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Abstract

Firms' competitive advantages are unsustainable when competitors poach their employees away to study and recreate those advantages. We document inter-firm knowledge spillovers through labor mobility in the mutual fund industry. About one quarter of the competitive advantage of the originating fund family spills over to the recipient family. These knowledge spillovers intensify when switching managers had better access to the organization processes of the originating family and frictions hampering knowledge absorption are weaker. Ease of knowledge integration, greater organizational similarity, and lower information barriers at the recipient family—acting as mitigants for the aforementioned frictions—also magnify these knowledge spillovers.

Keywords: organization capital, knowledge spillovers, mutual funds, learning-by-hiring

JEL-Classification: D86, G23 K12, K31, M5

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Competition in the mutual fund industry is high (e.g., Wahal and Wang 2011, Khorana and Servaes 2012, and Cremers, Ferreira, Matos, and Starks 2016), and fund families spend substantial resources to maintain existing competitive advantages or develop new ones. In that respect, they hire highly skilled managers and invest continuously in their organizational processes and supporting resources in order for their fund managers to achieve the best performance possible.[1] However, such investments undertaken by fund families are at risk when competitors hire away their fund managers as a means of studying and recreating their advantages. The reason is that a fund manager who has worked for a given fund family for a certain period of time is likely to have accumulated knowledge regarding that family's organizational processes and resources, which she can potentially transfer to her new employer after changing jobs.[2]

Such knowledge transfers are potentially important for two reasons. First, if knowledge spillovers happen and fund families are thus unable to protect their competitive advantage from being copied by competitors, fund families might have less of an incentive to invest in their organization processes and resources, which in turn might make the securities markets less efficient. Second, if knowledge spillovers exist and they affect the performance of the recipient and the originating family in opposite ways, this would suggest that spillovers of this type cause wealth transfers across investors who invest in the respective families. Despite their potentially high importance in the asset management industry, such knowledge spillovers due to labor

[1] Examples of organizational processes in this context include research, investment, and distribution processes and examples of resources include information systems and data or research analyst pools.

[2] The notion of knowledge spillovers via labor mobility was first acknowledged by Arrow (1962) in the economics literature. Subsequent papers have documented that labor mobility is an important channel through which knowledge spillovers occur across firms (e.g., Møen 2005; Stoyanov and Zubanov 2012; and Heggedal, Moen, and Preugschat 2017). A number of related papers also document knowledge spillovers through the labor channel from multinational corporations to local firms (e.g., Görg and Strobl 2005; Balsvik 2011; Pesola 2011; and Poole 2013).

mobility have not yet been studied. The objective of our study is to fill this gap left by previous research.

From a theoretical point of view, it is not clear whether such spillovers materialize. On the one hand, fund families with more limited resources or weaker organization processes might try to emulate families with competitive advantages by hiring away their fund managers in order to understand the know-how behind their advantages and consequently utilize this information to produce better investment outcomes. This would lead to knowledge transfers and ultimately to performance improvements for recipient families. On the other hand, there are reasons why transmission of knowledge through a learning-by-hiring strategy might not work and performance not increase. First, constraints and frictions at the recipient firm might undermine knowledge spillovers as argued by Eeckhout and Jovanovic (2002) and Song, Almeida, and Wu (2003).[3] Second, fund families might seek to limit the knowledge that a manager can transfer when she moves. For example, many fund families use non-compete or garden-leave clauses in employment contracts, which delay the actual time when the departing manager can start working at the new family, as a way of preventing these managers from transmitting up-to-date information to their new employers (e.g., Cici, Hendriock, and Kempf 2019).[4] Therefore, whether knowledge spillovers happen across fund families or not is an empirical question.

In our paper, to test whether knowledge spillovers happen through labor mobility, we rely on 290 cases of US mutual fund managers switching families during our 1992-2017 sample period in a difference-in-differences setting. Key to our analysis is what we refer to as the "performance gap", which is a proxy for the competitive advantage of the originating family relative to the recipient family in a particular sector. We compute performance gap as the

[3] Imperfect copying from leading companies is at the core of the dynamic model with knowledge spillovers of Eeckhout and Jovanovic (2002), whereas Song, Almeida, and Wu (2003) test and find support for the hypothesis that firms that are path-dependent exhibit lower acceptance of knowledge generated outside of the organization.

[4] A non-compete clause prohibits an employee from working for a competing firm during a limited period of time and in a certain geographical area. A garden leave clause extends employment by a period of time during which an employee is still officially employed and paid by the firm but has no significant responsibilities. Garden leave periods are typically six months or less, while non-complete clauses cover periods of up to three years.

performance difference in a given sector between the originating and the recipient family before the manager's switch.[5] Our methodology relates the performance gap with the change in performance of the recipient family in the respective sector after the switch in a regression framework. The resulting coefficient on the performance gap reflects the knowledge spillover, i.e., what fraction of the comparative advantage of the originating family spills over to the recipient family. If the switching manager facilitates knowledge spillovers, we expect the knowledge spillover coefficient to be positive and significant. In other words, we expect the knowledge spillover and the associated performance improvement for the recipient family to be greater when the performance gap between the originating and recipient family is greater, i.e., when the originating family enjoys a greater competitive advantage relative to the recipient family.

Our results show a positive relation between the performance change of the recipient family and the performance gap. This supports our main hypothesis that as a portfolio manager moves, she transfers knowledge from the originating to the recipient family. This result is both statistically and economically significant. To illustrate economic significance, our knowledge spillover coefficient estimates suggest that about one quarter of the competitive advantage of the originating family spills over to the recipient family during the three-year period after the manager switches families.

While the finding of a positive relation between the performance gap and the performance change of the recipient family supports the inference that the switching portfolio manager facilitates knowledge transfers from the originating to the recipient family, it is possible that the documented performance effect is due to the switching portfolio manager having superior general human capital, which improves the performance of the recipient fund family (e.g., Ma 2013). To rule this out, we re-compute the aggregate performance of the

[5] We measure characteristic-adjusted performance at the level of the aggregate equity portfolio of the family in each of the 12 Fama-French industries, which we refer to as sectors.

recipient family portfolio and the performance gap measure at the sector level after stripping away all the holdings contributed by the funds managed by the switching manager. The positive relation between the recomputed performance gap and the change in the recomputed performance of the recipient family persists. Further, we control explicitly for the performance of the switching manager prior to the switch in our regressions, and our results are again unaffected. In sum, we are able to rule out that human capital of the switching portfolio manager is responsible for the performance improvement of the recipient family. This supports our view that knowledge about organization processes and resources (organization capital, hereafter) spills over to the recipient family and leads to performance improvements.

Fund managers being more likely to move into families that have taken actions to improve future performance raises endogeneity concerns. Fund families might have already been investing in improving their general investment processes or their investment capabilities in certain sectors where they are at a disadvantage, perhaps, among others, to make the position attractive to new manager candidates. To account for the first possibility, we measure characteristic-adjusted performance at the level of the aggregate equity portfolio of the family in each of the 12 Fama-French industries (hereafter referred to as sectors) and employ recipient family-by-year fixed effects. This enables us to exploit within-recipient family variation in each given year. To account for the second possibility, we control explicitly for sector performance improving trends over the last 36 months that are likely to arise due to the second kind of investments. The knowledge spillover coefficient continues to be significant with almost no change in its magnitude. This provides additional support for the causal interpretation of our results.

The competitive advantage of the originating family relative to the recipient family measured by the performance gap reflects differences in the quality of human capital and organization capital between the two families. However, because only knowledge of organization capital is portable, we expect that knowledge spillover will intensify when the

switching manager has amassed a greater organization capital knowledge at the originating family, which should depend on the extent of access that the switching manager had to this knowledge. Thus, we expect that better access to the organization capital at the originating family leads to stronger knowledge spillovers from the originating to the recipient family. That is indeed what we find. The sensitivity of the performance change at the recipient family to the performance gap increases when the switching manager had better access to this organization capital while working at the originating family either by managing a larger fraction of the family assets or by holding a senior position in the organization. This provides further support for our main hypothesis.

Certain frictions might reduce inter-firm knowledge transfers through labor mobility, as argued in Eeckhout and Jovanovic (2002) and Song, Almeida, and Wu (2003), by lowering the absorption of new knowledge at the recipient family. We hypothesize that such frictions are going to be weaker and the new knowledge absorption higher when: (1) the organization capital at the originating family is broad as opposed to narrow; (2) the two families affected by the manager switch are similarly organized; and (3) the information barriers are lower at the recipient family. Intuitively, knowledge of broad organization capital is easier to translate into the organization processes of the recipient family than knowledge of narrow capital, which would be more complex and require more specialized skills for its integration. Similarities in organization structure between the affected families, should also allow for an easier integration of knowledge created under similar organizational conditions. Similarly, low information barriers at the recipient family would help with a quicker introduction of the transported knowledge to all members of the organization and easy follow-up communications regarding its integration, which is expected to increase the absorption of the new knowledge. Using various metrics to capture these various factors, we find evidence supporting our hypothesis.

Our paper makes a contribution to the literature that studies competition in the mutual fund industry (e.g., Elton, Gruber, and Busse 2004; Hortacsu and Syverson 2004; Choi,

Laibson, and Madrian 2010; Wahal and Wang 2011; Khorana and Servaes 2012; and Cremers, Ferreira, Matos, and Starks 2016). The most recent evidence from this literature suggests that competition in the mutual fund industry is high, with price competition as well as product differentiation featuring prominently in the strategies of mutual fund families. Our analysis furthers our understanding of the nature of competition in the mutual industry by suggesting another way in which mutual fund families compete, namely by obtaining knowledge of each other's organization capital through mobility of their work force.

Our paper also contributes to a growing literature that studies strategies employed by mutual fund families that affect the performance of their member funds. Examples of such strategies include cross-fund performance subsidization (e.g., Guedj and Papastaikoudi 2005 and Gaspar, Massa, and Matos 2006), centralization of decision making (e.g., Kacperczyk and Seru 2015), outsourcing of portfolio management (e.g., Chen, Hong, Jiang, and Kubik 2013; Kostovetsky and Warner 2015; Moreno, Rodriguez, and Zambrana 2018; and Debaere and Evans 2015). Our contribution to this literature is that by documenting knowledge spillovers that happen though labor mobility, we are in effect documenting an additional strategic decision, namely learning-by-hiring, that can potentially affect the quality of a family's organization capital and consequently its performance.

The rest of our paper is organized as follows. In Section 1 we describe our data and provide descriptive statistics. Section 2 documents that knowledge spillovers exist in the fund industry and, thus, presents the main results of the paper. In Section 3 we identify factors that strengthen knowledge spillover. Section 4 concludes.

1. Data

1.1 Data sources

We obtain information on family names and fund characteristics, such as monthly net returns, total net assets under management, investment objectives, and others, from the CRSP

Survivor-Bias-Free U.S. Mutual Fund Database (CRSP MF). Our sample consists of actively managed diversified U.S. domestic equity and sector funds, excluding international, balanced, bond, index, and money market funds. Information provided at the share-class level is aggregated at the fund level by value-weighting all share classes of a fund.

To obtain data on fund portfolio holdings, we merge the CRSP MF database with the Thomson Reuters Mutual Fund Holdings Database (MF Holdings) using the MFLINK tables. In addition, funds' common stock portfolio holdings are supplemented with stock-specific information from the CRSP Monthly Stock Database (CRSP MS), which we link with MF holdings using stock CUSIPS. We categorize stocks into twelve sectors using the 12 industry definitions provided in Kenneth French's data library.[6]

Finally, we obtain the names of fund managers from the Morningstar Direct Mutual Fund Database (MS Direct). We merge MS Direct with CRSP MF using fund CUSIPs. The combination of these two datasets helps us construct an employer-employee data set that maps portfolio managers to the funds that they manage at each point in time and the families they work for. Instances when a manager starts to manage funds for another family under a subadvising arrangement while still being an employee of the same family are manually checked and are not treated as family switches. The employer-employee data set allows us to track the exact date when a manager was lastly reported as a portfolio manager at the originating family and also shows the first date the switching manager assumed responsibilities at the recipient family. Manager switches due to mergers between fund families are manually checked and eliminated from our sample because the associated business restructuring, which might in turn give rise to restructuring of investment processes for the combined entities, makes it hard to isolate one-directional knowledge spillovers and their impact on performance. We restrict our sample of manager switches to observations, in which the time span between the originating

[6] Data on industry definitions is obtained from "Details" of 12 Industry Portfolios as published on http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

and recipient family is less than 36 months.[7] In cases of a longer time span, the likelihood that the managers engaged in interim activities such as working at or consulting for non-mutual fund companies is greater. This makes it hard to attribute the transferred knowledge to the originating family because part of that knowledge could have originated at other non-mutual fund firms where the manager worked in the interim.

The first manager switch in our sample happens in February 1992 and the last one in December 2014. Because our analysis (see below) requires 36 months of family and fund data before and after each switch, our sample period is from February 1989 till December 2017. We analyze 290 manager switches from 113 distinct originating families to 122 unique recipient families.

1.2 Descriptive Statistics

Table I provides descriptive statistics for the recipient and the originating families as well as all other (not treated) families. There are 122 distinct recipient and 113 distinct originating families compared to 661 not-treated families. There are no significant differences between recipient and originating families in our sample suggesting that recipient families hire, on average, managers from competitors with similar family characteristics. This might be due to the concern that big differences between the families could make the absorption of transferred knowledge more difficult for the recipient family, a hypothesis we test in Section 3.2.

All family groups show about the same average family size as measured by their assets under management. However, recipient and originating families employ more managers, on average, than the other families, with the difference being statistically significant at the 1%-level. This reflects the fact that families with more fund managers are more likely to be in the

[7] This time span between the end date at the originating family and start date at the recipient family is likely due to non-compete clauses in employment contracts used by mutual fund families to restrict portfolio manager mobility (e.g., Cici, Hendriock, and Kempf 2019). We chose to restrict it to less than 36 months because non-compete clauses restrict their employees to not work for a competitor typically for up to three years.

position of needing to hire a new manager or losing a manager to a competitor.

Insert Table I about here

All family groups employ the team-management approach and outsource funds to the same degree. Furthermore, there are no significant performance differences among the three family groups. They all deliver comparable DGTW-adjusted returns, which have been aggregated over all their equity holdings and measured over the last 36 months before the managers' switch.

1.3 Methodology and Definition of Key Variables

The main independent variable in our study is the performance gap (PG^S), which is a proxy for the competitive advantage of the originating family (denoted by O) relative to the recipient family (denoted by R) in a particular sector of the stock market (denoted by S).[8] It is measured as the performance difference of family portfolio holdings in sector *S* between the originating and the recipient family during the 3-year period before time *T* when the switching manager takes over her first fund at the recipient family. Thus, using DGTW characteristic-adjusted returns to measure portfolio performance, the performance gap is expressed as follows:

$$PG^S(T) = DGTW_O^S(T-3,T) - DGTW_R^S(T-3,T) \quad (1)$$

We want to assess the change in the performance of the recipient family resulting from potential knowledge transfer facilitated by the switching manager. Thus, the basis for the dependent variable is $\Delta DGTW_R^S(T)$, which is the change in the performance of the recipient family in sector *S* from the three-year period before to the three-year period after the starting

[8] The sector classification is based on the 12 Fama-French industry-based groupings. We exclude the Others sector due to its heterogeneity.

date T of the newly hired manager.

However, we need to control for performance changes that do not result from the manager switch. For example, long-term industry return reversals documented in previous research (e.g., Bornholt, Gharaibeh, and Malin 2015 and Wu and Mazouz 2016) could give rise to a spurious relation between the performance gap defined above and the performance change of the recipient family. Thus, to account for this possibility, we subtract $\Delta DGTW_C^S$, which is the performance change of a control group of families (denoted by C), from $\Delta DGTW_R^S(T)$, which is the performance change of the recipient family.[9] For each recipient family, the control group includes three fund families (i) that are closest to the recipient family with respect to performance in sector S in the three year period before *T*, (ii) that have not hired a new fund manager during the three-years periods before and after *T*, and (iii) from those no fund managers were hired away during the three-years periods before and after *T*.

We compute the DGTW return of a family sector portfolio as the value-weighted sum of the DGTW-adjusted returns of all stocks that the family holds in that sector (aggregated over all the family funds in our sample). We calculate a stock's characteristic adjusted return in a given month by subtracting from its return the return of the benchmark portfolio, to which that particular stock belongs. Each stock's benchmark portfolio is a value-weighted portfolio that includes all stocks that are part of the same size, book-to-market, and one-year past return quintile. Based on these DTGW returns of family sector portfolios, we calculate sector-specific performance gaps, sector-specific performance changes of the recipient family, and the respective performance measures for the control groups.

To examine the impact that the performance gap has on the performance change of the

[9] Furthermore, to account for any remaining spurious effects, we introduce a bootstrap approach in the next section.

recipient family, we estimate the following regression:

$$\Delta DGTW_R^S(T) - \Delta DGTW_C^S(T) = \alpha + \beta PG^S(T) + \varepsilon_R^S(T) \quad (2)$$

The β coefficient on the performance gap, which we refer to as the knowledge spillover coefficient, measures the knowledge spillover, i.e., what fraction of the comparative advantage of the originating family spills over to the recipient family. If the switching manager facilitates knowledge spillovers, we expect the knowledge spillover coefficient to be positive and significant.

It is important to note that to control for unobserved family heterogeneity, we employ recipient family-by-year fixed effects in regression (2) and thus exploit variation in sector performance within each recipient family in a given year.

2. Knowledge Spillovers and the Performance of the Recipient Family

2.1 Baseline Result

To examine whether knowledge spillovers facilitated by switching managers materialize, we estimate regression (2). Results are presented in Table II, where we employ in columns (1) – (3) various combinations of sector fixed effects to control for cross-sector differences in knowledge production intensity (e.g., Utilities vs. Healthcare) and recipient family by year fixed effects to control for unobserved heterogeneity across families. In all specifications, we cluster standard errors by recipient families.

Insert Table II about here

All specifications in Table II show a positive relation between the control-adjusted performance change of the recipient family and the performance gap. The knowledge spillover coefficient is statistically significant at the 1%- level and highly relevant in economic terms.

For example, when we use sector and recipient family-by-year fixed effects, the value of the knowledge spillover coefficient suggests that a one-percent performance gap is associated with a future performance improvement of 0.24 percentage points per year for the recipient family. This is consistent with almost one quarter of the competitive advantage of the originating family relative to the recipient family spilling over to the recipient family within three years after the manager switched families. Thus, the evidence from Table II provides strong support for our main hypothesis that knowledge spillovers facilitated by portfolio manager mobility are greater when the portfolio managers move from a family that is at a competitive advantage relative to the recipient family.

To rule out the possible concern that our methodology might lead to spurious results, we perform a bootstrap procedure where recipient and originating families are assigned randomly, i.e., these pseudo-recipient families hired no managers and from the pseudo-originating families no managers were hired away in fact. This sampling approach imposes the null hypothesis that the performance gap between the pseudo-originating and pseudo-recipient family has no impact on the performance change of the pseudo-recipient family. We re-estimate the models of Table II but now based on randomly assigned recipient and originating families. In each bootstrap run, in line with the actual number of manager switches, we assign 300 pseudo manager switches where the pseudo-originating and pseudo-recipient families are selected as described above and then estimate regression model (2). We repeat this procedure 1,000 times and thus estimate 1,000 coefficients from the corresponding regressions. In Figure 1, we display

the distribution of coefficient of the performance gap. Panels A - C correspond to columns (1) – (3) in Table II.

Insert Figure 1 about here

We observe that the actual coefficients of Table II are positioned at the right-hand tail of the bootstrap distribution, such that they are significantly greater than the mean of the empirical distribution. The p-value is smaller than 1% in each panel. This result rejects the null that the performance gap has no impact on the performance of the recipient family and thus rules out the concern that the results reported in Table II are spurious.

2.2. Controlling for the Human Capital of the Switching Manager

Previous research documents that various aspects of portfolio managers' human capital such as education (e.g., Chevalier and Ellison 1999; Gottesman and Morey 2006; Fang, Kempf, and Trapp 2014), investment experience (e.g., Golec 1996; Chevalier and Ellison 1999; Greenwood and Nagel 2009; and Kempf, Manconi, and Spalt 2017), and prior industry experience (e.g., Cici, Gehde-Trapp, Göricke, and Kempf 2018) have a positive effect on the investment performance of these managers. In light of this evidence, an alternative explanation for the performance effect we document above is that recipient families might hire managers with superior human capital (e.g., Ma 2013). In other words, the performance effect might result from the high quality of the switching fund manager and not from the knowledge spillover from the originating family.

We conduct two tests to control for any performance effects that are possibly related to the superior human capital of the switching portfolio manager. In the first test, we re-compute the performance of the recipient family after removing all the holdings contributed by the funds managed by the switching manager. We then re-estimate the results of Table II using the re-

computed variables that have been stripped of any direct influences coming from the human capital of the switching portfolio manager.

Insert Table III about here

Results are presented in Panel A of Table III. We observe that the positive relation between the re-computed performance gap and the change in the re-computed performance of the recipient family remains highly significant. This provides a first indication that the performance improvement of the recipient family does not result from hiring a portfolio manager with superior human capital.

To further support this conclusion, in the second test, we extend the analysis of Panel A by adding explicit control variables for the performance of the switching manager prior to the switch. We view prior performance of the switching manager as a comprehensive measure of the quality of the switching manager's human capital. The idea is that the superior human capital of the switching manager could affect the performance of the recipient family in ways other than through performance of the investments managed directly by the switching manager. For example, a skilled newly-hired fund manager might mentor, advise, and even help train other managers at the recipient family. Additionally, given her superior human capital, she might also increase the internal benchmark and thus the competitive pressure within the fund family. All these might cause the other fund managers from the recipient family to improve their performance.

In Panel B of Table III we control for the quality of the human capital of the switching managers in two ways. First, we control for the performance of all the holdings of the switching manager in the originating family during the three-year period prior to her departure. This captures the overall skills of the switching manager. Second, we control for the performance of the holdings of the switching manager during the same period in the respective sector, i.e., the

sector-specific skills. The positive relation between the re-computed performance gap and the change in the re-computed performance of the recipient family continues to be highly significant even after we control for the quality of the switching manager's human capital. In sum, the results from both tests rule out that the human capital of the switching portfolio manager is responsible for the overall performance improvement of the recipient family.

2.3. Endogeneity

The assignment of managers to recipient families is likely to be non-random with fund families deciding which managers to hire and fund managers self-selecting to join certain companies. It is likely that fund families planning to hire new managers first take actions intended to improve future performance that make the position attractive for their candidates. This could lead to endogeneity concerns and weaken the causal interpretation of our results. There are two possibilities that come to mind. First, the recipient families may have been investing in improving their general investment processes over the last couple of years or commit to do so going forward, which might appeal to certain managers, who then decide to join these families. In that case, the subsequent performance improvement we document in certain sectors could be at least in part attributed to these investments undertaken by the recipient family. We control for this possibility by using recipient family-by-year fixed effects, which allows us to exploit variation across different sectors within recipient families.

Another possibility is that, rather than making general investments, the recipient families have been investing specifically in strengthening their analytical capabilities in certain sectors over the last couple of years. This might be appealing to certain managers working at families that already enjoy comparative advantages in those sectors, motivating them to make the switch to what these managers might perceive to be challenging, yet rewarding, environment. If these sector-specific investments at recipient families indeed happened, we

would expect to see a gradual performance improvement in specific sectors in the period before the manager switch.

To control for this possibility, we proceed as follows. To capture the gradual improvement discussed above, which reflects sector-specific performance-improving investments at the recipient family, we estimate the coefficient on the time index from a linear trend model over the 36 months prior to the manager switch. The estimation is done on the performance of each sector portfolio of each recipient family, where performance in a given sector for a given recipient family is benchmarked against the average performance of all other families in that same sector. The resulting trend coefficient is then used as a control variable in Model (2). We also interact the trend coefficient with the performance gap to see whether the sector-specific investments by the recipient family amplify the effect of knowledge spillovers on performance.

Insert Table IV about here

Results are presented in Table IV. The trend coefficient has a positive effect on the performance change of the recipient family. This supports the notion that recipient families have been indeed making performance-improving investments in sectors—where they were at a comparative disadvantage—even before the manager switch, and these investments are in part responsible for the performance improvement we document. However, our main effect is not subsumed by the inclusion of the trend coefficient, which is what we would expect if the endogeneity aspect described above was responsible for it. On the contrary, the coefficient on the performance gap continues to be significant and its size almost unaffected by the inclusion of the trend coefficient. Moreover, the interaction of the performance gap with the trend coefficient is insignificant. Overall, this suggests that recipient families were following a two-pronged approach in trying to improve performance in sectors where they were at a comparative

disadvantage. One aspect involved making performance-improving investments even before attracting new personnel, and the other involved hiring managers from competitor families as a way to access their superior investment processes.

3. Factors that Strengthen the Effect of Knowledge Spillovers

In this section, we examine additional hypotheses related to factors that are expected to intensify the knowledge spillover we document above. We start with the hypothesis that the knowledge spillover due to manager mobility intensifies when the switching manager amasses more knowledge of the organization capital at the originating family. This amassment should depend on the extent of access the switching manager had to this capital. Next, we consider the ability of the recipient family to absorb the transferred knowledge as another factor expected to affect knowledge spillovers. We test these hypotheses in Section 3.1 and 3.2, respectively. In all specifications, we cluster standard errors by recipient families and employ sector as well as recipient family-by-year fixed effects to control for cross-sector differences in knowledge production intensity and for unobserved heterogeneity among the fund families.

3.1. Switching Manager's Access to Organization Capital

We expect that knowledge spillovers will intensify when the switching manager has amassed a greater organization capital knowledge at the originating family, which should depend on the extent of access that the switching manager had to the organization capital of the switching family. Thus, we expect that better access to the organization capital at the originating family leads to stronger knowledge spillovers from the originating to the recipient family.

We follow two approaches to identify switching managers that had better access to organization capital at the originating family. First, we argue that size of the assets managed by the switching manager while working at the originating family determines her access to organization capital. The rationale is that managers with a large asset base enjoy an

economically more important position in the family relative to managers with smaller asset base. Such a position should provide the managers with better access to the family resources and consequently better access to the organization capital of the originating family. Under this approach, we classify switching managers with *High Access* to organization capital as those whose assets under management were above the median assets of all fund managers from the same family. The second approach we follow to identify managers with better access to the organization capital of the originating family employs the position that the switching manager held in the originating family. The idea is that managers who held a more senior position at the originating family, by the nature of their job, had better access to the organization capital of the originating family. For example, a manager who is also a Director of Research and thus manages and coordinates many of family's research and investment processes is likely to have better access to the organization capital than someone who had no other responsibilities apart from portfolio management. To identify switching portfolio managers that held senior positions at the originating family, we look for keywords in the titles of those managers such as Director of Research, Chief Investment Office, etc.[10] Under this approach, we classify switching managers with *High Access* to organization capital as those managers that held a senior position in the originating family. To ensure that switching managers' access to organization capital was non-trivial, for both approaches of defining the *High Access* indicator variables, we also impose the condition that the manager had that position for at least six months. We interact both *High Access* indicator variables with the performance gap.

Insert Table V about here

[10] More specifically, we search for the keywords Chief Executive Officer, Chief Investment Officer, Co-Chief Investment Officer, Director of Equity Research, Director of Research, Executive Vice President, Head of Investments, Managing Director, Partner, President, Principal, Senior Vice President, and Senior Managing Director.

Results are reported in Table V. They show that the coefficient on the interaction of performance gap with the *High Access* dummy is statistically significant for both approaches of measuring access. In addition, these results are highly significant in an economic sense, suggesting that switching managers that had better access to the organization capital of the originating family facilitate knowledge spillovers that are twice as high as those of other switching managers that did not have that kind of access. In sum, our findings from Table V strongly suggest that better access to the organization capital of the originating family allows the switching manager to accumulate more potentially transferrable knowledge, which in turn strengthens the actual knowledge spillover that occur through managerial mobility. Thus, our findings are consistent with the view that hiring a fund manager with better access to the organization capital of the originating family pays off for the recipient families.

3.2. Absorption of Organization Capital Knowledge

So far, we have focused on how much organization capital knowledge the switching manager amassed at the originating family. Now, we turn our attention to factors that could affect the ability for the transferred knowledge to be absorbed, which ultimately will impact the extent of knowledge spillovers.

3.2.1. Broad versus Narrow Organization Capital

We hypothesize that the absorption of organization capital knowledge brought over by the switching manager will be greater for the recipient family if the organization capital at the originating family is broad as opposed to narrow. The reason is that knowledge of organization capital might be harder to translate or integrate into the investment processes of the recipient family when it is narrow because it (i) might not fit the needs of the recipient family and (ii) might require specialized skills to integrate it due to its more complex nature.

We use two ways to categorize the originating family as having broad rather than narrow

organization capital. The first approach employs family sector concentration; the idea being that a family with a lower sector concentration is more likely to have broad expertise in many sectors as opposed to narrow expertise in just a few sectors. We calculate sector concentration as proposed by Kacperczyk, Sialm, and Zheng (2005) using the Fama-French 12 Sectors and the CRSP MS universe as the benchmark portfolio. More specifically, the industry concentration index is calculated as the sum of the squared differences between the family weight in the sector and the weight of this sector in the market portfolio. This index is smaller if the family portfolio resembles the market portfolio in terms of holdings across sectors.

The second approach employs family style concentration. This reflects the observation that some families specialize in certain investment styles while others take a more generalist approach offering a broader menu of investment products. We calculate style concentration as the sum of the squared differences between the weight of the aggregated family portfolio in a particular style and the weight in the same style of the median family portfolio. Thus, style concentration is smaller if the family portfolio resembles the portfolio of the median family in terms of holdings across styles.

Using the two measures described above, we split the group of originating families into two groups based on whether their organizational capital is broad or narrow. We then denote families with broad organization capital by an indicator variable, *Broad*, which we interact with the performance gap. Results are presented in Table VI.

Insert Table VI about here

Results support our hypothesis. The coefficients on the interaction terms in columns (1) and (2) where the two different proxies for broad organization capital are used are positive and also economically and statistically significant. To illustrate economic significance, when originating families have broad organization capital the knowledge spillover is more than 50%

higher relative to the spillovers materializing when the originating families has narrow capital. This suggests that knowledge of broad relative to narrow organization capital is easier to transfer from the originating to the recipient family because such knowledge can be easily absorbed by both the switching manager and the recipient family.

3.2.2. Organizational Similarity between Originating and Recipient Family

Organizational differences between the originating and recipient families are likely to hinder the absorption of organization capital knowledge brought over by the switching manager. One important organizational difference that we can observe from the available data is associated with the fund management approach. In particular, if the originating family uses investment processes that revolve around an integrative team approach, knowledge of those processes brought over by the switching manager might be of limited use to a recipient family that does not use the team management approach. Thus, we hypothesize that knowledge spillovers are larger between fund families that follow a similar management approach.

To test this hypothesis, we capture the management approach by the percentage of team-managed funds in a family. Like before, we use an indicator variable approach. The originating and recipient families are considered as similar with respect to the management approach, i.e., the respective indicator (*High Similarity)* is set to one, if the absolute difference in their percentage of team-managed funds is below the median of all family pairs that exchanged a manager. Results are presented in Table VII. In Model (1), we use the fraction of the number of funds managed by teams, and in Model (2), we use the fraction of total fund assets in the family managed in teams to construct the *High Similarity* indicator variable.

Insert Table VII about here

Results from Table VII support our hypothesis. Knowledge spillover is stronger for families that use a more similar management approach. The interaction term of the *High Similarity* dummy with the performance gap is positive and statistically significant in both specifications. The effect is also significant in economic terms, as knowledge spillover is almost 50 percent stronger for families with above median similarity relative to families with below median similarity.

3.2.3. Information Barriers at the Recipient Family

So far, we have considered characteristics of the organization capital at the originating family and differences between the families that exchanged managers as factors that can affect the absorption of organization capital knowledge carried over by the switching manager from the originating family. We now consider characteristics of the recipient family that can also affect inter-family knowledge spillovers due to manager moves. In particular, we deem information barriers within recipient fund families to be highly relevant in this context. This is supported by previous research; for example, Cici, Jaspersen, and Kempf (2017) document that weaker information barriers lead to a higher speed of information dissemination among mutual fund managers of the same family. We hypothesize that lower information barriers within the recipient family strengthen the extent to which the organization capital knowledge of the switching manager is absorbed and thus intensify knowledge spillovers through labor mobility.

We employ three methods to classify recipient families as having fewer information barriers. The first method employs the number of fund managers in the family. The rationale is that in a family with fewer fund managers, fund managers are likely to get to know other managers better and communicate more frequently with them. This results in lower

coordination costs (e.g., Becker and Murphy 1992), and lower organization barriers to communication and information dissemination.

The second method employs the interconnectedness among family fund managers. Interconnectedness among fund managers within a family captures the extent to which fund managers work closely together. Information barriers are expected to be lower when fund managers work closely together because that increases the level of communication among them and thus causes information to travel freely in the family. Interconnectedness in a fund family is computed as the network density of its managers (see, e.g., Granovetter 2005), i.e., number of connections between any two managers normalized by the number of potential connections. We define a connection between two managers if they co-manage at least one fund.

Our final measure captures the fraction of funds in the family outsourced to subadvisors. Information barriers within a family are expected to be lower when families have a lower fraction of outsourced funds since managers of outsourced funds are less likely to communicate with in-house managers due to the fact that they belong to different organizations and follow different investment processes. This is consistent with Arrow (1975) who argues that information flows better within rather than across firm boundaries.

Using the three information barrier measures described above, we split the group of recipient families into two groups based on whether their information barriers are low or high. We then denote families with lower information barriers by an indicator variable, *Low Barrier*, which we interact with the performance gap. Results are presented in Table VIII.

Insert Table VIII about here

Results from Table VIII support our hypothesis. The coefficients on the interaction terms in columns (1) - (3) where the three different proxies for low information barriers are used are positive and highly statistically significant. They are also highly significant

economically in that they suggests knowledge spillovers due to manager mobility to be more than 60 percent higher for the recipient families with lower information barriers than those with high information barriers. This suggests that weaker information barriers at the recipient families can be make manager switches even more effective tools of knowledge spillovers.

In sum, the results of Section 3 provide a clear picture of factors that facilitate knowledge spillovers from the originating to the recipient family. This implies that a fund family hiring a new manager should take into account not only the relative competitive advantage of the family where the manager is coming from but also the access to this capital the switching manager had, the type of organization capital at the originating family, the similarity of the originating family to itself, and information barriers present in its organization.

4. Conclusion

Although competition in the mutual fund industry has been subject to long-standing academic scrutiny, little to nothing is known of knowledge spillovers that may occur among mutual fund families. In a highly competitive industry such as the mutual fund industry, fund families with competitive advantages would try to protect and sustain their advantages, while families with no such advantages would aspire to gain access to the knowledge behind the advantages of their more successful counterparts. Our study is the first to investigate knowledge spillover across mutual fund families, focusing on a particular channel through which such spillovers may occur, namely labor mobility. The idea is that families with few or no competitive advantages might try to make up for their disadvantages by hiring mutual fund managers away from their more successful competitors as a way to access knowledge pertaining to the organization capital of their competitors.

We document economically significant inter-family knowledge spillovers caused by the mobility of mutual fund managers, whereby recipient families are the beneficiaries of significant performance improvement that results from such knowledge spillovers. Specifically,

we find that the related performance improvement is greater when knowledge is transferred via incoming managers from a family that is at a greater competitive advantage, with about one quarter of that advantage spilling over to the recipient family. In addition, we find that knowledge spillovers intensify when the switching manager had better access to the organization capital of the originating firm and when frictions hindering knowledge absorption are weaker. We identify ease of knowledge integration, greater organizational similarity, and lower information barriers at the recipient family as mitigating factors for the aforementioned frictions and show that they also lead to stronger knowledge spillovers.

Our analysis and findings are important for a two reasons, at least. First, our findings have implications for the hiring decisions of fund families with limited or no competitive advantages. In particular, these families might benefit from a learning-by-hiring strategy, which targets hires from families with more organization capital and targets managers who had better access to such capital. Second, the fact that the knowledge spillovers documented in this study benefit the performance of the recipient families could suggest that these spillovers cause wealth transfers from investors who invest with the originating family to those that invest with the recipient family.

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Table I: Family characteristics

This table reports descriptive statistics at the fund family level. Means are provided for three groups of fund families: recipient (Rec), originating (Orig), and non-treated (NT) families. The last three columns provide differences between the means of the various family groups. Family size measures total net assets under management aggregated over the fund family. Number of family managers is the number of managers employed by the fund family. Team management is the percentage of funds in the family that are managed by more than one portfolio manager. Outsourcing is the fraction of family funds offered by the family that are outsourced to subadvisors. DGTW-adjusted returns are estimated as in Daniel, Grinblatt, Titman, and Wermers (1997), where a stock's characteristic-adjusted return in a given month is computed by subtracting from its return from the return of the benchmark portfolio to which that particular stock belongs. These adjusted returns are then value-weighted at the fund family portfolio level. Size is reported in $ millions and Sector concentration as well as DGTW-adjusted return in percent. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level, respectively.

Characteristics	Recipient families	Originating families	Non-Treated families	Difference Rec - Orig	Difference Rec - NT	Difference Orig - NT
# Families	122	113	661			
Family size	15,096	13,648	17,001	1,448	-1,904	-3,353
				(0.28)	(-0.22)	(-0.38)
# Family managers	10.36	10.02	6.23	0.3468	4.1308***	3.7840***
				(0.34)	(3.12)	(2.62)
Team management	0.49	0.47	0.44	0.0216	0.0526	0.0310
				(0.69)	(1.43)	(0.76)
Outsourcing (%)	21.21	21.06	21.19	0.15	0.02	-0.13
				(0.04)	(0.01)	(-0.05)
DGTW (per year)	0.41	0.41	0.57	0.00	-0.16	-0.16
				(0.03)	(-0.47)	(-0.61)

Table II: Baseline results

This table presents results from OLS regressions that relate the control-adjusted performance change of the recipient family with the performance gap between the originating and recipient family. The performance gap is measured over a three-year-interval before time T (when the manager takes over her first fund at the recipient family). The control-adjusted performance change of the recipient family is computed by subtracting the performance change of a control group of families from the performance change of the recipient family. For each recipient family, the control group includes three fund families (i) that are closest to the recipient family with respect to performance in the three year period before T, (ii) that have not hired a new fund manager during the three-years periods before and after T, and (iii) from those no fund managers were hired away during the three-years periods before and after T. Performance change of the recipient family is measured from the three-year period before to the three-year period after time T. Performance is measured using DGTW-returns in all specifications. Performance change and performance gap are measured at the family-sector level, i.e., we calculate the value-weighted sum of the DGTW returns of all stocks that the fund family held in each sector. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level, respectively.

	(1)	(2)	(3)
Constant	0.0001 (1.25)	-	-
Performance gap	0.2396*** (11.66)	0.2406*** (11.72)	0.2364*** (10.24)
Sector FE	No	Yes	Yes
Recipient x Year FE	No	No	Yes
Cluster	Recipient	Recipient	Recipient
Observations	3,098	3,098	3,098
Adjusted R-squared	0.0939	0.0963	0.1202

Table III: Baseline Result Controlled for Switching Manager's Human Capital

This table replicates Table II using two modifications. In Panel A, we exclude funds managed by the switching manager when calculating the performance of the recipient and originating family. In Panel B, we extend the analysis of Panel A by controlling for the prior performance of the switching manager. We measure the switching manager's prior performance as the average DGTW-adjusted return of the funds she has managed in the originating family during the three-year period prior to her departure. Manager DGTW (all holdings) is calculated using all her stock holdings, Manager DGTW (sector holdings) is calculated using only her stock holdings in a specific sector. T-statistics are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level, respectively.

Panel A: Excluding the Holdings of the Switching Manager

	(1)	(2)	(3)
Constant	0.0001 (1.06)	-	-
Performance gap	0.2318*** (11.07)	0.2324*** (11.14)	0.2238*** (9.84)
Sector FE	No	Yes	Yes
Recipient x Year FE	No	No	Yes
Cluster	Recipient	Recipient	Recipient
Observations	3,054	3,054	3,054
Adjusted R-squared	0.0840	0.0838	0.1006

Panel B: Controlling for Prior Performance of the Switching Manager

	(1)	(2)	(3)
Performance gap	0.2174***	0.2185***	0.2186***
	(9.18)	(8.98)	(9.00)
Manager DGTW (all holdings)	0.0369		0.0351
	(1.02)		(0.78)
Manager DGTW (sector holdings)		0.0039	0.0037
		(0.59)	(0.55)
Sector FE	Yes	Yes	Yes
Recipient x Year FE	Yes	Yes	Yes
Cluster	Recipient	Recipient	Recipient
Observations	2,760	2,590	2,586
Adjusted R-squared	0.0972	0.1011	0.1009

Table IV: Controlling for performance trends in the family sector portfolio

This table presents an extended version of Panel B of Table III. We augment the models by including the trend coefficient from a linear trend model estimated in a previous step and also its interaction with the performance gap. The trend coefficient is estimated as the coefficient on the time index from a linear trend model over the 36 months prior to the manager switch. The estimation is done on the performance of each sector portfolio of each recipient family, where performance in a given sector for a given recipient family is benchmarked against the average performance of all other families in that same sector. T-statistics, based on standard errors clustered by recipient families, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level, respectively. In all specifications, we employ sector and recipient family by year fixed effects.

	(1)	(2)	(3)
Performance gap	0.2168***	0.2180***	0.2181***
	(9.14)	(9.00)	(9.01)
First-stage time trend coefficient (%)	0.0114***	0.0127***	0.0128***
	(2.67)	(2.90)	(2.91)
Performance gap* First-stage time trend coefficient (%)	-0.2240	-0.1624	-0.1621
	(-1.17)	(-0.80)	(-0.80)
Manager DGTW (all holdings)	0.0415		0.0398
	(1.07)		(0.82)
Manager DGTW (sector holdings)		0.0039	0.0036
		(0.60)	(0.55)
Sector FE	Yes	Yes	Yes
Recipient x Year FE	Yes	Yes	Yes
Cluster	Recipient	Recipient	Recipient
Observations	2,760	2,590	2,586
Adjusted R-squared	0.1021	0.1062	0.1060

Table V: Impact of Switching Manager's Access to Organization Capital

This table presents an extended version of Model (3) from Panel B of Table III. We interact the performance gap with a dummy variable, *High Access*, which captures the degree of access that the switching manager had to the organization capital of the originating family. In Model (1), High Access denotes an indicator variable that equals one if the assets under management for which the switching manager was responsible at the originating family was above the median of all fund managers in that family. In Model (2), the High Access dummy equals one if the switching manager held a senior position (defined as Chief Executive Officer, Chief Investment Officer, Co-Chief Investment Officer, Director of Equity Research, Director of Research, Executive Vice President, Head of Investments, Managing Director, Partner, President, Principal, Senior Vice President, and Senior Managing Director) at the originating family. For both methods, we also impose the condition that the switching manager had "high access" for at least six months. T-statistics, based on standard errors clustered by recipient families, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level, respectively. In all specifications, we employ sector and recipient family by year fixed effects.

Access Measured by:	Managers' Assets under Management (1)	Managers' Position (2)
Performance gap	0.1208***	0.1904***
	(4.75)	(8.44)
High Access	-0.0005	0.0011***
	(-1.11)	(16.88)
Performance gap * High Access	0.1461***	0.1949**
	(3.59)	(2.36)
Manager DGTW (all holdings)	0.0128	-0.0007
	(0.27)	(-0.02)
Manager DGTW (sector holdings)	0.0005	0.0028
	(0.09)	(0.45)
Observations	2,586	2,586
Adjusted R-squared	0.1102	0.1026

Table VI: Broad versus Narrow Organization Capital

This table presents an extended version of Model (3) in Panel B of Table III. We interact the performance gap with an indicator variable, *Broad*, which captures whether the organization capital at the originating family is broad as opposed to narrow. In Model (1), *Broad* equals one if the sector concentration of the aggregated family portfolio is above the median of all originating families. In Model (2), *Broad*, equals one if the style concentration of the aggregated family portfolio is above the median of all originating families. We calculate sector concentration as in Kacperczyk, Sialm, and Zheng (2005) using the Fama-French 12 Sectors and the CRSP stock universe as the benchmark portfolio. More specifically, the sector concentration index is calculated as the sum of the squared differences between the family weight in the sector and the weight of this sector in the market portfolio. Style concentration is measured as the sum of the squared differences between the weight of the aggregated family portfolio in a particular style and the weight in the same style of the median family portfolio. All variables underlying the dummies are averaged over the three-year period before time T (when the manager takes over her first fund at the recipient family). T-statistics, based on standard errors clustered by recipient families, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level, respectively. In all specifications, we employ sector and recipient family by year fixed effects.

Originating Family Categorized by:	Sector Concentration (1)	Style Concentration (2)
Performance gap	0.1479***	0.1673***
	(6.05)	(5.91)
Broad	0.0002	0.0004
	(0.54)	(1.07)
Performance gap * Broad	0.1164***	0.0741*
	(2.76)	(1.72)
Manager DGTW (all holdings)	0.0054	0.0077
	(0.11)	(0.20)
Manager DGTW (sector holdings)	0.0024	0.0026
	(0.39)	(0.42)
Observations	2,586	2,586
Adjusted R-squared	0.1062	0.1031

Table VII: Impact of Similarity between Recipient and Originating Family

This table presents an extended version of Model (3) in Panel B of Table III. We interact the performance gap with a dummy variable, *High Similarity*, which captures organizational similarity between originating and recipient family. In Model (1), *High Similarity* equals one, if the absolute difference in the percentage of the number of team-managed funds is below the median of all family pairs that exchanged a manager. In Model (2), *High Similarity* equals one, if the absolute difference in the percentage of the assets managed by team-managed funds is below the median of all family pairs that exchanged a manager. All variables underlying the dummies are averaged over the three-year period before time T (when the manager takes over her first fund at the recipient family). T-statistics, based on standard errors clustered by recipient families, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level, respectively. In all specifications, we employ sector and recipient family by year fixed effects.

Team management comparison based on:	Number of Funds (1)	Assets of Funds (2)
Performance gap	0.1628***	0.1655***
	(6.67)	(5.98)
High Similarity	-0.0003	-0.0004
	(-0.87)	(-1.38)
Performance gap * High Similarity	0.0718*	0.0800**
	(1.80)	(2.14)
Manager DGTW (all holdings)	-0.0007	-0.0051
	(-0.02)	(-0.12)
Manager DGTW (sector holdings)	0.0029	0.0016
	(0.46)	(0.25)
Observations	2,586	2,586
Adjusted R-squared	0.1030	0.1036

Table VIII: Impact of Information Barriers at Recipient Family

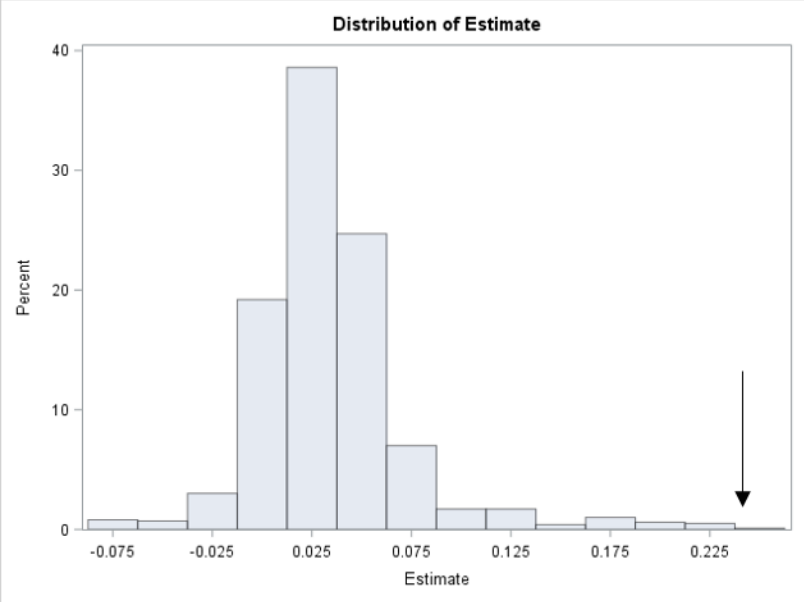
This table presents an extended version of Model (3) in Panel B of Table III. We interact the performance gap with a dummy variable, *Low Barrier*, which captures the weakness of information barriers at the recipient family. *Low Barrier* equals one if: the number of managers in the recipient family is below the median of all recipient families in Model (1); the interconnectedness of managers in the recipient family is above the median of all recipient families in Model (2); and fraction of outsourced funds in the recipient family is below the median of all recipient families in Model (3). Interconnectedness of a fund family is the network density of its managers (see, e.g., Granovetter 2005), measured as the number of connections between any two managers normalized by the number of potential connections. We define a connection between two managers if they co-manage at least one fund. All variables underlying the indicator variables are averaged over the three-year period before time T (when the manager takes over her first fund at the recipient family). T-statistics, based on standard errors clustered by recipient families, are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% significance level, respectively. In all specifications, we employ sector and recipient family by year fixed effects.

Information Barriers at Recipient Family Measured by:	Number of Managers (1)	Inter-connectedness (2)	Outsourced Funds (3)
Performance gap	0.1297***	0.1391***	0.1530***
	(5.48)	(5.44)	(6.39)
Low Barrier	0.0007	0.0006*	0.0012***
	(1.57)	(1.90)	(3.10)
Performance gap * Low Barrier	0.1067***	0.1158***	0.0934**
	(2.93)	(2.70)	(2.19)
Manager DGTW (all holdings)	0.0062	0.0073	0.0069
	(0.15)	(0.15)	(0.15)
Manager DGTW (sector holdings)	0.0028	0.0019	0.0012
	(0.44)	(0.30)	(0.19)
Observations	2,586	2,586	2,586
Adjusted R-squared	0.1052	0.1070	0.1047

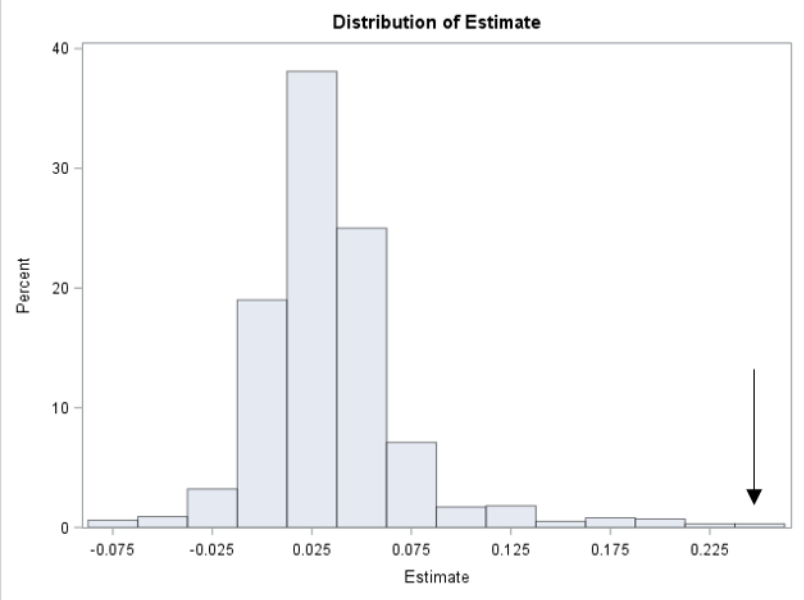
Figure 1: Simulation results

In each bootstrap run, we assign 300 pseudo manager switches where the pseudo-originating and pseudo-recipient families are selected as described below. Each random originating and recipient family pair is selected such that both families are not subject to a manager switch during the three-year periods before and after T, i.e., they have neither hired new fund managers nor have any of their fund managers hired away by competitors. Based on these random picks, we calculate $\Delta DGTW_R^S(T)$ and PG^S for each sector S. The control group needed to calculate $\Delta DGTW_C^S$ is chosen as described in Table 2. Based on these observations corresponding to one bootstrap run, we run regression (2). We repeat this 1,000 times and plot the resulting coefficients for the performance gap. Panels A – C correspond to columns (1) – (3) of Table II. Arrows indicate the positions of the actual coefficients for Table II.

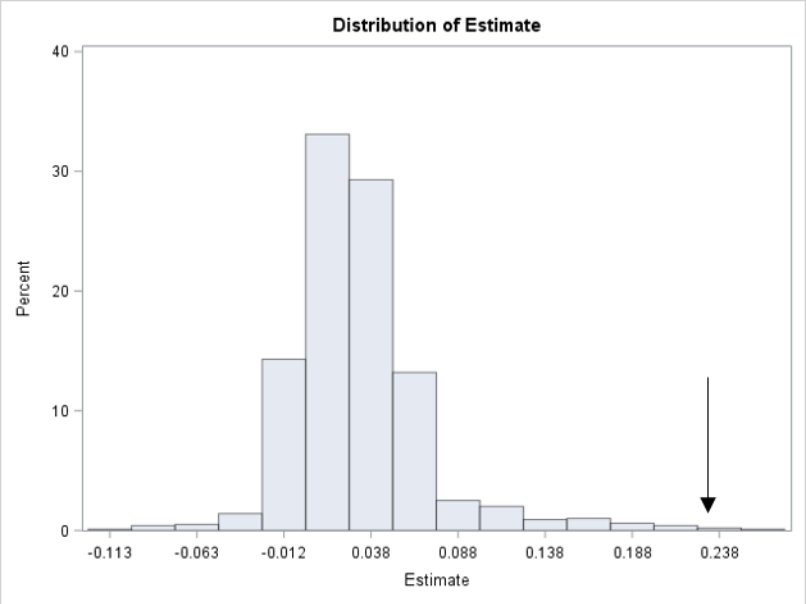
Panel A:



Panel B:



Panel C:


Distribution of Estimate
Percent
40
30
20
10
0
-0.113
-0.063
-0.012
0.038
0.088
0.138
0.188
0.238
Estimate

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