(7.466)	(16.77)	(205.4)	(9.505)	(25.32)	(18.29)	(6.342)	(11.60)	(190.2)	(9.446)	(15.44)	(16.55)
Adjusted R^2	0.046	0.040	0.052	-0.010	-0.059	0.026	0.048	0.045	0.090	-0.056	-0.056	0.070
N	1,078	582	496	917	478	439	1081	582	499	920	478	442

Table 4. Fund performance and ranges of managerial investment. In this table managerial investment is captured as a set of dummy variables for each range of managerial ownership disclosure. Year-fund objective, fund family and managing team fixed effects are included in all regressions. Standard errors are clustered by fund family and are reported in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

	All funds			Exclude non-owners		
	1	2	3	4	5	6
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Bin 1: $1-$10,000	-0.814	-0.988	-0.793			
	(0.586)	(0.784)	(1.083)			
Bin 2: $10,001-$50,000	0.543	0.632	0.766	1.428*	2.061*	1.613
	(0.674)	(0.730)	(1.450)	(0.770)	(1.190)	(1.287)
Bin 3: $50,001-$100,000	0.607	1.137	0.117	1.315	2.353	0.489
	(0.694)	(0.865)	(1.186)	(0.883)	(1.427)	(1.675)
Bin 4: $100,001-$500,000	0.237	0.469	-0.163	1.071	1.993	0.129
	(0.467)	(0.394)	(1.034)	(0.884)	(1.244)	(1.786)
Bin 5: $500,001-$1,000,000	0.290	0.179	0.272	1.214	1.655	0.633
	(0.574)	(0.949)	(1.332)	(0.993)	(1.563)	(1.939)
Bin 6: $1,000,001+	0.063	-0.237	0.591	1.120	1.403	0.977
	(0.528)	(0.714)	(1.076)	(0.945)	(1.264)	(1.888)
Expense ratio	0.841	0.421	0.245	0.422	-0.593	-0.351
	(1.249)	(1.231)	(2.854)	(1.572)	(1.343)	(3.146)
Fund age	0.012	0.015	-0.00703	0.0007	0.004	-0.012
	(0.024)	(0.052)	(0.0261)	(0.034)	(0.065)	(0.047)
Lagged fund size	0.003	-0.071	0.129	-0.065	-0.485	0.106
	(0.228)	(0.370)	(0.523)	(0.413)	(0.659)	(0.648)
Board size	-2.844	-1.251	-0.280	-8.841	-25.10	-0.673
	(2.260)	(3.667)	(9.468)	(13.15)	(16.77)	(10.61)
Board independence	-4.824	-3.166	-340.2	-15.22	-42.74	7.659
	(4.837)	(5.100)	(239.1)	(21.46)	(28.21)	(18.59)
Fund family size	-1.099**	-0.849	-1.341	-1.201	-0.392	-1.756
	(0.543)	(1.009)	(0.821)	(0.738)	(1.162)	(1.381)
Intercept	13.68	12.76	347.0	33.45	100.1	2.664
	(8.804)	(17.62)	(230.8)	(41.94)	(67.87)	(21.89)
Adjusted R^2	0.038	0.018	0.037	-0.022	-0.067	0.014
N	1,157	629	528	991	521	470

Table 5. Fund performance and managerial non-investment. In this table managerial non-investment is captured as a dummy variable. Year-fund objective, fund family and managing team fixed effects are included in all regressions. Standard errors are clustered by fund family and are reported in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

	1	2	3
	Baseline	Solo Managed	Team Managed
Non-investment dummy	-0.189	-0.265	0.033
	(0.434)	(0.524)	(0.859)
Expense ratio	0.859	0.381	0.133
	(1.266)	(1.253)	(2.901)
Fund age	0.011	0.008	-0.012
	(0.022)	(0.047)	(0.023)
Lagged fund size	0.008	-0.050	0.190
	(0.225)	(0.328)	(0.514)
Board size	-3.340*	-2.982	-2.803
	(1.923)	(2.708)	(9.048)
Board independence	-5.726	-6.175	-396.0*
	(4.519)	(4.104)	(220.7)
Fund family size	-1.019*	-0.674	-1.220
	(0.532)	(0.957)	(0.819)
Intercept	14.15*	18.19	404.6*
	(8.084)	(13.97)	(210.7)
Adjusted R^2	0.040	0.015	0.042
N	1,157	629	528

Table 6. The impact of changes in managerial investment on fund performance. In this table managerial investment is measured as the mid-point of each range, and the minimum value for the top range. Managerial ownership is measured in dollar levels in Columns 1-3 and as percent of assets under management in Columns 4-6. Year-fund objective, fund family and managing team fixed effects are included in all regressions. Standard errors are clustered by fund family and are reported in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

	Levels			Percent of assets		
	1	2	3	4	5	6
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Lagged total ownership	0.087	-0.227	0.019	-32.81	62.27**	-106.8***
	(0.325)	(0.567)	(0.566)	(67.74)	(26.70)	(23.16)
Change in ownership level	0.089	0.495	-0.031	0.094	0.495	0.010
	(0.228)	(0.361)	(0.298)	(0.229)	(0.358)	(0.313)
Expense ratio	0.563	0.288	0.174	0.497	0.375	-0.217
	(1.256)	(1.201)	(2.984)	(1.291)	(1.182)	(3.171)
Fund age	0.006	0.005	-0.012	0.009	-0.003	-0.0002
	(0.024)	(0.048)	(0.024)	(0.024)	(0.048)	(0.025)
Lagged fund size	0.023	-0.106	0.201	-0.072	0.074	-0.191
	(0.242)	(0.356)	(0.509)	(0.254)	(0.354)	(0.372)
Board size	-2.478	-0.432	0.087	-1.716	-2.135	0.826
	(1.708)	(3.226)	(9.521)	(1.369)	(1.800)	(7.632)
Board independence	-5.108	-2.833	-417.5*	-4.220	-5.065**	-477.7**
	(3.784)	(4.552)	(212.8)	(3.451)	(2.486)	(194.0)
Fund family size	-1.071*	-1.071	-1.093	-1.050*	-1.160	-1.032
	(0.575)	(0.954)	(0.827)	(0.562)	(0.936)	(0.780)
Intercept	13.00*	14.08	421.2**	11.56*	20.22	482.7**
	(7.484)	(16.84)	(201.6)	(6.446)	(12.26)	(185.5)
Adjusted R^2	0.045	0.044	0.048	0.047	0.050	0.086
N	1,078	582	496	1,078	582	496

Table 7. Asymmetry: the impact of increases or decreases in managerial investment on fund performance. In this table managerial investment is measured as the mid-point of each range, and the minimum value for the top range. Managerial ownership is measured in dollar levels in Columns 1-3 and 7-9, and as percent of assets under management in Columns 4-6 and 10-12. Year-fund objective, fund family and managing team fixed effects are included in all regressions. Standard errors are clustered by fund family and are reported in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

	Levels			Percent of assets			Levels			Percent of assets		
	1	2	3	4	5	6	7	8	9	10	11	12
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Lagged total ownership	0.176	0.151	0.037	-31.61	64.77**	-107.3***	0.100	-0.303	0.064	-32.32	64.16**	-108.2***
	(0.360)	(0.613)	(0.580)	(67.51)	(27.44)	(22.13)	(0.328)	(0.573)	(0.636)	(68.24)	(29.31)	(23.38)
Increase dummy	0.153	0.666	0.023	0.098	0.638	-0.049						
	(0.291)	(0.495)	(0.298)	(0.263)	(0.452)	(0.300)						
Decrease dummy							-0.051	0.007	-0.080	0.004	-0.101	0.079
							(0.271)	(0.445)	(0.334)	(0.277)	(0.469)	(0.319)
Expense ratio	0.531	0.234	0.159	0.493	0.374	-0.186	0.566	0.403	0.093	0.507	0.489	-0.151
	(1.260)	(1.248)	(2.972)	(1.288)	(1.198)	(3.126)	(1.268)	(1.265)	(2.989)	(1.300)	(1.256)	(3.133)
Fund age	0.004	0.002	-0.013	0.009	-0.006	0.002	0.005	0.0007	-0.014	0.009	-0.009	0.001
	(0.024)	(0.049)	(0.026)	(0.024)	(0.050)	(0.028)	(0.023)	(0.050)	(0.024)	(0.023)	(0.050)	(0.026)
Lagged fund size	0.029	-0.083	0.204	-0.066	0.085	-0.199	0.022	-0.094	0.204	-0.073	0.097	-0.202
	(0.239)	(0.338)	(0.513)	(0.253)	(0.352)	(0.372)	(0.238)	(0.350)	(0.510)	(0.250)	(0.348)	(0.372)
Board size	-2.664	-1.361	-0.019	-1.703	-1.894	1.140	-2.584	-0.938	0.060	-1.807	-2.914*	1.096
	(1.685)	(3.008)	(9.510)	(1.405)	(1.833)	(7.525)	(1.623)	(3.067)	(9.515)	(1.331)	(1.600)	(7.478)
Board independence	-5.417	-4.212	-413.6*	-4.185	-4.614*	-481.5**	-5.285	-3.409	-422.9*	-4.367	-6.028**	-473.4**
	(3.780)	(4.420)	(216.6)	(3.446)	(2.722)	(194.5)	(3.791)	(4.637)	(218.6)	(3.426)	(2.644)	(200.3)
Fund family size	-1.064*	-1.069	-1.093	-1.045*	-1.138	-1.033	-1.075*	-1.125	-1.098	-1.056*	-1.220	-1.030
	(0.575)	(0.941)	(0.823)	(0.564)	(0.927)	(0.782)	(0.575)	(0.938)	(0.829)	(0.564)	(0.915)	(0.778)
Intercept	13.48*	17.48	417.4**	11.45*	19.04	486.2**	13.42*	16.28	426.8**	11.94*	23.44**	478.1**
	(7.386)	(16.30)	(205.6)	(6.574)	(12.34)	(186.8)	(7.395)	(16.35)	(207.3)	(6.390)	(11.56)	(192.2)
Adjusted R^2	0.045	0.047	0.048	0.047	0.053	0.086	0.044	0.036	0.048	0.046	0.042	0.086
N	1,078	582	496	1,078	582	496	1,078	582	496	1,078	582	496

Table 8. Fund types: fund performance and managerial investment. In this table managerial investment is measured as the mid-point of each range, and the minimum value for the top range. Managerial ownership is measured in dollar levels in Columns 1-3 and as percent of assets under management in Columns 4-6. Year-fund objective, fund family and managing team fixed effects are included in all regressions. Standard errors are clustered by fund family and are reported in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

Panel A: Non-index funds

	Levels			Percent of assets		
	1	2	3	4	5	6
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Lagged total ownership	0.088	-0.267	0.013	-32.13	60.19*	-104.7***
	(0.330)	(0.618)	(0.568)	(67.16)	(30.61)	(22.32)
Expense ratio	0.240	-0.104	0.308	0.165	-0.008	-0.083
	(1.135)	(1.030)	(2.972)	(1.163)	(1.057)	(3.129)
Fund age	0.002	-0.002	-0.016	0.006	-0.012	-0.003
	(0.024)	(0.050)	(0.022)	(0.024)	(0.051)	(0.023)
Lagged fund size	0.029	-0.130	0.310	-0.069	0.058	-0.099
	(0.254)	(0.352)	(0.512)	(0.267)	(0.369)	(0.366)
Board size	-2.453	-0.742	2.253	-1.658*	-2.729*	1.061
	(1.587)	(3.232)	(8.502)	(0.990)	(1.422)	(7.415)
Board independence	-5.592	-3.990	-24.25	-4.710	-6.625**	-14.06
	(4.052)	(5.100)	(17.21)	(3.622)	(2.964)	(13.51)
Fund family size	-1.134*	-1.169	-1.111	-1.111*	-1.261	-1.047
	(0.581)	(0.962)	(0.826)	(0.567)	(0.940)	(0.781)
Intercept	13.64*	17.65	25.10	11.97*	24.80**	18.36
	(7.558)	(16.91)	(18.78)	(6.160)	(11.41)	(17.03)
Adjusted R^2	-0.020	-0.085	0.035	-0.017	-0.079	0.072
N	1,037	555	482	1,037	555	482

Panel B: International funds

	Levels			Percent of assets		
	1	2	3	4	5	6
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Lagged total ownership	-0.009	-0.335	-0.066	-38.54	50.58*	-108.1***
	(0.386)	(0.619)	(0.669)	(64.25)	(30.05)	(22.89)
Expense ratio	0.523	-0.013	1.865	0.419	0.039	1.391
	(1.336)	(1.200)	(2.833)	(1.392)	(1.185)	(3.026)
Fund age	0.021	0.030	-0.058	0.025	0.023	-0.057***
	(0.023)	(0.035)	(0.050)	(0.023)	(0.034)	(0.019)

Lagged fund size	-0.073	-0.277	0.198	-0.192	-0.111	-0.243
	(0.235)	(0.314)	(0.565)	(0.247)	(0.321)	(0.413)
Board size	-2.090	-0.136	-141.3**	-1.498	-2.099	-169.3***
	(2.173)	(3.756)	(68.60)	(1.641)	(1.816)	(57.13)
Board independence	-5.053	-3.925	684.7*	-4.615	-6.546**	836.1***
	(4.546)	(5.248)	(375.2)	(3.938)	(2.576)	(312.7)
Fund family size	-0.941	-0.750	-1.008	-0.924	-0.833	-0.957
	(0.634)	(1.164)	(0.834)	(0.619)	(1.130)	(0.791)
Intercept	11.89	11.30	-487.3*	11.39	18.40	-596.7**
	(9.157)	(20.20)	(279.8)	(7.565)	(14.07)	(233.6)
Adjusted R^2	0.033	0.071	-0.066	0.037	0.075	-0.019
N	889	472	417	889	472	417

Panel C: Purely domestic funds

		Levels			Percent of assets	
	1	2	3	4	5	6
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Lagged total ownership	0.475	1.578	0.265	100.4	1,049	-58.13
	(0.543)	(5.428)	(1.032)	(133.4)	(2,108)	(202.9)
Expense ratio	-0.091	5.018	-8.965	-0.0674	4.870	-8.961
	(5.187)	(4.972)	(6.599)	(5.218)	(4.427)	(6.583)
Fund age	-0.112	-0.365***	-0.021	-0.104	-0.378***	-0.011
	(0.125)	(0.097)	(0.095)	(0.129)	(0.095)	(0.077)
Lagged fund size	1.101	2.263	0.426	1.077	2.455	0.307
	(0.835)	(1.311)	(1.864)	(0.826)	(1.532)	(1.766)
Board size	17.15**	8.383	4.381	15.79*	16.18	3.225
	(8.336)	(40.85)	(9.608)	(8.021)	(11.57)	(6.974)
Board independence	11.80	8.729	10.88	17.67	4.924	14.04
	(17.80)	(27.76)	(37.98)	(14.61)	(21.33)	(36.33)
Fund family size	-3.036*	-3.389	-2.328	-2.954*	-3.128	-2.191
	(1.539)	(2.544)	(4.361)	(1.520)	(2.028)	(3.949)
Intercept	-22.63	-14.32	13.30	-24.24	-26.93***	13.18
	(19.14)	(49.55)	(17.47)	(18.74)	(5.841)	(17.81)
Adjusted R^2	0.071	-0.069	0.470	0.069	-0.066	0.470
N	189	110	79	189	110	79

Table 9. Fees and managerial ownership. In this table managerial investment is measured as the mid-point of each range, and the minimum value for the top range. Managerial ownership is measured in dollar levels in Columns 1-3 and as percent of assets under management in Columns 4-6. Year-fund objective, fund family and managing team fixed effects are included in all regressions. Standard errors are clustered by fund family and are reported in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

Panel A: Expense fees

	Levels			Percent of assets		
	1	2	3	4	5	6
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Total ownership	0.026	0.062	0.006	-0.399	49.48	-1.784
	(0.038)	(0.091)	(0.013)	(1.293)	(50.95)	(1.751)
Lagged returns	-0.005	-0.009*	0.0002	-0.005	-0.008*	0.0005
	(0.004)	(0.005)	(0.002)	(0.004)	(0.004)	(0.002)
Fund age	0.0008	0.002	0.0001	0.001	0.002	0.0005
	(0.002)	(0.003)	(0.0009)	(0.002)	(0.003)	(0.0008)
Lagged fund size	-0.036	-0.049	-0.014	-0.038	-0.039	-0.020
	(0.037)	(0.046)	(0.023)	(0.040)	(0.038)	(0.024)
Board size	0.551	0.539	-1.986***	0.608	0.493	-1.963***
	(1.070)	(1.338)	(0.259)	(1.031)	(1.304)	(0.238)
Board independence	-1.607	-1.629	28.72***	-1.525	-2.258	27.49***
	(1.540)	(1.887)	(6.927)	(1.467)	(1.993)	(6.635)
Fund family size	0.019	0.012	-0.009	0.019	0.029	-0.011
	(0.032)	(0.042)	(0.022)	(0.032)	(0.054)	(0.021)
Intercept	2.121	1.284	-24.62***	1.967	1.618	-23.37***
	(3.028)	(4.805)	(6.649)	(2.897)	(4.723)	(6.387)
Adjusted R^2	0.960	0.936	0.989	0.960	0.938	0.990
N	1078	594	484	1078	594	484

Panel B: Management fees

	Levels			Percent of assets		
	1	2	3	4	5	6
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Total ownership	0.491	2.590	0.119	-137.9	1,342	-324.4**
	(1.276)	(3.122)	(1.462)	(148.8)	(1,352)	(140.9)
Lagged returns	0.005	-0.109	0.019	0.015	-0.057	0.068
	(0.185)	(0.209)	(0.302)	(0.191)	(0.234)	(0.304)
Fund age	-0.031	-0.0006	-0.032	-0.019	0.018	0.009
	(0.149)	(0.200)	(0.092)	(0.148)	(0.205)	(0.103)
Lagged fund size	0.045	0.763	-3.304	-0.122	0.980	-4.539
	(1.507)	(1.526)	(2.625)	(1.534)	(1.600)	(2.803)
Board size	48.38***	51.06**	-59.66**	50.14***	51.86**	-51.49*
	(16.39)	(24.91)	(28.33)	(16.80)	(22.89)	(28.06)
Board independence	-68.75***	-55.66**	1,198	-65.38***	-69.93**	904.1
	(17.10)	(26.62)	(779.9)	(18.52)	(31.51)	(824.5)
Fund family size	2.042	0.278	2.993	1.944	0.823	2.675
	(2.348)	(2.923)	(2.757)	(2.358)	(3.211)	(2.639)
Intercept	89.72**	-22.53	-1,012	85.57**	-21.84	-718.9
	(34.74)	(83.97)	(752.8)	(37.70)	(73.76)	(797.3)
Adjusted R^2	0.970	0.965	0.977	0.970	0.966	0.978
N	1,078	594	484	1,078	594	484

Table 10. Total asset inflows and managerial ownership. In this table managerial investment is measured as the mid-point of each range, and the minimum value for the top range. Year-fund objective, fund family and managing team fixed effects are included in all regressions. Standard errors are clustered by fund family and are reported in parentheses. * denotes significance at the 10% level; **, 5%; and ***, 1%.

	Levels						Percent of assets					
	All funds			Exclude non-owners			All funds			Exclude non-owners		
	1	2	3	4	5	6	7	8	9	10	11	12
	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed	Baseline	Solo Managed	Team Managed
Lagged total ownership	524.4	1,108	68.38	641.4	1,477*	233.2	-18,467	-47,939	-3,974	-25,569	-97,163***	240.0
	(359.2)	(678.1)	(530.3)	(409.8)	(843.6)	(677.5)	(49,297)	(29,984)	(71,289)	(63,659)	(36,119)	(77,435)
Lagged excess returns	108.4	110.9	71.85	91.60	131.6	59.04	112.4	122.2	73.10	97.35	150.4	59.82
	(71.75)	(81.47)	(160.1)	(98.05)	(115.2)	(171.5)	(71.41)	(77.57)	(170.1)	(96.68)	(108.5)	(180.9)
Expense ratio	-890.2	-3,169	12,930	-470.0	-3,519	14,471	-841.6	-3,121	12,939	-517.5	-3,762	14,561
	(2,518)	(2,113)	(14,175)	(3,494)	(4,049)	(15,152)	(2,514)	(2,183)	(14,254)	(3,524)	(4,162)	(15,244)
Fund age	-35.68	-42.53***	-78.31**	-10.90	-19.07	16.96	-31.66	-33.83**	-77.91*	-10.88	-7.637	3.861
	(27.10)	(14.25)	(39.10)	(24.87)	(33.24)	(75.27)	(24.05)	(13.12)	(41.01)	(22.88)	(31.05)	(48.12)
Lagged fund size	-485.1	-270.7	-541.0	-696.4	-616.4	-449.8	-545.8*	-459.5*	-549.3	-771.1	-1,019***	-434.9
	(308.1)	(237.2)	(899.2)	(457.9)	(546.9)	(931.0)	(328.2)	(252.1)	(1,043)	(495.5)	(343.3)	(1,111)
Board size	1,777	-4,354	60,651*	-819.7	-10,376*	59,732	3,724	65.45	60,265*	2,136	-2,447	59,180
	(3,464)	(6,952)	(32,374)	(5,374)	(5,994)	(36,139)	(2,856)	(4,068)	(32,505)	(6,343)	(8,710)	(35,658)
Board independence	-3,106	-15,854	-1.160e+06**	-7,332	-27,900*	-268,287*	-68.13	-9,314	-1.158e+06**	-3,082	-17,723	-265,181*
	(8,400)	(12,706)	(464,405)	(13,941)	(16,260)	(152,579)	(7,729)	(9,237)	(450,652)	(14,644)	(19,849)	(155,194)
Fund family size	-965.6	208.2	-1,218	-1,259	259.8	-2,777	-945.7	336.8	-1,214	-1,209	516.0	-2,739
	(1,002)	(807.3)	(1,699)	(1,211)	(898.7)	(2,428)	(999.9)	(809.7)	(1,707)	(1,232)	(899.4)	(2,488)
Intercept	11,437	27,249	1.077e+06**	21,903	52,590	192,072*	5,870	10,443	1.075e+06***	13,845	24,166	189,555*
	(14,950)	(31,455)	(413,346)	(25,266)	(36,008)	(99,931)	(13,514)	(23,592)	(399,315)	(27,272)	(45,789)	(102,207)
Adjusted R^2	-0.214	-0.240	-0.271	-0.230	-0.314	-0.239	-0.215	-0.243	-0.271	-0.231	-0.315	-0.239
N	1,061	568	493	901	464	437	1,061	568	493	901	464	437