MATCHING CAPITAL AND LABOR

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<u>ABSTRACT</u>

We establish an important role for the firm by studying capital reallocation decisions of mutual fund firms. We show that firms add significant value by matching capital to labor. We find that, following the firm's decision to reallocate capital to one of its managers, future value added increases significantly. We find no evidence of a similar effect when a firm hires a manager from another firm. We conclude that an important reason why firms exist is the private information that derives from firms' ability to better assess the skill of their own employees.

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What makes a firm successful? Is it a characteristic of the firm itself, or is it simply that a successful firm is a collection of particularly talented employees? Why do people choose to work for firms rather than for themselves? Are employees more productive when they work as part of a larger group? Clearly the firm plays an important role in sharing risk, but does it have a role beyond that? As central as these questions are to the economics of organizations, studying them empirically is difficult because, in most cases, it is hard to measure employee productivity directly. In addition, it is equally difficult to measure the counterfactual — what would have happened to an employee working for a firm had she chosen to do the same job as an independent contractor.

There is now a large theoretical literature designed to answer these questions (see Hart and Moore (1990), Holmstrom and Tirole (1989) and Hart (1995)). A key aspect of modern theories of the firm is the concept of ownership. In a world with incomplete contracting, incomplete information and bounded rationality, ex-post bargaining power is affected by ownership. Asset owners, because they retain the rights of control, have inherently more bargaining power. An important insight of this literature is that firms exist to ensure that ex ante ownership is concentrated to allow for efficient ex post outcomes. Although these theories undoubtedly explain an important component of why modern firms exist, they cannot explain a particular, and increasingly important, type of firm — a firm that consists almost exclusively of human capital. Because these firms have little or no physical capital, there is very little to own, other than perhaps some intangible capital such as the firm's brand name. Hence a primary reason for the existence of these types of firms cannot be the assignment of ex-post bargaining rights through asset ownership. Thus the aforementioned theoretical literature is silent on why these firms exist.

In this paper, we study one of the best examples of a sector that is dominated by firms that own little or no physical capital: the mutual fund sector. A typical mutual fund company is essentially just a collection of people. Although in some sense the industry is
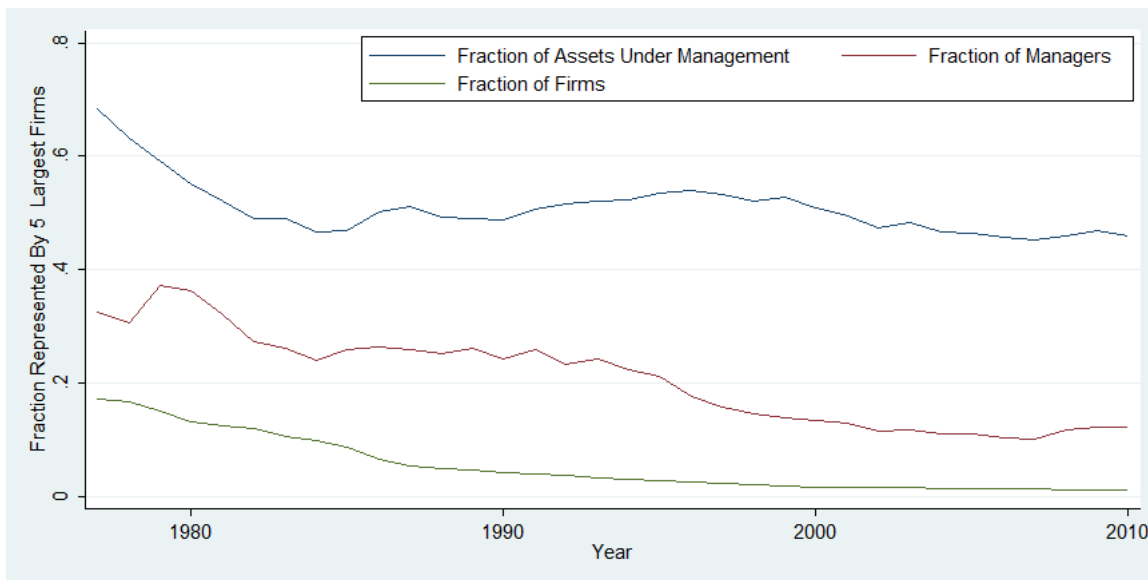
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Figure 1: **Capital and Human Resources Controlled by the Five Largest Firms**: This figure reports the fraction of assets controlled by and the fraction of managers working for the 5 largest firms (in assets under management) in April of each calendar year, for every year between 1977 and 2010. As a point of comparison we also provide the 5 firms as a fraction of the total number of firms.

actually very capital intensive (the business is, after all, about investing financial capital), what distinguishes this industry from other capital intensive industries is that the firm does not own its capital. Instead, the customers of mutual fund companies, that is, mutual fund investors, retain all ownership rights to their capital and in most cases can call it back at any time. Thus, unlike a typical firm, the value of a mutual fund firm does not include the value of the capital it needs to operate. So, in reality, mutual fund firms actually comprise little else but a collection of people. Thus the ownership rights to capital cannot play an important role in why mutual fund companies exist. Yet, as Figure 1 shows, the mutual fund industry is dominated by large firms. As of April 2010, the 5 largest asset management companies, which make up only 1% of the total number of firms, hire 12% of all managers and manage 46% of all assets in the mutual industry. What, then, does a mutual fund company bring to the table? Our objective in this paper is to answer this question.

We demonstrate, empirically, that an important role of a firm in the mutual fund

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sector is to efficiently match capital to skill. Mutual fund companies typically consist of a collection of mutual funds, each of which is managed by one or more managers. Investors invest their capital with firms by allocating their money to the firm's funds. Thus the amount of capital a typical mutual fund manager has under management is determined by one of two parties: investors or firm executives. Investors allocate their capital to particular mutual funds, and in doing so, also allocate capital to particular managers. But, additionally, mutual fund executives decide which fund a particular manager is given responsibility to manage. In a world with perfectly rational players, no frictions and no information asymmetries, the role of mutual fund executives would be irrelevant because investors themselves would efficiently allocate their own capital amongst managers. In reality, what we find, is that mutual fund executives play a very important role in capital allocation. Mutual fund firms appear to add substantial value by intermediating between investors and managers and thereby efficiently matching capital to skill.

We begin the empirical analysis of the mutual fund industry by demonstrating that there is an economically detectable role for mutual fund firms. We document the following two facts. First, firm performance is persistent. Second, a manager's future performance is predictable by the past performance of other managers in the same firm. We then explain the role of the firm by focusing on capital reallocation decisions within firms. We find that such decisions lead to future increases in value added. A decision to increase a portfolio manager's responsibility by assigning an additional fund to that manager (that is, a decision to increase the manager's AUM), leads to an increase in the manager's subsequent value added. We find that at minimum, the decision to reallocate capital to managers accounts for 39% of the total value added of the average manager.

Because capital allocation decisions within the firm dwarf investor flows in and out of funds, investors cannot replicate the firm's decision themselves. We postulate that the reason for this is that the firm has better information on the skill of its managers.

We provide supporting evidence in favor of this hypothesis: (1) flows of self employed managers (single manager firms) are no different to flows of other managers, (2) external promotion and demotion decisions (external hires that involve a change in AUM) do not lead to a detectable change in future value added and (3) while past performance does explain investor flows, it has very little explanatory power over firm capital reallocation decisions. These facts are consistent with the hypothesis, first theorized by Alchian and Demsetz (1972), that firm executives use other factors in making their capital reallocation decisions and that these factors are not easily observable to people outside the firm.

1   The Mutual Fund Industry

In the last 50 years there has been a secular trend away from direct investment. Individual investors used to make up more than 50% of the market, today they are responsible for barely 20% of the total capital investment in U.S. markets. During that time there has been a concomitant rise in indirect investment, principally in mutual funds. Rather than invest directly in stocks, a mutual fund investor invests his money in a fund that buys stocks on his behalf. Historically, mutual funds made up less than 5% of the market, today they make up 1/3 of total investment.[1] The industry itself has also changed. Initially made up of only *actively* managed funds — funds where the fund manager claims to add value by "beating the market", that is, providing an expected return in excess of the expected return provided by well diversified portfolio of equivalent risk, today 13% of the industry consists of *index* funds — funds that do not claim to provide an excess return, but simply provide diversification services. In this study we will restrict attention to actively managed mutual funds marketed to U.S. investors that never invest less than 2/3rds of their assets in stocks.

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[1]See French (2008).

For our purposes the rise in the index fund industry is fortuitous because these funds allow us to measure something that usually proves elusive to economists — what would have happened if the firm had not used its resources to generate value. Because index funds provide the lowest cost way for any investor to own a well-diversified portfolio, the value added of a mutual fund can be measured by comparing its performance against what would have happened had fund's assets been invested in an index fund of similar risk. The difference is the profits that accrue to the firm because of a skill in short supply, and what we will call value added. This value added is calculated by first determining the fund's realized *gross alpha* – the difference between the return the fund generated from its investments before any fees or expenses and the return that would have transpired had the assets been invested in a set of index funds of comparable risk. The realized gross alpha is then multiplied by the total amount of capital under management to provide the total value the fund added over the alternative investment opportunity set.

We will follow Berk and van Binsbergen (2013) and use, as the alternative investment opportunity set, the set of index funds offered by The Vanguard Group (see Table 1 for the specific funds used). There are good reasons to use these index funds. First, Vanguard is the firm that pioneered index funds and so we can be reasonably sure that the funds in our set represent a set of investable opportunities at the time. Second, Vanguard is the largest, and is widely regarded as the best, provider of diversification services. Finally, Berk and van Binsbergen (2013) show that Vanguard funds have added value relative to other index funds, that is, Vanguard provides these services at a lower cost than its average competitor.

The benchmark return is the return on closest portfolio in the alternative investment opportunity set to the mutual fund. If R_t^j is the excess return (the realized return minus the risk free rate) earned by investors in the j'th Vanguard index fund at time t, then the

Fund Name	Ticker	Asset Class	Inception Date
S&P 500 Index	VFINX	Large-Cap Blend	08/31/1976
Extended Market Index	VEXMX	Mid-Cap Blend	12/21/1987
Small-Cap Index	NAESX	Small-Cap Blend	01/01/1990*
European Stock Index	VEURX	International	06/18/1990
Pacific Stock Index	VPACX	International	06/18/1990
Value Index	VVIAX	Large-Cap Value	11/02/1992
Balanced Index	VBINX	Balanced	11/02/1992
Emerging Markets Stock Index	VEIEX	International	05/04/1994
Mid-Cap Index	VIMSX	Mid-Cap Blend	05/21/1998
Small-Cap Growth Index	VISGX	Small-Cap Growth	05/21/1998
Small-Cap Value Index	VISVX	Small-Cap Value	05/21/1998

Table 1: **Benchmark Vanguard Index Funds:** This table lists the set of Vanguard Index Funds used to calculate the Vanguard benchmark. The listed ticker is for the Investor class shares which we use until Vanguard introduced an Admiral class for the fund, and thereafter we use the return on the Admiral class shares (Admiral class shares have lower fees but require a higher minimum investment.)

*NAESX was introduced earlier but was originally not an index fund. It was converted to an index fund in late 1989, so the date in the table reflects the first date we included the fund in the benchmark set.

benchmark return for fund i is given by:

$$R_{it}^B = \sum_{j=1}^{n(t)} \beta_i^j R_t^j,\tag{1}$$

where $n(t)$ is the total number of index funds offered by Vanguard at time t and β_i^j is obtained from the appropriate linear projection of the i'th active mutual fund onto the set of Vanguard index funds. By using Vanguard index funds as benchmarks, we can be certain that investors had the opportunity to invest in the funds at the time and that the returns of these funds necessarily include transaction costs and reflect the dynamic evolution of active strategies.

The industry is characterized by a large number of firms that each market multiple funds to investors. Funds are managed by individual managers. Managers can manage

multiple funds within a firm and funds can be managed by more than one manager. Because of the SEC reporting requirements we are able to observe detailed information on each fund. For our purposes we know the fund's performance (i.e., realized returns), fees charged, total assets under management and importantly, the identity of its manager(s). Hence we observe instances when a manager switches firms as well as funds within firms. We will use this variation to help identify the role the firm and the manager play in adding value.

Customers provide the capital to mutual fund firms by investing in the firms' mutual funds. That is, mutual fund investors invest in funds, not firms. In that sense a firm has little control over the amount of capital invested in its funds. A firm, cannot, for example, arbitrarily move capital from one of its funds to another fund. That decision is exclusively the purview of its fund investors. However, what firms can and do, in fact, do is decide which manager gets to manage which fund. For that reason, the amount of capital a particular manager has under his control is affected by two things: (1) investors' decisions to put capital in or take capital out of the funds the manager manages, and (2) firms' decisions to either give the manager responsibility for managing an additional fund or taking away that responsibility. By observing the second mechanism we will be able to infer whether the firm adds value by assigning capital to labor.

2   Data

We use the dataset in Berk and van Binsbergen (2013). This dataset, which is comprised of monthly observations of all mutual funds since 1977 is compiled from combining two databases, the CRSP survivorship bias free mutual fund database and the Morningstar Principia database. The details on how the database was compiled from these two data sources are in Berk and van Binsbergen (2013).

We augment that data with the manager information provided by both data sources. Although both CRSP and Principia have information on fund managers and firms, this information is not consistently recorded in both databases. In many cases individual manager names are replaced with the words "Team Managed" and often how the manager is named is not consistent.[2] For this reason, we make use of a third data source: Morningstar Direct. The Morningstar Direct database supposedly contains a clean and complete list of managers and firms for each fund in Principia that is still in existence, merged, or closed. However, there are examples of funds in Principia that are not in Morningstar Direct, especially early in the sample. This suggests that the Morningstar Direct database is not survivorship bias free. To make sure that we do not inadvertently introduce a survivorship bias into our data, we only used Morningstar Direct to augment our database. That is, we update the manager names on our existing database with information from Morningstar Direct, but, importantly, still keep and use the data in the original database that we could not update. For those funds for which we cannot identify a match in Morningstar Direct, we employ an automated algorithm as well as manual screening to clean up the manager information.[3]

We drop all observations without an identifier, as well as observations with missing returns, AUMs, expense ratios or holdings information. We also remove all bond and money market funds (funds that at some point in time had at least 1/3 of AUM in bonds or cash) as well as index funds, by using the Principia *special criteria* indicator and screening fund names. We aggregate different share classes of the same fund into one fund, resulting in a database of 3628 funds. The final sample covers the period from January 1977 to December 2010.

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[2]In addition to examples of inconsistent spelling of a manager's name, there other inconsistencies that we need to address. For example, sometimes the full name is spelled out, sometimes only the manager's initials are used, and sometimes his/her middle name is included.

[3]For a detailed description, see the online appendix to this paper.

3 Definitions

Define the gross excess return at time t (that is, the return in excess of the risk free rate but before management fees and expenses are taken out) of fund i as R_{it}^g and the net excess return (the gross return minus fees and expenses) as R_{it}^n. The value added of fund i is:

$$V_{it} \equiv q_{i,t-1}\left(R_{it}^g - R_{it}^B\right) \tag{2}$$

where $q_{i,t-1}$ is the amount of assets under management of fund i at $t-1$ and R_{it}^B is the return of the benchmark, that is, a passive strategy of equivalent riskiness. V_{it} is the value, in dollars, the fund adds over and above what would have been earned if the capital was invested in the passive benchmark. The value added by firm f at time t is the sum of all value created by its funds:

$$V_{ft} = \sum_{i \in \Omega_{ft}} V_{it} \tag{3}$$

where Ω_{ft} is the set of all funds in firm f at time t.

Funds are managed by at least one manager in the firm and managers can manage multiple funds. So we define the value added by manager m at time t as the sum of the value added of all the funds he manages. When manager m co-manages fund i with N_{it} other manages, we ascribe $\frac{1}{N_{it}}$ th of the value added from fund i to each of the N_{it} managers. The manager's value added is therefore given by,

$$V_{mt} = \sum_{i \in \Omega_{mt}} \frac{V_{it}}{N_{it}} \tag{4}$$

where Ω_{mt} is the set of all funds managed by m at time t. Using the same logic, the manager's AUM is:

$$q_{m,t-1} = \sum_{i \in \Omega_{mt}} \frac{q_{i,t-1}}{N_{it}}, \tag{5}$$

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and the manager's gross and net return are:

$$R^g_{mt} = \frac{1}{q_{m,t-1}} \sum_{i \in \Omega_{mt}} \frac{q_{i,t-1}}{N_{it}} R^g_{it} \tag{6}$$

$$R^n_{mt} = \frac{1}{q_{m,t-1}} \sum_{i \in \Omega_{mt}} \frac{q_{i,t-1}}{N_{it}} R^n_{it}. \tag{7}$$

To differentiate superior past performance from poor past performance we need a measure to select funds. We use the firm *skill ratio*, defined in Berk and van Binsbergen (2013) as follows:

$$SKR^\tau_f \equiv \frac{\bar{V}^\tau_f}{\sigma(\bar{V}^\tau_f)} \tag{8}$$

where $\bar{V}^\tau_f = \sum_{t=1}^\tau \frac{V_{ft}}{\tau}$ is the average firm value added up to time τ and $\sigma(\bar{V}^\tau_f) = \frac{\sqrt{\sum_{t=1}^\tau (V_{ft} - \bar{V}^\tau_f)^2}}{\tau}$ is the standard error of firm value added up to time τ.[4] Note that the skill ratio is essentially the t-statistic of the mean value added up until time τ.

4   Firms Have a Role

Do firms have a role or are they only a random collection of managers? To investigate this question, we first establish two important characteristics of the data. First, we demonstrate that firm performance is persistent, that is, firms that have added value in the past keep adding value in the future. Second, we show that the future performance of a manager is predictable by the past performance of other managers at the same firm. These two results establish that there is a role for the firm.

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[4]For ease of exposition, we have assumed that the fund starts at time 1. For a fund that starts later, the start date in the skill ratio is adjusted to reflect this.

4.1 Persistence in Firm Value Added

We demonstrate firm persistence by sorting funds into quantiles based on the skill ratio of their firms and showing that funds that belong to firms with high skill ratios have superior future performance. Using the firm skill ratio measured at each time t, we sort funds into two quantiles, the top and bottom 50%.[5] We then count the number of times, over a specified future time horizon, that a fund outperforms the median fund.

To be included in this sort, we require a firm to have a fund with at least three years of historical data. We estimate the fund's future value added over a *measurement horizon* of h months. Because we need a minimum number of months to estimate the fund's betas, we drop all funds with less than 18 observations in the measurement horizon. To remove the obvious selection bias, for the remaining funds we drop the first 18 value added observations as well, leaving the remaining observations exclusively in the horizon $\{t + 19, .., t + h\}$. At each future time $\tau \in \{t + 19, .., t + h\}$ we compare the value added of every fund to the value added of the median fund, and count the number of times the fund's value added exceeds the median value added. At the end of the horizon, funds are again sorted on the firm's skill ratio at that time, and the process is repeated as many times as the data allows. At the end of the process we add up the total number of times funds in each half of the sample beat the median fund.[6] The first column of Table 2 reports the results. At the three and four year horizon, funds of firms with above median skill ratios significantly outperform (at the 95% confidence level) funds of firms with below median skill ratios.

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[5]When we need to break a tie in the sort, we use the fund's age to order older firms above younger firms.

[6]The main difficulty with implementing this strategy is uncertainty in the estimate of the fund's betas. When estimation error in the periods before the sort is positively correlated to the error in the measurement horizon, a researcher could falsely conclude that evidence of persistence exists when there is no persistence. To avoid this bias we do not use information from the periods before the sort to estimate the betas in the periods after the sort. This means that we require a future horizon of sufficient length to produce reliable beta estimates, so the shortest horizon we use to measure future performance is three years.

We repeat the above analysis sorting funds into the top decile and bottom decile based on their firm's skill ratio, as well as top quintile and bottom quintile. That is, in the measurement horizon we restrict attention to top and bottom decile/quintile funds and record the number of times each fund outperforms the median fund in the restricted sample. The second and third column of Table 2 reports the results. At all horizons, and for both quintile and decile sorts, the results show that funds from firms with higher skill ratios statistically outperform (at the 95% confidence level) funds from firms with lower skill ratios.

	Top x% Outperforms Bottom x%		
	x = 50	x = 20	x = 10
3 Years	50.57*	51.13*	51.46*
	(0.17)	(0.30)	(0.39)
4 Years	50.55*	50.93*	51.18*
	(0.18)	(0.33)	(0.43)
5 Years	50.51	50.87*	50.98*
	(0.39)	(0.43)	(0.46)

Table 2: **Predicting Fund Performance Using Firm Skill:** We report the fraction of times (in percentages) a fund sorted into the top $x\%$ quantile (based on its firm's skill ratio) has higher realized value added than the median fund over the next 3, 4, or 5 years. Standard errors, clustered by date, are given in parentheses. * indicates that the estimate is significantly greater than 50% at the 95% confidence level.

4.2 Predicting a Manager's Performance by the Past Performance of His Colleagues

We next establish that a manager's future performance can be predicted by the past performance of other managers at the same firm. To do this test, we complete the following three steps for every fund i: (1) We identify the set of managers managing fund i, (2) we identify all funds in the firm managed by any member of this set of managers, and (3) we recalculate the firm's skill ratio excluding those funds, hereafter, the *adjusted skill ratio*. We then sort funds using the adjusted skill ratio and proceed with the same test

as described in the previous section. By completing these three steps, we ensure that the adjusted skill ratio by which we sort a fund is only driven by information regarding the *other* funds in the firm. That is, there is no overlap in the managers involved in fund i and the corresponding adjusted skill ratio. Table 3 tabulates the resulting statistics using 2, 5 and 10 quantiles. The table shows that funds sorted into the top quantile significantly outperform the bottom quantile for all 3 sorts and over all 3 measurement horizons.

	Top x% Outperforms Bottom x%		
	x = 50	x = 20	x = 10
3 Years	50.31*	50.73*	50.86*
	(0.13)	(0.22)	(0.29)
4 Years	50.30*	50.58*	50.95*
	(0.14)	(0.23)	(0.31)
5 Years	50.44*	50.70*	50.91*
	(0.14)	(0.23)	(0.32)

Table 3: **Predicting Managers' Performance by Their Peers:** We report the fraction of times (in percentages) a fund sorted into the top $x\%$ quantile (based on skill ratio of other managers belonging to the same firm but not managing this fund) has higher realized value added than the median fund over the next 3, 4, or 5 years. Standard errors, clustered by date, are given in parentheses. * indicates that the estimate is significantly greater than 50% at the 95% confidence level.

Although, taken together, these results clearly establish that a firm is not merely a random collection of managers, they do not provide additional insight into what the exact role of the firm is. At first glance, it might seem that the most direct way to study the role of the firm would be to estimate an attribution model. Managers move frequently enough between firms to form a very well-connected network. So the most obvious approach to studying the role of the firm is to estimate a panel regression that includes fixed effects for firms and managers. Unfortunately, the results of such an approach would be difficult to interpret because manager moves are endogenous. Conceivably, the firm could merely be a co-ordination device for managers to work together. To avoid the aforementioned endogeneity problem, in the next section we study the role of the firm by concentrating on internal moves within the firm. The advantage of focusing attention on these moves is that our results cannot be driven by managers self selecting into firms.

Capital Reallocation	0.496*	
	(0.197)	
• Promotion		0.669*
		(0.278)
• Demotion		0.193
		(0.331)
Year FE	Yes	Yes
Manager FE	Yes	Yes

Table 4: **Matching Capital with Skill:** This table reports statistics on the value added (in \$ Millions/month) through internal capital reallocation by the firm. The first row reports the coefficient estimate from equation (9). The next two rows report the estimates from (10). Standard errors, heteroskedasticity-robust and two-way clustered by manager and manager group × year, are provided in parentheses. * indicates that the estimate is significantly different from zero at the 95% confidence level.

5 Matching Capital with Skill

In this section we focus on one specific potential role of the firm: matching capital to skill. We take as the Null hypothesis the neoclassical model as described in Berk and Green (2004). Under those assumptions investors already invest the optimal amount of capital in funds and therefore there is no role for the firm to assign more or less capital to its fund managers.

To test this Null, we study changes in value added after internal capital allocation decisions by firms. Firms make these allocation decisions when they either give a fund to a manager to manage and thereby increase the manager's AUM, hereafter a promotion, or take away a fund from a manager and thereby decrease the manager's AUM, hereafter a demotion.[7]

We begin by focusing attention on promotions and demotions together, that is, we run the following panel regression:

$$V_{mt} = \lambda_y + \lambda_m + \beta \cdot \mathbf{1}_{mt}^{\text{internal}} + \epsilon_{mt} \tag{9}$$

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[7]Because we need to observe the manager's performance at the same firm after the demotion decision, we have to exclude demotions that are also termination decisions.

where V_{mt} is the estimated value added of manager m at time t (defined in (4)); $\mathbf{1}_{mt}^{\text{internal}}$ is an indicator variable that takes on the value of 1 if manager m is internally promoted or demoted at or before time t; λ_m are manager fixed effects; and λ_y are year fixed effects to control for any general time trends in managers' ability to add value. The results are reported in the first column of Table 4. The firm adds \$496,000 per month when it makes a decision to either promote or demote one of its managers. This point estimate is statistically different from zero at the 95% confidence level.

Estimates of equation (9) can be biased if the capital reallocation decisions are correlated with past performance. If a manager is promoted (demoted) after superior (poor) performance, and if past performance has a component that is due to good (bad) luck, then in expectation the manager's future performance will mean revert.[8] Consequently, bad luck will be measured as future value added and good luck will be measured as value destroyed by the manager. To examine the importance of this issue, we further split the manager move dummy $\mathbf{1}_{mt}^{\text{internal}}$ into two dummies, one for promotion ($\mathbf{1}_{mt}^{\text{P}}$), and one for demotion ($\mathbf{1}_{mt}^{\text{D}}$). The promotion dummy takes on the value of 1 if the most recent capital reallocation decision resulted in a net increase in the manager's assets under management. Similarly, the demotion dummy takes on the value of 1 if the most recent capital reallocation decision resulted in a net decrease in the manager's AUM. We then run the following panel regression:

$$V_{mt} = \lambda_y + \lambda_m + \beta_P \cdot \mathbf{1}_{mt}^{\text{P}} + \beta_D \cdot \mathbf{1}_{mt}^{\text{D}} + \epsilon_{mt} \qquad (10)$$

where the definitions of all other variables are consistent with those from equation (9). The second column of Table 3 reports the results. The coefficients on the promotion and demotion dummies are positive, and importantly, the promotion dummy is statistically

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[8]As we will presently show, past performance does indeed predict promotion and demotion decisions (see Table 5).

significantly different from zero. Because the mean reversion biases the coefficient on the promotion dummy downwards, we can be certain that this bias is not driving the rejection of our Null. In summary, we establish at the 95% significance level that firms' decisions to promote their managers add value on average.

The point estimate of the coefficient on the demotion dummy is positive, as one would expect if the decision to demote is optimal. If the manager was managing too much money and thereby destroying value (perhaps by trading too much) the decision to demote will increase the manager's value added. However, caution is in order. First, the coefficient is not significantly different from zero and second, it is biased upwards by the aforementioned mean reversion bias.

The value added numbers reported in Table 4 are quantitatively large. However, the size of these estimates should be interpreted with caution because we don't know the counterfactual. That is, we don't know what would have happened had the firm not reassigned the capital. Presumably investors would have eventually learned about the manager's quality and, over time, directed capital towards the manager. Our estimate is therefore an upper bound on how much value the firm adds by matching capital to labor because it implicitly assumes that no capital adjustment would have occurred through the flow of funds. In the short term, this implicit assumption is not unrealistic; the magnitude of the firm's capital allocation decisions dwarfs the magnitude of inflows and outflows. However, over longer periods of time, inflows and outflows could, in principle, accumulate and eventually lead to an overall change in AUM that is commensurate with the magnitude of promotions and demotions. So to correctly assess the magnitude of the marginal value added of the firm, we must construct a counterfactual.

To construct a realistic counterfactual, we focus exclusively on promotions and assume that the manager's subsequent inflows would match the inflows, over the same time period, of a comparable set of funds. Rather than construct a single counterfactual from a

one set of comparables, we construct a range of counterfactuals. We construct the first counterfactual by assuming the promoted manager would have experienced the same percentage increase in her AUM as the weighted average percentage increase due to flows of all funds in that month. We then narrow the set of comparable funds by eliminating poorly performing funds. That is, we eliminate all funds whose monthly net return over the benchmark was below a particular quantile and then assume that the manager's percentage inflows would have been the same as the weighted average percentage inflow of the remaining funds. For example, the second counterfactual eliminates the funds in the bottom 10% and computes the flow of funds by taking the weighted average of the remaining 90%. The third counterfactual eliminates the bottom 20% and we continue this process up to the extreme counterfactual which eliminates the bottom 99%, and thus computes the flows by taking the weighted average of the top 1%.

Using the percentage increases computed under the counterfactual fund flows, we re-compute what the AUM of the fund would have been. We do this until the counterfactual AUM either grows to the manager's actual AUM or the manager is demoted. Once either event occurs, we use the actual AUM from then onwards. We then re-estimate the value added of a promotion using the counterfactual AUM.

Formally, then, the value added of the manager can then be expressed in terms of the counterfactual as follows:

$$V_{mt} = \left(q_{m,t-1}^0 + \left(q_{m,t-1} - q_{m,t-1}^C \right) + \left(q_{m,t-1}^C - q_{m,t-1}^0 \right) \right) \left(R_{mt}^g - R_{mt}^B \right)$$

where q_{mt} denotes the actual AUM of manager m at time t; q_{mt}^C denotes the AUM under the counterfactual; and q_{mt}^0 to denotes the AUM of the manager at the time of the promotion. The first term measures the manager's value added without the promotion and without future inflows or outflows. The second term measures the contribution to the managers

value added of the promotion. The last term measures the contribution to value added by investors under the counterfactual. To measure just the contribution of the promotion, we need to drop the third term. Thus, define the adjusted value added:

$$
\begin{aligned}
\hat{V}_{mt} &\equiv \left(q_{m,t-1}^0 + \left(q_{m,t-1} - q_{m,t-1}^C \right) \right) \left(R_{mt}^g - R_{mt}^B \right) \\
&= V_{mt} \cdot \frac{q_{m,t-1}^0 + q_{m,t-1} - q_{m,t-1}^C}{q_{m,t-1}}.
\end{aligned}
$$

To estimate the magnitude of the value added of just the promotion we replace V_{mt} with $\hat{V}_{mt}$ over the time period from the promotion until the first time $\hat{V}_{mt} > V_{mt}$ or the manager is demoted (whichever comes first). We then repeat the previous test, that is, we estimate (10), using the counterfactually computed value added. Figure 2 plots the coefficient on the promotion dummy over a range of different counterfactuals corresponding to flows computed from performance quantiles ranging from all funds to only funds whose performance is in the top 1%. Even under the extreme assumption that the counterfactual is computed solely from funds in the top 1% of the performance distribution, the firm's contribution to value added is still very large ($506,076$ per month).

Another way to assess the overall impact of promotions is to ask how long it would have taken for investors to achieve the reallocation of funds the promotion decision achieved. To answer this question, under each counterfactual, we compute how many years it would have taken for investors to provide the equivalent amount of additional AUM through the flow of funds alone. That is, for each promotion decision we compute the number of years it takes for $\hat{V}_{mt} > V_{mt}$. If this date does not occur by the last date of our sample, we assume that capital will continue to flow at a rate equal to the average flow of funds under the counterfactual over our entire sample. That is, fund flow after 2010 is assumed to be equal to the average historical fund flow under the counterfactual. We then average the time taken across all promotions for given counterfactual. Figure 3 plots the results
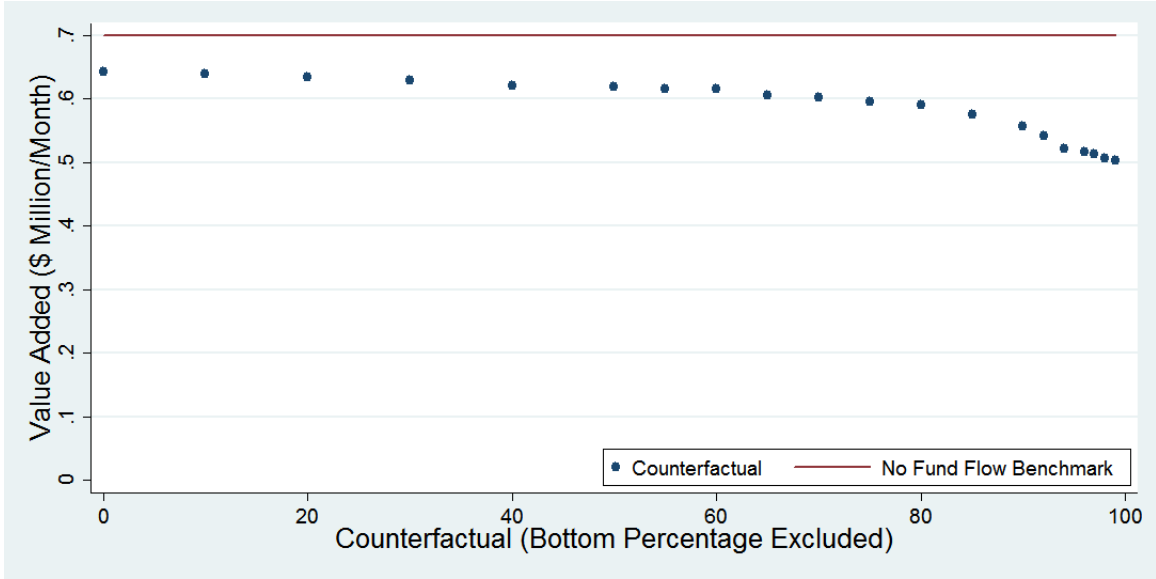
Figure 2: **Firm Value Added Under Realistic Counterfactuals**: We construct the counterfactual by excluding all funds with performance below the indicated percentile and then assume that under the counterfactual a fund would have experienced the same percentage increase in its AUM as the weighted average percentage increase of all remaining funds in that month.

over the same set of counterfactuals as before. Even for the counterfactual computed using the top 1% of funds, it would have taken investors 11 years to achieve what the firm achieved in a single month. Clearly, the firm's capital reallocation decisions are much more important in determining the manager's AUM than the flow of funds.

We end this section by estimating a lower bound on the total value a typical mutual fund firm creates by correctly matching capital to skill. Because we are computing a lower bound, we can focus exclusively on promotions where we have the most confidence in our estimates. Obviously, our estimate depends on our assumption on what would have happened had the promotion not occurred, so we use the same set of counterfactuals as before. Taking the estimates for the value added of a promotion reported in Figure 2, we multiply this estimate by fraction of months in which the promotion dummy is equal to one to get the average value of a promotion decision. Figure 4 reports this number as a fraction of the total value added by an average manager (which is $237,573$ per month).[9]

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[9]That is, the average V_{mt} across all managers at all points in time.
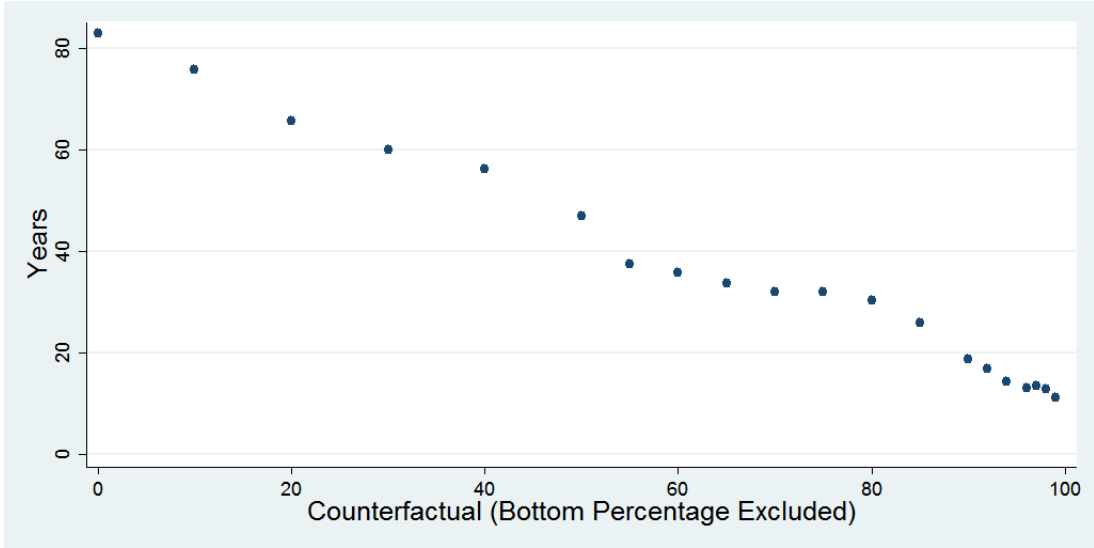
Figure 3: **Time Taken to Reach Same AUM under the Counterfactual**: Under each counter-factual, we compute how many years it would have taken for investors to provide the equivalent amount of additional AUM through the flow of funds alone.

Even for the extreme counterfactual where flows are assumed to be equivalent to the flows of the top 1% of funds, a lower bound on the average value added by the firm is $92,612/month which accounts for 39% of the total value added by an average manager.

6 Source of Firm Skill

The results in the previous section imply that the amount of capital under management affects a manager's ability to generate value. Although such a result might seem obvious, as we have already pointed out, it is in fact not consistent with the standard neoclassical assumptions in Berk and Green (2004). In that model, investor fund flows are always sufficient to make sure that managers have enough capital to extract the maximum amount of value from markets. If, in fact, the manager was managing the optimal amount of capital before being promoted, she would not be able to put the new capital to productive use, resulting in no increase in value added (the additional fees generated would have to come from investors, leaving value added unchanged). The fact that adding capital
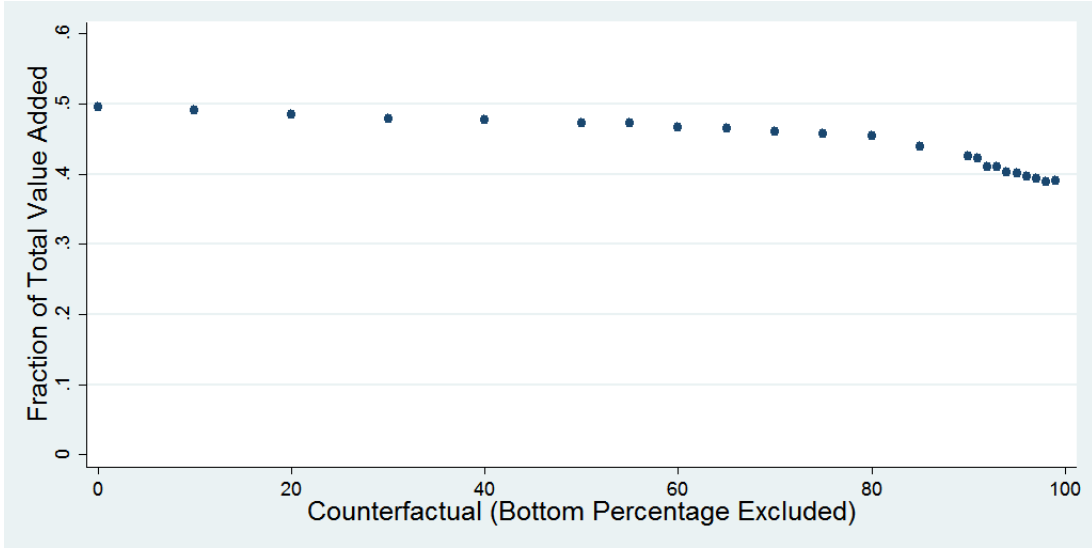
20

Figure 4: **Lower Bound Firm Value Added by Promotions**: We generate a lower bound on the total value a typical mutual fund firm creates by multiplying the value of a promotion under each counterfactual by the fraction of periods in which the promotion dummy is equal to one. We then divide this estimate by the average value added per manager per month to obtain the contribution of the firm as a fraction of total value added by the mutual fund industry.

creates value implies that, for whatever reason, the manager was not managing the optimal amount of capital prior to the promotion, and, more importantly, this misallocation was corrected by a decision made by the firm (rather than by investors).

A key assumption in Berk and Green (2004) is that investors and managers have the same information about the manager's ability. Thus one possible explanation for our results is an asymmetry of information between investors, managers and firms. As a consequence of this asymmetry, firms have a role intermediating between managers and investors. Promotion decisions add value because firms have more information than investors about managerial ability and firm executives use this information to direct capital towards better managers.[10]

A concern that one might have interpreting the value added by the firm as rents for private information, is that investors might rationally anticipate the firm's capital reallo-

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[10]Note that if managers know their own ability and are able to borrow (or go short) the firm would not need to intermediate. This explanation for our results therefore requires that one or both of these conditions are also violated.

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cation decisions in determining their own investment decisions. That is, it is conceivable that investors have the same information as the firm, but knowing that firms will reallocate capital for them, investors rationally choose not to allocate capital themselves. In this case our estimate of value added by the firm measures a transfer of duty from investors to firms, but does not represent additional value creation by the firm. Of course, since it is costly to run a firm, this hypothesis begs the question of why an investor would pay somebody else to do something they could do themselves. Nevertheless, to test the plausibility of this hypothesis we compare the flow of funds relation of funds of self-employed managers and those in firms.

In our sample there are firms that consist of a single manager (self-employed managers). By construction, these firms cannot reallocate capital between managers and therefore constitute a natural control group. We test for differences in the flow of fund performance relation between single manager and other firms by running the following regression over horizons of $\tau = 1$, 3, 6 or 12 months:

$$flow_{mt} = \alpha + (\beta + \gamma \mathbf{1}_{mt}^s) \sum_{s=0}^{\tau-1} \frac{1}{\tau} \left(R_{m,t-s}^n - R_{m,t-s}^B \right) + \epsilon_{mt} \tag{11}$$

where $flow_{mt}$ is the percentage change in manager m's assets under management in period t that is attributable to the fund flow from investors; $\mathbf{1}_{mt}^s$ is a dummy variable that takes on the value of 1 if manager m is self-employed at time t and 0 otherwise. γ in (11) compares the sensitivity of the flow performance relation of self-employed managers with all other managers. Table 5 reports the coefficient estimates.

For both types of funds (those in single-manager firms and those in multi-manager firms), fund flow responds significantly to performance. But more importantly for our purposes, γ is only significantly different from zero at the 1 year horizon and in that case the point estimate is negative. There is no evidence that the flow of funds performance

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	1-Months	3-Months	6-Months	12-Months
β	-0.001	0.377*	0.739*	1.399*
	(0.103)	(0.110)	(0.122)	(0.123)
γ	0.009	-0.191	-0.437	-0.894*
	(0.140)	(0.194)	(0.342)	(0.434)

Table 5: **Sensitivity of Fund Flow to Performance:** This table reports the coefficient estimates of equation (11) over the past 1, 3, 6, and 12 months. Standard errors, in parentheses, are two-way clustered by fund and by date. * indicates that the estimate is significantly different from zero at the 95% confidence level.

relation is stronger for single manager firms than for multiple manager firms. Therefore, there is no evidence that investors anticipate the promotion and demotion decisions of the firm.

Presumably the firm's information advantage results from its unique ability to observe its own employees. Consequently, if private information plays an important role in the firm's decisions, we should expect internal capital allocation decisions to add more value than capital reallocations that result from managers changing firms. With this test in mind, define an external promotion as a change in jobs that is also accompanied by an increase in the manager's AUM. Similarly, an external demotion is a job change that is accompanied by a decrease in the manager's AUM. We repeat the same tests as we did for internal capital changes using these two definitions. The results are reported in the third and fourth columns of Table 6. None of the coefficients are significantly different from zero. Thus our evidence is consistent with the hypothesis that the firm's competitive advantage in assigning capital to skill derives from its ability to closely observe its own employees.

If one were willing to assume that investors' information set contains no more information than what is available in past returns, then an alternative way to measure the importance of the firm's informational advantage is to measure how much of the capital reallocation decision can be explained by past performance alone. To do this, we run a probit model where we regress the promotion (or demotion) event, expressed as a dummy

	Internal		External	
Capital Reallocation	0.496*		-0.014	
	(0.197)		(0.233)	
• Promotion		0.669*		-0.019
		(0.278)		(0.288)
• Demotion		0.193		-0.009
		(0.331)		(0.274)
Year FE	Yes	Yes	Yes	Yes
Manager FE	Yes	Yes	Yes	Yes

Table 6: **Comparing Internal with External Capital Reallocations:** This table reports statistics on the value added (in $ Millions/month) through internal and external capital reallocations by the firm. The first row reports the coefficient estimate from equation (9) for both internal and external promotion dummies. The next two rows report the estimates from (10). Standard errors, heteroskedasticity-robust and clustered by manager, are provided in parentheses. * indicates that the estimate is significantly different from zero at the 95% confidence level.

in that period, on the manager's performance in excess of the benchmark over the previous 6 months, 7-18 months and the entire history, T, from then onwards, up to a maximum of 10 years. Writing this out formally, first define

$$\hat{\alpha}_{mt}^{6} \equiv \sum_{s=1}^{6} \frac{1}{6}\left(R_{m,t-s}^{n} - R_{m,t-s}^{B}\right)$$

$$\hat{\alpha}_{mt}^{18} \equiv \sum_{s=7}^{18} \frac{1}{12}\left(R_{m,t-s}^{n} - R_{m,t-s}^{B}\right)$$

$$\hat{\alpha}_{mt}^{120} \equiv \sum_{s=19}^{\hat{T}} \frac{1}{\hat{T}-18}\left(R_{m,t-s}^{n} - R_{m,t-s}^{B}\right)$$

where $\hat{T} \equiv \min(T, 120)$. We then restrict attention to managers with at least two years of historical data and run the following probit panel regression:

$$\Pr[\mathbf{1}_{mt}^{\text{move type}} = 1] = \Phi\left(\beta + \beta_{6}\hat{\alpha}_{mt}^{6} + \beta_{18}\hat{\alpha}_{mt}^{18} + \beta_{120}\hat{\alpha}_{mt}^{120}\right) \tag{12}$$

where the indicator function $\mathbf{1}_{mt}^{\text{move type}}$ equals one if the move event under consideration occurs to manager m at time t. Estimates of the coefficients of equation (12) and pseudo-R^2 are reported in Table 7 where we separately consider internal and external promotions

and demotions. Few of the beta coefficients are significantly different from zero so it appears that little of the promotion or demotion can be attributable to past performance. The pseudo-R^2 of the regressions are extremely low. Only 0.02% (0.23%) of the decision to promote (demote) a manager can be explained by past performance, suggesting that other factors play a more important role in the decision. The extent to which these other factors are attributable to the firm's informational advantage can be gauged by comparing these results to what we get when we use external promotions rather than internal promotions in the estimation. The pseudo-R^2 for internal promotions and demotions are 0.03% and 0.44% respectively (see Table 7). Both of these numbers are higher than their counterparts for internal moves, supporting our hypothesis that private information plays a role in internal capital allocation decisions.

The pseudo-R^2 coefficients of a probit regression should be interpreted with caution. That said, they are remarkably small. One way to benchmark these results is to compare them to investor decisions to reallocate capital. Presumably, in this case past performance is the most important criteria for reallocating capital. Consequently, we also report, in Table 7, the pseudo-R^2 coefficients for investors' decision to promote or demote. We define an investor promotion (demotion) dummy which takes on the value 1 in months when a manager receives a net inflow (outflow) of funds from investors, and 0 otherwise. Using these dummies, all the coefficient estimates are significantly different from zero and the pseudo-R^2 coefficients are 3.17% for promotions and 3.36% for demotions. The dramatically smaller pseudo-R^2 coefficients for firm reallocations of capital is consistent with the hypothesis that firm executives use other factors in making their decisions.

If, indeed, the firm's ability to assign capital to labor derives from private information about employee skill, then this advantage should be more apparent for newer employees. To test this hypothesis, we define manager tenure as the length of time (in months) since the manager first entered our data sample. If investors learn the skill of managers from

Panel A: β Estimates

	R^2	1-6 Months	7-18 Months	18-120 Months
Promotion				
Internal	0.02%	0.974	2.507*	0.839
		(0.685)	(0.946)	(1.517)
External	0.03%	0.328	1.896	2.849
		(0.722)	(1.106)	(1.548)
Investor	3.17%	22.40*	27.25*	9.205*
		(0.551)	(0.914)	(1.360)
Demotion				
Internal	0.23%	-6.863*	-1.422	-0.056
		(0.878)	(1.166)	(1.639)
External	0.44%	-5.649*	-8.826*	-0.198
		(1.021)	(1.399)	(1.832)
Investor	3.36%	-24.66*	-26.21*	-7.649*
		(0.549)	(0.914)	(1.382)

Panel B: Marginal Effects

	Prob.	1-6 Months	7-18 Months	18-120 Months
Promotion				
Internal	0.96%	0.026%	0.066%	0.022%
External	0.62%	0.006%	0.034%	0.052%
Investor	51.2%	8.935%	10.87%	3.672%
Demotion				
Internal	0.63%	-0.137%	-0.028%	-0.001%
External	0.43%	-0.084%	-0.132%	-0.003%
Investor	46.1%	-9.835%	-10.45%	-3.050%

Table 7: **Predictability of Promotions and Demotions:** Panel A of this table reports estimated coefficients and Pseudo R^2 for a probit regression of a promotion (or demotion) dummy on historical realized alpha (over the past 1-6 months, 7-18 months, and the remaining history of the fund up to 10 years). Provided in parentheses are standard errors, clustered by fund manager. Estimates significant at 5% are highlighted with *. Panel B of this table reports the probability of a promotion (or demotion) and the marginal effect historical alphas have on the probability of being promoted (or demoted). Marginal effects provided are for a 0.01 (1%) increase in a regressor while keeping other regressors fixed.
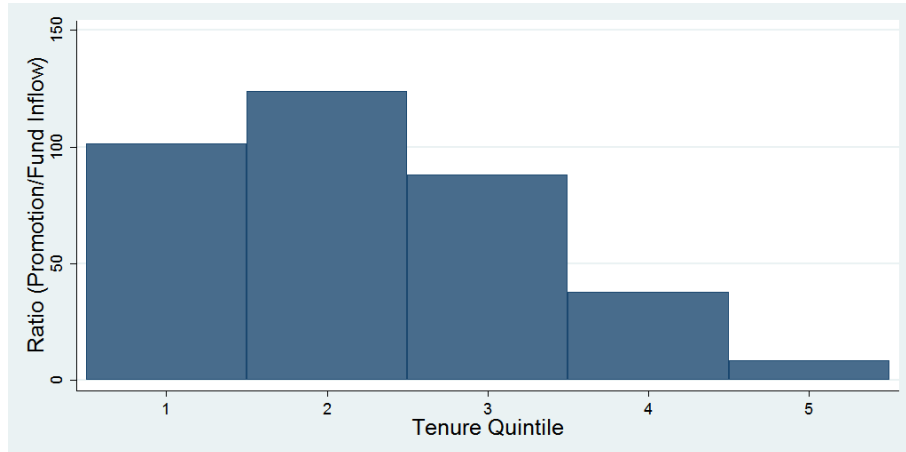
Figure 5: **Size of Promotions by Manager Tenure**: Starting in 1987, we sort managers into quintiles based on their tenure. Within each quintile, we calculate the average size of a promotion as a percentage of the promoted manager's initial AUM. We also compute the average percentage change in AUM as a result of positive fund flow. This table reports the ratio of these two averages (average promotion as percentage of AUM over average positive fund flow as percentage of AUM).

their historical performance, we should expect that the firm's informational advantage to decrease with manager tenure. We therefore sort managers into quintiles based on their tenure. Because our data sample begins in 1977, tenure is censored from above. We address this issue by starting the analysis in 1987,[11] and for every promotion in the remaining sample we calculate the ratio of the magnitude of the promotion to the manager's AUM just before the promotion. We then average over all managers in the quintile to get the average fraction of promotion to AUM. We then repeat the same analysis using the definition of investor promotion above. That is, we restrict attention to positive inflows, and divide those inflows by the AUM prior to the inflow and average across all observations in each quintile. Figure 5 plots the ratio of these two averages (average promotion as percentage of AUM over average positive fund flow as percentage of AUM) for each of the age quintiles. Consistent with our hypothesis, we find the firm's role in capital allocation is significantly larger for newer employees.

Taken together our results are consistent with the hypothesis that firms use additional

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[11] A manager who has been in the sample for more than 10 years is always in the top quintile.

information not available to investors to make capital reallocation decisions.

7 Conclusion

Arguably one of the most important questions in economics is why firms exist. A large literature has addressed this question both from a theoretical and an empirical point of view. In this paper, we establish a new role for the firm by studying capital reallocation decisions of mutual fund firms. We show that firms add significant value by matching capital to labor. That is, following the firm's decision to reallocate capital to one of its managers, future value added increases significantly. We find no evidence of a similar effect when a firm hires a manager from another firm. This is consistent with the idea that an important competitive advantage of the firm is its ability to better assess the skill of its own employees.

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