Common Ownership Directors

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Abstract

We develop a stylized model in which common owners of firms in the same industry appoint a common director to benefit from information-sharing between firms with similar products. Information sharing increases the likelihood of product success but also reduces profits from heightened competition. Empirically, we find that common ownership by investors with large stakes, long horizons, and concentrated portfolios - notably in pharmaceuticals - is associated with a higher likelihood of common directors. Consistent with the model, common directors are associated with greater product similarity and broader scope, but with lower markups and diminished exploratory innovation. Our findings point to an active governance channel linking common ownership to strategy.

Keywords: Common Ownership, Board Interlocks, Institutional Shareholders, Activist Investors,

JEL Classification: G32, G24, K22

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ABSTRACT

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I. Introduction

There is a growing literature examining how common institutional ownership influences managerial behavior and firm outcomes. On the one hand, common owners have incentives to maximize industry-wide profits; if managers internalize these incentives, common ownership may reduce competition and lower overall welfare (Bresnahan and Salop, 1986; O'Brien and Salop, 2000; Azar, 2017; Ederer and Pellegrino, 2025). On the other hand, common ownership may have beneficial effects by facilitating information spillovers or encouraging product market collaboration (Antón et al., 2024; López and Vives, 2019; He and Huang, 2017). Most existing studies assume that corporate managers internalize the interests of their common owners in maximizing portfolio-wide returns rather than firm-specific performance. However, because institutional investors tend to be passive and rarely intervene directly in firm management, some commentators have questioned whether common ownership can meaningfully influence firm strategy and outcomes (Gilje et al., 2020; Fox and Patel, 2022).

This paper explores an active channel through which common ownership may influence managerial incentives: overlapping board membership across competing firms. Although there is substantial evidence that competitors frequently share directors (Nili, 2020; Eldar and Grennan, 2024), the role of these interlocked directors as a conduit for common ownership remains underexplored. This gap is notable given that directors are responsible for shaping firm strategy and ensuring its execution through appropriate managerial incentives. Moreover, board appointments are arguably the primary mechanism through which shareholders can actively influence strategic direction and managerial behavior.

We develop a simple model in which common owners of firms in the same industry influence firm strategy by appointing a shared director who serves as a focal point for informational exchange among portfolio firms. Information sharing—such as knowledge about R&D processes or regulatory pathways—is more effective when firms offer similar products, as their strategic and operational challenges are more aligned. These spillovers can increase the probability of successful product development. However, greater product similarity also intensifies competition between the firms, reducing markups. Common directors, who possess privileged information about both firms, can

influence product similarity to facilitate such exchanges. In doing so, they face a fundamental tradeoff: enhancing the likelihood of product success through information sharing, while potentially reducing profitability through heightened product market competition.

The theoretical framework shows that common owners favor greater product similarity among commonly owned firms when the benefits from information sharing outweigh the costs from reduced markups. Their role is to pursue the common owners' joint incentives by shaping firm strategy—specifically, product positioning—to align with portfolio-level objectives. This mechanism is especially relevant in industries such as pharmaceuticals, where failure rates are high and information sharing can significantly reduce development risks, but product differentiation may affect pricing power.

The model generates several testable predictions: (1) common directors are more likely to be appointed between firms in the same industry when common ownership is held by investors with significant stakes; (2) such appointments are associated with greater product similarity, which facilitates information sharing and reduces the likelihood of project failure; (3) higher product similarity is linked to lower markups due to intensified competition; and (4) investment in innovation declines when the complementarity between R&D and product similarity across commonly owned firms is low. In this setting, maximizing joint portfolio returns for common owners may involve accepting increased competition and compressed markups across their portfolio firms.

To test the model's predictions, we collect comprehensive data on board membership for U.S. public firms between 2000 and 2019. Our dataset includes all firm-pairs operating in the same industry, using both three-digit SIC codes and the Hoberg-Phillips product market classifications to capture industry affiliation.

We begin by examining the relationship between common ownership and the appointment of shared directors across firms in the same industry. Board interlocks among competitors are relatively common: approximately 38% of public firms in our sample share at least one director with another firm in their industry. Strikingly, these interlocks are highly concentrated in the pharmaceutical sector—especially in drug companies—which accounts for over 50% of all such interlocks. An additional 25% arise in the computer and electronics industries (see Table I). These industries are particularly reliant on new product development, innovation, and strategic positioning

to maintain a competitive edge, making them fertile ground for information-sharing benefits.

Next, we test whether common institutional shareholding is associated with a greater likelihood of board interlocks. Our baseline measure of common ownership is the pair-level metric developed by Gilje et al. (2020) (GGL), which captures both the size of the common owner's stake in a given firm and the relative importance of that stake within the owner's overall portfolio. As we aim to uncover an active channel of influence, the GGL measure is particularly appropriate because it reflects the intensity of common ownership across firm pairs, rather than simply the extent of market overlap.[1]

We find a robust relationship between common ownership and the probability that two firms in the same industry share a director. A one standard deviation increase in GGL is associated with a 66% higher likelihood that a firm pair shares a director. In specifications with firm-pair fixed effects, we find that a one standard deviation increase in GGL increases the probability of sharing a director by roughly 13% relative to the unconditional probability. These findings are consistent with common ownership facilitating an active governance channel—through board appointments—by which investors may shape firm strategy.

We further investigate the types of institutional investors associated with these results. We find no evidence that the "Big Three" passive fund families—BlackRock, Vanguard, and State Street—play a meaningful role in the observed effect. Despite their substantial holdings, these investors are not significantly associated with board interlocks among commonly held firms. Instead, the effect is concentrated among non-Big Three institutional investors, particularly those with characteristics typically associated with active engagement. Specifically, we find that the probability of sharing a director is higher when the common owners are large, maintain concentrated portfolios, and hold investments for longer durations. We also detect a positive relationship between hedge fund ownership and director interlocks. However, the effect is not limited to hedge funds: other institutional investors with similarly active profiles are also more strongly associated with shared board membership across competing firms.

Next, we turn to examine the impact of director interlocks on firm outcomes. Consistent

[1] In the robustness section, we show that the qualitative pattern is similar when we use the Kappa measure instead, although the magnitudes are smaller.

with the model, we find that board interlocks are associated with greater Hoberg-Phillips product similarity between firms in the same industry (Hoberg and Phillips, 2016). The estimated effect remains robust when controlling for the level of common ownership which also has a positive, though smaller, effect. These findings are consistent with the alignment of product portfolios through common directors and with the information-sharing mechanism emphasized in our model. Further, board interlocks are also associated with greater scope of operations (Hoberg and Phillips, 2025), a pattern that is consistent with more successful project development enabled by shared knowledge.

Turning to pricing outcomes, we find evidence that board interlocks are associated with lower markups. Using the production-function approach of De Loecker et al. (2020), we estimate that interlocked firms experience approximately 2% to 3% lower markups. These results are robust across most specifications and remain significant when using weighted markups. This finding is consistent with the model's prediction that increased product similarity, while enhancing success probabilities, intensifies competition and compresses margins. Overall, the evidence of reduced markups is more consistent with greater competitive pressure than with tacit collusion.

Finally, we examine how director interlocks affect innovation outcomes. An improved information environment may lead to R&D complementarity across commonly owned firms. However, when such complementarity is low, we may still observe a reduction in R&D investment. The intuition is that informational exchange may already sufficiently increase the probability of product success, thereby reducing the need for costly investment.

Consistent with this hypothesis, we find that common director interlocks among firms in the same industry are associated with lower R&D intensity. We do not find a statistically significant association between interlocks and patent counts or patent value. We do, however, find a negative association with exploratory patents, defined as patents citing technologies not previously cited by the firm (Hall et al., 2001). These findings suggest a change in the intensity and composition of innovation effort rather than a wholesale reduction in innovative output. Taken together, the overall pattern is consistent with the view that informational spillovers enabled by common directors may substitute for some firm-level R&D investment.

Our empirical strategy combines lagged common ownership, firm-pair fixed effects, year fixed

effects, and event-study evidence around large increases in common ownership. These features allow us to absorb time-invariant pair heterogeneity and aggregate shocks, and they substantially improve on simple cross-sectional comparisons. This is a demanding empirical design given the pair-level nature of the data. While we cannot fully rule out time-varying pair-level shocks—such as technological convergence, regulatory changes, or broader strategic realignment, the use of lagged common ownership together with firm-pair and year fixed effects provides a stringent test, and the resulting evidence on product similarity, markups, and innovation is consistent with a plausible active governance channel in our model.

Our study contributes to the literature on the channels through which common ownership influences firm outcomes. Prior work has focused largely on passive channels, particularly the role of large, diversified institutional investors. On the one hand, common owners have incentives to maximize industry-wide profits; if managers internalize these incentives, common ownership may reduce competition and lower overall welfare (Bresnahan and Salop, 1986; O'Brien and Salop, 2000; Azar, 2017).[2] On the other hand, common ownership may have beneficial effects by facilitating information spillovers or encouraging product-market collaboration (Antón et al., 2024; López and Vives, 2019; He and Huang, 2017).

More recently, Antón et al. (2023) explore the channel through which common ownership by passive institutions affects firm outcomes. Specifically, they show that common ownership influences executive compensation, with firms adopting incentive structures that discourage aggressive competition. However, such mechanisms often assume that managers internalize investor preferences without clear evidence of an active conduit. In contrast, Eldar and Grennan (2024) show that common venture capital ownership is associated with overlapping directors in startups, but their findings apply only in the context of highly engaged VCs. Geng et al. (2022b) provide evidence that direct board representation by institutional investors is rare, suggesting that this is not a dominant channel. Yet, as we show, a large share of public firms, nearly 40%, share a director with another firm in the same industry, and interlocks are significantly more likely when common ownership is high, particularly among investors with large, long-term, and concentrated positions.

[2]However, recent work by Lewellen and Lowry (2021) and Dennis et al. (2022a) questions whether these documented effects are causal.

Our central contribution is to document and model an active channel of influence—the appointment of common directors—which contrasts with the extensively studied passive channel of common ownership. Common ownership is generally associated with increased prices and enhanced innovation. For instance, Azar et al. (2018) report higher prices on airline routes under common ownership, and Ederer and Pellegrino (2025) find substantial welfare costs to consumers due to increasing common ownership over time.[3] On the other hand, Antón et al. (2024) suggest that common ownership might improve innovation quality and facilitate informational spillovers, suggesting that common ownership has certain positive effects.[4] In contrast, our findings suggest that this active channel can be associated with different outcomes. Specifically, common directors are associated with lower markups, reduced R&D expenditures, and diminished exploratory innovation. These findings imply that although informational spillovers could boost product success probabilities, they might also intensify competitive pressures and discourage innovation investment when complementarity is low.

We also contribute to the literature on director interlocks. Nili (2020) documents the prevalence of "horizontal directors" who sit on the boards of competing firms. Bouwman (2011), Barzuza and Curtis (2017), and McClane and Nili (2021) show that such interlocks can transmit governance practices or affect financial reporting outcomes. Similarly, Eldar and Grennan (2024) show that director interlocks among venture capitalists in startups operating in the same industry are associated with a higher likelihood of receiving financing and achieving successful exits. Our study extends this literature by demonstrating that director interlocks also affect real outcomes in the product market and innovation behavior—not only in the private startup context but also among public firms. This highlights the broader strategic role that shared directors can play in shaping firm trajectories in commonly owned portfolios.

Our study is related to recent work by Cabezon and Hoberg (2022) and Gopalan et al. (2024), who examine how board connections among competitors affect innovation and competition. Like Cabezon and Hoberg, we emphasize the role of informational exchange through shared directors,

[3]However, others have questioned whether common ownership indeed raises prices or harms consumers; see Dennis et al. (2022b) and Backus et al. (2021a).

[4]Similarly, evidence indicates that common ownership by venture capital investors fosters informational spillovers and greater innovation (Eldar and Grennan, 2024).

but while they focus on systemic leakage and coordination failure, we offer a governance-based explanation grounded in rational tradeoffs by common owners. Unlike their analysis, which centers on IP diffusion and innovation herding, we examine the effects of interlocks on product market outcomes. We find higher product similarity and lower markups following common director appointments. These patterns are consistent with a distinct mechanism in which common directors facilitate information sharing. Our findings add a new dimension to the policy debate, suggesting that interlocks may not reduce competition directly, but can have adverse consequences for innovation.

II. A Theoretical Framework

We develop a stylized model in which a common director chooses the degree of product similarity, d, between two competitors that share a common owner. A higher level of d facilitates informational exchange between the firms through the shared director. This exchange increases the likelihood of successful product innovation by improving the expected quality of firm actions or outcomes. However, greater similarity also intensifies competition between the firms, leading to lower profit margins. We further extend the model to incorporate a tradeoff between informational exchange and investment in R&D, and show that enhanced information flow may reduce firm-level incentives to invest in innovation. The framework is intentionally stylized and is meant to organize the tradeoffs in the data rather than provide a full description of the institutional environment.

A. Informational Exchanges and Product Market Competition

Basic Setup: Two firms $i \in \{1, 2\}$ share a common investor. The investor decides whether to appoint a common director, $C \in \{0, 1\}$. If $C = 1$, the common director enables the investor to coordinate the firms' strategies by choosing the degree of product similarity d, where higher d indicates greater similarity. If $C = 0$, product similarity remains at an exogenous baseline d_0 (so $d = d_0$).

Each firm attempts to develop a new product. Success depends on a signal ε_i, which summarizes the cumulative technical and market-relevant information acquired during product development.

Firm i succeeds if $\varepsilon_i > 0$, where

$$\varepsilon_i \sim \mathcal{N}\left(-1 + \gamma C d,\, \sigma^2\right), \quad \sigma > 0,\ \gamma > 0.$$

The mean is normalized to -1 in the absence of a common director, reflecting that a firm acting independently—without external informational support—is unlikely to succeed. When no common director is appointed ($C = 0$), we have $\gamma C = 0$, implying no informational exchange, even if initial similarity d_0 is high.

When a common director is appointed ($C = 1$), increasing similarity d facilitates informational exchange, which enhances the firm's capabilities—such as technical know-how or product development—thereby raising the probability of success.

The probability that firm i successfully develops a product and enters the market is

$$p(d, C) = \Pr(\varepsilon_i > 0) = \Phi\left(\frac{-1 + \gamma C d}{\sigma}\right),$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function. Thus, without coordination ($C = 0$), the success probability remains fixed at a low level $p(d_0, 0) = \Phi(-1/\sigma)$, even if similarity d_0 is high. With coordination ($C = 1$), success probability increases in d ($p'(d, 1) > 0$).

Profits and Competition: If both firms succeed, each with constant marginal cost c, they compete à la Cournot in a homogeneous-product market. Firm i's inverse demand, equilibrium output, and profit are

$$P_i \;=\; a \;-\; q_i \;-\; (\beta_0 + \alpha d)\, q_j \quad \Longrightarrow \quad q_C(d) \;=\; \frac{a - c}{2 + \beta_0 + \alpha d}, \quad \pi_C(d) \;=\; \left(\tfrac{a-c}{2+\beta_0+\alpha d}\right)^2.$$

As in Ederer and Pellegrino (2025), increasing d makes the products more closely aligned and thus intensifies competition, reducing the equilibrium price. It follows immediately that markups decrease in d as $\pi_C'(d) = -2\alpha \cdot \frac{(a-c)^2}{(2+\beta_0+\alpha d)^3} < 0$.

If only one firm succeeds, that firm becomes the monopolist, and then

$$q_M = \frac{a-c}{2}, \quad \pi_M = \left(\frac{a-c}{2}\right)^2$$

It follows that the common investor's expected profit is

$$V(d, C) = 2s\left[p(d, C)^2\,\pi_C(d) + p(d, C)(1 - p(d, C))\,\pi_M\right],$$

where s is the investor's ownership stake in each firm and the factor of 2 reflects symmetry across the two firms.[5]

Investor's Decision to Appoint a Common Director: The investor appoints a common director if and only if it yields higher expected profits:

$$V(d^*, 1) > V(d_0, 0), \quad \text{where } d^* \text{ is optimally chosen under } C = 1.$$

PROPOSITION 1: *There exist values of initial product similarity d_0 and informational exchange parameter γ such that the investor strictly prefers appointing a common director (i.e., setting $C = 1$) and choosing a similarity level d^*. This is more likely when:*

1. ***Strong informational channel:*** *The informational exchange parameter γ is sufficiently large, making $p'(d_0, 1)$ large.*
2. ***Low baseline success probability:*** *The initial probability of success without coordination, $p(d_0, 0)$, is sufficiently low, indicating scope for informational gains.*

Moreover, the investor will choose $d^* > d_0$—that is, to increase similarity—whenever

$$\left.\frac{\partial V}{\partial d}\right|_{d=d_0,\, C=1} > 0.$$

This inequality holds if:

[5]The parameter s does not alter the qualitative results of the model but captures the idea that larger ownership stakes strengthen the investor's incentive to appoint a common director.

3. ***Mild competition effect:*** *The profit reduction due to heightened competition, $|\pi'_C(d_0)|$, is sufficiently small.*

Proof The first part of Proposition 1, establishing the conditions under which $V(d^*, 1) > V(d_0, 0)$, follows from the functional form of $V(d, C)$ and $p(d, C)$. The second part, which identifies the conditions for $d^* > d_0$, follows directly from the derivative:

$$\left.\frac{\partial V}{\partial d}\right|_{d=d_0,\, C=1} = 2s\left[2p(d_0,1)p'(d_0,1)\pi_C(d_0) + p(d_0,1)^2\pi'_C(d_0) + p'(d_0,1)(1-2p(d_0,1))\pi_M\right] > 0.$$

Then the optimal $d^* > d_0$ given $C = 1$, and the investor indeed prefers appointing a common director since $V(d^*, 1) > V(d_0, 1) > V(d_0, 0)$.

The first term (informational gain) is strictly positive and increases with $p'(d_0, 1) > 0$. The second term (competition loss) is negative since $\pi'_C(d_0) < 0$, and its absolute magnitude grows with $p(d)$. The third term is positive only when $p(d_0, 1) < \frac{1}{2}$, reflecting that the benefit from potential monopoly profits vanishes as the probability of success becomes very high.

Note that this implies investors do not necessarily increase d beyond d_0, and may appoint a common director ($C = 1$) if the informational gains at a sufficiently high d_0 justify it. However, increasing d further requires that the marginal value of information outweigh both the competition effect and the already high baseline level of success potential.

In practice, true monopoly outcomes are rare: most markets feature multiple active firms, either because there are limited barriers to entry, regulatory constraints on monopolies, and sufficiently high $p(d)$. As a result, the "monopoly-loss" term in $V'(d)$ is in practice likely negligible, and the investor's decision hinges on the balance between the informational benefit and the intensified-competition cost. We therefore obtain:

COROLLARY 1: *If the outcome of product development is perfectly correlated between firms (and therefore no monopoly), the investor appoints a common director and increases similarity above the exogenous baseline d_0 whenever:*

$$\frac{p'(d_0, 1)}{p(d_0, 1)} > \frac{-\pi'_C(d_0)}{\pi_C(d_0)}, \tag{1}$$

meaning the informational gain dominates markup reduction from competition.

Our theoretical setup clarifies that high initial product similarity alone (d_0) does not necessarily imply a high success probability without explicit coordination through common directors. Firms may exhibit high product similarity prior to common director appointments yet still face low success probabilities due to ineffective informational exchanges. The economic role of common directors is thus to unlock and leverage the informational potential embedded in existing product similarity and enable directors to actively increase it. Accordingly, a strong informational channel can arise either from appointing common directors to firms already having high similarity scores or from actively causing commonly owned firms to increase their product similarity.

Empirical Predictions: From the model, we predict that:

- Common directors are more likely appointed to firm pairs within the same industry when initial success probabilities are low and potential informational gains (γ) are large.
- The appointment of common directors is followed by greater product similarity within firm pairs.
- Higher product similarity is associated with lower markups due to increased competition intensity.

B. Informational Exchanges and Innovation

We extend the model by allowing each firm to improve its success probability through three channels:

- Informational exchange (d) via a common director;
- R&D investment ($r \geq 0$) at a quadratic cost;
- A complementarity between R&D investment and product similarity via a common director, in proportion to d.

Under symmetry ($r_1 = r_2 = r$), the innovation signal becomes:

$$z(d, r, C) = \frac{-1 + \gamma_d C d + \gamma_r r + \gamma_f C d r}{\sigma}, \quad p(d, r, C) = \Phi(z(d, r, C)),$$

with $\gamma_d, \gamma_r, \gamma_f, \sigma > 0$. The parameter γ_d captures the informational spillover effect, while γ_f captures the complementarity between product similarity and R&D in the presence of a common director. When no common director is present ($C = 0$), the terms $\gamma_d Cd$ and $\gamma_f Cdr$ drop out, eliminating both the informational benefits from similarity and the complementarity effect.

Given that our empirical setting focuses on competing firms and does not separately identify monopoly outcomes, we assume—as in Corollary 1—that the outcomes of product development are perfectly correlated across firms. This assumption rules out the possibility of monopoly, and the investor's payoff becomes:

$$V(d, r, C) = 2\, p(d, r, C)\, \pi_C(d) - \tfrac{1}{2}\kappa_r\, r^2,$$

where $\frac{1}{2}\kappa_r\, r^2$ denotes the R&D investment cost.

The Tradeoff between d and r To examine this tradeoff, we again assume standard regularity conditions:

1. The functions $p(d, r, C)$, $\pi_C(d)$, and all relevant derivatives are continuously differentiable in their arguments.
2. The function V is concave in r ($V_{rr} < 0$) and differentiable around the equilibrium.

We examine under which conditions a common investor prefers to appoint a director ($C = 1$), thereby facilitating informational exchange while potentially reducing incentives to invest in R&D (r). The first-order condition in r is $V_r = 0$. Implicitly differentiating with respect to d yields:

$$V_{rr}\, \frac{dr}{dd} + V_{dr} = 0 \quad \Longrightarrow \quad \frac{dr}{dd} = -\frac{V_{dr}}{V_{rr}}.$$

A unique interior solution for r requires $V_{rr} < 0$. Hence, $dr/dd < 0$ (i.e., d and r are substitutes) if and only if $V_{dr} < 0$.

Computing explicitly, we have:

$$V_{dr} = 2\left[p_{dr}\pi_C(d) + p_r\pi'_C(d)\right].$$

Thus, the substitutability condition ($dr/dd < 0$) can be expressed as:

$$-\frac{\pi'_C(d)}{\pi_C(d)} > \frac{p_{dr}}{p_r}. \tag{2}$$

Inequality (1) continues to hold when incorporating R&D into the success probability. By combining (1) and (2), we obtain the conditions under which a common investor appoints a director, increases product similarity, and reduces R&D investment—assuming that the outcomes of product development are perfectly correlated between firms. Specifically:

$$\frac{p_{dr}}{p_r} < -\frac{\pi'_C(d)}{\pi_C(d)} < \frac{p_d}{p} \tag{3}$$

This condition confirms the notion that the relative reduction in markups must be smaller than the information-sharing effect in order for the investor to appoint a common director. However, to induce a reduction in R&D investment, the relative markup effect must exceed the complementarity effect ($\frac{p_{dr}}{p_r}$). The intuition is that any gains in the probability of success from the complementarity between R&D and similarity are outweighed by the negative impact of intensified competition on markups.

PROPOSITION 2: *There exist values of initial similarity d_0, informational parameters γ_d, γ_f, and R&D effectiveness parameter γ_r such that the common investor strictly prefers appointing a common director ($C = 1$), actively increasing similarity above d_0, and reducing private R&D investment r. This is more likely when:*

1. *The complementarity parameter γ_f are sufficiently small (weak informational benefit from similarity and free-riding).*
2. *The marginal gain from further R&D (γ_r) is big, meaning R&D investment itself is effective.*
3. *The competition-driven markup reduction ($|\pi'_C(d)|$) is moderate, reflecting non-trivial competitive costs from increased similarity.*

Proof: The result follows directly from the conditions in Equation (3). The left-hand side of the inequality, $\frac{p_{dr}}{p_r}$, is smaller when p_{dr} is low—which occurs when γ_f is small—and when p_r is large—which occurs when γ_r is large—thereby amplifying the denominator. The middle term,

$-\frac{\pi'_C(d)}{\pi_C(d)}$, is larger when the negative effect of competition is strong, i.e., when $\pi'_C(d)$ is more negative in magnitude. Hence, the inequality is satisfied when informational complementarity is weak (low γ_f), private R&D is relatively effective (high p_r), and the markup loss from similarity is nontrivial. Under these conditions, the investor appoints a common director, increases similarity, and reduces R&D investment, as stated in Proposition 2.

Empirical Predictions: The model suggests that the tradeoffs between information exchange and innovation will lead to the following empirical patterns:

- Common directors are more likely to be appointed between same-industry firm pairs when baseline innovation probabilities are low and the gains from informational exchange are high (i.e., γ_d is large).
- Following the appointment of common directors, firms increase product similarity and reduce private R&D investment when the potential gains from R&D complementarity (γ_f) are modest.

III. 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

$$N_t = \binom{N_{ft}}{2} \tag{4}$$

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).[6] 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 698,842 pair firms in our sample and 4,522,076 observations using SIC-3 codes, and 872,029 pair firms and 6,227,928 observations using the Hoberg-Phillips industry classifications.

For each pair-year observation, we create an indicator variable, $Interlock_{ijt}$, which equals 1 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.

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 $A_{ijt} = \{\alpha_{it}^m, \alpha_{jt}^m\}_{m=1}^{M_{ijt}}$ be their ownership stakes in each firm, where m indexes a common owner. Finally, let their portfolio shares allocated to each firm be $B_{ijt} = \{\beta_{it}^m, \beta_{jt}^m\}_{m=1}^{M_{ijt}}$. We construct the common ownership measure, GGL_{ijt}, as follows:

$$GGL_{ijt} = 0.5 \times \sum_{m}^{M_{ijt}} \left(\alpha_{it}^m \times \beta_{it}^m \times \alpha_{jt}^m\right) + 0.5 \times \sum_{m}^{M_{ijt}} \left(\alpha_{it}^m \times \beta_{jt}^m \times \alpha_{jt}^m\right) \tag{5}$$

The original measures used in Gilje et al. (2020) are one-directional, in the sense that $GGL_{ijt} \neq GGL_{jit}$. 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

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

common ownership increases by one standard deviation.

E. Investor Classification

To better understand which types of institutional investors are most strongly associated with common directors, we construct separate GGL measures based on investor characteristics commonly associated with active ownership. These classifications allow us to test whether the effect of common ownership is concentrated among institutions more likely to influence firm strategy. For brevity, we refer to these characteristics as proxies for more active institutional ownership, while recognizing that they do not directly observe intervention.

"Big Three": We first distinguish the "Big Three" index fund families—BlackRock, Vanguard, and State Street—from other investors. These fund families have been widely criticized for adopting passive strategies and deferring to management, making them less likely to engage in board-level interventions. We construct GGL_{ijt}^{B3} using only the ownership stakes of the Big Three, and GGL_{ijt}^{X3} using the ownership stakes of all other investors.

Investor Size: Larger institutional investors are more likely to exert influence on firm strategy due to the scale of their investments and stronger access to management. We classify investors as large or small based on the annual median value of their equity portfolios (from 13F filings) and construct corresponding GGL measures.

Turnover Rate: Investors with long investment horizons are more likely to care about strategic outcomes that take time to materialize, such as board appointments. We measure turnover using the portfolio churn rate from Gaspar et al. (2005) and classify investors as high- or low-turnover.

Portfolio Concentration: Institutions with more concentrated portfolios are likely to have greater incentives to monitor and influence specific firms. We compute portfolio concentration using a Herfindahl–Hirschman Index (HHI) of portfolio weights and classify investors as high- or low-concentration.

Hedge Funds: Hedge funds are well-known for their active engagement in governance, including running proxy fights and nominating directors. We identify hedge funds using the list of 13D filers from Bebchuk et al. (2015) and the FactSet database. Hedge funds also tend to be highly concentrated and non-diversified, further increasing their incentive to influence strategy. We con-

struct separate GGL measures for hedge funds and for non-hedge institutional investors, with the latter further classified by size, turnover, and concentration.

All GGL measures are right-winsorized and standardized so that a unit increase reflects a one standard deviation change. Measures based on size, turnover, concentration, and hedge fund classification exclude holdings by the Big Three.

F. Product Similarity and Scope of Operations

Our measure of pair-level product similarity is based on Hoberg and Phillips (2016). Product similarity is computed by analyzing firms' 10-K business descriptions: the methodology extracts nouns, creates binary word vectors for each firm, normalizes them to unit length, and calculates cosine similarity between firm pairs.

Firm-level scope of operations is obtained from Hoberg and Phillips (2025)[7]. We use the D2V-scope measure, which applies Doc2Vec embeddings to 10-K product descriptions to represent each firm in a 300-dimensional semantic space. The authors identify clusters of firms—referred to as market clusters based on textual similarity in this space. The number of distinct markets in which a firm operates is determined by the similarity of its product descriptions to these clusters. We compute both unweighted and weighted (by market capitalization) average scope across firm pairs and winsorize the measure at the 1% level.

G. Markups

In the main specification, we measure markups following the estimation method of De Loecker et al. (2020), which uses a production approach based on firm-level output and input data. This method derives from a firm's cost minimization problem, where markups μ_{it} are estimated as $\mu_{it} = \beta_v \frac{S_{it}}{C_{it}}$, with β_v denoting the output elasticity of variable inputs, S_{it} representing sales revenue, and C_{it} the cost of goods sold. The output elasticity β_v is estimated from industry-specific Cobb-Douglas production functions of the form $q_{it} = \beta_v v_{it} + \beta_k k_{it} + \omega_{it} + \epsilon_{it}$, where v_{it} is the variable

[7]We download the product similarity and scope of operations directly from the Hoberg-Phillips data library, available at hobergphillips.tuck.dartmouth.edu.

input and k_{it} is the capital input.

For robustness checks, we use two alternative measures of markups. The first is the ratio $\frac{\text{Sales}}{\text{Sales}-\text{EBIT}}$, following Geng et al. (2022a). This measure, which is the inverse of the operating margin, captures the extent to which firms generate revenue in excess of operating costs. A higher value indicates greater pricing power and is commonly interpreted as a proxy for the markup of price over marginal cost. The second measure is the ratio $\frac{\text{Sales}}{\text{COGS}}$, which approximates price divided by marginal cost under the assumption that cost of goods sold reflects variable costs.

For all measures of markups, we compute the unweighted and weighted (by market capitalization) average markups across firm pairs and winsorize the measure at the 1% level.

H. R&D and Innovation

We use the standardized measure $\frac{R\&D}{Sales}$ as our primary proxy for R&D intensity.

We also use the count of patents and the real value of patents from Kogan et al. (2017), where the real value is computed by capturing the private economic value of each patent through analysis of stock market reactions during the three-day window following patent grants. [8]

To capture innovation quality and direction, we use four patent-based measures from the NBER Patent Citation Data File compiled by Hall et al. (2001).

Originality is defined as one minus the Herfindahl Index of the three-digit technology class distribution of all patents cited by a firm's patent. A higher originality score indicates that the firm draws on a more diverse set of prior technologies, reflecting greater breadth in knowledge sourcing. *Generality* is similarly defined as one minus the Herfindahl Index of the technology classes of all patents that cite a firm's patent. A higher generality score indicates that the firm's innovation is used broadly across different technological domains.

We also classify patents as *exploitative* or *exploratory* based on the knowledge base they build upon. A patent is labeled *exploitative* if at least 80% of its citations are to the firm's previously cited knowledge—i.e., technologies the firm had already cited in prior patents. In contrast, a patent is considered *exploratory* if at least 80% of its citations are to technologies not previously cited by the firm. These measures help distinguish whether innovation leverages existing internal capabilities

[8] We download the data directly from github.com/KPSS2017/ and the data is updated to 2023.

or explores novel technological areas.

For each variable, we compute both the unweighted and weighted (by market capitalization) across firm pairs and winsorize the resulting values at the 1% level.

IV. Sample Description

In Table I, we summarize our sample. Panel A shows that among 4,522,076 pair-year observations, 16,670 (0.37%) share a director. A substantially larger share—0.77%—of unique firm pairs (i.e., not pair-year observations) share a director at least once during the sample period. In total, 38.7% of unique firms share a director with another firm at least once. In the Hoberg-Phillips universe, 0.41% of pair-year observations share a director, 0.84% of unique pairs share a director at some point, and more than half (51.2%) of firms share a director with another firm at least once.

We further report the level of common ownership between firm pairs. Because each GGL measure is standardized, the unconditional averages are zero by construction and should be interpreted relative to the standard deviation. We also report averages for pairs of firms that share a director. In these cases, the GGL measure averages 0.678 in the SIC-3 universe and 0.685 in the Hoberg-Phillips universe, indicating a strong cross-sectional association between the level of common ownership and the presence of overlapping directors.

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 co-movement through time is, of course, suggestive only. In our regression specifications, we capture such co-movement with time fixed effects and focus on variation *within* pairs across time.

Table I, Panel B, shows the distribution of director interlocks across industries. To highlight where the identifying variation in our outcome variable arises, we report the ten industries with the most year-over-year additions of common directors. The drugs industry accounts for the largest share of interlocks and additions, with nearly 50% of all director interlocks, despite comprising only 22.43% of pair-year observations. The second highest is the computer and data processing

services industry, which represents about 18% of interlocks but 23% of pair-year observations. Two additional industries with disproportionately high levels of interlocks are electronic components and accessories (7.25% of interlocks vs. 4.8% of observations) and medical instruments and supplies (5.5% vs. 3.4%, respectively). Interestingly, commercial banks—while accounting for 27.70% of all pair-year observations—account for only 1.42% of director interlocks.

Overall, director interlocks are concentrated in innovative industries where the potential gains from informational spillovers are likely to be high. By contrast, they are far less prevalent in traditional industries such as banking and manufacturing, where strategic information sharing may be less valuable or more constrained.

V. 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 II panel A we estimate the following regression at the pair-year level:

$$Interlock_{ijt} = \beta_0 + \beta_1 GGL_{ij,t-1} + (\alpha_t) + (\alpha_{ij}) + \epsilon_{ijt} \tag{6}$$

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 III.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.

The cross-sectional results are susceptible to the possibility that the presence of interlocked directors is not solely or fully related to common owners but rather also to a strategic decision by companies to better align their products, possibly with anticipation of greater activist intervention. To mitigate these concerns, 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 substantially 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 0.04-0.06% higher probability that a firm pair shares a director. 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). The robustness section shows a similar qualitative pattern when we use the Kappa measure, although the magnitudes are smaller.

B. Dynamic Effects

In Figure 2 (SIC-3 universe) and Figure 3 (Hoberg-Phillips universe), we present the results from an event study framework designed to test for dynamic effects in the probability of sharing a director before and after a sharp increase in common ownership. We define "treat years" as those pair-year observations where the number of common institutional owners increases by at least ten relative to the previous year (for the first time). We then estimate the following specification:

$$Interlock_{ijt} = \beta_0 + \sum_{t=-5}^{t=5} \beta_t \times treat_i \times post_t + \alpha_t + \alpha_{ij} + \epsilon_{ijt} \tag{7}$$

The estimated coefficients β_t represent changes in the probability that two firms share a director in each year relative to the event year (year 0). As shown in Figure 2 (SIC-3 universe) and 3 (Hoberg-Phillips universe), there is little evidence of a pre-trend in director interlocks in the years leading up to the increase in common ownership. Starting in the event year, the probability of sharing a director rises sharply and remains elevated. While sharp increases in common ownership are not necessarily exogenous, the absence of a visible pre-trend helps mitigate the concern that director interlocks were already rising within the treated pairs before the increase in common ownership. The point estimates are economically meaningful, and the confidence intervals confirm that the increases are statistically significant in the post-treatment period.

C. Investor Heterogeneity

In this section, we examine the extent to which the relationship between common ownership and common directors varies across different types of institutional investors. Because we are interested in an active channel of common ownership, we focus specifically on whether this relationship is stronger for investors who tend to hold more significant stakes and are more likely to actively influence firm strategy. As discussed in Section III, we construct separate GGL measures for different categories of institutional investors and estimate variants of the baseline specification in Equation (6), replacing the overall GGL measure with investor-type-specific GGL variables.

The results are presented in Table II. First, we find that common director appointments are not primarily associated with the "Big Three" index fund families—BlackRock, Vanguard, and State Street. These fund families are widely regarded as passive and deferential to management. Across both the SIC-3 and Hoberg-Phillips industry universes, the coefficient on the GGL measure for Big Three investors is small and statistically insignificant. These results suggest that more active institutional investors—not passive index funds—are more strongly associated with board interlocks among commonly owned firms.

Next, we find that the relationship between common ownership and common directors is

stronger for large investors. For instance, in the SIC-3 universe, a one standard deviation increase in common ownership by large investors increases the likelihood of sharing a director by 0.031%, compared to just 0.012% for small investors. This difference is statistically significant and suggests that the relationship between common ownership and director interlocks is concentrated among institutions with more substantial economic stakes and, presumably, greater influence.

We also find that investors with longer horizons—i.e., low portfolio turnover—are more strongly associated with common director appointments. 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 0.028%, compared to 0.020% for high-turnover investors. The magnitude of the difference is smaller than in the size comparison and only marginally significant, but still directionally consistent with the hypothesis that longer-term investors are more engaged in governance.

When we classify investors by portfolio concentration, we again find stronger effects among institutions with high concentration. In the SIC-3 universe, the effect of common ownership by high-concentration investors is nearly double that of low-concentration investors. This result is statistically significant and somewhat surprising, as much of the literature emphasizes the role of large, diversified institutions. Our findings suggest that it is the less-diversified institutions—those with more firm-specific exposure—that are more strongly associated with common director appointments.

Finally, in Table III, we evaluate the role of hedge funds. Hedge funds are well-known for their activist strategies, including efforts to influence governance through director nominations. We find that both the GGL measure for hedge fund common ownership and the measure for non-hedge fund ownership are positively associated with director interlocks. However, the effect is significantly larger for non-hedge fund investors. This suggests that while hedge funds play a role, they are not the primary source of the interlocks we observe.

To refine this analysis, we reclassify non-hedge institutional investors by size, turnover, and concentration and estimate the same specifications. We confirm that larger, more concentrated, and longer-term non-hedge investors are more strongly associated with common directors. Two differences are worth noting. First, once hedge funds are accounted for, we find stronger support for

the role of investment horizon—low-turnover institutions remain significantly more influential than high-turnover ones. Second, the previously significant effect of high portfolio concentration becomes statistically insignificant, likely because hedge funds tend to be highly concentrated investors.

Taken together, these findings are consistent with the view that board interlocks among commonly owned firms are more strongly associated with active institutional investors—those with large, focused, and long-term stakes—than with passive or highly diversified owners.

VI. Real Outcomes

Having documented that common ownership by more active institutional investors is associated with a higher likelihood of director interlocks, we next examine whether such interlocks are associated with firm strategy, product market outcomes, and innovation investment. Consistent with the theoretical framework developed in Section II, we find that director interlocks are associated with increased product similarity and broader scope of operations. These interlocks are also associated with lower markups—consistent with heightened competition—and with reduced R&D investment and a lower incidence of exploratory patenting.

A. Product Similarity

Table IV presents the results. We find that common directorship has a statistically significant and positive association with product similarity scores. The cross sectional results in the SIC-3 universe are particularly telling. Director interlocks are associated with 28% higher similarity score, a pattern consistent with informational exchanges through common directors being especially relevant when similarity scores are already high. The result is much weaker in the Hoberg-Phillips universe, but likely because the construction of the pairs is already based on high similarity scores among firms.

However, in both industry definitions, following the appointment of common directors, product similarity increases. The economic magnitude corresponds to an approximate 2–3% increase relative to the mean product similarity among firm pairs in the sample. This effect is larger, approximately 5%, when restricting the sample to the pharmaceutical industry, which is characterized by high

failure rates and strong dependence on innovation. It is also noteworthy that an increase in the GGL measure is associated with higher product similarity, though the magnitude of the effect is smaller.

B. Scope and Markups

Although scope is not a direct object of the model, it may rise in settings where informational exchanges lower failure rates. Consistent with this interpretation, as shown in Table V Panel A, common directors are associated with an increase in product scope in both the SIC-3 and Hoberg-Phillips universes. The presence of a common director is associated with an approximate 1.4% increase in scope relative to the sample mean. This pattern is consistent with firms connected through shared directors being less likely to fail in product development and more likely to expand into additional markets. The GGL measure is positively associated with scope, but the magnitude of the effect is smaller.

Table V Panel B summarizes the result for the markups estimated following De Loecker et al. (2020). The results show that common directorship is negatively associated with firm markups. Specifically, when a pair of firms shares a director ($Interlock = 1$), markups decrease by 2.4–3.6% across all specifications, with stronger effects in the SIC-3 universe than in the Hoberg-Philips universe. Our findings are consistent with board interlocks being associated with a more competitive product-market environment, potentially through information sharing rather than facilitating collusion. Interestingly, there is a positive association between GGL and markups, consistent with studies that suggest that common ownership, primarily through the passive channel, has harmful effect on product market competition (Azar et al., 2018; Antón et al., 2023; Ederer and Pellegrino, 2025). Thus, it is possible that the active and passive channels of common ownership have different effects.

C. R&D and Innovation

Proposition 2 outlined the conditions under which common directors may lead to lower innovation—specifically, when the relative reduction in markups due to heightened competition is not too

large. The observed 2.4–3.6% decrease in markups is arguably consistent with a moderate markup effect: small enough to justify informational exchange, but large enough to weaken firms' incentives to innovate.

Table VI summarizes the results for R&D investment and patenting. As shown in Panel A, interlocks are associated with lower R&D intensity across both industry classifications. The estimated magnitudes correspond to declines of about 0.29 to 0.51 in R&D intensity, or roughly 21% to 26% relative to the sample mean. Notably, the decline in R&D intensity is not accompanied by a comparable decline in patent counts or patent value, suggesting a change in the intensity or composition of innovation effort rather than a wholesale reduction in innovative output. This pattern is consistent with the model's prediction that when complementarity is limited, information sharing through board interlocks substitutes for some internal R&D investment.

To further examine innovation quality, we analyze measures such as originality, generality, and the share of exploratory versus exploitative patents. As shown in Table VII, interlocks are consistently associated with a statistically significant decline in exploratory patenting, while effects on other dimensions are smaller and not statistically significant. In particular, interlocked firms show a 27–28% reduction in the share of exploratory patents.

These findings suggest that firms with common directors may rely less on novel knowledge and pursue less exploratory innovation strategies—potentially due to overlapping information channels or reduced incentives to differentiate technologically. Notably, the GGL measure is positively and significantly associated with originality, generality, and exploitative innovation across both classification systems. It is negatively associated with exploratory innovation, though the magnitude is smaller than that observed for common directors.

Overall, the apparent contrast between the effects of common directors and the GGL measure suggests that while largely passive common ownership may be associated with more broadly cited and cumulative innovation (Antón et al., 2024), it is the presence of common directors that is strongly associated with less exploratory R&D activity.

VII. Robustness

The first set of robustness results relate to the evidence that common directors are more likely to be appointed if the level of common ownership is higher. In the main specification, we rely on the GGL measure of common ownership. In Table A1, we use the Kappa measure, the profit weight measure, following Backus et al. (2021b). The pair level Kappa measure between firm f and firm g is defined as:

$$Kappa_{ij} = \left(\frac{\sum_{\forall s} \gamma_{fs} \beta_{gs}}{\sum_{\forall s} \gamma_{fs} \beta_{fs}} \right) \tag{8}$$

where s indexes investors. γ_{fs} is the Pareto weight firm f put on investor s and β_{fs} is the share investor s holds in firm f. In this paper, we assume the proportional control, i.e., $\gamma_{fs} = \beta_{fs}$. Like the GGL measure, we also divide each measure by its full-sample mean to facilitate interpretation, right-winsorize each measure at the 95th percentile, and standardize the measure.

The results in Panel A show show a statistically significant relationship between Kappa and common director appointment across specifications, although the magnitudes are smaller than those reported for GGL in Table II. This is expected because the Kappa measure does not capture the relative importance of the common owner's stake within that owner's overall portfolio. It is unlikely that if the relative importance of these stakes are small that a common owner will seek to pursue an active channel for influencing corporate strategy by appointing a common director.

In Panel B and Table A2, we further show results exploring the heterogeneity of investors. The result are qualitative similar to our main specifications that focus on GGL. Common ownership by the Big-3 does not predict director interlocks, while other types of investors are correlated with interlocks. The main differenced from the main results is that the coefficient on large investors is smaller than than on small, and that the differences between different types of investors are not statistically significant. These differences likely emanate from the fact that Kappa does not capture the true economic stake of inevstors in the commonly owned firms. Thus, the stakes of small investors largely have higher relative size in their portfolio, which is likely the explanation for the larger coefficients for small investors.

The second set of robustness results focus on the real outcomes of director interlocks. Tables A3, A6 and A7 present robustness test, where outcome variables across firm pairs are weighted

by market capitalization. The purpose of weighted specifications is to ensure that the economic magnitude are not driven by small firms.

The results remain qualitatively and quantitatively similar to the unweighted main specifications. In Table A3, Panel A, the estimated effect of director interlocks implies a 1.59% increase in scope following an interlock, slightly larger than the 1.33% increase in the unweighted case. In the Hoberg-Phillips universe, the effect is 1.90%, again slightly higher than the unweighted effect of 1.45%. Table A3, Panel B shows that the effect of interlocks on markups (using the De Loecker method) remains negative and statistically significant, with effect sizes of –3.1% in SIC-3 universe and –2.2% in Hoberg-Phillips universe, closely matching the 2.4–3.6% reductions reported in Table IV.

Table A4 reports the association between interlocks and markups using two alternative measures: $\frac{\text{Sales}}{\text{Sales}-\text{EBIT}}$ (Panel A) and $\frac{\text{Sales}}{\text{COGS}}$ (Panel B). The results are quantitatively similar to the main specification and support the model's prediction that markups moderately decline following the appointment of a common director. In Panel A, the coefficient on interlocks is negative, though statistically significant only in Column (3). In Panel B, the estimated coefficients are negative and statistically significant in all columns except Column (1), suggesting that interlocks are associated with a decline in markups ranging from 0.68% to 0.76% relative to the sample mean. These results remain qualitatively similar when using weighted versions of these measures, as shown in Table A5, although the statistical significance varies across specifications.

Table A6 confirms that director interlocks are associated with reductions in R&D intensity in the weighted regressions. In the SIC-3 universe, the estimated coefficient is –0.2564, which amounts to a 20.1% reduction relative to the mean R&D intensity of 1.2753. In Hoberg-Phillips, the effect is a 14.6% drop—similar to the decline observed in the unweighted results. Moreover, as in the main specifications, there is no statistically significant relationship between interlocks and the number of patents or their value.

Finally, Table A7 reports effects on patent quality. The sign of the coefficients on exploratory patents remain negative and significant, but it is statistically significant only in the Hoberg-Phillips universe. Economically, the magnitudes are again similar to those in the main specifications, showing a decline of about 23%, similar to that in the unweighted specifications.

Overall, these robustness tests underscore that our findings are not driven by outliers or unweighted averaging, and the economic effects of director interlocks persist when accounting for the relative size of firms within each pair.

VIII. Conclusion

Recent research on common ownership has focused primarily on the influence of large, passive institutional investors. In contrast, we document a novel and active channel through which common owners may shape firm strategy: the appointment of common directors. This phenomenon is widespread—nearly 40% of public firms share a director with another firm in the same industry. We provide evidence that director interlocks are significantly more likely when common ownership across a firm pair is high, and that this relationship is more pronounced for investors with larger stakes, more concentrated portfolios, longer holding periods, and a greater propensity to engage in governance.

We develop an economic model in which a common director influences firm strategy by increasing product market proximity among commonly owned firms. Greater proximity facilitates informational spillovers that improve the likelihood of product success. However, these spillovers also raise the risk of intensified product market competition, resulting in lower markups. The model further shows that common directors can reduce incentives to invest in innovation when the degree of complementarity is low. These dynamics are especially relevant in industries characterized by high failure risk and substantial potential monopoly profits—a pattern consistent with our empirical finding that nearly 50% of intra-industry director interlocks occur in the pharmaceutical sector.

We provide evidence consistent with the model's predictions. The appointment of common directors is followed by a statistically and economically significant increase in product similarity and firm scope, along with a reduction in price markups. At the same time, we observe a meaningful decline in R&D intensity and a shift away from exploratory patenting, indicating weaker innovation incentives. The decline in R&D intensity is not accompanied by a comparable decline in patent counts or patent value, suggesting a change in the intensity and composition of innovation effort

rather than a wholesale reduction in innovative output. While common ownership (as measured by the GGL metric) is sometimes associated with greater originality and generality in patenting, the presence of a common director is associated with lower investment in research and less novel invention.

Overall, our study highlights that common ownership can operate through both passive and active channels, with complex and sometimes counterintuitive effects. Rather than concluding that common ownership necessarily operates only through reduced competition, our evidence points to a plausible active governance channel through which commonly held firms may adjust product positioning and innovation choices. Although we cannot fully rule out other forms of governance or strategic convergence, these patterns are consistent with information sharing and arise in a demanding empirical setting with lagged common ownership and firm-pair and year fixed effects.

These findings underscore the need for a nuanced and careful analysis of common ownership—one that accounts for heterogeneous investor strategies, varied mechanisms of influence, and the trade-offs they create for firm behavior and market outcomes (Crane, 2021; Francis, 2024).

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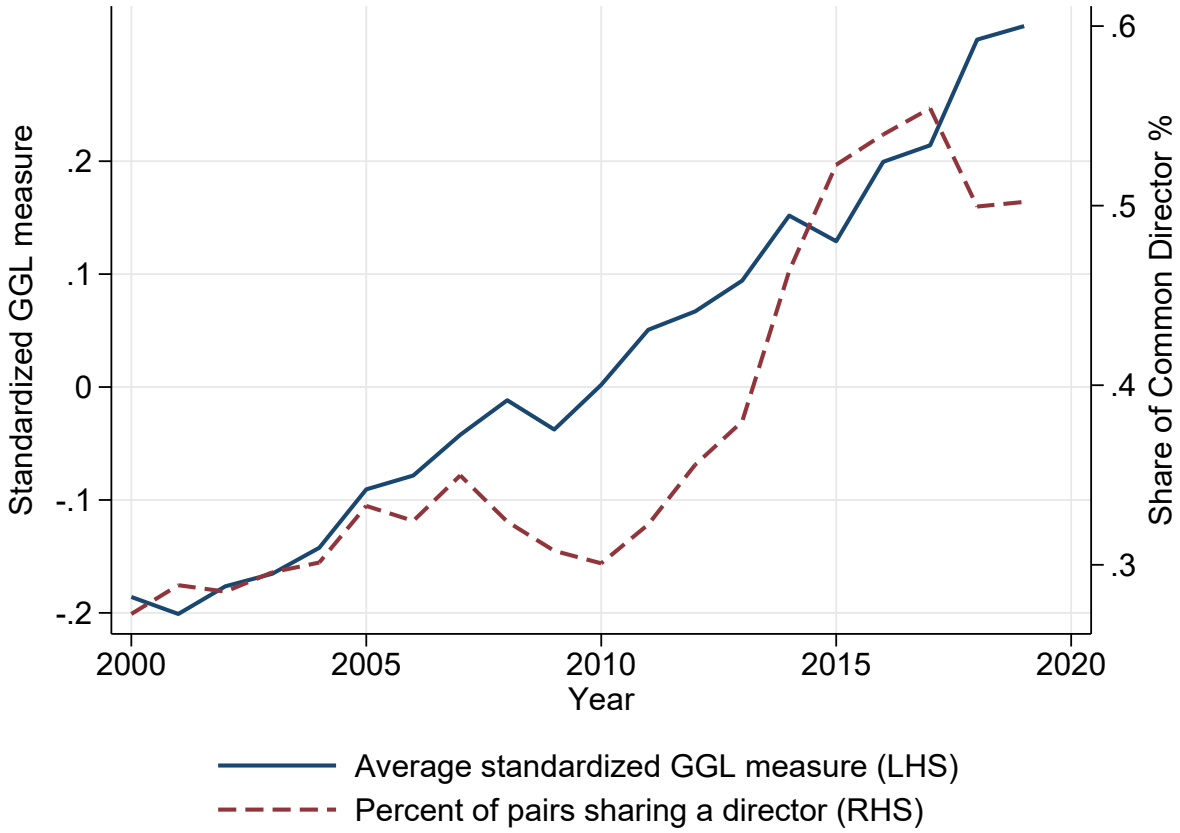
Appendix: Variable Definitions

Variable	Definition	Data Source
Interlock	Indicator variable equal to 1 if two firms in the same industry share a common director in a given year, and 0 otherwise.	BoardEx
GGL	Common ownership measure from Gilje et al. (2020). Standardized and winsorized at the 5% level.	Thomson Reuters 13F; CRSP
Kappa	Common ownership measure from Backus et al. (2021b). Standardized and winsorized at the 5% level.	Thomson Reuters 13F; CRSP
GGL Big Three	Constructed using only holdings by the "Big Three" institutional investors: BlackRock, Vanguard, and State Street. Standardized and winsorized at the 5% level.	Thomson Reuters 13F; CRSP
GGL Excluding Big Three	Constructed using all institutional holdings except those from the Big Three.	Thomson Reuters 13F; CRSP
GGL Large	Constructed using holdings of institutional investors whose total AUM exceeds the median in a given year.	Thomson Reuters 13F; CRSP
GGL Small	Constructed using holdings of institutional investors whose AUM falls below the median in a given year.	Thomson Reuters 13F; CRSP
GGL Low Turnover	Constructed using holdings of institutional investors in the bottom half of the turnover (churn) distribution.	Thomson Reuters 13F; CRSP; Gaspar et al. (2005)
GGL High Turnover	Constructed using holdings of institutional investors in the top half of the churn distribution. Standardized and winsorized at the 5% level.	Thomson Reuters 13F; CRSP; Gaspar et al. (2005)
GGL High Concentration	Constructed using investors with above-median portfolio concentration (Herfindahl Index of holdings). Standardized and winsorized at the 5% level.	Thomson Reuters 13F; CRSP
GGL Low Concentration	Constructed using investors with below-median portfolio concentration. Standardized and winsorized at the 5% level.	Thomson Reuters 13F; CRSP
GGL Hedge Funds	Constructed using only investors identified as hedge funds via Brav et al. (2008) and FactSet. Standardized and winsorized at the 5% level.	Brav et al. (2008); FactSet
GGL Excluding Hedge Funds	Constructed excluding all hedge fund investors. Standardized and winsorized at the 5% level.	Brav et al. (2008); FactSet
Product Similarity	Cosine similarity between firm business descriptions in 10-K filings. Winsorized at 1% level.	Hoberg and Phillips (2016)
Scope	Number of product markets a firm operates in, based on doc2vec clustering. Averaged across firm pairs. Winsorized at 1% level.	Hoberg and Phillips (2025)
Markup (De Loecker)	Estimated using production function approach of De Loecker et al. (2020). Averaged across firm pairs. Winsorized at 1% level.	Compustat
Markup (COGS)	$\frac{\text{Sales}}{\text{COGS}}$, interpreted as inverse of operating margin. Averaged across firm pairs. Winsorized at 1% level.	Compustat
Markup (EBIT)	$\frac{\text{Sales}}{\text{Sales}-\text{EBIT}}$, interpreted as inverse of operating margin. Averaged across firm pairs. Winsorized at 1% level.	Compustat
R&D Intensity	R&D expenditures divided by sales revenue. Averaged across firm pairs. Winsorized at 1% level.	Compustat
Patent Count	Number of patents granted to a firm in a given year. Averaged across firm pairs. Winsorized at 1% level.	Kogan et al. (2017)
Patent Value	Real dollar value of patents based on market reaction to grant events. Averaged across firm pairs. Winsorized at 1% level.	Kogan et al. (2017)
Originality	One minus the Herfindahl Index of cited patent technology classes. Averaged across firm pairs. Winsorized at 1% level.	USPTO; Hall et al. (2001); Kogan et al. (2017)
Generality	One minus the Herfindahl Index of citing patent technology classes. Averaged across firm pairs. Winsorized at 1% level.	USPTO; Hall et al. (2001); Kogan et al. (2017)
Explorative	Share of patents with over 80% of citations to previously uncited technologies. Averaged across firm pairs. Winsorized at 1% level.	USPTO; Hall et al. (2001); Kogan et al. (2017)
Exploitative	Share of patents with over 80% of citations to previously cited technologies. Averaged across firm pairs. Winsorized at 1% level.	USPTO; Hall et al. (2001); Kogan et al. (2017)

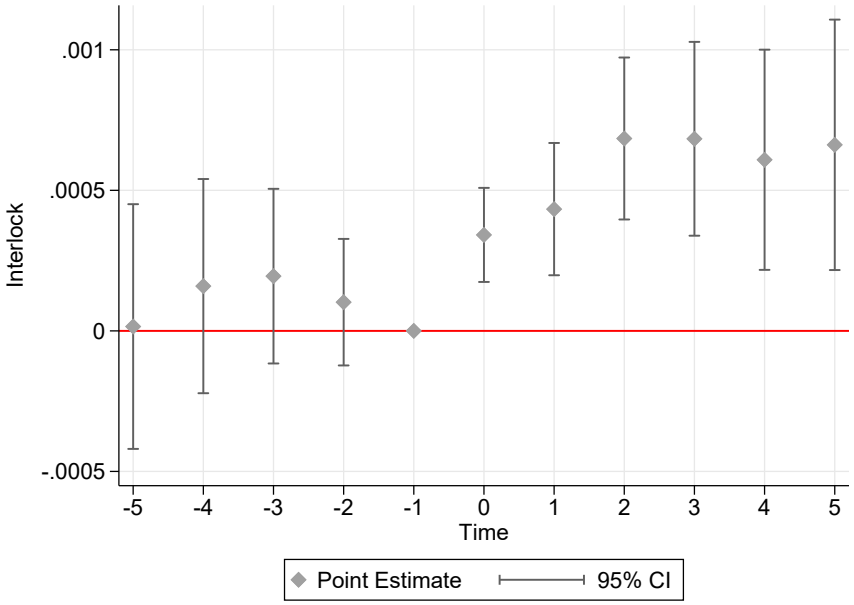
Figures

Figure 1. Common Ownership and Director Interlocks



Note: This figure shows time trends in the average level of common ownership and the incidence of board interlocks between publicly traded firms from 2000 to 2019. Common ownership is measured using the GGL measure following Gilje et al. (2020). A pair is classified as interlocked if the two firms share at least one board member in a given year. The figure illustrates the rise in institutional common ownership over time, and its coincident pattern with the increase in director interlocks.

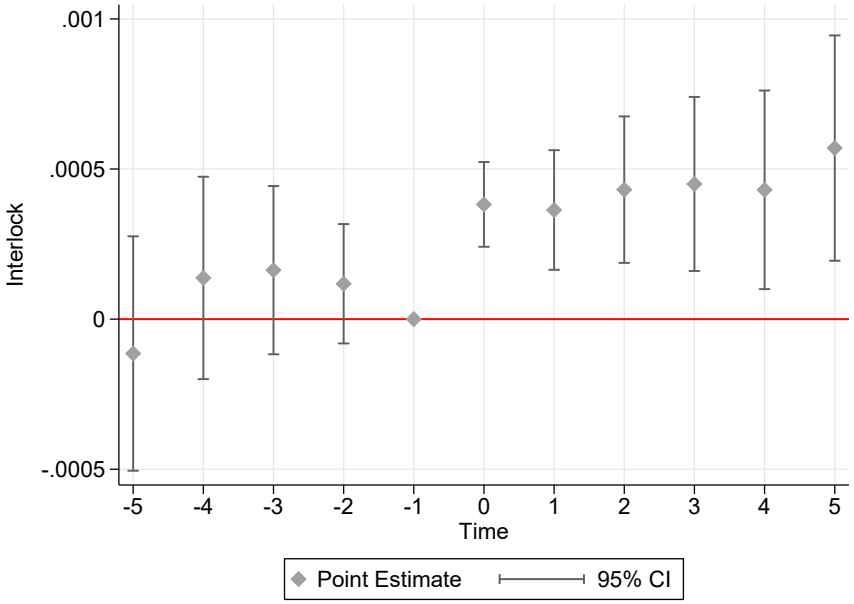
Figure 2. Dynamic Effect of Common Ownership on Director Interlocks
(SIC-3 Universe)



Note: This figure estimates the dynamic effect of changes in common ownership on the probability that two firms share a director, using an event-study specification corresponding to Equation (7). The dependent variable is $Interlock_{ijt}$, which equals 1 if firms i and j share at least one director in year t, and 0 otherwise. The treatment is defined as the first year in which the number of common owners between a firm pair increases by at least 10 relative to the previous year for the first time. The horizontal axis plots event time relative to this treatment year. The sample includes firm pairs that share a 3-digit SIC code in at least one year between 2000 and 2019. Regressions include firm-pair and year fixed effects. Standard errors are clustered at the firm-pair level, and 95% confidence intervals are shown.

Figure 3. Dynamic Effect of Common Ownership on Director Interlocks

(Hoberg–Phillips Universe)



Note: This figure estimates the dynamic effect of changes in common ownership on the probability that two firms share a director, using the event-study specification in Equation (7). The dependent variable is $Interlock_{ijt}$, which equals 1 if firms i and j share at least one director in year t. The treatment is defined as the first year in which the number of common owners between a firm pair increases by at least 10 relative to the previous year for the first time. The horizontal axis plots years relative to this treatment year . The sample includes firm pairs with non-zero Hoberg–Phillips TNIC similarity in at least one year from 2000 to 2019. Regressions include firm-pair and year fixed effects. Confidence intervals represent 95% levels, with standard errors clustered at the firm-pair level.

Tables

Table I. Summary Statistics and Industry Distribution

Panel A: Director interlocks

	SIC-3 universe	Hoberg-Phillips universe
Number of pair-year observations	4,522,076	6,227,928
Number of unique pairs	698,842	872,029
Number of unique firms	6,984	6,920
Number (%) of pair-years interlocked	16,670 (0.37%)	25,552 (0.41%)
Number (%) of pairs ever interlocked	5,369 (0.77%)	7,442 (0.84%)
Number (%) of firms ever interlocked	2,704 (38.70%)	3,538 (51.12%)
GGL (standardized)	0.678	0.685

Panel B: Distribution of Interlock Additions by Industry (SIC-3 universe)

SIC-3	Description	Obs.	(%)	Interlocks	(%)	Additions	(%)
283	Drugs	854,200	22.43	7,545	49.87	891	45.93
737	Computer & data processing services	872,943	22.92	2,743	18.13	403	20.77
367	Electronic components & accessories	183,254	4.81	1,097	7.25	158	8.14
384	Medical instruments & supplies	128,297	3.37	829	5.48	131	6.75
357	Computer and office equipment	52,611	1.38	250	1.65	46	2.37
131	Crude petroleum & natural gas	72,784	1.91	394	2.60	42	2.16
602	Commercial banks	1,054,974	27.70	215	1.42	35	1.80
581	Eating & drinking places	26,574	0.70	199	1.32	25	1.29
382	Measuring & controlling devices	62,166	1.63	173	1.14	23	1.19
366	Communications equipment	43,437	1.14	187	1.24	22	1.13

Note: Panel A reports summary statistics for firm pairs in the SIC-3 universe (pairs sharing 3-digit SIC codes for at least one year between 2000–2019) and Hoberg-Phillips universe (pairs with non-zero TNIC scores for at least one year). $Interlock_{ijt}$ equals 1 if firms i and j share a director in year t, and 0 otherwise. GGL is the standardized common ownership measure from Gilje et al. (2020); reported values are averages for pairs that share a director. Panel B shows the distribution of interlock additions across the ten SIC-3 industries with the most year-over-year director additions.

Table II. Common Ownership and Director Interlocks

	SIC-3 universe			Hoberg-Phillips universe		
Panel A: Common Ownership and Director Interlocks						
Dep Var: $Interlock \times 100$	(1)	(2)	(3)	(4)	(5)	(6)
GGL	0.2420***	0.0467***	0.0427***	0.2780***	0.0533***	0.0500***
	(0.0096)	(0.0065)	(0.0065)	(0.0092)	(0.0061)	(0.0061)
Pair fixed effects	No	Yes	Yes	No	Yes	Yes
Time fixed effects	Yes	No	Yes	Yes	No	Yes
Mean of Dep Var	0.3673	0.3612	0.3612	0.4103	0.4055	0.4055
Adjusted R^2	0.0018	0.6091	0.6091	0.0020	0.5908	0.5909
Observations	4,538,746	4,433,166	4,433,166	6,227,928	6,118,602	6,118,602
Panel B: Investor Heterogeneity						
Dep Var: $Interlock \times 100$	(1)	(2)	(3)	(4)	(5)	(6)
GGL^{B3}	0.0129	0.0107	0.0144*	0.0133	0.0109	0.0146*
	(0.0085)	(0.0086)	(0.0085)	(0.0085)	(0.0085)	(0.0085)
GGL^{Large}	0.0312***			0.0352***		
	(0.0061)			(0.0057)		
GGL^{Small}	0.0114***			0.0141***		
	(0.0036)			(0.0033)		
GGL^{Steady}		0.0277***			0.0318***	
		(0.0059)			(0.0057)	
GGL^{Churny}		0.0200***			0.0232***	
		(0.0042)			(0.0039)	
GGL^{Conc}			0.0285***			0.0292***
			(0.0049)			(0.0043)
GGL^{Div}			0.0147***			0.0190***
			(0.0056)			(0.0053)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	0.3612	0.3612	0.3612	0.4055	0.4055	0.4055
Difference	0.0198	0.0077	0.0138	0.0211	0.0086	0.0102
p-value	0.0024	0.1166	0.0237	0.0006	0.0808	0.0572
Adjusted R^2	0.6091	0.6091	0.6091	0.5908	0.5908	0.5908
Observations	4,433,166	4,433,166	4,433,166	6,118,602	6,118,602	6,118,602

Note: Panel A estimates Equation (6) where the dependent variable $Interlock_{ijt} \times 100$ equals 100 if firms i and j share a director in year t, and 0 otherwise. Panel B estimates variants with investor-type-specific GGL measures. GGL^{B3} uses Big Three investors (BlackRock, Vanguard, State Street), $GGL^{Large/Small}$ uses investors above/below median portfolio value, $GGL^{Steady/Churny}$ uses low/high portfolio turnover investors, and $GGL^{Conc/Div}$ uses high/low portfolio concentration investors. All GGL measures are standardized and right-winsorized at the 95th percentile. Standard errors are clustered at the pair level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table III. Hedge Fund Ownership and Director Interlocks

	SIC-3 universe				Hoberg-Philips universe			
Dep Var: $Interlock \times 100$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GGL^{B3}	0.0114	0.0121	0.0105	0.0132	0.0114	0.0122	0.0104	0.0129
	(0.0085)	(0.0085)	(0.0086)	(0.0085)	(0.0085)	(0.0085)	(0.0085)	(0.0085)
GGL^{HF}	0.0117***	0.0114**	0.0115***	0.0117***	0.0177***	0.0173***	0.0175***	0.0175***
	(0.0044)	(0.0044)	(0.0044)	(0.0044)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
GGL^{NHF}	0.0291***				0.0316***			
	(0.0060)				(0.0057)			
$GGL^{NHF-Large}$		0.0252***				0.0273***		
		(0.0060)				(0.0057)		
$GGL^{NHF-Small}$		0.0101***				0.0121***		
		(0.0035)				(0.0033)		
$GGL^{NHF-Steady}$			0.0228***				0.0257***	
			(0.0059)				(0.0057)	
$GGL^{NHF-Churny}$			0.0129***				0.0147***	
			(0.0041)				(0.0039)	
$GGL^{NHF-Conc}$				0.0175***				0.0205***
				(0.0045)				(0.0041)
$GGL^{NHF-Div}$				0.0140**				0.0178***
				(0.0057)				(0.0055)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	0.3612	0.3612	0.3612	0.3612	0.4055	0.4055	0.4055	0.4055
Difference	0.0174	0.0151	0.0099	0.0036	0.0138	0.0152	0.0110	0.0027
p-value	0.0090	0.0140	0.0615	0.3023	0.0223	0.0102	0.0371	0.3370
Adjusted R^2	0.6091	0.6091	0.6091	0.6091	0.5908	0.5908	0.5908	0.5908
Observations	4433166	4433166	4433166	4433166	6118602	6118602	6118602	6118602

Note: This table estimates variants of Equation (6), where the dependent variable $Interlock_{ijt} \times 100$ equals 100 if firms i and j share at least one director in year t. GGL^{HF} reflects generalized common ownership calculated using hedge fund portfolios. GGL^{B3} uses the Big Three (BlackRock, Vanguard, State Street). GGL^{NHF} captures non-hedge fund institutional ownership. Subgroups include: *Large/Small* investors (based on portfolio size), *Steady/Churny* (based on turnover), and *Conc/Div* (based on portfolio concentration). All GGL measures are standardized and winsorized at the 95th percentile. Year and pair fixed effects are included in all regressions. Standard errors are clustered at the firm-pair level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table IV. Product Similarity

	SIC-3 universe				Hoberg-Phillips universe			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Interlock	0.0126***	0.0126***	0.0017***	0.0016***	-0.0009	0.0022***	0.0012***	0.0011***
	(0.0011)	(0.0011)	(0.0006)	(0.0006)	(0.0008)	(0.0008)	(0.0004)	(0.0004)
GGL		-0.0001*		0.0004***		-0.0046***		0.0003***
		(0.0001)		(0.0000)		(0.0001)		(0.0000)
Pair fixed effects	No	No	Yes	Yes	No	No	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	0.0454	0.0454	0.0450	0.0450	0.0471	0.0471	0.0465	0.0465
Adjusted R-squared	0.0174	0.0174	0.8533	0.8533	0.0179	0.0179	0.8311	0.8311
Observations	4,538,746	4,538,746	4,433,166	4,433,166	6,227,928	6,227,928	6,118,602	6,118,602

Note: This table estimates the effect of director interlocks on product similarity between firms. The dependent variable is a continuous measure of product similarity from Hoberg and Phillips (2016). $Interlock_{ijt}$ equals 1 if firms i and j share a director in year t, and 0 otherwise. GGL is the standardized measure of common ownership from Gilje et al. (2020). Columns (1)–(4) correspond to the SIC-3 universe, defined as firm pairs that share a 3-digit SIC code in at least one year from 2000 to 2019. Columns (5)–(8) correspond to the Hoberg-Phillips universe, defined as firm pairs with non-zero TNIC similarity in at least one year. Columns (3), (4), (7), and (8) include firm-pair fixed effects; all specifications include year fixed effects. GGL is standardized and winsorized at the 95th percentile. Standard errors are clustered at the firm-pair level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table V. Effect of Interlocks on Firm Outcomes

	SIC-3 universe		Hoberg-Phillips universe	
	(1)	(2)	(3)	(4)
Panel A: Scope				
Interlock	0.1326**	0.1279**	0.1660***	0.1630***
	(0.0529)	(0.0529)	(0.0467)	(0.0467)
GGL		0.0342***		0.0234***
		(0.0025)		(0.0023)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	9.9875	9.9875	11.4461	11.4461
Adjusted R^2	0.7712	0.7712	0.7622	0.7622
Observations	4,433,166	4,433,166	6,118,602	6,118,602
Panel B: Markups (DeLoecker Method)				
Interlock	−0.0851***	−0.0925***	−0.0596**	−0.0664***
	(0.0312)	(0.0311)	(0.0255)	(0.0255)
GGL		0.0710***		0.0575***
		(0.0017)		(0.0015)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	2.5951	2.5951	2.4949	2.4949
Adjusted R^2	0.6679	0.6687	0.6712	0.6717
Observations	3,285,839	3,285,839	3,961,230	3,961,230

Note: This table estimates the effect of director interlocks on firm-level outcomes. Panel A examines the impact on firm scope, measured as the number of unique product segments, following the definition in Hoberg and Phillips (2016). Panel B reports effects on firm-level markups, estimated using the production approach from De Loecker et al. (2020). The variable $Interlock_{ijt}$ equals 1 if firms i and j share a director in year t, and 0 otherwise. GGL is the standardized measure of common ownership from Gilje et al. (2020), winsorized at the 95th percentile. Columns (1)–(2) use the SIC-3 universe, defined as firm pairs that share a 3-digit SIC code in at least one year between 2000 and 2019. Columns (3)–(4) use the Hoberg-Phillips universe, defined as pairs with non-zero TNIC similarity in at least one year. All regressions include firm-pair and year fixed effects. Standard errors are clustered at the firm-pair level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table VI. Effect of Interlocks on Innovation

	SIC-3 universe		Hoberg-Phillips universe	
	(1)	(2)	(3)	(4)
Panel A: R&D Intensity (R&D / Sales)				
Interlock	−0.5071***	−0.5054***	−0.2925***	−0.2914***
	(0.1946)	(0.1945)	(0.0989)	(0.0989)
GGL		−0.0134*		−0.0093**
		(0.0069)		(0.0043)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	1.9223	1.9223	1.3700	1.3700
Adjusted R^2	0.5443	0.5443	0.5723	0.5723
Observations	4,177,541	4,177,541	5,833,617	5,833,617
Panel B: Patent Count				
Interlock	0.6081	0.5204	0.0318	−0.0466
	(0.4728)	(0.4718)	(0.3584)	(0.3581)
GGL		0.6479***		0.6090***
		(0.0251)		(0.0194)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	10.0044	10.0044	8.1289	8.1289
Adjusted R^2	0.8989	0.8991	0.8823	0.8825
Observations	4,433,166	4,433,166	6,118,602	6,118,602
Panel C: Real Value of Innovation Output				
Interlock	−4.7074	−6.3429	−4.6194	−6.3345
	(8.6715)	(8.6389)	(7.4938)	(7.4801)
GGL		12.0749***		13.3215***
		(0.5911)		(0.4649)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	180.7463	180.7463	152.9862	152.9862
Adjusted R^2	0.8860	0.8861	0.8772	0.8773
Observations	4,433,166	4,433,166	6,118,602	6,118,602

Note: This table estimates the effect of director interlocks and common ownership (GGL) on firm-level innovation outcomes. Panel A reports results for R&D intensity, defined as R&D expenditure divided by sales. Panel B examines the effect on the number of patents applications from Kogan et al. (2017). Panel C considers the real monetary value of granted patents from Kogan et al. (2017). The variable $Interlock_{ijt}$ equals 1 if firms i and j share a director in year t, and 0 otherwise. GGL is the measure of common ownership from Gilje et al. (2020), standardized and winsorized at the 95th percentile. Columns (1)–(2) use the SIC-3 universe, defined as firm pairs that share a 3-digit SIC code in at least one year between 2000 and 2019. Columns (3)–(4) use the Hoberg-Phillips universe, which includes firm pairs with non-zero TNIC similarity in at least one year. All regressions include firm-pair and year fixed effects. Standard errors are clustered at the firm-pair level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table VII. Effect of Interlock on Patent Quality

Panel A: SIC–3 Universe

	Originality		Generality		Explorative		Exploitative	
Interlock	0.0012	0.0010	−0.0027	−0.0030	−0.0023**	−0.0023**	0.0051	0.0046
	(0.0022)	(0.0022)	(0.0023)	(0.0023)	(0.0009)	(0.0009)	(0.0036)	(0.0036)
GGL		0.0021***		0.0025***		−0.0003***		0.0035***
		(0.0001)		(0.0001)		(0.0000)		(0.0002)
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	0.1455	0.1455	0.1122	0.1122	0.0082	0.0082	0.2620	0.2620
Adjusted R^2	0.7535	0.7536	0.7244	0.7245	0.0418	0.0418	0.7756	0.7756
Observations	4,433,166	4,433,166	4,433,166	4,433,166	4,433,166	4,433,166	4,433,166	4,433,166

Panel B: Hoberg–Philips Universe

	Originality		Generality		Explorative		Exploitative	
Interlock	0.0018	0.0015	0.0002	−0.0001	−0.0018***	−0.0017***	0.0038	0.0033
	(0.0017)	(0.0017)	(0.0018)	(0.0018)	(0.0007)	(0.0007)	(0.0027)	(0.0027)
GGL		0.0023***		0.0023***		−0.0004***		0.0038***
		(0.0001)		(0.0001)		(0.0000)		(0.0001)
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	0.1174	0.1174	0.0920	0.0920	0.0063	0.0063	0.2168	0.2168
Adjusted R^2	0.7883	0.7884	0.7558	0.7559	0.0391	0.0392	0.8161	0.8161
Observations	6,118,602	6,118,602	6,118,602	6,118,602	6,118,602	6,118,602	6,118,602	6,118,602

Note: This table estimates the effect of director interlocks on multiple measures of patent quality. Panel A uses the SIC-3 universe, defined as firm pairs that share a 3-digit SIC code in at least one year between 2000 and 2019. Panel B uses the Hoberg–Phillips universe, defined as firm pairs with non-zero TNIC similarity in at least one year. The dependent variables include: (i) *Originality*, defined as one minus the Herfindahl index over the technology classes cited by a patent; (ii) *Generality*, defined as one minus the Herfindahl index over the technology classes of patents that cite a given patent; (iii) the share of patents classified as *explorative* (those citing technology classes not used by the firm in the past three years); and (iv) the share of *exploitative* patents (those building on the firm's existing technological base). $Interlock_{ijt}$ equals 1 if firms i and j share at least one director in year t. GGL is the measure of common ownership from Gilje et al. (2020), standardized and winsorized at the 95th percentile. All regressions include firm-pair and year fixed effects. Standard errors are clustered at the firm-pair level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Internet Appendix for

"Common Ownership Directors"

Ofer Eldar (UC Berkeley, IWH-Halle & ECGI)

Yaron Nili (Duke University & ECGI)

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Table A1. Common Ownership and Director Interlocks (Kappa)

	SIC-3 universe			Hoberg-Philips universe		
Panel A: Common Ownership and Director Interlocks						
Dep Var: $Interlock \times 100$	(1)	(2)	(3)	(4)	(5)	(6)
$Kappa$	0.0351***	0.0144***	0.0074**	0.0741***	0.0204***	0.0139***
	(0.0046)	(0.0035)	(0.0032)	(0.0049)	(0.0035)	(0.0031)
Pair fixed effects	No	Yes	Yes	No	Yes	Yes
Time fixed effects	Yes	No	Yes	Yes	No	Yes
Mean of Dep Var	0.3673	0.3612	0.3612	0.4103	0.4055	0.4055
Adjusted R^2	0.0003	0.6090	0.6091	0.0003	0.5908	0.5908
Observations	4,538,746	4,433,166	4,433,166	6,227,928	6,118,602	6,118,602
Panel B: Investor Heterogeneity						
Dep Var: $Interlock \times 100$	(1)	(2)	(3)	(4)	(5)	(6)
$Kappa^{B3}$	-0.0020	-0.0023	-0.0021	-0.0012	-0.0013	-0.0013
	(0.0029)	(0.0029)	(0.0029)	(0.0025)	(0.0025)	(0.0025)
$Kappa^{Large}$	0.0083***			0.0153***		
	(0.0030)			(0.0030)		
$Kappa^{Small}$	0.0141***			0.0148***		
	(0.0034)			(0.0032)		
$Kappa^{Steady}$		0.0051***			0.0105***	
		(0.0029)			(0.0029)	
$Kappa^{Churny}$		0.0029			0.0072***	
		(0.0023)			(0.0022)	
$Kappa^{Conc}$			0.0147***			0.0186***
			(0.0033)			(0.0030)
$Kappa^{Div}$			0.0072***			0.0121***
			(0.0030)			(0.0029)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	0.3612	0.3612	0.3612	0.4055	0.4055	0.4055
Difference	-0.0058	0.0023	0.0075	0.0004	0.0033	0.0065
p-value	0.9130	0.2585	0.0401	0.4568	0.1668	0.0494
Adjusted R^2	0.6091	0.6091	0.6091	0.5908	0.5908	0.5908
Observations	4,433,166	4,433,166	4,433,166	6,118,602	6,118,602	6,118,602

Note: Panel A estimates Equation (6) but replaces GGL with Kappa, where the dependent variable $Interlock_{ijt} \times 100$ equals 100 if firms i and j share at least one director in year t, and 0 otherwise. Panel B estimates variants using investor-type-specific $Kappa$ measures. $Kappa^{B3}$ isolates the influence of Big Three investors (BlackRock, Vanguard, State Street), $Kappa^{Large/Small}$ splits investors by portfolio size, $Kappa^{Steady/Churny}$ distinguishes investors by portfolio turnover, and $Kappa^{Conc/Div}$ contrasts investors by portfolio concentration. All $Kappa$ variables are standardized and right-winsorized at the 95th percentile. Standard errors are clustered at the firm-pair level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A2. Hedge Fund Ownership and Director Interlocks (Kappa)

	SIC-3 universe				Hoberg-Phillips universe			
Dep Var: $Interlock \times 100$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Kappa^{B3}$	-0.0023	-0.0022	-0.0024	-0.0022	-0.0013	-0.0013	-0.0013	-0.0012
	(0.0029)	(0.0029)	(0.0029)	(0.0029)	(0.0025)	(0.0025)	(0.0025)	(0.0025)
$Kappa^{HF}$	-0.0009	-0.0010	-0.0006	-0.0008	0.0023	0.0022	0.0026	0.0024
	(0.0030)	(0.0030)	(0.0030)	(0.0030)	(0.0029)	(0.0029)	(0.0029)	(0.0029)
$Kappa^{NHF}$	0.0099***				0.0152***			
	(0.0033)				(0.0032)			
$Kappa^{NHF\text{-}Large}$		0.0064**				0.0117***		
		(0.0029)				(0.0028)		
$Kappa^{NHF\text{-}Small}$		0.0111***				0.0121***		
		(0.0034)				(0.0031)		
$Kappa^{NHF\text{-}Steady}$			0.0042				0.0087***	
			(0.0029)				(0.0028)	
$Kappa^{NHF\text{-}Churny}$			0.0020				0.0045**	
			(0.0022)				(0.0021)	
$Kappa^{NHF\text{-}Conc}$				0.0076***				0.0099***
				(0.0029)				(0.0027)
$Kappa^{NHF\text{-}Div}$				0.0069**				0.0118***
				(0.0030)				(0.0028)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Difference	0.0107	-0.0047	0.0022	0.0008	0.0128	-0.0004	0.0042	-0.0019
p-value	0.0069	0.8620	0.2688	0.4261	0.0012	0.5413	0.1056	0.6919
Adjusted R^2	0.6091	0.6091	0.6091	0.6091	0.5908	0.5908	0.5908	0.5908
Observations	4433166	4433166	4433166	4433166	6118602	6118602	6118602	6118602

Note: This table estimates variants of Equation (6) but replaces GGL with Kappa, where the dependent variable $Interlock_{ijt} \times 100$ equals 100 if firms i and j share at least one director in year t. $Kappa^{HF}$ measures ownership concentration based on hedge fund portfolios. $Kappa^{B3}$ corresponds to Big Three investors (BlackRock, Vanguard, State Street). $Kappa^{NHF}$ reflects non-hedge fund institutional investors. Subgroups include: *Large/Small* (based on investor portfolio size), *Steady/Churny* (based on portfolio turnover), and *Conc/Div* (based on portfolio concentration). All *Kappa* variables are standardized and winsorized at the 95th percentile. Year and pair fixed effects are included in all regressions. Standard errors are clustered at the firm-pair level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A3. Effect of Director Interlocks on Firm Outcomes (Weighted)

	SIC-3 universe			Hoberg-Philips universe		
Panel A: Scope (Weighted)						
	(1)	(2)	(3)	(4)	(5)	(6)
Interlock	0.1646**	0.1634**	0.1638**	0.2220***	0.2211***	0.2206***
	(0.0677)	(0.0677)	(0.0678)	(0.0576)	(0.0576)	(0.0576)
GGL		0.0085**			0.0068**	
		(0.0033)			(0.0030)	
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	10.3800	10.3800	10.3800	11.7156	11.4601	11.4601
Adjusted R^2	0.7304	0.7304	0.7304	0.7272	0.7272	0.7272
Observations	4,433,166	4,433,166	4,433,166	6,118,602	6,118,602	6,118,602
Panel B: Markups (Weighted, De Loecker Method)						
	(1)	(2)	(3)	(4)	(5)	(6)
Interlock	-0.0855**	-0.0929***	-0.0833**	-0.0572**	-0.0641**	-0.0540**
	(0.0342)	(0.0340)	(0.0341)	(0.0272)	(0.0271)	(0.0271)
GGL		0.0711***			0.0571***	
		(0.0019)			(0.0017)	
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	2.7409	2.7409	2.7409	2.6102	2.6102	2.6102
Adjusted R^2	0.6817	0.6822	0.6821	0.6758	0.6762	0.6764
Observations	3,285,839	3,285,839	3,285,839	3,961,230	3,961,230	3,961,230

Note: This table estimates the effect of director interlocks on firm outcomes, weighted by market capitalization. Panel A uses the number of product segments (measured by Compustat business segments) as a proxy for firm scope. Panel B reports effects on firm-level markups computed using the production approach from De Loecker et al. (2020), also weighted by the market capitalization. The key explanatory variable is $Interlock_{ijt}$, which equals 1 if firms i and j share a director in year t, averaged across all firm-pair connections. Columns (2) and (5) include the generalized common ownership measure GGL_{ijt} as a control. All regressions include firm-pair and year fixed effects. Standard errors are clustered at the firm-pair level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A4. Effect of Interlocks on Markups

	SIC-3 Universe		Hoberg-Phillips Universe	
	(1)	(2)	(3)	(4)
Panel A: Markup measure: $\frac{Sale}{COGS}$				
Interlock	−0.0785	−0.0963	−0.1234***	−0.0034
	(0.0652)	(0.0648)	(0.0449)	(0.1499)
GGL		0.1381***		0.1859***
		(0.0033)		(0.0122)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	3.5970	3.5970	3.3703	3.3703
Adjusted R^2	0.5592	0.5598	0.5725	0.1253
Observations	4,201,231	4,201,231	5,864,467	5,864,467
Panel B: Markup measure: $\frac{Sale}{Sale-EBIT}$				
Interlock	−0.0067	−0.0082*	−0.0062*	−0.0079**
	(0.0048)	(0.0048)	(0.0037)	(0.0037)
GGL		0.0116***		0.0128***
		(0.0002)		(0.0002)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	1.0840	1.0840	1.1656	1.1656
Adjusted R^2	0.8605	0.8609	0.8522	0.8526
Observations	4,383,934	4,383,934	6,041,116	6,041,116

Note: This table presents robustness results using alternative markup measures. Panel A uses the cost-based markup, defined as $Sale/COGS$, where higher values reflect greater gross markups. Panel B uses the earnings-based markup, defined as $Sale/(Sale - EBIT)$, which captures profitability relative to earnings before interest and taxes. The key independent variable is $Interlock_{ijt}$, indicating whether firms i and j share a director in year t. Columns (2) and (4) include the common ownership measure GGL_{ijt} as a control, standardized and winsorized at 5% level. All specifications include firm-pair and year fixed effects. Standard errors are clustered at the firm-pair level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A5. Effect of Interlocks on Markups (Weighted)

	SIC-3 Universe		Hoberg-Phillips Universe	
	(1)	(2)	(3)	(4)
Panel A: Markup measure: $\frac{Sale}{COGS}$				
Interlock	−0.0713	−0.0893	−0.1120**	−0.0950*
	(0.0749)	(0.0745)	(0.0490)	(0.0491)
GGL		0.1401***		0.0919***
		(0.0037)		(0.0029)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	3.8442	3.8442	3.4859	3.4859
Adjusted R^2	0.5821	0.5826	0.5949	0.5952
Observations	4,201,231	4,201,231	5,864,467	5,864,467
Panel B: Markup measure: $\frac{Sale}{Sale-EBIT}$				
Interlock	−0.0052	−0.0066	−0.0079*	−0.0064
	(0.0053)	(0.0053)	(0.0042)	(0.0042)
GGL		0.0099***		0.0110***
		(0.0002)		(0.0002)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	1.1496	1.1496	1.2203	1.2203
Adjusted R^2	0.8264	0.8266	0.8123	0.8121
Observations	4,383,934	4,383,934	6,041,116	6,041,116

Note: This table presents robustness results using alternative markup measures. Panel A uses the cost-based markup, defined as $Sale/COGS$, where higher values reflect greater gross markups. Panel B uses the earnings-based markup, defined as $Sale/(Sale - EBIT)$, which captures profitability relative to earnings before interest and taxes. The key independent variable is $Interlock_{ijt}$, indicating whether firms i and j share a director in year t. Columns (2) and (4) additionally include the common ownership measure GGL_{ijt} from Gilje et al. (2020), standardized and winsorized at the 95th percentile. Both markup measures are weighted by the average market capitalization of the firm in a pair. All specifications include firm-pair and year fixed effects. Standard errors are clustered at the firm-pair level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A6. Effect of Interlocks on Innovation and R&D Intensity (Weighted)

	SIC-3 Universe		Hoberg-Phillips Universe	
	(1)	(2)	(3)	(4)
Panel A: R&D Intensity (R&D / Sales)				
Interlock	−0.2564*	−0.2578*	−0.1307*	−0.1315*
	(0.1322)	(0.1322)	(0.0676)	(0.0676)
GGL		0.0109**		0.0067**
		(0.0043)		(0.0027)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	1.2753	1.2753	0.8979	0.8979
Adjusted R^2	0.5596	0.5596	0.5822	0.5822
Observations	4,177,541	4,177,541	5,833,617	5,833,617
Panel B: Patent Count				
Interlock	0.6081	0.5204	0.0318	−0.0466
	(0.4728)	(0.4718)	(0.3584)	(0.3581)
GGL		0.6479***		0.6090***
		(0.0251)		(0.0194)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	10.0044	10.0044	8.1289	8.1289
Adjusted R^2	0.8989	0.8991	0.8823	0.8825
Observations	4,433,166	4,433,166	6,118,602	6,118,602
Panel C: Real Value of Innovation Output				
Interlock	−4.7074	−6.3429	−4.6194	−6.3345
	(8.6715)	(8.6389)	(7.4938)	(7.4801)
GGL		12.0749***		13.3215***
		(0.5911)		(0.4649)
Pair fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Mean of Dep Var	180.7463	180.7463	152.9862	152.9862
Adjusted R^2	0.8860	0.8861	0.8772	0.8773
Observations	4,433,166	4,433,166	6,118,602	6,118,602

Note: This table estimates the effect of interlocks on firm innovation and R&D outcomes. Panel A reports results for R&D intensity, measured as the ratio of R&D expenditure to sales. Panel B examines the count of successful patent applications from Kogan et al. (2017). Panel C considers the real monetary value of innovation output from Kogan et al. (2017). The main independent variable is $Interlock_{ijt}$, equal to one if firms i and j share at least one director in year t. GGL_{ijt} is the common ownership measure, standardized and winsorized at 5% level. All independent variables are weighted by the combined market capitalization of the firm pair. Regressions include firm-pair and year fixed effects. Standard errors are clustered at the firm-pair level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table A7. Effect of Director Interlocks on Patent Quality (Weighted)

Panel A: SIC–3 Universe

	Originality		Generality		Explorative		Exploitative	
Interlock	−0.0032	−0.0035	−0.0066**	−0.0069**	−0.0008	−0.0008	−0.0026	−0.0030
	(0.0027)	(0.0027)	(0.0028)	(0.0028)	(0.0005)	(0.0005)	(0.0041)	(0.0041)
GGL		0.0017***		0.0027***		−0.0001***		0.0029***
		(0.0001)		(0.0001)		(0.0000)		(0.0002)
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	0.1835	0.1835	0.1470	0.1470	0.0043	0.0043	0.3251	0.3251
Adjusted R^2	0.7642	0.7643	0.7374	0.7375	0.0476	0.0476	0.7784	0.7784
Observations	4,433,166	4,433,166	4,433,166	4,433,166	4,433,166	4,433,166	4,433,166	4,433,166

Panel B: Hoberg–Philips Universe

	Originality		Generality		Explorative		Exploitative	
Interlock	−0.0006	−0.0008	−0.0012	−0.0014	−0.0006**	−0.0006**	−0.0006	−0.0009
	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0003)	(0.0003)	(0.0032)	(0.0032)
GGL		0.0018***		0.0020***		−0.0002***		0.0026***
		(0.0001)		(0.0001)		(0.0000)		(0.0002)
Pair fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of Dep Var	0.1446	0.1446	0.1175	0.1175	0.0026	0.0026	0.2631	0.2631
Adjusted R^2	0.7865	0.7865	0.7558	0.7559	0.0431	0.0431	0.8081	0.8082
Observations	6,118,602	6,118,602	6,118,602	6,118,602	6,118,602	6,118,602	6,118,602	6,118,602

Note: This table estimates the effect of director interlocks on multiple measures of patent quality. Panel A uses the SIC-3 universe, defined as firm pairs that share a 3-digit SIC code in at least one year between 2000 and 2019. Panel B uses the Hoberg–Phillips universe, defined as firm pairs with non-zero TNIC similarity in at least one year. The dependent variables include: (i) *Originality*, defined as one minus the Herfindahl index over the technology classes cited by a patent; (ii) *Generality*, defined as one minus the Herfindahl index over the technology classes of patents that cite a given patent; (iii) the share of patents classified as *explorative* (those citing technology classes not used by the firm in the past three years); and (iv) the share of *exploitative* patents (those building on the firm's existing technological base). $Interlock_{ijt}$ equals 1 if firms i and j share at least one director in year t. GGL is the measure of common ownership from Gilje et al. (2020), standardized and winsorized at the 95th percentile. All regressions include firm-pair and year fixed effects. Standard errors are clustered at the firm-pair level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

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