Skin or Skim? Inside Investment and Hedge Fund Performance*

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Abstract

We document the role that inside investment plays in managerial compensation and hedge fund performance. Merging against a comprehensive dataset of US hedge funds, we find that funds with greater inside investment outperform on a factor-adjusted basis. We emphasize the role of capacity constraints in explaining this result: insider funds are smaller, are less likely to accept inflows in response to positive returns, and are more likely to be closed to outside investors. These results suggest that managers earn outsize rents by operating trading strategies further from their capacity constraints when managing their own money.

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I Introduction

Delegated asset managers are commonly seen as being compensated through fees imposed on outside investors. However, access to limited internal investment opportunities is also an important, and previously overlooked, component of hedge fund compensation. Out of a total $3 trillion in assets under management by hedge funds, $400 billion can be attributed to investments from insiders and related parties.[1] In Figure I, we decompose total hedge fund compensation into management fees, performance fees, and excess return earned on privately managed capital, and find that returns on personal capital are roughly as important as either source of fee income.

The role of discretion in General Partner (GP) capital commitment has in turn raised considerable investor and regulatory interest.[2] This paper explores the potential for this large allocation of this inside investment, or "skin in the game," to affect managerial incentives regarding strategy allocation, signaling ability to outsiders, and capital raising in ways that impact returns received by outside investors as well as their ability to access funds. While inside investment is an important tool to align incentives, we show that it plays a role in total managerial compensation and can lead to managers limiting fund scale in ways that maximize returns at the expense of capital participation on the part of outsiders.

We examine the relationship between inside investment, fund returns, and fund flows through a novel usage of a comprehensive dataset, Form ADV, provided by the Securities and Exchange Commission (SEC). This regulatory form requires all hedge funds with assets over $100m in total regulatory assets under management to disclose the fraction of fund assets held by insiders yearly at the fund level. We merge Form ADV data with

[1] For the size of the industry, see figures provided by the Securities and Exchange Commission: https://www.sec.gov/reportspubs/special-studies/im-private-fund-annual-report-081514.pdf. Inside investment is estimated using the inside ownership measure from Form ADV.

[2] See Mary Jo White, SEC Chair on Oct. 16, 2015: "Examiners observed that some hedge fund advisers may not be adequately disclosing conflicts related to advisers' proprietary funds and the personal accounts of their portfolio managers. Examiners saw, for example, advisers allocating profitable trades and investment opportunities to proprietary funds rather than client accounts in contravention of existing policies and procedures."

numerous commercially available datasets on hedge fund returns and assets under management to understand the role that inside investment plays in the profit maximization motives for fund managers.[3]

We analyze the relationship between inside investment and hedge fund performance using a panel regression. Using both the Fama and French (1992) and Carhart (1997) factors, as well as the Fung and Hsieh (2004) seven factors, we control for factor exposure of returns at the fund level. We find that inside investment—as measured either by percentage or gross investment—remains an important predictor of excess returns even when comparing different funds *within* firms. An investor who changes their allocation from a fund with the mean inside investment to one with a standard deviation increase in inside investment, within the same firm, will see a rise in annualized excess returns of 1.26%. This significant and economically large magnitude indicates that inside investment is an important, and previously neglected, cross-sectional predictor of hedge fund returns.

Having established the superior performance of insider investment funds, we next investigate possible mechanisms driving these results. We find evidence that managers limit inflows to funds with greater amounts of their own capital, consistent with the idea that insiders internalize the fund-size performance tradeoff when their own capital is at stake. When managing capital access to insider funds, managers both limit inflows to the high-performing funds, as well as strategically close access to outsiders entirely. The presence of funds closed to outside investors is a challenge for conventional models of delegated asset management, as managers are leaving money on the table by forgoing the management fees earned on additional capital. Instead, we find that such funds strongly outperform—delivering 2–4% additional excess returns yearly. Such strong performance suggests that outside investors are in fact rationed from fund participation. Notably, such funds closed to outside investors are disproportionately funded by inside capital.

Our paper advances our knowledge of the asset management industry by highlighting the role for inside investment as an incentive to alter the decisions of managers to strategically allocate capital in ways that affect the returns and investment opportunities available

[3]Including HFR, CISDM, eVestment, BarclayHedge, and Eurekahedge.

to institutional investors. This contributes to the literature on managerial compensation more broadly by emphasizing the unique role for returns on personal capital contributions as a component of overall managerial income in the hedge fund industry.[4] We also contribute to the literature studying diseconomies of scale by highlighting the novel incentives for more optimal fund scaling generated by non-contract features of managerial behavior in the form of private capital stakes.[5] Finally, this paper provides a novel perspective to literature examining fund families by showing that hedge fund managers allocate personal capital strategically across funds at the expense of crowding out outsider capital.[6]

We also examine the heterogeneity of our main result across fund strategies. In agreement with the role of managerial discretion in the face of capacity constraints, our results are driven by funds engaged in specialist roles, arbitrage strategies, and equity funds that might be expected to deploy trading strategies subject to diminishing returns to scale. Our results suggest that when managing personal capital, managers internalize the fact that raising additional capital is dilutive in the sense that it causes the strategy to operate further from its optimum, lowering the returns for all existing investors. The joint behavior of fund flows, performance, and inside investment suggests that capacity constraints are an important driver of hedge fund performance; and that managers of hedge funds choose to raise less capital (and so gain greater alpha) when their own personal capital is involved.

We investigate alternate explanations for our results, such as superior information on the part of fund managers, signaling, risk, and agency conflicts. Our tests suggest that these alternate factors are unlikely to fully explain our results. We find that higher inside investment funds take on less leverage, and do not have assets with worse liquidity properties—suggesting that these higher returns are not compensation for alternate forms of risk. Additionally, funds with greater insider capital accept less, not more, outside capital; including in other funds that are part of their families, which is in line with a moral

[4]See Agarwal et al. (2009), Burasachi et al. (2014), Chen et al. (2008), Ackermann et al. (1999), Qiu et al. (2016), Ibert et al. (2017), and Ozik and Sadka (2015).

[5]See Chen et al. (2004), Yin (2016), Ramadorai (2013), Homberta and Thesmar (2014).

[6]See Massa (2003), Sialm and Tham (2017), Berk et al. (2017).

hazard explanation. While we cannot fully rule out the relationship between inside investment and other fund attributes, understanding inside investment through the lens of fund capacity constraints appears to best explain our results.

Finally, we investigate whether insiders are able to "cream skim" outside investors through the formation of new funds and the strategic allocation of capital. Specifically, we use an event study framework to analyze firms that begin as a single-fund firm and create a new fund. This transition is illustrated in Figure II. The generation of a second fund provides a test case to analyze the effects of inside investment on fund performance, because insiders have a discretionary choice of private capital allocation: 1) Keep their money in the old fund, and invite outsiders to invest in the new fund; or 2) Move internal capital into the new fund. The two cases present differing predictions on the performance level of the initial fund: when inside capital remains in the original fund, we expect the original fund to outperform relative to when insiders move their capital out of the newly formed fund. We find evidence consistent with this hypothesis, suggesting the possibility of "skimming" motives on the part of fund managers.

Our results come with several caveats which we emphasize here. Though we establish inside ownership as an important predictor of excess returns and highlight the role for capacity constraints and moral hazard considerations in understanding this result, it is possible that other channels operate in addition to the ones we emphasize. We discuss in section I.C possible mechanisms behind our result. It is possible that inside investors are better informed about the skill of various fund managers and deploy capital accordingly; alternatively, high-insider-investment funds may be less subject to agency conflicts and engage in superior research analysis (see Berk et al. (2017)). Finally, it is possible that higher returns from high insider-investment funds are a proxy for some risk factors (unrelated to either the Fama-French, Carhart, or Fung-Hsieh factors, such as tail risk as mentioned in Agarwal et al. (2017)). While more research is needed to establish the precise reasons for the outperformance of high inside-investment firms, we emphasize that our work provides novel evidence that managerial ownership is an important predictor of cross-sectional fund

performance and capital flows in ways consistent with a basic framework including capacity constraints and inside investment.

Related Literature

Our work contributes to several distinct strands of the asset management literature. First, we contribute to the literature on hedge fund compensation by examining the specific role of inside capital investments. Here, our innovation is to obtain high quality data on a segment of the market (hedge funds) which feature substantially greater amounts of inside investment. Previous papers have explored the compensation contract structure of investment advisors (such as Das and Sundaram (2002)), or investigated empirically the relationship between manager pay and performance (such as Ma and Tang (2018), Burasachi et al. (2014), and Ibert et al. (2017)). In the context of this literature, we emphasize that access to superior investable opportunities helps explain why financial intermediaries—particularly hedge funds—appear to be so highly compensated even in the face of stiff competition. Our findings are therefore relevant in understanding the recent rise in inequality among the top 1%, who are disproportionately financial managers of capital (See Kaplan and Rauh (2013), Philippon and Reshef (2012), and Alvaredo et al. (2013)). The closest papers to ours examine the role of managerial contract structure on hedge fund performance, such as Agarwal et al. (2009). This paper uses the delta—the effect of a 1% increase in a fund's NAV on expected dollar increase in compensation—as a proxy for managerial incentives, and estimates managerial investment by assuming all fees are reinvested in the fund. In contrast to this paper, we use highly detailed data which allow for a precise measurement of inside investment at the fund level, as well as an assessment of inside investment as an incentive in affecting strategic managerial capital allocation.

Second, our work contributes to the literature studying the diseconomies of scale by introducing a new element of managerial incentives which effects the optimal scale tradeoff of funds. We empirically show that the managers strategically allocate private capital to maximize dollar return. This relates to prior evidence on capacity constraints, as in

Ramadorai (2013), and funding constraints as in Homberta and Thesmar (2014). The most closely related paper to ours in this literature is Yin (2016), which finds that hedge fund managers have incentives to oversize funds when diseconomies of scale exist under standard investment contracts. In contrast to our paper, Yin (2016) focuses on the difference between the marginal return to assets against the marginal benefit of fees, and proposes management fees as a driver of the diseconomies of scale. Though this is an important consideration, it omits a significant portion of the compensation structure, inside investment, which we show plays an important role in the contracting environment by further aligning incentives beyond stated contract terms. While Yin (2016) infers that funds must close to maintain style average returns, we find instead that fund closures to outsiders are used instead for fund managers to extract surplus from arbitrage strategies.

This paper additionally contributes to the literature studying agency frictions within the delegated asset management industry. Starting with Berle and Means (1932), Jensen and Meckling (1976), and Holmstrom (1985) have analyzed the consequences of firm capital structure and internal ownership on governance and agency conflicts as well as firm performance. The papers closest to ours are Evans (2008), Cremers et al. (2009), and Ibert (2017), which find evidence that greater insider investments improve mutual fund performance. Recent papers in the mutual fund literature have explored this issue include Khorana et al. (2007), which suggests the relationship between portfolio management ownership and performance may be the result of superior information on the part of managers or better alignment of incentives. Supporting the second channel, Ma and Tang (2018) suggests that managerial firm-level ownership results in incentive alignment by lowering risk taking. Our paper extends the analysis of agency frictions to the hedge fund industry, where the scope for inside investment is substantially greater. For instance, Chen et al. (2008) documents an average director ownership of $126,000 in funds, however in contrast, a typical hedge fund in our sample would have closer to $5m in insider investment. Brown et al. (2008) find that hedge fund firms with concentrated ownership are related to lower performance and suggest possible agency conflicts; in contrast, Agarwal et al. (2009)

imputes fund ownership based on the assumption of reinvested fees and finds estimates positive relationship; while Qiu et al. (2016) finds no relationship between hedge fund personal commitments and failure rates. Our paper resolves the conflicting evidence by using regulatory filings to measure actual inside investments and relate it to hedge fund performance. Further, our paper goes beyond establishing the cross-sectional relationship between ownership and performance by also analyzing managerial choices in terms of discretionary capital inflows.

Finally, this paper provides a unified view of family of funds, and the managerial strategic allocation between funds. Related papers include Massa (2003), which documents strategy differentiation across funds in a family; Berk et al. (2017), which examines the allocation of talent across funds within a family; while Sialm and Tham (2017) analyzes the relationships between the performance of funds and their overall management companies. Our research expands on this literature by highlighting the differential allocation of internal capital within a family of funds and the link to within-family performance.

The remainder of the paper is organized as follows. Section 2 outlines our data and empirical strategy, and also comments briefly on the nature of corporate governance in hedge funds as well as mechanisms. Section 3 presents our main results, while Section 4 concludes. The Appendix contains further details on our auxiliary results.

II Data and Empirical Strategy

II.A Data

Our dataset combines regulatory Form ADV filings with commercial hedge fund return series from HFR, eVestment, BarclayHedge, Eurekahedge, and CISDM. Form ADV is a required regulatory disclosure form used to register with both the Securities and Exchange Commission (SEC) and state securities authorities. Reporting under Form ADV is governed by the US Investment Advisers Act of 1940, as amended by Dodd-Frank. Disclosure requirements under this form have changed over the years. In the period from 1996–2011,

funds with assets under management below $25 million, or fewer than 15 clients, were generally exempt from registration. Hedge funds in this period frequently used complex fund structures to evade disclosure even when assets were above this threshold.

Private fund reporting increased in 2005, when the SEC went to court to force funds to count all investors as clients. Though courts ultimately struck down the SEC's interpretation, disclosure through Form ADV increased throughout this period. Our primary sample is formed after 2011, in the aftermath of changes in required disclosure imposed by Dodd-Frank. Under prevailing regulations, all investment advisors—including hedge funds—are now required to file a Form ADV with the SEC if they (1) reach a $100 million threshold for assets under management for a typical fund, (2) reach a $150 million threshold if the firm has only private clients, (3) have over $25 million in assets and are not subject to examination in their home states (states that do not require examination currently include New York and Wyoming). Subsequent to their initial filing, firms must refile once a year (as long as their assets under management exceed $25 million), or if there have been changes in material information since the last filing.

We obtain Form ADV from the SEC over the period 2011–2016. We link Form ADV information together with information on hedge fund returns obtained from a combination of five datasets: HFR, eVestment, BarclayHedge, Eurekahedge, and CISDM. We begin the merge with HFR, eVestment and BarclayHedge, which contain for many firms an SEC identifier common to both the commercial hedge fund datasets and Form ADV. If we do not have an SEC identifier, we next look for close matches (selecting only perfect matches) among firm and fund names in both datasets, after eliminating extraneous stop words and abreviations (such as LLC, LP, etc.).

In 2012, Form ADV was updated to include questions about the internal investment of their funds. We draw specifically on Section 7.B.(1), question 14 of Form ADV: "What is the approximate percentage of the *private fund* beneficially owned by you and your *related persons*." This question asks funds to disclose the percentage of investment stakes in the fund which can be attributed in ultimate ownership to "related persons."

Summary Table I shows basic summary information about both our core Form ADV dataset taken from 2016, while Table II reports information on our merged sample. The broad ADV sample is able to establish key statistics about the overall size and scope of the entire hedge fund industry beyond prior work. Figure III demonstrates our merge rate across the range of firm ownership. We find that funds with complete inside investment (100 percent) and no inside investment (0 percent) exhibit worse merge rates into our ADV dataset. These funds also pose additional identification questions—either outsiders cannot invest, or insiders have chosen not to invest in these funds. For these reasons, we focus the remainder of our analysis on funds in the interior of the internal investment distribution: between 1 and 99 percent inside investment, inclusive (our result are robust to their inclusion).

A breakdown of "related parties" is provided in Table III, which illustrates all possible responses for which parties constitute related parties. The most common response is "Sponsor of GP,"[7] suggesting that the definition of related party most often corresponds to a vehicle used by the actual managers or general partners of the fund. Alternately, related parties can include other closely-related entities, such as asset investment by a broker/dealer. A separate set of questions asks the legal name of all related parties: these entities are typically closely related to the management company, share a supervised person three quarters of the time, and over half of the time share a common physical office. Despite the limitations of this measure in exactly calculating managerial stakes, we document that related parties are typically vehicles for fund investment by the general partners, and typically represent asset management on behalf of closely-related entities that can be considered "inside capital."

Panel A of Figure IV illustrates the density of responses on inside investment across our full merged dataset. Panel B of Figure IV shows the distribution of assets under management attributable to inside investment, shown on a log-dollar scale.

[7] Appendix Table A1 examines our main analysis regressing inside investment against excess returns, subsetting on funds with only GP Investments as their related party.

II.B Conflicts and Disclosure

In this section we comment briefly on the legal obligation of managers regarding their internal investments. Hedge fund operating agreements demand few fiduciary obligations for managers to prioritize one fund over another, or to prioritize funds with their own internal capital on the same basis as funds with a greater preponderance of outside capital. As noted in Nowak (2009) and quoted in Morley (2014), the manager:

> is required to devote to the [fund] only that amount of time and attention that the [manager] in its sole discretion deems reasonably necessary to achieve the [fund's] objectives.

Discretion is typically left in the hands of the manager to handle any conflicts of interest across classes of investors, different funds in a family, or in accepting additional outside capital. Corporate governance within hedge funds is deliberately minimal due to strong exit rights among investors, and restrictions on investment to classes of accredited or well-informed investors. For these reasons, we do not automatically assume that proprietary investments by managers represent an agency conflict with respect to investors.

We have also so far assumed that using investment skill to earn outsize returns on private accounts can be considered to be compensation. We think this is a reasonable assumption in our setting, as we do not include truly family funds in our analysis; the funds considered here are investment advisors managing capital on behalf of others with the choice of allowing outsider investor participation. For this reason we view the ability to access profitable but scarce internal investment opportunities (generated as a part of ordinary work effort managing money for clients) to be a part of the full basket of compensation available to insiders. In turn, we view returns generated from these sources as representing income alongside managerial and performance fees. However, we acknowledge that an alternative interpretation of the role of insider returns may view some of these returns as reflecting in part purely proprietary returns. This distinction is not crucial for our analysis, which focuses on the incentives that this privately managed capital presents to managers, and the impacts on returns received by outsiders.

II.C Mechanisms

In this section, we outline the key possible mechanisms underlying the relationship between inside investment and fund performance.[8]

1. *Moral Hazard: Size Performance Tradeoff:* One channel for the role of inside investment as a predictor of cross-sectional fund performance relies on the tradeoff between managerial compensation through fee income on delegated asset management and returns on privately invested capital. With limited commitment, managers cannot credibly commit to not increasing the size of their fund in the future to the point that the excess returns to investment strategies are driven down to zero. Personal capital commitments better align the incentives of managers and outsiders, and provide greater incentives for managers to scale their funds less aggressively in a manner which results in greater returns for all investors.

2. *Other Aspects of Moral Hazard:* Another possible mechanism driving the relationship between fund performance and inside investment is the possibility for managers to allocate additional attention or trade differently on funds which have greater amounts of privately invested capital. While our main proposed explanation highlights one aspect of this—the ability for managers to preferentially manage fund size on funds managing private capital—managers can potentially change other attributes of funds managing private capital. These include allocating additional attention or superior managerial quality to these funds, or executing superior trading strategies. Potentially, funds can take different risks on funds managing private capital than on funds managing the capital of outside investors.

3. *Superior Information:* An alternate, and complementary, explanation for the relationship between inside investments and fund performance is that inside investors are simply better informed about managerial ability within the fund family, and allocate their capital to the better fund managers.

[8] A detailed model highlighting these channels is available upon request.

4. *Signaling:* One potentially offsetting role for managerial capital allocation to funds relies in the role of public signaling. Fund managers, particularly for less established funds, may need to demonstrate private capital commitments in order to convince outside investors of fund quality. When managers are required to hold costly private stakes in order to demonstrate quality and earn management fees on outside capital; inside investment could potentially predict flows but be a poor predictor of fund performance. As Form ADVs are commonly used by outside investors to assess fund quality, managerial stakes in this context reflect a verifiable and costly personal commitments.

These channels need not be mutually exclusive—for instance, the greater the role of moral hazard or risk-shifting effects in driving managers to exert effort or allocate trades differentially depending on private capital investments; the more private information there will be on the success of different funds within a family.

In our initial analysis, we establish the role of inside investment as a predictor of cross-sectional hedge fund performance, focusing on return variation within the fund family. We find support for our main hypothesis that aspects of moral hazard—in particular, managerial control over fund sizing and accessibility of the fund to outside investors—appear to help explain our result. While we cannot fully rule out the possibility of a signaling story, the bulk of the evidence is consistent with a moral hazard channel, as discussed above.

II.D Empirical Strategy

II.D.1 Main Specification

Our main specification tests whether inside investment results in greater risk-adjusted fund-level returns. To do so, we adopt a two-step approach. In the first step, we estimate a time-series regression of excess returns on factor exposures. In the second step, we consider both a panel regression (which allows us to control for firm and year fixed effects) as well as a standard Fama and MacBeth (1973) cross-sectional regression which relates excess

returns from fund specific factors to inside ownership and other variables. A summary of the main dependent variables used in our analysis can be found in Table IV.

First, we run a return regression, taking as our benchmark the Fung and Hsieh (2004) 7-Factor model:

$$\begin{aligned} r^e_{it} \equiv r_{it} - r_{ft} &= \alpha_{it} + \beta_{1,i} S\&P_t + \beta_{2,i}(SC - LC)_t + \beta_{3,i} 10Y_t + \beta_{4,i} CredSpr_t \\ &+ \beta_{5,i} BdOpt_t + \beta_{6,i} FXOpt_t + \beta_{7,i} ComOpt + \varepsilon_{it} \quad i = 1, \ldots, N \end{aligned} \tag{1}$$

In this specification, we consider excess returns ($r_{it} - r_{ft}$) to be the net returns after fees minus the risk-free rate, as we take the standpoint of an institutional investor interested in allocating across the broad investable universe of fund managers.[9] This monthly time-series analysis is run for each of N funds in order to generate fund-specific factor loadings. The Fung and Hsieh (2004) factors are widely used in hedge fund research, including Fung et al. (2008) and Patton and Ramdorai (2013).[10]

We restrict our sample to funds for which we have at least 24 months of data, exclude the first 24 months of data to avoid incubation bias, and also require funds to have at least $20 million in gross asset value. We exclude fund-of-funds because their inside investment is relatively limited, and the scope for investment is radically different.[11] We also exclude funds with either 0 or 100 percent inside ownership. We find that funds with complete inside investment (100 percent) and no inside investment (0 percent) exhibit worse merge rates into our ADV dataset. These funds also pose additional identification questions—either outsiders cannot invest, or insiders have chosen not to invest in these funds. For

[9] Our results also hold when we regress against gross returns, adding fee income back in.

[10] These factors are: 1) an equity market factor — the S&P 500 Index monthly return (S&P); 2) A size-spread factor — the Russell 2000 Index monthly return - S&P 500 (SC-LC); 3) a bond market factor — the monthly change on the 10-year Treasury constant maturity yield (10Y); 4) a credit spread factor — the monthly change in the Moody's Baa yield - 10-year Treasury constant maturity yield (CredSpr); 5) a bond trend-following factor (BdOpt); 6) a currency trend-following factor (FXOpt); and 7) a commodity trend-following factor (ComOpt). Additional details on the factors can be found at: http://faculty.fuqua.duke.edu/~dah7/DataLibrary/TF-FAC.xls.

[11] Because fund-of-funds invest in other investment vehicles, rather than underlying securities, we do not expect the same patterns of diminishing returns. We also expect flow-performance and return persistence to work very differently with these investment advisors.

these reasons, we focus the remainder of our analysis on funds in the interior of the inside investment distribution: between 1 and 99 percent inside investment, inclusive.[12]

We also consider the Fama and French (1992) and Carhart (1997) 4-Factor model, which is more commonly used in mutual fund research:

$$r_{it} - r_{ft} = \alpha_{it} + \beta_{1,i} RMRF_t + \beta_{2,i} SMB_t + \beta_{3,i} HML_t + \beta_{4,i} MOM_t + \varepsilon_{it} \quad i = 1, \ldots, N \tag{2}$$

The factor exposures allow us to compute an average excess return α_{it} for each month and fund, shown here for the Fama-French and Carhart 4-Factor model (comparably, we estimate a Fung and Hsieh (2004) excess return α_{it}^{FH}):

$$\alpha_{it}^{FFC} = r_{it}^{e} - \hat{\beta}_{1,i} RMRF_t + \hat{\beta}_{2,i} SMB_t + \hat{\beta}_{3,i} HML_t + \hat{\beta}_{4,i} MOM_t \quad i = 1, \ldots, N \tag{3}$$

With the monthly estimates of risk-adjusted returns, we estimate Fama and MacBeth (1973) cross-sectional regressions against fund characteristics, including our measure of ownership:

$$\alpha_{it} = \phi + \gamma Ownership_{i,t-1} + \mathbf{X}'_{\mathbf{i,t-1}} \Theta + \varepsilon_{it} \tag{4}$$

The key variable of interest is γ, which captures the predictive role of greater inside investment on excess returns. To measure ownership, we use both the percentage of the fund that consists of insider investment (our preferred measure) as well as the gross insider exposure. This measure of ownership is drawn from annual ADV forms, and represents the ownership stake from the prior year. Additional controls in $\mathbf{X}$ include controls for fund age, size, and strategy.

Though standard in the mutual fund literature, a key limitation of the Fama and MacBeth (1973) cross-sectional specification is that it does not allow us to control for time and firm fixed effects. To do so, our baseline specification is a panel regression of fund and firm characteristics against excess returns:

[12] Our analysis is robust to the inclusion of funds with zero or 100 percent inside ownership, the inclusion of fund-of-funds, and the inclusion of smaller funds.

$$\alpha_{it} = \phi + \gamma Ownership_{i,t-1} + \mathbf{X'_{i,t-1}}\Theta + Firm_i + Year_t + \varepsilon_{it} \tag{5}$$

The key difference is that in this specification; our key coefficient of interest, γ, captures the impact of an additional dollar of inside investment on excess return *relative* to another fund in the same family (i.e., within the same firm) and year with less inside investment. This allows us to control for all other invariant firm and time characteristics which might otherwise drive excess returns. Standard errors are clustered at the month level.[13] We also extend our analysis to consider return smoothing motivations, which have been documented for hedge funds (Getmansky et al., 2004).

To test for the relationship between ownership and size, we also perform a comparable analysis regressing the assets under management of funds against the fraction of inside investment:

$$AUM_{it} = \psi Ownership_{it-1} + Firm_i + Year_t + \varepsilon_{it} \tag{6}$$

The ψ coefficient here captures the relationship of size and fractional inside investment, within firm and year.

II.D.2 Fund-Flow Sensitivity and Return Predictability

Following prior literature, such as Chevalier and Ellison (1997), we define fund flows using net flows $r_{i,t}$ as:

$$Flow_{it} = \frac{AUM_{it} - (1 + r_{it}) \cdot AUM_{i,t-1}}{AUM_{i,t-1}} \tag{7}$$

Using this definition, we also test standard fund-flow sensitivities:

$$\begin{aligned} Flow_{it} &= \eta \text{High Insider Ownership}_{it-1} + \beta_1 \alpha_{it-1} \times \text{High Insider Ownership}_{it-1} \\ &+ \beta_2 \alpha_{it-2} \times \text{High Insider Ownership}_{it-1} + \beta_3 \alpha_{it-3} \times \text{High Insider Ownership}_{it-1} \\ &+ \delta_1 \alpha_{it-1} + \delta_2 \alpha_{it-2} + \delta_3 \alpha_{it-3} + \mathbf{X'_{it}}\theta + Firm_i + Year_t + \varepsilon_{it} \end{aligned} \tag{8}$$

[13] See Petersen (2009).

In these specifications, time is measured quarterly. Other controls in **X** include: leverage, lagged fund size, management fees, performance fees, redemption period, high watermark, lagged flows, and fund formation and strategy fixed effects.[14] The key coefficient of interest is β_1: whether funds with high inside ownership (defined as inside investment above the median) exhibit less flow-performance. Lower flow-performance would indicate that when funds with greater inside investment accept less additional funding in responsive to better prior performance.

III Results

III.A Describing Inside Investment

We begin with an analysis of the determinants of inside investment. In Table V, we run a yearly panel regression of inside investment against a variety of fund and firm characteristics. We begin in column 1 with a regression of the percentage of fund assets attributable to investments by insiders and related parties against a number of fund and firm characteristics without additional fixed effects. Standard errors are clustered at the firm level. We then add fixed effects for fund inception year, firm, and year of observation.

The most robust correlate of inside investment is fund size—high inside investment funds are smaller overall. We also find that leverage is negatively associated with inside investment once we control for firm fixed effects. One interpretation of this result is that insiders appear to be taking fewer risks when their own money is at stake. Given that we document in the next section higher after-fee returns on these funds, the implication is that excess alpha in high insider funds is not the result of greater leverage-enabled risk-taking.

An alternative interpretation, aside from the risk explanation, is that skilled managers facing capacity constraints may simply prefer to avoid all outside money (both debt and equity) in select funds, in which they prioritize allocations of their own private capital.

[14] Following Getmansky et al. (2015).

For this reason, they may simply prefer to avoid both accepting additional assets under management, as reflecting debt claims.[15]

There is some slight evidence that fees—particularly performance fees—are associated with higher inside investment, though this relationship is generally small in magnitude and not statistically significant once we add firm fixed effects. One possible reason to consider the endogenous determination of fees might be that insiders use higher fees to further ration out investors in funds with high inside investment. However, our key prediction—that inside investment will be associated with higher post-fee alpha—remains as long as we assume that managers cannot fully set fees to maximize all of the investor surplus. Fee data indicate that they appear to be sticky, do not exhibit substantial cross-sectional or time-series variation, and are not robustly associated with inside investment once we control for other variables.

Figure V also highlights the evolution of inside investment across fund age and calendar year. We observe that many funds are seeded with inside investments at inception, and display a broadly flat profile of inside investment over the fund's life.

III.B Main Regression Results

In our main specifications, we use a two-step approach to control more closely for fund factor exposure. We hypothesize that within firms, funds with a greater proportion of inside capital will outperform because managers will allocate there least scalable strategies to funds managing their money, and internalize the capacity constraints of the investment strategy when accepting new capital. Funds with greater inside capital retain greater alpha, in equilibrium, because managers maximize profits by not accepting additional outside capital beyond the capacity limit of the investing strategy.

To analyze the role of inside investment and risk-adjusted returns, we examine in Table VI the fund-level regressions as outlined in section II.D, above.[16] In Panel A, we focus

[15] We thank a referee for making this point.

[16] The relationship between Inside Investment and Excess Returns is robust to the inclusion of lagged returns, as shown in the Appendix Table A2.

on a panel specification using as the key regressor the percent of a fund's asset under management that can be attributed to insider investment in the prior year against excess returns. In columns 1–2, we measure excess returns using a 7-factor model in the first stage, and show the results of a second stage regression of inside investment against excess returns. We find that inside investment is statistically associated with excess returns. This relationship persists in our preferred specification in column 2, which controls for year and firm effects. Additional fund level controls include: a size control (log of gross asset value), the fund's inception year, and the fund's strategy.[17] Our estimates in that column suggest that a fund with a 1 percentage point increase in inside investment experiences a 0.48 basis point higher excess return per month; relative to another fund in the same family and year of observation with the same strategy, size, and inception year.

Scaling our result, we find a 1.26% increase in alpha per year for a fund with a standard deviation increase (22%) in the amount of inside investment relative to another fund in the same firm with similar characteristics in the same year. These results are quite large quantitatively, and suggest a strong importance for internal investment as a predictor of cross-sectional fund performance. The larger magnitude and significance of results when controlling for firm fixed effects suggests the importance of discretionary fund allocation by insiders: there is high dispersion of fund returns within firms in our sample, and insiders choose which investment strategies to pursue in which funds, and which funds to invest in. Our results suggest that their private capital is more likely to be deployed in funds that outperform others within the family. We find similar results in columns 3 and 4 of Panel A, which use the Fama-French and Carhart 4-factor model to adjust for factor exposure.[18]

We also find a strong role for inside investment in Panel B of Table VI, in which we examine the *gross* amount of inside investment, rather than the fractional amount, while also

[17] Adding management and performance fees leaves the results unchanged; but these are potentially endogenous to inside investment levels so we exclude them from our main specifications. Controlling for strategy × year fixed effects—to account for capacity constraints at the level of strategy type—also leaves our effects unaffected.

[18] To better understand the underlying risk exposure behind these numbers, in Appendix Figures A1 and A2 we plot estimated factor exposures for both sets of models; while Appendix Figure A3 shows the correlation between risk factors and inside investment.

controlling for size and other fund-level characteristics. These results are equal-weighted and make a series of sample restrictions outlined in the section above.[19]

In Panel C of Table VI, we also examine a Fama-MacBeth cross-sectional regression. In this specification, as outlined above, we do not control for firm or year fixed effects. However, we also find comparable results in these specifications across both the 7-factor and 4-factor models, illustrating the robustness of our result that greater inside investment is associated with superior performance.

These results are subject to several important caveats. First, while these results suggest that fund-level inside investment predicts superior excess returns, the relationship might not be causal. It may well be that our measure of inside investment is a proxy for other fund-level characteristics. Another important caveat is that we are not able to fully control for whether our results are driven by some element of risk or are instead due to agency conflicts within the firm. Despite our attempts to control for risk using the benchmark fund factors, it is also possible that the outperformance of high inside-investment funds is due to a novel risk factor. To further analyze the mechanisms driving our main result, we examine fund decisions along other dimensions.

III.C Main Mechanism: Capacity Constraints

Having established that investment by insiders predicts fund outperformance, we next consider the possible drivers of this relationship. In order to investigate the source of relative outperformance of high investment funds, we are guided by our framework (discussed in section II.C), which yields key predictions on the mechanisms behind inside investment and fund performance.

First, we consider how lagged excess returns relate to asset flows to funds. Figure VI plots a non-parametric relationship between lagged returns and fund inflows by funds with a greater or lesser degree of insider investment measured at a quarterly frequency.

[19] To test for robustness of these restrictions, in Appendix Table A3 we include funds with 0 or 100 percent inside investment; as well as a specification which value-weights our main specification by Gross Asset Value (measured reliably for all funds from ADV data). We find comparable results in these samples.

Insider funds are defined as those with a greater-than sample average amount of fraction of fund assets attributable to insiders. Flows are winsorized at a 1% level.[20]

The figure illustrates that outsider funds exhibit a standard fund flow-performance relationship as documented in prior research on hedge funds and mutual funds. However, insider funds demonstrate a different profile: insider funds that experience positive excess returns do not exhibit as subsequently high inflows, consistent with the idea that high performing funds with greater insider capital manage funds further away from their capacity constraint by restricting inflows after good returns.

The fact that high-inside-investment funds do not attract higher inflows is strong evidence in our setting against signaling-based explanations of the role of inside investment. If personal stakes by managers were necessary to attract additional capital; we would expect that funds with greater inside investment might attract additional funds; particularly when prior returns were high. Instead, we find that high-inside-investment funds do not scale up as much as outsider funds when returns are high. Instead, these results point to a role for moral hazard explanations for why inside investment is associated with superior performance.

Additionally, we find little evidence that insider funds feature greater capital stability—we do not see strong evidence that poor returns are followed by lower outflows among insider funds relative to funds catering to outside capital. This is suggestive evidence that insider funds are not characterized by a longer horizon to wait out poor returns, offering funds a more patient source of capital.

Table VII illustrates additional flow performance specifications to test possible signaling explanations, as outlined in equations 8. The dependent variable in these specifications is the percent flow, or an indicator whether inflows are positive. A variety of other controls are included in these specifications.[21] We find in column 1 that greater lagged excess

[20] For all flow-based analysis, we exclude eVestment from our sample due to unreliable NAV information from this data provider.

[21] These include: leverage, management fees, number of redemption days, high watermark, lagged flow, and the log of gross asset value (lagged one year).

returns predict lower flows among funds with greater inside investment, suggesting that insider funds do not accept as much flows in response to positive returns. Column 2 of this table highlights the extensive margin and suggests that funds with greater inside investment are also much less likely to accept any additional inflows at all in responsive to past superior performance.

The remaining columns of this table expand our analysis to the *other* funds within the family. We do so to test a broader class of signaling explanations—perhaps funds operate certain "flagship" funds to an optimum scale in order to advertise returns. If this is true, we might expect that returns do not predict flows for some high insider funds (because managers are using these funds to advertise high returns); but signaling stories would predict that forgoing additional fee income today (to produce better returns for marketing) should be followed up with higher inflows in the future, perhaps in other funds, generating future fee income.

We test whether high returns result in inflows to other funds in the family. In columns 3–4, we find little evidence that lagged excess returns drive flows to other funds in the family, either measured at the extensive margin or intensive (whether inflows are positive). In columns 5–6, we restrict our attention to high ownership funds. For this subset, as well, we find little evidence that high returns drive inflows to other funds in our family. In other words, investors appear to distinguish between different funds in the family when allocating capital, and preferentially increase flows only to the funds that directly outperform. As a result, we do not find evidence for the idea that managers may want to leave personal capital in some funds in order to signal their quality, and so drive flows (and management fees) to other vehicles they manage. While this does not fully rule out a signaling explanation behind our results, the bulk of the evidence is more consistent with a moral hazard view.

A limitation of this analysis is that it examines fund flows in equilibrium: we do not know whether inflows are low in high performing insider funds because managers are actively restricting inflows, or whether outsiders prefer not to allocate flows to these insider funds—perhaps, because they are less informed.

To further explore the role of active capital rationing, we focus in Table VIII on a sample of funds for which we are able to establish the role of managerial discretion in accepting capital. In this table, we examine funds which are explicitly closed to outside investors, as reported by commercial databases. In columns 3–6 of this table, we find strong evidence that funds that are closed to outside investors strongly outperform. In these specifications, we regress a dummy variable for funds open to investors against excess returns measured using a 4- or 7-factor model, finding that funds closed to outside investors outperform by 0.23–0.45% each month, corresponding to 2–4% a year in excess returns.

Funds which do not accept additional inflows are able to generate superior performance. These excess returns are suggestive that outsiders would like to enter these funds, and are being actively rationed out of them. However, the presence of these funds poses a challenge for traditional views of delegated asset managers—why do managers leave money on the table by not accepting outside investors into these funds and taking management fees?

A potential resolution to this puzzle is suggested in columns 1–2 of Table VIII. In these specifications, we examine the relationship between inside investment and funds that are open to investors. We find that funds which are closed to investors are substantially more likely to have a greater concentration of inside investment.

Our analysis of fund flows highlights managerial capital rationing as a mechanism explaining the outperformance of insider funds. Managers restrict the participation of outsider investors both on the intensive margin (but restricting inflows to insider-funds that outperform), as well as on the extensive margin (by prohibiting outsider capital entry entirely on some highly outperforming funds). By contrast, the superior performance of these insider funds does not drive inflows to other funds within the family, which points to the role of moral hazard as the key driver of the relationship between inside investment and fund returns.

III.D Robustness

III.D.1 Alternative Risks

An important caveat to our analysis is that superior performance in insider funds may reflect risk exposure. To account for risks, other than the factors controlled for throughout the paper,we explore two other measures of liquidity and tail risk, as has emphasized in the hedge fund industry (see Teo (2011), Agarwal et al. (2015), and Agarwal et al. (2017)). In Panel A of Figure VII, we explore the relationship between our measure of inside investment and the Getmansky et al. (2004) liquidity measure. This uses an indication of autocorrelation in returns to estimate the extent to which return series are smoothed, and so provides a measure of asset liquidity (higher numbers indicate greater asset liquidity). While we cannot reject equality across the distribution of inside investment; we find that, if anything, funds with lower inside investment have lower values of the smoothed index—indicating that their holdings have a higher autocorrelation indicating holdings of less liquid instruments. Despite the imprecision, we can rule out the possibility that high inside investment funds are holding less liquid securities, at least as judged by the autocorrelation of returns using this metric.

In Panel B of Figure VII, we explore an alternate measure of performance—the maximum drawdown. This measures the greatest percentage loss the fund has experienced, relative to the maximum asset value, and so provides an estimate of tail risk. We plot average maximum drawdown for funds by each percentage of inside investment, and also find no statistically significant relationship between inside investment and tail risk. However, there is a slight positive relationship between the extent of the maximum drawdown and inside investment—which could potentially suggest that hedge fund managers prefer to take risks with their own private capital which yield excess return in exchange for a small probability of extreme losses. Despite the plausibility of this mechanism, we emphasize we find little statistically robust evidence that high inside investment funds are engaging in systematically engaging in strategies characterized by greater tail risk.

In additional robustness to explore the role of autocorrelation of returns, in Appendix Table A2 we include three lags of return to account for return smoothing and illiquidity as omitted factors, which leaves our main results unchanged.[22]

III.D.2 Fund Size

We also analyze the role of size and inside investment. Again, we hypothesize in II.C that a key mechanism driving the superior performance of insider funds is their smaller size, due to decreasing returns to scale in investment technologies. To test this hypothesis, in Table IX, we regress the size of the fund against inside investment. In column 2 of Panel A, we focus on our matched dataset and find that an additional percent of inside investment is associated with a $4–8 million smaller fund. This relationship persists when we examine a specification where the dependent variable is the log of assets under management in columns 3–4.

We are also able to run this specification on the Form ADV dataset only, in Panel B. These specifications use the field "Gross Asset Value" derived from fund-level information in Form ADV. Gross asset value differs from assets under management in that it does not subtract out the value of short positions from the portfolio, and so overestimates true fund size. Despite the limitations of this measure, using this field as a dependent variable enables us to avoid losing observations on the merge between our Form ADV dataset and the commercial hedge fund datasets. Results are very similar when not restricting on funds that merge into commercial hedge fund datasets: we find in column 2 that within a firm, funds with an additional percent of inside investment are around $10 million smaller in gross asset value. These results provide additional support for our main hypothesis: inside investment funds are both smaller and outperform, suggesting that managers do not hit the limits of the capacity constraints of their investment strategy when their own private capital is deployed. The reluctance to accept additional outside capital on these funds explains why they continue to outperform and gain excess returns, even in equilibrium.

[22] We have run additional robustness checks controlling instead for the Getmansky et al. (2004) measure directly for this and other key specifications, which are available upon request.

III.D.3 Heterogenous Treatment Effects

In this section we test alternative stories that may be driving our main result. We first test the relationship between inside investment and excess returns across fund categories. Figure VIII illustrates the main effect (as in column 2 of Panel A Table VI). Panel A of this figure plots the coefficient of inside investment against excess return by fund categories, as measured in our set of commercial hedge fund datasets. The main effects are driven by funds that engage in specialist absolute return strategies, arbitrage strategies, and equity funds. As suggested by Getmansky et al. (2015), these are categories where we expect to see greater capacity constraints in terms of fund style. Within equity funds (Panel B), effects are driven by long-short funds. These fund strategies also plausibly feature capacity constraints in their investment strategies. By contrast, effects are insignificant among fund-of-funds and CTAs, which are typically associated with greater capacity.

Next, we examine the role of discretion over personal capital contributions. In Appendix Table A4, we first impute a "mechanical" component of personal capital contributions derived from rolling over prior fee income from the observed inside investment, attributing the residual to reflect discretionary capital contributions of the mangers. We find that even after subtracting this "synthetic" or mechanical inside investment potentially resulting from rolled over fees, the discretionary component remains a large and statistically significant driver of fund returns.

We additionally test our main result across the distribution of inside investment. As shown by the quantile regression in Figure A4 in the Appendix, our results are largely being driven by funds with higher levels of inside investment; those funds for which inside capital provides a substantial component of the capital base, for which we expect to see the highest-powered incentives.[23] In Appendix Table A5 we examine our basic regres-

[23]Our findings are weaker if we exclude high inside-investment funds from our sample. When we impose a $500m cutoff and restrict to funds with inside investment of $< 50\%$, we find similar results as in the analysis in Kruttli et al. (2017) based on a linkage of Form PF-ADV. However, our focus is on the larger universe of hedge funds, including those smaller funds not required to file Form PFs and those funds with substantial inside investment stakes.

sion across different fund size levels, finding significant effects for the top two fund size quantiles (corresponding to fund sizes of at least $126 million).[24]

We also investigate the implications of dispersion in firm-level ownership and its relation with fund-level inside investments. As shown in the Appendix, Table A6, column 3, suggests that inside investment at the fund level remains a significant predictor of excess returns, even when controlling for measures of firm-level ownership. In addition to fund-level inside investment, we find that the number of equity owners (as a measure of the dispersion in a hedge fund family's ownership structure) negatively predicts excess returns. While this result would be consistent with the idea that dispersion in a firm's equity structure is a sign of agency frictions and internal firm conflict, other explanations might also potentially explain the relationship between the dispersion in firm-level equity ownership and fund performance. Despite the limitations of our measures of firm-level equity, we emphasize that our paper is the first to our knowledge to examine measures of insider capital allocations for a comprehensive sample of hedge funds at the level of fund allocation, as well as firm-level equity contributions.

III.D.4 Superior Manager Information

An alternate and complementary mechanism in explaining our main result that greater insider investment predicts higher excess returns is that managers have superior private information on the abilities of fund managers than do outside investors, and so deploy personal capital to the superior managers. To test this hypothesis, we estimate the following specification in Table X:

$$\alpha_{it} = \beta InsiderInflow_{i,t-1\to t} + \gamma OutsiderInflow_{i,t-1\to t} + \varepsilon_{it} \tag{9}$$

This specification tests whether *changes* in insider investment predict excess returns. We find that changes in neither inside nor outside flows predict excess returns. While this

[24] We also examine our results separately for funds with inception years prior to 2011 and funds started afterwards, examining the hypothesis that funds originated more recently might be more subject to signaling effects. We do not find evidence for a statistically significant difference between these two groups.

test is not fully conclusive regarding the channel of superior inside information, this result suggests that insiders do not appear to be able to time their capital allocation decisions in ways that predicts future excess returns. Put differently: levels of inside investment, rather than changes, predict future returns. In conjunction with the results on fund flows and performance, this result is perhaps unsurprising: fund insiders appear to frequently extract assets from their best performing funds, rather than further invest, in order to continue to operate funds further from their capacity constraint and gain excess returns.

III.D.5 Event Study: Skimming

The results from the previous section provide evidence of a role for insider investment in driving fund returns and suggest that the possibility of insider investment should be seen as a critical component of the compensation of managers in addition to management and incentive fees. They raise the prospect that fund managers may seek to further take advantage of this relationship by steering clients into lower performing funds.

We explore this possibility in Figure IX, which conducts an event study in the aftermath of the creation of a new fund among firms which previously only had one. The creation of an additional fund presents two possibilities for fund managers: they can either keep their internal capital invested in the original fund (using the new fund to attract new capital); or they can shift their own capital to the new fund (and market the original fund to investors). If the amount of insider capital is an important determinant of fund performance, we expect different fund performance in the *original* fund under the two cases. If managers are shifting their capital outside of the fund, we expect the performance of the original fund to deteriorate (since managers are no longer as invested in success of the fund). If, on the other hand, managers keep their capital in the original fund, the performance of the original fund should remain strong.

To test this possibility, we focus on all cases in which a hedge fund, which previously only operated one fund, opens a second. We isolate two cases: one in which the new fund has less internal investment than the original (the new fund has "low inside investment"),

and another in which the new fund has more internal investment than the original. We plot cumulative returns of the original fund for the two-year window both before and after the fund creation date. We track the returns on the original fund to avoid the issue of incubation bias (Evans, 2010) which would be posed by analyzing the returns of the newly generated fund.

Our results suggest that fund performance is relatively similar before the event date for the original fund, regardless of whether the firm subsequently creates a new fund with high or low internal investment. Differences grow more pronounced in the aftermath of fund creation. We find that when the new fund has "low inside investment"—suggesting that managers keep their internal capital in the original fund—fund performance suffers relative to when the newly create fund has "high inside investment." We expect to see this difference because managers are more invested in the success of the initial fund if their capital remains deployed in the fund. If their own capital has moved to a different fund, performance tends to suffer in the window after fund creation.[25]

Though these results are not fully conclusive, they are suggestive of the possibility of "skimming" motives on the part of fund managers. If managers are able to shift their internal investments across funds within the same family, they seem able to focus their investments on successful funds, while steering outside capital into the lower performing funds. These results therefore provide additional context to our discussion of mechanisms in section II.C and previous empirical results, suggesting that active decisions made by fund managers regarding fund creation and where capital is deployed play a role in determining returns for outside investors.

To be clear, this analysis does not distinguish whether this is due to insiders having better information on which fund managers can outperform relative to outsiders, or because managers devote more effort when greater amounts of personal capital are on the line. Despite the multiple possible explanations, we emphasize that our result provides novel evidence on the role of inside investment in shaping fund performance as new funds are created.

[25] In a Difference-in-difference regression, the interacted term of High Inside$\times$Post has a coefficient of 0.969 and a standard error of 0.214, which is significant at the 1% level.

IV Conclusions

The ability to access and allocate capital to profitable, but highly limited, investment opportunities within the companies they oversee is a substantial element of fund manager compensation. However, the scope of these inside investments, and the incentives they pose for managerial capital allocation, has rarely been explored in an empirical analysis of delegated asset management.

Our paper explores the tension posed by the incentives resulting from inside investment. From outside investors' perspective, a positive feature is that the alignment of incentives improves their returns. Funds with higher internal investment have greater excess returns, even when we control for firm fixed effects. They do so by taking on less leverage and less exposure to asset illiquidity, suggesting that hidden risks are not driving this result. Our results are large in magnitude, and suggest that a fund with a one standard deviation increase in inside investment relative to the mean will provide an additional 1.26% of excess returns annually.

However, this improvement in return performance comes at the cost of fund participation by outsiders. We find evidence consistent with the idea that greater inside investment incentivizes managers to better manage the size-performance tradeoff in ways that displace outside capital. High-insider investment funds are less likely to accept inflows in response to positive returns, and are more likely to be closed to outside investors entirely. Additionally, we find evidence for strategic capital allocation at the time of new fund creation. When internal assets are shifted to newly created funds, the original fund tends to underperform; relative to the case when managerial commitments remain with the original fund. However, high returns at insider funds do not drive inflows to other funds in the family, suggesting that signaling motives cannot entirely explain our results. The joint relationship between internal investment, fund flows, and performance suggests that funds better manage capacity constraints when managers have personal capital at stake, leading to superior returns at the expense of fewer managed investments.

These results, taken as a whole, provide powerful support for our hypothesis that hedge funds face capacity constraints in their operations, and differentially allocate capital across their funds to maximize profits, depending on the mix of inside and outside capital. When funds rely on outside capital, managers are compensated primarily from managerial fees and leave little value to outside investors. Greater reliance on internal financing better aligns incentives of managers and outside investors, leading them to leave substantial "slack" in fund size and operate strategies on a lower scale, thereby receiving excess returns, even in a competitive market.

Our results contribute to the ongoing debates regarding the presence of managerial alpha and financial rents. Many observers are puzzled at the apparently outsize rents earned by financial intermediaries such as hedge funds, even in the wake of apparently strong competition and the role of fund inflows on diminishing returns. In turn, these managerial rents have driven top-end wealth and income inequality (see Kaplan and Rauh (2013)). We suggest a possible reconciliation of these facts can be found in examining the option that fund managers have of not only of earning management and performance fees, but also of deploying their own capital in funds they manage.

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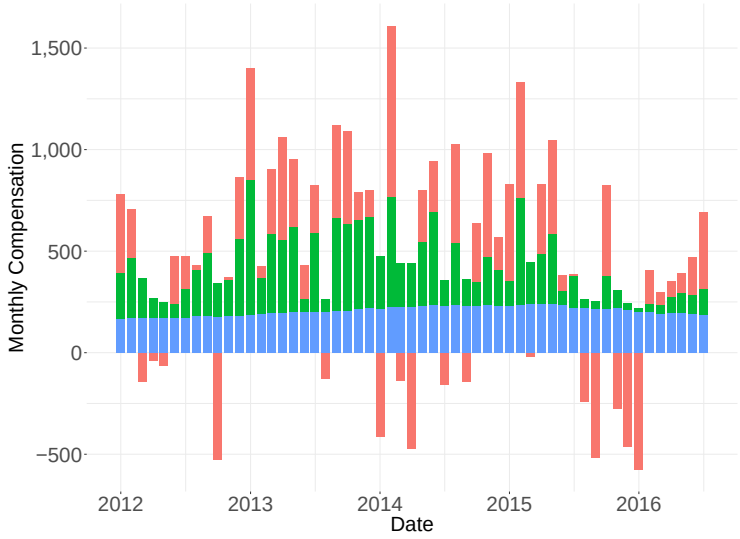
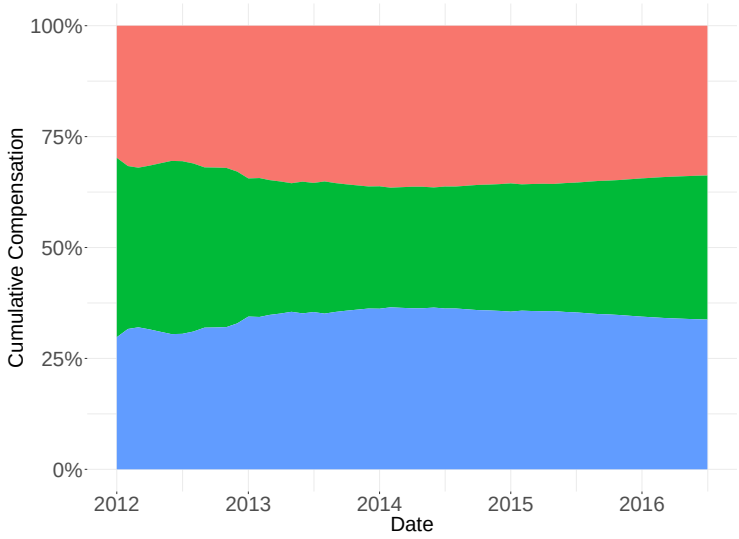


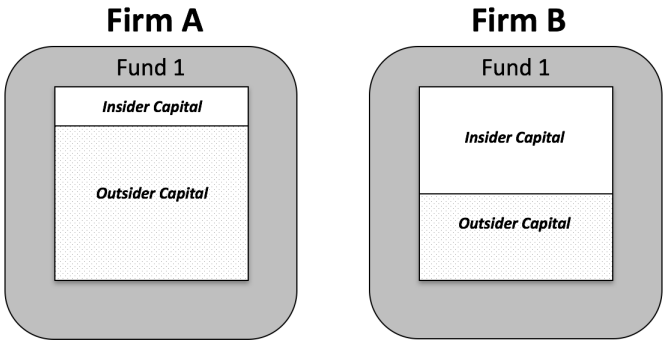
Panel A: Monthly Compensation by Source



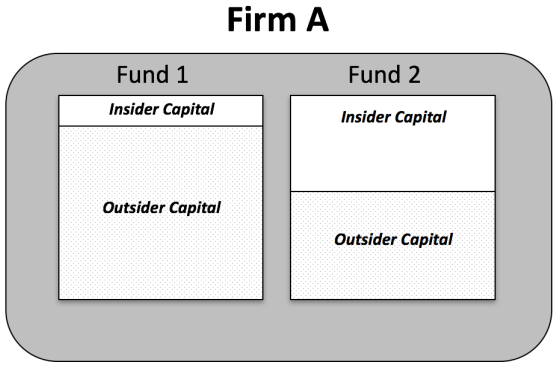
Panel B: Cumulative Compensation by Source

FIGURE I **Hedge Fund Compensation by Source**

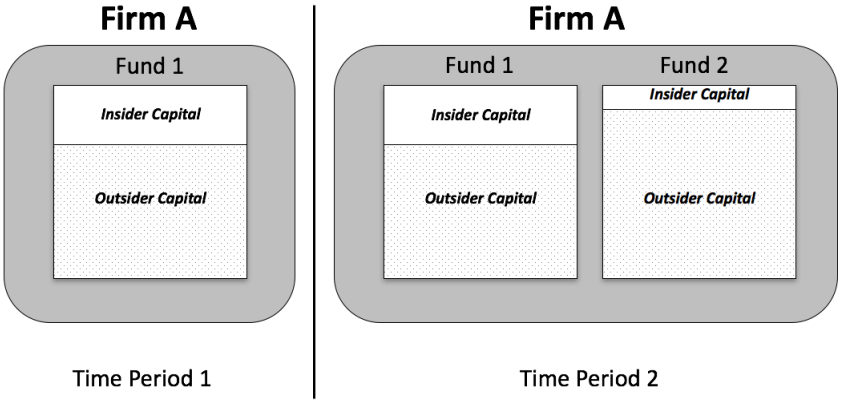
This figure breaks out three sources of hedge fund compensation—managerial fees (blue), performance fees (green), and excess returns on privately invested capital (red). The sample is restricted to funds for which all fee data is available, and excludes eVestment (for which we do not have accurate assets under management data). To compute management fees, we multiply listed management fees for each fund against monthly assets under management invested by outside investors (assuming that insiders do not pay fees). Performance fees are computed assuming that all funds operate under a high-water mark which begins the first month for which we observe each fund's performance. Stated performance fees are multiplied by the total raw return (assuming no hurdle rate) on outsider fund investment. Insider returns are calculated based on each fund's excess return from a Fung-Hsieh 7-Factor model multiplied by the quantity of inside investment in place within in each fund. Panel A of this Figure breaks out each source of hedge fund compensation. Panel B shows the running cumulative total of each source, outlining the fraction of aggregate managerial compensation attributable to each source.



Panel A: One Firm, One Fund



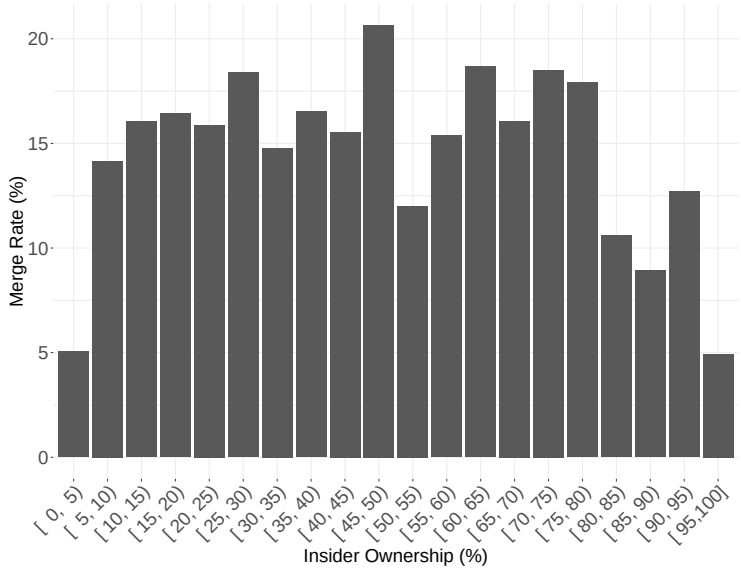
Panel B: Different Insider Investment, Within Firm



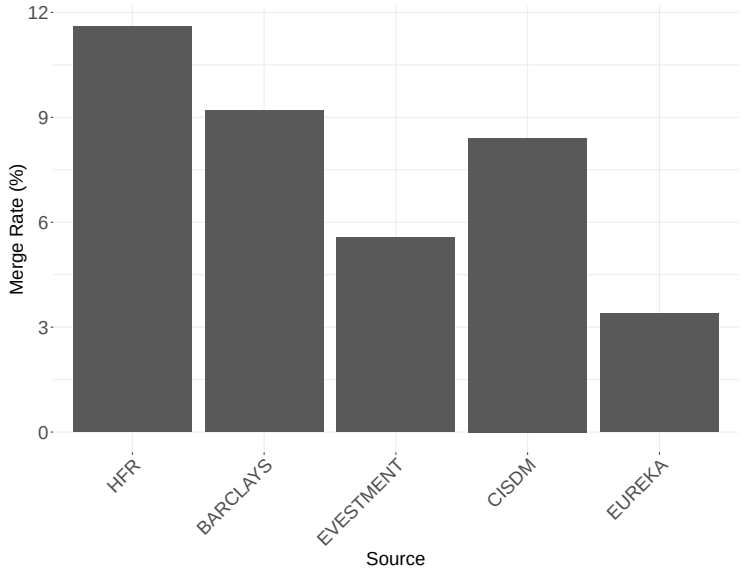
Panel C: Event Study Analysis

FIGURE II **Firm and Fund Analysis**

This figure outlines the difference between firm and fund in the context of this paper and emphasizes the different setups we analyze. Panel A describes a one firm one fund structure and the comparison of incentives between two hypothetical firms. Panel B describes a firm with two separate funds with different insider capital. Our within firm analysis compares Fund 1 against Fund 2, within firm. Panel C shows the time evolution of Firm A, transitioning from a one fund to multi-fund firm.



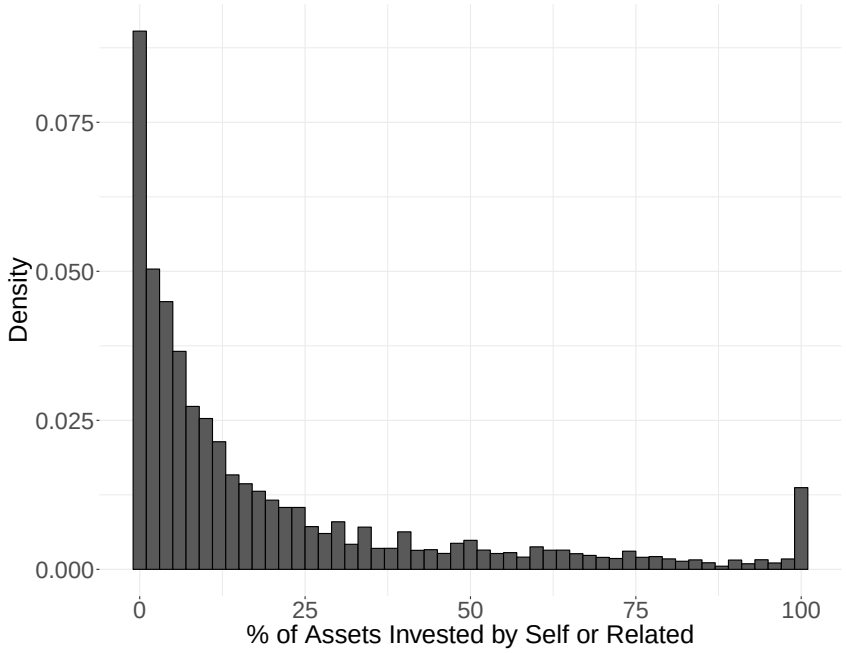
Panel A: Among ADV Hedge Funds, merge rate into Commercial Datasets



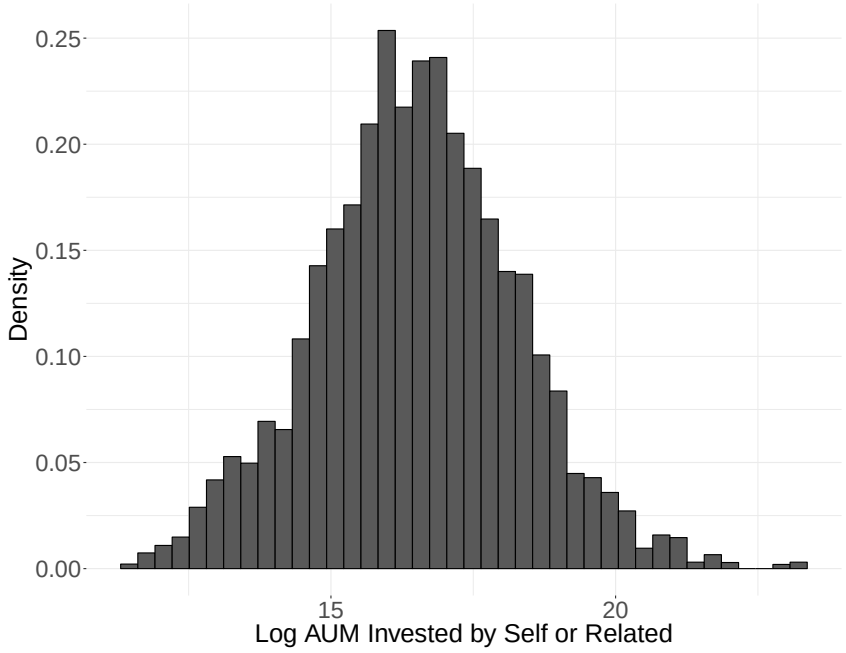
Panel B: Merge Rate by Commercial Data Provider

FIGURE III **Merge Details**

This figure plots the merge rate between observations in Form ADV and the hedge fund commercial return datasets (outlined in the data section). All data is taken as of 2015. In Panel A, we report the fraction of observations in the ADV dataset for which we find a merged counterpart in the commercial return datasets, with the fraction reported for each 5-point interval of inside investment. In Panel B, we report the merge rate as a fraction of the total funds listed in each of the commercial hedge fund data providers. The order of the datasets reflects the sequential match process—we first search for matches in HFR, then BarclayHedge, then eVestment, then CISDM, then Eureka. For this reason, the match rate for each datasets reflects a conditional match rate, given that the fund did not merge in the previous dataset, and so our merge rates are generally decreasing as we move across providers.



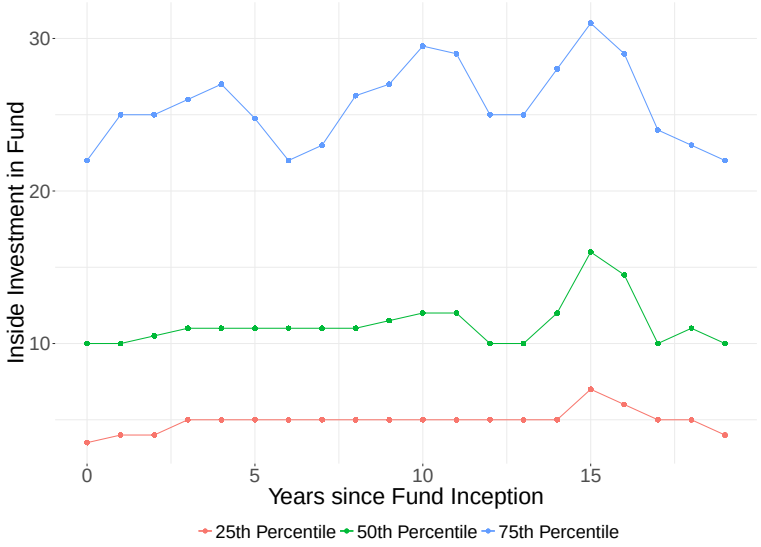
Panel A: Distribution of Insider Investment Across Funds, Percentage of Total Assets



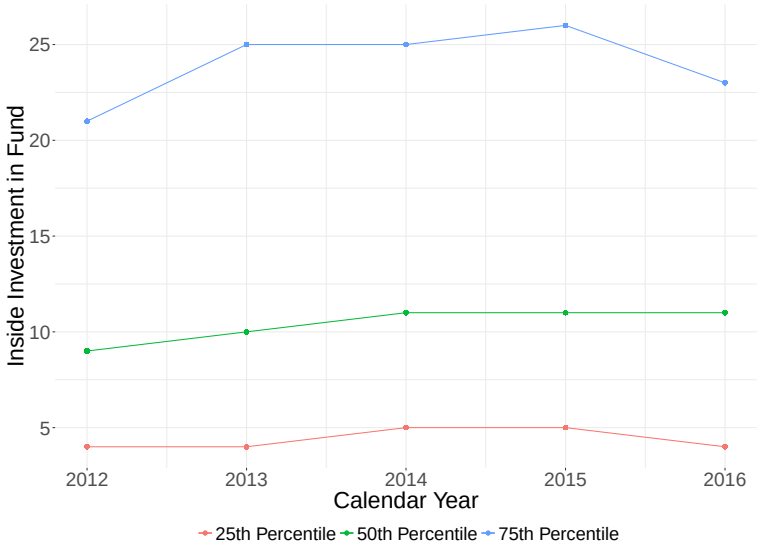
Panel B: Distribution of Insider Investment Across Funds, Gross Inside Investment

FIGURE IV **Distribution of Insider Investment from Merged Sample**

This figure plots the insider investment into hedge funds from the merged sample of hedge fund returns and ADV forms. Panel A is a histogram of insider investment, and is in units of percent of total investment. Insider investment displays a "dumbbell" distribution. Panel B is a histogram of log(Gross Asset Value) of insider investment across funds for the merged sample between ADV and the commercial hedge fund datasets.



Panel A: Inside Investment against Fund Age



Panel B: Inside Investment against Year

FIGURE V **Evolution of Inside Investment**

This figure highlights the evolution of inside investment. Panel A highlights the mean level of inside investment of a fund over its lifetime. The red, green, and blue lines correspond to the 25th, 50th, and 75th percentile of inside investment, respectively. Panel B plots the same statistics over all funds aggregated by calendar year.

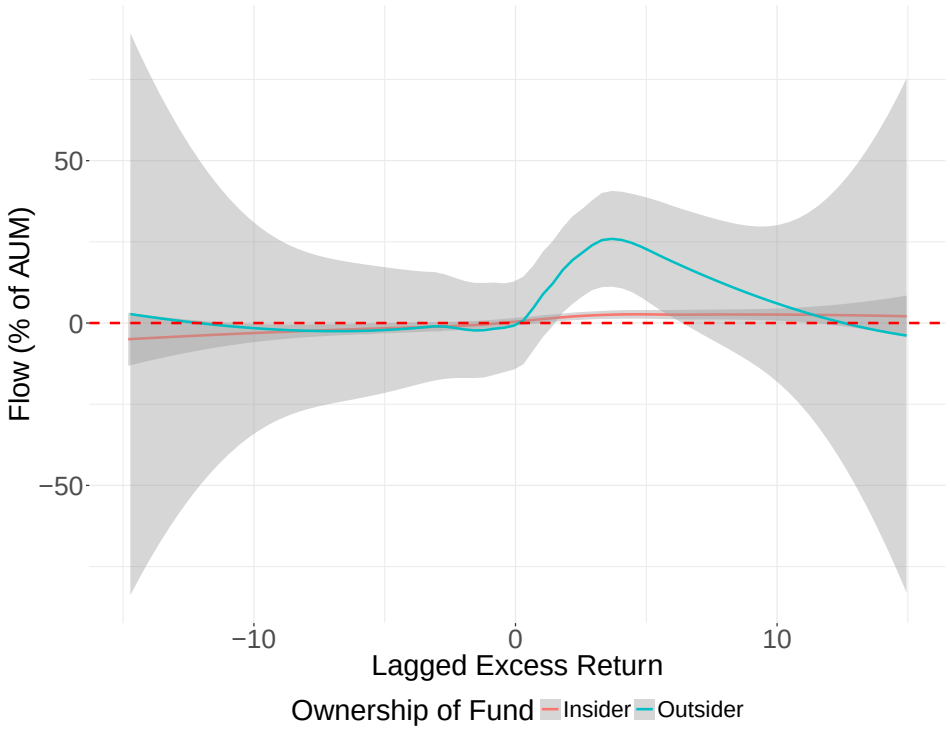
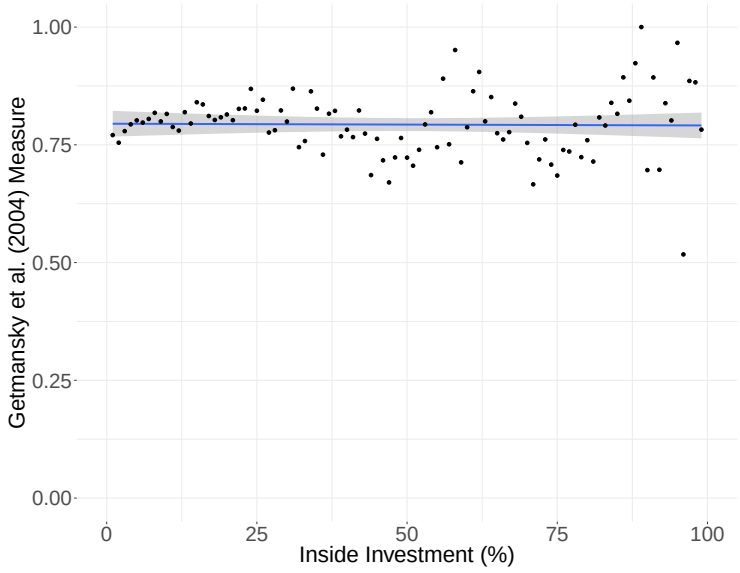
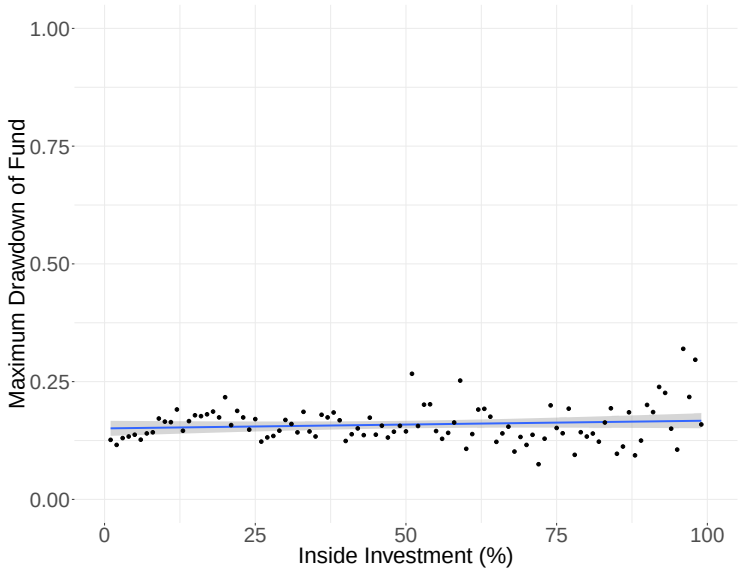


FIGURE VI **Flow Performance of Funds by Insider Status**

This figure plots a density of the relationship between lagged excess return and contemporaneous flow. The flow measure is defined as: $Flow_{it} = \frac{AUM_{it} - (1+r_{it}) \cdot AUM_{i,t-1}}{AUM_{i,t-1}}$. Excess returns are defined using the Fung-Hsieh 7-Factor model. Funds are divided by the average level of inside investment into insider funds ($>$ 20.8% Inside Investment) and outsider funds. Grey bars correspond to 95% confidence intervals.



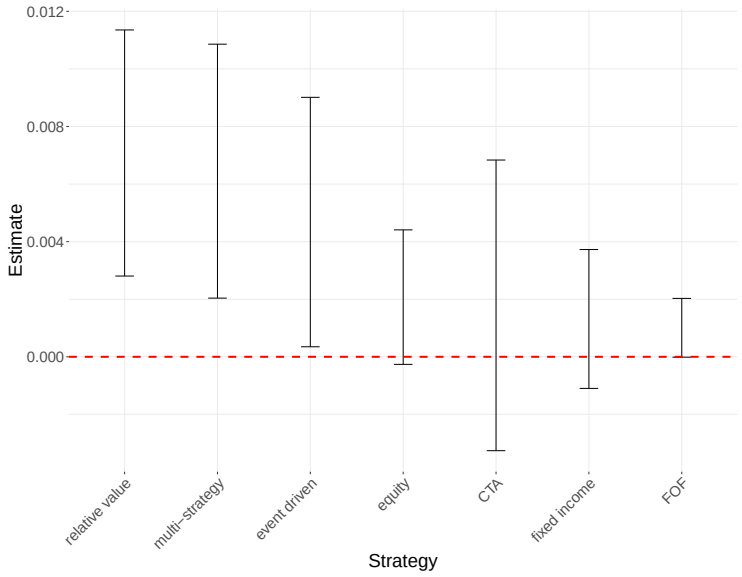
Panel A: Liquidity and Inside Investment



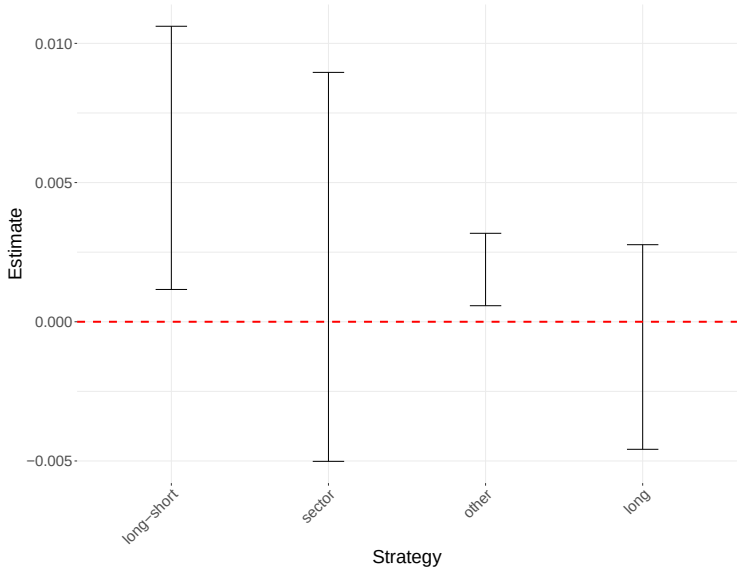
Panel B: Maximum Drawdown and Inside Investment

FIGURE VII **Alternative Risks and Inside Investment**

This figure illustrates explores the relationship between alternate possible risks and inside investment. In Panel A, we examine asset liquidity. To measure liquidity, we adopt the return smoothing measure from Getmansky et al. (2004). For each percent of inside investment, we compute the average normalized measure of liquidity risk as highlighted in that paper. Lower measures correspond to greater autocorrelation indicative of less liquidity; higher numbers associate with less autocorrelation associated with more liquidity (or a worse fit). In Panel B, we plot the distribution of maximum drawdowns (the greatest percentage loss in the fund's history, relative to the maximum attained asset value) across inside investment, so higher numbers indicate a greater average percentage loss. For each percent of inside investment, we plot the average max drawdown for funds in that bucket.



Panel A: Effects by Fund Type



Panel B: Effects by Fund Type among Equity Funds

FIGURE VIII **Inside Investment Return Relationship by Fund Type**

This figure examines a robustness analysis of our main specification, as shown in column 2 of Panel A of Table VI, which is a panel regression of inside investment against factor-corrected returns. This figure plots the coefficient on inside investment, corresponding to the predictive value of that variable on excess returns, run in a separate regression for each fund category. Funds are categorized based on descriptions in commercial hedge fund datasets listed in the Data section. The error bars indicate 95% confidence interval for the estimated coefficients.

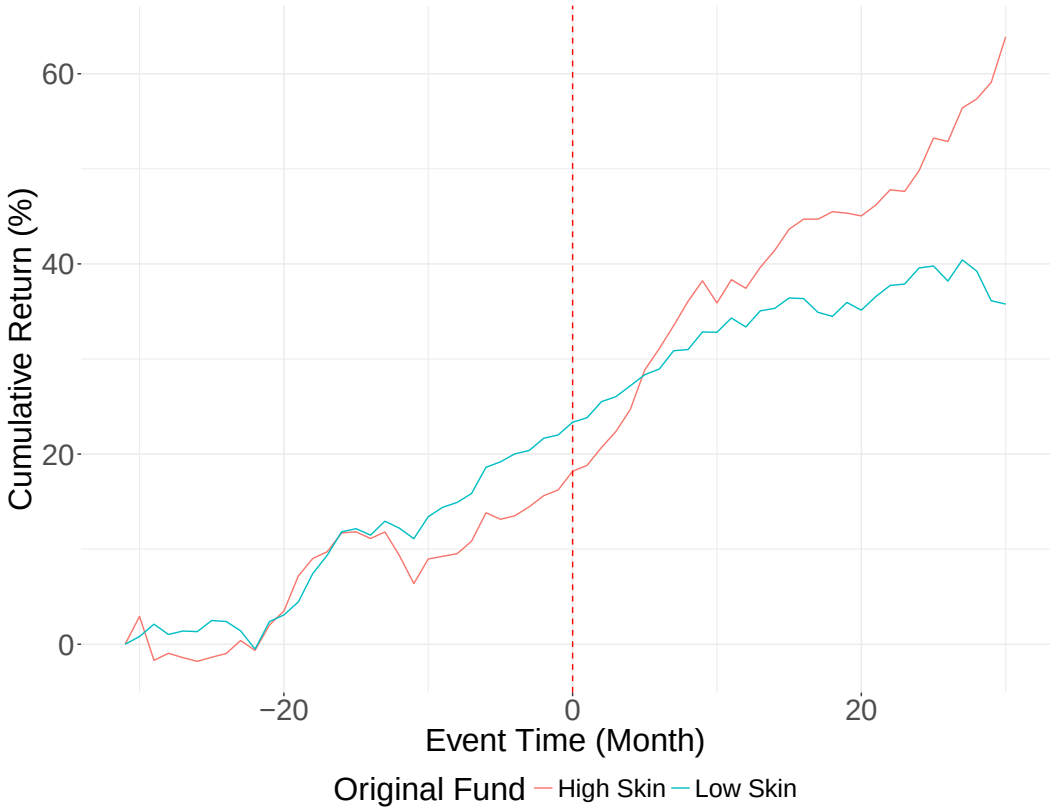


FIGURE IX **Event Study, Transition From One Fund to Multiple Funds**

This figure plots the net cumulative returns of a firm which launches an additional fund after previously only having one. Event times correspond to months from the fund creation date. The lines plot the cumulative performance of the original fund; with the red line tracking a fund in which inside investment increases in the original fund after new fund creation (suggesting that the newly created fund is marketed to outside investors). The blue line tracks the performance of funds in which inside investment the original fund falls after new fund creation (suggesting that the original fund is marketed to outside investors). The post-fund creation rise in returns of the red line indicates that fund performance improves when inside investment is strengthened in the fund. In a difference-in-difference regression, the interacted term of High Inside$\times$Post has a coefficient of 0.969 and a standard error of 0.214, which is significant at the 1% level.

TABLE I **Summary Statistics: ADV Data**

This summary table describes data on investment advisors taken from Form ADV in 2016. Data is only taken from funds which are registered as hedge funds; firms must have at least one hedge fund and a minimum level of assets of $20 million. Panel A describes firm level information at the level of the management company. Panel B describes information available at the level of individual funds. Note that some assets may be double-counted due to the inclusion of fund of funds. Inside Investment corresponds to ownership by management or related parties, the key variable explored in this paper.

Panel A: **Firm Level Variables**

Names	Total	Median	Mean	Std.Dev
Custodial AUM ($m)	8,525,754.0	775.5	6,458.9	28,332.9
Regulatory AUM ($m)	18,084,715	1,166.7	13,700.5	72,114.3
Discretionary AUM ($m)	17,518,589	1,030.8	13,271.7	71,040.1
Non-Discretionary AUM ($m)	566,126	0	428.9	2,585.1
Number of Employees	139,264	13	57.2	199.0
— Support Staff	81,033	5	33.3	132.9
— Advisors	58,231	7	23.9	75.6
Number of Firms	2,433			

Panel B: **Fund Level Variables**

Names	Total	Median	Mean	Std.Dev
Number of Hedge Funds	9,763			
Gross Asset Value ($m)	6,177,174.0	127.8	632.7	3,060.7
Gross Assets, Inside Investment ($m)	772,663	3.8	79.1	553.2
Gross Assets, Fund of Funds ($m)	1,160,354.0	0	118.9	873
Gross Assets, Non-US Investors ($m)	2,492,344.0	4.7	255.3	1,698.6
Number of Owners		19	66.8	544.3
Minimum Investment ($m)		1	7.5	70.3
Inside Investment (%)		3	16.7	28.6
Investment by Fund of Funds (%)		0	15.9	29.5
Non-US Investors (%)		4	30.7	39.0
Number of Fund of Funds	2,322			

TABLE II **Summary Statistics: Merged Data**

This summary table describes data on the primary dataset based on a merged dataset of Form ADV and commercial hedge fund data providers (Eureka, HFR, BarclaysHedge, eVestment, and CISDM). Data is taken as of 2016. Data is only taken from funds which are registered as hedge funds; firms must have at least one hedge fund and a minimum level of assets of $20 million. Panel A describes firm level information at the level of the management company. Panel B describes information available at the level of individual funds. Note that some assets may be double-counted due to the inclusion of fund of funds. Panel B reports additional variables not included in Table 1. Inside Investment corresponds to ownership by management or related parties, the key variable explored in this paper.

Panel A: **Firm Level Variables**

Names	Total	Median	Mean	Std.Dev
Custodial AUM	1,195,040.0	591	5,218.5	16,444.6
Regulatory AUM	1,759,749.0	1,022	7,684.5	27,716
Discretionary AUM	1,750,849	952.9	7,645.6	27,633.2
Non-Discretionary AUM	8,899.7	0	38.9	195.1
— Number of Employees	16,665	12	38.8	100.4
— Number of Support Staff	9,941	5	23.1	72.4
Advisors	6,724	6	15.6	29.9
Number of Firms	504			

Panel B: **Fund Level Variables**

Names	Total	Median	Mean	Std.Dev
Number of Hedge Funds	720			
Gross Asset Value ($m)	497,625.5	88.3	278.3	708.9
— Equity	219,868.9			
— Relative Value	122,522.7			
— Fund of Funds	53,330.4			
— Multi-Strategy	55,526.5			
— Fixed Income	29,912.7			
— CTA	26,240.1			
— Event Driven	22,403.2			
— Other	20,527.9			
— Options	623.5			
Gross Assets, Inside Investment ($m)	61,380.4	11.9	41.5	108.8
Gross Assets, Fund of Funds ($m)	73,352.2	0	45.8	200.8
Gross Assets, Non-US Investors ($m)	176,673.4	0.2	112.5	400.9
Number of Owners		39	162.3	865.0
Minimum Investment ($m)		1	1.1	3.3
Inside Investment (%)		10	22.8	27.1
Investment by Fund of Funds (%)		0	9.0	16.7
Non-US Investors (%)		1	24.6	36.2
Management Fee		1.5	1.5	0.5
Performance Fee		20	18.2	5.4
Leverage Ratio		1.1	1.5	0.9

TABLE III **Related Party Information**

This table illustrates the identity of related parties, and listed in form ADV in 2016. The rows need not sum to one: firms select as many options that apply to identify all related parties.

Statistic	Mean	SD
Sponsor of GP	0.741	0.438
Other Investment Advisor	0.501	0.500
Commodity Pool	0.401	0.490
Broker/Dealer	0.160	0.367
Insurance	0.065	0.246
Sponsor of LP	0.046	0.210
Bank or Thrift	0.045	0.207
Trust	0.042	0.201
Pension	0.027	0.161
Accountant	0.025	0.156
Real Estate	0.024	0.153
Lawyer	0.019	0.138
Municipal Advisor	0.013	0.113
Futures Merchant	0.009	0.094
Swap Dealer	0.007	0.081
Swap Participant	0.001	0.026
Share Supervised Persons	74%	
Share Office	59%	

TABLE IV **Summary Statistics of Dependent Variables**

This table presents the summary statistics of key dependent variable used throughout the paper. Each panel summarizes the 10th, 25th, 50th, and 90th percentile, as well as the mean and standard deviation. Years include 2011 through 2016, inclusive. Panel A summarizes the excess return imputed by a Fama-French and Carhart model. Panel B summarizes the excess return imputed by the a Fung-Hsieh model. Panel C summarizes the percent asset flow, computed quarterly, and is winsorized at the 1% level. Panel D summarizes the percent of inside investment, at the fund level.

Panel A: **Alpha from Fama-French and Carhart Model**

Year	10%	25%	50%	75%	90%	Mean	St.Dev
2011	-3.73	-1.68	-0.16	1.00	2.49	-0.46	3.25
2012	-2.28	-0.79	0.31	1.31	2.68	0.24	2.53
2013	-2.28	-0.85	0.18	1.13	2.49	0.14	2.56
2014	-2.55	-0.96	0.14	1.17	2.71	0.14	3.25
2015	-2.77	-1.09	0.13	1.25	2.90	0.16	3.26
2016	-3.36	-1.58	-0.02	1.15	2.77	-0.26	3.13

Panel B: **Alpha from Fung-Hsieh Model**

Year	10%	25%	50%	75%	90%	Mean	St.Dev
2011	-3.49	-1.17	0.27	1.69	3.94	0.18	3.72
2012	-2.59	-0.84	0.37	1.54	3.18	0.32	2.85
2013	-1.51	-0.20	0.84	2.18	3.87	1.04	2.73
2014	-2.81	-0.97	0.40	1.82	3.73	0.45	3.49
2015	-3.48	-1.24	0.28	1.69	3.76	0.23	3.57
2016	-3.79	-1.25	0.31	1.73	3.69	0.07	3.54

Panel C: **Percent Flow, Quarterly**

Year	10%	25%	50%	75%	90%	Mean	St.Dev
2011	-9.66	-4.11	-0.44	1.29	6.49	-1.13	10.83
2012	-10.55	-3.45	-0.07	2.96	11.92	1.04	14.78
2013	-9.26	-2.93	0.24	4.09	17.89	2.86	17.21
2014	-7.66	-2.56	0.02	3.31	12.38	1.59	14.53
2015	-8.49	-3.12	-0.51	1.49	9.62	0.42	12.20
2016	-10.08	-3.82	-0.57	1.59	8.58	-0.32	12.42

Panel D: **Inside Investment, Percentage**

Year	10%	25%	50%	75%	90%	Mean	St.Dev
2011	2	4	9	22	46	17.35	20.87
2012	2	4	10	23	50	17.89	21.04
2013	2	4	10	25	54	19.11	21.59
2014	2	5	11	26	58	20.15	22.48
2015	2	5	11	25	58	20.19	22.72
2016	2	5	11	25	59	20.23	22.74

TABLE V **Determinants of Inside Investment**

This table shows a yearly panel regression of inside investment against fund and firm characteristics. Column 1 includes no additional fixed effects, while column 2 adds fund inception year fixed effects, column 3 adds firm fixed effects, and column 4 also adds year of observation fixed effects. Standard errors are clustered at the firm level. The omitted strategy is Equity funds.

	Inside Investment (Percent)			
	(1)	(2)	(3)	(4)
log(Fund Size)	-3.1461^{***}	-3.2257^{***}	-6.4338^{***}	-6.9775^{***}
	(0.4519)	(0.4382)	(0.8473)	(0.8656)
Management Fee	-0.5006	-0.4119	3.7062	4.1315
	(1.6504)	(1.6810)	(3.0880)	(3.0326)
Performance Fee	0.3901^{***}	0.3955^{***}	0.1775	0.1769
	(0.1229)	(0.1230)	(0.2211)	(0.2100)
High Watermark	-0.7488	-0.8052	-1.1501	-0.3707
	(1.5650)	(1.6582)	(2.8761)	(2.8641)
Redemption Days	0.0043	0.0032	0.0079	0.0072
	(0.0082)	(0.0079)	(0.0200)	(0.0193)
Leverage	0.5363	0.3984	-5.0499^{***}	-5.1682^{***}
	(0.9839)	(1.0431)	(1.7544)	(1.7464)
Number of Advisors	0.0405^{***}	0.0371^{***}	-0.0410	-0.0326
	(0.0087)	(0.0097)	(0.0574)	(0.0519)
Strategy:				
− CTA	2.2385	2.4984	5.3826	4.8524
	(2.8050)	(2.9209)	(7.6972)	(7.5276)
−Event Driven	-4.3384^{*}	-4.4216^{*}	13.6770^{**}	13.5364^{**}
	(2.2823)	(2.4024)	(6.9444)	(6.7910)
−Fixed Income	-2.4840	-1.8786	17.8290^{**}	17.8366^{**}
	(2.4639)	(2.4680)	(7.4266)	(7.1818)
−Multi-Strategy	-1.8645	-1.6295	1.6652	2.3089
	(2.6426)	(2.5617)	(6.8248)	(6.9296)
−Other Strategy	-5.6653^{*}	-6.3861^{*}	11.4604^{**}	11.8979^{**}
	(3.3476)	(3.5624)	(5.6058)	(5.7574)
−Relative Value	0.2941	0.1653	8.9426	8.8212
	(3.1162)	(3.1154)	(8.8751)	(8.8400)
Inception Year FE	No	Yes	Yes	Yes
Firm FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Observations	4,484	4,484	4,484	4,484
R^2	0.0541	0.0890	0.7105	0.7176
Note:				*p<0.1; **p<0.05; ***p<0.01

TABLE VI **Relationship between Inside Investment and Excess Return**

This table shows the panel regression between the excess monthly return of an investment advisor and percent investment from an insider or related party. The first two columns always regress against the Fung-Hsieh 7-Factors, and the second two columns always regress against the Fama-French and Carhart 4-Factor model as outlined in equations 4 and 5 in the text. A size control is always included. Panel A shows a panel regression of percentage inside investment against excess returns. Column 4 includes only a size control, while column 2 also adds additional fund controls (a year fixed effect, a firm fixed effect, and controls for age of fund inception and strategy type). Columns 3 and 4 similarly show results with and without controls for the Fama-French and Carhart model. Panel B shows panel results changing the main dependent variable from percentage inside investment to gross inside investment (log of total insider capital committed). Standard errors are clustered monthly for panels A and B. Finally, Panel C illustrates a Fama-MacBeth cross-sectional specification. This specification differs in that year and firm fixed effects are not included, and standard errors are computed using the Fama and MacBeth (1973) approach.

Panel A **Baseline Specification**

	FH Excess Returns		FFC Excess Returns	
	(1)	(2)	(3)	(4)
Inside Investment (Percent)	0.0024***	0.0048***	0.0024***	0.0048***
	(0.0009)	(0.0015)	(0.0009)	(0.0013)
Year FE	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes
Fund Controls	No	Yes	No	Yes
Log(Fund Size)	Yes	Yes	Yes	Yes
Observations	41,097	41,097	41,097	41,097
R^2	0.0003	0.0368	0.0009	0.0404

Panel B: **Gross Inside Investment**

	FH Excess Returns		FFC Excess Returns	
	(1)	(2)	(3)	(4)
Inside Investment (Gross)	0.0397**	0.0710**	0.0297**	0.0856***
	(0.0184)	(0.0284)	(0.0150)	(0.0235)
Year FE	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes
Fund Controls	No	Yes	No	Yes
Log(Fund Size)	Yes	Yes	Yes	Yes
Observations	41,097	41,097	41,097	41,097
R^2	0.0002	0.0367	0.0008	0.0404

Panel C: **Fama MacBeth Approach**

	FH Excess Returns		FFC Excess Returns	
	(1)	(2)	(3)	(4)
Inside Investment (Percent)	0.0024***	0.0020**	0.0020**	0.0021**
	(0.0008)	(0.0008)	(0.0008)	(0.0009)
Year FE	No	No	No	No
Firm FE	No	No	No	No
Fund Controls	No	Yes	No	Yes
Log(Fund Size)	Yes	Yes	Yes	Yes
Observations	41,097	41,097	41,097	41,097
R^2	0.1662	0.2034	0.0469	0.0690

Note: *p<0.1; **p<0.05; ***p<0.01

TABLE VII **Fund Flow Analysis**

This table summarizes the relationship between fund flows and excess returns. Columns 1 and 2 relate excess returns to fund flows of the same funds. Columns 3 through 6 relate excess returns to fund flows of funds within the same family, referred to as complementary funds. Columns 5 and 6 restrict their analysis to funds where the inside investment is greater than the median level. Firm, inception year, calendar year, and strategy fixed effects are included in all regressions.

	Flow Percent	Flow Percent >0	Complementary Flow Percent	Complementary Flow Percent >0	Complementary Flow Percent	Complementary Flow Percent >0
	(1)	(2)	(3)	(4)	(5)	(6)
High Ownership	−0.0073	0.0295	−0.0033	0.0201		
	(0.0079)	(0.0331)	(0.0121)	(0.0403)		
Excess Return$_{t-1}$	0.1880***	0.7927***	−0.1365	−0.3876*	0.0121	−0.3650
	(0.0509)	(0.2714)	(0.1238)	(0.2340)	(0.1206)	(0.2230)
Excess Return$_{t-2}$	0.1780***	0.7715***	−0.2110*	−0.7776**	−0.1350	−0.6218
	(0.0639)	(0.2541)	(0.1216)	(0.3324)	(0.1275)	(0.4062)
Excess Return$_{t-3}$	0.2122***	0.7774***	−0.1875*	−0.7340**	−0.1188	−0.5208*
	(0.0685)	(0.2081)	(0.0967)	(0.2971)	(0.0810)	(0.3019)
Excess Return$_{t-1}$×Insider	−0.0523	−0.1669				
	(0.0713)	(0.2577)				
Excess Return$_{t-2}$×Insider	−0.0960	−0.4574**				
	(0.0900)	(0.1960)				
Excess Return$_{t-3}$×Insider	0.0056	−0.1894				
	(0.0792)	(0.3437)				
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Inception Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Strategy FE	Yes	Yes	Yes	Yes	Yes	Yes
High Ownership	No	No	No	No	Yes	Yes
Observations	4,918	4,918	2,130	2,130	1,133	1,133
R^2	0.2563	0.2612	0.2325	0.2163	0.4750	0.2462

Note: *p<0.1; **p<0.05; ***p<0.01

TABLE VIII **Open for New Investments**

This table shows the panel regressions between fund and if they are open for new investments. The analysis is based on the HFR, Eurekahedge and BarclayHedge dataset. Columns 1 and 2 relates percent of inside investment to the openness of a fund. Columns 3 and 4 relate the openness of the fund to monthly excess returns, as measured by the Fung-Hsieh 7-Factors model. Columns 5 and 6 similarly show results with and without controls for the Fama-French and Carhart model.

	Open for Investors		Excess Returns (FH)		Excess Returns (FFC)	
	(1)	(2)	(3)	(4)	(5)	(6)
Inside Investment (%)	-0.0013^{***}	-0.0021^{***}				
	(0.0003)	(0.0003)				
Open for Investors			-0.2291^{**}	-0.2186^{***}	-0.4463^{***}	-0.3141^{***}
			(0.0971)	(0.0746)	(0.0660)	(0.0706)
Fixed Effects	No	Yes	No	Yes	No	Yes
Log(Fund Size)	No	Yes	No	Yes	No	Yes
Sample:	Yearly	Yearly	Monthly	Monthly	Monthly	Monthly
Observations	1,977	1,977	12,065	12,065	12,065	12,065
R^2	0.0069	0.1385	0.0007	0.0168	0.0034	0.0130
Note:						*p<0.1; **p<0.05; ***p<0.01

TABLE IX **Inside Investment and Fund Size**

This table shows the panel regression between size and inside investment. Panel A conducts analysis on the matched sample connecting Form ADV with commercial hedge fund datasets (where the key dependent variable is assets under management, taken from the commercial hedge fund datasets, reported as the log of AUM or in millions). Panel B performs analysis on the complete ADV dataset, using as the dependent variable Gross Asset Value. All specifications regress the fraction of the fund which consists on insider investment against a measure of size, measured yearly. Columns 1 and 3 across all specifications perform this regression with no additional controls; columns 2 and 4 add firm and year fixed effects. Standard errors are in parenthesis.

Panel A: **Results on Matched Dataset**

	AUM (in $m)		Log(AUM)	
	(1)	(2)	(3)	(4)
Inside Investment (Percent)	-3.82^{***}	-7.86^{***}	-0.01^{***}	-0.02^{***}
	(0.24)	(1.20)	(0.001)	(0.003)
Year FE	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes
Fund Controls	No	Yes	No	Yes
Dataset	Matched	Matched	Matched	Matched
Observations	2,633	2,633	2,633	2,633
R^2	0.01	0.88	0.02	0.86

Panel B: **Results on ADV Dataset**

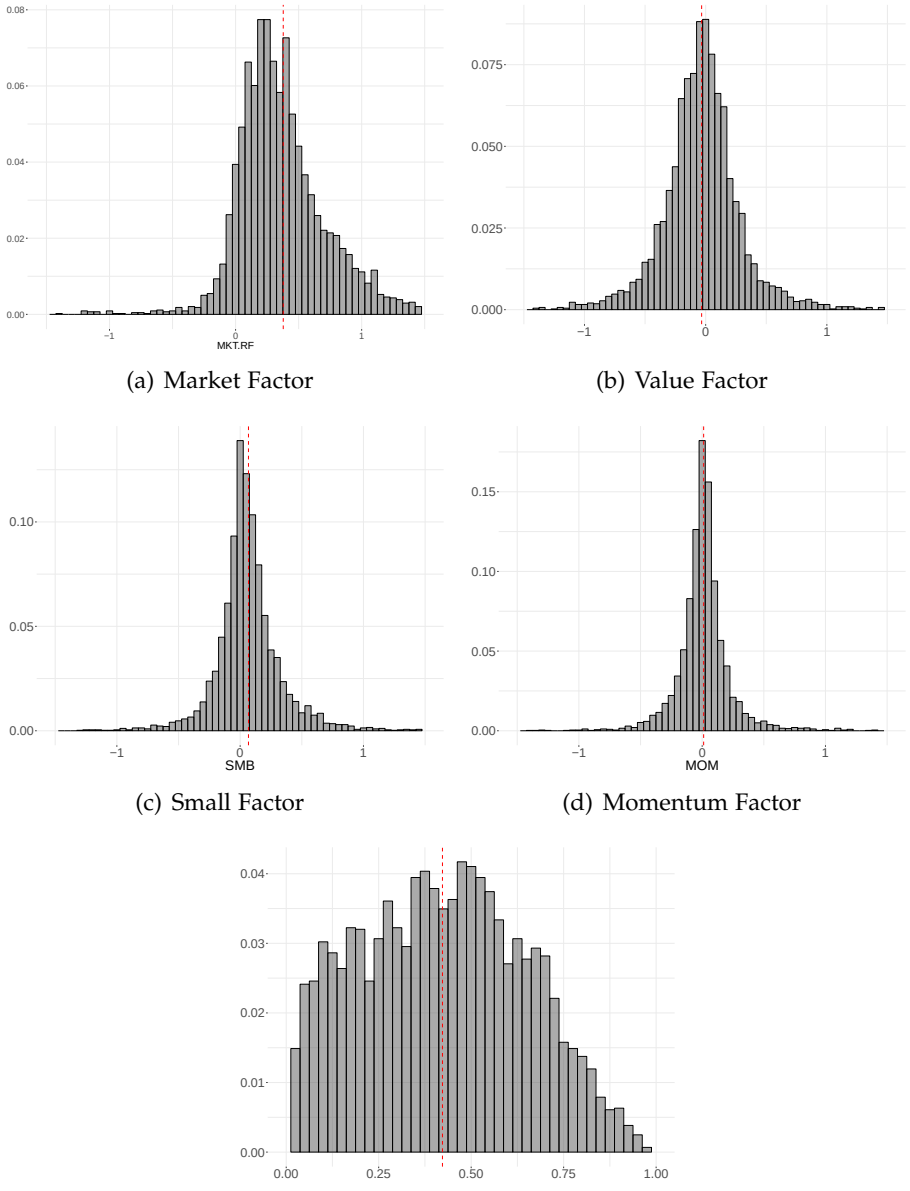
	Gross Asset Value (in $m)		Log(Gross Asset Value)	
	(1)	(2)	(3)	(4)
Inside Investment (Percent)	-6.34^{***}	-10.14^{***}	-0.01^{***}	-0.02^{***}
	(0.89)	(1.12)	(0.001)	(0.001)
Year FE	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes
Fund Controls	No	Yes	No	Yes
Dataset	ADV	ADV	ADV	ADV
Observations	35,960	35,960	35,960	35,960
R^2	0.002	0.57	0.03	0.57
Note:				*p<0.1; **p<0.05; ***p<0.01

TABLE X **Fund Flows and Performance**

This table shows the panel regression between size and flows by insiders and outsiders. "Insider Flow" corresponds to changes in capital provided by insiders and related parties, while "Outsider Flow" captures changes in capital provision by all other investors. Inside and Outsider flow changes are measured annually with the release of new ADV forms. Column 2 adds year fixed effects, and column 3 adds firm fixed effects. Standard errors clustered at the year level.

	(1)	(2)	(3)
Insider Flow (%)	−0.00034	−0.00025	−0.00029
	(0.00023)	(0.00023)	(0.00039)
Outsider Flow (%)	0.00002	0.00003	0.00003*
	(0.00002)	(0.00002)	(0.00002)
Size	Yes	Yes	Yes
Year FE	No	Yes	Yes
Firm FE	No	No	Yes
Observations	228	228	228
R^2	0.00372	0.05192	0.11300
Note:			*p<0.1; **p<0.05; ***p<0.01

A Additional Results



(a) Market Factor

(b) Value Factor

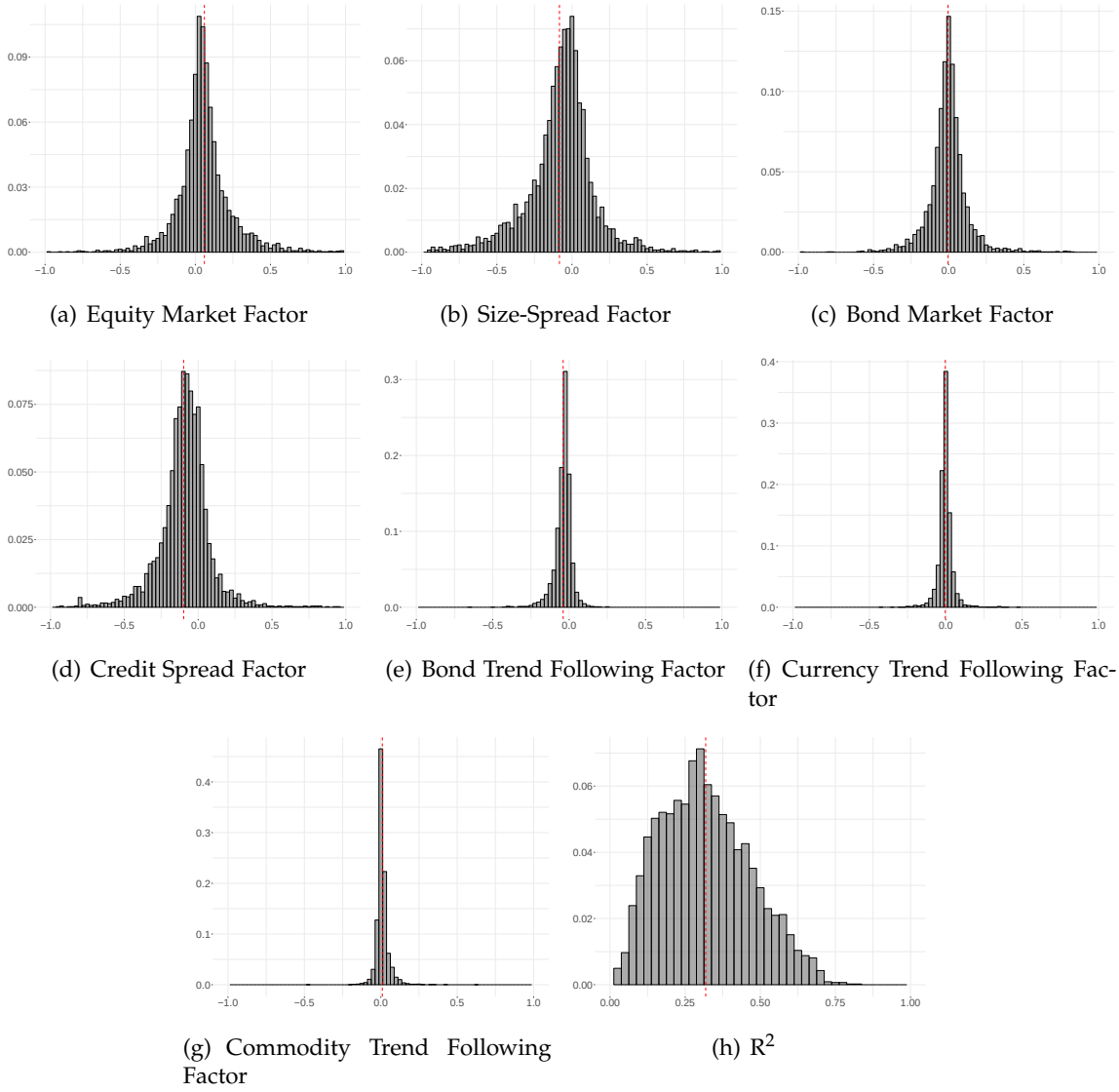
(c) Small Factor

(d) Momentum Factor

(e) R^2

FIGURE A1 **Factor Distribution in 4-Factor Model**

This figure plots the distribution of factor exposures in the 4-Factor (Fama-French and Carhart) model. The histograms plot the coefficient estimates from a time-series regression of factor exposures against hedge fund returns run for each fund, as well as the R^2 of each model fit.



(a) Equity Market Factor

(b) Size-Spread Factor

(c) Bond Market Factor

(d) Credit Spread Factor

(e) Bond Trend Following Factor

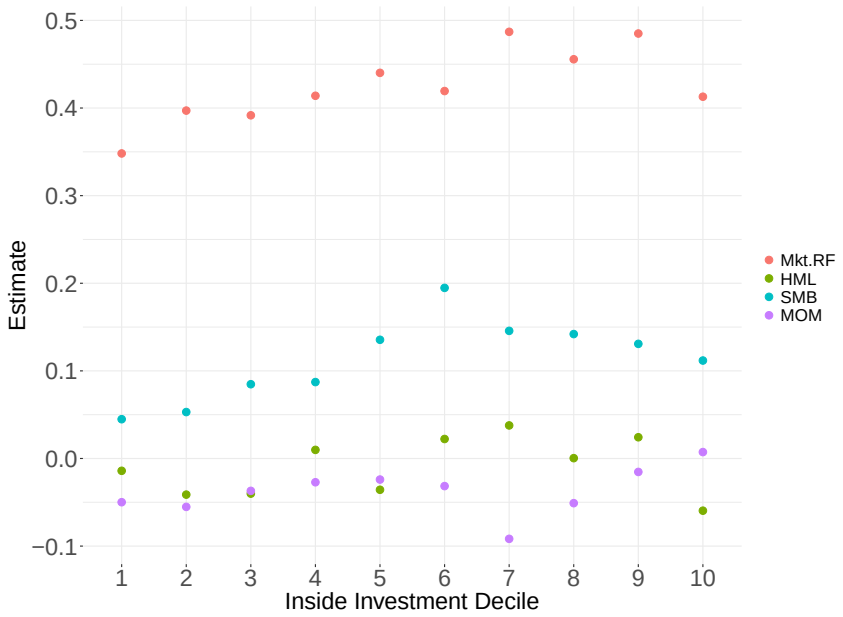
(f) Currency Trend Following Factor

(g) Commodity Trend Following Factor

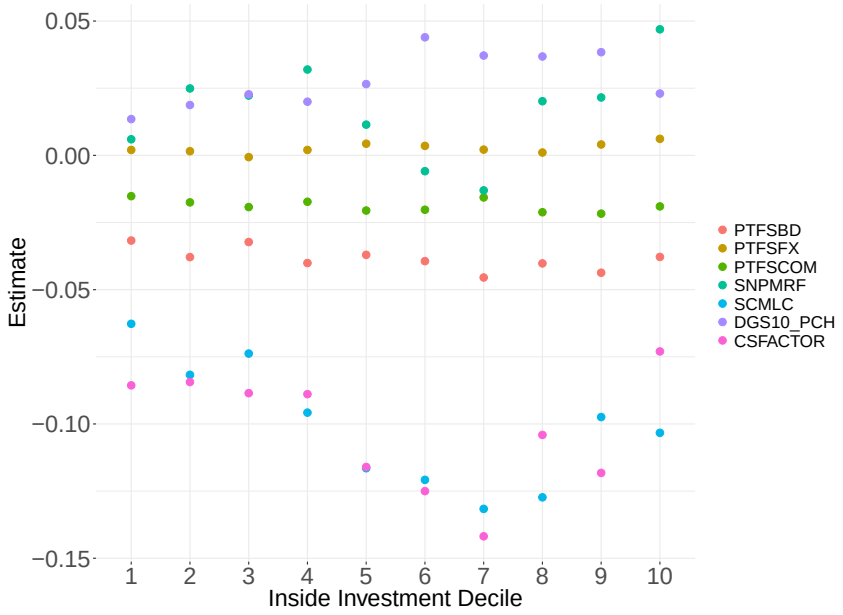
(h) R^2

FIGURE A2 **Factor Distribution in 4-Factor Model**

This figure plots the distribution of factor exposures in the 7-Factor Fung-Hsieh model. The histograms plot the coefficient estimates from a time-series regression of factor exposures against hedge fund returns run for each fund, as well as the R^2 of each model fit.



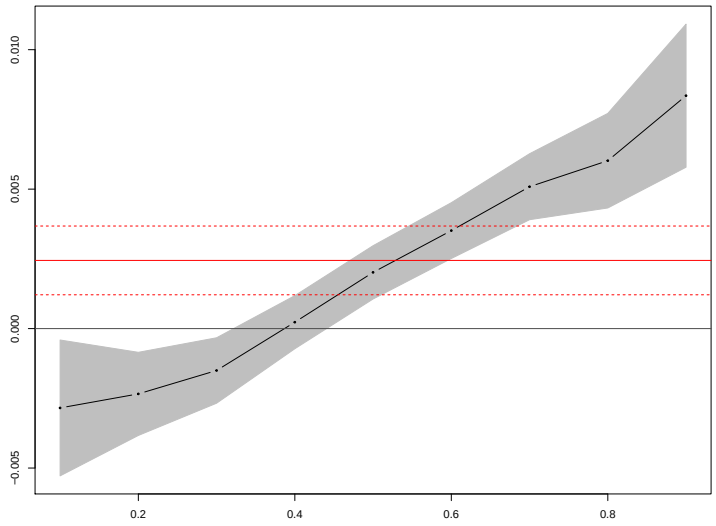
Panel A: Inside Investment Decile against FFC Factor Exposure



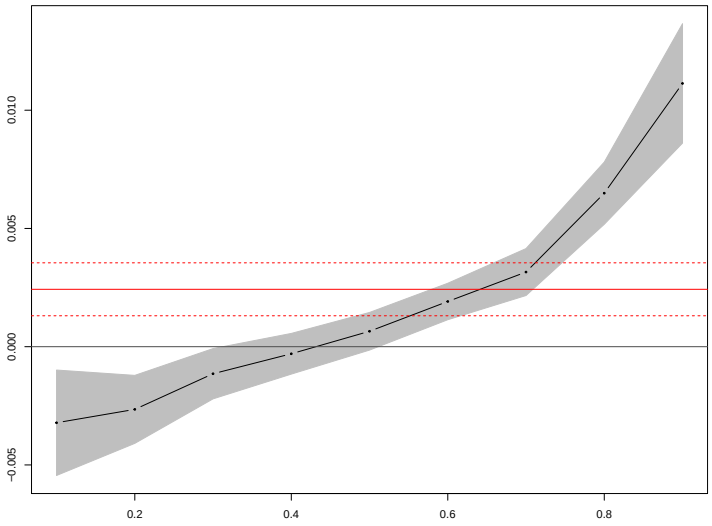
Panel B: Inside Investment Decile against FH Factor Exposure

FIGURE A3 **Factor Exposure and Inside Investment**

This figure illustrates the relationship between factor exposure and insider investment. For each decile of inside investment, the figures plot the average factor exposures across the two sets of models explored in the paper. Panel A shows the beta exposures from the Fama-French and Carhart model. Panel B shows the factor exposures for the Fung-Hsieh 7-factor model. In each decile, each average factor exposure is plotted equal-weighting all funds.



Panel A: Quantile Regression, 7-Factor



Panel B: Quantile Regression, 4-Factor

FIGURE A4 **Quantile Regression of Inside Investment on Excess Returns**

This figure plots results from a quantile regression of percentage inside investment against fund-level excess returns, also controlling for fund size. Panel A shows the returns corrected for the Fung-Hsieh 7-factor model, while Panel B shows returns corrected for the Fama-French and Carhart 4 factor model. Across each of the ten deciles of percentage inside investment, we examine the slope of the relationship between inside investment and excess returns. The shaded grey area illustrates the 95% confidence interval. We find that our results are driven by funds at high levels of inside investment.

TABLE A1 **Inside Investment and Excess Returns — Restricting to Funds with only GP Investment Related Parties**

This table repeats the analysis of Table VI, but restricts its analysis to funds with *only* GP investments as their related parties. The first two columns regress against the Fung-Hsieh 7-Factors, and the second two columns regress against the Fama- French and Carhart 4-Factor model as outlined in equations 4 and 5 in the text, respectively.

	FH Excess Returns		FFC Excess Returns	
	All	Controls	All	Controls
	(1)	(2)	(3)	(4)
Inside Investment (Percent)	0.0035***	0.0055***	0.0030***	0.0056***
	(0.0011)	(0.0017)	(0.0010)	(0.0014)
Log(Fund Size)	No	Yes	No	Yes
Fixed Effects	No	Yes	No	Yes
Observations	29,691	29,691	29,691	29,691
R^2	0.0006	0.0387	0.0015	0.0492

TABLE A2 **Relationship between Inside Investment and Excess Return – with Lagged Returns**

This table repeats the analysis of Table VI, but restricts its analysis to funds with *only* GP investments as their related parties. The first two columns always regress against the Fung-Hsieh 7-Factors, and the second two columns always regress against the Fama- French and Carhart 4-Factor model as outlined in equations 4 and 5 in the text, respectively.

Panel A **Baseline Specification**

	FH Excess Returns		FFC Excess Returns	
Inside Investment (Percent)	0.0025**	0.0055***	0.0021**	0.0045***
	(0.0010)	(0.0014)	(0.0009)	(0.0013)
$Return_{i,t-1}$	0.0066	−0.0249	0.1027***	0.0837***
	(0.0384)	(0.0363)	(0.0206)	(0.0218)
$Return_{i,t-2}$	−0.0014	−0.0273	0.0334	0.0143
	(0.0331)	(0.0315)	(0.0238)	(0.0219)
$Return_{i,t-3}$	0.0341	0.0117	0.0138	−0.0081
	(0.0369)	(0.0370)	(0.0202)	(0.0199)
Log(Fund Size)	No	Yes	No	Yes
Fixed Effects	No	Yes	No	Yes
Observations	37,958	37,958	37,958	37,958
R^2	0.0020	0.0425	0.0212	0.0535

Panel B: **Gross Inside Investment**

	FH Excess Returns		FFC Excess Returns	
Inside Investment (Gross)	0.0406**	0.0812***	0.0246*	0.0829***
	(0.0195)	(0.0290)	(0.0144)	(0.0240)
$Return_{i,t-1}$	0.0067	−0.0248	0.1028***	0.0837***
	(0.0384)	(0.0363)	(0.0206)	(0.0217)
$Return_{i,t-2}$	−0.0013	−0.0272	0.0335	0.0143
	(0.0331)	(0.0315)	(0.0238)	(0.0219)
$Return_{i,t-3}$	0.0342	0.0118	0.0139	−0.0081
	(0.0369)	(0.0371)	(0.0202)	(0.0199)
Log(Fund Size)	Yes	Yes	Yes	Yes
Fixed Effects	No	Yes	No	Yes
Observations	37,958	37,958	37,958	37,958
R^2	0.0019	0.0424	0.0211	0.0535

Panel C: **Fama MacBeth Approach**

	FH Excess Returns		FFC Excess Returns	
Inside Investment (Percent)	0.0022***	0.0021***	0.0015*	0.0019**
	(0.0008)	(0.0008)	(0.0008)	(0.0008)
$Return_{i,t-1}$	0.0469**	0.0504**	0.0893***	0.0886***
	(0.0225)	(0.0216)	(0.0191)	(0.0192)
$Return_{i,t-2}$	0.0404*	0.0403*	0.0522***	0.0487**
	(0.0245)	(0.0244)	(0.0194)	(0.0202)
$Return_{i,t-3}$	0.0130	0.0134	0.0002	0.0050
	(0.0242)	(0.0232)	(0.0170)	(0.0171)
Log(Fund Size)	No	Yes	No	Yes
Fixed Effects	No	Yes	No	Yes
Observations	37,958	37,958	37,958	37,958
R^2	0.2585	0.2836	0.1285	0.1492

Note: *p<0.1; **p<0.05; ***p<0.01

TABLE A3 **Alternate Specifications for Inside Investment and Return**

This table illustrates some alternate specifications of our main result. In Panel A, we modify the benchmark specification to include funds with zero or 100 percent inside investment. These funds are excluded from our benchmark results because of difficulty in matching. Panel B illustrates a value-weighted specification using the Gross Asset Value field from form ADV (our primary specification is equal-weighted).

Panel A **Including Full Inside Investment Distribution**

	FH Excess Returns		FFC Excess Returns	
	(1)	(2)	(3)	(4)
Inside Investment (Percent)	0.0017**	0.0035***	0.0026***	0.0044***
	(0.0007)	(0.0012)	(0.0007)	(0.0011)
Log(Fund Size)	Yes	Yes	Yes	Yes
Fixed Effects	No	Yes	No	Yes
Observations	47,589	47,589	47,589	47,589
R^2	0.0002	0.0348	0.0010	0.0393

Panel B: **Value-Weighted**

	FH Excess Returns		FFC Excess Returns	
	(1)	(2)	(3)	(4)
Inside Investment (Percent)	0.0060***	0.0048**	0.0047***	0.0073***
	(0.0014)	(0.0022)	(0.0013)	(0.0024)
Log(Fund Size)	Yes	Yes	Yes	Yes
Fixed Effects	No	Yes	No	Yes
Observations	41,097	41,097	41,097	41,097
R^2	0.0015	0.0389	0.0006	0.0352
Adjusted R^2	0.0015	0.0216	0.0006	0.0178
Note:				*p<0.1; **p<0.05; ***p<0.01

TABLE A4 **Inside Investment, Adjusted for Mechanically Reinvested Compensation**

This table examines the role of discretion over personal capital contributions. The emphadjusted inside investment measure subtracts the "mechanical" component of personal capital contributions derived from rolling over prior fee income from the observed inside investment. This residual results the discretionary capital contributions of the mangers. Panel A regresses the adjusted measure of invest investment against all funds, while Panel B restricts this analysis to funds less than eight years old.

Panel A: All Funds

	All	Controls	All	Controls
	(1)	(2)	(3)	(4)
Adjusted Inside Investment (Percent)	0.0039***	0.0085***	0.0028***	0.0069***
	(0.0013)	(0.0017)	(0.0009)	(0.0014)
Log(Fund Size)	No	Yes	No	Yes
Fixed Effects	No	Yes	No	Yes
Observations	41,097	41,097	41,097	41,097
R^2	0.0008	0.0377	0.0011	0.0410
Note:				*p<0.1; **p<0.05; ***p<0.01

Panel B: Young Funds

	All	Controls	All	Controls
	(1)	(2)	(3)	(4)
Adjusted Inside Investment (Percent)	0.0034**	0.0085***	0.0026**	0.0078***
	(0.0015)	(0.0015)	(0.0012)	(0.0017)
Log(Fund Size)	No	Yes	No	Yes
Fixed Effects	No	Yes	No	Yes
Observations	25,938	25,938	25,938	25,938
R^2	0.0005	0.0415	0.0007	0.0424
Note:				*p<0.1; **p<0.05; ***p<0.01

TABLE A5 **Cuts by Fund Size**

This table illustrates our main specification (column 2 of Panel A in Table VI) across the fund size distribution. We cut by the quantiles of fund size, which correspond to the buckets: [$20m-$57m), [$57m, $126m), [$126m, $378m), [$379m+). Standard errors are clustered at the date level. Excess returns are computed using the Fung-Hsieh model.

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
	(1)	(2)	(3)	(4)
Inside Investment (Percent)	0.0009	0.0021	0.0037***	0.0054***
	(0.0015)	(0.0013)	(0.0014)	(0.0017)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Fund Controls	Yes	Yes	Yes	Yes
Log(Fund Size)	Yes	Yes	Yes	Yes
Observations	10,280	10,281	10,267	10,269
R^2	0.0133	0.0127	0.0141	0.0189
Note:				*p<0.1; **p<0.05; ***p<0.01

TABLE A6 **Firm-Level Equity Ownership and Returns**

This table shows a panel regression with alternate measures of firm ownership. # of Equity Holders captures the total number of beneficial owners listed in Form ADV for the firm's equity. HHI of Firm Equity captures a Herfindahl-Hirschman index measure of concentration of equity ownership. Standard errors are clustered at the fund level and are shown in parenthesis. Excess return is computed using the Fung-Hsieh model.

	Monthly Excess Return (FH)			
	(1)	(2)	(3)	(4)
Inside Investment (Percent)	0.0029^{***}	0.0024^{***}	0.0029^{***}	0.0028^{***}
	(0.0009)	(0.0008)	(0.0009)	(0.0008)
# of Equity Holders	-0.0174^{**}		-0.0197^{***}	-0.0191^{***}
	(0.0071)		(0.0070)	(0.0068)
HHI of Firm Equity		0.0444	−0.0645	−0.0578
		(0.0826)	(0.0794)	(0.0796)
log(Gross Assets)	0.0312	0.0163	0.0317	0.0350
	(0.0243)	(0.0249)	(0.0241)	(0.0218)
Year	Yes	Yes	Yes	Yes
Log(Size)	Yes	Yes	Yes	Yes
Fund Controls	No	No	No	Yes
Observations	41,097	41,097	41,097	41,097
R^2	0.0105	0.0101	0.0105	0.0116
Note:				*p<0.1; **p<0.05; ***p<0.01