Firm Boundaries and the Power of Incentives: Evidence from Mutual Funds

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Abstract How do the employment contracts inside the firm differ from the employment contracts between the firm and an outsider? Theory of the firm models don't have a clear prediction about the power of incentives, i.e, the sensitivity of the agent's compensation to performance, inside vs outside the firm. I empirically investigate this question in the Mutual Funds Industry. I build a unique dataset with detailed information gathered on the characteristics of contracts between the funds and investment advisers, both when they are employed by the fund and when they are hired from outside. Using this information I create a measure of power of incentives that takes into account the effect of performance on the level of assets and on the probability of termination of the contract. Exploring variation induced by funds that switch organizational type, I find that outsourcing is associated with a 7% increase in the power of the contracts. A decomposition of the measure of power shows that the sensitivity of dismissal to past performance is very important to explain the estimated difference in power. Furthermore, there is suggestive evidence that learning by the fund about adviser's ability is stronger for outsourced funds, which accounts for 21% of the difference in power. Finally, I find a positive effect of the outside option on the power of contracts, as well as a positive effect of spillovers of integrated funds to other funds in the fund family on the power of incentives. Although these predictions drawn from theory of the firm models find support in the data, they fail to explain most of the difference in power between organizational type.

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1 Introduction

How incentives between a firm and an agent are provided has long been an object of study in economics. Given that the agent could be working under the control of the firm or could be an independent contractor, an interesting problem the firm faces is whether to provide similar contracts to both. A contract between a firm and an agent is said to be high powered when the payment to the agent is strongly tied to performance. Williamson (1985) conjectures incentives are lower-powered in firms as compared to higher-powered incentives in markets. The reason is employees are more likely to overuse the assets of the firm when given high powered incentives than they would if they owned the assets, in which case they would internalize the effect of overutilization on the value of those assets.

Since Coase's seminal paper (Coase, 1937) economists have been concerned with understanding why some transactions are done inside a firm and not in the market. A good theory of the firm is one that can explain the costs and benefits of integration. And these should be informed by an understanding of how things are organized in the firm as opposed to the market. The provision of incentives is a key ingredient. Whether incentives are higher powered in the market than inside the firm is an empirical question that is crucial to understand the boundaries of the firm. Despite widespread belief that incentives are higher-powered in the market than inside firms, the existing evidence is largely anecdotal (Gibbons, 2005). Moreover, the theoretical models produced in this literature have not settled this issue. There are economic arguments that sustain the previous belief. But there are also economic models that predict the opposite. There is, therefore a significant gap in the literature that I intend to fill by empirically answering this question in the context of the Mutual Funds industry. I also go deeper into the question by exploring possible mechanisms affecting the power of contracts.

In my analysis, I use a unique dataset with detailed information on contracts between Mutual Funds and their investment advisers. I model the compensation of the adviser by using key features of the institutional environment to create a measure of power that takes into account the effect of performance both on the current and future compensation and on the probability of dismissal of the adviser. Using a difference-in-difference approach I find that the power of contracts is higher when the fund is outsourced than when it is integrated, with oustourced contracts having 7% higher powered contracts. The crucial channel driving this result is the sensitivity of dismissal to past performance, although it does not account for the whole difference in power. I also find that a fraction of the difference in power can be explained by the fund's learning about the adviser's ability. On the other hand, although there is preliminary evidence supporting predictions from theory of the firm models, these explain a very small part of the difference in power found.

The Mutual Fund industry is an excellent setting to study this question due to the existence of both types of organizational structure and the availability of contracts data. Integration and separation exist in this setting because the portfolio of the fund can be managed by an in-house adviser, who is affiliated with the fund family, or by an independent adviser firm, who has no affiliation with the fund family. When the fund hires an investment adviser, either an in-house or outsourced one, an investment advisory contract is celebrated between the two parties. Under the Investment Company Act of 1940, all registered Mutual Funds investment companies have to file NSAR forms semi-annually. These forms contain information on the existence of an investment advisory contract, the parties involved, the specific type of contract, and the fee for contracts based on the value of assets under management paid by the fund to the adviser. There is, therefore, detailed information in this industry on the terms of the contracts celebrated between funds and advisers.

I build a unique hand-collected data set from three sources: NSAR-B forms, CRSP Survival-Bias-Free and Lexis Nexis Academic databases. I collect all fiscal year-end NSAR-B forms present in the Securities and Exchange Commission website between 1994 and 2008. I then merge this data set with CRSP Survival-Bias-Free US Mutual Fund database in order to have information on assets, performance and several other characteristics of the funds. This had to be done manually as there is no common code or crosswalk in the two data sets. Finally, I create the outsourcing variable by checking the affiliation of the outside investment advisers with the fund family in Lexis-Nexis Academic database.

The level of detail of the information collected allows me to construct a measure of the power of contracts by computing the semi-elasticity of the investment adviser's wealth with respect to a change in performance. More specifically, it is the percentage change in the investment adviser's wealth due to a 1 percentage point increase in excess performance of the fund. To compute it I model the adviser's expected present value of all future compensation. This measure includes both explicit and implicit incentives faced by the adviser, since it includes the marginal fees received by the adviser in all periods, the relation between assets under management and performance, as well as the relation between the probability of dismissal and past performance. Finally, it also takes into account the value of outside option of the adviser.

Exploring the timing of fund changes in organizational type, I conduct a difference-in-differences estimation and find a robust effect of the choice of outsourcing on the power of contracts. In particular, the power of contracts is 7% larger for funds that have their management outsourced than for funds managed in-house. This result holds when comparing outsourced and in-house management within fund and family group, and controlling also for year and investment objective fixed effects. If the power of contracts is different under the two distinct organizational formats I also expect the power of incentives to change permanently after the change in organizational format. The analysis of the power of contracts over time for a given fund corroborates this prediction: the power suffers a significant shift at the time of the switch in organizational type followed by no growth in power in all subsequent periods. Strictly speaking, the power of a contract is permanently increased when the fund switches to outsourcing and permanently decreased when it switches to in-house management. Moreover, I exclude concerns that the estimated effect results from selection of organizational type due to the fund's search for a better quality adviser by looking at the pattern of adviser quality around the switch in organizational type.

To understand the sources driving the main result, I decompose the measure of power. In particular, I compute the measure of power assuming no sensitivity of dismissal to past performance and no sensitivity of assets under management to past performance. I find that the sensitivity of dismissal to past performance is the main source of the difference in power. On the other hand, the incentives given by the marginal fees are only important when both inflow growth and probability of dismissal depend on past performance. This means the difference in power of incentives is mainly driven by the impact of adviser's current actions on the future compensation.

I also make a preliminary attempt at testing predictions from different types of theories. There is suggestive evidence that learning by the fund about the advisers occurs at the beginning of the adviser's tenure at the fund, and this mechanism is responsible for 21% of the difference in power. In addition, I find the power of contracts is positively associated with the value of the outside option, and also that spillovers of in-house managed funds to other funds in the fund family are associated with higher powered incentives of integrated funds. However, these fail to account for most of the difference in the power of contracts.

The theoretical literature that relates the power of contracts to the boundaries of the firm produces different predictions regarding how the power of contracts should differ inside and outside the firm. On one hand, several theory of the firm models predict higher-powered incentives in the market than in the firm. For example, in a multi-task agency model, Holmström and Milgrom (1991) predict that tasks whose performance is harder to measure should have lower powered incentives, and therefore, be integrated since better monitoring may take place inside the firm. At the same time, easier to measure tasks should be oustourced and have higher powered incentives. Additionally, Baker et al. (2002) argue that lower-powered incentives are easier to sustain under integration, because the fund has property rights over the work developed by the adviser under integration. This leads to a higher temptation to renege on performance related promotions, since the fund appropriates all the gains from reneging. This is not the case with separation because the adviser has property rights over research output and can sell it to the highest bidder. Other authors also reach the same broad prediction, namely, Holmström and Milgrom (1994) and Holmström (1999b).[1]

On the other hand, Holmström and Tirole (1991) and Laffont and Martimort (1997) argue that in the presence of input complementarities, the power of incentives should be higher inside the firm. The intuition behind these predictions hinges on the importance of work done by the adviser of one of the funds to the other funds in the family. Research produced for the management of one of the funds may benefit the management of other integrated funds in the same mutual fund family. High powered incentives are provided to the advisers because the mutual fund family appropriates the benefits from this complementarity. If the management of one of the funds is outsourced, research outcomes are not shared and the mutual fund will find it optimal to provide lower powered incentives to the outsourced manager than in the previous case.

To test the role of the different theory of the firm models I relate elements of the job design with the power of incentives, as predicted in these models. In particular, I test a prediction from Holmström and Milgrom (1991) by relating the difficulty of measuring performance with the power of incentives. To do so I create a measure of the difficulty of measuring performance based on the monthly volatility of the fund's estimated alpha. Additionally, I test Baker et al. (2002) by relating the power of incentives with the outside option of the adviser. The benefit from reneging on a promise to "promote" the investment adviser should be higher the lower the value of the opportunities available to the adviser to sell research output to the highest bidder. Thus, higher powered incentives should be higher when the adviser's outside option is higher. Finally, I run a test of Holmström and Tirole (1991) and Laffont and Martimort (1997) by exploring spillovers produced by a star fund in a fund family to the other funds in the family. If star integrated funds produce information that can be shared with other integrated funds in the family, there should be higher powered incentives to star funds that are in-house managed than for outsourced managed star funds.

This paper also relates to the broad literature on compensation, which I divide in two main areas: static and dynamic agency contracts. The literature on CEO compensation tests the strength of

[1] They argue that lower powered incentives inside the firm are observed because it is optimal to keep incentives in balance in firms that have more than one "incentive instrument". To illustrate, suppose mutual funds use as "incentive instruments" performance contracts and adviser reputation. Choosing stronger incentive contracts for in-house advisers may lead to overutilitation of the asset "family name", which coincides with the adviser's name (because in-house investment advisers are associated with the reputation of the fund family). This could happen if the adviser takes unconventional risks to try to achieve higher performance. That would not occur with strong incentive contracts for outsourced advisers, because in this case they would fully incorporate the costs of its actions on the "adviser's name". That is, they would take into account the effect of their actions on the likelihood of new business with other fund families.

the static incentive contract by assessing the magnitude of the pay-performance relation for CEOs. Several different measures are constructed, although there is no consensus on which measure to use (Jensen and Murphy (1990), Baker and Hall (2004), Frydman and Jenter (2010)).[2] I contribute to this literature by constructing a related measure and precisely modeling adviser compensation using key institutional features. The literature on whether incentives matter focuses on three different types of tests (Prendergast, 1998): the relation between contracts offered and productivity (Lazear (2000) and Paarsch and Shearer (1996)), the effects of nonlinearities in contracts on behavior (Chevalier and Ellison (1997) and Garen (1994)), and others studies that test if contracts accord to available theory (Anderson and Schmittlein (1984) and Levin and Tadelis (2004)).[3] I contribute to the latter type of tests.

This study also adds to the literature on dynamic agency contracts. Harris and Holmström (1982) use a model of wage dynamics where both the fund and the adviser are learning about the quality of the adviser. They predict that there is more updating at the beginning of adviser's tenure at the fund if the measure of adviser's performance is more informative. Holmström (1999a) and Gibbons and Murphy (1992) build a model that takes into account both the explicit incentives provided by the contract and implicit incentives provided by career concerns. Gibbons and Murphy (1992) and Chevalier and Ellison (1999) empirically show that career concerns affect the way incentives are provided. I test the importance of implicit incentives produced by the fund's learning about the adviser's quality, as is predicted in Harris and Holmström (1982).

Finally, this paper adds to the literature on Mutual Funds, and more specifically, to mutual funds compensation and mutual funds outsourcing. Deli (2002) and Warner and Wu (2011) find that higher fees are associated with superior past performance. The emerging literature on Mutual Funds Outsourcing focuses on performance differences between outsourced funds and in-house managed funds. Chen et al. (2006) find that outsourced mutual funds under-perform those ran internally, whereas Duong (2007) finds that underperformance only happens for funds that have both funds managed internally and outsourced.

The rest of the paper is organized as follows. In the next section I describe the institutional setting, the three data sets used and the construction of variables. In section 3 I build a measure of power of contracts. I present the test of the difference in power of contracts inside vs outside the firm in section 4 and in section 5 I decompose the main result to find which channels are driving

[2] Namely, Jensen and Murphy (1990) measure the pay-performance strength by computing the dollar impact on CEO compensation of a $1000 change in market valuation of the firm. Hall and Liebman (1998) use instead the dollar change in CEO compensation due to a "typical" change in the value of the firm since Schaefer (1998) shows that the former is negatively correlated with firm size.

[3] Anderson and Schmittlein (1984) use data the integration of personal selling and Levin and Tadelis (2004) use data on local governments' decision of what services to provide or privatize.

it. In section 6 I further investigate the sources of the result by relating it to specific predictions of the theory of firm and learning models. Finally, I conclude in section 7.

2 Mutual Funds Data

In this paper I use data from the Mutual Funds Industry. The Mutual Funds Industry is a very important sector of the U.S. economy. In 2010 it managed $11.8 trillion corresponding to 24% of the U.S. stock market[4]. I build a unique data set that contains detailed hand-collected information on the conditions of contracts between the fund and the investment adviser. In the next subsection, I start by briefly describing the institutional background and then present the sources and process used for the construction of the dataset. Finally, I present the variables used in this study.

2.1 Institutional Background

The Mutual Funds Industry is a very interesting and appropriate setting to study the importance of organizational form in the power of the contracts, due to the coexistence of both separation and integration, and the availability of information on the fees paid by the fund to the advisers. Mutual funds are owned by their shareholders and establish a board of directors[5], who oversees the fund's activities. One of these activities is the management of the fund's portfolio, which is done by an investment adviser who handles the day-to-day management of the fund. An advisory agreement between the fund and the adviser is established conditional on board's approval. The board oversees the performance of the fund and also approves the fees paid to the investment adviser, yet it is not involved in the day-to-day management. The chosen investment adviser may be affiliated or unaffiliated with the fund family, that is, may be an in-house or outsourced adviser.

A Mutual Fund family, also referred to as family complex, is composed of several mutual funds series and each mutual fund series may be comprised of several mutual funds. For example, Eaton Vance family complex has among others mutual fund series "Eaton Vance Securities Trust" with funds EV Classic Stock Fund, EV Marathon Stock Fund and EV Traditional Stock Fund, and series "Eaton Vance Cash Management Fund" with one fund with the same name. Each series is legally formed as an investment company, that is, a family complex has then several investment companies. Under the Investment Act of 1940, an investment company has to register with the Securities and Exchange Commission (henceforth SEC) and has to file semiannual NSAR forms, along with other documents. Each family complex may file several distinct NSAR forms.

[4]Investment Company Institute 2010 Factbook.

[5]According to SEC regulations, majority of board directors must be independent. The board has the responsibility of looking after the interests of investors.

2.2 Three different data sources

The dataset is constructed using three main different sources: NSAR-B forms, Lexis Nexis Academic database and CRSP Survival-Bias-Free US Mutual Fund dataset. NSAR-B forms are filed at the fiscal year-end with the SEC and can be found in its website[6]. I downloaded all NSAR-B forms between 1994 and 2008, totaling 48090 filings. After incorporating information from amendments and transition filings and there were a total of 40964 filings. These consist of one observation per investment company per year. In the NSAR-B forms there are several features related to the organization and financial management of a fund. Among these are whether the funds have an advisory contract and the name of the investment adviser. Table 1 summarizes information on contracts collected from NSAR-B forms.

Mutual fund companies use different forms of contracts to pay their investment advisers. The NSAR form has specific questions about five different types of contracts used by each company. In particular it asks whether the contract is based on assets, on income, on assets and income, on investment performance and on assets, income or investment performance of other funds. Additionally, the richness of the data set allows me to have information on the fee level paid to the adviser in each period for contracts that are based on Assets. In the data, advisory contracts based on Assets have either a fixed fee - a fee level that is independent of the level of assets under management - or a convex fee schedule, that specifies the fee level for different ranges of the level of assets under management.

This is the only type of contract with fee information available, which is crucial to the construction of the measure of power of contracts. Even though there is no fee information for all different types of contracts there are reasons to believe the results found in this paper are not particular to contracts based on assets. These contracts are the most common in the industry, representing about 80% of all contracts. Additionally, these results would be specific to these types of funds if outsourcing has a different effect for these than the ones without information. Given that there is information on the variables that are used to construct the measure of power for all funds, I can test whether outsourcing is correlated to these variables in a different way for each type of contract. I find that outsourcing does not affect these funds in a qualitatively different way than the ones whose contracts are solely based on assets.

The main variable in my analysis is *Outsourcing*. To create it I use the investment adviser name and manually check its affiliation with the fund family. I look for information on the affiliation of the adviser by first checking Lexis Nexis Academic database. If I cannot find information there, I inspect the advisers website when it exists, old newspapers and/or prospectus to find the affiliation

[6] http://www.sec.gov

at the specific date. In 2008, 10.8% of the funds were managed by outside investment advisers, representing approximately \$1 trillion. Table 2 presents a breakdown by year of the fraction of funds by type of organizational form. It can be seen that outsourcing corresponds to 7 to 11% of the market, and maintains a very stable pattern over time. Table 3 shows the breakdown of the types of contracts that can be seen in the data by type of organizational structure. Outsourcing seems to be associated with relatively more contracts with convex schedules fees when contracts are based on assets, as well as more contracts based on investment performance.

I also use CRSP Survival-Bias-Free US Mutual Fund database, henceforth CRSP, between 1994 and 2008 in order to have information on assets, performance, several other characteristics of the funds and investment objectives they operate in. I also allow for the Lipper and Strategic Insights Group definitions of investment objectives available in CRSP. Furthermore, I include both equity and bond funds. Since an observation in NSAR-B data is a *fund-year* pair, I use the CRSP with yearly frequency. CRSP has information on all classes issued by a single fund, and thus an observation is a *fund class-year* pair. Some mutual funds issue several classes of the same fund, even though each class allows access to the same portfolio pool. The difference between classes resides on the type and number of shareholders services provided, distribution arrangements, fees and/or expenses. From the point of view of the adviser this should not matter. To transform the data to have an observation of the form *fund-year* pair I follow the idea introduced by Wermers (2000) and weight each relevant variable by total net asset value of the share class.

I then merge CRSP with NSAR-B dataset and the outsourcing variable. This had to be done manually as there is no common code in the two datasets and the names of the funds are not identical or done in a systematic way. I hired a team of research assistants to create a bridge between the two data sets by matching the names of the funds. To properly align incentives, I created a compensation scheme that was dependent on the quality of the match. To ensure quality I inspect 5% of random matches and found no mistakes. I also used different RAs for matching the same funds for a subsample of the funds.

2.3 Description of variables

I now describe the construction of the variables used for the main tests of these study: outsourcing, excess return, dismissal probability and marginal fee. And present control variables assets under management, inflow growth, fund age, adviser's quality. I close this section by presenting the variables used in the tests of specific theoretical predictions: difficulty of measuring performance, contract duration, value of adviser's outside option star fund and family size.

A fund chooses *Outsourcing* when the investment adviser chosen to manage the fund is not affiliated with the family complex. This variable takes the value 1 when the adviser is independent of the family and 0 otherwise. The definition of *Outsourcing* is not affected by the adviser's own strategic decisions of how to manage the fund. That is, if an in-house adviser hires an independent sub-adviser to help manage the fund, the investment adviser is still considered an in-house adviser if he is affiliated with the fund family.

The *excess return* is used as the measure of performance of the mutual fund. It is the fund return observed in the period in excess of the average return occurred in the investment objective the fund belongs to.

The measure of power I construct in the next section uses two main ingredients: the marginal fee paid to the adviser by the fund and the probability of dismissal. Throughout the analysis, I rely on the information of the fee when the contract is based only on assets. Contracts based on assets can have two forms: a fixed fee or a convex fee schedule, where the fee level depends on the level of assets under management. This information permits the construction of a *marginal fee* in the following way. For fixed fee contracts the marginal fee equals the fixed fee. For convex fee contracts, I choose the fee level associated with the range of asset level the fund is in each period by looking at the level of assets under management each period.

I use two measures of *dismissal*. I consider an adviser to be dismissed if the fund does not exist in the following period or the fund exists but with a new adviser. To ensure that the adviser is dismissed and avoid classifying as a dismissal cases where the manager leaves the fund due to a promotion, I impose restrictions on the quantity and value of the funds the adviser manages in the following period. Thus the first measure of dismissal imposes that the number of funds the adviser is managing in the following period does not increase. And the second one imposes that the total value of assets of the new funds the adviser manages is smaller than the value of assets in the fund the adviser was fired from.

I now describe the variables used as controls in the power regressions. The size of the fund, measured by the value of assets under management, is controlled for in all of the regressions. There are two different reasons that motivate this control. The first is related to importance of the fund to the family. The bigger the size of the fund the higher the level of recognition of the fund. Thus, the family may want to have higher powered contracts when the fund is larger, since the stakes are higher for the family and it is more important to closely align the incentives of the adviser. This implies the use of a relative size measure. Since I include family fixed effects in all regressions the absolute size of the fund effectively measures relative size. The second reason is motivated by the arguments present in Berk and Green (2004). If there are decreasing marginal returns in ability of generating high average returns as they assume, larger funds may choose to have lower powered contracts as they realize the difficulty for advisers of generating high returns. On the other hand, firms may feel tempted to give higher powered incentives to elicit more effort given the higher difficulty in obtaining returns. In any case, it is crucial to control for size of the fund.

I also control for adviser quality by building adviser past return ($\bar{r}_{t-1,A}$), which is is the average return of all funds managed by the adviser in the previous period. As in the previous case, there is no clear directional effect on power of this control. Better skilled advisers, as measured by higher past average return may select into higher-powered contracts, as found by Lazear (2000). On the other hand, a better adviser may have a better bargaining position and therefore be more able to extract rents and negotiate a smaller pay-performance relation (Freeman and Medoff, 1984).

Finally, I describe the variables that are used in the tests of specific predictions of the theoretical models. I build two variables of the difficulty in assessing performance. The difficulty of measuring performance should measure how close the performance measure available to the firm is to the underlying true performance of the adviser. To proxy for this I use the volatility of the fund's alpha. I assume that the underlying true performance of the fund can be approximated by two models of fund performance: the Fama and French (1993) 3-factor and the Carhart (1997) 4-factor models. In each model the fund return can be replicated by building a portfolio of three or four factors: Market Index, HML (high minus low book to market), SMB (Small minus big) and Momemtum, with the three factor model using the first three factors.[7] These portfolios are estimated by using a moving average of the monthly values of the fund returns and factors during the last 24 months.[8] From this procedure, the fund's alpha is inferred which is interpreted as reflecting the skill of the adviser. I create the standard deviation of the monthly alphas during a year to proxy for the difficulty of measuring true performance (σ_{alpha3} and σ_{alpha4}). The idea is that the skill of the adviser should be constant and variability in the estimated alpha should reflect the difficulty of measuring true performance in that activity.

The *contract duration* is the number of years the adviser has been managing the fund. On account of the lack of information about the date when the contract originated, I exclude contracts which started before 1994 (the beginning date of the data set) for this test.

I create several proxies for the outside option. The first set of proxies is related to the degree of adviser dependency of the fund and family. I create the importance of the fund relative to the value of all funds managed by the adviser. In particular, I build the share of assets of the fund relative to total assets the adviser manages (*fund asset dependency*), and the share of adviser compensation

[7] The following model is estimated: $R_{it} = \alpha_{iT} + b_{iT}(M_t - rf_t) + h_{iT}HML_t + s_{iT}SMB_t + m_{iT}Mom_t + e_{it}$, for $t = 1, 2, \ldots, T$, and where rf_t is the risk-free rate in period t and M_t is the Market Index in period t.

[8] I require at least 12 months to obtain an estimate of α. More specifically, α is estimated using T periods of monthly data if the fund has $12 \leq T \leq 24$ periods of available return information prior to t. For funds with more than 24 moths of prior return information, I use a moving window of 24 months for the estimation.

relative to total compensation (*fund compensation dependency*), where compensation is *marginal fee* times assets under management. The second set of proxies is related to the potential size of the market the adviser operates in. *ln(potential market)* is the logarithm of the total assets in the investment objectives in which the adviser participates in. I also build a related variable that takes into account the prevalence of outsourcing in each market *ln(potential outsourcing market)*. More specifically, I compute $\ln\left(\sum_{o\in obj} Assets_{t,o} Prob(Oustourcing)_{t,o}\right)$, where $Assets_{t,o}$ is the total value of assets in investment objective o. Finally, I construct *ln(number of clients)*, which is the logarithm of the sum of the total number of funds in each investment objective the adviser belongs to.

Finally, I create two variables to test the relation between spillovers and the power of the contract. $Star_i$ is a dummy variable that takes the value one for funds that perform who have the 10% higher estimated alphas in a year, where $i = \{3, 4\}$ stands for the number of factors used to estimate alpha. Following Nanda et al. (2004), *Fmly size* is the logarithm of the average fund size of the family relative to the median of the average size of funds in a family.

2.4 Summary Statistics

In table 4 I present summary statistics for the most important variables by type of organizational form. Funds don't seem to differ in size, inflow growth and adviser's average past performance between organizational type. However, funds are different in the marginal fee, probability of dismissal, contract duration and fund age between organizational type. Without controlling for any fund, family or objective characteristics, funds in outsourcing have a statistically smaller marginal fee and fund age. They also have a higher probability of dismissal.

To understand if funds opt for different types of contracts when hiring an in-house adviser than when they hire an outside one, I run a multinomial logit. The five types of contracts I described in section section 2.2 are not mutually exclusive, that is a fund may say it pays a fee based on assets and also based on investment performance. I, thus, construct the following mutually exclusive types of contracts: contract based on assets only; on assets and income; on own investment performance; on performance, assets or income of other funds only; based on assets and investment performance; on assets and measures of other funds; on assets, income, investment performance and measures of other funds.

The table 5 shows the marginal effects on the probability of choosing a contract type. It can be seen that Mutual Fund companies do choose different types of contracts for the different organizational structures used. Funds that are managed in outsourcing have a higher probability of choosing contracts that depend on assets only and investment performance. It can also be seen the type of contracts used by the fund is associated with the characteristics of the market the fund is in, since contracts that pay based on income are more likely to be used when the fund invests in debt securities. This table is suggestive of a different pattern of contracting behavior with in-house and outsourced advisers, as both the types of contracts that are more likely to be chosen vary between organizational forms.

3 Measure of Power of Incentives

In order to analyze how the power of incentives differs inside and outside the firm a measure of the strength of incentives of the advisory contract needs to be constructed. The distinction between high-powered and low-powered incentives is usually centered on how dependent the contract between the firm and the agent is on the measure of performance used in the contract. The theoretical literature typically uses wage contract $w = a \cdot r + b$, where w is the wage payment received by the agent, r is the performance measure, b is the fixed component and a is the sensitivity of the wage contract to the performance measure. The higher a, the higher the power of the contract. Thus, a measure of the power of incentives in the contract is the sensitivity of the agent's payment to the measure of performance specified in the contract.

A measure of incentives which proxies a should include all links between performance and manager's compensation. It should include the effects of current performance on current and future compensation, and on the probability of dismissal of the manager. The measure of power I construct computes the impact on the adviser's total expected compensation due to an increase in performance. To implement it I look at the adviser's expected present value of compensation by modeling compensation and the probability of dismissal in each period as a function of performance. I use the excess return of the fund as a measure of performance. The excess return will capture how well the manager did relative to the rest of the market.

To measure the power of contracts I construct the semi-elasticity of compensation with respect to current performance. And to make this study comparable to the CEO compensation literature, I compute one additional measure. The Jensen and Murphy (1990) measure the dollar change in the CEO's compensation due to a $1000 change in the value of the firm, henceforth, *percent ownership*. This measures the incentives faced by managers when making decisions whose impact on the value of the firm is independent of firm size (Baker and Hall, 2004). In contrast, the semi-elasticity gives the percentage change in the adviser's compensation and, thus, makes no assumption about the value of manager's activities to the fund.[9]

[9] It does not have the problem encountered in the CEO compensation literature of being mechanically close to one, due to the fact that in some studies only stocks and stock options reevaluations are considered.

3.1 Definitions

In this section I present the definitions for the two measures of power and the relevant quantities used in their computation. First, I present the measure of performance used. Second, I present the expected present value of the manager's compensation. Third, I define the revenue of the fund and, finally, present the definition of the two measures of power used in this study.

I consider adviser's performance, $r_{i,t}$, to be the fund's return in period t in excess of the average return observed in the investment objective in which the fund participates.

I start by defining the expected present value of the investment adviser's compensation associated with being employed by fund i, for which he currently provides advisory services. Funds pay a fee to the investment adviser based on the amount of assets under management. Let $\phi_{i,t+j}$ be the fee paid to the adviser by fund i in period $t+j$, that is, the percentage of assets under management the adviser receives, and $A_{i,t+j}$ be the value of assets under management in fund i in period $t+j$. Then, in each period the adviser is employed with fund i, he gets $\phi_{i,t+j} \cdot A_{i,t+j}$ This is the adviser's per period compensation.

Assets under management in a given period can be decomposed into asset (de)valuation and net inflows to the fund. Let $R_{i,t}$ and $n_{i,t}$ be the gross return and inflow growth of the fund i between periods $t-1$ and t, respectively. Assets under management in period t evolve according to:

$$\begin{aligned} A_{i,t} &\equiv (1+R_{i,t})A_{i,t-1} + n_{i,t} \cdot A_{i,t-1} \qquad (1) \\ \text{with } n_{i,t} &\equiv \frac{A_{i,t} - A_{i,t-1}(1+R_{i,t})}{A_{i,t-1}} \\ \text{and } R_{i,t} &= r_{i,t} + r_{o,t} \end{aligned}$$

where $r_{o,t}$ is the average return in the investment objective o in which fund i participates in period t.

The adviser receives the per year compensation as long as he is employed by the fund and as long as the fund is open. In each period, the fund decides whether to maintain the adviser or replace him, or to close the fund. Let $\mu_{i,t+j}$ be the per period probability of dismissal of the adviser in fund i in period $t+j$. This probability is conditional on employment of the adviser in period $t+j-1$, and takes into account the probability of fund closure.

Let $Q_{k,t+s}$ be the per period adviser's k compensation after being dismissed in period $t+s$ and $S_{k,t+s}$ be the discounted value in period $t+s$ of all adviser's future income when he is fired in period $t+s$. In case of dismissal of the adviser in period $t+s$ the adviser starts receiving in period $t+s+1$, that is, there is a one year lag between dismissal from the fund and new employment.

Then,

$$S_{k,t+s} = \sum_{j=s+1}^{\infty} \delta^{j-s} Q_{k,t+s}$$

I now present the adviser's wealth. Let $W_{ik,t}$ is the expected present value of adviser's all future compensation of adviser k in fund i in period t,

$$\begin{aligned} W_{ik,t} = E_t \big[& \phi_{i,t} A_{i,t}(1-\mu_{i,t}) + S_{k,t}\mu_{i,t} + \delta(1-\mu_{i,t}) \left[\phi_{i,t+1}A_{i,t+1}(1-\mu_{i,t+1}) + S_{k,t+1}\mu_{i,t+1}\right] + \dots \\ & + \delta^j \left(\prod_{l=0}^{j-1} (1-\mu_{i,t+l}) \right) \left(\phi_{i,t+j}A_{i,t+j}(1-\mu_{i,t+j}) + S_{k,t+j}\mu_{i,t+j}\right) + \dots \big] \end{aligned}$$

To simplify the exposition, I will separate the flows the adviser receives associated to employment in fund i from the flows he receives if he is dismissed from the fund. Let $V_{i,t}$ be the expected present value of the adviser's compensation in fund i in period t in case of survival and δ the adviser's discount factor. The probability of survival of the adviser until period $t+j$ given he is employed at the beginning of period t is given by $\prod_{l=0}^{j}(1-\mu_{i,t+l})$. Then the expected present value of adviser's compensation from employment in fund i is

$$V_{i,t} = E_t \left[\sum_{j=0}^{\infty} \delta^j \phi_{i,t+j} A_{i,t+j} \left(\prod_{l=0}^{j} (1-\mu_{i,t+l}) \right) \right]$$

If $U_{k,t}$ denotes the value of the outside option for adviser k currently providing advisory services in firm i in period t, then

$$U_{ik,t} = E_t \left[\sum_{j=0}^{\infty} \delta^j \mu_{i,t+j} S_{k,t+j} \left(\prod_{l=1}^{j} (1-\mu_{i,t+l-1}) \right) \right]$$

The expected present value of adviser's all future compensation as defined in period t is, thus, $W_{ik,t} = V_{i,t} + U_{ik,t}$.

The *percent ownership* measure requires a proxy of revenue of the firm. Let $RV_{i,t}$ be the present value of all future revenue streams of the fund i in period t, p_{it} be the fee charged by the fund to its investors in period t and let the fund have the same discount factor as the adviser. Additionally, let $\tau_{i,t+j}$ be the probability the fund is closed.

$$RV_{i,t} = \sum_{j=0}^{\infty} \delta^j p_{it+j} A_{i,t+j} \left(\prod_{l=0}^{j} (1-\tau_{i,t+j}) \right)$$

The two measures of power used in the study are:

$$power = \frac{\partial W_{i,t}}{\partial r_{i,t}} \frac{1}{W_{i,t}}$$
$$percent\ ownership = \frac{\frac{\partial W_{i,t}}{\partial r_{i,t}}}{\frac{\partial RV_{i,t}}{\partial r_{i,t}}} \times 1000$$

3.2 Assumptions

In this section I will start stating the assumptions underlying the construction of a measure of the power of incentives, that I can empirically evaluate. I construct the expected compensation from the view point of the adviser so that the measure of power captures the incentives faced by the adviser.

I assume the adviser has full information on the mean fee schedule he will face in future periods in fund i and takes this mean fee as given.

I also assume net inflows to the fund are a function of past performance, specifically, they are a function of last period excess return. They will be higher the higher the performance of the fund relative to the competitors in the same market. I assume this relation and estimate it from the data, and find that the coefficient on last period excess return is positive and significant. Specifically, net inflows are:

$$n_{i,t}(r_{i,t-1}) = \alpha^n_{i,t} + \beta^n r_{i,t-1}$$

where, β^n is the same for all funds. I empirically test if inflow growth has a different sensitivity to past performance for outsourced funds and reject this hypothesis. Thus, (1) becomes

$$A_{i,t} = \left(1 + r_{i,t} + r_{oi,t} + \alpha^n_{i,t} + \beta^n r_{i,t-1}\right) A_{i,t-1} \equiv a_{i,t}(r_{i,t-1}, r_{i,t}, r_{oi,t}) A_{i,t-1}$$

where $a_{i,t}$ is asset growth between periods $t-1$ and t for fund i.

The probability of being dismissed by the fund and the probability of fund closure will depend on the past rate of return. Again, I empirically infer these relations and assume the functional forms:

$$\mu_{i,t}(r_{i,t-1}) = \alpha^\mu_{i,t} - \beta^\mu_h r_{i,t-1}, \text{ for } h = ih, out \tag{2}$$
$$\tau_{i,t+j} = \alpha^\tau_{i,t} - \beta^\tau r_{i,t-1}$$

where ih stands for in-house and out stands for oustsourced. Thus, the sensitivity to performance of the probability of dismissal in funds that are managed by in-house advisers is allowed to be different than in oustourced funds. Funds are, however, homogeneous in the dismissal sensitivity to past performance within each organizational type category. In contrast, the sensitivity to performance of the probability of fund closure is the same for all funds.

Excess return in each period will depend solely on the effort of the adviser that period, which implicitly assumes managerial skill is not a determinant of excess returns. This implies that two distinct funds managed by two different managers can expect on average the same excess return if both managers exert exactly the same level of effort. And in each period the adviser has to decide how much effort to exert. Average investment objective return is assumed to be constant in each period and independent of the level of effort of an individual adviser. Let $e_{i,t}$ denote adviser's effort. Then:

$$r_{i,t} = r(e_{i,t}) + \varepsilon_{i,t}, \text{ where } \varepsilon_{i,t} \text{ is } iid \text{ and } E(\varepsilon_{i,t}|e_{i,t}, \varepsilon_{i,t+1}, ...,) = 0$$
$$r_{o,t} = \nu_{ot} + \eta_{i,t}, \text{ where } \eta_{i,t} \text{ is } iid \text{ and } E(\eta_{i,t}|\nu_o, e_{i,t}, \eta_{i,t+1}, ...) = 0$$

The next paragraphs present a description of what is on the adviser's information set in period t. The adviser knows the linear functions $n_{i,t+j}(r_{i,t+j-1})$ and $\mu_{i,t+j}(r_{i,t+j-1})$, as does the econometrician. Concretely, the adviser knows coefficients β^n, β^μ_h and β^τ_h, and will form expectations regarding $\alpha^n_{i,t}$, $\alpha^\mu_{i,t}$, $\alpha^\tau_{i,t}$ and $r_{i,t+j-1}$. Furthermore, he knows ν_{ot} and expects it to be the same in all future periods,that is, $\nu_{ot+j} = \nu_{ot}$ for $j = 1, 2, \ldots$.

I now describe information in period t ($j = 0$) and then describe what the adviser knows about future periods, that is, for $j = 1, 2, \ldots$. I assume he can correctly predict current period excess return. That is, he knows $r_{i,t-1}$, since he observes past periods variables, and $r_{i,t}$. He also knows he was not fired and so he is still employed in the fund in period t. Thus, I compute this measure for advisers that are employed by a given fund in period t. The manager has knowledge about current period characteristics of fund i and therefore can predict $\alpha^n_{i,t}$, $\alpha^\mu_{i,t}$ and $\alpha^\tau_{i,t}$. Knowledge of $\alpha^n_{i,t}$ implies a correct prediction of $n_{i,t}(r_{i,t-1})$, as well as of asset growth in period t:

$$a_{i,t}(r_{i,t-1}, r_{i,t}, \nu_o) = 1 + r_{i,t} + \nu_o + \alpha^n_{i,t} + \beta^n r_{i,t-1}$$

It remains to clarify the expectations of the adviser regarding future period variables, that is, for $j = 1, 2, \ldots$. The adviser takes the value of its specific characteristics to be the same in every period and equal to its t period value, $\alpha^n_{i,t}$, $\alpha^\mu_{i,t}$ and $\alpha^\tau_{i,t}$. I also assume the adviser has knowledge about the distribution of returns in the mutual fund market each year. That is, in each year the adviser knows that funds are ranked in terms of performance quintiles, which are constructed every year. And he is informed of the performance quintile the fund he manages belongs to in period t. He has information on the value of excess return of the average fund in that performance quintile. He takes this value to form his expectations about future variable values. Thus,

$$\begin{aligned}
&E_t[r_{i,t+j}|i \in \text{quintile } qt] = r(e_{qt}) = r_{qt}, && \text{for } j = 1, 2, \ldots \\
&E_t[a_{i,t+1}|i \in \text{quintile } qt] = a_{i,t+1}(r_{it}, r_{qt}, \nu_{ot}) && \\
&E_t[a_{i,t+j}|i \in \text{quintile } qt] = a_{i,t+j}(r_{qt}, r_{qt}, \nu_{ot}) = a_{qt}, && \text{for } j = 2, 3, \ldots \\
&E_t[\mu(r_{i,t+j})|i \in \text{quintile } qt] = \mu(r_{qt}) = \mu_{qt}, && \text{for } j = 1, 2, \ldots \\
&E_t[n_{i,t+1}|i \in \text{quintile } qt] = \alpha^n_{it} + \beta^n r_{i,t} && \\
&E_t[n_{i,t+j}(r_{i,t+j})|i \in \text{quintile } qt] = n(r_{qt}) = n_{qt}, && \text{for } j = 2, 3, \ldots \\
&E_t[\tau(r_{i,t+j})|i \in \text{quintile } qt] = \tau(r_{qt}) = \tau_{qt}, && \text{for } j = 1, 2, \ldots
\end{aligned}$$

These assumptions imply that the adviser expects to make the same level of effort in every period.

The last assumptions are related to the outside option of the adviser. I assume a competitive market for advisers' management services in a given investment objective, who have been dismissed in the previous period. The lack of managerial skill coupled with a competitive market implies that $Q_{k,t+s}$ is independent of past performance. By way of explanation, given knowledge of dismissal in the previous period from a fund operating in a given investment objective, all managers are treated in the market for management services in that objective as identical. Then the expected per year compensation after dismissal, $Q_{k,t+s}$, can be estimated from the data. I assume that the adviser expects in period t the value of per year compensation to be the same in the future periods, when computing $U_{k,t+j}$ in period t. This implies:

$$S_{o,t+s} = \sum_{j=s+1}^{\infty} \delta^{j-s} Q_{o,t+s}$$

where o stands for the investment objective the fund belongs to.

The impact of an increase in performance on expected present value of adviser's compensation from fund i is:

$$\frac{\partial V_{i,t}}{\partial r_{i,t}} = \phi_{i,t}\frac{\partial A_{i,t}}{\partial r_{i,t}} + \delta\left(\phi_{i,t+1}(1-\mu(r_{i,t}))\frac{\partial E_t[A_{i,t+1}]}{\partial r_{i,t}}\right) + \delta\left(\phi_{i,t+1}\beta^{\mu}E_t[A_{i,t+1}]\right) + \delta^2\frac{\partial V_{i,t+2}}{\partial r_{i,t}} \quad (3)$$

where,

$$\frac{\partial E_t[A_{i,t+1}]}{\partial r_{i,t}} = (a_{i,t+1} + \beta^n a_{i,t})A_{i,t-1}$$

To compute the measure I assume a stopping point in the investment adviser's career, that is, I compute the measure of power for M years. Thus, for the case of an expected fixed marginal fee over time,

$$\frac{\partial V_{i,t+2}}{\partial r_{i,t}} = (1-\mu_{qt})a_{qt}\bar{\phi}\frac{1-(a_{qt}\delta(1-\mu_{qt}))^{M-1}}{1-a_{qt}\delta(1-\mu_{qt})} \times \left[(1-\mu(r_{i,t}))\frac{\partial E_t[A_{i,t+1}]}{\partial r_{i,t}} - \mu'(r_{i,t})a_{qt}^2 A_{i,t-1}\right] \tag{4}$$

And the impact on the outside option is given by:

$$\frac{\partial U_{k,t}}{\partial r_{i,t}} = -\delta\beta_h^{\mu} S_{o,t+1} + \delta^2\beta_h^{\mu}\mu_{qt}S_{o,t+1}\frac{1-(\delta(1-\mu_{qt}))^M}{1-\delta(1-\mu_{qt})}$$

which is identical for all advisers in the same performance quintile and investment objective that year. The overall impact on expected present value of compensation is then:

$$\frac{\partial W_{i,t}}{\partial r_{i,t}} = \frac{\partial V_{i,t}}{\partial r_{i,t}} + \frac{\partial U_t}{\partial r_{i,t}} \tag{5}$$

A more detailed exposition of the derivation steps used in the computation of the derivative can be found in the appendix.

Equations (3) and (4) show that performance affects the level of assets in every period. It affects the level of assets in the current period through (de)valuation and the level of assets in the level of assets in the following period through its effect on inflow growth, which leads to an increase in all subsequent periods. It also affects the probability of being fired the next period, and consequently the probability of having an advisory contract in all the subsequent periods relative to the alternative of earning the outside option.

3.3 Discussion of Assumptions

In this section I discuss the validity of the assumptions. Most of the assumptions made are inferred from the analysis of the data. The rest are based on the Mutual Fund Industry context.

Mutual Fund managerial skill does not exist in the model. This assumption is based on past literature. Although there are contradicting results regarding this issue, the vast evidence supporting the lack of managerial skill (Malkiel (1995), Gruber (1996) and Carhart (1997), among others) has lead to claims that good performance is not persistent and just a product of luck.

I also assume the adviser has full knowledge of the fee schedule. The assumption implies that managers can accurately predict fee changes and the evolution of assets under management. If contracts are not renegotiated frequently, this is likely the case. The manager knows how the fee scheduled is expected to evolve, for example, the manager anticipates a promotion as a response to good performance, and also has information about the characteristics of the fund that allow for a correct prediction of the fee evolution.

Finally, I allow the sensitivity of dismissal to past performance to differ between in-house and outsourced managed funds, and estimate it from the data. Finding a difference in the probability of dismissal between the two organizational forms does not mechanically cause the power of contracts between in-house and outsourced funds to differ in the same way. To see this, I collect the terms that are multiplied by β_h^μ by rearranging equation (5):

$$\frac{\partial W_{i,t}}{\partial r_{i,t}} = \Gamma_{i,t} + \beta_h^\mu \delta \left[\delta(1+\theta_{A,r}) A_{i,t+1} g(a_{qt}, \mu_{qt}) - S_{o,t+1} \left(1 - \delta \mu_{qt} \frac{1-(\delta(1-\mu_{qt}))^M}{1-\delta(1-\mu_{qt})} \right) \right]$$

where $\Gamma_{i,t}$ represents the terms in equation (5) that are not multiplied by β_h^μ, $\theta_{A,r}$ is the elasticity of assets with respect to performance and $g(a_{qt}, \mu_{qt}) = \frac{1-(a_{qt}\delta(1-\mu_{qt}))^M}{1-a_{qt}\delta(1-\mu_{qt})}$.

It can be seen that, for the case where sensitivity of dismissal is higher for outsourced funds, it is possible for in-house managed funds to have higher powered incentives. In particular, the term that is multiplied by β_h^μ is negative for funds with low long term probability of dismissal, low level of assets and low elasticity of assets with respect to performance. That is, when the gain from increasing compensation in the subsequent periods is smaller than the decrease in the value of the outside option.

3.4 Implementation of two measures

In this subsection I clarify some hypothesis and assumptions made to implement the measure of power just described. Throughout the analysis, I assume the discount factor is equal to 0.95. Additionally, I computed the measures of power by assuming $M = 15$. I checked the sensibility of the results to these assumptions and find the results are qualitatively unaltered.

The expected present value of all future compensation of the adviser is built using information on the marginal fee the adviser receives from the fund. To simplify the exposition and notation I implicitly assumed the adviser receives the marginal fee applied to the end of year value of assets under management. To be precise, the contract stipulates the investment adviser receives ϕ percent of the average monthly assets under management. This assumption is nevertheless innocuous, since the correlation between assets under management at the end of the period and average monthly assets under management is 0.98 and highly significant.

To make this study comparable to the CEO literature, where compensation has been extensively studied, I compute also the *percent ownership* measure. To do so, I compute the proxy for revenue of the fund that was presented in section 3.1, which requires a single fee for each fund that can be considered the price of the fund. This is not a trivial matter in the Mutual Funds industry. As is discussed in Hortaçsu and Syverson (2004), there are several dimensions in which price varies from the traditional concept of price. It is not a dollar value, but a percentage of the dollar amount held in the fund by investors. All funds have a percentage charge in every year, the annual expense ratio. But some funds also charge other types of one-time fees when money flows into or out of the fund: a percentage is charged when buying or selling shares of the fund (front- or back-load fees). I adopt the convention used in the mutual fund literature of considering the price in each year to be the expense ratio plus one seventh of the total other fees charged by the fund. Total fees are divided by seven due to the stylized fact that seven years is the average tenure of investor's mutual fund accounts.

4 Power of contracts in-house vs oustourced advised funds

In this section I test the broad prediction of several different models about theory of the firm: the difference in power of contracts that are celebrated in integration and in separation. I explore two different approaches to test this hypothesis. First, I look at the cross section by running a pooled-OLS fixed effects model. Second, I explore variation from dynamic changes in the type of organizational form of a fund using a difference-in-differences approach.

Before proceeding to the empirical analysis, it is interesting to look at the raw statistics of the two measures by type of organization, which can be found in table 6. The average power of an investment advisory contract is 1.277%, which means that when the adviser increases its performance by 1 percentage point, the adviser's wealth increases 1.277%. The power of the average contract is high, as one yearly standard deviation increase in the excess return leads to a 16% increase in the investment adviser's wealth. The power of the advisory contract is also high when measured by the *percent ownership*. The investment adviser has approximately a 42.5% ownership of the fund, which is substantially higher than the values found for CEOs, which are between 0.325 and 0.64 percent ownership (Frydman and Jenter, 2010). One possible explanation behind this difference is the higher specificity of activities employed by the investment advisers to successfully manage a portfolio relative to the more broad set of tasks a CEO of a company has to do. Furthermore, it is important to note that the compensation considered in this study to compute the pay-performance relationship is the compensation of the investment advisory firm as a whole, whereas the CEO compensation literature focuses on individual CEO compensation[10]. More importantly, in panel B of table 6 the mean difference between the power of contracts in outsourcing relative to the power of in-house contracts is presented. Without controlling for any important variables, *power* and *percent ownership* are statistically bigger in outsourcing.

4.1 Cross-Sectional analysis

I start by estimating a pooled-OLS fixed effects model. I regress the measure of power I construct on the *Outsourcing* variable and control for size of the fund, adviser's quality, fund family×year, and objective fixed effects. This set of fixed effects allows me to exclude concerns that results are driven by correlation between unobserved effects of family and year groups and the choice of organizational type. For example, there could be some fund families that choose higher powered incentives and also a higher share of funds run by outside investment advisers, which would induce a spurious correlation between the power of incentives and organizational choice. By including these fixed effects I allow the coefficient on outsourcing to measure the effect of outsourcing on the contract's power relative to other funds in the same family and same year. I additionally cluster the standard errors to allow the error term to be correlated within each fund. More precisely, I estimate the following regression:

$$Power_{it} = \alpha + \beta \cdot Outsourcing_{it} + X'_{it}\gamma + \epsilon_{it} \tag{6}$$

The results of this regression with different control variables can be found in table 7. Outsourcing is associated with approximately 4% higher powered incentives than the in-house contracts. The size of the fund is also associated with higher powered incentives, supporting the view that the higher the stakes for the family, the higher importance of aligning the incentives of the adviser. Additionally, an adviser's better track record (measured by the average past return) is associated with higher powered contracts on average, which is consistent with investment adviser of higher quality sorting into higher powered contracts, although this effect lacks statistical power. Interestingly, the sorting effect seems to be more important the bigger the fund, which suggests that higher quality advisers select into higher powered contracts more for larger funds. In the last column of table 7 I also run specification (6) with the dependent variable substituted by the *percent ownership* measure. Again,

[10]Another reason for this difference is related with the type of information on the compensation available about investment advisers: I have no information on non-fee related compensation of the investment advisers. In contrast, some studies on CEO compensation have information on many components of CEO compensation, such as salary, bonus, benefits, stock and stock option holdings.

outsourcing is associated with higher *percent ownership*. The coefficient is not, however, significant at any reasonable level of confidence. Finally, the sign of the coefficient on the size of the fund is reversed. This is consistent with the evidence produced in the literature that this measure is inversely correlated with the size of the fund (Schaefer (1998) and Baker and Hall (2004)).

4.2 Impact of changes in organizational type

To test the difference in the power of the contracts between in-house and outsourced managed funds it is important to isolate the effect of a change of organizational type on the power of contracts, accounting for fund unobservables so that the results are not driven by some funds' specific paying policies. In this section I focus on the effect on power for funds that changed from being managed by an in-house to an outsourced investment adviser, or vice-versa, that is, for funds that switched organizational type.

To more precisely isolate the effect on power I use a difference-in-differences approach and assume the model:

$$Power_{it} = \alpha + \beta Outsourcing_{it} + \delta_i + \rho_M + \tau_t + \eta_o + X'_{it}\gamma + \epsilon_{it} \tag{7}$$

where δ_i is the fund-specific fixed effect, η_o the investment objective effect, ρ_M the family and τ_t the year fixed effects. The inclusion of fund fixed effects allows me to alleviate concerns that the results are driven by fund unobservables that affect the way these funds provide incentives to its investment advisers and that are unrelated to organizational type.

I estimate this model in first differences, as the data is serially correlated. The prediction from the theory of the firm models implies that the two different structures should have a different power of contracts, and thus I expect power of contacts to change permanently.

The independent variable of interest is the first difference $\Delta Outsourcing_{it} = Outsourcing_{it} - Outsourcing_{i,t-1}$. This variable can take three different values, 0, -1, 1. The coefficient β will therefore capture the average effect of switching organizational form. This assumes that difference in power between different organizational forms doesn't depend on the previous organizational form chosen.

To find the effect on power of changing organizational form for the funds that chose to change relative to the effect on power of all other funds, the funds that did not change organizational form are included in the regression. Effectively I am using as control group the funds that did not switch organizational type. Furthermore, to avoid confounding effects I exclude from the sample funds that switched organizational form more than once. The standard errors are clustered at the fund level.

The results from running (7) in first differences can be found in table 8. A change from in-house to outsourced management is associated with an increase in the power of the advisory contract of 0.090 percentage points, which means that oustourced management is associated with approximately 7% higher powered incentives. The change in organizational type regressions provide further evidence that outsourcing is associated with higher powered incentives than in-house portfolio management.

4.3 Robustness Checks

One caveat from this approach is that the choice of changing organizational type made by the mutual funds is not random. This selection is particularly problematic if it is associated with the power of contracts. If better advisers select into contracts with higher powered incentives and the choice of organizational form is mainly related with the fund looking for a high quality adviser, then I could find that there are higher powered incentives in outsourcing if these are the advisers of better quality. There are two reasons to believe this is not driving the results. First, if this were the case I should see an increase in the power of contracts when funds switch to in-house management. Strictly speaking, if a switch in organizational type results from the fund's search for a higher quality adviser, a switch from outsourcing to in-house management should also be associated with an increase in the power of incentives. If this were the case, the estimated coefficient on $\Delta Outsourcing_{it}$ would be driven down, since for these funds the estimated coefficient would be negative (notice that $\Delta Outsourcing_{it}$ is -1 when this switch occurs), which would make it harder to find a difference in power. On the other hand, if outsourcing is associated with higher power incentives, I expect the power to increase permanently when a fund switches to outsourcing and to decrease permanently when it switches to in-house management. To test these two hypothesis I run the following specification for both types of funds:

$$\Delta Power_t = \sum_{l=-6}^{6} d_l Switch_{i,t-l} + \Delta\rho_M + \Delta\tau_t + \Delta X'_{it}\gamma + \Delta\epsilon_{it} \tag{8}$$

where $Switch_{i,t-l}$ is a dummy variable for the number of periods before or after the switch in organizational type. The coefficients d_l are plotted in figure 1. For both types of funds, the ones that start by being in-house managed and the ones that start to be outsourced managed, the switch in organizational types is associated with the expected effect. That is, power decreases for outsourced funds that switch to in-house management and increases for the reverse switch. In addition, power is roughly stable following the change in organizational form. Thus, power changes in a permanent way after the change in organizational type, which is consistent with the prediction that the power of contracts is different between in-house and outsourced management. Furthermore, there is no evidence of trends in power before or after the switch.

Second, I diagnose the importance of adviser's quality in this analysis. I proxy for the adviser quality in column 2 of table 8 and find that although it has a positive significant effect, the coefficient on $\Delta Outsourcing_{it}$ decreases only slightly. I further complement this evidence by looking at the evolution of $\Delta r_{t-1,A}$ over time. To do this I run (8) with the dependent variable substituted by $\Delta r_{t-1,A}$ for both types of organizational types. In figure 2, $\Delta r_{t-1,A}$ does not seem to have a clear trend. More importantly, there is no evidence that $\Delta r_{t-1,A}$ changes after the event. This further supports the evidence that the increase in power does not occur as a result of an increase in quality.

Another possible concern is that the results are mainly driven by the assumption that in-house and outsourced funds have a different dismissal sensitivity to performance, but are otherwise homogeneous in this sensitivity within groups (equation (2)). Ideally, I would allow each fund to have different sensitivities. However, there is not information to estimate them. To exclude this concern I estimate different sensitivities to performance for each family, even though this estimation still produces very noisy results. In particular, instead of (2) I assume:

$$\mu_{i,t}(r_{i,t-1}) = \alpha^{\mu}_{i,t} - \beta^{\mu}_{f} r_{i,t-1}$$

where f is the dismissal sensitivity to performance for family f. In figure 3 I plot the coefficients d_l from running specification (8). It is clear from this figure that the change in organizational type is associated with an increase at time zero of the power of the contracts with a magnitude of approximately 0.060 percentage points. Furthermore, the changes in power in the periods preceding and following the change in organizational type are not statistically different from zero.

Overall, the results in this section strongly support the existence of a difference in the power of incentives between integrated and separated fund management.

5 Sources of power of incentives

In this section I analyze what are the forces driving the difference in the power of incentives. It is important to understand the relative importance of the various channels affecting the difference in power of contracts, as it should give clues as to which types of models are more important to explain the results. The measure *power of incentives* computed takes into account explicit and implicit incentives. The explicit incentives are given by the marginal fee the investment adviser receives from managing the fund. And the implicit incentives are composed by two main components: the probability of dismissal following poor performances and the increase in the marginal fee received in the next period following good performances. All these explicit and implicit incentives may be part of the agency contract designed by the fund. But the implicit incentives given by the probability of dismissal may reflect the fund's learning process about the ability of the investment adviser.

To be able to shed some light as to what the sources of this difference in power are, I start by analyzing how the main ingredients of the measure of power differ for different organizational types. This is an important first step to assess the relative importance of the mechanisms. The power of incentives should work through these ingredients and their interactions. Thus, finding these ingredients do not vary with organizational type would not imply that these ingredients are not important, but rather that they are important only through the interactions of the model. I, then, proceed by analyzing which mechanisms, i.e. the strength of the relation between probability of dismissal and past performance, or the relation between asset value and past performance, explain the difference in the power of contracts.

5.1 How marginal fees and the probability of dismissal vary with organizational type

In the first column of table 9 it can be seen that the marginal fees are higher with separation of the mutual fund and the investment adviser. In particular, outside management is associated with a 0.048 percentage points higher marginal fee than in-house management, which represents an 8% difference in the level of fees between the two types of organizational form. It can also be seen from the regression that the marginal fee is lower for larger funds, which is consistent with evidence on economies of scale being passed to the fund's investors, as found by Warner and Wu (2011). The coefficient on adviser's past performance is positive but insignificant.

In the remaining columns of table 9 I estimate the probability of dismissal of a contract as a function of past performance, and other control variables using a linear probability model, and allow the sensitivity of the probability of dismissal to past performance to differ for in-house and outsourced funds. In column 2 the dependent variable is a dummy variable for dismissal based on the number of funds managed, and in column 3 it is based on the value of assets under management. I find that the probability of dismissal of an investment adviser is not associated with their past performance when they are employees of the fund, since the coefficients on r_{t-1} are not statistically distinguishable from zero. However, the sensitivity of the probability of dismissal to past performance of outsourced funds is much larger and negative. It is also statistically significant at the 5% level for dismissal based on the decrease in the size of the assets managed by the adviser.[11] Further-

[11] This result is robust to different levels of the decrease in the level of assets under management by the adviser.

thermore, the sensitivity is economically large, as one standard deviation increase in the adviser's excess return in the fund in the previous period leads to a 1.2 percentage point decrease in the probability of dismissal, which corresponds to a 17% decrease of the average dismissal probability of the adviser. Finally, it can be seen that larger funds are associated with a smaller probability of dismissal of the adviser, whereas the other variables do not seem to affect this probability.

Table 9 establishes that both ingredients of the measure of power differ for in-house and outsourced managed funds. The relative importance of each ingredient cannot however be assessed from the table.

5.2 Relative importance of probability of dismissal and asset value to past performance

I now analyze how the semi-elasticity of adviser's wealth with respect to performance changes when closing the performance dependency channel for the probability of dismissal and the value of assets under management. I explore the structure of the measure of power I constructed to be able to properly diagnose the effects of each channel.

I separate the analysis in two parts. First I impose that the probability of dismissal does not depend on past performance. Specifically, I rerun model (6) assuming that the probability of dismissal is independent of past performance, that is, I assume $\beta^{\mu}_{ih} = \beta^{\mu}_{out} = 0$. By closing this channel, I am assessing how the marginal fee affects the results. I analyze how the results differ for three different cases in Panel A of table 10: asset value is dependent on performance through its two channels (in column (a)); asset value depends on performance through asset valuation only, that is, inflow growth is independent of past performance (column (b)); and finally, asset value depends on performance through inflow growth only, i.e., there is no asset valuation.

In the first and third columns outsourcing has no impact on the power of incentives, and in column 2 it has a statistically significant negative impact, even though, as it was shown in the previous section, marginal fees are higher for outsourced funds. After incorporating the impact of performance on inflow growth and asset valuation, the power provided by such marginal fee is the same inside and outside the fund, when there is no interaction with the sensitivity of the probability of dismissal to past performance and when inflow growth depends on past performance. It is clear from Panel A that the sensitivity of the probability of dismissal to past performance is a crucial determinant of the difference in the power of incentives. Additionally, the incentives provided only by asset valuation are smaller for outsourced funds.

Specifically, I defined dismissal as decreases of 5 and 10% of the value of assets under management, to allow for situations where high quality advisers leave the fund to open their own funds, which would likely be smaller. The results are virtually unchanged.

Second, I let the sensitivity of dismissal to past performance be the one estimated from the data and, as before, close different channels through which asset values depend on performance. In particular, in Panel B I analyze the following three cases: in column (a) I rerun the model assuming that the value of assets under management is independent of performance, i.e., that $\frac{\partial A_{i,t+j}}{\partial r_{i,t}} = 0$; in column (b) I relax this condition and impose that only inflow growth is independent of performance; and in column (c) I impose that there is no asset valuation. The results strikingly support the importance of the dependence to past performance of the probability of dismissal.

In column (a) it can be seen that only allowing the probability of dismissal to depend on past performance leads to a statistically significant difference in the power of incentives between in-house and outsourced management, and that accounts a big share of the main result. In particular, it is 77% of the difference in power found previously. However, it also fails to account for the whole difference in the power of contracts. This suggests that although the probability of dismissal sensitivity to past performance is a very crucial part of the semi-elasticity of compensation, it does not account for all sources of power in the contract. Interestingly, in column (b) the coefficient on *Outsourcing* decreases to 0.019 percentage points. Therefore, the interaction between the probability of dismissal in the following period and the marginal fee, through its effect on the current period compensation leads to a smaller effect of *Oustourcing* on the power of incentives. Finally, in column (c) I consider the case where inflow growth depends on past performance and there is no asset valuation. The coefficient on *Outsourcing* increases 0.035 percentage points, which is bigger than the coefficient found in (4) of table 7.

The results in table 10 highlight how crucial the sensitivity of dismissal to past performance is to the difference in power between organizational type, and suggest that this implicit incentive is a major driver of the results. It is interesting, therefore, to try to understand if funds use dismissal as an instrument of the agency contract, or if it is a reflection of the fund learning about the quality of the investment adviser.

These results also highlight that the marginal fee is important when interacted with the probability of dismissal. Its role through the dependency of inflow growth on past performance is very crucial, when the interaction is considered. In particular, including the inflow growth dependency leads to an increase in the coefficient which is 0.875 times the impact of dismissal sensitivity alone. Thus, the marginal fee seems to have two opposing directional effects. The introduction of asset valuation decreases the coefficient on *Outsourcing*, whereas the exclusion of asset valuation and the inclusion of inflow growth dependency leads to an important increase in the coefficient. This suggests that the power of incentives comes mainly from the perceived effect of the present actions of the adviser on future outcomes, such as the increase in compensation in the following period due to higher inflows, the likelihood of a promotion or the increase probability of remaining in the fund in case of good performance.

6 Tests of Theoretical Predictions

Different theories have distinct predictions about the difference in power of contracts between integrated and separated funds. In this section I relate the power of contracts to specific predictions from different theory of the firm and dynamic agency contract models, and assess the importance of the different theories in explaining the difference in power found in this study to further investigate the forces driving the main result.

6.1 Theoretical Predictions

The difficulty of measuring performance in a particular task is a crucial parameter for the optimal power of incentives in several models. When considering static agency contracts, Holmström and Milgrom (1991) and Holmström and Milgrom (1994) predict that as performance becomes harder to measure, the lower the power of incentives on that measure should be. On the other hand, Harris and Holmström (1982) predict that, since the fund and the adviser are learning about the adviser's ability, the difficulty of measuring performance is very important at the beginning of the contract. The reason for this is that the fund will update information about the adviser more at the beginning of the contract if the signals are more informative, in other words, if the difficulty of measuring performance is smaller. Since the probability of dismissal is a crucial channel driving the difference in power, it is interesting to test if part of the difference found is due to more updating by the fund.

In order to test Holmström and Milgrom (1991)'s prediction I test if power of contracts is negatively associated with the difficulty of measuring performance proxied by the volatility of Fama and French (1993) 3-factor alpha (σ_{alpha3}).

I also test the hypothesis that the higher powered incentives are generated as a byproduct of the learning process about adviser's abilities. To test this hypothesis, I regress *power* on *contract duration*, σ_{alpha3} and the interaction of these two variables. The prediction is that the negative relation between *power* and the difficulty of measuring performance should be stronger at the beginning of the contract, if the fund is learning about the adviser's ability.

In addition I relate the power of contracts to the value of the outside option if investment advisers. Baker et al. (2002) build a relational contract model and analyze in which conditions relational employment (integration) is more likely to occur. Their model rests on the assumption that there are performance related payments between parties that are not written in a contract. This model is relevant in this context because one of the sources of power comes from "promotions", that is higher future marginal fees, as a result of good past performances. In fact, Warner and Wu (2011) have shown that increases in marginal fees are more likely to occur after superior performances by the adviser. Baker et al. (2002) conclude that high-powered incentives are more likely to occur with outsourcing than in integration, as they are easier to sustain with outsourcing. This is due to the fact that under employment the firm has property rights of research output even in case of reneging on a performance related payment, whereas with separation the fund would have to pay the spot contracting price. Therefore, higher performance related payments can be sustained when the value the adviser would get from selling research output (and insight on how to choose a portfolio) to another fund is higher. Thus, I test the prediction that the power of incentives is higher, the higher the value of the outside option of the adviser.

The last prediction to be tested is drawn from Holmström and Tirole (1991) transfer pricing model. They argue that the power should be higher for funds managed by an in-house adviser when there are input complementarities. In particular, an in-house adviser may generate spillovers to other in-house managed funds in a family by sharing research outputs. In this case the family benefits more from having the fund be integrated, and they argue *power* should be higher in this situation for in-house than outsourced managed funds. Nanda et al. (2004) and Massa (2003) have shown that the presence of a star fund generates inflows to the other funds in the same family of funds. Contrary to the hypothesis of the transfer pricing model, these spillovers don't happen only if the star fund is in-house managed. However, I assume that there may be other spillovers associated with having a star fund that is in-house managed, such as, research related spillovers. For example, the research that led to the particular fund becoming a star fund may be shared with the other funds in the family. In this case, the power of incentives should be higher if a fund is a star fund managed by an in-house adviser, and the increase in power should be higher when the spillovers are bigger. That is the larger the fund family, the larger the positive relation between being a star fund and the power of incentives should be. To test this hypothesis, I regress the power of contracts on a dummy for being a star fund and the interaction of this variable with the size of the family, and test if the estimated coefficient on the interaction is different for outsourced managed funds.

6.2 Tests of the predictions

6.2.1 The power of contracts and the difficulty of measuring performance

I take the volatility of the fund's alpha to proxy for the difficulty of measuring true performance and present tests of both theories in table 11. Since the volatility is constructed using the alpha estimated using Fama and French (1993) factors for equity funds, I restrict the sample in this table to equity funds. To have an understanding of the importance of these predictions to explain the higher powered incentives associated with outsourcing, in column 1 I present specification (6) estimated for the restricted sample. The goal is to compare the coefficient on *Outsourcing* with the one obtained in columns 2 and 3 when the variables capturing these predictions are introduced. In column 2 of the table I test if the volatility of alpha affects the power of contracts. It can be seen that the coefficient is negative, and thus a higher difficulty of measuring performance is associated with lower powered incentives. In particular, a 1 standard deviation increase in the volatility of the alphas leads to approximately a 1% decrease in the power of incentives. Additionally, the inclusion of this variable leads to a slight decrease in the difference in power for outsourced funds. More interestingly, in column 3 I add the following variables: *Contract Duration*, *Contract Duration*$\times \sigma_{alpha3}$ and *Contract Duration*$\times$*Outsourcing*. I find that σ_{alpha3} is more strongly negatively correlated with the power of contracts than in column 2, but this effect is specially strong for advisers that have not been with the fund for long. As the contract duration increases, the effect of the difficulty of measuring performance on the power of contracts is decreased. More specifically, the effect of the difficulty of measuring performance on the power of incentives is negative for contracts younger than 10 years old. Additionally, the inclusion of these variables is associated with a decrease in the coefficient on the outsourcing variable from 0.085 to 0.067, which corresponds to a 21% decrease in the difference in power.

The results suggest that learning about the adviser's ability shapes the power of contracts and explains part of the difference in power observed between in-house and outsourced managed funds. That is, a part of the difference in the power of incentives observed for outsourced funds is explained by funds learning more about the advisers that are independent from the fund early on in the contract's life. Nevertheless, the learning model fails to account for all the difference in power found between the two types of organizations.

6.2.2 The power of contracts and the value of the outside option

In table 12 I test the implication from Baker et al. (2002) that the higher the value of the outside option, the higher the power of incentives. In columns 1-3 of panel A, I test this prediction using different variables that proxy for the potential size of the market relevant to the investment adviser. The prediction is that the higher the value of the potential market the adviser may have access to, the higher the power of contracts should be. All coefficients in the table have the expected sign. A 1% increase in the size of the market proxied by total size and total size of market in outsourcing leads to a 0.012 and 0.011 percentage points increase in the power of contracts, respectively. A 1% percent increase in the number of funds in the potential market also leads to a 0.013 percentage points increase in power.

Additionally, in columns 4-5 of panel A I regress the power of contracts on 2 variations of measures of adviser dependency on the specific contract: the dependency of the adviser on the size of the fund and on the compensation received from the fund. The higher the dependency of the adviser to the fund, the lower the power of the contract should be. In columns 4 and 5 I find negative and significant coefficients as expected. A one standard deviation decrease in the variables for dependency of the adviser lead to roughly a 1% increase in the power of contracts.

Finally, in panel B of table 12 I check the effect on the difference of power inside and outside the fund when the value of the outside option is taken into account. As before, the first column shows the coefficient obtained when none of these variables are included, and regressions columns 2 and 3 include the potential size of the market in asset value and the dependency of the adviser on the compensation received by the fund. Surprisingly, the inclusion of both variables does not decrease the coefficients on the variable *Outsourcing* and on the outside option proxies. This suggests that although the value of the outside option has the expected impact on the power of incentives, it does not help in explaining the difference in power found in the data.

6.2.3 The power of incentives and the importance of spillovers

Table 13 produces the tests of the hypothesis that input complementarities affect the power of contracts. In column 1, equation (6) is estimated restricting the sample to be the same as the one used to estimate specifications in columns 2 and 3. In these columns I include the variables that proxy for the generation of spillovers to the other funds in the estimation. In particular, I include $Star_i$, $Star_i \times Outsourcing$, $Star_i \times$*Fmly size* and $Star_i \times Outsourcing \times$*Fmly size*. In both columns it can be seen that the coefficient on the interaction between the size of the fund and a dummy for being a star fund that is managed by an in-house investment adviser is positive and statistically significant. This means that the more important spilllovers are, the bigger the power of incentives for in-house managed funds, where the importance of the spillovers is measured by family size. It can also be seen that there is no statistically significant difference in the effect this interaction has for oustourced funds. However, to be able to test whether there is no impact on power for star funds that are outsourced managed the coefficient on the interaction for outsourced funds should be equal to (-1) times the coefficient found for in-house managed funds. I test this hypothesis in the bottom of the table and find that the null cannot be rejected, implying that it cannot be rejected that there is no impact on power of being a star fund that is managed in outsourcing. This is consistent with in-house star funds having higher powered incentives due to the generation of positive spillovers to the remaining funds in the family, while that does not seem to occur for oustourced star funds.

Furthermore, the inclusion of these variables slightly decreases the difference in power found between in-house and outsourced funds. In particular, the inclusion of these variables leads to a decrease in the difference in the power of incentives found of approximately 5%. Spillovers, therefore, affect the power of incentives and also help explain the difference in power between in-house and outsourced managed funds.

6.3 Discussion

The results presented in this section corroborate two main conclusions. The higher powered incentives found for oustourced advised funds can be linked to both a learning by the fund about the investment adviser's abilities, and to static agency models. There is evidence that the optimal investment advisory contracts vary with variables in the ways predicted by different models. However, the agency model predictions explain very little of the documented power difference, whereas learning does seem to account for a larger fraction.

Even after accounting for these distinct possible sources of the power of incentives between in-house and outsourced managed funds, a part of the difference is still left unexplained.

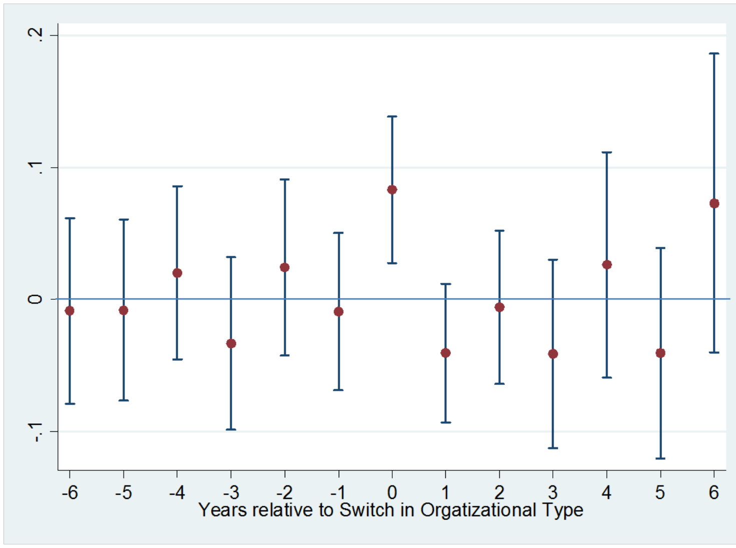
7 Conclusion

In this paper I provide evidence on the difference between the power of contracts inside a firm and between the firm and outside contractors. Although there is a widespread belief that incentives are higher powered outside the firm, the evidence sustaining this belief is largely anecdotal. To have a good theory of the firm it is crucial to have an understanding of how transactions are done inside vs. outside the firm. One of the most important transactions is the one realized between the firm and its employees. In particular, the firm wants to design incentives that induce an agent to be productive on the tasks that are relevant for the firm. How these incentives differ inside and outside the firm is thus an important component of any theory of the firm.

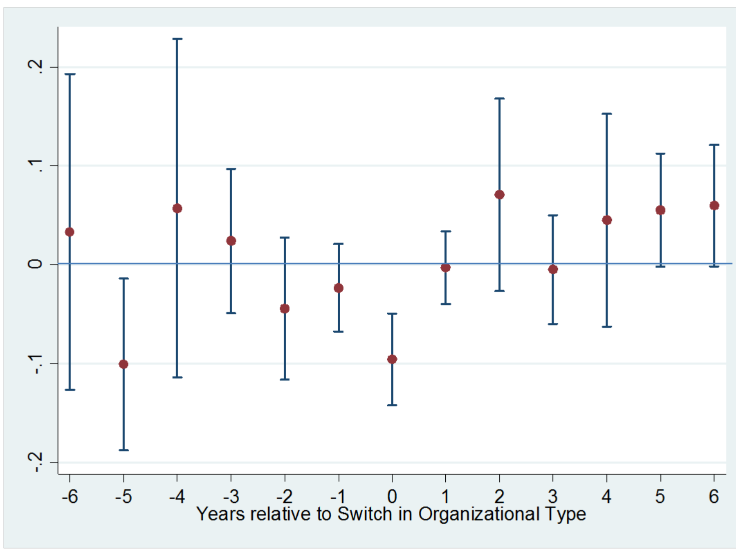
I find that incentives are higher powered for outside than in-house investment advisers. In particular, the semi-elasticity of compensation with respect to an 1 percentage point increase in performance is 7% higher for outside managed funds. I also try to give some insight on the forces that are driving the difference in the power between the different organizational designs. I find that the probability of dismissal is a very important determinant of the difference in power of contracts, and also that the explicit incentives given by the marginal fees are important when inflow growth depends on past performance. Therefore, outsourced advisers have stronger incentives for actions that have an impact on future outcomes than in-house managed funds.

Interestingly, 21% of the difference in power found between inside and outside managed funds can be explained by funds learning about adviser's ability at the beginning of the adviser's tenure with the fund.

I also find that several different theories of the firm predictions are supported by the data. Yet they fail to explain the difference in power of contracts between organizational types found in this study.



(a) Funds that switch to outsourcing



(b) Funds that switch to in-house

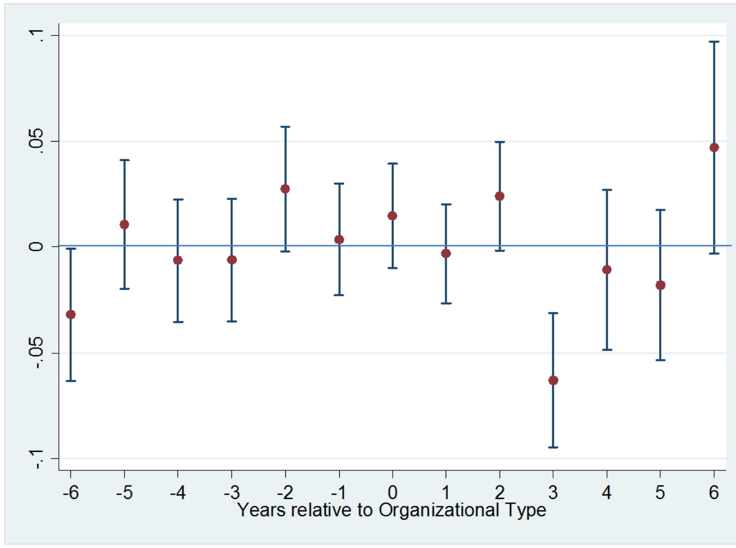
Figure 1: Power of contracts by type of organization

Notes: This figure plots the coefficients d_l obtained from estimating the following regression:

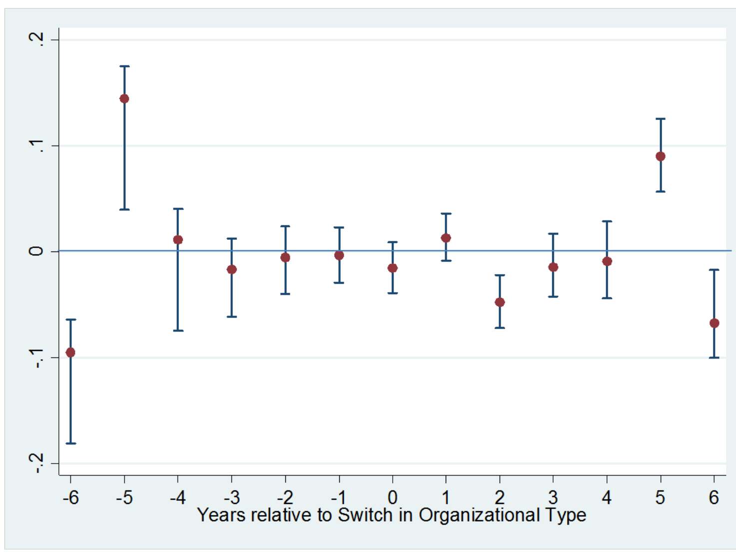
$$\Delta Power_{it} = \sum_{l=-6}^{6} d_l Switch_{i,t-l} + \Delta\rho_M + \Delta\tau_t + \Delta X'_{it}\gamma + \Delta\epsilon_{it}$$

Where $Power_{it}$ is $\frac{\partial W_{it}}{\partial r_{it}}\frac{1}{W_{it}}$ as defined by equation (5) and $Switch_{i,t-l}$ is a dummy variable for the number of periods before or after the switch in organizational type.

Additionally the matrix of controls X includes $\ln(Assets_{t-1})$, $r_{t-1,A}$, Family and Year fixed effects. Error bars are $\pm$ 2 standard errors. And standard errors are clustered by fund.



(a) Funds that switch to outsourcing



(b) Funds that switch to in-house

Figure 2: Adviser past performance by organizational type

Notes: This figure plots the coefficients d_l obtained from estimating the following regression:

$$\Delta r_{t-1,A} = \sum_{l=-6}^{6} d_l Switch_{i,t-l} + \Delta\rho_M + \Delta\tau_t + \Delta X'_{it}\gamma + \Delta\epsilon_{it}$$

Where $\bar{r}_{t-1,A}$ is the investment adviser's average performance in the previous period in all the funds he was managing and $Switch_{i,t-l}$ is a dummy variable for the number of periods before or after the switch in organizational type. Additionally the matrix of controls X includes $\ln(Assets_{t-1})$, Family and Year fixed effects. Error bars are $\pm$ 2 standard errors. And standard errors are clustered by fund.

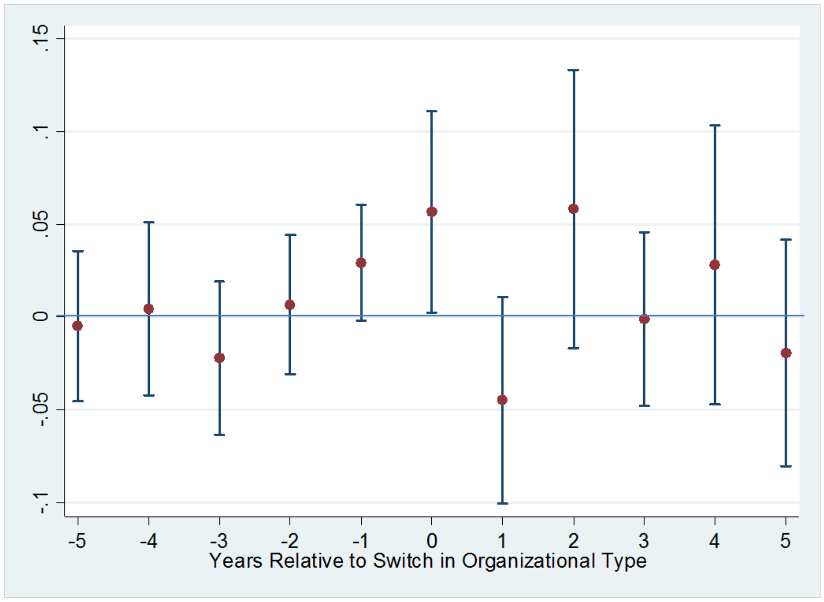


Figure 3: Power of contracts and switches in organizational type

Notes: This figure plots the coefficients d_l obtained from estimating the following regression:

$$\Delta Power_{it} = \sum_{l=-6}^{6} d_l Switch_{i,t-l} + \Delta\rho_M + \Delta\tau_t + \Delta X'_{it}\gamma + \Delta\epsilon_{it}$$

Where $Power_{it}$ is $\frac{\partial W_{it}}{\partial r_{it}} \frac{1}{W_{it}}$ as defined by equation (5) assuming the dismissal sensitivity to performance varies by family, and $Switch_{i,t-l}$ is a dummy variable for the number of periods before or after the switch in organizational type.

Additionally the matrix of controls X includes $\ln(Assets_{t-1})$, $r_{t-1,A}$, Family and Year fixed effects. Error bars are $\pm$ 2 standard errors. And standard errors are clustered by fund.

Table 1: Description of observations from N-SAR forms

	Total
Number of distinct investment companies	5,171
Number of funds	118,083
Share of all funds with contract information	61.32%
Share of contracts with information that are based on assets	80.57%
Total Observations	40,964

Table 2: Breakdown of Organizational Type by year

Year	Total	Share of funds	
		In-house	Outsourcing
1994	628	0.916	0.084
1995	985	0.911	0.089
1996	1,161	0.926	0.074
1997	1,302	0.927	0.073
1998	1,522	0.917	0.083
1999	1,824	0.927	0.073
2000	2,031	0.926	0.074
2001	2,091	0.912	0.088
2002	2,109	0.912	0.088
2003	2,081	0.909	0.091
2004	2,065	0.915	0.085
2005	2,014	0.924	0.076
2006	2,029	0.912	0.088
2007	2,093	0.909	0.091
2008	1,575	0.892	0.108

Table 3: Share of contracts by organizational structure

	Total		Share by type of contract	
	Share	Number	In-house	Outsourced
Assets	80.57%	4,429	92.89%	11.45%
fixed fee	51.52%	2,832	84.85%	8.51%
convex fee	38.58%	2,121	90.48%	13.63%
Income	0.8%	44	88.64%	11.36%
Assets and Income	2.51%	138	98.55%	3.62%
Invest. Performance	4.60%	253	72.33%	28.06%
Others	11.52%	633	98.58%	3.16%
Distinct contracts		5,497		

Table 4: Summary Statistics of Funds

Characteristics by Organizational Form

	In-house	Outsourcing	Total
Marginal fee	0.607	0.551	0.603
	(0.293)	(0.529)	(0.320)
Assets	692.6	632.1	688.6
	(3034.1)	(2316.4)	(2992.3)
Dismissal based on	0.154	0.192	0.157
# of funds managing	(0.361)	(0.394)	(0.364)
Dismissal based on	0.134	0.172	0.137
assets under management	(0.341)	(0.377)	(0.344)
Adviser past return	-0.0148	-0.0170	-0.0149
	(0.0824)	(0.0702)	(0.0816)
Fund age	9.254	8.150	9.181
	(9.246)	(7.814)	(9.163)
Inflow Growth	0.132	0.123	0.131
	(1.073)	(0.684)	(1.052)
Observations	64,508		

Notes: This table presents raw statistics for several control variables by type of organizational type: in-house and outsourced management. The coefficients are the raw means and standard deviations are in parentheses. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Table 5: Probability of choosing contract type

	Assets & Income	Inv. Perf.	Others	Assets & Perf.	Assets & Other	All & Other
Outsourcing	-1.6325***	1.9871***	-1.7696***	-0.2698	-0.6471**	-16.6630
	(0.383)	(0.141)	(0.262)	(0.348)	(0.215)	(1275.331)
$\ln(Assets_t)$	0.1284***	0.3399***	0.3074***	-0.0045	0.0509	0.3018***
	(0.029)	(0.036)	(0.018)	(0.050)	(0.027)	(0.050)
Inflow Growth	-0.0873	-1.2020***	-0.0833	-0.1251	-0.0208	-0.0018
	(0.087)	(0.247)	(0.052)	(0.156)	(0.049)	(0.048)
$\bar{r}_{t-1,A}$	1.7374**	-0.1989	0.7088	-1.3603	0.5441	1.2097
	(0.619)	(0.892)	(0.436)	(1.001)	(0.699)	(0.742)
Debt	0.9124***	-1.6818***	-0.5571***	-1.9625***	0.5541***	-2.2177***
	(0.128)	(0.173)	(0.068)	(0.243)	(0.106)	(0.238)
International	-0.1089	-0.0147	-0.7302***	-0.2713	0.0882	-17.2103
	(0.197)	(0.156)	(0.110)	(0.215)	(0.153)	(750.461)
N	19,006					
Pseudo R-square	0.0599					

Notes: This table presents the coefficients obtained from estimating a multinomial logit. The dependent variable is *Type of contract*, which is composed of the following types of contracts: based on assets; on assets and income; on own investment performance, on assets, performance or income of other funds (Others); on assets and investment performance; on assets and measures of other funds; on assets, income, investment performance and measures of other funds. The baseline type is contracts based on assets only. *Outsourcing* takes the value of 1 when the investment adviser is unaffiliated with the fund and zero otherwise. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Table 6: Power Measure - Descriptive Statistics

	Panel A Means & Standard Deviations			Panel B Difference in power of outsourcing	
	In-house	Outsourcing	Total	Mean difference	t-statistics
Power	1.277	1.327	1.281	0.0501***	12.65
	(0.137)	(0.161)	(0.140)		
Percent ownership	424.6	464.3	427.2	39.66***	5.38
	(194.5)	(457.6)	(221.2)		
Observations	16,187				

Notes: This table presents raw statistics of the measures of power by type of organizational type: in-house and outsourced management. $Power_{it}$ is $\frac{\partial W_{it}}{\partial r_{it}}\frac{1}{W_{it}}$ as defined by equation (5), *Percent ownership*, which is the Jensen and Murphy (1990) measure of the pay-performance relationship, $\frac{\frac{\partial W_{it}}{\partial r_{it}}}{\frac{\partial RV_{it}}{\partial r_{it}}} \times 1000$. The coefficients are the raw means and standard deviations are in parentheses. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Table 7: Relation of power of contracts and organizational type

	Power				Percent
	(1)	(2)	(3)	(4)	Ownership
Outsourcing	0.052***	0.053***	0.052***	0.052***	20.718
	(0.008)	(0.009)	(0.009)	(0.009)	(39.919)
$\ln(Assets_{t-1})$		0.008***	0.009***	0.010***	-20.039***
		(0.002)	(0.003)	(0.003)	(3.933)
$\bar{r}_{t-1,A}$			0.115	-0.324	55.795
			(0.151)	(0.264)	(101.238)
$Assets_{t-1} \times \bar{r}_{t-1,A}$				0.086**	-2.582
				(0.036)	(16.774)
Constant	1.234***	1.193***	1.191***	1.186***	460.962***
	(0.013)	(0.021)	(0.022)	(0.022)	(27.332)
R-squared	0.321	0.326	0.323	0.324	0.600
Observations	16187	16187	15642	15642	14453
Family×Year FE	Yes	Yes	Yes	Yes	Yes
Objective FE	Yes	Yes	Yes	Yes	Yes

Notes: This table presents the coefficients obtained from estimating the following regression:

$$Power_{it} = \alpha + \beta \cdot Outsourcing_{it} + X_{it}'\gamma + \epsilon_{it}$$

Where $Power_{it}$ is $\frac{\partial W_{it}}{\partial r_{it}} \frac{1}{W_{it}}$ as defined by equation (5), *Outsourcing* takes the value of 1 when the investment adviser is unaffiliated with the fund and zero otherwise. In column 5 the dependent variable is substituted by *Percent ownership*, which is the Jensen and Murphy (1990) measure of the pay-performance relationship.

Additionally the matrix of controls X includes $\ln(Assets_{t-1})$, $\bar{r}_{t-1,A}$, which is the investment adviser's average performance in the previous period in all the funds he was managing, $Assets_{t-1} \times \bar{r}_{t-1,A}$, Family × Year and objective fixed effects. The standard errors in parenthesis are clustered by fund. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Table 8: Difference-in-difference from change

in organizational type from change in organizational type

	$\Delta Power$	$\Delta Power$
$\Delta Outsourcing$	0.096***	0.090***
	(0.019)	(0.016)
$\Delta \ln(Assets_{t-1})$		0.152***
		(0.006)
$\Delta \bar{r}_{t-1,A}$		0.356***
		(0.050)
R-squared	0.041	0.170
Observations	11837	11424
Family FE	Yes	Yes
Year FE	Yes	Yes

Notes: This table presents the coefficients obtained from estimating the following regression:

$$\Delta Power_{it} = \beta \Delta Outsourcing_{it} + \Delta \rho_{Mt} + \Delta X'_{it}\gamma + \Delta \epsilon_{it}$$

Where $Power_{it}$ is $\frac{\partial W_{it}}{\partial r_{it}} \frac{1}{W_{it}}$ as defined by equation (5), *Outsourcing* takes the value of 1 when the investment adviser is unaffiliated with the fund and zero otherwise.

Additionally the matrix of controls X includes $\ln(Assets_{t-1})$, $\bar{r}_{t-1,A}$, which is the investment adviser's average performance in the previous period in all the funds he was managing, $Assets_{t-1} \times \bar{r}_{t-1,A}$ and Family $\times$ Year fixed effects. The standard errors in parenthesis are clustered by fund. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Table 9: Ingredients and organizational design

	Marginal fee	*Dismissal based on number of funds*	*Dismissal based on assets managed*
Outsourcing	0.048***	0.013	0.005
	(0.008)	(0.008)	(0.007)
Outs. x r_{t-1}		-0.060	-0.094**
		(0.049)	(0.041)
r_{t-1}		-0.011	0.008
		(0.012)	(0.010)
$\ln(Assets_{t-1})$	-0.011***	-0.011***	-0.006***
	(0.001)	(0.001)	(0.001)
$\bar{r}_{t-1,A}$	0.093*		
	(0.049)		
Fund age$_{t-1}$		0.000***	0.000
		(0.000)	(0.000)
Inflow Growth$_{t-1}$		0.001	-0.001
		(0.001)	(0.001)
r_{t-2}		-0.019*	-0.010
		(0.011)	(0.009)
Constant	0.833***	0.139***	0.100***
	(0.010)	(0.010)	(0.008)
R-squared	0.726	0.613	0.660
Observations	22259	31825	31825
Family×Year FE	Yes	Yes	Yes
Objective FE	Yes	Yes	Yes

Notes: This table presents the coefficients obtained from estimating two distinct regressions. In the first column, I regress *marginal fee* paid to the investment adviser on *Outsourcing*, which takes the value of 1 when the investment adviser is unaffiliated with the fund and zero otherwise, while controlling for $\ln(Assets_{t-1})$, $\bar{r}_{t-1,A}$, which is the investment adviser's average performance in the previous period in all the funds he was managing.

In the second and third columns I estimate a linear probability model, with dependent dummy variables *Dismissal based on number of funds* and *Dismissal based on assets under management*. The first one is 1 when the fund closes, or switches adviser, and the adviser manages a smaller number of funds in the following period. The second measure is 1 when the fund closes, or switches adviser and the new funds the adviser manages in the following period are smaller than the assets managed in the current fund. The independent variables are *Outsourcing*, r_{t-1}, which is the fund's past performance, *Outs.* $\times r_{t-1}$, $\ln(Assets_{t-1})$, $\bar{r}_{t-1,A}$, Fund age$_{t-1}$, Inflow Growth$_{t-1}$ and r_{t-2}. All regressions include Family $\times$ Year and objective fixed effects. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Table 10: Sensitivity analysis

Panel A: Probability of dismissal independent from performance			
	(a) $\frac{\partial A_{i,t+1}}{\partial r_{i,t}} \neq 0$ Asset dependent of performance	(b) Inflow growth independent of performance	(c) No asset valuation
Outsourcing	0.000	-0.013***	-0.002
	(0.009)	(0.004)	(0.004)
$\ln(Assets_{t-1})$	-0.003	0.009***	0.043***
	(0.003)	(0.001)	(0.001)
$\bar{r}_{t-1,A}$	-0.388	-0.099	0.152
	(0.264)	(0.135)	(0.147)
R-squared	0.297	0.342	0.605
Observations	15480	15676	16352

Panel B: Probability of dismissal dependent from performance			
	(a) $\frac{\partial A_{i,t+1}}{\partial r_{i,t}} = 0$ Asset independent of performance	(b) Inflow growth independent of performance	(c) No asset valuation
Outsourcing	0.040***	0.017***	0.075***
	(0.002)	(0.005)	(0.004)
$\ln(Assets_{t-1})$	0.000	0.020***	0.050***
	(0.000)	(0.001)	(0.001)
$\bar{r}_{t-1,A}$	-0.003	-0.074	0.122
	(0.006)	(0.140)	(0.143)
R-squared	0.877	0.426	0.649
Observations	15808	15695	16380

Notes: This table presents the coefficients obtained from estimating the following regression:

$$Power_{it} = \alpha + \beta \cdot Outsourcing_{it} + X_{it}'\gamma + \epsilon_{it}$$

Where $Power_{it}$ is $\frac{\partial W_{it}}{\partial r_{it}} \frac{1}{W_{it}}$ as defined by equation (5) with different assumptions about the relation between probability of dismissal and performance, and the level of assets and performance. In Panel A, the probability of dismissal is independent from past performance. In column 1 assets depend on performance as estimated from the data. In column 2 I assume inflow growth is independent of performance, and in column 3 I assume there is no asset valuation. In Panel B, the probability of dismissal depends on performance and different assumptions are imposed on the relation between asset and performance. In column 1, assets do not depend on performance. In column 2, assets depend on performance only through asset valuation and in column 3, assets depend on performance only through inflow growth. *Outsourcing* takes the value of 1 when the investment adviser is unaffiliated with the fund and zero otherwise. Additionally the matrix of controls X includes $\ln(Assets_{t-1})$, $\bar{r}_{t-1,A}$, which is the investment adviser's average performance in the previous period in all the funds he was managing, $Assets_{t-1} \times \bar{r}_{t-1,A}$, Family $\times$ Year and objective fixed effects. The standard errors in parenthesis are clustered by fund. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Table 11: Power and difficulty in measuring performance

	Power	Power	Power
Outsourcing	0.085***	0.083***	0.067***
	(0.018)	(0.018)	(0.022)
σ_{alpha3}		-7.197***	-11.149***
		(2.109)	(3.108)
Contract Duration			-0.003
			(0.002)
Contract Duration$\times$			1.107
σ_{alpha3}			(0.706)
Constant	1.138***	1.158***	1.170***
	(0.028)	(0.031)	(0.030)
R-squared	0.188	0.193	0.194
Observations	5443	5443	5443
Family FE	Year	Year	Year
Objective FE	Year	Year	Year
Year FE	Year	Year	Year

Notes: This table presents the coefficients obtained from estimating the following regression:

$$Power_{it} = \alpha + \beta_1 \cdot Outsourcing_{it} + \beta_2 \sigma_{alpha3} + \beta_3 Contract\ Duration + \beta_4 Contract\ Duration \times \sigma_{alpha3} + X'_{it}\gamma + \epsilon_{it}$$

Where $Power_{it}$ is $\frac{\partial W_{it}}{\partial r_{it}} \frac{1}{W_{it}}$ as defined by equation (5) and *Outsourcing* takes the value of 1 when the investment adviser is unaffiliated with the fund and zero otherwise. σ_{alpha3} is the volatility of the fund's monthly alpha estimated using Fama and French (1993) 3-factor model. *Contract duration* is the adviser's tenure at the fund. Additionally the matrix of controls X includes $\ln(Assets_{t-1})$, $\bar{r}_{t-1,A}$, which is the investment adviser's average performance in the previous period in all the funds he was managing, $Assets_{t-1} \times \bar{r}_{t-1,A}$, *Contract duration*$\times$*Outsourcing*, Family, Year and Objective fixed effects. The standard errors in parenthesis are clustered by fund. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Table 12: Power of contracts and the value of the outside option

Panel A: Relation between power of contracts and the value of outside option					
	Potential Market Size			Adviser Dependency	
	Power	Power	Power	Power	Power
ln(*potential market*)	0.012**				
	(0.006)				
ln(*potential outsourcing market*)		0.011**			
		(0.005)			
ln(*number of clients*)			0.013**		
			(0.006)		
Fund Asset Dependency				-0.062***	
				(0.015)	
Fund Compensation Dependency					-0.061***
					(0.014)
R-squared	0.352	0.351	0.352	0.381	0.381
Observations	12351	12348	12351	12351	12351

Panel B: Difference in power between organizational type and outside option			
	Power	Power	Power
Outsourcing	0.060***	0.063***	0.060***
	(0.010)	(0.010)	(0.009)
ln(*potential market*)		0.016**	
		(0.006)	
Fund Compensation Dependency			-0.066***
			(0.014)
R-squared	0.356	0.357	0.386
Observations	12351	12351	12351

Notes: Panel A of table presents the coefficients obtained from estimating the following regression:

$$Power_{it} = \alpha + \beta \cdot Outside\ option_{kt} + X'_{it}\gamma + \epsilon_{it}$$

Where $Power_{it}$ is $\frac{\partial W_{it}}{\partial r_{it}} \frac{1}{W_{it}}$ as defined by equation (5) and $Outside\ option_{kt}$ is the outside option of the investment adviser k which is proxied by five alternative variables. ln(*potential market*) is the logarithm of the sum of size of the investment objectives the adviser participates in. *ln*(*potential outsourcing market*) is the logarithm of the sum of the size of the investment objective times the share of outsourcing in the objective. *ln*(*number of clients*) is the logarithm of the sum of the number of funds in all investment objective the adviser belongs to. Additionally, *Fund asset dependency* is the share the fund represents in the total assets managed by the adviser. And *Fund compensation dependency* is the share the fund represents in the total compensation of the adviser.

Panel B of table presents the coefficients obtained from estimating the following regression:

$$Power_{it} = \alpha + \beta_1 \cdot Outsourcing + \beta_2 \cdot Outside\ option_{kt} + X'_{it}\gamma + \epsilon_{it}$$

Where *Outsourcing* takes the value of 1 when the investment adviser is unaffiliated with the fund and zero otherwise. Additionally the matrix of controls X includes $\ln(Assets_{t-1})$, $\bar{r}_{t-1,A}$, which is the investment adviser's average performance in the previous period in all the funds he was managing, $Assets_{t-1} \times \bar{r}_{t-1,A}$, *Contract duration* is the adviser's tenure in the fund, Family, Year and Objective fixed effects. The standard errors in parenthesis are clustered by fund. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Table 13: Power of contracts and spillovers

	Power	Power	Power
Outsourcing	0.057***	0.054***	0.054***
	(0.004)	(0.004)	(0.004)
$Star_3$		0.019	
		(0.013)	
$Star_3\times$		0.043	
Outsourcing		(0.035)	
$Star_3\times$		0.015***	
Fmly size		(0.004)	
$Star_3\times$*Fmly size*		0.025	
$\times$*Outsourcing*		(0.026)	
$Star_4$			0.021
			(0.013)
$Star_4\times$			0.042
Outsourcing			(0.044)
$Star_4\times$			0.015***
Fmly size			(0.004)
$Star_4\times$*Fmly size*			0.026
$\times$*Outsourcing*			(0.034)
Constant	1.161***	1.156***	1.156***
	(0.026)	(0.024)	(0.024)
R-squared	0.101	0.106	0.106
Observations	15555	15555	15555
Year FE	Yes	Yes	Yes
Objective FE	Yes	Yes	Yes
Test: $H_0 : \beta_4 + \beta_5 = 0$			
F-statistic		2.16	1.40
p-value		0.1642	0.2569

Notes: This table presents the coefficients obtained from estimating the following regression:

$$Power_{it} = \alpha + \beta_1 \cdot Outsourcing_{it} + \beta_2 Star_j + \beta_3 Star_j \times Outsourcing + \\ + \beta_4 Star_j \times Fmly\ size + \beta_5 Star_j \times Fmly\ size \times Outsourcing + X'_{it}\gamma + \epsilon_{it}$$

Where $Power_{it}$ is $\frac{\partial W_{it}}{\partial r_{it}} \frac{1}{W_{it}}$ as defined by equation (5) and *Outsourcing* takes the value of 1 when the investment adviser is unaffiliated with the fund and zero otherwise. $Star_j$ is a dummy variable for funds in the top 10 percentile of j-factor alphas in the year. *Fmly size* is the logarithm of the average fund size of the family relative to the median of the average size of funds in a family. Additionally the matrix of controls X includes $\ln(Assets_{t-1})$, $\bar{r}_{t-1,A}$, which is the investment adviser's average performance in the previous period in all the funds he was managing, $Assets_{t-1} \times \bar{r}_{t-1,A}$, *Fmly funds* is the logarithm of number of funds in a family, Year and Objective fixed effects. The standard errors in parenthesis are clustered by fund. Statistical significance at 1%, 5% and 10% is market with ***, ** and * respectively.

Appendices

A Computation Steps for Power Measure

Take as starting point equation 5.

$$E_t\left[\frac{\partial W_{i,t}}{\partial r_{i,t}}\right] = \phi_{i,t}\frac{\partial A_{i,t}}{\partial r_{i,t}} + \delta E_t\left[\phi_{i,t+1}(1-\mu(r_{i,t}))\frac{\partial A_{i,t+1}}{\partial r_{i,t}}\right] - \delta E_t\left[\phi_{i,t+1}\mu'(r_{i,t})A_{i,t+1}\right] + \delta^2 E_t\left[\frac{\partial W_{i,t+2}}{\partial r_{i,t}}\right]$$

and consider separately $E_t\left[\frac{\partial W_{i,t+2}}{\partial r_{i,t}}\right]$ for the case of the linear fixed fee.

$$\begin{aligned}
E_t\left[\frac{\partial W_{i,t+2}}{\partial r_{i,t}}\right] &= \frac{\partial}{\partial r_{i,t}}E_t\left[\sum_{j=0}^{N_q-2}\delta^j(1-\mu(r_{i,t}))\left(\prod_{l=0}^{j}(1-\mu(r_{i,t+1+l}))\right)\phi_{i,t+2+j}A_{i,t+2+j}\right] = \\
&= -\mu'(r_{i,t})\sum_{j=0}^{N_q-2}\left(\delta^j(1-\mu_q)^{j+1}\bar{\phi}E_t(A_{i,t+2+j})\right) + \\
&\qquad + (1-\mu(r_{i,t}))\sum_{j=0}^{N_q-2}\delta^j(1-\mu_q)^{j+1}\bar{\phi}E_t\left(\frac{\partial A_{i,t+2+j}}{\partial r_{i,t}}\right) = \\
&= -\mu'(r_{i,t})\bar{\phi}A_{i,t-1}\sum_{j=0}^{N_q-2}\delta^j(1-\mu_q)^{j+1}a_q^{j+3} + (1-\mu(r_{i,t}))\bar{\phi}\frac{\partial A_{i,t+1}}{\partial r_{i,t}}\sum_{j=0}^{N_q-2}\delta^j(1-\mu_q)^{j+1}a_q^{j+1}
\end{aligned}$$

This leads to the final result:

$$E_t\left[\frac{\partial W_{i,t+2}}{\partial r_{i,t}}\right] = (1-\mu_q)a_q\bar{\phi}\frac{1-(a_q\delta(1-\mu_q))^{N_q-1}}{1-a_q\delta(1-\mu_q)} \times \left[(1-\mu(r_t))\,E_t\left[\frac{\partial A_{i,t+1}}{\partial r_{i,t}}\right] - \mu'(r_t)a_q^2A_{i,t-1}\right]$$

B Comparison to Jensen-Murphy's assumptions

Jensen and Murphy (1990) first computed a very comprehensive measure of the sensitivity to performance in CEO compensation contracts. They included the effects of performance on current and future compensation, on the values of stock and option holdings and on the probability of dismissal of the CEO. They compute total compensation of the CEO, including current and future salary and bonus, and stock and option holdings. They assume changes in salary and bonuses today will last until retirement. Total compensation is regressed on the change of shareholder wealth to obtain the sensitivity of compensation due to changes in performance. This exercise produces a sensitivity to performance parameter associated with CEO compensation.

To account for the probability of dismissal, they estimate this probability for different levels of returns. Assuming a fixed manager wage of \$1 million per year and a zero outside option, they

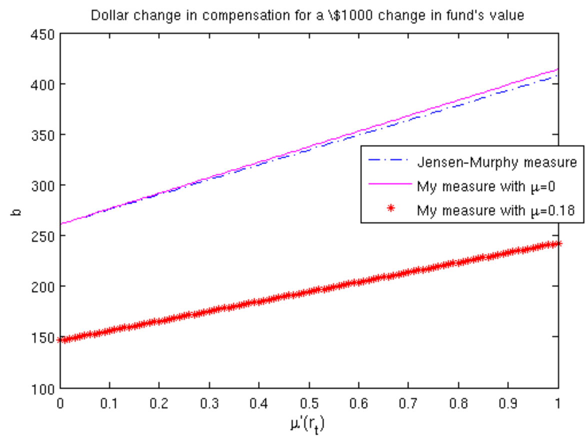


Figure 4: Percentage ownership measure as a function of the sensitivity to performance

compute the estimated wealth loss for the manager when firm returns match the market return and when firm returns are 50% below the market return. They compute the sensitivity to performance due to changes in the probability of dismissal by comparing the incremental wealth loss of the manager to the loss shareholders face when firm returns change from matching the market to being 50% below the market. This produces a sensitivity to performance parameter associated with CEO dismissal. The overall sensitivity parameter is computed by adding the two sensitivities to performance obtained.

The parameter obtained is nevertheless different from the one obtained in this paper by modeling the adviser's compensation. The difference hinges on the fact that, although they compute the effect on the parameter due to a change in the probability of dismissal in the current period that results from variations in performance, they otherwise assume that the probability of dismissal in each period is zero.

Figure 4 shows how Jensen and Murphy (1990) evolves as the sensitivity of dismissal to performance changes. The dashed line represents their measure. Percent ownership increases with the sensitivity of dismissal to performance, which is what is expected. The line is computed using the model I developed, with the assumption that the expected per period probability of dismissal is zero, to make the same assumption they make. These two lines are identical. However, in my model I assume a per period probability of dismissal. Using the average dismissal probability found in the data, 18%, I generate the thicker line. It is increasing in $\mu'(r_{it})$ but always below Jensen-Murphy measure. according to my results their measure overestimates the percent ownership when assuming a per period probability of dismissal of zero.

Figure 5 further illustrates this point by showing how percent ownership varies with probability

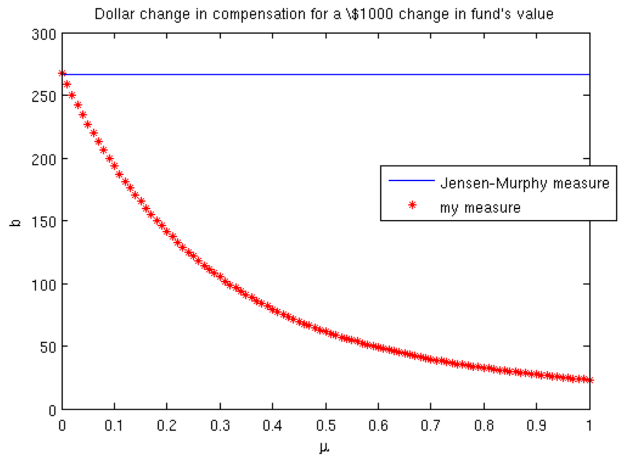


Figure 5: Percentage ownership measure as a function of the probability of dismissal

of dismissal when modeling compensation as I described. The percent ownership computation due to the sensitivity of dismissal to performance assumes a loss from dismissal in a given period. The expected loss is computed assuming dismissal today but employment for sure in every subsequent period. This is what explains the difference between the two methods.

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