Matching Capital and Labor*

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Abstract

We establish an important role for the firm by studying capital reallocation decisions of mutual fund firms. At least 30% of the value mutual fund managers add can be attributed to the firm's role in efficiently allocating capital amongst its mutual fund managers. We find no evidence of a similar effect when a firm hires managers from another firm. We conclude that an important reason why firms exist is the private information that derives from the firm's ability to better assess the skill of its own employees and the use of that information to efficiently allocate capital to labor.

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We demonstrate, empirically, that an important role of a firm in the mutual fund sector is to efficiently match capital to skill. In a world with perfectly rational players, no information asymmetries and no other frictions, the role of a mutual fund firm 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.

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 assets under management, hereafter AUM), leads to an increase in the manager's subsequent value added. Similarly, we find that decisions to reduce managers' responsibilities by taking away a fund also leads to increases in subsequent value added. We find that at a minimum, the decision to allocate additional capital to a manager adds, on average, $983,000 per manager per month. This implies that the firm is responsible for at least 30% of the total value added of the average manager. At best, we estimate that it would take six years for investors to achieve the same reallocation of capital. Capital allocation decisions within the firm dwarf investor flows in and out of funds.

We hypothesize that the reason investors are unable to match the firm's capital reallocation decision themselves derives from the significant informational advantage mutual fund executives have relative to investors. We provide supporting evidence in favor of this hypothesis: (1) 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 (2) while past performance does explain investor flows, it has very little explanatory power over firm capital reallocation decisions. We also find that the capital reallocation decisions add more value for young managers, supporting the hypothesis that the firm's advantage derives from its access to better information about managerial ability. These facts are consistent with the hypothesis, first theorized by Alchian and Demsetz (1972), that firm executives use factors in making their capital reallocation decisions that are not easily observable to people outside the firm.

Many of the questions pertaining to the economics of organizations are difficult to study because it is often hard to measure employee output directly. The advantage of the mutual fund sector is that because the performance of a mutual fund is public information, employee output is directly observable. That is, a mutual fund manager has one task —

to invest capital on behalf of investors. The return he generates, as well as the amount of capital invested, is public information. Furthermore, so is the investor's next best alternative investment opportunity, an investment in passively managed index funds. By comparing the manager's performance against this alternative, we can directly calculate an individual manager's output, that is, the value she adds. We are then able to infer at least part of the firm's role in creating value by looking at how firm decisions affect the manager's value added.

The mutual fund sector is comprised of firms that own little or no physical capital. Consequently it provides an ideal place to study the importance of theories of firm existence that do not rely on ownership rights to capital. Although in some sense the industry is 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. Thus the ownership rights to capital cannot play an important role in why mutual fund companies exist or are valuable. Yet the industry is dominated by large firms. In January 2011, the 5 largest mutual fund firms manage 43% of all assets while only making up 1% of all firms in the industry. In this paper we identify an economically important role for firms in the mutual fund industry — firms intermediate between investors and managers, efficiently matching capital to skill. The main implication of our results is that while ownership rights to capital undoubtably play an important role in firm value, other factors, such as the informational role of the firm, potentially have just as important a role.

1 Background

The literature on the economics of organizations has raised several important questions related to the role of firms. 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?

There is now a large theoretical literature designed to answer these questions (see Hart

and Moore (1990), Holmstrom and Tirole (1989), Hart (1995) and Rajan and Zingales (1998)). 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.

Our paper is part of the expanding literature that seeks to isolate the role of the manager (worker) from that of the firm. Abowd, Kramarz, and Margolis (1999) find worker fixed effects to be more important than firm fixed effects in driving heterogeneity in workers' wages. Bertrand and Schoar (2003) study persistence in CEO characteristics (or styles) and its connection to performance and pay. Graham, Li, and Qiu (2011) decomposes variation in CEO compensation and show that most of this difference is explained by manager heterogeneity rather than firm heterogeneity. Ewens and Rhodes-Kropf (2013) separate the value added in venture capital projects into a manager component and a firm component and argue that human capital, rather than organizational capital, accounts for most of the skill in the venture capital world. This research relies on the fact that workers move between firms to identify the separate roles of workers and firms. However, because switching firms is an endogeneous decision, the methodology is generally unable to put a quantitative bound on a manager's (worker's) contribution to the firm, or alternatively, the contribution of the firm independent of those working for it. Instead of relying on external moves as the identification strategy, we instead rely on the firm's internal decision to promote and demote its workers and thus we are able to derive a lower bound on the firms contribution to productivity.

Although the focus of this study is on the mutual fund sector, it is part of the literature that studies how the intra-firm allocation of capital and labor affects productivity and drives heterogeneity in the quality of firms. In a recent paper, Tate and Yang (2014) show that diversified firms have higher labor productivity and actively redeploy their human

capital to business areas with better prospects. Giroud and Mueller (2014) find that firms take resources away from less productive plants and reallocate them to plants with better investment opportunities. Resource allocation (or misallocation) across firms and across industries has also been identified as a major determinant of economic productivity at the macroeconomic level.[1] Most mutual funds are owned and marketed as part of a fund family, so a number of studies have looked into how the family structure affects the mutual fund industry.[2]

2 The Mutual Fund Industry

In the last 50 years there has been a secular trend away from direct investment in the stock market. 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 a third of total investment.[3] 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 a 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 on average invest more than half of their assets in stocks (i.e. equity funds).

For our purposes the rise of 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

[1]For example, see Hsieh and J. (2009), Alfaro, Charlton, and Kanczuk (2009) and Bartelsman, Haltiwanger, and Scarpetta (2013).

[2]Massa (2003) argues that having fund families reduces investors' cost of switching between funds. Gaspar, Massa, and Matos (2006) and Bhattacharya, Lee, and Pool (2013) find evidence that mutual fund families transfer performance from one group of funds to another group of funds through coordinated trades. Kempf and Ruenzi (2008) shows that intra-firm competition has important effects on managers' appetite for risk. Chen, Hong, Jiang, and Kubik (2013) finds that funds outsourced to advisory firms underperform funds managed in-house. The study closest to ours, Fang, Kempf, and Trapp (2014), in that is focuses on managerial skill as a determinant of the fund family structure, shows that a firm allocates its skilled managers to funds targeting inefficient markets.

[3]See French (2008).

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 the 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.

The definition of value added that we use in this paper was introduced by Berk and van Binsbergen (2013). It 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 add of the fund.[4]

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 alternative investable opportunities that were available 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 the 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 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

[4]For further details as well as an explanation why traditional measures in the literature do not measure value added, see Berk and van Binsbergen (2013)

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.

certain that these portfolios 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 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).

Customers provide the capital to mutual fund firms by investing in the firms' funds. That is, investors invest in funds, not firms. A firm cannot arbitrarily move capital from one of its funds to another fund. However, what firms can, and do, 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.

3 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).[5]

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 manager names are not consistently recorded.[6] 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 use Morningstar Direct to augment our existing 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.[7]

We drop all observations without an identifier, as well as observations with missing returns, AUMs, expense ratios or information on holding composition. We also remove all bond and money market funds[8] as well as index funds, by using the Principia *special*

[5]This data set does not include bond fund managers. In the appendix, we repeat our analysis with the data sample expanded to include both equity and bond fund managers. We find almost identical results.

[6]In addition to examples of inconsistent spelling of a manager's name, there are 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.

[7]For a detailed description, see the Online Appendix to this paper.

[8]Consistent with Berk and van Binsbergen (2013), we define a fund with over 50% assets in bond and cash, but with less than 20% assets in cash, as a bond fund; and a fund with on average over 20% assets in cash as a money market fund.

criteria indicator and screening fund names. We aggregate different share classes of the same fund into one fund, resulting in a database of 5190 funds. The final sample covers the period from January 1977 to March 2011.

4 Definitions

Let R^g_{it} be the gross excess return of fund i at time t, that is, the return in excess of the risk free rate before management fees and expenses are taken out. The value added of fund i is:

$$V_{it} \equiv q_{it-1}\big(R^g_{it} - R^B_{it}\big) \tag{2}$$

where $q_{i,t-1}$ is the amount of assets under management of fund i at $t-1$ and R^B_{it} 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 a fund is managed by multiple managers, we divide the funds value added equally across its managers. Let n_{it} be the number of managers managing fund i at time t. Then manager m's value added is,

$$V_{mt} = \sum_{i \in \Omega_{mt}} \frac{V_{it}}{n_{it-1}}, \tag{4}$$

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

$$q_{mt} = \sum_{i \in \Omega_{mt}} \frac{q_{it}}{n_{it}}. \tag{5}$$

Using this AUM sharing rule, the manager's gross return is defined as follows:

$$R^g_{mt} = \frac{1}{q_{mt-1}} \sum_{i \in \Omega_{mt}} \frac{q_{it-1}}{n_{it-1}} R^g_{it}. \tag{6}$$

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

$$SKR_f^\tau \equiv \frac{\bar{V}_f^\tau}{\sigma\left(\bar{V}_f^\tau\right)} \tag{7}$$

where $\bar{V}_f^\tau = \sum_{t=t_0}^{\tau} \frac{V_{ft}}{\tau - t_0}$ is average firm value added up to time τ, $\sigma\left(\bar{V}_f^\tau\right) = \frac{\sqrt{\sum_{t=t_0}^{\tau}(V_{ft}-\bar{V}_f^\tau)^2}}{\tau - t_0}$ is the standard error of firm value added up to time τ and t_0 is the start date of the firm. Note that the skill ratio is essentially the t-statistic of the mean value added up until time τ.

Finally, change in AUM of fund i during time t that is due to the flow of funds from investors can be defined as

$$flow_{it} = \frac{q_{it} - q_{it-1}\left(1 + R_{it}^n\right)}{q_{it-1}} \tag{8}$$

and investors' fund flow at the manager level is

$$flow_{mt} = \frac{1}{q_{mt-1}} \sum_{i \in \Omega_{mt}} \frac{q_{it-1}}{n_{it-1}} flow_{it}. \tag{9}$$

The change in AUM of manager m during time t that is due to capital reallocation by the firm (if there is a reallocation) is define as $q_{mt} - q_{mt-1}\left(1 + R_{mt}^n + flow_{mt}\right)$.

5 The Importance of Firms

Even though firms in the mutual fund sector own little physical capital, the industry is dominated by a few large firms. As of January 2011, the 5 largest mutual fund firms, which make up less than 1% of the total number of firms, hire 14% of all mutual fund managers and manage 43% of all assets in the industry (see Figure 1). That 14% of managers manage 43% of the assets is suggestive that larger firms are able to hire better managers. To establish this fact, we begin by showing that firm performance is persistent, that is, firms that have added value in the past keep adding value in the future. We then show that the future performance of a manager is predictable by the past performance of other managers at the same firm. These two results show that better managers work for better firms.

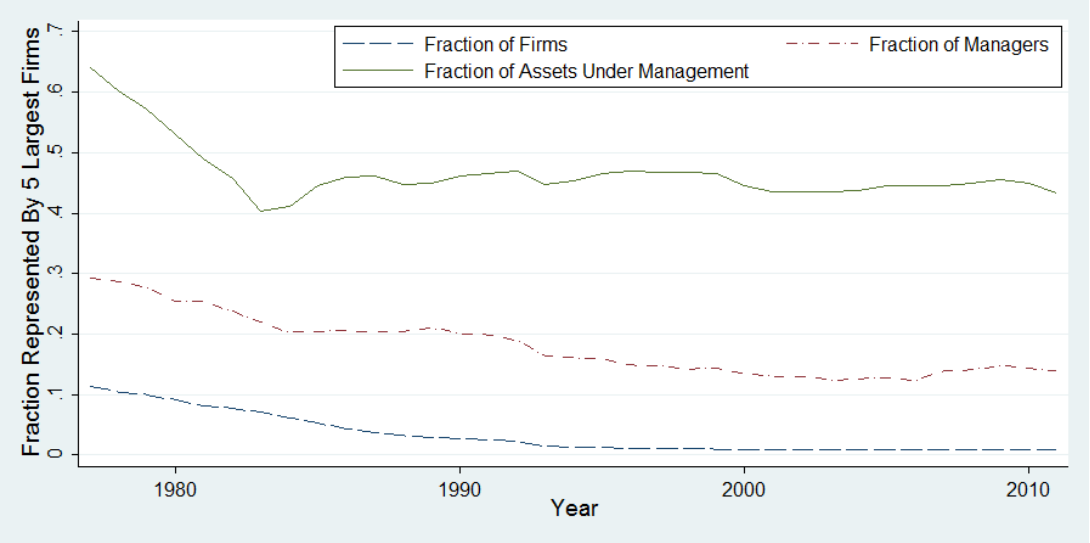


Figure 1: **Capital and Human Resources Controlled by the Five Largest Firms**: This figure reports the fraction of assets controlled by and the fraction of managers working for the 5 largest firms in January of each calendar year, for every year between 1977 and 2011. As a point of comparison we also provide the 5 firms as a fraction of the total number of firms.

5.1 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%. We then count the fraction of times, over a specified future time horizon, that a fund of each quantile outperforms the median fund.

For a fund to be included in this sort, we require its firm to have 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 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. To convert this number into a percentage, we divide it by the total number of observations in that half of the sample.[9] The first column of Table 2 reports the results. At the 3, 4 or 5 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.

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 fraction of times funds in each decile/quintile outperform the median fund in the restricted sample. The second and third column of Table 2 report these 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 q% Outperforms Bottom q%		
	q=50	q=20	q=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 q% 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% (99%) confidence level.

[9]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.

5.2 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, thus ensuring that the sort is and proceed with the same test as described in the previous section. Table 3 tabulates the resulting statistics using 2, 5 and 10 quantiles. The table shows that funds sorted into the top quantile consistently outperform the bottom quantile for all 3 sorts and over all 3 measurement horizons.

	Top q% Outperforms Bottom q%		
	q=50	q=20	q=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 q% 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% (99%) confidence level.

Although, taken together, these results clearly establish that better managers work for better firms, they do not provide additional insight into what the exact role of the firm is. Do better managers choose to work at better firms (so that firms are merely "clubs" that managers choose to join) or do firms pick better managers to hire? The next section answer this question.

6 Matching Capital with Skill

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 coordination device for managers to work together. We avoid the aforementioned endogeneity problem by concentrating on promotions and demotions within the firm, because these internal firm decisions cannot be driven by managers self selecting into firms.

We take as the Null hypothesis the Coasian benchmark, a neoclassical world with no frictions and informational asymmetries. In this world 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 a firm reassigns capital to its managers. Firms make these reallocation 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.[10]

We begin our analysis by asking whether firms' reallocation decisions create value, that is, we run the following panel regression:

$$V_{mt} = \lambda_t + \lambda_m + \beta \cdot \mathbb{1}_{mt}^{\text{reallocated}} + \epsilon_{mt}, \tag{10}$$

where V_{mt} is the estimated value added of manager m at time t (defined in (4)); $\mathbb{1}_{mt}^{\text{reallocated}}$ is an indicator variable that takes on the value of 1 if manager m is internally promoted or demoted *before* time t; λ_m are manager fixed effects; and λ_t are time fixed effects. The results are reported in the first column of Table 4.[11] The firm adds \$715,000 per month when it makes a decision to either promote or demote one of its managers which is statistically different from zero at the 99% confidence level.

Estimate of equation (10) may be biased if the capital reallocation decisions are cor-

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

[11]Standard errors of equation (10) estimates are two-way clustered by manager and *comanagement block*. Recall that if a fund is comanaged we assign equal shares of the fund's value added to all of its managers, so two managers have correlated value added by construction if there exists a fund managed by both managers. Consequently, we cluster standard errors by comanagement block, which is defined so that two observations of the same year are assigned to the same block if their managers comanage a fund during that year. Standard errors do not further increase if we instead assume all observations of the same year belong to the same comanagement block (i.e. we find no correlation across comanagement blocks). See Gameron, Gelbach, and Miller (2006) and Petersen (2009) for details on multi-way clustering.

Capital Reallocation	0.715**				
	(0.229)				
• Promotion		0.983*	1.149**	0.749*	0.818*
		(0.386)	(0.422)	(0.341)	(0.361)
• Demotion		0.414	0.424	0.246	0.569
		(0.302)	(0.298)	(0.305)	(0.307)
AUM			-0.473		
			(0.452)		
Yearmonth FE	Y	Y	Y	Y	Y
Manager FE	Y	Y	Y	Y	Y
Manager Tenure FE	N	N	N	Y	N

Table 4: **Internal Reallocation of Capital for Equity Fund Managers:** The first column of the table reports the panel regression specification that uses the capital reallocation dummy from equation (10). The next three columns report the specification where we split reallocations into promotions and demotions, that is, the estimates from (11). The final column defines promotions and demotions based on the change in the total dollar fees collected, rather than just the change in AUM. Standard errors, heteroskedastic-robust and two-way clustered by manager and by comanagement block, are provided in parentheses. All numbers are reported in $ millions/month. * (**) indicates that the estimate is significantly different from zero at the 95% (99%) confidence level.

related 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.[12] 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 split the reallocation dummy ($\mathbb{1}_{mt}^{\text{reallocated}}$) into two dummies, one for a promotion ($\mathbb{1}_{mt}^{\text{promoted}}$), and one for a demotion ($\mathbb{1}_{mt}^{\text{demoted}}$). The promotion dummy takes on a value of 1 if the most recent capital reallocation decision resulted in a net increase in the manager's AUM and zero otherwise. 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 and zero otherwise. So, for example, if for a particular manager, the first capital reallocation decision is a promotion at time t_1 and the second decision is a demotion at time t_2, then both dummies will be zero up to time t_1, the promotion dummy will be 1 until time t_2 and zero afterwards and the demotion dummy will be zero up to time t_2 and 1 afterwards.

[12] As we will presently show, past performance does indeed predict promotion and demotion decisions (see Table 6). Also see Hu, Hall, and Harvey (2000).

We then run the following panel regression:

$$V_{mt} = \lambda_t + \lambda_m + \beta_p \cdot \mathbb{1}_{mt}^{\text{promoted}} + \beta_d \cdot \mathbb{1}_{mt}^{\text{demoted}} + \epsilon_{mt} \tag{11}$$

where the definitions of all other variables are consistent with those from equation (10). 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 almost a million dollars per month and statistically 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.

One might be concerned that, in a world with constant returns to scale, one would expect to see a positive coefficient on the promotion dummy.[13] That is, if a manager's gross alpha is independent of the amount of money under management, then an increase in AUM necessarily implies an increase in value added. Although it is unclear how the mutual fund market would equilibrate in such a world, to rule out this possibility, we include the beginning of month AUM as an additional explanatory variable and report the results in the third column of Table 3. Were this explanation of our results correct, the coefficient on AUM would be positive and it would better explain variation in value added than the promotion dummy. In fact, the coefficient is insignificant and the point estimate has the wrong sign, while the promotion dummy remains highly significant.

It is likely that a manager's value added rises with experience and so the firm's promotion decisions will be partially based on management tenure.[14] To decompose the capital reallocation decision into the portion that is driven by experience and the portion driven by other factors, we control for managerial experience by including the number of prior years the manager has managed money (at the current firm as well as any prior firms she might have worked for). As reported in the fourth column of Table 4, including tenure only partially reduces the magnitude of the coefficient on the promotion dummy. More importantly the coefficient remains statistically significantly different from zero. Firms use factors other than just tenure to make promotion decisions.

We have defined promotions (and demotions) based on the change in AUM. But from the firm's perspective, what is arguably more important is the dollar fees the manager

[13]However, see, among others, Berk and Green (2004), Chen, Hong, Huang, and Kubik (2004), Pollet and Wilson (2011), Pastor and Stambaugh (2012), and Pastor, Stambaugh, and Taylor (2014) for theoretical and empirical evidences against constant returns to scale.

[14]See Pastor, Stambaugh, and Taylor (2014) for analysis on the relationship between skill and management tenure.

generates for the firm. To address this issue, we redefine promotion and demotion based on the change in the manager's revenue. That is, a promotion is a capital reallocation decision that increases the dollar fees collected (assets under management $\times$ expense ratio), and a demotion decreases the dollar fees collected. We then re-estimate, in the fifth column of Table 4, equation (11) under this definition. A comparison between the second and fifth columns reveals that using this alternative definition of a promotion and a demotion does not change our results.

Capital Reallocation	0.735^{**}			
	(0.192)			
• Promotion		0.878^{**}	0.727^{*}	0.714^{*}
		(0.341)	(0.319)	(0.315)
• Demotion		0.628^{**}	0.557^{*}	0.728^{**}
		(0.225)	(0.218)	(0.233)
Yearmonth FE	Y	Y	Y	Y
Manager FE	Y	Y	Y	Y
Manager Tenure FE	N	N	Y	N

Table 5: **Internal Reallocation of Capital for Equity Fund Managers (Adjusted for Firings):** If a manager drops off the database when his demotion dummy is on we fill in a value added of zero for that manager for all subsequent firm observations. The first column of the table reports the panel regression specification that uses the capital reallocation dummy from (10). The next two columns report the specification where we split reallocations into promotions and demotions, that is, the estimates from (11). The final column defines promotions and demotions based on the change in the total dollar fees collected, rather than just the change in AUM. Standard errors, heteroskedastic-robust and two-way clustered by manager and by comanagement block, are provided in parentheses. All numbers are reported in $ millions/month. * (**) indicates that the estimate is significantly different from zero at the 95% (99%) confidence level.

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. Unfortunately the estimate itself is not statistically significantly different from zero. But as we have already mentioned, the power to reject is lower for demotions than for promotions because our data set is censored. When a manager is demoted and fired at the same time we do not observe his subsequent value added. One way to address this issue is to explicitly recognize that once a manager leaves a firm his contribution to the firm's value added is zero by filling in zeros for value added

observations of those managers in the regressions. The problem is that the decision to leave is not necessarily the firm's decision, so not all separations are also demotions. To separate voluntary separations (retirement decisions) from firings (demotions) we attempt to infer whether the manager was fired based on the firm's earlier capital reallocation decisions and the manager's subsequent actions. We assume that if the most recent capital reallocation decision was a demotion and the manager does not get another job with a different firm, then the separation decision was a firing. That is, when a manager leaves the database, we set all subsequent value added observations to zero only when his demotion dummy is on at the time of the separation. Table 5 presents the results of rerunning the above analysis in this augmented database. The demotion dummy remains positive and is now statistically significantly different from zero in all specifications, consistent with the hypothesis that the decision to demote is optimal. Managers who are dismissed were destroying value prior to the dismissal. However, caution in interpreting these results is still in order. First, our decision rule separating voluntary separations from firings is unlikely to work perfectly, and second, the coefficient on the dismissal dummy is potentially upward biased because of the aforementioned tendency for value added to mean revert. We will provide further evidence on the second concern in the next section.

The value added numbers reported in Table 4 indicate that the value created from a capital reallocation decision is large. However, it is important to appreciate that we don't know what would have happened had the firm not reassigned the capital. That is, these numbers quantify the total value created, but do not necessarily quantify the value created by the firm. Had the firm not reassigned the capital, potentially, investors could have done the reassignment themselves. That is, to interpret our estimates as solely the value created by the firm, one has to assume 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 quantitatively assess the magnitude of the additional value added of the firm, we must construct a counterfactual. To be conservative, we will focus on promotions because, as we argued above, our estimate of the value added of a promotion is a lower bound whereas the estimate of value added for a demotion is an upper bound because of the aforementioned mean reversion effect.

To construct a realistic counterfactual we assume that the manager's subsequent in-

flows would match the inflows, over the same time period, of a comparable set of funds. Rather than construct a single counterfactual from 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 construct the other counterfactuals by narrowing the set of comparable funds. 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 1% and computes the flow of funds by taking the weighted average of the remaining 99%. The third counterfactual eliminates the bottom 2% 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 recompute 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 be expressed as follows:

$$\begin{aligned} V_{mt} &= \left(q^0_{m,t-1} + \left(q^C_{m,t-1} - q^0_{m,t-1}\right) + \left(q_{m,t-1} - q^C_{m,t-1}\right)\right)\left(R^g_{mt} - R^B_{mt}\right) \\ &= \underbrace{q^0_{m,t-1}\left(R^g_{mt} - R^B_{mt}\right)}_{\{1\}} + \underbrace{\left(q_{m,t-1} - q^C_{m,t-1}\right)\left(R^g_{mt} - R^B_{mt}\right)}_{\{2\}} + \underbrace{\left(q^C_{m,t-1} - q^0_{m,t-1}\right)\left(R^g_{mt} - R^B_{mt}\right)}_{\{3\}} \end{aligned}$$

where q_{mt} denotes the actual AUM of manager m at time t; q^C_{mt} denotes the AUM under the counterfactual; and q^0_{mt} denotes the AUM of the manager at the time of the promotion. The first term, $\{1\}$, measures the manager's value added without the promotion and without future inflows or outflows. The second term, $\{2\}$, measures the contribution to the manager's value added of the promotion. The last term, $\{3\}$, 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:

$$\begin{aligned}\hat{V}_{mt} &\equiv \left(q^0_{m,t-1} + \left(q_{m,t-1} - q^C_{m,t-1}\right)\right)\left(R^g_{mt} - R^B_{mt}\right) \\ &= V_{mt} \cdot \frac{q^0_{m,t-1} + q_{m,t-1} - q^C_{m,t-1}}{q_{m,t-1}}.\end{aligned}$$

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 (11), using the counterfactually computed value added. Figure 2 (left sub-figure) plots the coefficient on the promotion dummy over the range of counterfactuals discussed above. 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 ($715,000 per month).

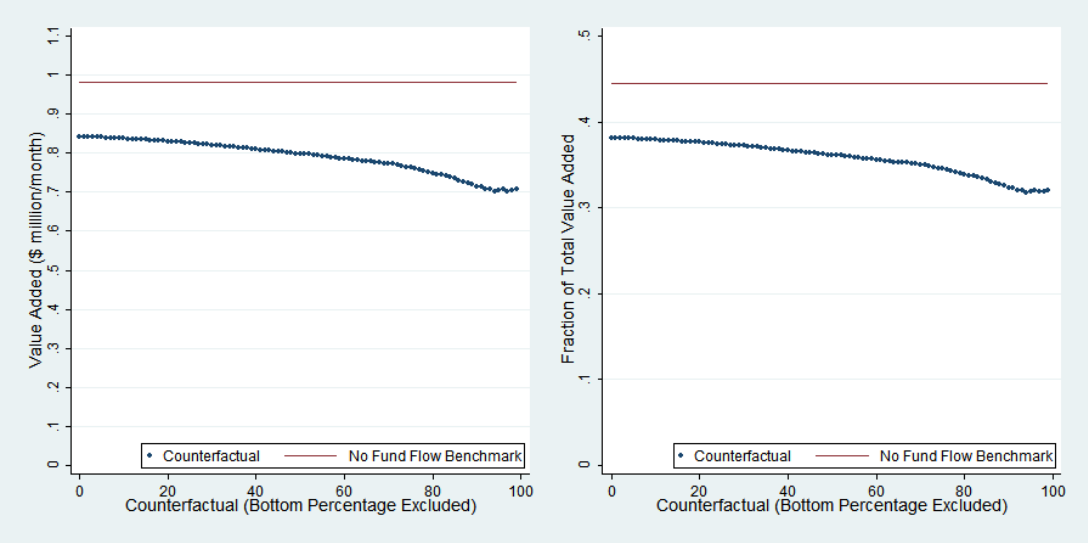


Figure 2: **Firm Value Added Under Realistic Counterfactuals**: We construct the counterfactual by excluding all funds with performance below the indicated percentile and then assume that under the counterfactual a fund would have experienced the same inflow of funds as the weighted average inflow of all remaining funds in that month. Under each counterfactual, we estimate the value added by a internal promotion per manager per month, after taking into account the counterfactual. This value added is reported in the sub-figure on the left. We then compute a lower bound on firm's contribution as a fraction of total value added 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. This fraction is reported in the sub-figure on the right.

We can interpret the values in Figure 2 (left sub-figure) as a lower bound on the average value a firm adds to its manager upon promotion. From these numbers we can

also compute a lower bound on the fraction of value added that is attributable to the existence of mutual fund firms. Taking the estimates for the value added of a promotion reported in Figure 2 (left sub-figure), we multiply by the fraction of months in which the promotion dummy is equal to one (12%) to get the average value of a promotion decision. Figure 3 (right sub-figure) reports this number as a fraction of the total value added by an average manager (which is $\$274,000$ per month) for all the counterfactuals.[15] Even for the extreme counterfactual where flows are assumed to be equivalent to the flows of the top 1% of funds, the firm still contributes 30% of total value added.

Another way to assess the overall impact of promotions (demotions) is to ask how long it would have taken for investors to achieve the reallocation of funds the promotion (demotion) decision achieved. To answer this question for promotions, 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. 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 March 2011 is assumed to be equal to the average historical fund flow under the counterfactual. We then average the time taken across all promotions for a given counterfactual. We conduct a similar exercise for demotions, except that we redefine the counterfactuals. In this case instead of dropping the worst performing funds, we drop the best performing funds. That is, we eliminate all funds whose monthly net return over the benchmark was above a particular quantile and then assume that the manager's percentage inflows would have been the same as the weighted average percentage inflow in that month of the remaining funds. For example, the most extreme counterfactual eliminates the top 99% of funds and computes the flow of funds by taking the weighted average of the remaining 1%.

Figure 3 plots the the average time it would have taken for investors to achieve the same change in AUM, for each counterfactual, for both promotions and demotions. For promotions, even under the most extreme counterfactual, it would have taken 6 years for investors to achieve what the firm achieved in a single month. For demotions the effect is less extreme. Under the most extreme counterfactual, it would take a year for investor outflows to achieve the same effect as the demotion decision. However, in this case, the fact that we ignore demotions that are associated with firings is likely to materially impact our estimates. The reason is that when a manager is fired, the magnitude of the demotion

[15] That is, the average V_{mt} across all managers at all points in time.

is large (the manager loses all of his funds). Thus, by ignoring those observations we are restricting attention to the smaller demotions decision, and so it is not surprising that investors can match the firms decision in a shorter amount of time than for promotions.

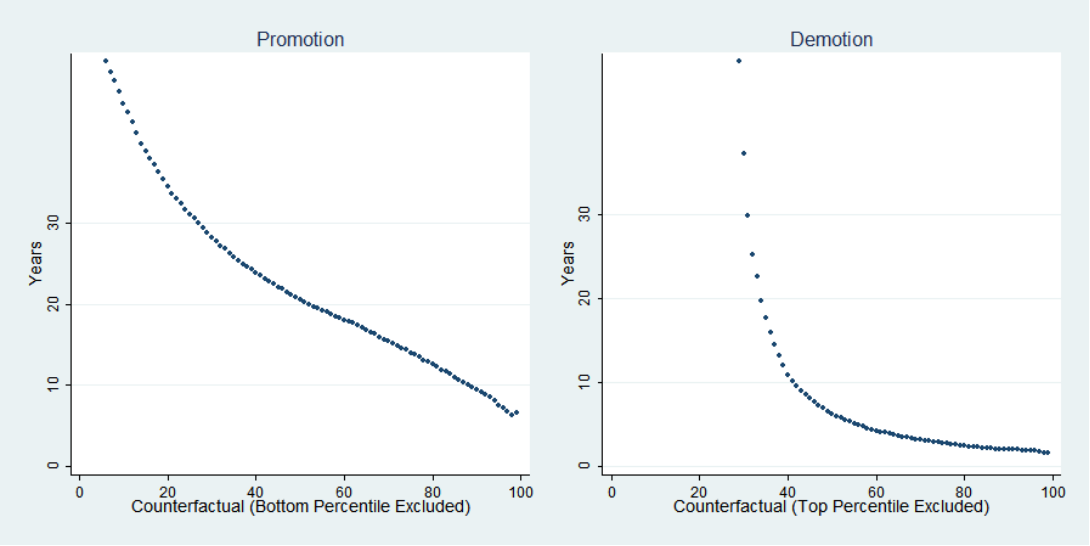


Figure 3: **Time Taken to Reach Same AUM under the Counterfactual**: Under each counterfactual, we compute how many years it would have taken for investors to provide (or remove in the case for demotion) the equivalent amount of additional AUM through the flow of funds alone.

7 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 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 ensure 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 fact that adding capital 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.[16] As a consequence of this asymmetry, firms have a role intermediating between managers and investors. Capital reallocation decisions add value because firms have more information than investors about managerial ability and firm executives use this information to direct capital away from overfunded managers and towards underfunded managers. 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.

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 reallocation 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 that would not otherwise occur. 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, we can use the existence of self-employed managers to test the plausibility of this hypothesis. For a self-employed manager, there is no firm, so the flow of funds is the only mechanism that adjusts AUM. Thus, if investors are letting firms do something they could do themselves, we should observe a much stronger flow of funds relation for self-employed managers than for those that work for firms.

We test for differences in the flow of fund performance relation between single manager firms and other firms by running the following regression over horizons of $\tau = 1$, 3, 6, 12 and 24 months:

$$flow_{mt} = \lambda_t + \lambda_{tenure} + \left(\beta + \gamma \cdot \mathbb{1}_{mt}^{\text{self-employed}}\right) \sum_{s=1}^{\tau} \frac{1}{\tau}\left(R_{m,t-s}^{n} - R_{m,t-s}^{B}\right) + \epsilon_{mt} \qquad (12)$$

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; λ_t are time fixed effects; λ_{tenure} is the number of years the manager has been in the database at time t; and $R_{m,t}^{n}$ is the manager's net return (his return minus the fees he charges) and is calculated by weighting his net return across the funds he manages just as we did for the gross return (that is, (6)).

[16] Gervais, Lynch, and Musto (2005) makes this assumption.

	1-Months	3-Months	6-Months	12-Months	24-Months
β	0.013	0.352**	0.673**	1.145**	1.518**
	(0.059)	(0.053)	(0.063)	(0.072)	(0.097)
γ	0.001	0.165	-0.296*	-0.514*	-0.664*
	(0.065)	(0.087)	(0.130)	(0.204)	(0.308)

Table 6: **Sensitivity of Fund Flow to Performance:** This table reports the coefficient estimates of equation (12) over the past 1, 3, 6, 12 and 24 months. Yearmonth and management tenure (in years) fixed effects are included. Standard errors, in parentheses, are two-way clustered by fund and by yearmonth. * (**) indicates that the estimate is significantly different from zero at the 95% (99%) confidence level.

The dummy variable $\mathbb{1}_{mt}^{\text{self-employed}}$ takes on the value of 1 if manager m is self-employed at time t and 0 otherwise so the coefficient γ in (12) compares the sensitivity of the flow performance relation of self-employed managers with all other managers. To remove extreme outliers, we winsorize flow of funds at the 1st and 99th percentiles.[17] Table 6 reports the coefficient estimates.

For both types of funds, fund flow responds significantly to performance. But more importantly, for our purposes, γ is always negative (and often even significantly negative). There is no evidence that the flow of funds performance 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 informational 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. To test this hypothesis, we 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 Table 7. None of the coefficients that use AUM as the determinant of a promotion/demotion are significantly different from zero. Interestingly, when the capital reallocation decision is based on dollar revenue, the demotion dummy is significantly negative, likely reflecting the new firm's adverse selection concerns. That is, when the new firm hires the manager, because it understands that it is at an informational disadvantage relative to the old firm,

[17] Winsorizing fund flow (at top and bottom 1%) to reduce the effect of outliers has been a standard practice in this literature. For example, see, among others, Chen, Hong, Jiang, and Kubik (2013), Kacperczyk, Sialm, and Zheng (2008), and Huang, Sialm, and Zhang (2011).

it responds by allocating too little capital to the manager.

Capital Reallocation	0.046			
	(0.194)			
• Promotion		0.458	0.263	0.476
		(0.321)	(0.286)	(0.280)
• Demotion		-0.294	-0.395	-0.439*
		(0.269)	(0.263)	(0.201)
Yearmonth FE	Y	Y	Y	Y
Manager FE	Y	Y	Y	Y
Manager Tenure FE	N	Y	Y	N

Table 7: **External Reallocation of Capital for Equity Fund Managers:** This table reports statistics on the value added (in $ millions/month) to an average equity fund manager through external capital reallocations by the firm. The first row reports the coefficient estimate from equation (10) for both external promotion and external demotion dummies. The next two rows report the estimates from (11). Standard errors, heteroskedasticity-robust and clustered by manager group, are provided in parentheses. * (**) indicates that the estimate is significantly different from zero at the 95% (99%) confidence level.

If one were willing to assume that the 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 in that period, on the manager's net return in excess of the benchmark over the previous 6 months, 7-18 months and the entire history, T. Writing this out formally, first define

$$\hat{\alpha}^6_{mt} \equiv \sum_{s=1}^{6} \frac{R^n_{m,t-s} - R^B_{m,t-s}}{6}, \quad \hat{\alpha}^{18}_{mt} \equiv \sum_{s=7}^{18} \frac{R^n_{m,t-s} - R^B_{m,t-s}}{12}, \quad \hat{\alpha}^{T}_{mt} \equiv \sum_{s=19}^{T} \frac{R^n_{m,t-s} - R^B_{m,t-s}}{T-18}$$

where managers with fewer than 24 months of experience are excluded so that all three performance measures are well defined. We then run the following probit panel regression:

$$\Pr[\mathbb{1}^{\text{reallocation event}}_{mt} = 1] = \Phi\left(\beta_0 + \beta_6 \hat{\alpha}^6_{mt} + \beta_{18} \hat{\alpha}^{18}_{mt} + \beta_T \hat{\alpha}^T_{mt}\right) \tag{13}$$

where the indicator function $\mathbb{1}^{\text{reallocation event}}_{mt}$ equals one if the reallocation event under consideration occurs to manager m at time t. Estimates of the coefficients of equation

(13) and pseudo-R^2 values are reported in Table 8, where we separately consider internal promotions and demotions. The pseudo-R^2 of the regressions are 0.04% for promotions and 0.12% for demotions.

Because the pseudo-R^2 coefficient is difficult to interpret, we repeat the same analysis for investor flows, and use the relative difference in the pseudo-R^2's to infer the importance of past performance in capital reallocations. Consequently, 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 and report the results in Table 8. The pseudo-R^2 is 3.90% for investor promotions and 3.94% for investor demotions. The pseudo-R^2 coefficients for firm reallocations of capital are an order of magnitude smaller, consistent with the hypothesis that firm executives use factors other than past performance in making their decisions. This result also implies that the mean reversion bias mentioned in the last section is likely to be small.

In Berk and Green (2004), investors learn a manager's ability from historical performance. The longer a manager stays in the mutual fund industry, the more accurately investors assess his skill. Thus, if 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 their historical performance, we should expect 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 January 1987, and for each quintile of the remaining sample, in each month, we compute the average of the absolute value of the percentage change in managers' AUM that is the result of a capital reallocation of the firm. Next, we also compute the average monthly absolute percentage change in AUM that is due to inflows and outflows of funds from investors. The ratio of the two tells us the relative importance of the firm in determining a manager's AUM.[18] Figure 4 plots this ratio for managers of each of the five age groups. 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 information not available to investors to make capital reallocation decisions.

[18]Both capital reallocation and investors fund flow are winsorized below at the 1% level and winsorized above at the 99% level to reduce the effect of extreme outliers.

Panel A: β Estimates

	R^2	1-6 Months	7-18 Months	19+ Months
Promotion				
Firm (Internal)	0.04%	0.155	3.695**	2.039
		(0.652)	(0.862)	(1.300)
Investor	3.90%	26.28**	28.82**	10.04**
		(0.548)	(0.865)	(1.322)
Demotion				
Firm (Internal)	0.12%	-3.858**	-4.108**	-0.546
		(0.685)	(1.007)	(1.284)
Investor	3.94%	-26.24**	-29.07**	-11.08**
		(0.554)	(0.875)	(1.349)

Panel B: Marginal Effects

	Prob.	1-6 Months	7-18 Months	19+ Months
Promotion				
Firm (Internal)	0.92%	0.004%	0.092%	0.051%
Investor	47.6%	10.44%	11.52%	4.012%
Demotion				
Firm (Internal)	0.88%	-0.091%	-0.097%	-0.013%
Investor	51.8%	-10.46%	-11.59%	-4.419%

Table 8: **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 (19+)). Provided in parentheses are standard errors, clustered by fund manager. * (**) indicates that the estimate is significantly different from zero at the 95% (99%) confidence level. 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.

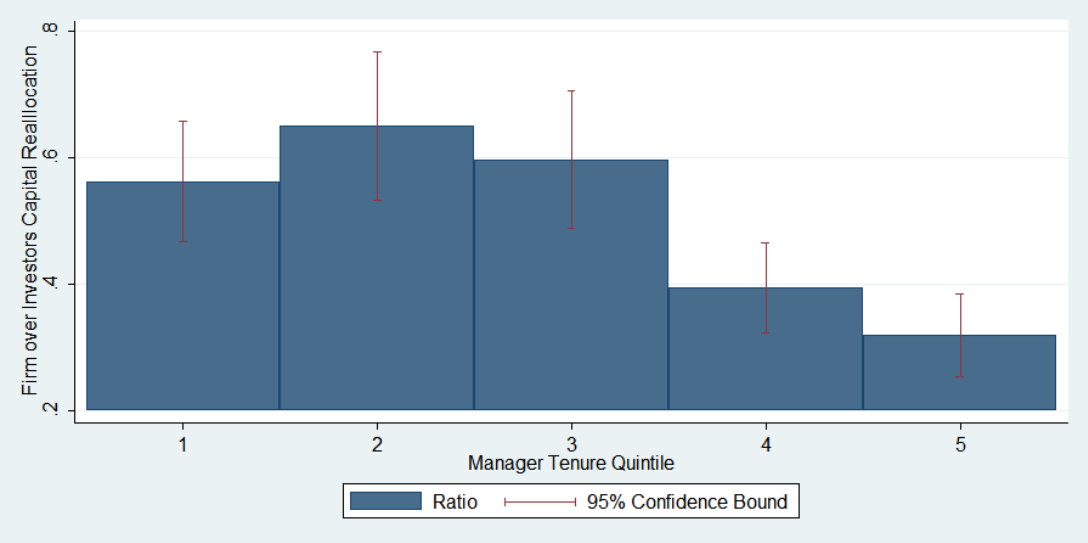


Figure 4: **Capital Reallocation and Manager Tenure**: Starting in 1987, we sort managers into quintiles based on their tenure. Within each quintile, in each month, we compute the average of the absolute value of the percentage change in managers' AUM that is the result of a capital reallocation of the firm. If a manager is not reallocated capital by his firm in a given month, we define his percentage change in AUM due to capital reallocation to be 0 during that month. We also compute the average monthly absolute percentage change in AUM that is due to inflows and outflows of funds from investors. The figure reports the ratio of these two averages for each quintile.

8 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. That literature has identified the important role of capital in determining the boundary of the firm. In recent years, however, the importance of firms with little or no capital has increased. This growth raises the question of what other factors determine the boundary of the firm. In this paper we identify another important role of the firm — the efficient allocation of capital to labor.

To identify reasons for firm existence that do not rely on the ownership of capital, we study the mutual fund industry because firms in this industry do not own most of their capital. Another advantage of this industry is that we can directly measure employee productivity. Furthermore, we can accurately predict what the return on capital would be were it not invested in the firm. Using this information, we are able to bound the value added by a mutual fund firm by reallocating capital. We find that the role of the firm is important. At least 30% of the value added of a manager can be attributed to the firm's decision to efficiently allocate capital to managers.

Although we establish our results in the mutual fund sector, it is unlikely that this sector is exceptional. Thus measuring the importance of the efficient matching of capital to labor in other sectors is an important topic for future research.

Appendix

In this appendix, we repeat our main results using an extended data sample that includes both equity and bond funds. Recall that a bond fund is defined as a fund with on average over 50% assets in bond and cash, but with less than 20% assets in cash. The larger sample still covers the period from January 1977 to March 2011, but now includes 6941 funds. To account for additional risk exposure of fixed income assets, we add 3 Vanguard fixed income index funds to the original 11 Vanguard funds used as the benchmark. Table 9 lists these 3 funds. Because of the lack of money-market index funds to serve as a benchmark, we still exclude money-market funds, defined as funds with on average over 20% assets in cash, from this extended data sample. In our original analysis we dropped funds with fewer than 18 observations. Because 3 new index funds are added to the set of benchmarks, we now drop funds with fewer than 24 observations.

Fund Name	Ticker	Asset Class	Inception Date
Total Bond Market Index	VBMFX	Fixed Income	12/11/1987
Long Term Bond Index	VBLTX	Fixed Income	03/01/1994
Short Term Bond Index	VBISX	Fixed Income	03/01/1994

Table 9: **Benchmark Vanguard Index Funds (Fixed Income Asset Class):** This table lists the set of additional Vanguard Fixed Income 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.)

As in our main analysis, we begin with a panel regression of manager value added on an indicator variable that takes on the value of 1 if the manager has been reallocated capital by his current firm, along with manager fixed effects and year fixed effects

$$V_{mt} = \lambda_y + \lambda_m + \beta \cdot \mathbb{1}_{mt}^{\text{reallocated}} + \epsilon_{mt}. \tag{14}$$

Estimates of the equation are reported in the first column of Table 10. Next, we split the capital reallocation dummy $\mathbb{1}_{mt}^{\text{reallocated}}$ into a promotion dummy $\mathbb{1}_{mt}^{\text{promoted}}$ and a demotion dumm $\mathbb{1}_{mt}^{\text{demoted}}$, where promotion is still defined by a net increase in AUM and demotion a net decrease in AUM. We then regress

$$V_{mt} = \lambda_y + \lambda_m + \beta_p \cdot \mathbb{1}_{mt}^{\text{promoted}} + \beta_d \cdot \mathbb{1}_{mt}^{\text{demoted}} + \epsilon_{mt}. \tag{15}$$

We report estimates of equation (15) in the second column of Table 10. Then, we add AUM or manager tenure fixed effects to the left-hand side of (15) and report the estimates in columns 3 and 4 of the same table. In column 5, we report estimates of equation (15)

with promotion and demotion alternatively defined based on net changes in fees collected (i.e. assets under management × expense ratio).

Capital Reallocation	0.390*				
	(0.168)				
• Promotion		0.611*	0.681*	0.487*	0.555*
		(0.257)	(0.304)	(0.228)	(0.248)
• Demotion		0.130	0.129	0.039	0.152
		(0.186)	(0.186)	(0.195)	(0.207)
AUM			-0.236		
			(0.369)		
Yearmonth FE	Y	Y	Y	Y	Y
Manager FE	Y	Y	Y	Y	Y
Manager Tenure FE	N	N	N	Y	N

Table 10: **Internal Reallocation of Capital for Equity and Bond Fund Managers:** This table reports statistics on the value added (in $ millions/month) through internal capital reallocations by the firm. The data sample is restricted to only equity fund managers. The first row reports the coefficient estimate for the capital reallocation dummy from equation (14). The next two rows report estimates from (15), where we split reallocations into promotions and demotions. Standard errors, heteroskedasticity-robust and two-way clustered by manager and by comanagement group, are provided in parentheses. * (**) indicates that the estimate is significantly different from zero at the 95% (99%) confidence level.

Both the capital reallocation dummy and the promotion dummy are significant at 95% confidence. The demotion dummy is also positive, but not statistically significant. These results are consistent with our findings when data is restricted to only equity funds. Quantitatively, a comparison between Table 10 and Table 4 reveals that the size of the coefficient on the promotion dummy is much higher when only equity funds are investigated (with promotion defined by fees collected the numbers are 0.983 for equity funds alone and 0.681 for equity and bond funds combined). Does this imply that the firm only plays a role in the allocation of capital for equity fund managers but not for bond fund managers? Not necessarily. When interpreting these numbers, it is important to also note that while an equity fund manager adds $\$274,000$ per month in an average month, this number drops to $\$222,000$ when bond fund managers are also added. Moreover, while the probability of $(\mathbb{1}_{mt}^{\text{promoted}} = 1)$ is only 12% in a sample restricted to equity fund managers, this percentage increases to 15% after the data sample is expanded to include bond fund managers. In other words, a firm adds less when it promotes a bond fund manager partly because a bond fund manager on average is less skilled than an equity fund manager and partly because the firm makes up for less value added per promotion by promoting more.

Consequently, rather than using dollar quantities, it is better to compare firm's con-

tribution as a percentage of total value added of the mutual fund sector. To compute this percentage, we multiply value added per promotion per month by the probability an average manager in a given month is promoted (which is 15%), and divide this product by the value added of an average manager (which is $222,000 per month). We then reporduce Figure 5 under the same set of counterfactuals but with the sample expanded to include both equity and bond fund managers. We present the new Figure in 5. Under the most extreme counterfactual where fund flow is assumed to be equivalent to that of the top 1% performing managersl, at least 30% of the value added by equity fund managers can be attributed to the firm. When bond fund managers are also considered, this percentage is still approximately 30%. The two sets of estimates are almost identical.

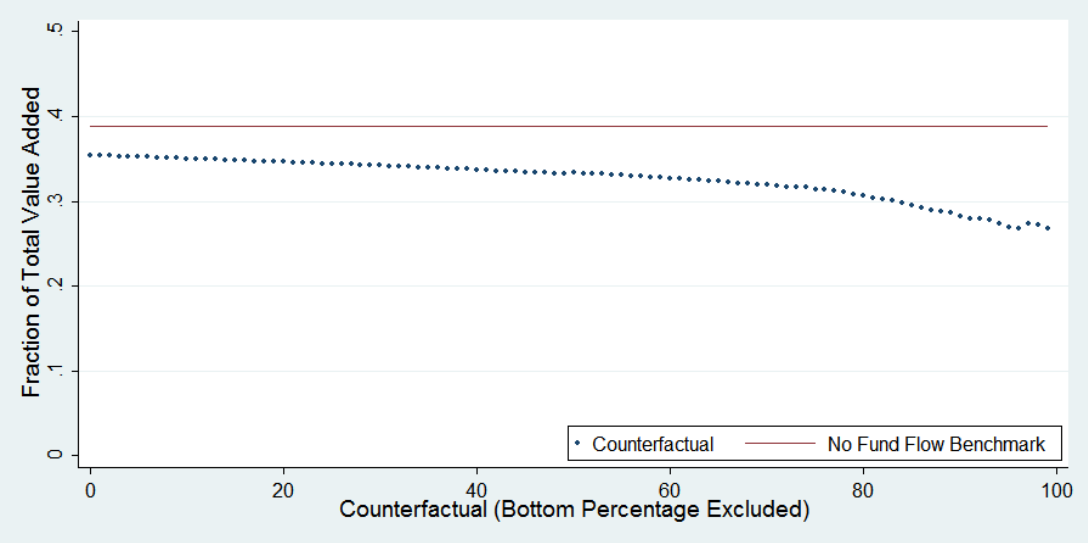


Figure 5: **Firm Contribution as Fraction of Total Value Added**: We compute a lower bound on firm's contribution as a fraction of total value added by multiplying the value of a promotion under each counterfactual by the fraction of periods in which the promotion dummy is equal to one. We then divide this estimate by the average value added per manager per month. We plot this fraction for each of the 100 counterfactuals considered.

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