Skin or Skim?*

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Abstract

We document novel patterns of insider investment in hedge funds, and explore the implications for fund returns. Using a comprehensive and survivor-bias free dataset of U.S. hedge funds, we find that funds with greater investment by insiders outperform funds with less "skin in the game" on a factor-adjusted basis. Our results have implications for optimal portfolio allocations of institutional investors and agency models of delegated asset management.

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COMMENTS VERY WELCOME

1 Introduction

Delegated asset managers invest the capital of outside investors and typically only have a portion of their own capital in the firm. This raises the prospect, as in Jensen and Meckling (1976), of agency conflicts between the managers and investors. In this paper, we investigate whether greater coinvestment by managers of hedge funds and related parties leads to improved returns. We find that investors who are able to invest in hedge funds with greater "skin in the game" are able to systematically outperform investors who invest in funds with low skin in the game.

Understanding the cross-sectional predictors of hedge fund returns contributes to an understanding of delegated asset management. The hedge fund industry has grown to over \$3 billion in assets under management, making it an important vehicle for institutional investment.[1] An important driver of the growth of the industry has been its reliance on insider investment as a tool to compensate managers and better align the incentives of managers and investors. However, not much is understood about the extent of insider investments in hedge funds, or the extent to which they drive fund performance.

As motivation, consider the case of Renaissance Technologies.[2] The company's Medallion Fund, one of the most successful funds in history, is predominately a fund for insider investment (as we confirm in Figure II). The company also maintains other funds with greater outside investor participation, which typically exhibit worse returns.

The case of firms such as Renaissance Technologies suggests that the possibility for fund insiders to invest their own capital in the fund is a crucial component of the compensation along with the stated management and incentive fees. In order to investigate the relationship between ownership and returns, we take advantage of Form ADV data from the SEC. This regulatory form requires all hedge funds with assets over \$100m to disclose yearly the fraction of fund returns held by insiders, enabling us to establish a genuinely survival bias-free and comprehensive dataset on hedge funds. We use this dataset to examine novel facts about the distribution of insider ownership of assets deployed in hedge funds.

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[1]See, for instance, figures collected provided by the Securities and Exchange Commission available at: https://www.sec.gov/reportspubs/special-studies/im-private-fund-annual-report-081514.pdf

[2]See, for instance https://www.bloomberg.com/news/articles/2016-11-21/how-renaissance-s-medallion-fund-became-finance-s-blackest-box

We then hand-merge Form ADV data with several commercially available datasets on hedge fund returns to understand the connection between "skin in the game" and fund returns. We test the idea that greater managerial ownership better aligns incentives betweens mangers and investors by identifying funds with greater managerial ownership, and tracking the hypothetical performance of investors who systematically invest in hedge funds with the highest fraction of internal ownership, rebalancing yearly as new information about internal ownership is made publicly available. We find this strategy results in sizable returns over time above that of a portfolio invested in low ownership funds.

To further isolate the role of ownership on fund returns, we next control for risk in the context of a factor approach. Using both the Fama and French (1992) and Carhart (1997) factors, as well as the seven Fung and Hsieh (2004) factors, we control for factor exposure of returns at the fund level. We find that inside ownership—as measured either by percentage or gross ownership—remain important predictors of excess returns when looking *within* firms. A hypothetical fund moving from zero percent inside investment to 100 percent would experience a rise in excess returns of 44 basis points a month, a significant and economically large magnitude.

Our results suggest a novel source of advantage for fund managers—the ability to preferentially invest in funds with higher performance. To further investigate whether insiders are able to "cream skim" outside investors, we adopt an event study in the event of a firm, which previously only had one fund, creating a novel fund. The generation of a second fund provides an experiment to analyze the effects of inside investment on fund performance, because insiders have two options: 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 have differing predictions on the performance level of the initial fund: when inside capital remains in the fund, we expect the fund to outperform; relative to when insiders move their capital out of the fund. We find evidence consistent with this expectation, suggesting the possibility of "skimming" motives on the part of fund managers.

Our results point to a large role for inside capital in explaining the cross-section of hedge fund performance, and have implications for the optimal portfolio allocation strategies of

institutional investors. They also point to important agency issues in the context of delegated asset management. While the literature examining hedge fund returns has examined the role of contract structure (such as Agarwal, Daniel and Naik (2009)), we emphasize that managers have another option to gain returns: invest their own capital. The possibility of inside investment adds an additional dimension to the agency conflict inherent in delegated asset management, and we find suggestive evidence that higher levels of inside investment better aligns the incentives of managers and investors.

Our results come with several caveats which we emphasize here. First, though we establish inside ownership as an important predictor of excess returns, we cannot yet ascribe a causal status to inside investment. Second, we do not establish the precise mechanism by which inside ownership predicts returns. It is possible that inside investors are better informed about the skill of various fund managers and deploy capital accordingly; alternatively, high skin-in-the-game funds may be less subject to agency conflicts and engage in superior research analysis. Finally, it is possible that higher returns from high-skin-in-the-game funds is a proxy for some risk factor (unrelated to either the Fama-French, Carhart, or Fung-Hsieh factors). 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 ownership is an important predictor of cross-sectional fund performance.

Our work connects to several strands of literature. Most directly, our paper and results relates to previous studies in the relationship between portfolio manager ownership and mutual fund performance. Papers such as Khorana, Servaes and Wedge (2007), Evans (2008), Chen, Goldstein and Jiang (2008), and Cremers et al. (2009) show broad heterogeneity of insider investments by mutual fund managers, and find that higher insider investment related to higher risk adjusted returns.

Boradly, our paper relates to previous work studying the relationship between ownership and firm performance. Seminal references include Berle and Means (1932), Jensen and Meckling (1976), and Holmstrom (1985). Related seminal empirical work include Demsetz and Lehn (1985), Randall, Shleifer and Vishny (1988), and Himmelberg, Hubbard and Palia (1999).

2 Data and Empirical Strategy

2.1 Data

Our dataset combines regulatory ADV filings with commercial hedge fund return series from Barclays Hedge, Eureka Hedge, 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 U.S. Investment Advisers Act of 1940, as amended by Dodd-Frank. Disclosure requirements under this form have changed over the years. Since 1996, funds with assets under management below $25 million, or fewer than 15 clients, have been generally exempt from registration. Hedge funds in this period frequently used complex fund structures to evade disclosure in this period 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, after 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 fund has only private clients; or 3) Have over $25 million in assets and are not subject to examination in their home states (which 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 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 three datasets: Barclays, Eureka Hedge, and CISDM. To merge the datasets, we look for close matches in the names of the firms and funds in two datasets based on a string comparison of names. For Barclays, we additionally use an SEC identifier which is common to both datasets. We then hand-check every fund in our sample to arrive at a final "Merged Dataset" which connects Form ADV with our three hedge fund series.

Summary Table I shows basic summary information about both our core Form ADV dataset, as well as the merged subset. Figure VII demonstrates our merge rate across the range of firm ownership. We find that firms with complete inside investment (100 percent) and no inside investment (0 percent) exhibit worse merge rates into our ADV dataset. These are firms which pose additional identification questions—since outsiders cannot invest in funds with complete insider investment. For these reasons, we focus in the remainder of our analysis on firms in the interior of the internal investment distribution: between one and 99 percent inside investment, inclusive

Over this period, Form ADV was updated with questions about the internal investment of their funds. Figure II shows a sample Form ADV (publicly available through the SEC's website) for Renaissance Technologies. Panel A captures firm level information for the filing firm, Renaissance Technologies LLC. Panel B identifies a specific fund as listed in section 7.B.(1), in this case Medallion Fund L.P. Panel C of II displays the precise question we draw on from 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 the ultimate ownership of investment stakes in the fund which can be attributed to "related persons."

A breakdown of "related parties" is provided in Table II, which illustrates all possible responses for which parties constitute related parties. The most common response is "Sponsor of GP"[3], suggesting that the definition of related party most often corresponds to a vehicle used by the actual managers 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 are typically closely related entities to the management company, and frequently share a common 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 the behalf of closely related entities that can be considered "inside capital."

Panel B of Figure III illustrates the density of fund responses across different fund vehicles for Renaissance Technologies, and demonstrating a clear dispersion of fractional inside

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[3]We verify that results hold when we subset on firms for which this is true.

investment across different funds within the firm family. Figure VIII in the appendix illustrates other sample inside investment distributions across funds for a sample of hedge fund firms. The common pattern is one in which hedge funds operate a variety of vehicles with varying degrees of inside investment.

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

2.2 Empirical Strategy

First, we examine the returns on portfolios invested in baskets of hedge funds. Our motivation is the investing decisions of an institutional investor interested in allocating across the broad investable universe of fund managers.

$$r_{it} = \alpha_{iT} + \beta_{1,iT}RMRF_t + \beta_{2,iT}SMB_t + \beta_{3,iT}HML_t + \varepsilon_{it}$$

Where $i = 1, \dots, 4$ different portfolios, $t = 2012 - 2016$ monthly, and r_{it} represents the value-weighted returns of funds sorted along quartiles internal investment in excess of the risk free rate. We also consider factor-correction using the set of seven factors as described in Fung and Hsieh (2004):

$$\begin{aligned} r_{it} = \alpha_{iT} &+ \beta_{1,iT}S\&P_t + \beta_{2,iT}SC - LC_t + \beta_{3,iT}10Y_t + \beta_{4,iT}CredSpr_t + \beta_{5,iT}BdOpt_t \\ &+ \beta_{6,t}FXOpt_t + \beta_{7,t}ComOpt + \varepsilon_{it} \end{aligned} \tag{1}$$

Next, we turn to a fund-based approach and estimate the impact of ownership on returns on a fund-by-fund level, adjusting for factor exposure:

$$r_{it} = \alpha_{iT} + \gamma Ownership_{it} + \hat{\beta}_{1,iT}RMRF_t + \hat{\beta}_{2,iT}SMB_t + \hat{\beta}_{3,iT}HML_t + \varepsilon_{it}$$

Where to proxy for ownership we examine both the percentage of the fund which consists of insider investment; as well as the gross insider exposure. We value-weight this regression by

assets under management to better proxy the portfolio allocation decision of an institutional investor. They key variable of interest is γ, which captures the predictive role of greater inside investment on excess returns.

We are particularly interested in this analysis using firm and year fixed effects.

$$r_{it} = \alpha_{iT} + \gamma Ownership_{it} + \hat{\beta}_{1,iT} RMRF_t + \hat{\beta}_{2,iT} SMB_t + \hat{\beta}_{3,iT} HML_t + \delta FIRM_i + \eta Year_t \varepsilon_{it}$$

Which allows us to control for other year and firm factors driving excess return. The interpretation of γ in this case is the amount of excess return attributed to investing in a high-skin fund *relative to* a low-skin fund within the same company and year.

In addition to the above factor model, we also use Fung and Hsieh (2004) seven-factor model:[4]

$$r_{it} = \alpha_{iT} + \gamma Ownership_{it} + \hat{\beta}_{1,iT} S\&P_t + \hat{\beta}_{2,iT} SC - LC_t + \hat{\beta}_{3,iT} 10Y_t$$
$$+ \hat{\beta}_{4,iT} CredSpr_t + \hat{\beta}_{5,iT} BdOpt_t + \hat{\beta}_{6,t} FXOpt_t + \hat{\beta}_{7,t} ComOpt + \varepsilon_{it}$$

The interpretation of γ in this equation is similar, and allows us to examine the role of additional "skin-in-the-game" on fund performance.

3   Results

3.1   Graphical Results

To illustrate our basic result, we first show the relationship between the non-parametric relationship between inside ownership and raw returns. Figure VI illustrates the outcome of an implementable trading strategy that that sorts funds into quartiles each year based on inside investment. The high ownership tercile consists of an equal-weighted investment in all funds in the high-ownership bucket; with yearly balancing each year as new ADV data becomes publicly available. The figure illustrates that the high ownership category outperforms fund portfolios with less skin in the game over our sample period from 2012–2016.

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[4]This factor model has been widely used in previous empirical research on hedge fund returns and have been shown to have considerable explanatory power. The trend following factors can be found at http://faculty.fuqua.duke.edu/~dah7/DataLibrary/TF-FAC.xls

3.2 Regression Results

Next, we turn to regressions which control more closely for fund factor exposure. To begin with, we examine the portfolio returns in the previous section and control for factor exposure at the level of the sorted portfolio. Table III illustrates this regression using the Fama and French (1992) 3-Factors as well as the Carhart (1997) momentum factor. In this specification, we examine the amount of monthly excess return of value-weighted portfolios sorted along the dimension of inside investment rebalanced yearly. Results in this table are not statistically significant, but we that the greater performance of the high-inside investment portfolio persists under factor correction. We find greater statistical significance in Table IV which uses the Fung and Hsieh (2004) series of seven hedge fund factors. In this table, we find that the fund portfolio in the highest quartile of inside investment has a statistically significant excess performance of 67 basis points a month, relative to an excess performance of 33 basis points for the portfolio with least inside investment. Results follow a monotonic pattern of increasing alpha with the degree of inside investment in between.

To further analyze the role of inside investment and risk-adjusted returns, we turn next to fund-level regressions as outlined in our Empirical Strategy Section in Table V. In Panel A, we focus on the standard four-factor model to correct for factor exposure and regress excess returns against measures of inside investment. Column 1 of this table regresses the percent of a fund's assets under management which can be attributed to insider investment against excess returns. While inside investment is not statistically associated with excess returns unconditionally, we find larger results in column 2, which controls for year and firm effects. Our estimates in that column suggest that a fund at 100 percent skin in the game exhibits a 44 basis point higher excess monthly return relative to a fund with no internal investment, or 5.28% higher excess returns a year. These results are quite large quantitatively, and suggest a strong importance for internal investment as a predictor of cross-sectional fund performance.

We find a similar picture in columns 3 and 4, which examine the *gross* amount of inside investment, rather than the fractional amount. We also find substantially larger estimates in Panel B, which uses the Fung and Hsieh (2004) measure of hedge fund returns. In this specification, we find that inside investment is associated with internal investment (as measured on a percentage or gross level) unconditionally, as well as in conjunction with fund and

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firm results. Our results in these specifications are larger in magnitude, and suggest that a fund with 100 percent skin in the game can expect 61 basis points higher in excess return, monthly, relative to a fund with zero percent inside investment.

Our results are subject to several important caveats. First, these results do not necessarily suggest a causal role for fund level inside ownership. It may well be that our measure of inside skin in the game is a proxy for other fund level characteristics. However, for the purposes of our analysis, we are primarily interesting in establishing that fund level ownership is an important *predictor* of returns, even controlling for commonly accepted drivers of fund performance. Our findings that fund-level inside ownership predicts results provides an important guide for institutional investors seeking to allocate capital across funds, in suggesting that funds with higher levels of inside ownership outperform.

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 hedge fund. Despite our attempts to control for risk using the benchmark fund factors, it is possible that the outperformance of high skin-in-the-game funds is due to a novel risk factor.

3.3   Event Study

The results from the previous suggestion provide suggestive 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 further steering clients into lower performing funds.

We explore this possibility in Figure VI, 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 instead 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,

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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 skin"), and another in which the new fund has more internal investment than the original. We plot cumulative returns of the fund for the two year window both before and after the fund creation date.

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 skin"—suggesting that managers keep their internal capital in the original fund—fund performance suffers; relative to what happens when the newly create fund has "high skin." 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.

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 less performing funds. To be clear, this analysis does not distinguish whether that 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.

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4   Conclusions

We assemble a comprehensive and survivor-bias free dataset of hedge fund characteristics using Form SEC. We document novel patterns of inside investment in hedge funds by related parties, which typically include sponsors of the general partners and closely related entities. We find that an implementable hedge fund investment strategy which selects high inside investment firms outperforms a portfolio invested in low skin in the game funds.

To further analyze the role of inside ownership, we regress excess returns (controlling for the Fama-French 3 factors and the Carhart factor, as well as the Fung-Hsieh 7 factors) against measures of ownership. We find that firms with higher internal investment have higher excess returns, even when controlling for firm fixed effects. Our results are large in magnitude, suggesting that firms with purely internal ownership rather than purely outsider ownership outperform at a rate of around 44 basis points a month.

Our results suggest the importance of considering the option that fund managers have to invest in their own fund as a component of their compensation. Hedge fund managers have the option not only of earning management and performance fees, but also of deploying their own capital in funds. We document that funds which rely more on insider money outperform funds which do not "eat their own cooking."
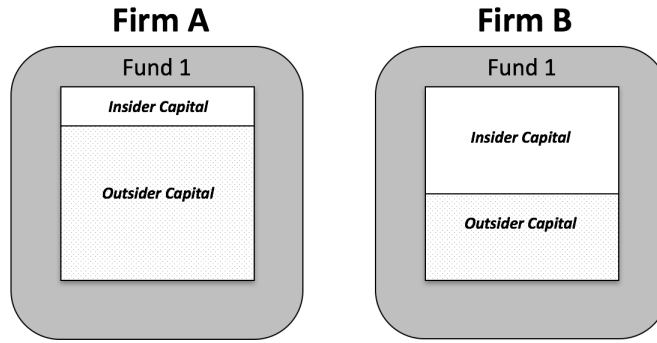
We also find suggestive evidence that fund managers are able to use their inside advantage to further "skim" investors. We document that firm performance improves when a newly created fund contains largely outsider capital but inside capital remains in the fund; relative to when insider investments shift to newly created funds.

Our results are so far preliminary and admit several possible explanations, which we plan future research to analyze. It is possible that insiders are better informed about managerial ability and disproportionately invest in more successful funds. Alternatively, high ownership funds may be less susceptible to redemption risk suffered when investors pull out cash, and so be able to invest in higher-yielding but less liquid securities. Finally, it is possible that our measure of excess returns represents a novel risk factor. Despite the multiplicity of possible explanations behind our finding, we emphasize that inside investment is a powerful predictor of hedge fund returns in the cross section and an important, albeit neglected, component of hedge fund compensation.
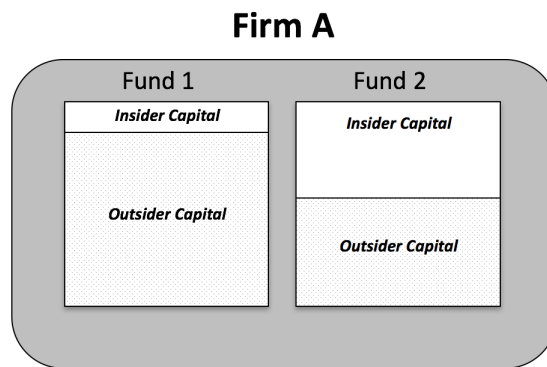
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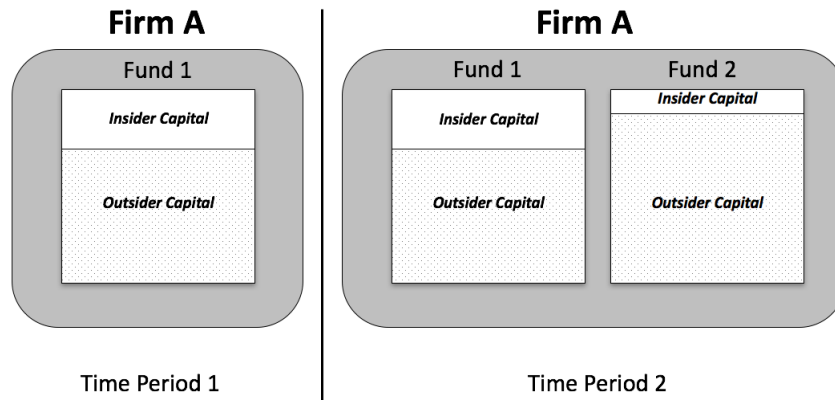
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Firm A

Fund 1

Insider Capital

Outsider Capital

Firm B

Fund 1

Insider Capital

Outsider Capital

Panel A: One Firm, One Fund (1F1F)

Firm A

Fund 1

Insider Capital

Outsider Capital

Fund 2

Insider Capital

Outsider Capital

Panel B: Different Insider Investment, Within Firm

Firm A

Fund 1

Insider Capital

Outsider Capital

Time Period 1

Firm A

Fund 1

Insider Capital

Outsider Capital

Fund 2

Insider Capital

Outsider Capital

Time Period 2

Panel C: Event Study Analysis

FIGURE I **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 (1F1F) 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.

FORM ADV

UNIFORM APPLICATION FOR INVESTMENT ADVISER REGISTRATION AND REPORT BY EXEMPT REPORTING ADVISERS

Primary Business Name: RENAISSANCE TECHNOLOGIES LLC	CRD Number: 106661
Annual Amendment - All Sections	Rev. 10/2012
3/30/2016 6:03:03 PM	

WARNING: Complete this form truthfully. False statements or omissions may result in denial of your application, revocation of your registration, or criminal prosecution. You must keep this form updated by filing periodic amendments. See Form ADV General Instruction 4.

Item 1 Identifying Information

Responses to this Item tell us who you are, where you are doing business, and how we can contact you.

A. Your full legal name (if you are a sole proprietor, your last, first, and middle names):
    RENAISSANCE TECHNOLOGIES LLC

B. Name under which you primarily conduct your advisory business, if different from Item 1.A.:
    RENAISSANCE TECHNOLOGIES LLC

    List on Section 1.B. of Schedule D any additional names under which you conduct your advisory business.

C. If this filing is reporting a change in your legal name (Item 1.A.) or primary business name (Item 1.B.), enter the new name and specify whether the name change is of
    ☐ your legal name or ☐ your primary business name:

D. (1) If you are registered with the SEC as an investment adviser, your SEC file number: **801-53609**
    (2) If you report to the SEC as an *exempt reporting adviser*, your SEC file number:

Panel A: Section 1, Form ADV

A. PRIVATE FUND

Information About the *Private Fund*

1. (a) Name of the *private fund*:
        MEDALLION FUND L.P.
    (b) *Private fund* identification number:
        (include the "805-" prefix also)
        805-5297474322

2. Under the laws of what state or country is the *private fund* organized:
    State: Country:
    Delaware   United States

3. Name(s) of General Partner, Manager, Trustee, or Directors (or persons serving in a similar capacity):

Name of General Partner, Manager, Trustee, or Director
RENAISSANCE TECHNOLOGIES LLC

Panel B: 7.B.1, Fund Identity, Form ADV

Ownership

12. Minimum investment commitment required of an investor in the *private fund*:
    $ 10,000
    NOTE: Report the amount routinely required of investors who are not your *related persons* (even if different from the amount set forth in the organizational documents of the fund).

13. Approximate number of the *private fund*'s beneficial owners:
    342

14. What is the approximate percentage of the *private fund* beneficially owned by you and your *related persons*:
    67%

15. What is the approximate percentage of the *private fund* beneficially owned (in the aggregate) by funds of funds:
    0%

16. What is the approximate percentage of the *private fund* beneficially owned by non-*United States persons*:
    0%

Panel C: 7.B.1, Ownership Reporting, Form ADV

FIGURE II **Sample Form ADV — Renaissance Technologies**

This figure shows three excerpts from the SEC's form ADV for a sample firm, Renaissance Technologies LLC. Panel A shows basic information to identify firms. Panel B shows basic fund information for our sample fund, Medallion Fund L.P., and is found in section 7.B.(1). Panel C shows ownership data such as minimum investment, number of investors, and basic composition of investors, and is reported at the fund level. We rely primarily on question 14, at the fund level, when studying insider ownership. Form ADVs can be searched at https://www.adviserinfo.sec.gov/

Panel A: Bloomberg Article Highlighting Rentech Returns
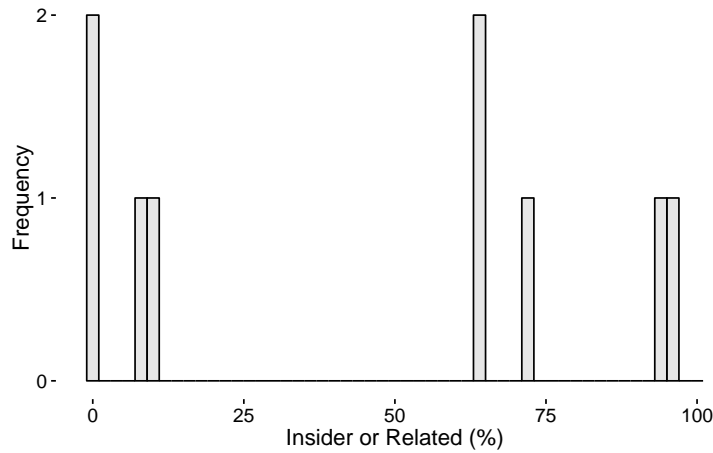
Panel B: Within-Fund Investment Distribution

FIGURE III **Anecdotal Evidence, Relating Performance to Insider Investment**

This figure highlights the performance and heterogeneity of insider ownership. Panel A shows a Bloomberg article from November 21, 2016 [Burton (2016)] discussing Renaissance Technologies' highly successful insider fund, the Medallion Fund. Panel B is a histogram of percent insider capital across all funds within Renaissance Technologies and shows the heterogeneity of insider investment.
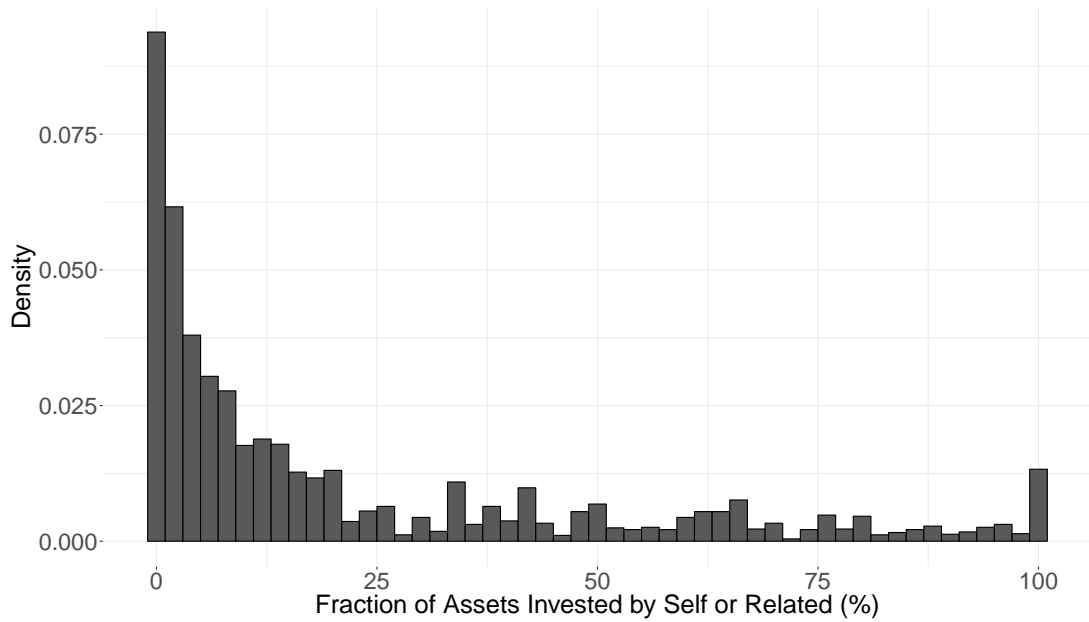
Panel A: Distribution of Insider Investment Across Funds, Percentage of Total Assets
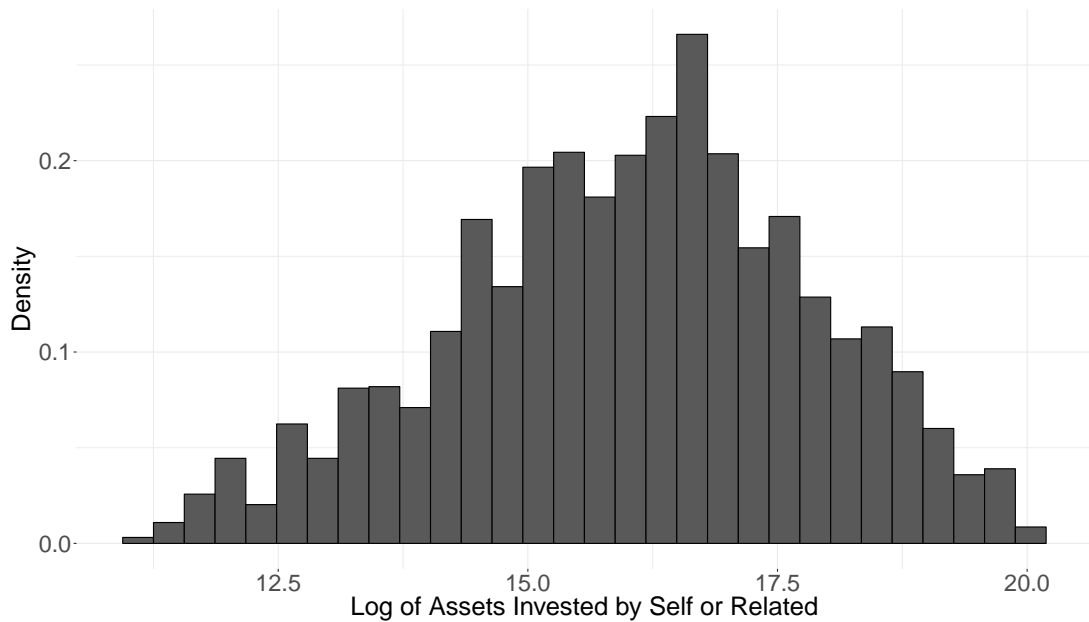
Panel B: Distribution of Insider Across Funds, NAV

FIGURE IV **Distribution of Insider Investment from Merge 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. This displays the "dumbbell" insider investment pattern common across fund types. Panel B is a histogram of log(NAV) of insider investment for the merged sample.
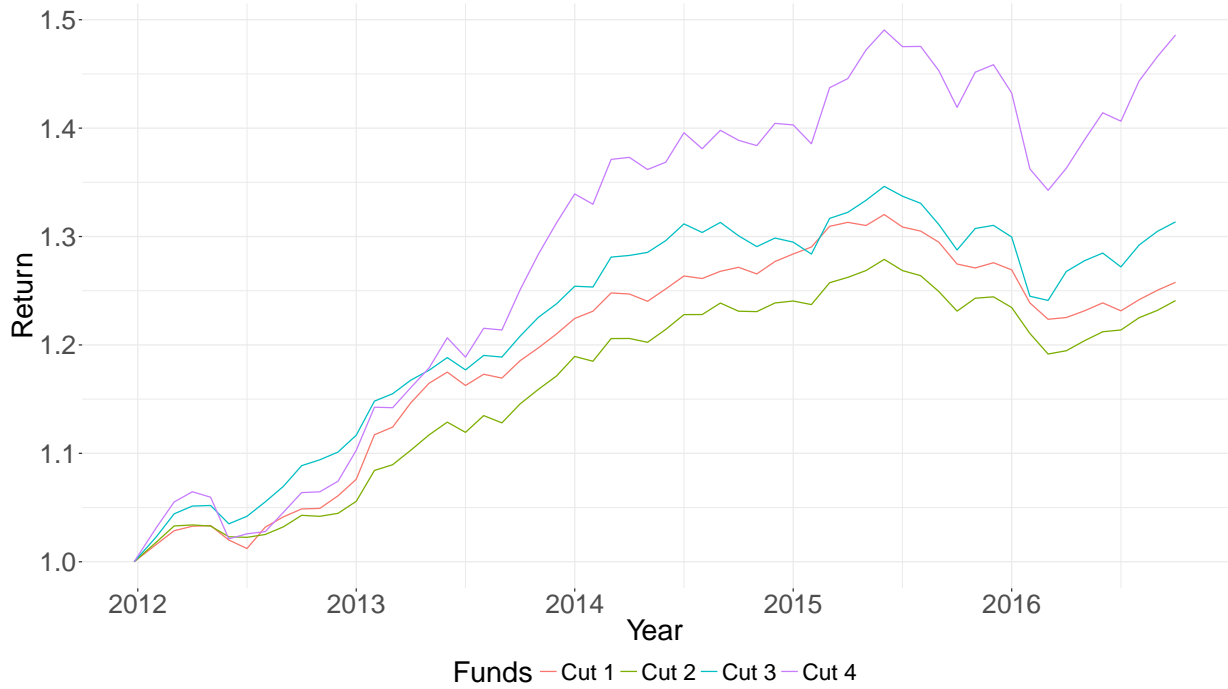
FIGURE V **Return on Trading Strategy Buying Inside Investment Sorted Portfolios**

This figure plots the net cumulative returns to portfolios formed on a quartile sort of percent insider invested. Cut 1 corresponds to funds in the lowest quartile of inside investment; Cut 4 corresponds to funds in the highest quartile of investment. Returns reflect the value-weighted performance of baskets of funds within these ownership buckets, rebalanced annually.
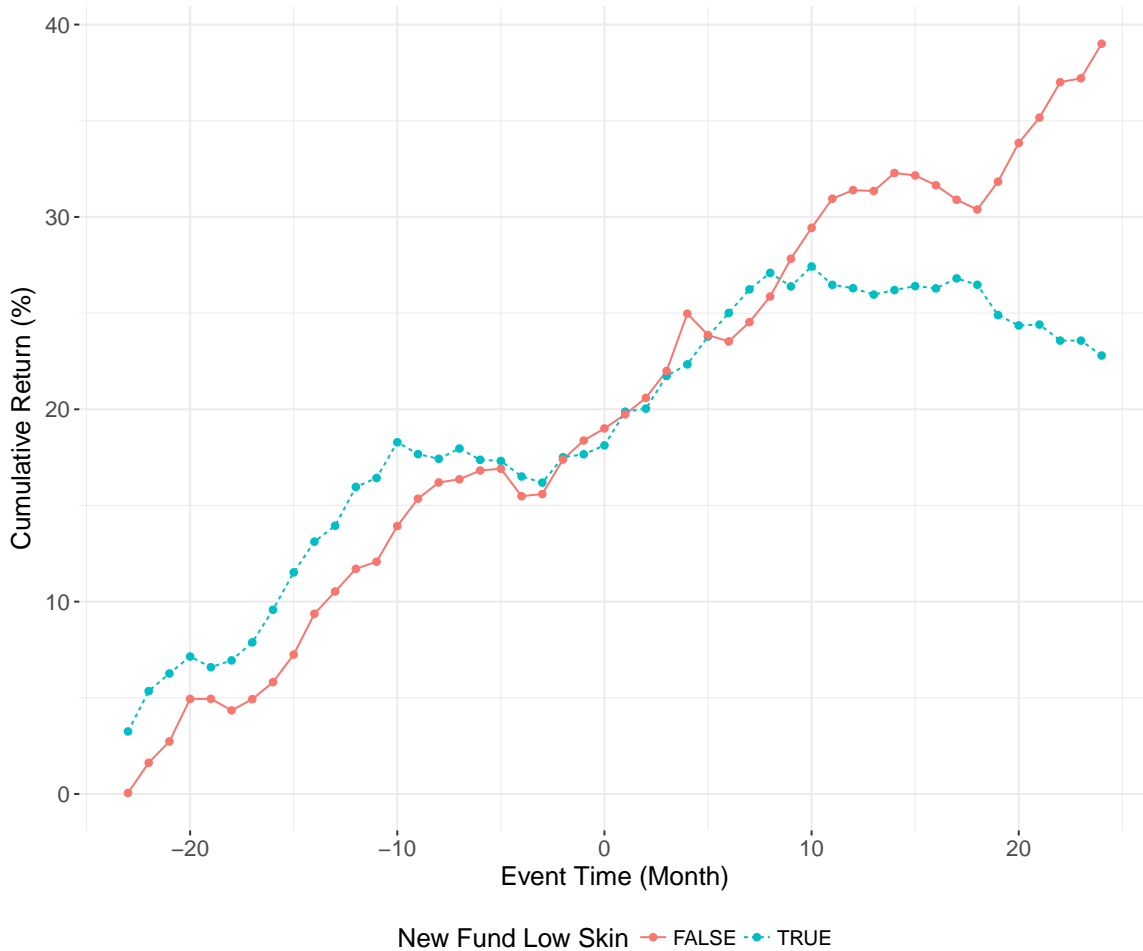
FIGURE VI **Event Study, Transition From One Fund to Multiple Funds**

This figure plots the net cumulative returns of a firm transitioning from having one fund to multiple funds. The event time corresponds to the creation of the new fund, with time zero as the month a new fund is created. The lines corresponds to the cumulative performance of the original fund. After time zero, the high insider investment fund is flagged and tracked. The red solid line corresponds to the original fund that has the highest percent of insider investment. In contrast, the blue dotted line corresponds to the original fund that does not have the highest percent of insider investment.
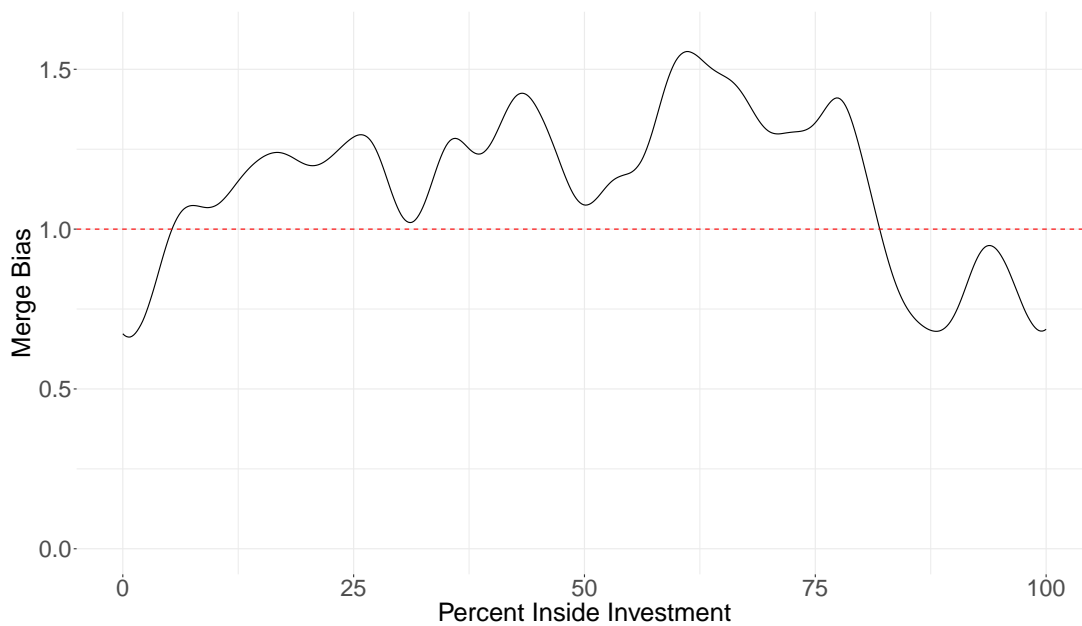
FIGURE VII **Bias Analysis of Merged Sample**

This figure analyzes the bias in the merge between the insider investment observations and hedge fund returns. It is generated by dividing the empirical distribution of the merged sample against the unmerged sample of funds. The red, dotted line, highlights the unbiased boundary. Larger than one indicates a higher match rate relative to the average match rate. Observations for 0% and 100% inside investment have been omitted to be consistent with the analysis. See Appendix for further bias analysis.

TABLE I This table illustrates basic aggregate summary statistics for the entire ADV sample in 2015, as well as the subsample which matches with commercial hedge fund datasets (Eureka Hedge, Barclays, and CISDM).

	Total	Merged Sample
Total Gross Asset Value	6,013	236
Number of Employees	2,524,566	26,091
Non-Advisory Employees	1,699,510	15,669
Advisory Employees	825,056	10,422

TABLE II This table illustrates the identity of related parties. The rows need not sum to one: firms select as many options apply to identify all related parties.

Statistic	N	Mean	St. Dev.	Min	Max
Broker/Dealer	6,821	0.182	0.386	0	1
Other Investment Adviser	6,821	0.471	0.499	0	1
Municipal Advisor	6,821	0.019	0.138	0	1
Swap Dealer	6,821	0.014	0.118	0	1
Swap Participant	6,821	0.002	0.042	0	1
Commodity Pool	6,821	0.399	0.490	0	1
Futures Merchant	6,821	0.015	0.122	0	1
Bank or Thrift	6,821	0.061	0.239	0	1
Trust	6,821	0.062	0.241	0	1
Accountant	6,821	0.018	0.135	0	1
Lawyer	6,821	0.017	0.130	0	1
Insurance	6,821	0.070	0.255	0	1
Pension	6,821	0.042	0.200	0	1
Real Estate	6,821	0.030	0.170	0	1
Sponsor of LP	6,821	0.047	0.212	0	1
Sponsor of GP	6,821	0.731	0.443	0	1

TABLE III Return Analysis of Trading Strategy, Four Factor Model

This table reports the returns attribution of the trading strategy described in Figure V. The risks of the net returns are modeled by the standard four-factor model. Cuts 1 through Cut 4 correspond to the portfolios of increasing insider investment, with Cut 1 having the smallest insider allocation and Cut 4 having the largest.

Number of Funds	(Intercept)	Mkt.RF	SMB	HML	MOM
Cut 1	0.16	0.2	0.03	0.02	0.02
	(1.31)	(5.12)	(0.64)	(0.24)	(0.53)
Cut 2	0.09	0.24	0.04	0.04	0.01
	(1.14)	(8.68)	(1)	(0.84)	(0.48)
Cut 3	0.13	0.31	0.04	0.01	-0.05
	(1.36)	(9.73)	(0.96)	(0.19)	(-1.42)
Cut 4	0.2	0.44	0.11	0.03	-0.06
	(1.5)	(10.11)	(1.78)	(0.35)	(-1.24)

TABLE IV **Return Analysis of Trading Strategy, Fung-Hsieh Model**

This table reports the returns attribution of the trading strategy described in Figure V. The risks of the net returns are modeled by Fung and Hsieh (2004) seven-factor model. Cuts 1 through Cut 4 correspond to the portfolios of increasing insider investment, with Cut 1 having the smallest insider allocation and Cut 4 having the largest.

Number of Funds	(Intercept)	PTFSBD	PTFSFX	PTFSCOM	SNPMRF	SCMLC	BD10RET	BAAMTSY
Cut 1	0.33	-0.01	0.01	-0.01	0.04	0.02	0	-0.02
	(2.34)	(-0.84)	(0.92)	(-1.53)	(1.1)	(0.3)	(0.62)	(-1.54)
Cut 2	0.37	0	0	-0.01	0	0.01	0.01	-0.02
	(2.96)	(-0.37)	(0.54)	(-2.08)	(-0.06)	(0.31)	(1.14)	(-2.32)
Cut 3	0.43	-0.01	0	-0.02	0	0.01	0.01	-0.04
	(3.02)	(-1.08)	(0.13)	(-2.38)	(-0.12)	(0.2)	(1.26)	(-3.46)
Cut 4	0.67	-0.03	0.01	-0.02	-0.03	0.01	0.02	-0.04
	(3.17)	(-1.5)	(0.51)	(-1.82)	(-0.52)	(0.13)	(2.02)	(-2.31)

TABLE V This table shows the panel regression between the excess monthly return of an investment advisor and percent investment from an insider or related party, skin. Column one regresses percent inside investment against excess returns without additional controls. Column two adds additional firm and year fixed effects. Column 3 and 4 repeat this exercise for a different measure of inside investment—total gross inside investment in the firm. Specifications are repeated for the standard four-factor model (Panel A) and Fung and Hsieh (2004) factor models (Panel B).

Panel A: Fama-French Excess Returns

	Risk Adjusted Excess Returns (FF)			
	All	Controls	All	Controls
	(1)	(2)	(3)	(4)
Skin (percent)	0.0001	0.0044***		
	(0.0007)	(0.0013)		
Skin (log of gross)			0.0154	0.0601***
			(0.0102)	(0.0206)
Log AUM			0.0134	−0.0918***
			(0.0114)	(0.0256)
Intercept	0.1328***		−0.4107**	
	(0.0148)		(0.1834)	
Year FE	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes
Observations	27,163	27,163	27,163	27,163
R^2	0.000001	0.0460	0.0004	0.0461

Panel B: Fung-Hsieh Excess Returns

	Risk Adjusted Excess Returns (FH)			
	All	Controls	All	Controls
	(1)	(2)	(3)	(4)
Skin (percent)	0.0047***	0.0061***		
	(0.0007)	(0.0014)		
Skin (log of gross)			0.0536***	0.0716***
			(0.0110)	(0.0222)
Log AUM			−0.0884***	−0.0961***
			(0.0123)	(0.0275)
Intercept	0.3304***		1.2499***	
	(0.0160)		(0.1979)	
Year FE	No	Yes	No	Yes
Firm FE	No	Yes	No	Yes
Observations	27,163	27,163	27,163	27,163
R^2	0.0015	0.0531	0.0019	0.0529

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

Appendix A: Insider Fund Allocation

(a) Appaloosa LP

(b) AQR Capital Management

(c) BlueCrest Capital Management

(d) Citadel Advisors LLC
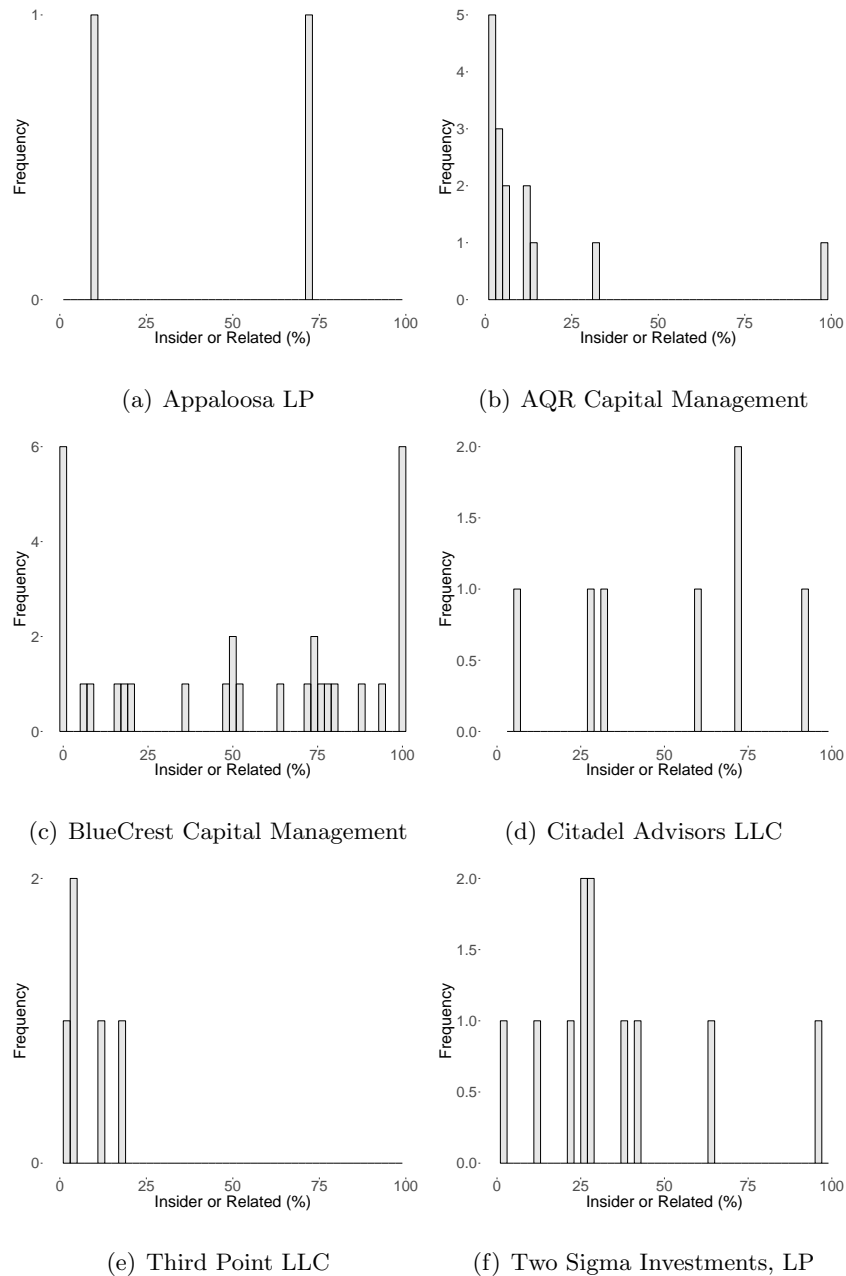
(e) Third Point LLC

(f) Two Sigma Investments, LP

FIGURE VIII **Heterogeneity of Insider Investment Across Numerous Funds**

This figure shows the heterogeneity of insider investment for a set of sample firms. The horizontal axis corresponds to the percent of insider investment and the vertical axis corresponds to the count of funds. The histograms correspond to 2016 ADV filings, and excluded any funds less than $10 million to avoid incubation fund or fund in the process of winding down.