Common Ownership Directors*

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ABSTRACT

Although there is evidence that common ownership of public firms may affect various outcomes, the mechanism through which common owners affect corporate strategy remains unclear. Using data on overlapping directors and institutional shareholding from 2000 to 2019, we show that common ownership across firms in the same industry is associated with a higher probability that they share a director. The results are particularly strong for institutions with lower portfolio turnover and longer investment horizons. However, we find little relationship using common ownership by the "Big Three" fund families (BlackRock, Vanguard, and State Street). Our results hold across various measures of common ownership, different definitions of competitors, and a variety of robustness checks. Overall, we present a mechanism through which common ownership may affect managerial incentives.

JEL classification: G32, G24, K22.

Keywords: Common Ownership, Board Interlocks, Institutional Shareholders, Hedge Fund Activists

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I. Introduction

In public equity markets, it is increasingly the norm that competing firms are owned by the same set of institutional shareholders. However, the effect of such *common ownership* on managerial behavior remains ambiguous. If overlapping shareholders have an incentive to maximize industry-wide profits, and if managers internalize these incentives, common ownership may have anticompetitive effects and reduce welfare (Bresnahan and Salop, 1986; O'Brien and Salop, 2000; Azar, 2017). By contrast, common ownership may have beneficial effects if it leads to information spillovers or product market collaboration (Antón et al., 2021; López and Vives, 2019; He and Huang, 2017). Regardless of its consequences, however, identifying a *channel* through which common ownership affects managerial behavior has proved challenging because institutional investors rarely intervene in the management of their portfolio firms (Mancini and Nyeso, 2017).

This paper proposes one such mechanism: overlap in the boards of directors of competing firms. Despite evidence that competitors frequently share directors (Nili, 2020), the role of such interlocked directors as a conduit for common ownership is under-explored. This is perhaps surprising because directors are responsible for setting firm strategy and ensuring its implementation through appropriate managerial incentives. Further, the appointment of directors is often the only way shareholders can exert influence on firms. Thus, the appointment of *common directors* is one mechanism for *common owners* to influence managerial behavior.

Using comprehensive data on board membership between 2000 and 2019, we evaluate the relationship between common ownership and the appointment of overlapping directors in the same industry. Approximately [17%] of the public firms in our sample share a common director with another firm in the same industry. We find a robust empirical relationship between common ownership and the appointments of common directors. Specifically, we show that a pair of firms operating in the same industry is more likely to share a director when the level of common ownership across the pair is high.[1]

As our primary measure of common ownership, we use the GGL measure suggested by Gilje

[1] Our results are robust to different industry classifications.

et al. (2020). This measure has conceptual advantages over industry-wide measures of common ownership, such as the Δ MHHID measure, because it is constructed at the pair-level. Further, the GGL measure captures not only the size of a common owner's investment in a given firm, but also the size of that investment within its broader portfolio.

We find that a one standard deviation increase in the level of common ownership between two firms in the same industry increases the probability that they share a director by 0.04%. This result is estimated using our strictest specification, which includes year and pair fixed effects. While this effect appears small, it is largely an artifact of the data structure which consists of all possible firm pairs at the industry level. Thus, as the unconditional probability of common directors at the pair-year level is only 0.37%, the economic magnitude of our estimates is relatively large.

Our finding shows that institutions may affect board appointments calls for further investigation of the type of owners that drive these results. If institutions are actively involved in director appointments, we would expect the results to be driven by an increase in common ownership of active institutions, as opposed to passive owners.

We test whether the relationship between common ownership and board interlocks is driven by certain types of investors. We start by focusing on the "Big Three" fund families, Vanguard, BlackRock, and State Street. These fund families hold a very large percentage of most public firms, and they are generally regarded as passive and deferential to firm management [CITE]. Consistent with this view, we find that common ownership by the "Big Three" is not associated with an increase in common directors. Instead, our baseline result is driven by non-Big Three investors.

We further divide institutional investors (other than the Big Three) into different types by constructing the GGL measure for each type. First, we find that the results are driven by larger investors. Larger investors are likely to have greater influence on firm management. When common ownership by large investors increases by one standard deviation, the probability that a pair of firms shares a director increases by [0.033%]. Increasing common ownership by large investors has more than twice the effect of small investors.

Second, we consider portfolio concentration, which we calculate using a portfolio Herfindahl–Hirschman index ("HHI") measure. Less diversified investors are likely to be more active in the affairs of the firms in their portfolios. Indeed we find that institutions with high portfolio concentration have twice as large an effect as institutions with low portfolio concentration.

Third, we consider the investment horizon of different institutions. Investors with a longer time horizon are more likely to care about board appointments whose effect may take time to materialize. We measure portfolio turnover using the churn ratio from Gaspar et al. (2005). We find a larger effect for low-turnover institutions. Compared to high-turnover institutions, a one standard deviation increase in common ownership by low-turnover institutions has a 25% larger effect on the probability a pair of firms shares a director.

Finally, we further evaluate the effect of hedge fund ownership on board appointments. Hedge funds are well-known for active interventions in corporate strategy, including running proxy fights to get their representatives to be elected to the boards. Using the names of hedge funds from Brav and Jiang's database and Factset's list of hedge funds, we find that an increase in common ownership by hedge funds is associated with a greater likelihood of board interlocks.

Interestingly, however, the results remain statistically and economically significant for common ownership by non-hedge funds. In particular, non-hedge funds that are larger, more concentrated, and have longer investment horizons are associated with a greater likelihood of appointing a common director. Thus, our results are not limited to hedge funds, and suggest other institutions may be active in board appointments.

Taken together, our study provides a channel through which common ownership can affect managerial behavior regardless of the ultimate consequences. Pairs of firms with overlapping shareholders are more likely to share a director, and this relationship is driven by large, non-Big Three investors with low-turnover and high-concentration portfolios.

Our study contributes to the literature studying *channels* through which common ownership might affect firm outcomes. Antón et al. (2023) find that firms with high common ownership adopt compensation packages with lower sensitivity to performance, arguing that common owners tolerate compensation schemes that discourage managers from taking competitive actions. While appealing, the authors' mechanism may be incomplete, because in practice, the board of directors sets compensation without clear input from investors. Eldar et al. (2020) find that common ownership by venture capital firms is associated with overlapping directors, but their findings are limited to VCs playing an active role in managing startups. Recently, Geng et al. (2022), show that the percentage of overlapping directors that work at institutional investors is small. Their study however understates the possibility that directors may represent the interest of institutional investors even if they do not directly work for them. Moreover, while the number of common directors as a percentage of the total number of firm pairs in each industry for every year is low (0.037%), the percentage of firm pairs in each industry that at some point have common directors is large (32.1%).

We also contribute to the broader debate on the *outcomes* of common ownership. In a prominent study, Azar et al. (2018) find a positive relationship between common ownership and prices in the airline industry, leading to proposals for stronger antitrust enforcement (Elhauge, 2016), to limit the holdings of institutions in public firms (Posner et al., 2017) and to use Section 7 of the Clayton Act to enjoin common owners from acquiring significant shares in competitors (Morton and Hovenkamp, 2018). However, the evidence regarding the anti-competitive effects of common ownership has been questioned either for its empirical foundations (see Dennis et al. (2022), Rock and Rubinfeld (2018), McClane and Sinkinson (2021), and Backus et al. (2021).), or because of the lack of a clear mechanism through which common ownership affects outcomes (Hemphill and Kahan, 2020). Other studies portray a more positive view of common ownership, emphasizing that it may improve informational spillovers between firms (López and Vives, 2019; González-Uribe, 2020; Antón et al., 2021), facilitate product market collaboration (He and Huang, 2017), or reduce contracting and financing frictions (Lindsey, 2008; Eldar et al., 2020).

Our paper also contributes to the literature on director interlocks. Nili (2020) shows that competitors frequently share a director, a phenomenon the author refers to as "horizontal directors." Bouwman (2011) and Barzuza and Curtis (2017) show that director interlocks are a mechanism for governance practices to be transmitted across firms. Omer et al. (2020) and McClane and Nili (2021) show that director interlocks are associated with accounting quality. Finally, we contribute to a large literature on institutional investors and their effect on corporate governance.[2]

[2]Examples include Catan (2019), Eldar and Magnolfi (2020),Cremers and Sepe, 2020, McCahery et al. (2016), Bebchuk and Hirst 2019, Bebchuk and Hirst 2021, Kahan and Rock 2020, Fisch et al 2019), (Bebchuk and Hirst 2019), Aghion et al. (2013), Pawliczek et al. (2021), Iliev et al. (2021).

II. Data and Sample Construction

A. Directorships

We collect data on directorships from BoardEx for a sample of firms from 2000 to 2019. For each directorship, we observe: (i) the identity of the firm; (ii) the identity of the individual; and (iii) information about the directorship, such as its start and end dates. We keep only directorships at public companies, which BoardEx lists as "Listed Organizations", and only positions that BoardEx explicitly identifies as board positions. This removes records indicating corporate officer roles, such as "VP/Treasurer."

We then match BoardEx firms to firms in the CRSP-Compustat database using the firms' CUSIP. Using the start and end date of each directorship, we construct each firm's board as of December 31 each year. We drop firm-year observations where we do not observe at least one active director or where we do not observe a valid market capitalization. We keep only firms with CRSP share codes equal to 10 or 11.

B. Institutional Ownership

We use 13F filings as our data source for institutional ownership, which we access through Thomson Reuters. We collect manager-level holdings as of December of each year, where we use the total number of shares held as our measure of ownership; therefore, we make no distinction between voting and non-voting shares. Using share price and shares outstanding data from CRSP, we compute each manager's dollar investment as the product of the share price and the number of shares held. We then sum across all dollar positions to measure each manager's total portfolio value. We compute each manager's portfolio share in each firm as its dollar investment divided by total portfolio value. Finally, we compute each institution's ownership stake in each firm as its number of shares held divided by the firm's number of shares outstanding. Following Gormley et al. (2022), we consolidate BlackRock's different reporting entities into a single manager-firm-year record.

C. Pair-Level Panel Structure

Because our goal is to study the relationship between common ownership and director interlocks at the pair-year level, we enumerate all possible pairs of firms using our firm-year dataset. By way of notation, let ij represent a pair of firms, where $i(j)$ indexes the first (second) firm in the pair. Letting N_{ft} be the number of unique firms in the BoardEx dataset in year t, the number of pairs of firms, N_T, is given by

$$N_t = \binom{N_{ft}}{2} \tag{1}$$

where $(\cdot)$ denotes the binomial coefficient. We focus on common ownership within industries on the assumption that firms in the same industry operate in a similar space and may compete for similar business opportunities. We use two alternative industry designations. Our first designation is based on each firm's three-digit Standard Industry Classification (SIC) code. If a pair of firms shares an SIC-3 code for at least one year between 2000 to 2019, we mark them as competitors. We refer to this sample as the "SIC-3 universe." Our second designation is based on the Hoberg Phillips Text Based Industry Classification (TNIC) which was developed in (Hoberg and Phillips, 2016).[3] We deem a pair of firms as competitors if they share a non-zero TNIC score for at least one year between 2000 and 2019. We refer to this latter sample as the "Hoberg-Phillips universe." There are 713,363 pair firms in our sample and 4,588,228 observations using SIC-3 codes, and 896,681 pair firms and 6,389,879 observations using the Hoberg-Phillips industry classifications.

For each pair-year observation, we create an indicator variable, $Interlock_{ijt}$, which equals 100 if firms i and j share a director in year t, and 0 otherwise. We construct this variable by taking the intersect of each firm's board: if the size of the intersect is greater than or equal to one, the firms share a common director. We treat $Interlock_{ijt}$ as our main outcome variable.

[3]We download the claissification directly from the online Hoberg-Phillips data library available at hoberg-phillips.tuck.dartmouth.edu/.

D. Common Ownership Measures

We use the GGL measure developed by Gilje et al. (2020) as our main measure of common ownership, which we measure at the pair-year level. For each pair of firms i and j year t, we find the set of institutional investors owning either, or both, firms in the pair. Let M_{ijt} be their count and let $A_{ijt} = \{\alpha^m_{it}, \alpha^m_{jt}\}^{M_{ijt}}_{m=1}$ be their ownership stakes in each firm, where m indexes a common owner. Finally, let their portfolio shares allocated to each firm be $B_{ijt} = \{\beta^m_{it}, \beta^m_{jt}\}^{M_{ijt}}_{m=1}$. We construct the common ownership measure, GGL_{ijt}, as follows:

$$GGL_{ijt} = 0.5 \times \sum_{m}^{M_{ijt}} \left(\alpha^m_{it} \times \beta^m_{it} \times \alpha^m_{jt}\right) + 0.5 \times \sum_{m}^{M_{ijt}} \left(\alpha^m_{it} \times \beta^m_{jt} \times \alpha^m_{jt}\right) \quad (2)$$

The original measures used in Gilje et al. (2020) are one-directional, in the sense that $GGL_{ijt} \neq GG_{jit}$. However, because our outcome variable, $Interlock_{ijt}$, is bidirectional, we remain agnostic about the direction of the influence of common ownership. Our common ownership measure thus takes the average of both one-directional GGL measures.

Following Gilje et al. (2020), we divide each measure by its full-sample mean to facilitate interpretation. Due to the large right skew apparent in the measures, we right-winsorize each measure at the 95th percentile, and, within each regression sample, we standardize the measure, such that our coefficients reflect the change in the probability a pair of firms shares a director when common ownership increases by one standard deviation.

For robustness, we construct a simpler measure of common ownership, which simply counts the number of managers who hold both firms in the pair. For pair-year ijt, we construct $NumCommonOwners_{ijt}$ as the count of institutions who hold both firm i and firm j in year t.

Unless otherwise indicated, we use lagged measures of common ownership: we regress our indicator variable for sharing a director in year t, $Interlock_{ijt}$, on common ownership one year before, $GGL_{ij,t-1}$.

E. Investor Classification

We construct separate GGL measures for different types of investors. We describe each classification below.

"Big Three": We identify the "Big Three" fund families — BlackRock, Vanguard, and State Street. We then construct GGL_{ijt}^{B3} using only the ownership stakes of the Big Three, and GGL_{ijt}^{X3} using the ownership stakes of managers other than the Big Three.

Investors' size: We then classify investors based on their portfolio characteristics. We first classify investors as large or small based on their size. Each year, we compute the value of each investor's equity portfolio by summing across all positions reported in 13F filings. Investors above (below) the within-year median of this size measure are classified as large (small). We then compute GGL_{ijt}^{Large} (GGL_{ijt}^{Small}) using only the ownership stakes of investors classified as large (small).

Turnover Rate: We then measure the turnover rate of each manager's portfolio. We construct this measure using the "churn" rate from Gaspar et al. (2005). For each manager-year observation, we compute the churn rate as:

$$Churn_{mt} = \frac{\sum_i |N_{imt}P_{it} - N_{im,t-1}P_{i,t-1} - N_{im,t-1}\Delta P_{it}|}{\sum_i 0.5 \times (N_{imt}P_{it} + N_{im,t-1}P_{i,t-1})} \tag{3}$$

where N_{imt} is the number of shares manager m holds in firm i in year t, P_{it} is the share price of firm i in year t, and ΔP_{it} is the change in share price of firm i from year $t-1$ to year t. This definition produces a measure of portfolio turnover for each manager-year observation, with a higher value indicating the manager's portfolio turns over more frequently. For each year, we find the within-year median churn ratio across all managers and classify managers as high-churn or low-churn based on this cutoff. We then compute $GGL_{ijt}^{HighChurn}$ ($GGL_{ijt}^{LowChurn}$) using only the ownership stakes of investors classified as high-churn (low-churn).

Portfolio concentration: We use the HHI measure of portfolio shares to measure portfolio concentration. Following earlier notation, we compute this as:

$$Concentration_{mt} = \sum_i \left(\frac{N_{imt} P_{it}}{\sum_i N_{imt} P_{it}} \right)^2 \tag{4}$$

This measure is increasing in portfolio concentration. For each year, we find the within-year median concentration measure across all managers and classify managers as high-concentration or low-concentration based on this cutoff. We then compute $GGL_{ijt}^{HighConc}$ ($GGL_{ijt}^{LowConc}$) using only the ownership stakes of investors classified as high-churn (low-churn).

Hedge Funds: We further classify investors by whether or not they were identified as hedge funds in either academic literature or commercial databases. Hedge funds are known for their active engagement with firms' governance and management, and one of their key strategies is trying to get their representatives elected to corporate boards. We hand-match the names of institutional investors to activist hedge funds using the name lists from Bebchuk et al. (2015)[4] These hedge funds consist of all 13D filers from 1994 to 2018 as identified on their Form ADV, or that self-identify as hedge funds. We also hand-match the names of institutional investors to a list of investors that are classified as hedge funds in the FactSet database. The total number of investors identified as hedge funds in our sample is 809. We compute We then compute $GGL_{ijt}^{HedgeFunds}$ ($GGL_{ijt}^{Excl.HedgeFunds}$) using only the ownership stakes of investors classified as hedge funds (or excluding hedge funds). In addition, we classify all institutional investors that are not identified as hedge funds based on size, turnover and concentration.

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As with the general GGL measure, each additional GGL measure is right-winsorized and standardized such that a unit increase in the measure reflects a one standard deviation increase. In addition, the measures based on size, turnover, concentration, and the hedge fund classification exclude holdings by the Big Three investors. When we include in regression analysis the measures based on size, turnover, concentration, or the hedge fund classification, we also include GGL_{ijt}^{B3} as a control variable.

[4] We are grateful to Alon Brav for providing the data used in previous activism projects but updated through the year 2018.

III. Sample Description

In Table I, we summarize our sample. Panel A shows that the unconditional probability of sharing a director is low: of 4,588,228 pair-year observations, only 16,970 (0.37%) share a director. However, twice as large a share (0.76%) of unique pairs (i.e., not pair-year observations) share a director for at least one year throughout our sample. Finally, 38.9% of unique firms share a director with another firm at least once throughout our sample. In Panel B, we report statistics on the level of common ownership between pairs of firms. In columns 1 and 3, we report averages across all pair-year observations. Because we standardize each GGL measure, these unconditional averages are zero by construction and should be interpreted as a share of the unconditional standard deviation of each GGL measure. In columns 2 and 4, we report the same averages but restrict to pairs of firms sharing a director. Because these averages are positive, they show that firms who share a director have higher common ownership than firms who do not.

When we examine investor heterogeneity, we observe that the GGL measure for the Big-3 is generally smaller than that of other institutional owners, suggesting that interlocks are not driven by the Big-3. The GGL measure is larger for large investors and those with more concentrated portfolios. It is generally smaller for investors with low portfolio turnover and hedge funds, but the economic magnitude is relatively small. In any event, these differences reflect cross-sectional variation in ownership pattern rather than changes in ownership patterns within firm-pairs, and they do not necessarily reflect the findings int he regression analysis.

In Figure 1, we show a time series plot of the frequency of director interlocks and the average level of common ownership, both of which increase steadily throughout our sample. In 2000, 0.27% of pairs shared a director, while by 2015, this share increases to over 0.50%. Similarly, relative to its level in 2000, the average amount of common ownership between firms has increased by over 50%. This comovement through time is, of course, suggestive only. In our regression specifications, we capture such comovement with time fixed effects and focus on variation *within* pairs across time.

Table II shows the distribution of director interlocks across industries. To emphasize which industries contain the identifying variation in the outcome variable, we report the ten industries with the most year-over-year additions of a common director. The drugs industry accounts for the largest share of interlocks and additions, followed by "computer and data processing services." Table II also emphasizes that our sample is considerably skewed towards certain industries. For example, the drugs industry comprises 22.92% of all pair-year observations, while commercial banks comprise 27.47%. Therefore, over half of all observations come from two industries. This is due to the fact that we consider *pairs* of firms, so any over-representation of industries at the firm level is magnified. To see this, suppose there are five airline firms and fifty firms in the pharmaceutical (drug) industry. The ratio of pharmaceutical firms to airline firms is $10 : 1$. There are $\begin{pmatrix} 5 \\ 2 \end{pmatrix} = 10$ possible pairs of airline firms, but there are $\begin{pmatrix} 5 \\ 2 \end{pmatrix} = 1225$ possible pairs of pharmaceutical firms. Therefore, at the pair-level, the ratio is $122.5 : 1$.

In Table III, we show statistics on the committee membership of director interlocks, focusing on the three major committees: compensation, nominating, and audit. We show the percent of observations with a director interlock where an interlocked director sits on a major committee of either firm. The vast majority of director interlocks meet this criterion. For example, in the drugs industry, almost 90% of pairs sharing a director, that director is present on a major committee of at least one of the firms in the pair. This fraction falls when we require the director to sit on a major committee at *both* firms, but remains high at about 55%. Across all industries, these figures are similar, at approximately 85% and 50%, respectively. When we focus on pairs of firms that add a common director from the previous year, the percentages for all industries are slightly lower but largely portray the same picture.

IV. The Relationship between Common Ownership and Common Directors

A. *Main Specification*

In this section, we examine whether the level of common ownership between a given pair of firms predicts the likelihood they share a director. In Table IV, we estimate the following regression at the pair-year level:

$$Interlock_{ijt} = \beta_0 + \beta_1 GGL_{ij,t-1} + (\alpha_t) + (\alpha_{ij}) + \epsilon_{ijt} \tag{5}$$

The dependent variable, $Interlock_{ijt}$ equals 100 if firms i and j share a director in year t and 0 otherwise. We use 100, rather than 1, as the binary outcome variable so that all coefficients can be interpreted as the percent change in the probability of sharing a common director. The dependent variable, $GGL_{ij,t-1}$, is the lagged GGL measure of common ownership described in Section II.D. Because we standardize the GGL measure, the coefficients reflect the change in the likelihood of a board interlock that is associated with a one standard deviation increase in GGL. α_t are year fixed effects and α_{ij} are pair fixed effects. We repeat the specification for the SIC-3 universe and the Hoberg-Phillips universe.

In columns (1) and (4), we show results using year fixed effects, which purges time series correlation in common ownership and director interlocks. Depending on the universe, a one standard deviation in common ownership increases the probability a pair of firms shares a director by between 0.24% and 0.28%, which is more than 60% of its unconditional probability. Therefore, our result is economically significant.

In columns (2) and (5), we replace the year fixed effects with pair fixed effects, and in columns (3) and (6), we add the most stringent specification, by running the regression with both year and pair fixed effects. In this setup, we purge the data of two sources of confounding variation: (1) time-invariant characteristics within pairs, across years; and (2) time trends within years, across pairs. This strategy mitigates the concerns that unobservable economic factors affect the level of common ownership within a given pair and the probability that pair shares a director.

The results of these specifications show that a one standard deviation increase in GGL is associated with a 0.04-0.05% higher probability that a common director will be appointed. As expected, the point estimates are smaller than in the cross-sectional analysis, but they remain economically significant as compared to the mean likelihood of common directors (more than 10% increase as compared to the unconditional mean).

B. Dynamic Effects

In Figure 2, we report the results from an event study framework, where our goal is to test for trends in the probability of sharing a director in the years leading up to and the years after an increase in common ownership. We first mark all pair-year observations where the number of common owners increases by at least three from the previous year and mark these observations as "event years." We then mark all observations within a three-year window before and after the event year, and estimate the following regression:

$$Interlock_{ijt} = \beta_0 + \sum_{e=-3}^{e=3} \beta_e + \alpha_t + \alpha_{ij} + \epsilon_{ijt} \tag{6}$$

The coefficients of interest, β_e, are equal to one if the given pair experiences an increase in common ownership of at least three common owners e years prior to the current year t. For example, if a given pair's number of common owners increases by ten common owners in 2007, we set $\beta_{-3} = 1$ for 2004, $\beta_{-2} = 1$ for 2005, ... , $\beta_2 = 1$ for 2009, and $\beta_3 = 1$ for 2010. Because we do not include a coefficient for the event year in the regression, each β_e is interpreted as answering the following question: on average, for years e after an increase in common ownership, is the probability of sharing a director higher or lower than during the event year?

The results suggest two conclusions. First, there is little evidence of a pre-trend in director interlocks in the years preceding common ownership increases. The three coefficients for the pre-period, $\beta_{-1,-2,3}$, are statistically indistinguishable from zero, implying that the increase in director interlocks appears in the year of the increase in common ownership, not in the years leading up to it. Second, the effect appears immediate and permanent. The three coefficients for the post-period, $\beta_{1,2,3}$, are statistically indistinguishable from zero. If the effect were delayed, we would observe post-period coefficients above zero, as they given the difference in interlock probability relative to the event year. In addition, if the increase in interlock probability were reverted, we would see post-period coefficients *below* zero. Neither is apparent in Figure 2, suggesting an immediate and permanent effect.

V. Investor Heterogeneity and Common Directors

In this section we examine the extent to which the appointment of common directors is driven by different types of institutional investors. As discussed in section II, we create different measures of GGL for different types of investors. We test whether these measures are related to the likelihood of common director appointments.

A. The "Big Three" Investors

First, we examine whether the relationship between common ownership and director interlocks varies by type of investor. We first compare the "Big Three" passive investors — Vanguard, BlackRock, and State Street — with other investors by running the following regression:

$$Interlock_{ijt} = \beta_0 + \beta_1 GGL^{B3}_{ij,t-1} + \beta_2 GGL^{Excl.B3}_{ij,t-1} + (\alpha_t) + (\alpha_{ij}) + \epsilon_{ijt} \tag{7}$$

where $GGL^{B3}_{ij,t-1}$ ($\beta_2 GGL^{Excl.B3}_{ij,t-1}$) is the GGL measure constructed using only Big Three (non-Big Three) investors. Since each measure is standardized, the magnitudes of β_1 and β_2 can be compared to test which type of investor explains more of the variation in director interlocks.

Table V shows that the result is *not* driven by the Big Three investors. Across different specifications, the coefficient on GGL^{B3} is not consistently positive or negative. By contrast, the coefficient on $GGL^{Excl.B3}$ is positive and significant across all specifications. In particular, in the specification with pair and year fixed effects, while the coefficient on GGL^{B3} is positive, it is insignificant, and its magnitude is roughly a third of the coefficient on $GGL^{Excl.B3}$. Moreover, the p-value on the Wald statistics that tests the null hypothesis that the coefficient on GGL^{B3} is larger or equal to $GGL^{Excl.B3}$ is below 1%, indicating that common director appointments are driven by institutions other than the Big Three. This applies to our SIC-3 and Hoberg-Phillips universes alike.

B. *Investor Characteristics (Size, Turnover and Concentration)*

We next use our portfolio-based classifications. In Table VI , we run a series of regressions to identify the more important group of investors within each of the size, turnover, and concentration classifications. In columns (1) and (4), we run the following regression:

$$Interlock_{ijt} = \beta_0 + \beta_1 GGL^{B3}_{ij,t-1} + \beta_2 GGL^{Large}_{ij,t-1} + \beta_3 GGL^{Small}_{ij,t-1} + \alpha_t + \alpha_{ij} + \epsilon_{ijt} \tag{8}$$

where we include both pair and year fixed effects. The results in Table VI show that large investors have a larger impact. For example, in the SIC-3 universe, a one standard deviation increase in common ownership by large investors increases the probability of sharing a director by 0.031%, while a one standard deviation increase by small investors increases the probability by 0.012% only. Therefore, the effect for large investors is 2.6 times greater than the effect for small investors, adn the Wald test shows that the difference is statistically significant at the 1% level. These regressions suggest that large investors *other* than the Big Three drive the relationship between common ownership and director interlocks.

In columns (2) and (5), the regression equation is

$$Interlock_{ijt} = \beta_0 + \beta_1 GGL^{B3}_{ij,t-1} + \beta_2 GGL^{LowChurn}_{ij,t-1} + \beta_3 GGL^{HighChurn}_{ij,t-1} + \alpha_t + \alpha_{ij} + \epsilon_{ijt} \tag{9}$$

The results in Table VI show that investors with low portfolio turnover have the larger effect.

This result is generally consistent with longer-term investors exerting greater influence on their portfolio companies. However, the difference is less stark as the result on size. For example, in the Hoberg-Phillips universe, a one standard deviation increase in common ownership by low turnover investors increases the probability of sharing a director by 0.030%, while for high turnover investors, the increase is only 0.021%. In the SIC-3 universe we cannot reject the hypothesis that $\beta_3 GGL^{HighChurn} \geq \beta_2 GGL^{LowChurn}$, and in the Hoberg-Phillips universe, we can reject it only at the 10% significance level.

Finally, in columns (3) and (6), we run the regression with our measures based on portfolio concentration:

$$Interlock_{ijt} = \beta_0 + \beta_1 GGL^{B3}_{ij,t-1} + \beta_2 GGL^{HighConc}_{ij,t-1} + \beta_3 GGL^{LowConc}_{ij,t-1} + \alpha_t + \alpha_{ij} + \epsilon_{ijt} \tag{10}$$

We find a larger effect for high concentration investors; in the SIC-3 universe, the effect is almost twice as large. Moreover, the p-value of the Wald test allows us to reject the hypothesis that $\beta_3 GGL^{LowConc} \geq \beta_2 GGL^{HighConc}$ at the 5% level in both the SIC-3 and Hoberg-Phillips universes. This result is perhaps surprising, given that much of the literature has focused on common ownership emerging from the growth of large, diversified investors. Our evidence suggests that, while diversified investors may have contributed to this increase, in terms of its effect on outcomes, it is more concentrated investors that matter.

In summary, larger investors with greater leverage over firm management and investors with longer time-horizons and more concentrated portfolios that have a greater stake in their portfolio companies are more likely to be active in appointments of common directors. Overall, our results are consistent with an active channel through which common owners may affect board appointments.

C. *Hedge Fund Investors*

As our findings suggest an active channel for the appointment of common directors, it is possible that the results are partly driven by activist investors, particularly hedge funds. To account for this possibility, in Table VII, we run tests to evaluate the relationship between the likelihood of common directors and the GGL measures for hedge fund investors and all other investors. In columns (1) and (5), we run the following regression specification:

$$Interlock_{ijt} = \beta_0 + \beta_1 GGL^{B3}_{ij,t-1} + \beta_2 GGL^{HedgeFunds}_{ij,t-1} + \beta_3 GGL^{Excl.HedgeFunds}_{ij,t-1} + \alpha_t + \alpha_{ij} + \epsilon_{ijt} \quad (11)$$

We find that the coefficients on both $GGL^{HedgeFunds}$ and $GGL^{Excl.HedgeFunds}$ are positive and significant. Interestingly however, the coefficient on $GGL^{Excl.HedgeFunds}$ is significantly larger than the coefficient on $GGL^{HedgeFunds}$. Thus, common director appointments are not predominantly driven by hedge funds, though common ownership by hedge funds is associated with a higher probability of common directors.

We further classify all non-hedge fund investors by size, turnover rate and portfolio concentration, and we run the same regression in equation 11, except that instead of $GGL^{Excl.HedgeFunds}$, we include the GGL measures for large and small institutional investors, investors with high and low turnover rate, and investors and high and low portfolio concentration.

The results in columns (2)-(4) and (6)-(8), generally confirm the findings that common ownership by larger investors with longer-term horizons and greater portfolio concentrations are more likely to be associated with common director appointments.

There are two main differences however from the findings in Table VI. First, when accounting for hedge funds, we can reject the hypothesis that $\beta_3 GGL^{HighChurn} \geq \beta_2 GGL^{LowChurn}$ at the 10% and 5% significance level in the SIC-3 universe and Hoberg-Phillips universe, respectively. Accordingly, inestitutions' investment horizon seem to matter significantly for director appointments, except for hedge fund investors. Second, we cannot reject the hypothesis that $\beta_3 GGL^{LowConc} \geq \beta_2 GGL^{HighConc}$. This suggests that the common ownership by highly concetrated investors that predicts common director appointments is to a large extent based on common ownership by hedge fund investors.

VI. Conclusion

Common directors is a relatively common phenomenon with almost 40% of public firms sharing a common director with another firm int he same industry. We provide evidence that a pair of firms in the same industry is more likely to share a director when common ownership across the pair is high. Our results hold when using either SIC-3 industry codes or the Hoberg-Phillips industry classifications. The results are economically significant. In our strictest specification, we find that a one standard deviation increase in common ownership is associated with more than 10% greater probability of a common director appointment in a given year as compared to the unconditional probability of common directors in our sample. Our result is not driven by the "Big Three" passive investors — Vanguard, BlackRock, and State Street. Instead, we find that large, non-Big Three institutions with low portfolio turnover and high portfolio concentration drive our result. Overall, we present an *active* mechanism through which common ownership may affect managerial incentives.

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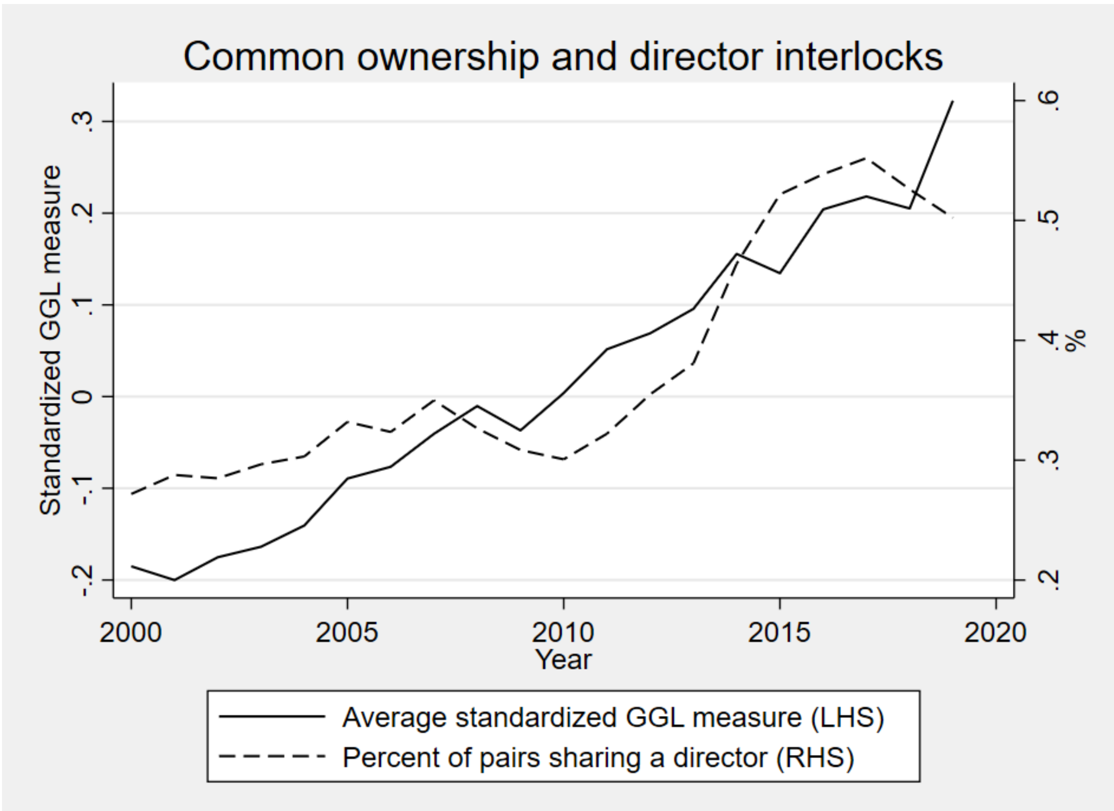

Figure 1. Common Ownership and Director Interlocks

This figure shows time trends in common ownership and director interlocks throughout our sample. On the left axis, we plot the average GGL measure of common ownership across all pairs within a given year. We chain the yearly average GGL to 100 in 2000. On the right axis, for each year, we plot the percent of pairs sharing at least one director. We show results for the SIC-3 universe.

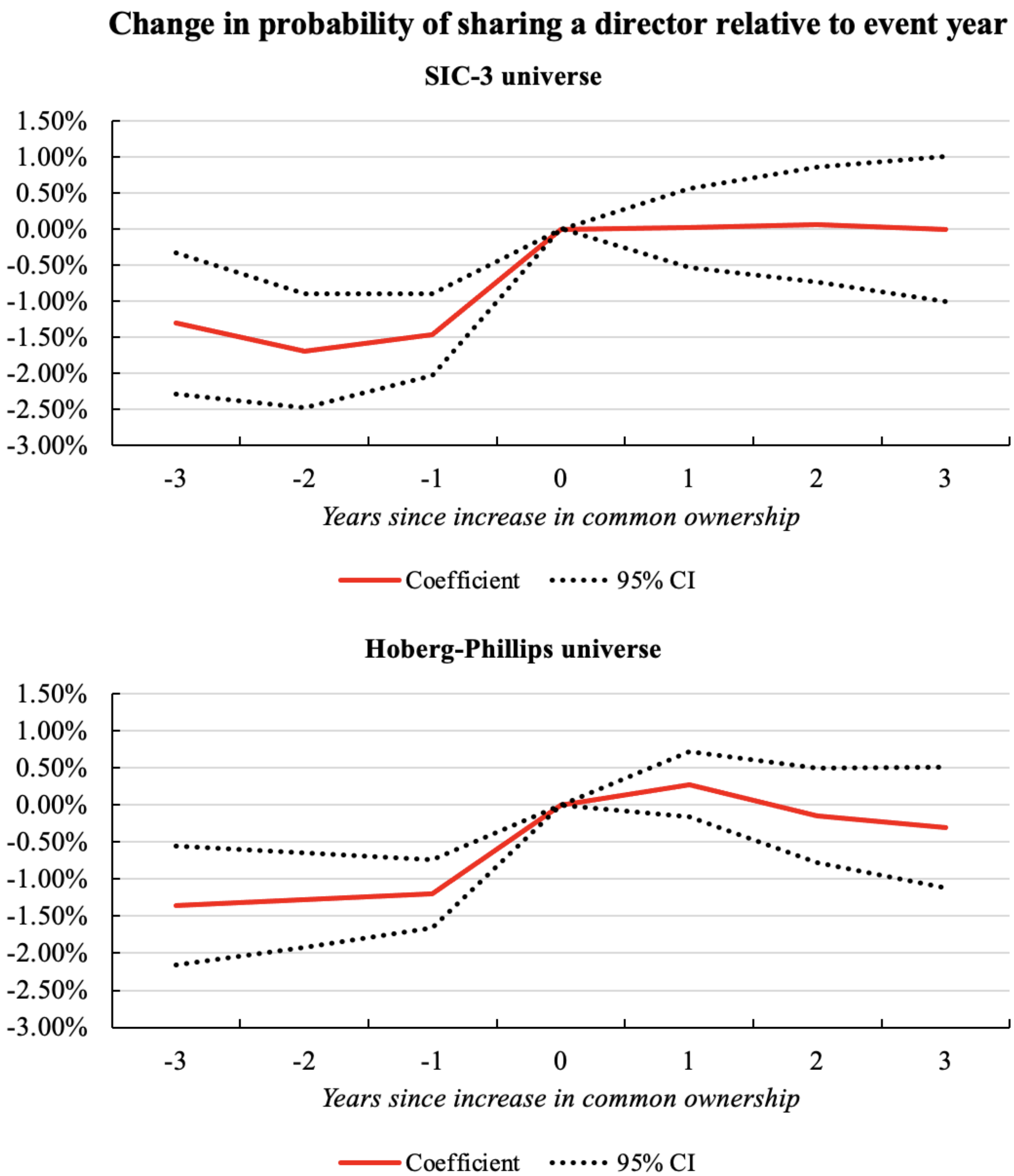

Figure 2. Robustness: Dynamic Effects

This figure reports estimation results from the event-study framework in equation (6). The red line reports point estimates for the coefficients β_e and the black lines report the associated 95% confidence intervals.

Table I. Summary Statistics

This table reports summary statistics for our sample. In Panel A, we summarize the distribution of interlocks. In Panel B, we report average GGL measures across all pair-year observations and pair-year observations that share a director. Each GGL measure is standardized, such that the average GGL measures for all pairs are all zeros. The p-value

Panel A: Director interlocks		
	SIC-3 universe	Hoberg-Phillips universe
Number of pair-year observations	4,588,228	6,389,879
Number of unique pairs	713,363	896,681
Number of unique firms	7,024	7,038
Number (%) of pair-years interlocked	16,970 (0.37%)	25,879 (0.40%)
Number (%) of pairs ever interlocked	5,451 (0.76%)	7,442 (0.83%)
Number (%) of firms ever interlocked	2,733 (38.90%)	3,307 (46.98%)

Panel B: Average common ownership				
	SIC-3 universe		Hoberg-Phillips universe	
	All pairs	Interlocks	All pairs	Interlocks
GGL	0	0.677	0	0.685
Big Three vs. non-Big Three				
GGL^{B3}	0	0.245	0	0.288
$GGL^{Excl.B3}$	0	0.707	0	0.711
t-stat		(-37.033)		(-42.169)
Size				
GGL^{Large}	0	0.658	0	0.674
GGL^{Small}	0	0.433	0	0.407
t-stat		(15.011)		(22.241)
Turnover				
$GGL^{LowChurn}$	0	0.553	0	0.558
$GGL^{HighChurn}$	0	0.597	0	0.603
t-stat		(-3.214)		(-2.280)
Concentration				
$GGL^{HighConc}$	0	0.745	0	0.643
$GGL^{LowConc}$	0	0.488	0	0.545
t-stat		(16.646)		(7.985)
Hedge Funds v. non-Hedge Funds				
$GGL^{HedgeFunds}$	0	0.515	0	0.475
$GGL^{Excl.HedgeFunds}$	0	0.591	0	0.632
t-stat		(-5.148)		(-13.274)

Table II. Distribution of Interlocks by Industry

This table reports the distribution of industries in the SIC-3 universe. We report the top ten industries sorted by the number of additions of a common director, which occurs when a pair of firms does not share a director in year $t-1$ but shares a director in year t. The percent shares are computed with respect to all observations and not only the top ten in the table.

SIC-3	Description	Observations		Interlocks		Additions	
283	Drugs	885525	(22.92%)	7782	(50.37%)	921	(46.52%)
737	Computer & data processing services	879016	(22.76%)	2787	(18.04%)	408	(20.61%)
367	Electronic components & accessories	184010	(4.76%)	1099	(7.11%)	158	(7.98%)
384	Medical instruments & supplies	130339	(3.37%)	839	(5.43%)	132	(6.67%)
357	Computer and office equipment	52685	(1.36%)	250	(1.62%)	46	(2.32%)
131	Crude petroleum & natural gas	74357	(1.92%)	401	(2.60%)	44	(2.22%)
602	Commercial banks	1060944	(27.47%)	223	(1.44%)	36	(1.82%)
581	Eating & drinking places	26574	(0.69%)	199	(1.29%)	25	(1.26%)
382	Measuring & controlling devices	62645	(1.62%)	175	(1.13%)	23	(1.16%)
366	Communications equipment	43533	(1.13%)	187	(1.21%)	22	(1.11%)

Table III. Interlocks and Committee Membership

This table summarizes the committee membership of interlocked directors. We report statistics for pair-year observations sharing an interlocked director for the top five industries in Table II. We define a major committee to include the compensation, nominating, or audit committees. In the third and fifth columns, we report the percent of observations where an interlocked director sits on the named committee of at least one firm in the pair. In the fourth and sixth columns, we report the percent of observations where an interlocked director sits on the named committee of both firms. We repeat the analysis for pair-year observations with an interlock and for pair-year observations with an addition of a common director, where we define an addition as in Table II.

SIC-3	Description	Committee			
		Major		Compensation	
		One	Both	One	Both
Interlocks					
283	Drugs	88.7%	54.5%	43.9%	7.9%
737	Computer and data processing services	88.3%	55.9%	43.4%	8.5%
367	Electronic components and accessories	88.5%	54.4%	43.9%	8.3%
384	Medical instruments and supplies	88.7%	52.6%	42.5%	8.4%
357	Computer and office equipment	91.2%	51.8%	36.5%	5.8%
	All industries	84.4%	50.3%	41.5%	7.2%
Additions					
283	Drugs	87.9%	45.9%	43.2%	7.7%
737	Computer and data processing services	90.1%	49.7%	46.0%	8.1%
367	Electronic components and accessories	92.4%	56.5%	44.1%	10.0%
384	Medical instruments and supplies	85.0%	41.4%	37.9%	6.4%
357	Computer and office equipment	93.8%	50.0%	39.6%	8.3%
	All industries	86.3%	45.0%	42.6%	7.3%

Table IV. Common Ownership and Director Interlocks

This table reports coefficient estimates for the regression in equation (5). The dependent variable equals 100 if the pair of firms shares a director and 0 otherwise. Standard errors are clustered by firm-pair, and t-statistics are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	SIC-3 universe			Hoberg-Phillips universe		
	(1)	(2)	(3)	(4)	(5)	(6)
GGL	0.243***	0.047***	0.043***	0.275***	0.052***	0.048***
	(25.307)	(7.297)	(6.602)	(30.452)	(8.674)	(8.048)
Year fixed effects	Yes	No	Yes	Yes	No	Yes
Pair fixed effects	No	Yes	Yes	No	Yes	Yes
Observations	4,588,228	4,481,313	4,481,313	6,389,879	6,280,839	6,280,839
Adjusted R-squared	0.002	0.611	0.611	0.002	0.591	0.591

Table V. The Effect of the "Big Three"

This table reports coefficient estimates for the regression in equation (7). The dependent variable equals 100 if the pair of firms shares a director and 0 otherwise. The $p - value$ is the p-value of the Wald statistic that tests the null hypothesis that the coefficient on GGL^{B3} is larger or equal to the coefficient on $GGL^{Excl.B3}$. Standard errors are clustered by firm-pair, and t-statistics are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	SIC-3 universe			Hoberg-Phillips universe		
	(1)	(2)	(3)	(4)	(5)	(6)
GGL^{B3}	-0.030***	0.022**	0.013	-0.004	0.021**	0.013
	(-3.691)	(2.599)	(1.471)	(-0.534)	(2.587)	(1.577)
$GGL^{Excl.B3}$	0.266***	0.040***	0.039***	0.287***	0.042***	0.042***
	(27.696)	(6.565)	(6.386)	(32.576)	(7.610)	(7.505)
$\text{GGL}^{Excl.B3} - GGL^{B3}$	0.296***	0.018**	0.026***	0.292***	0.021**	0.029***
$p - value$	0.000	0.050	0.009	0.000	0.023	0.003
Year fixed effects	Yes	No	Yes	Yes	No	Yes
Pair fixed effects	No	Yes	Yes	No	Yes	Yes
Observations	4,588,228	4,481,313	4,481,313	6,389,879	6,280,839	6,280,839
Adjusted R-squared	0.002	0.611	0.611	0.002	0.591	0.591

Table VI. Investor Heterogeneity

This table reports coefficient estimates for the regressions in equations (8), (9), and (10). The dependent variable equals 100 if the pair of firms shares a director and 0 otherwise. $p-value$ is the p-values of the Wald statistics that test the null hypotheses that the coefficients on GGL^{Large}, $GGL^{LowChurn}$ and $GGL^{HighConc}$ are larger or equal to the coefficients on GGL^{Small}, $GGL^{HighChurn}$ and $GGL^{LowConc}$, respectively. Standard errors are clustered by firm-pair, and t-statistics are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	SIC-3 universe			Hoberg-Phillips universe		
	(1)	(2)	(3)	(4)	(5)	(6)
GGL^{B3}	0.014	0.011	0.015	0.014*	0.012	0.015*
	(1.592)	(1.326)	(1.771)	(1.718)	(1.48)	(1.871)
GGL^{Large}	0.031***			0.033***		
	(5.072)			(5.926)		
GGL^{Small}	0.012***			0.014***		
	(3.309)			(4.336)		
$GGL^{Large} - GGL^{Small}$	0.019***			0.019***		
$p - value$	0.003			0.001		
$GGL^{LowChurn}$		0.028***			0.030***	
		(4.675)			(5.340)	
$GGL^{HighChurn}$		0.021***			0.021***	
		(4.864)			(5.503)	
$GGL^{LowChurn} - GGL^{HighChurn}$		0.007			0.009*	
$p - value$		0.133			0.076	
$GGL^{HighConc}$			0.029***			0.028***
			(5.966)			(6.556)
$GGL^{LowConc}$			0.015**			0.017***
			(2.628)			(3.313)
$GGL^{HighConc} - GGL^{LowConc}$			0.014**			0.010*
$p - value$			0.019			0.052
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,481,313	4,481,313	4,481,313	6,280,839	6,280,839	6,280,839
Adjusted R-squared	0.611	0.611	0.611	0.591	0.591	0.591

Table VII. Investor Heterogeneity (including Hedge Funds)

This table reports coefficient estimates for the regressions in equation (11) in columns (1) and (5). In columns (2)-(4) and (6)-(8), the regression model is the same except that instead of $GGL^{Excl.HedgeFunds}$, we classify all investors that are not classified as hedge funds based on size, turnover rate and portfolio concentrations as in equations (8), (9), and (10). The dependent variable equals 100 if the pair of firms shares a director and 0 otherwise. $p-value$ is the p-values of the Wald statistics that test the null hypotheses that the coefficients on $GGL^{Excl.HedgeFunds}$, GGL^{Large}, $GGL^{LowChurn}$ and $GGL^{HighConc}$ are larger or equal to the coefficients on $GGL^{HedgeFunds}$, GGL^{Small}, $GGL^{HighChurn}$ and $GGL^{LowConc}$, respectively. Standard errors are clustered by firm-pair, and t-statistics are reported in brackets. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	SIC-3 universe				Hoberg-Phillips universe			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GGL^{B3}	0.012	0.013	0.011	0.014	0.012	0.013	0.012	0.014
	(1.408)	(1.482)	(1.293)	(1.627)	(1.497)	(1.591)	(1.398)	(1.689)
$GGL^{HedgeFunds}$	0.012**	0.011**	0.012**	0.012**	0.017***	0.017***	0.017***	0.017***
	(2.665)	(2.589)	(2.618)	(2.667)	(4.428)	(4.334)	(4.386)	(4.382)
$GGL^{Excl.HedgeFunds}$	0.030***				0.030***			
	(4.964)				(5.351)			
$GGL^{HedgeFunds} - GGL^{Excl.HedgeFunds}$	0.018***				0.013**			
$p-value$	0.007				0.032			
GGL^{Large}		0.026***				0.025***		
		(4.296)				(4.514)		
GGL^{Small}		0.011**				0.011***		
		(3.012)				(3.402)		
$GGL^{Large} - GGL^{Small}$		0.015**				0.014**		
$p-value$		0.013				0.013		
$GGL^{LowChurn}$			0.023***				0.023***	
			(3.868)				(4.227)	
$GGL^{HighChurn}$			0.014***				0.012***	
			(3.419)				(3.294)	
$GGL^{LowChurn} - GGL^{HighChurn}$			0.009*				0.011**	
$p-value$			0.089				0.035	
$GGL^{HighConc}$				0.019***				0.020***
				(4.150)				(4.946)
$GGL^{LowConc}$				0.014*				0.015**
				(2.427)				(2.851)
$GGL^{HighConc} - GGL^{LowConc}$				0.005				0.005
$p-value$				0.244				0.225
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,481,313	4,481,313	4,481,313	4,481,313	6,280,839	6,280,839	6,280,839	6,280,839
Adjusted R-squared	0.611	0.611	0.611	0.611	0.591	0.591	0.591	0.591