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All in the family: Economies of scale in retail and institutional investment management

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Abstract

This paper examines the (dis)economies of scale related to the joint management of retail mutual funds and institutional funds (i.e., investment portfolios catering to institutional clients). Similar to well-known observations for mutual funds, the performance of institutional funds is negatively related to fund size but positively related to fund family size, suggesting diseconomies of scale at individual fund level and economies of scale at fund family level. More importantly, there is spillover of the family size effect -- the performance of mutual funds (institutional funds) is positively related to the total institutional assets (mutual fund assets) managed by the same firms. We also find that certain types of funds -- e.g., larger mutual funds and institutional funds with higher fees -- benefit more from this spillover effect, suggesting that large investment firms are able to deploy firm-wide resources to favor a subset of funds that are of high value to the firms. However, there is no evidence that jointly managed funds, either retail or institutional, perform worse than independently managed ones. Overall, our findings suggest that the prevalence of jointly managed retail and institutional funds is consistent with economies of scale in the investment management industry.

I. Introduction

Institutional funds are delegated investment portfolios managed by external investment advisory firms and catering to institutional clients such as pensions, insurers, foundations, and university endowments. By assets under management, the institutional fund industry is comparable in size to the retail mutual fund industry, and dwarfs the hedge fund industry.[2] Institutional funds and retail mutual funds serve different investor clienteles, take different product forms, and are subject to different regulations. Nevertheless, they may employ similar investment strategies and require similar skills in terms of identifying mispricing and timing the market, to the extent that many investment advisory firms find it appealing to offer both type of products. Indeed, the joint management of retail mutual funds and institutional funds is quite prevalent. The largest mutual fund companies in the U.S., such as Vanguard, Fidelity, Capital Research and Management, and T. Row Price, are also among the largest institutional fund managers. The size of the institutional assets they manage is often comparable to (or even exceeds) the size of their mutual fund assets.

The concurrent management of retail and institutional funds suggests that various decisions within fund management companies -- for example, allocating managers and analysts to funds, sharing investment ideas, coordinating trade executions, and launching new products – are made with both types of funds in mind, rather than for each type alone. This aspect of the investment management industry has not attracted sufficient attention of academic studies. With a few exceptions (discussed later), the vast research on mutual funds and the burgeoning literature on institutional funds typically look at the two types of funds separately.

In this study, we examine whether there are economies of scale, or lack of it, in the joint management of retail and institutional funds. Economies of scale are perhaps the most important economic rationale for such a joint fund management phenomenon. Conceptually, investment firms managing both types of funds may enjoy operating synergies, such as efficient allocation

[2] The main product form of institutional funds is separately-managed accounts, with a small proportion of institutional funds offered in the form of commingled funds and institutional mutual funds. Institutional funds (except institutional mutual funds) are not subject to the regulation of the Investment Company Act of 1940, which regulates mutual funds. See a publication by the Investment Company Institute (2006) for a detailed comparison of these two types of funds. By some tally, institutional funds have $6 trillion to $7 trillion assets under management, which is about half of the size of the mutual fund industry, and more than twice the size of the hedge fund industry.

of investment talents, and cost savings in shared accounting, client service, and other back-office functions. For fund investors, perhaps the most relevant synergies for fund investors are those directly affecting fund performance. However, based on what we know from existing studies that are discussed below, synergy gains for fund performance are not to be taken for granted. It is well-observed that the investment management industry suffers from decreasing return to scale. Further, managing products that cater to different clienteles may create incentive problems on the part of fund managers. It is unclear, but important to find out, whether the joint management of retail and institutional funds is good news or bad news for fund performance.

The decreasing return to scale in the mutual fund industry has been well documented by existing studies; see, e.g., the pioneering study by Chen, Hong, Huang, and Kubik (2004) and subsequent studies by Yan (2008) and Pollet and Wilson (2008). These studies show that fund performance is negatively associated with fund size, and link this relation to illiquidity and organizational diseconomies. The negative relation between fund size and performance has also been documented for the hedge fund industry; see, e.g., Naik, Ramadorai, and Stromqvist (2007), Fung, Hsieh, Naik, and Ramadorai (2007), and Zhong (2008), Teo (2009), Getmansky (2012), and Yin (2016). By an interesting contrast, economies of scale, if any, are only visible at the fund family level – notably, Chen, Hong, Huang, and Kubik (2004) report a positive relation between mutual fund performance and the total mutual fund assets managed by the fund company. On an ex ante basis, it is unclear whether joint management of retail and institutional funds leads to exacerbated decreasing return to scale (due to combined size of retail and institutional products being similarly managed) that resembles the individual fund size effect, or has a positive impact on fund performance that resembles the family size effect. Further complicating the matter, the pervasiveness of this positive family size effect is questioned recently by Yin (2016). He finds that in the hedge fund industry, the relation between fund performance and family size is negative.

Conflicts of interest may arise whenever the same fund manager or the same investment firm serves two different types of clients (retail and institutional). In particular, because payoffs received from different clients are different, the investment firm may allocate efforts and resources discriminatively to favor one type of clients over another. Several studies, including Chen and Chen (2009), Nohel, Wang, Zheng (2010), Cici, Gibson, and Moussawi (2010),

Guercio, Genç, and Tran (2016), examine the performance consequence of conflicts of interest in side-by-side management of mutual funds and hedge funds, with somewhat mixed conclusions.[3] One may argue that conflicts of interest are less acute when a mutual fund firm manages institutional funds, relative to the case of a mutual fund firm manages hedge funds, because fees collected by hedge funds are much more sensitive to performance relative to those by mutual funds, while the assets-based fee structures of institutional funds and mutual funds are more homogenous. Nevertheless, retail and institutional funds differ in investor sophistication, sensitivities of flows to fund performance, levels of assets-based fees, as well as regulations on disclosure and investor protection. Thus conflicts of interest remain a valid concern in the context of our study. Interestingly, the existing studies have reached mixed conclusions regarding whether simultaneous management of hedge funds hurts the performance of mutual funds. [4] Thus, this issue is far from settled in the literature.

We examine the implications of joint management of retail and institutional money on investment performance, for both retail and institutional funds, and at individual fund level as well as at the family level. To do so, we combine data on mutual funds from CRSP with data on institutional funds from a newly available source, eVestment Alliance, and then manually identify investment firms that jointly manage mutual funds and institutional funds. Our sample includes actively managed mutual funds and institutional funds that primarily invest in U.S. stocks, during the period of 2001-2015. Below, we describe several key findings of the paper and discuss their implications.

First, we show that, within the mutual fund segment and within the institutional fund segment, fund performance is negatively associated with individual fund size while positively associated with fund family size. Our findings for mutual funds confirm those documented in

[3] These studies do not examine the issue of economies of scale, because the hedge funds assets managed by mutual fund companies are typically much smaller than their mutual fund assets, making economies of scale less of a concern.

[4] Cici et al. (2010) find that mutual fund performance suffers when fund companies also manage hedge funds. Nohel et al. (2010), however, find that fund managers deliver superior mutual fund performance when they also manage hedge funds. They point out that this finding is consistent with fund management companies using hedge funds to retain talented managers. Chen and Chen (2009) separate the case where a hedge fund manager starts the management of a mutual fund from the case where a mutual fund manager starts to manage a hedge fund. They find conflicts of interest in the former case but not the latter. Finally, based on SEC filings, Guercio, Genç, and Tran (2016) identify a more complete sample of side-by-side managed mutual funds and hedge funds for recent years, and find that such side-by-side arrangements hurt mutual fund performance.

existing studies (e.g., Chen et al. 2004) that there are diseconomies of scale at individual fund level and economies of scale at fund family level. Our new findings regarding institutional funds suggest that the scale economics for institutional funds is quite similar to that for mutual funds, but different from hedge funds, which exhibit decreasing returns to scale even at the fund family level (Yin 2016). We conduct analysis using panel regressions. Inferred from regression coefficients, the negative impact of fund size on performance for institutional funds is similar in magnitude to that for mutual funds, while the positive effect of family size on performance for institutional funds is smaller in magnitude to that for mutual funds.

More importantly, we document a significant spillover effect of family size. Specifically, we find that mutual fund performance is positively related to the total institutional fund assets managed by the same firms, and institutional fund performance is positively related to the total mutual fund assets managed by the same firms. Not only are such spillovers mutual, judged by regression coefficients the spillover effects for mutual funds and for institutional funds are at about the same magnitude. This essentially says that the performance of both types of funds gets a boost by from large amount of combined assets managed by the same firm. Therefore, economies of scale work at the whole firm level, which are possibly driven by the operating synergies, e.g., efficient deployment of investment talents and other limited resources between mutual funds and institutional funds.[5] As a further implication, by ignoring the prevalent phenomenon of joint management of mutual funds and institutional funds, previous studies may have underestimated the magnitude of economies of scale in the investment management industry.

Interestingly, while we detect significant spillover of the family size effect, there is no significant evidence for spillover of the fund size effect. To assess spillover at the fund level, we identify mutual funds and institutional funds that are managed by the same firms and belong to the same investment style. We find that the relation between institutional (mutual) fund performance and the size of same-style mutual (institutional) funds is insignificantly negative. That is, there is no substantial performance loss to a fund when the firm manages large amount of assets in a similar investment style but in the form of a different fund type. Chen et al. (2004)

[5] Note that the spillover of family size effect only captures the synergies from allocating resources that directly impact performance. Operating synergies in the form of cost savings from administrative and back office functions do not directly affect fund performance. Such synergies cannot be detected by our performance analysis.

observe that illiquidity and organizational diseconomies impose capacity constraints on funds and are behind the negative fund size effect. Our findings likely indicate that fund companies may have been able to alleviate the capacity constraints when they jointly manage retail and institutional funds with similar investment styles. For example, they may assign different managers to the same-style mutual funds and institutional funds to ensure they generate sufficiently diverse investment ideas, and carefully coordinate the trades from the two types of funds.

Further, we find that the spillover benefits of the family size effect are distributed unevenly across individual funds. Within mutual funds, those with the large size or belong to the investment style with the largest amount of assets benefit more in performance than others from the institutional family size of the same firm. Within institutional funds, those with high expense ratios benefit more in performance than others from the mutual fund family size of the same firm. Note that large funds and high-expense ratio funds are perceived of higher value to the fund management companies (e.g., Gasper, Massa, and Matos, 2006). Thus, a possible interpretation of this finding is that large investment firms deploy firm-wide resources in a way that disproportionally benefit high-value funds.

Finally, despite the evidence for the existence of economies of scale in the joint management of mutual and institutional funds, we question whether at the same time conflicts of interest also significantly affect performance in the context of jointly managed funds. To detect all forms of conflicts of interest is challenging and perhaps unrealistic. Here, we limit our examination to the analysis of significant performance transfer, following the analysis in existing studies on the joint management of mutual funds and hedge funds (e.g., Nohel et al. 2010; Cici, et al. 2010). We find that, relative to their independently managed counterparts, jointly managed mutual funds and institutional funds on average perform at least no worse; and in some cases, they perform substantially better. Thus, if there is any performance transfer between mutual and institutional funds, the magnitude is not strong enough as to cause detectable performance deterioration on the part of either type of funds. This is consistent with the notion that due to similar fee structure, investment firms face similar incentives for fund performance for the two types of funds, creating no urge for performance transfer.

Overall, the evidence gathered from our study shows that economies of scale at investment firm level do exist when such investment firms manage both retail mutual funds and institutional funds. By managing large amount of assets, such investment firms enjoy a scale advantage – they have more sources and can allocate limited resources more efficiently, and they may be able to attract and retain talented investment managers and analysts. This offers a rationale for the prevalence of the joint management practice. We also find that certain funds, especially those of high value to the investment firms, benefit more from economies of scale, suggestively of uneven allocation of firm-wide resources by investment firms. However, we do not detect substantial performance transfer between mutual funds and institutional funds when they are jointly managed. This indicates that fund performance has not yet suffered substantially from conflicts of interest, if any, arising from the joint management practice.

In Section II we provide a detailed review of related literature. Here, we provide a focused discussion on two studies that explicitly take into account the joint management of mutual funds and institutional funds, and therefore are most related to ours. First, Evans and Fahlenbrach (2012) examine the performance of a subset of retail mutual funds that offer a separate version of the fund for institutional investors in either mutual fund or separate account form, but where the same managers follow virtually the same strategy for both the retail and institutional assets. They find that retail mutual funds with institutional twins perform better than retail funds without. They attribute this performance difference to the spillover effect of investor governance; that is, retail fund investors benefit from the monitoring efforts by sophisticated institutional investors on fund performance. Second, based on SEC filings by fund companies, Guercio, Genç, and Tran (2016) examine the case where mutual fund managers simultaneously manage either hedge funds or institutional funds. They find that mutual fund performance suffers when mutual fund managers are also involved in the management of hedge funds, but no significant performance impact when mutual fund managers are involved in managing institutional funds, regardless of whether institutional funds charge performance-based fees or not.

There are two key differences between the above two studies and ours. First, the above two studies are interested in the incentive and governance problems, but do not say anything about the issue of interest in our study, (dis)economies of scale. Second, these studies do not have data on the performance of institutional funds, and instead focus on the performance of

mutual funds. By contrast, we are able to combine data on both mutual funds and institutional funds, and analyze the performance consequence on both mutual funds and institutional funds. Being able to tell the stories of both sides is particularly important for assessing economies of scale.

The rest of the paper is organized as follows. Section II provides a literature review. Section III discusses the data and sample. Section IV reports empirical results. Section V concludes.

II. Related Literature

Relative to the large literature on mutual funds, there has been relatively sparse research on the institutional funds. The following papers, to our knowledge, delineate the main landscape of academic research on institutional funds in the U.S. Del Guercio and Tkac (2002) examine 562 pension fund managers and find that institutional clients consider excess fund return rather than raw return in deciding capital allocation. They also report that institutional flows respond sensitively to both good and poor past performance. Goyal and Wahal (2008) focus on plan sponsors' hiring and firing decisions of institutional investment managers, and find evidence of return chasing, especially for hiring decision, but they do not examine the general flow pattern. In terms of performance and persistence, Lakonishok, Shleifer, and Vishny (1992) show that conflicts of interests prevent (341) institutional funds from adding value to end investors. James and Karceski (2006) report that institutional mutual funds with low initial investment requirements and those with retail mates perform significantly worse than other institutional mutual funds. They attribute their findings to the effect of investor monitoring. Busse, Goyal and Wahal (2010) also find little evidence of performance persistence for institutional funds. Recently, Chaudhuri, Ivkovic, and Trzcinka (2013) report evidence that institutional investment management firms strategically allocate performance across various funds they manage, in a way to maximize the benefit to the management firms themselves. Chaudhuri, Ivkovic, Pollet, and Trzcinka (2013) report that Ph.D. degrees earned by fund managers are a positive indicator of institutional fund performance. Finally, Jenkinson, Jones, and Martinez (2016) study the role of investment consultants in advising institutional clients and find that consultants' recommendations negatively predict institutional fund performance. These studies, however, do

not focus on the key issue we are interested in, i.e., economies of scale in the joint management of retail and institutional funds.

By comparison, many studies have analyzed the (dis)economies of scale in the mutual fund industry. Diminishing return to scale features prominently as an assumption in the theories offered to explain various phenomena in the mutual fund industry; see, e.g., Berk and Green (2004), and Pastor and Stambaugh (2012). It is well observed that when a mutual fund grows larger, it becomes more difficult for the fund to identify worthwhile investment opportunities and its trading costs increase. On the other hand, large fund management firms may have more research resources, more dedicated trading desks, and potentially more efficient operations due to organizational advantages in terms of marketing and distributions.

Evidence on diseconomies of scale in the mutual fund industry has been widely reported. Chen, Hong, Huang, and Kubik (2004) represent the seminal work on this issue. They further hypothesize that the result is driven by liquidity and its interaction with organizational diseconomy, and provide empirical evidence consistent with this hypothesis. Subsequent studies including Yan (2008) and Pollet and Wilson (2008) report evidence consistent with the diseconomy of scale for mutual funds and further investigate the causes of the diseconomy of scale. Yan show that the negative relation between fund size and performance is stronger among funds holding less liquid portfolios as well as funds demanding more intermediacy for trading (e.g., growth funds and high turn-over funds). Pollet and Wilson (2008) find that when fund size grows, funds are reluctant to increase the number of positions, and only those few with better investment ideas do so. Thus lack of new investment ideas combined with the price impact of large positions exacerbates the role of liquidity in driving the relation between fund size and performance. Recently, Pastor, Stambaugh, and Taylor (2013) examine the implication of changing stock selection skills among fund managers in the inference on diseconomy of scale. They detect decreasing return to scale at the fund industry level but not at individual fund level. They argue that the emergence of new funds with stock selection skills complicates the detection of decreasing return to scale at individual fund level. Reuters and Zitzewitz (2015) focus on the fund size change due to large fund flows induced Morningstar fund rating changes and find that such fund size change is not related to subsequent fund performance.

Chen et al. (2004) also report that fund family size is positively related to fund performance, suggesting economy of scale at the fund family level. They conjecture, albeit without empirical investigation, that this effect is driven by large fund families' advantages in marketing and in trading. Pollet and Wilson (2008) offer an additional explanation based on large fund families' advantage in research; they find that fund family growth is typically related to introduction of new funds with relatively low portfolio overlaps with existing funds. Thus fund families appear to be able to take advantage of new investment ideas as they grow.

There are also quite extensive studies on the decreasing return to scale, or capacity constraints, in the hedge fund industry; see, e.g., Naik, Ramadorai, and Stromqvist (2007), Fung, Hsieh, Naik, and Ramadorai (2007), Zhong (2008), Teo (2009), Getmansky (2012), and Yin (2016). Interestingly, Yin (2012) documents that in the hedge fund industry, fund family size negatively impacts hedge fund performance. Thus, there are diseconomies of scale for hedge funds, even at the fund family level.

The implications on the joint management of mutual funds and hedge funds are the subject of analysis by Chen and Chen (2009), Cici, Gibson, and Moussawi (2010), Nohel, Wang, and Zheng (2010), and Guercio, Genç, and Tran (2016). Relative to mutual funds, hedge funds offer more attractive fee revenues to fund advisors. A typical hedge fund advisor charges 2% flat fees based on assets under management, plus 20% performance-based fee. By contrast, a typical equity mutual fund advisor charges 1% flat-fees on assets under management. Thus, fund advisors may have incentives to devote more resources and efforts to the management of the more lucrative hedge fund business, away from the mutual fund business. Cici et al. examine the performance of mutual funds when the fund companies also manage hedge funds. They focus on the conflicts of incentives offered by hedge funds vs. mutual funds. Consistent with the idea that fund companies divert resources and efforts to the more lucrative hedge fund business, they find that mutual fund performance tends to suffer when hedge funds are jointly managed by the same advisory firms. This conclusion is not without debate though. In comparison, Nohel et al. point out that fund companies often use hedge fund business as a way to retain star mutual fund managers. By looking at the cases where an individual fund manager jointly manages mutual funds and hedge funds, their sample selection is also different from that of Cici et al. Consistent with their hypothesis, they find that in the cases of side-by-side management, mutual funds

generate superior performance, while hedge funds do not outperform peers. Similar to Nohel et al. (2010), Chen and Chen (2009) also look at the cases of individual managers concurrently managing mutual funds and hedge funds. However, they separate the case where a hedge fund manager starts the management of a mutual fund from the case where a mutual fund manager starts to manage a hedge fund. They find conflicts of interest in the former case but not the latter. Finally, based on SEC filings on disclosure of performance-based fees, Guercio, Genç, and Tran (2016) find that side-by-side management of mutual funds and hedge funds hurts mutual fund performance.

Finally, existing studies have examined incentive issues within the family of mutual funds managed by the same advisory firms. Prominently, Gasper, Massa, and Matos (2006) find that funds with important "family values", i.e., those with high fees or high past performance, outperform at the expense of "low family value" funds. Further, "high-value" funds receive favorable treatment by the fund families—they receive more allocations of underpriced IPO shares, and are at the better side of transactions when they have trades in the opposite direction of trades made by other funds in the same families. Chaudhuri, Ivkovic, and Trzcinka (2013) report strategic performance transfer within institutional fund families. However, no academic research has examined differential treatment of institutional funds and mutual funds under the same advisory firms.

III. Data and Sample

III.1 Data

Our data mainly come from two sources. Data on mutual funds are from CRSP, i.e., the CRSP Survivorship Free Mutual Fund Database. The CRSP database reports mutual fund returns and fund characteristics at the level of each fund share classes. By contrast, institutional funds do not have share classes. To facilitate comparison, we combine multiple share classes of the same mutual fund into a single fund, by taking the weighted averages overfund returns and characteristics, using the TNAs of share classes as weights.

Data on institutional funds are from a relatively new source: eVestment Alliance. Below we provide details about the eVestment data.

The Investment Company Act of 1940 requires mutual funds to price their shares and disclose performance to fund investors on a daily basis. By contrast, there is no such reporting requirement for institutional funds in general. In fact, the disclosure practice of institutional funds (other than institutional mutual funds) is quite similar to that of hedge funds. In order to attract investments, institutional funds voluntarily provide periodical performance data to investment consultants and certain commercial data vendors. This has been the main sources of data on this industry.

A few existing studies on the institutional fund industry use data from investment consultants. For example, Lakonishok et al. (1992) use the data provided by the consultant SEI. Data used by both Coggin et al. (1993) and Christopherson et al. (1998) are from Frank Russell. Ferson and Khang (2002) use data from Callan Associates. Goyal and Wahal (2008) use data from Mercer. And the U.K data used by Blake et al. (2013) are from the consultant subsidiary of BNY Mellon. As pointed out by Lakonishok et al. (1992), investment consultants often only have data on funds that their clients invest in or may potentially invest in, and thus may be subject to potential selection biases. The data collected by consultants in early periods are typically not survivorship bias free.

A few commercial vendors have attempted to gather more complete coverage of this industry, and have made their data available to consultants, plan sponsors, investment managers, as well as researchers. The early data vendors include Plan Sponsors Network (PSN) and the Mobius Group; both later acquired by Informa Investment Solutiuons (IIS) (in 1998 and 2006 respectively). Currently, IIS and eVestment Alliance are the two main commercial data vendors on institutional fund data. Del Guercio and Tkac (2002) use data from Mobius, Busse et al. (2010) use data from IIS, and Jenkinson et al. (2016) use the eVestment data, respectively. There are similar quality issues on data collected by these vendors during early periods. However, data quality has improved over time. For example, Del Guercio and Tkac (2002) note that the Mobius data they use are subject to the survivorship bias. By contrast, Busse et al. (2010) note that the data from IIS (the successor to Mobius) are free from the survivorship bias.

Based on our conversations with data vendors, the differences between the IIS data and the eVestment data are mainly in terms of their coverage for early years and for international advisory firms. IIS has better fund coverage for early periods, while eVestment has better coverage for institutional fund managers outside the U.S.. In terms of U.S. domestic institutional funds, since the 2000s, the coverage by eVestment is comparable to that of IIS and both are free of the survivorship bias. In addition, the eVestment data have more information on the management firm characteristics and fund characteristics, which are important to our study.

For the above considerations, we choose eVestment as our main data source for institutional funds. The information provided by eVestment include quarterly assets under management, monthly (as well as quarterly and annual) returns, fee scheme, investment approach, the profile of investment advisory firms, as well as information about the investment accounts that reveal the characteristics of investment clients. The sample in our study is the actively-managed institutional funds that are domiciled in U.S. and mainly invest in domestic equities, for the period from 1998 to 2014. Even though data for earlier years are available, we focus on this relatively recent period to alleviate data quality issues discussed above.

The eVestment data deal with the survivorship issue in the following way. If a fund stops reporting to the database at a certain time point, the fund is classified as “inactive”. The database provides the date on which a fund becomes inactive, and keeps all the historical data prior to the inactive date. Note that survivorship is not the only known issue for self-reported performance data. To alleviate the incubation bias (e.g., Evans 2010), we only include fund performance observations after a portfolio’s inception date and exclude funds with assets under management below $25 million (as funds in incubation typically are small). To address the back-filling bias, we require at least 24 months of prior performance data for a fund to be included in analysis.

We proceed to discuss a few unique reporting conventions in the institutional fund industry to help understand the way we process the data. Although collectively referred to as ``institutional funds" in our study, delegated investment portfolios catering to plan sponsors actually take several forms, ranging from separately managed accounts, commingled funds, to the institutional version of mutual funds. For this reason, the institutional funds are termed “products” in the database. Each product consists of a number of investor accounts. As noted by Del Guercio and Tkac (2002) and Busse et al. (2010), because separate-account clients can

request various portfolio restrictions or adjustments, accounts under the same product can have slightly different portfolio compositions even though they are managed by the same manager using the same strategy. This creates complications in performance reporting.

The fund returns reported in the database are "composite returns". They are returns net of trading costs but gross of management fees, on "composite portfolios", i.e., combined holdings from various representative investment accounts of the same product. Similar to the practice in the mutual fund industry, fees charged on an institutional account are typically a flat percentage of the account size.[6] The percentage fees typically decline when the account size exceeds certain breakpoints, e.g., $10 million, $50 million, and $100 million. Therefore, the after-fee returns of individual accounts under the same product can be different due to both difference in portfolio compositions and difference in fees.

We calculate the average expense ratio of an institutional portfolio based on the fee for the average account size of the main product form of the portfolio. For example, if the main product form is separate account, and the average separate account size is $15m, then we take the expense ratio set for accounts with size between $10m and $50m.

We measure net fund return, or after-expense fund return, as the reported composite return minus the average expense ratio. The return calculated this way represents the experience of an investor with an average-sized account of that portfolio. We have alternatively calculated returns based on the maximum or minimum percentage fee. We have also performed analysis by only including return records where the composite portfolio represents a very high fraction of the entire portfolio (following Del Guercio and Tkac 2002). The analyses based on such alternative fee assumptions and composition restrictions do not result in any significant departure from our conclusions. For brevity we do not tabulate the results of such alternative analysis in the paper.

Further, for both mutual funds and institutional funds, we measure abnormal fund performance by the style-adjusted net return of a fund. The net returns of mutual funds are

[6] eVestment and IIS do not report the performance-based fees in their datasets. Performance-based fees were rare for institutional products in the early sample period but are more often observed in recent years. Based on our inquiry with a large institutional investment management firm, between 10% and 20% of the accounts it manages have performance fees now. However, the amount of fees tied to performance is much smaller than that tied to account size (even for their top-performing products). Further, performance-based fees charged by institutional funds are at a much smaller percentage relative to those charged by hedge funds.

directly reported in CRSP. As explained above, the net returns of institutional funds are the reported composite returns minus the average expense ratio. All funds are then classified into one of twelve investment styles. The investment styles are based on the marketcap and value dimeions, including Allcap Core, Allcap Growth, Allcap Value, Largecap Core, Largecap Growth, Largecap Value, Midcap Core, Midcap Growth, Midcap Value, Smallcap Core, Smallcap Growth, and Smallcap Value. In the CRSP data, we follow the Lipper investment objective code to classify investment styles, and map Lipper investment objectives into the above 12 styles. In eVestment, we follow the investment universe classification provided in the data and map them into the above 12 styles. The details of investment style mapping are provided in the Appendix of the paper.

Once we obtain the style classifications of each mutual fund and institutional fund, we calculate a monthly benchmark return for each style, separately for mutual funds and institutional funds. The style benchmark return is the average monthly net return of all funds in that style. Then, we measure abnormal monthly performance of a fund -- denoted as PERF in the rest of the paper -- as the monthly net return minus the benchmark return for the style the fund belongs to. This procedure is done separately for mutual funds and for institutional funds.

In Table 1, we provide the details of all the variables employed in our analysis, including the style-adjusted fund performance measure, fund size, fund family size, etc..

III.2 Identifying Joint Management of Mutual Funds and Institutional Funds

Given our purpose of studying economics of scale for actively managed equity portfolios, we begin with all investment firms managing active US equity mutual funds from the CRSP data, and all investment firms managing active US equity institutional funds from the eVestment data. The sample period is from 1998 to 2014.

To identify advisory firms that concurrently manage mutual funds and institutional funds, we match the names of investment firms in the eVestment data with the names of investment firms in the CRSP data. We use an algorithm to match the firm names first. The algorithm takes into account patterns of variations and abbreviations in firm names in the two databases (e.g.,

one database using the abbreviation "mgmt" while another using "management" in a firm's name). We then manually verify the matched names, and perform additional manual matching among the remaining firms that the algorithm fails to identify initially.

Having identified investment firms that manage both mutual funds and institutional funds, we then identify, within each firm, specific institutional funds and mutual funds that have the same investment styles. When funds of the same investment firm have the same investment style, they likely have substantial overlaps in stock holdings and trades. Thus they may suffer from diseconomies of scale jointly as if they were a single fund. Following Cici et al. (2010) and Nohel et al. (2010), we refer to these matched funds as "side-by-side managed" (SBS) funds. We use two methods to identify such SBS funds. First, we use fund investment styles reported in both eVestment and CRSP to perform such matching. Second, we use the return regression to estimate the factor exposures of a fund and determine the investment styles by the estimated factor exposures.

III.3 Additional Data Details

Before going into the summary statistics of the sample and the empirical results, below we discuss three additional pieces of data details,

III.3.1 Institutional Mutual Funds

First, mutual funds and institutional funds are not mutually exclusive concepts. Institutional mutual funds or the institutional share classes of mutual funds, are both mutual funds and institutional funds, and they show up in both CRSP and eVestment. When we construct the samples, an issue we have to deal with is how to classify these funds – whether to include into the mutual fund sample or the institutional fund sample.

It turns out that the aggregate assets of these funds or share classes are relatively small, compared with either the aggregate size of retail mutual funds or the aggregate size of institutional funds. Therefore, we find that the conclusions are not sensitive to how these institutional mutual funds are classified. In our reported analysis we treat them as mutual funds and exclude them from the institutional fund sample. We note that if we treat them as

institutional funds and exclude them from the mutual fund sample, all our key results remain unchanged.

III.3.2 Subsidiaries of Investment Firms

A second issue is the treatment of subsidiaries of parent investment firms. From time to time, conglomerates emerge in the investment management industry. In these conglomerates, a large investment firms hold full ownerships or majority-ownerships of a collection of small investment firms. Take Legg Mason for example. While Legg Mason itself is an investment firm with a large mutual fund operation and a large institutional fund operation, it also owns nine subsidiaries that manage wide varieties of investment portfolios – Brandywine Global, Clarion Partners, ClearBridge Investments, EnTrustPermal, Martin Currie, QS Investors, RARE, Royce & Associates, and Western Asset.[7] The investment decisions are made relatively independently by the subsidiaries, but many back-office functions are somewhat integrated at the parent firm level.

In CRSP and eVestment, assets managed by these subsidiaries are reported separately from the assets managed directly by the parents. That is, the subsidiaries are considered separate investment firms or families. A question arises when studying economies of scale – should we aggregate the assets to the parent firm level, and consider the family size effect at such a highly aggregated level, or treat each subsidiary as a family and consider the family size effect at the subsidiary level?

In our reported analysis, we choose to treat subsidiaries as families without aggregating to the parent firm level. The reason behind our choice is that investment decisions are typically made at the subsidiary level, and therefore, if there are any synergies in investment operations, most likely such synergies take place across portfolios within the same subsidiary. Because of lack of investment resource sharing across subsidiaries, we are less likely to see synergies across subsidiaries.

III.3.3 Actively Managed Equity Assets vs All Assets

[7] See https://www.leggmason.com/en-us/about/affiliates.html.

A third issue we have to deal with is the tally of family size. Investment firms sometimes manage money in multiple asset classes, from equities, fixed income, to real estates and commodities, etc.. While synergies for back-office operations may exist across investments in different assets classes, the synergies for investment operations are less likely so. Conceptually, the performance of a stock fund may unlikely benefit from having many fixed income fund managers working in the same firm.[8] Similarly, within the equity funds, the performance of an active fund may unlikely benefit from having many index equity fund managers around. Therefore, in all our reported analysis, we calculate family size as the total net assets of all the actively managed equity portfolios of a firm.

III.4 Summary Statistics

Here we provide summary statistics on the samples of mutual funds, institutional funds, and the jointly managed funds. First, in Table 2, we list the largest 10 mutual fund management firms and the largest 10 institutional fund management firms. The largest firms are defined by the total active equity TNA they manage as of December 2014, the end of our sample period. A quick browse through the list reveals the prevalence of the joint management of mutual funds and institutional funds. Five of the top ten mutual fund firms also show up among the 10 largest institutional fund firms – Vanguard, Fidelity, T Row Price, Capital Group, and JP Morgan. Among the remaining 5 institutional fund firms, 2 are also well-known to have large mutual fund assets, even though they are not among the top 10 mutual fund firms – BlackRock, and Wellington Capital Management. However, there are also dedicated institutional fund managers without substantial mutual fund assets, such as State Street Global Advisors, Northern Trust, and Mellon Capital.

Table 3 provides summary statistics on the entire mutual fund sample and the entire institutional fund sample. The statistics provided in the table include the number of firms, number of funds, TNAs, turnover ratio, expense ratio, and fund age. They are first obtained for each year (1998-204), and then averaged over years. The total net assets under management

[8] See, for example, a Wall Street Journal report on the issues faced by stock funds managed by the fixed income giant PIMCO -- "PIMCO Pulls Out of Stock Strategies", Wall Street Journal, May 14, 2015.

(TNA) reported in the table are for their actively managed US equity portfolios. In our sample, there are about 495 mutual fund management firms and 665 institutional fund management firms in the sample. The average TNAs managed is $7.4 billion per mutual fund management firm, and $8.5 billion per institutional fund management firm. These average numbers are small, as the sample is dominated by small management firms. When we further classify firms into quintiles by their assets, we see a wide dispersion in TNAs across fund families. Both the mutual fund firms and the institutional fund firms in their respective lowest TNA quintiles manage only $18 million of TNAs. By contrast, the average TNA for the mutual fund firms in the top TNA quintile is $33 billion, and that for the top-quintile institutional fund firms is $39 billion. Note that even in the top quintiles, there are still close to 100 mutual fund firms and 133 institutional fund firms. Not all in the top quintile are considered truly large, since fund assets are typically concentrated among the mega 20 or 30 firms.

At individual fund level, the average TNA of mutual funds is $1.35 billion, also with a large dispersion across funds – an average TNA of $18 billion in the bottom quintile and an average TNA of $10 billion in the top quintile. The same pattern holds for institutional funds, with an overall average TNA of $2.6 billion, only $9 million for the bottom quintile and $40 billion for the top quintile.

The table further reveals that the average annual expense ratio for institutional funds is 0.7%, smaller than that of 1.3% for mutual funds. Among the top quintile funds, the average expense ratio of mutual funds is 1%, versus 0.6% for institutional funds.

Table 4 report the matched sample – firms managing both mutual funds and institutional funds. In each year, on average 90 matched firms are identified. These firms manage 213 mutual funds and 343 institutional funds. They manage a total of $4.8 billion mutual fund assets and a total of $17 billion institutional fund assets. The average TNA of individual mutual funds they manage is $964 million, and the average TNA of individual institutional fund they manage is $3.83 billion. Apparently these firms are at the large end, compared with the assets distributions for the entire samples reported in Table 3. Relative to the entire sample of mutual funds, the mutual funds under joint management are larger, older, with lower turnover and lower expense ratio. Relative to the entire sample of institutional funds, those under joint management are also larger, but with similar level of expense ratio.

Overall, the summary statistics reveal a pattern that large investment firms tend to offer both mutual funds and institutional funds. At the same time, many smaller investment firms specialize in one segment of the market – either retail or institutional, but not both.

IV. Empirical Results

We report the empirical results in this part of the paper. We first report results on the analysis of (dis)economies of scale, followed by the analysis on the heterogeneity of the spillover effect, and an analysis on the potential performance transfer between mutual funds and institutional funds due to conflicts of interest.

IV.1 Impact on Fund Performance by Fund Size and Family Size: (Dis)economies of Scale, and Spillovers

We start with the most fundamental question of interest: are there economies of scale and diseconomies of scale, in the joint management of mutual funds and institutional funds?

To examine this issue, we perform panel regressions. The regression specification is motivated by existing studies, in particular, Chen, Hong, Huang, and Kubik (2004), combined with the additional effects we are interested in – the impact of managing mutual (institutional) fund assets on the performance of institutional (mutual) funds. In other words, the regressions look at the performance impact of fund size, the size of the side-by-side fund--i.e., the mutual (institutional) fund that has the same investment style as the institutional (mutual) fund of interest, the size of all mutual funds the firm manages, and the size of mutual funds and institutional funds the advisory firm manages.

Specifically, the baseline panel regression specification is the following:

$$PERF_{i,t} = c_0 + c_1*LogTNA_{i,t-1} + c_2*LogMutualFamTNA_{i,t-1} + c_3*LogInstFamTNA_{i,t-1} + CONTROLS + e_{i,t} \quad (1)$$

where the dependent variable PERF is the abnormal fund performance measure, described in Section III.3 – that is, abnormal fund performance is measured by the monthly style-adjusted

fund net returns, i.e., fund net returns in excess of the style benchmark returns. The style benchmark is the average net returns to funds in the same investment style.

The explanatory variables are the following. LogTNA is the log total net assets of the fund. LogMutualFamTNA is the log total net assets of all mutual funds the advisory firm manages. LogInstFamTNA is the log total net assets of all institutional funds the advisory firm manages. Finally, CONTROLS include the following set of control variables. For the mutual fund sample, we include the lagged fund performance (LAGPERF), fund turnover (TURNOVER), fund age (AGE), fund expense ratio (EXP). For institutional funds, we include the lagged fund performance (LAGPERF), and fund expense ratio (EXP). The panel regressions also include style-fixed effects and year-fixed effects. The standard errors of the regressions are double-clustered by fund and by year. The regression is run separately for mutual funds and institutional funds.

The dependent variable, style-adjusted fund net return, is measured at the monthly frequency. The explanatory variables are available at various different frequencies – monthly for LAGPERF, quarterly for LogTNA, LogMutualFamTNA, LogInstFamTNA, and annually for AGE, EXP, and TURNOVER. In the regression, we use the most recently available data for the explanatory variables prior to month t, the month of reported fund performance (i.e., the dependent variable).

If there are diseconomies of scale at fund level and economies of scale at fund family level, then we expect the coefficient for LogTNA to be negative and that for LogMutualFamTNA for the mutual fund sample and LogInstFamTNA for the institutional fund sample to be positive. In addition, if there is spillover of the economies of scale across fund types, we expect the coefficient for LogMutualFamTNA for the institutional fund sample to be positive, and LogInstFamTNA for the mutual fund sample to be positive.

The results of the regressions are reported in Table 5. First, look at the impact of fund size per se on fund performance. For both mutual funds and institutional funds, the coefficient on LogTNA is significantly negative: -0.0003 for mutual funds, with a t-statistic of -7.68 (based on double-clustered standard errors, same below), and -0.0002 for institutional funds, with a t-statistic of -14.19. Thus, for both mutual funds and institutional funds, there are diseconomies of

scale at the individual fund level. As discussed earlier, such an effect is already well-known for mutual funds. However it is not reported before for the institutional funds. Perhaps the result is not surprising, as the investment operations of mutual funds and institutional funds are similar in nature and thus both suffer from decreasing return to scale. Judged by the coefficients, the magnitude of this effect for institutional funds is similar to that of mutual funds. Further, the economic significance if the individual fund size effect can be assessed this way. As reported in the summary statistics (Table 2), the standard deviation of LogTNA is 2.02 for mutual funds, and 2.32 for institutional funds. Thus, for mutual funds, one standard deviation increase in LogTNA causes a performance loss of about 6 basis points (0.06%) per month, or 72 basis points (0.72%) per year. For institutional funds, one standard deviation increase in LogTNA causes a performance loss of about 4.64 basis points (0.0464%) per month, or 56 basis points (0.56%) per year. Both estimates are quite sizable economically, and similar in magnitude.

Further, look at the impact of fund family size on fund performance. Again, for both mutual funds and institutional funds, the coefficients on the respective family size measures – LogMutualFamTNA for mutual funds, and LogInstFamTNA for institutional funds -- are significantly positive: 0.00017 for mutual funds, with a t-statistic of 6.37, and 0.000093 for institutional funds, with a t-statistic of 2.53. Thus, for both mutual funds and institutional funds, there are economies of scale at the fund family level. As reported in the summary statistics (Table 3), the standard deviation of LogMutualFamTNA is 2.58, and that for LogInstFamTNA is 2.51. Thus, for mutual funds, one standard deviation increase in LogMutualFamTNA causes a performance gain of about 4.4 basis points (0.044%) per month, or 53 basis points (0.53%) per year. For institutional funds, one standard deviation increase in LogInstFamTNA causes a performance gain of about 2.3 basis points (0.023%) per month, or 28 basis points (0.28%) per year. In this sense, the family size effect for institutional funds is about half of the magnitude relative to that for mutual funds.

More importantly, look at the spillover effect of family size. The coefficient for LogInstFamTNA is significantly positive for the mutual fund regression, at 0.000052, with a t-statistic of 3.65. And the coefficient for LogMutualFamTNA is significantly positive for the institutional fund regression, at 0.000031, with a t-statistic of 2.53. The spillover coefficients for mutual funds and institutional funds are at about the same magnitude. These results suggest the

existence of spillover of the family size effect – mutual fund performance benefits from the large institutional assets managed by the same firm, and institutional fund performance benefits from the large mutual fund assets managed by the same firm. The economic significance of the results can be again assessed by taking into account the cross-sectional standard deviations of LogMutualFamTNA and LogInstFamTNA reported in Table 3. For mutual funds, one standard deviation increase in LogInstFamTNA causes a performance gain of about 1.3 basis points (0.013%) per month, or 16 basis points (0.16%) per year. For institutional funds, one standard deviation increase in LogMutualFamTNA causes a performance gain of about 0.78 basis points (0.0078%) per month, or 9.4 basis points (0.094%) per year. In this sense, the economic impact of the spillover for institutional funds is about a little more than half of the magnitude of that for mutual funds.

We also compare the spillover of the family size effect with the family size effect per se. The economic significance discussed in the above suggests that the spillover effect is about one third of the magnitude of the family size effect per se, for both mutual funds and institutional funds. Thus, the spillover effect should not be lightly dismissed.

In addition to these main variables of interest, the regression results show that for both mutual funds and institutional funds, there is performance persistence – the coefficient for LAGPERF is significantly positive. Further, for mutual funds, expense ratio and turnover both have a significantly negative impact on fund performance, while the impact of fund age is significantly positive. For institutional funds, the impact of expense ratio on fund performance is negative but statistically insignificant.

Overall, the analysis reported in Table 5 provides evidence for 1) decreasing return to fund size at individual fund level, 2) economies of scale at fund family level, and 3) a positive spillover impact of institutional fund family size on mutual fund performance, as well as a positive spillover impact of mutual fund family size on institutional fund performance. The evidence suggests existence of economies of scale at the entire investment firm level, rather than separately for retail funds or institutional funds. The significance of the spillover effect further suggests that by ignoring the prevalent phenomenon of joint management of mutual funds and institutional funds, previous studies may have underestimated the magnitude of economies of scale in the investment management industry.

IV.2 Spillover of Fund Size Effect

The regressions performed in Table 5 do not take into account any spillover effect of individual fund size -- that is, whether the size of institutional fund affects the performance of a mutual fund in the same investment style, and vice versa. A reason to hypothesize a negative fund size spillover effect is that when two funds are managed by the same manager using the same investment strategies, essentially they are just one fund, and the impact of liquidity and organizational diseconomies (e.g., Chen et al. 2004) apply jointly to both funds. When two funds are not perfectly the same, they may still suffer from the impact of liquidity and organizational diseconomies, albeit to a lesser extent. We examine this effect in this part of the analysis.

The regressions we use to examine the spillover of the fund size effect are based on a variation of the regressions specified in Equation (1):

$$PERF_{i,t} = c_0 + c_1*LogTNA_{i,t-1} + c_3*LogSBSTNA_{i,t-1} + c_4*LogMutualFamTNA_{i,t-1} + c_5*LogInstFamTNA_{i,t-1} + CONTROLS + e_{i,t} \quad (2)$$

where the dependent variable PERF continues to be the style-adjusted monthly net returns of a fund. LogTNA, LogMutualFamTNA, LogInstFamTNA, and the set of control variables are the same as those in Equation (1). The additional explanatory variable of interest is LogSBSTNA. It is the log total net assets of the side-by-side (i.e. style-matched) fund. For example, in the mutual fund regression, LogSBSTNA is the log TNA of the institutional funds that are managed by the same investment firm and have the same investment style of the mutual fund in question. And in the institutional fund regression, LogSBSTNA is the log TNA of the mutual funds that are managed by the same investment firm and have the same investment style of the institutional fund in question. The identification of such side-by-side funds is detailed in Section III.2.

Again, we perform panel regressions for mutual funds and institutional funds separately, with style-fixed effects and year-fixed effects, and the standard errors for the regression coefficients are double-clustered by fund and by year. If the side-by-side management of mutual and institutional funds of the same investment style causes diseconomies of scale, we expect the coefficient for LogSBSTNA to be negative.

The regression results are reported in Table 6. The coefficients for the key variable of interest, LogSBSTNA, are negative but statistically insignificant. For example, in the mutual fund sample, the coefficient for LogSBSTNA is -0.00004, with a t-statistic of -0.74. In the institutional fund sample, the coefficient for LogSBSTNA is -0.00003, with a t-statistic of -0.48. Thus, although the size of institutional (mutual) funds of the same investment style negatively affects the performance of a mutual (institutional) fund managed by the same firm, the impact is not significant.

Meanwhile, the coefficients on other explanatory variables are largely consistent with those obtained in Table 5.

How do we interpret the results? In analyzing the diseconomies of scale associated with fund size, Chen et al. (2004) point out that as a fund becomes larger, if the fund can hire more managers and invest in more stock ideas, there need not be a negative relation between fund size and performance. Oft-time a fund cannot do that, due to what they refer to as organizational diseconomies. Crucially, investment decisions are often based on soft information. Such soft information puts a large organization into a disadvantage in the effectiveness of decision making (Stein 2002). However if the firm keeps managers in separate funds, and let them make their own investment decisions separately, decision making needs not suffer from this inefficiency.

Although we do not perform any formal test on the above idea, we have observed that frequently in the data, the style-matched mutual funds and institutional funds in the same firms are managed by different investment managers. Stock selection activities of the mutual fund manager and the institutional fund manager are likely to be relatively independent in this case. This perhaps explains the lack of a negative fund size spillover effect between style-matched mutual funds and institutional funds.

IV.3 Heterogeneity in the Family Spillover Effect

Now back to the family size spillover effect. Such an effect, as reported in Table 5, suggests that large investment firms may be able to deploy firm-wide resources (e.g., managers, analysts, and traders) better to generate investment ideas and execute trades, relative to small

investment firms, which are often more resource constraints and thus are not as efficient in allocation. But since resource allocation is at the discretion of the firm, a natural question arises is whether investment firms allocate resources to benefit all funds evenly, or in a way that favors certain funds over others.

Investment firms' strategic resource allocation behavior has been documented by a few existing studies, in the context of both mutual funds and institutional funds. For example, Gasper, Massa, and Matos (2006) find that mutual funds of high values to the firms, i.e., those with large size, high fees or high past performance, receive favorable treatments by the fund families, such as more allocations of underpriced IPO shares, and are at the better side of transactions when they have trades in the opposite direction of trades made by other funds in the same families. Chaudhuri, Ivkovic, and Trzcinka (2013) report strategic performance transfer within institutional fund families, in a way similar to what Massa et al. report for mutual funds.

Motivated by the above studies, we conjecture that certain funds may benefit more from the family size spillover effect, due to discretionary firm-wide resource allocation decisions. For example, when a large mutual fund company launches several institutional funds, the firm may allocate more analysts (who previously work for mutual fund managers) to work for a high-value institutional fund, relative to a low-value institutional fund. To investigate this possibility, we perform the following regressions.

For the mutual fund sample, the regression specification is as follows:

$$PERF_{i,t} = c_0 + c_1*LogTNA_{i,t-1} + c_3*LogSBSTNA_{i,t-1} + c_4*LogMutualFamTNA_{i,t-1}$$
$$+ c_5*LogInstFamTNA_{i,t-1} + c_6*HiVal_{i,t-1} + c_7*LogInstFamTNA_{i,t-1}*HighVal_{i,t-1}$$
$$+ CONTROLS + e_{i,t} \quad (3)$$

where HiVal is a dummy indicating a fund being a high-value one to the firm. We use three fund characteristics to define HiVal: fund size, the size of the investment style the fund belongs to, and expense ratio. HiVal takes value of 1 if a mutual fund is the largest one by TNA among all mutual funds the firm manages, or if the total TNAs of all mutual funds of the investment style is the largest among all investment styles the firm manage, or if the mutual fund has the highest expense ratio among all mutual funds managed by the firm.

And for the institutional fund sample, the regression specification is:

$$PERF_{i,t} = c_0 + c_1*LogTNA_{i,t-1} + c_3*LogSBSTNA_{i,t-1} + c_4*LogMutualFamTNA_{i,t-1}$$
$$+ c_5*LogInstFamTNA_{i,t-1} + c_6*HiVal_{i,t-1} + c_7*LogMutualFamTNA_{i,t-1}*HighVal_{i,t-1}$$
$$+ CONTROLS + e_{i,t} \quad (4)$$

where HiVal is similarly defined as in Equation (3), except that here it is defined for the institutional fund sample.

Again, the panel regressions are performed separately for mutual funds and institutional funds, with style-fixed effects and year-fixed effects, and the standard errors for the regression coefficients are double-clustered by fund and by year. The interaction term, LogInstFamTNA*HighVal for mutual funds and LogMutualFamTNA*HighVal for institutional funds, capture the differential spillover family size effect. If investment firms favor high value funds as defined by fund size, style size, and expense ratio, we expect the coefficients on these two interactions terms to be positive. The regression results are reported in Table 7. Panel A, B, and C of the table use three different definitions of HiVal, based on fund size, style size, and expense ratio.

For the mutual fund sample, when HiVal is represented by the largest fund in the family, the coefficient for the interaction term LogInstFamTNA*HighVal is significantly positive, at 0.00013, with a t-statistic of 2.97. This suggests that relative to other mutual funds in the family, the largest mutual fund enjoys extra performance boost from having large amount of institutional fund assets managed by the same firm. Further, when HiVal is represented by the investment style with the largest amount of TNA in the family, the coefficient for the interaction term LogInstFamTNA*HighVal is also significantly positive, at 0.000089, with a t-statistic of 2.47. This suggests that relative to other mutual funds in the family, the mutual funds belonging to the largest investment style (likely the firm's expertise) enjoys extra performance boost from having large amount of institutional fund assets managed by the same firm. Finally, when HiVal is represented by the mutual funds with the highest expense ratio in the family, the coefficient for the interaction term LogInstFamTNA*HighVal is also insignificantly positive, at 0.000029, with a t-statistic of 0.77.

For the institutional fund sample, when HiVal is represented by the largest fund in the family, the coefficient for the interaction term LogMutualFamTNA*HighVal is insignificantly positive, at 0.000029, with a t-statistic of 0.40. When HiVal is represented by the investment style with the largest amount of TNA in the family, the coefficient for the interaction term LogMutualFamTNA*HighVal is also insignificantly positive, at 0.000087, with a t-statistic of 0.21. The above results suggest that relative to other institutional funds in the family, the ones with the largest TNA or belonging to the largest investment style do not significantly enjoy any extra performance boost from having large amount of mutual fund assets managed by the same firm. However, when HiVal is represented by the institutional funds with the highest expense ratio in the family, the coefficient for the interaction term LogMutualFamTNA*HighVal is significantly positive, at 0.00012, with a t-statistic of 2.95. This suggests that the high-expense institutional funds enjoy more performance boost from having a large amount of mutual fund assets managed by the investment firm.

Combining results for the mutual fund sample and the institutional fund sample, we conclude that the spillover effect of family size is not distributed evenly across funds. Rather, certain funds benefit more from it than others. The ones receiving extra benefits tend to be the ones of high value to the investment firms – those with large TNA and belonging to the largest investment style (in the case of mutual funds) and those with high fees (in the case of institutional funds). Possibly, this is the outcome of intentional decisions by the investment firms. That is, investment firms strategically deploy firm-wide resources across mutual funds and institutional funds they manage, to maximize the benefit of the investment firms.

IV.4 Performance Transfer Between Jointly Managed Mutual Funds and Institutional Funds

The results obtained in Table 7, showing uneven benefit of family size spillover across funds, smell conflicts of interest. However, this may not be the more egregious form of conflicts; afterall, we seldom hear outcry of unfairness if all funds benefit, except that some benefit more than others.

In the joint management of mutual funds and institutional funds, there is an even more direct and important form of conflicts of interest, which is between the two types of funds. For example, an investment management firm, responding to different incentives, may allocate resources away from one type of funds onto another, to the extent that mutual funds (institutional funds) receive a performance boost but the performance of institutional funds (mutual funds) is hurt by such arrangements. Such conflicts of interest are sometimes referred to as performance transfer and analyzed by in existing studies in a different context. For example, Nohel et al. (2010) and Cici et al. (2010) examine performance transfer between mutual funds and hedge funds managed by the same investment firms, with mixed conclusions.

To study potential performance transfer, we follow Nohel et al. (2010) and Cici et al. (2010) to perform the following panel regressions:

$$PERF_{i,t} = c_0 + c_1*JOINT_{i,t} + c_2*MAIN_{i,t} + c_3*LogTNA_{i,t-1} + c_4*LogFamTNA_{i,t-1} + CONTROLS + e_{i,t} \quad (5)$$

where the dependent variable PERF is the style-adjusted fund performance measure. JOINT is a dummy variable that takes the value of 1 if the investment firm engages in joint management of retail and institutional funds, and 0 otherwise. MAIN is a dummy variable that takes the value of 1 if the fund belongs to the main type of funds the firm offers (e.g., a mutual fund if the majority of the firm's assets is mutual fund; an institutional fund if the majority of the firm's assets is institutional) and 0 otherwise. Specifically, in the mutual fund sample, if for an investment firm, the TNAs of its mutual funds exceed the TNAs of its institutional funds, than MAIN equals 1, and 0 otherwise. Similarly, in the instutitional fund sample, if for an investment firm, the TNAs of its intitutional funds exceed the TNAs of its mutual funds, than MAIN equals 1, and 0 otherwise. LogFAMTNA takes the value of LogMutualFAMTNA in the mutual fund sample, and takes the value of LogInstFAMTNA for the institutional fund sample. Finally, CONTROLS refer to the same set of control variables previously defined for Equation (1).

Note that the regression specification in (5) is quite similar to that in (1), except that the variable representing the family size spillover effect (LogInstFAMTNA for mutual funds and LogMutualFAMTNA for institutional funds) is replaced by the dummy variable JOINT. However, what one can infer from these two regressions is quite different. The coefficient for the

family size spillover variable in Equation (1) tells us about how mutual fund performance changes with an increase in the assets of institutional funds. However, it does not tell as the average effect on mutual fund performance by having institutional assets. That average effect is part of the intercept in Equation (1). In Equation (5), that average effect is captured by the coefficient on JOINT, which are further explained below.

If there are differential incentives in resource allocation and effort allocation that cause substantial performance transfer, then we expect the coefficient for JOINT to be significantly different from zero. Of particular interest is the case of a negative coefficient, which means that performance transfer results in significant negative impact on fund performance (potentially to benefit the other type of funds managed by the firm). For example, a negative coefficient for JOINT in the mutual fund sample would suggest that on average, the performance of mutual funds is worse when the firm jointly manage institutional funds, relative to independently managed mutual funds. A positive coefficient for JOINT can be interpreted in several ways. It may either signal that overall the type of funds studied benefits from the economies of scale, or indicate that this type of funds benefits from performance transfer at the cost of the other type. The case of negative coefficients, on the other hand, has a clear interpretation. Specifically, in the mutual fund sample, if the coefficient for JOINT is negative, it suggests that mutual fund performance is hurt by the performance transfer behavior of the investment firm (potentially benefiting institutional funds). And if the coefficient for JOINT is negative in the institutional fund sample, it suggests that the performance of institutional funds is hurt by performance transfer behavior of the investment firm.

In the case of jointly managed mutual funds and hedge funds, the incentive differences are clear so that the natural prior is that performance transfer may hurt mutual funds at the benefit of hedge funds (e.g., Cici et al. 2010; Nohel et al. 2010). In the case of jointly managed mutual funds and institutional funds, the incentive difference is not so clear, and thus there is no strong prior with respect to which type of funds may be favored and which type may be hurt. Both mutual funds and institutional funds charge asset-based fees. A small proportion of institutional funds have performance fee features, but the magnitude of the performance fee is much smaller relative to the hedge funds. In addition, as shown in Table 2, the expense ratios of institutional fund on average are lower than those of mutual funds. However, due to large

individual account size and small number of accounts, institutional funds incur much lower client service costs relative to mutual funds. At the end of day, it is still unclear whether mutual funds or institutional funds are more profitable operations of a typical investment management.

In addition, we introduce the dummy variable MAIN to additional test a hypothesis that an investment firm would favor or disfavor a type of funds depending on whether that type of funds represents the major assets it manages. For example, an investment manager may have incentives to favor mutual funds against institutional funds if mutual funds represent the majority of its assets. Or to the opposite, to cultivate still growing institutional funds that account for a small proportion of its assets, an investment firm may find it worthwhile to subsidize institutional funds. Based on these hypotheses, In the mutual fund sample, if the regression coefficient for MAIN is negative, it suggests that resources may have being siphoned away more from mutual funds as the major type of assets, relatively to the case where institutional funds are the main type of assets. On the other hand, if the regression coefficient for MAIN is positive, it suggests that resources may have being siphoned into mutual funds more relative to the case where institutional funds are the major type of assets.

The panel regressions include style-fixed effects as well as year-fixed effects. The standard errors of the regressions are double-clustered by fund and by year. The regression is run separately for mutual funds and institutional funds. The results are reported in Table 8.

In the mutual fund sample, the coefficient for JOINT is significantly positive, at 0.00054, with a t-statistic of 3.58. This suggests that performance transfer, if any, has not substantially hurt the performance of mutual funds when institutional funds are jointly managed. The coefficient on MAIN is negative but statistically insignificant (-0.0001, with a t-statistic of -0.61). Thus, there is no evidence either that investment firms have extra incentive to favor mutual funds when they represent the major assets of the firm.

In the institutional fund sample, the coefficient for JOINT is 0.00047, with a t-statistic of 1.63. Thus, on average there is no significant impact on institutional fund performance when the firm also manages mutual funds. The coefficient on MAIN is -0.0004, with a t-statistic of -1.36. Thus, there is no significant evidence either, on the hypothesis that investment firms transfer

resources away from the main operations of institutional funds to favor mutual funds that represent the minor part of its operation.

Overall, the evidence in this part of the analysis does not support the hypothesis that investment firms deploy resources between mutual funds and institutional funds in a substantially discriminative way, to the extent that such deployment absolutely hurts either mutual funds or institutional funds. Rather, the evidence suggests that due to economies of scale, the investment firms can deploy resources to benefit one type or both types of funds, without absolutely hurting either one.

It is also worth noting that the coefficients for other variables reported in Table 8 are largely consistent with those obtained in Table 5. In particular, in Table 8, the coefficients for fund size per se are significantly negative, while the coefficients for the fund family size are significantly positive, consistent with the diseconomies of scale at individual fund level and economics of scale at fund family level. The coefficients on lagged fund performance, fund expense ratio, fund age, and turnover, are also consistent with those in Table 5.

V. Conclusions

In this study, we examine the performance consequences of the joint management of mutual funds and institutional funds by investment management firms. Such joint management practices are quite prevalent in the investment industry, especially for large investment firms.

We find evidence that there are economies of scale in the joint management of the two types of funds. The performance of a mutual fund gets a boost when its management firm also manages a large amount of institutional money. And the performance of an institutional fund gets a boost when its management firm also manages a large amount of mutual funds. Meanwhile, within both the mutual funds segment and the institutional fund segment, fund performance suffers from diseconomies of scale at individual fund level and economies of scale at the fund family level. Relative to the family size effect, the spillover of the family size effect across fund type is about a third of the magnitude. Thus, both the family size effect and the spillover effect are important part of the overall economies of scale.

We also find that the spillover of the family size effect benefit fund performance unevenly. Certain funds, such as large mutual funds or mutual funds belonging to the large investment style of the firm, and high-expense institutional funds, benefit more relative to other funds. This suggests that large investment firms deploy firm-wide resources in a way to favor funds of higher economic values to the firms.

Despite the possibility of such favoritism, we find no evidence that joint management of the two types of funds hurts the performance of either the mutual funds or the institutional funds jointly managed. Thus, economies of scale, rather than conflicts of interest, are the dominant driver of investment firms' practice of jointly managing mutual funds and institutional funds.

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Appendix. Mapping of eVestment investment universe codes and Lipper investment objective codes into investment styles

Panel A. Mapping of eVestment codes for institutional funds into the 12 investment styles

Style no.	Style Name	Universe ID	Universe Name
1	All Cap Core	1105	eA US Enhanced Equity
		1134	eA US All Cap Equity
		1158	eA All US Equity
		45611	eA SMA - US Equity
		45618	eA SMA - US All Cap Equity
		4259	eA US All Cap Core Equity
		4271	eA US Enhanced All Cap Equity
2	All Cap Growth	4261	eA US All Cap Growth Equity
3	All Cap Value	4262	eA US All Cap Value Equity
4	Large cap core	1130	eA US Large Cap Equity
		3860	eA US Large Cap Core Equity
		4267	eA US Enhanced Large Cap Equity
		4268	eA US Enhanced S&P 500 Equity
		45612	eA SMA - US Large Cap Equity
		45613	eA SMA - US Large Cap Core Equity
		55314	eA US Enhanced Russell 1000 Equity
5	Large Cap Growth	1132	eA US Large Cap Growth Equity
		45614	eA SMA - US Large Cap Growth Equity
		55315	eA US Enhanced Russell 1000 Growth E
6	Large Cap Value	1239	eA US Large Cap Value Equity
		45615	eA SMA - US Large Cap Value Equity
		55316	eA US Enhanced Russell 1000 Value Eq
7	Mid Cap Core	1135	eA US Mid Cap Equity
		1136	eA US Mid Cap Core Equity
		1143	eA US Small-Mid Cap Equity
		1146	eA US Small-Mid Cap Core Equity
		4269	eA US Enhanced Mid Cap Equity
		45616	eA SMA - US Mid Cap Equity
		51322	eA SMA - US Small-Mid Cap Equity
8	Mid Cap Growth	1137	eA US Mid Cap Growth Equity
		1144	eA US Small-Mid Cap Growth Equity
9	Mid Cap Value	1138	eA US Mid Cap Value Equity
		1145	eA US Small-Mid Cap Value Equity
		1139	eA US Small Cap Equity
10	Small Cap Core	1140	eA US Small Cap Core Equity
		2796	eA US Micro Cap Equity
		2797	eA US Micro Cap Core Equity

		4270	eA US Enhanced Small Cap Equity
		45617	eA SMA - US Small Cap Equity
11	Small Cap Growth	1141	eA US Small Cap Growth Equity
		2798	eA US Micro Cap Growth Equity
12	Small Cap Value	2680	eA US Small Cap Value Equity
		2799	eA US Micro Cap Value Equity

Panel B. Mapping of Lipper codes for mutual funds into the 12 investment styles

Style No	Style Name	Lipper Class Name	Lipper_obj_code
1	All core	Growth and Income Funds	GI
		Multi-Cap Core Funds	MLCE
2	All growth	Growth Funds	G
		Multi-Cap growth Funds	MLGE
3	All value	Equity Income Funds	EI
		Equity Income Funds	EIEI
		Multi-Cap Value Funds	MLVE
4	Large cap core	Large-Cap Core Funds	LCCE
5	Large cap growth	Large-Cap Growth Funds	LCGE
6	Large cap value	Large-Cap Value Funds	LCVE
7	Mid Cap Core	Mid-Cap Funds	MC
		Mid-Cap Core Funds	MCCE
8	Mid Cap Growth	Mid-Cap Growth Funds	MCGE
9	Mid Cap Value	Mid-Cap Value Funds	MCVE
10	Small-Cap Core	Micro-Cap Funds	MR
		Small-Cap Funds	SG
		Small-Cap Core Funds	SCCE
11	Small-Cap Growth	Small-Cap Growth Funds	SCGE
12	Small-Cap Value	Small-Cap Value Funds	SCVE

Table 1. Definitions of variables used in the analysis

Variable Name	Variable Notation	Explanation
Net return		Monthly returns for equity mutual funds and institutional products, net of expense ratio
Style-adjusted return	PERF	Monthly net returns adjusted for the return of the same style the fund belongs to
Total net assets (TNA)	LogTNA	Logarithm of total net assets (in $millions) at the end of each month (quarter) for mutual funds (institutional products)
Mutual fund family TNA	LogMutualFAMTNA	Logarithm of the total net assets (in $millions) of a management company at the end of each quarter (as reported in CRSP mutual fund database).
Institutional family TNA	LogInsFAMTNA	Logarithm of the total net assets (in $millions) at the end of quarter of all US domestic equity institutional products for a management company
Fund expense ratio	EXP	Annual expense ratio for institutional products and mutual funds
Mutual fund turnover	TURNOVER	Mutual fund turnover ratio
Mutual fund age	AGE	Mutual fund age since inception till current year
TNA for matched mutual funds	LogSBSTNA	Logarithm of the sum of TNA (in $millions) of all matched mutual funds for each matched institutional product
TNA for matched institutional products	LogSBSTNA	Logarithm of the sum of TNA (in $millions) of all matched institutional products for each matched mutual fund
Matched fund dummy	JOINT	Indicator that is one if an institutional product (mutual fund) has a matched mutual fund (institutional product) in the same family, and zero otherwise
Institutional majority dummy	MAIN	Indicator that is one if within the same fund family the total TNA for institutional products is greater than the that of the mutual funds, and zero other wise
Mutual fund majority dummy	MAIN	Indicator that is one if within the same fund family the total TNA for mutual funds is greater than that of the institutional products, and zero other wise
Large fund size dummy	HiVal	Indicator that is one if the TNA of an institutional product (mutual funds) is the largest among all institutional products (mutual funds) in the same fund family, zero otherwise.
Large style size dummy	HiVal	Indicator that is one if an institutional product (mutual funds) belongs to the style with the largest TNA among all institutional product (mutual funds) styles in the same fund family.
High expense dummy	HiVal	Indicator that is one if the expense ratio of an institutional product (mutual funds) is above the median value among all institutional products (mutual funds) in the same fund family, zero otherwise.

Table 2. Largest mutual fund families and institutional fund families

This table lists the top ten fund families by assets under management (AUM) as of end of 2014, for the mutual fund management companies, and the institutional management companies, respectively. The AUM for the institutional management companies is based on the sum of fund level AUM among all institutional products for each institutional management company in our sample (i.e, US equity products). The AUM for the mutual fund management company is based on the sum of AUM of acive US domestic equity funds within each mutual fund family.

Rank	Mutual fund management company	Rank	Institutional management company
1	Capital Research & Management	1	Vanguard
2	Fidelity Management & Research	2	State Street Global Advisors
3	T Rowe Price Associates	3	BlackRock
4	Vanguard Group	4	Capital Group
5	Franklin Templeton Investments	5	FMR Corp
6	MFS Investment Management	6	T. Rowe Price Group
7	Dodge & Cox	7	Northern Trust
8	Van Kampen Asset Management	8	J.P. Morgan Investment Management
9	American Century Investment Management	9	Wellington Management
10	JPMorgan Funds	10	Mellon Capital Management

Table 3. Summary statistics for mutual funds and intuitional funds

This table reports the time-series means of the cross-sectional mean and standard deviations of fund characters for both mutual funds and institutional products. Variable definitions are given in Table 1. Panel A reports the above summary statistics for mutual funds, and Panel B for institutional products. In addition to all funds, we also report the summary statistics separately for quintile portfolio of funds formed by fund TNA. (For variables "No. of mutual fund companies", "TNA of mutual fund companies", "No. of institutional management companies", and "TNA of institutional management companies", the quintiles are formed based on fund family TNA.) Fund TNAs are in $millions. The sample is from January 1998 through December 2014.

Panel A: mutual funds

	small TNA		2		3		4		Large TNA		all funds	
	mean	stdev	mean	stdev	mean	stdev	mean	stdev	mean	stdev	mean	stdev
No. of mutual fund companies	98.79		99.29		99.26		99.32		98.90		495.57	
TNA of mutual fund companies	18.33	12.72	119.38	55.20	582.18	274.07	3048.57	1461.77	33308.00	57332.54	7400.34	28697.83
No. of funds	329.12		330.18		330.32		330.25		329.91		1650.41	
fund net return	0.01	0.03	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02
fund style adjusted return	0.00	0.03	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02
TNA	18.30	11.86	83.20	27.60	241.74	70.26	687.50	219.05	5735.18	10209.14	1352.54	5070.35
log(TNA)	2.41	1.04	4.27	0.35	5.36	0.30	6.41	0.33	8.06	0.90	5.30	2.02
Log (family TNA)	5.59	2.93	7.11	2.20	8.08	1.85	8.92	1.56	10.08	1.45	7.96	2.58
annual fund turnover ratio	1.16	1.92	0.99	1.21	0.89	0.83	0.84	0.72	0.68	0.63	0.91	1.20
annual fund expense ratio	0.02	0.02	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.01
fund age	7.78	7.85	10.17	9.07	12.02	10.26	15.42	13.14	23.04	17.27	13.69	13.16

Panel B: institutional products

	small TNA		2		3		4		Large TNA		all funds	
No. of institutional management companies	132.61		133.30		133.24		133.29		132.84		665.29	
TNA of institutional management companies	17.85	19.37	181.75	81.98	716.54	253.60	2385.97	890.06	39372.85	107271.77	8501.04	50294.45
no. of funds	508.93		509.53		509.51		509.56		509.14		2546.67	
fund net return	0.01	0.03	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02
fund style adjusted return	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.00	0.02
TNA	9.27	9.63	90.69	40.19	327.22	105.93	1012.99	330.38	11557.19	40476.65	2596.90	18779.46
log(TNA)	1.72	1.34	4.32	0.50	5.69	0.34	6.84	0.33	8.49	0.92	5.61	2.32
Log (family TNA)	6.33	3.07	7.20	2.19	8.14	1.89	8.92	1.67	10.26	1.55	8.22	2.51
annual expense ratio	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.00

Table 4. Summary statistics for matched mutual funds and institutional funds

This table reports the time series means of the cross-sectional mean and standard deviation of the characters of the jointly managed mutual funds and institutional products, and those of their management companies. Two approaches of fund matching are adopted. In the "Matched by firm" approach, a mutual fund (institutional product) is considered as matched for a month if its management company is managing at least one institutional product (mutual fund) during the same month. In the "Matched by Firm/style" approach, a mutual fund (institutional product) is considered as matched for a month if its management company is managing at least one institutional product (mutual fund) during the same month that belongs to the same investment style as its counterpart. Panel A provides summary statistics at the management company level: Number of matched firms, the TNA of matched institutional products family (and mutual funds family). Panel B reports the number of matched mutual funds per quarter and for each matched mutual fund, the number of matched institutional products. Panel B also reports the cross-sectional means of the cross-sectional mean and standard deviation of other mutual fund characters as reported in Table 3. Panel C reports the number of matched institutional products per quarter and for each matched institutional product, the number of matched mutual funds. Panel C also reports the cross-sectional means of the cross-sectional mean and standard deviation of other institutional product characters as reported in Table 3. Fund TNAs are in $millions. The sample is from January 1998 through December 2014.

	Matched by Firm		Matched by Firm/style	
Panel A: management firms				
No. of matched firms	89.58		23.32	
TNA of matched institutional product family	17771.60	69601.15	26539.17	67535.67
TNA of matched mutual fund family	4876.53	14872.72	8689.69	20609.48
Panel B: mutual funds				
No. of matched mutual funds	213.11		61.50	
No. of matched institutional products	8.62		3.28	
(per mutual fund per month)				
fund net return	0.01	0.02	0.01	0.02
fund style adjusted return	0.00	0.02	0.00	0.02
TNA	964.14	3087.05	711.94	1211.62
log(TNA)	5.15	1.90	5.35	1.70
Log (family TNA)	7.82	2.16	8.29	1.91
annual fund turnover ratio	0.91	0.85	0.79	0.69
annual fund expense ratio	0.01	0.00	0.01	0.00
fund age	11.74	10.44	14.51	13.43
Panel C: institutional products				
No. of matched institutional products	343.24		116.95	
No. of matched mutual funds	5.51		1.80	
(per institutional products per month)				
fund net return	0.01	0.02	0.01	0.02
fund style adjusted return	0.00	0.02	0.00	0.02
TNA	3830.83	19699.15	2821.01	8691.74
log(TNA)	6.13	2.23	6.10	2.17
Log (family TNA)	9.06	2.11	9.38	1.83
annual expense ratio	0.01	0.00	0.01	0.00

Table 5. Effects of fund size and family size on performance

This table reports panel regression results of mutual fund (institutional products) style-adjusted monthly returns on lagged returns, mutual fund (institutional product) TNA, mutual fund family TNA (institutional product family TNA), matched institutional product family TNA (mutual fund family TNA), and other fund characters. Variables are defined in Table 1. A mutual fund (institutional product) is considered as matched for a month if its management company is managing at least one institutional product (mutual fund) during the same month. If a mutual fund (institutional product) has no matched counterpart, the matched institutional family TNA (mutual fund family TNA) is set as zero. For the right hand side variables, style-adjusted returns and mutual fund TNA are lagged by one month. The other variables are lagged by one quarter. The *t*-stats are based on clustered standard errors at the fund and year level. The sample is from January 1998 through December 2014.

Mutual Funds			Institutional products		
	Coeff.	t-stat.		Coeff.	t-stat.
Intercept	0.00082	(2.01)	Intercept	0.00036	(2.07)
Style-adjusted return	0.09769	(21.61)	Style-adjusted return	0.02749	(9.44)
Total net assets (TNA)	-0.0003	(-7.68)	Total net assets (TNA)	-0.0002	(-14.19)
Mutual fund family TNA	0.00017	(6.37)	Mutual fund family TNA	3.1E-05	(2.53)
Institutional family TNA	5.2E-05	(3.65)	Institutional family TNA	9.3E-05	(5.75)
Expense ratio	-0.0536	(-2.69)	Expense ratio	-0.0103	(-0.80)
Mutual fund turnover	-0.0002	(-2.43)			
Mutual fund age	1.2E-05	(3.45)			

Table 6. Spillover of fund size effect

This table reports panel regression results of mutual fund (institutional products) style-adjusted monthly returns on lagged returns, mutual fund (institutional product) TNA, mutual fund family TNA (institutional product family TNA), TNA for matched institutional products (mutual funds), matched institutional product family TNA (mutual fund family TNA), and other fund characters. Variables are defined in Table 1. A mutual fund (institutional product) is considered as matched for a month if its management company is managing at least one institutional product (mutual fund) during the same month that belongs to the same investment style as its counterpart. If a mutual fund (institutional product) has no matched counterpart, the matched institutional family TNA (mutual fund family TNA) is set as zero. For the right hand side variables, style-adjusted returns and mutual fund TNA are lagged by one month. The other variables are lagged by one quarter. The *t*-stats are based on clustered standard errors at the fund and year level. The sample is from January 1998 through December 2014.

Mutual Funds			Institutional products		
	Coeff.	t-stat.		Coeff.	t-stat.
Intercept	0.00088	2.15	Intercept	0.00035	2.05
Style-adjusted return	0.09771	21.62	Style-adjusted return	0.02749	9.43
Total net assets (TNA)	-0.0003	-7.58	Total net assets (TNA)	-0.0002	-14.11
Mutual fund family TNA	0.00017	6.24	Institutional family TNA	9.4E-05	5.80
TNA for matched institutional products	-4E-05	-0.74	TNA for matched mutual funds	-3E-05	-0.48
Institutional family TNA	7.4E-05	1.87	Mutual fund family TNA	7.6E-05	1.65
Expense ratio	-0.0539	-2.70	Expense ratio	-0.0100	-0.77
Mutual fund turnover	-0.0002	-2.44			
Mutual fund age	1.2E-05	3.31			

Table 7. Fund characteristics and the spillover effect of family size

This table reports panel regression results of mutual fund (institutional products) style-adjusted monthly returns on lagged returns, mutual fund (institutional product) TNA, mutual fund family TNA (institutional product family TNA), TNA for matched institutional products (mutual funds), matched institutional product family TNA (mutual fund family TNA), and other fund characters. In addition, three fund level indicators and their interaction with matched institutional products (mutual funds) family TNA are included: Large fund indicator, Large style indicator, and High expense ratio indictor, and the corresponding interaction terms. All variables are defined in Table 1. A mutual fund (institutional product) is considered as matched for a month if its management company is managing at least one institutional product (mutual fund) during the same month that belongs to the same investment style as its counterpart. If a mutual fund (institutional product) has no matched counterpart, the matched institutional family TNA (mutual fund family TNA) is set as zero. For the right hand side variables, style-adjusted returns and mutual fund TNA are lagged by one month. The other variables are lagged by one quarter. Panel A reports results for Large fund indicator, Panel B for Large style indicator, and Panel C for High expense ratio indicator. The *t*-stats are based on clustered standard errors at the fund and year level. The sample is from January 1998 through December 2014.

Panel A. Fund size

Mutual Funds			Institutional products		
	Coeff.	t-stat.		Coeff.	t-stat.
Intercept	0.0011	2.64	Intercept	0.00045	2.39
Large fund indicator	-0.0003	-2.20	Large fund indicator	-0.0001	-1.23
Style-adjusted return	0.09768	21.60	Style-adjusted return	0.02748	9.43
Total net assets (TNA)	-0.0003	-6.42	Total net assets (TNA)	-0.0002	-11.59
Mutual fund family TNA	0.00014	4.28	Mutual fund family TNA	7.4E-05	1.60
TNA for matched institutional products	-5E-05	-0.91	TNA for matched mutual funds	-3E-05	-0.50
Institutional family TNA	5.4E-05	1.36	Institutional family TNA	7.8E-05	3.87
Institutional family TNA *Large fund indicator	0.00013	2.97	Mutual fund family TNA *Large fund indicator	2.9E-05	0.40
Expense ratio	-0.054	-2.70	Expense ratio	-0.0108	-0.84
Mutual fund turnover	-0.0002	-2.43			
Mutual fund age	1.2E-05	3.37			

Panel B. Style

Mutual Funds			Institutional products		
	Coeff.	t-stat.		Coeff.	t-stat.
Intercept	0.00105	2.52	Intercept	0.0005	2.76
Large style indicator	-0.0002	-2.06	Large style indicator	-0.0002	-2.49
Style-adjusted return	0.09769	21.61	Style-adjusted return	0.02748	9.43
Total net assets (TNA)	-0.0003	-7.06	Total net assets (TNA)	-0.0002	-12.91
Mutual fund family TNA	0.00015	5.37	Mutual fund family TNA	7.2E-05	1.27
TNA for matched institutional products	-4E-05	-0.74	TNA for matched mutual funds	-3E-05	-0.44
Institutional family TNA	3.5E-05	0.84	Institutional family TNA	8.1E-05	4.71
Institutional family TNA *Large style indicator	8.9E-05	2.47	Mutual fund family TNA *Large style indicator	8.7E-06	0.21
Expense ratio	-0.0541	-2.70	Expense ratio	-0.0114	-0.89
Mutual fund turnover	-0.0002	-2.44			
Mutual fund age	1.2E-05	3.27			

Panel C. Expense

Mutual Funds			Institutional products		
	Coeff.	t-stat.		Coeff.	t-stat.
Intercept	0.0007	1.84	Intercept	0.00037	2.18
High expense indicator	0.00021	1.90	High expense indicator	9.2E-05	1.29
Style-adjusted return	0.09768	21.61	Style-adjusted return	0.02745	9.42
Total net assets (TNA)	-0.0003	-7.47	Total net assets (TNA)	-0.0002	-13.93
Mutual fund family TNA	0.00017	6.39	Mutual fund family TNA	1.5E-05	0.31
TNA for matched institutional products	-3E-05	-0.51	TNA for matched mutual funds	-4E-05	-0.63
Institutional family TNA	5.4E-05	1.16	Institutional family TNA	9.3E-05	5.77
Institutional family TNA *High expense indicator	2.9E-05	0.77	Mutual fund family TNA *High expense indicator	0.00012	2.95
Expense ratio	-0.0555	-2.69	Expense ratio	-0.0216	-1.46
Mutual fund turnover	-0.0002	-2.45			
Mutual fund age	1.3E-05	3.57			

Table 8. Regression analysis on performance transfer between mutual funds and institutional funds

This table reports panel regression results of mutual fund (institutional products) style-adjusted monthly returns on the Matched fund indicator, The Mutual fund (Institutional product) majority indicator, as well as all the other variables listed in Table 5. All variables are defined in Table 1. A mutual fund (institutional product) is considered as matched for a month if its management company is managing at least one institutional product (mutual fund) during the same month. If a mutual fund (institutional product) has no matched counterpart, the matched institutional family TNA (mutual fund family TNA) is set as zero. For the right hand side variables, style-adjusted returns and mutual fund TNA are lagged by one month. The other variables are lagged by one quarter. The sample is from January 1998 through December 2014.

Mutual Funds			Institutional products		
	Coeff.	t-stat.		Coeff.	t-stat.
Intercept	0.00075	1.81	Intercept	0.00052	2.50
Matched fund indicator	0.00054	3.58	Matched fund indicator	0.00047	1.63
Mutual fund majority indicator	-0.0001	-0.61	Institutional majority indicator	-0.0004	-1.36
Style-adjusted return	0.09767	21.61	Style-adjusted return	0.02459	8.56
Total net assets (TNA)	-0.0003	-7.69	Total net assets (TNA)	-0.0002	-13.19
Mutual fund family TNA	0.00018	6.54	Institutional family TNA	7.2E-05	4.76
Expense ratio	-0.0534	-2.68	Expense ratio	-0.0316	-1.50
Mutual fund turnover	-0.0002	-2.43			
Mutual fund age	1.3E-05	3.53			