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On the Purpose of New Board Overlap Enabled by Corporate Opportunity Waivers

Finance Working Paper N° 803/2021
January 2026

Heng Geng
Victoria University of Wellington

Harald Hau
University of Geneva, CEPR, Swiss Finance Institute and ECGI

Roni Michaely
University of Hong Kong and ECGI

Binh Nguyen
Victoria University of Wellington

ECGI Working Paper Series in Finance

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Abstract

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Keywords: Board overlap, corporate opportunity waivers, firm coordination

JEL Classifications: G30, G38, K21, K22

Heng Geng
Senior Lecturer
Victoria University of Wellington
Rutherford House, 23 Lambton Quay
Wellington 6012, New Zealand
e-mail: griffin.geng@vuw.ac.nz

Harald Hau*
Professor of Finance
University of Geneva, Geneva School of Economics and Management
42 Bd du Pont d'Arve
CH1204 Genève, Switzerland
phone: +41 22 379 9581
e-mail: prof@haraldhau.com

Roni Michaely
Professor of Finance and Entrepreneurship
University of Hong Kong, HKU Business School
Pokfulam Road
Hong Kong, Pokfulam HK, China
e-mail: ronim@hku.hk

Binh Nguyen
Senior Lecturer in Data Science
Victoria University of Wellington, School of Mathematics and Statistics,
Rutherford House, 23 Lambton Quay
Wellington 6012, New Zealand
e-mail: binh.nguyen@vuw.ac.nz

*Corresponding Author

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RESEARCH

Swiss Finance Institute Research Paper Series N°21-79

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RMIT University Vietnam

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*School of Economics and Finance, Rutherford House, 23 Lambton Quay, Wellington, New Zealand. E-mail: griffin.geng@vuw.ac.nz. **Geneva Finance Research Institute, 42 Boulevard du Pont d'Arve, 1211 Genève 4, Switzerland. E-mail: prof@haraldhau.com. ***HKU Business School, K.K. Leung Building, Hong Kong. E-mail: ronim@hku.hk. ****School of Business and Management, 702 Nguyen Van Linh District 7, Ho Chi Minh City, Vietnam. E-mail: binh.nguyen44@rmit.edu.vn.

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The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

1 Introduction

Board overlap is a common feature of modern corporations and has been the subject of policy debate since the early 20th century. Predicated on the notion that board overlap between industry rivals impedes competition, the Clayton Act of 1914 outlawed board overlap between direct competitors. But social science research has struggled to produce convincing evidence on whether board overlap limits firm competition. The early empirical literature on the consequences of board overlap suffered from data and measurement shortcomings due to limited board and corporate data. Since the 1980s, these issues have been superseded by methodological concerns about proper identification stemming from the endogenous nature of board composition (Mizruchi, 1996; Hermalin and Weisbach, 2001). While a more recent debate has centered on the controversial coordinating role of overlapping shareholders (Azar, Schmalz, and Tecu, 2018; Eldar and Grennan, 2024), much less attention has been devoted to the question of how board overlap affects firms' conduct and performance.

This question has renewed importance in light of the Department of Justice's (DOJ) recent antitrust enforcement targeting rival firms with interlocked directors due to violations of Section 8 of Clayton Act. Notably, six out of eight recent cases involve R&D-intensive firms.[1] In these contexts, board overlap may serve functions beyond facilitating anti-competitive behaviors; it could play a crucial role in coordinating joint research activities or mitigating patent conflicts. This raises an important empirical question: Is the primary motivation for board overlap to foster such "desirable" coordination, rather than managing product rivalry

[1] These eight cases involve a total of 14 technology firms. The average revenue of the 14 firms is $830 million in the fiscal year ending in 2022. More information about DOJ's investigation can be found at https://www.justice.gov/opa/pr/justice-department-s-ongoing-section-8-enforcement-prevents-more-potentially-illegal and https://www.justice.gov/opa/pr/directors-resign-boards-five-companies-response-justice-department-concerns-about-potentially.

in an anti-competitive manner? This paper focuses on unraveling the underlying purposes of board overlap.

To structure the discussion, we begin with the conceptual framework developed by Bloom, Schankerman, and van Reenen (2013), which highlights why research-intensive firms could have particularly strong incentives to coordinate through board overlap. According to these authors, the interactions between research-intensive firms are shaped by two countervailing corporate spillovers, labeled *competitive spillovers* and *technology spillovers*. The former refers to the product market rivalry effect of R&D, where one firm's R&D activities can erode another firm's market share. Under intense R&D competition, each firm escalates R&D spending to win the technology race where the winner takes all (e.g., be first to patent or first to set technology standards). By contrast, technology spillovers are externalities where one firm's R&D advancement benefits the research of technologically related firms. The presence of technology spillover can lead to inefficiently low ex-ante incentives to invest in R&D due to a free-riding problem (Bolton and Harris, 1999; Jones and Williams, 2000; Arora *et al.*, 2021). The framework of the two potential spillovers leads to questions about the unique role of board overlap among R&D-intensive firms: Is its purpose primarily to attenuate competitive spillovers or to manage technology spillovers?

To address this question, we use the staggered adoption of Corporate Opportunity Waivers (COWs) in nine U.S. states as a natural experiment. The implementation of the COW legislation reduced the litigation risk associated with board overlap and created a surge in board overlap for research intensive firms in the respective states. We identify which firm pairs seek to enhance their coordination through board overlap and whether these firm pairs are characterized primarily by competitive or technology spillovers. We

then explore how the resulting board overlap affects firms' conduct and performance. While the active management of both spillovers through board overlap can explain higher profitability, the prediction for firm investment is more discriminating. Better coordination of technology spillovers should stimulate more investment due to reduced free-riding concern facilitated by board overlap, while the mitigation of competitive spillovers predicts reduced investment due to eased R&D competition. A second discriminating outcome relates to the introduction of new products and their product market overlap. Board overlap motivated by competition spillovers should reduce the number of new products and decrease product-market overlap, while technology-driven overlap should have the opposite effect.

The skeptical reader may ask why board overlap should make any difference to firm coordination? First, board overlap enhances transparency by enabling interlocked directors to observe and monitor strategic decision-making in both firms. From a game-theoretical perspective, this mutual observability acts as a deterrent against opportunistic behaviors such as cheating or free riding, which can undermine the stability of any type of coordination (Harrington and Skrzypacz, 2011; Griffin and Xiong, 1997; Hagedoorn, Link, and Vonortas, 2000). Second, board overlap can foster personal relationships and establish mutual trust, which reduces transaction costs (Gulati, 1995; Williamson, 1979). Mutual trust reduces the expectation that the partner acts opportunistically and exploits holdup power when the coordination requires asset-specific investments. This argument is supported by a large body of literature in management and sociology, highlighting the crucial role of trust in organizing inter-firm coordination and managing conflicts (Fukuyama, 1995; Ring and Van de Ven, 1992). We also note that these arguments are more salient for R&D-intensive firms. Transparency and mutual trust appears more crucial because of a high degree of

information asymmetry in R&D-intensive firms (Aboody and Lev, 2000).[2] This information asymmetry amplifies the potential for opportunistic behavior during collaboration and again raises transaction costs. This collaboration challenge is highlighted in a survey of German manufacturing firms conducted by Rotering (1990), which identifies elevated coordination costs as a primary barrier to R&D cooperation.[3]

Our main empirical results can be summarized as follows:

1. The legislation of corporate opportunity waiver triggers an economically significant increase in intra-industry board overlap by 2.7 percentage points among firms with high R&D intensity, but *not* for firms with low R&D intensity. No corresponding change is found for inter-industry board overlap. For a median board of 8 members, this corresponds to roughly one new intra-industry board overlap for every fifth firm ($0.027 \times 8 = 21.6\%$). This finding is further supported by a separate study by Manjunath, Kahrobai, Lemley, and Kumar (2024), which reveals an exceptionally high prevalence of board overlap among medical research firms, a sector known for its R&D intensity.

2. Firms with increased in intra-industry board overlap experience a consecutive increase in profitability, as measured by a higher return on assets (ROA) and a higher operating

[2] Aboody and Lev (2002) indicate that R&D-intensive firms exhibit a high degree of information asymmetry for three primary reasons: (i) the uniqueness of R&D investments, which prevents investors from gathering valuable insights about a firm's R&D based on other firms' R&D performances; (ii) the absence of an organized market for R&D, resulting in the unavailability of asset prices for extracting information; and (iii) the limitations of accounting rules pertaining to R&D reporting, which provides no information to investors on the value and productivity changes of R&D.

[3] Brockhoff (1992) summarizes Rotering's survey results in Table 1. Concerns related to transaction costs in R&D cooperation include (1) development of a dependency on partners; (2) high costs of negotiations and transactions; (3) problems of assigning contributions and results to partners; (4) problems of technology transfer. 144.4% of respondents shared at least one concern related to transaction costs. Other responses less related to transaction costs include secrecy problems (21.5% of respondents), the loss of own technological competence (11.1%), and the inhibition of own developments (11.1%). It is important to note that respondents could select more than one concern in the survey, resulting in the total percentage being greater than one.

margin. At the same time, these firms demonstrate relatively stable sales revenue but reduced costs of goods sold (COGS). Alternative ways of defining industry rivals do not affect the robustness of the observed firm performance improvement conditional on new intra-industry board overlap and high R&D intensity following the law change.[4]

3. Intra-industry board overlap among US listed firms predominantly occurs in firm pairs that exhibit high levels of competitive spillovers, rather than in those with strong technology spillovers. This finding is confirmed by a conditional analysis based on the (exogenous) introduction of COW legislation. Specifically, new board overlaps in states adopting the COW legislation involve firm pairs with strong competitive spillovers, not those with technology spillovers. These findings suggest that attenuating competitive spillovers is the primary purpose of board overlap.

4. R&D-intensive firms with new board overlap following the COW legislation (in their state of incorporation) exhibit a statistically and economically significant reduction of their capital and R&D investment. This finding is consistent with attenuated competitive spillovers through board overlap, but difficult to reconcile with enhanced management of technology spillovers by interlocked boards.[5]

5. Intra-industry board overlap results in decreased growth of product offerings for R&D-intensive firms, and leads to more differentiated product offerings between interlocked firms. The measures for product offering growth and product similarity are derived from a textual analysis of companies' regulatory filings, as documented by Hoberg

[4] We respectively define industry rivals based on the three-digit SIC classification, the four-digit NAICS classification, or a text-based industry classification based on Hoberg and Phillips (2010, 2016). Our main results are consistent across all these industry rival definitions.

[5] The investment reduction is unlikely to stem from eliminating "wasteful" spending" (e.g., empire building), as the reduction does not significantly vary with firms' free cash flows, which are typically associated with wasteful expenditures (Jensen and Meckling, 1976).

and Phillips in their 2017 and 2016 studies, respectively.[6] This finding again supports the hypothesis that reducing competitive spillovers is the primary purpose of board overlap.

Our identification relies on the Corporate Opportunity Waiver (COW) legislation, which was initially introduced in Delaware in 2000 with the aim of removing an impediment to startup financing. However, the law was drafted with unrestricted applicability to all firms. The new legislation allows firms to suspend the so-called "Corporate Opportunity Doctrine," which represents a legal obstacle to establishing board overlap between firms operating within the same industry. As a fundamental principle of US corporate law, this doctrine defines specific fiduciary duties concerning business opportunities and creates a legal conflict for interlocked directors when a business opportunity occurs in the overlapping business lines of the interlocked firms. The New York Supreme Court Judge Bernard Shientag highlights this legal conflict as follows: "It is only when a business opportunity arises which places the director in a position of servicing two masters, and when, dominated by one, he neglects his duty to the other, then a wrong has been done." By explicitly permitting the suspension of the corporate opportunity doctrine through private contracting, COWs eliminate an important deterrence for establishing intra-industry board overlap. As a result, the COW legislation lowers the cost of board overlap and provides an opportunity for a quasi-natural experiment.

We argue that the COW legislation is exogenous to firm performance, product market development, and technology advancement. First, the COW legislation itself occurred in response to two specific Delaware court decisions, which highlight that directors' fiduciary

[6] We thank Professor Gerard Hoberg and Professor Gordon Phillips for making the data available.

duty could only be made contractible if changes to state corporate law would explicitly allow this. The particular timing of these verdicts is related to Delaware's legal history and unlikely to be related to any macroeconomic events—making the COW legislation exogenous to macroeconomic conditions. Second, board overlap among public firms does not appear to have been the legal intent behind the COW legislation. Prior to the legislation, the debate focused on how the fiduciary duty of loyalty had adversely impacted financing for small private firms, and public firms were seldom concerned. Third, examining the lobbying scripts for COWs, Eldar and Grennan (2024) do not find evidence of lobbying by public firms.[7]

The evidence in this paper that COW laws triggered more board overlap evokes conceptual similarities with the research on common ownership, which is also alleged to enhance collaboration and collusion among rival firms. Antón, Ederer, Giné, and Schmalz (2024) employ a conceptual framework similar to ours and explore the interactions between common institutional shareholders and the competitive and technology spillovers among public firms. Eldar and Grennan (2024) and Li, Liu, and Taylor (2023) focus on collaboration among startups facilitated through common venture capitalists. These studies raise questions about the relationship between board overlap and common ownership (Azar, 2012, chapter 5; Azar, Schmalz, and Tecu, 2018; Geng, Hau, Lai, and Liu, 2025). We argue that common ownership is an unlikely explanation for our findings for two reasons. First, our results remain unchanged if we control for common ownership with other firms in the indus-

[7] Critics of the corporate opportunity doctrine argue that the duty of loyalty impedes firms' ability to raise capital. However, these critics point toward small private firms often held by venture capital and private equity, which found it difficult to invest in multiple firms in the same industry before the COW legislation. These investors usually require a board seat as a condition for investment, and the joint board representation by a common investor would be considered a breach of fiduciary duty. By contrast, institutional investment in public firms does not usually condition on board representation (Geng, Hau, Michaely, and Nguyen, 2022). Thus the law's intent to facilitate firm financing is less relevant to public firms.

try. Second, we undertake a comprehensive analysis in a separate study (Geng *et al.*, 2025) of the relationship between overlapping board directors and common institutional ownership. Specifically, we examine directors who are employed by or nominated by institutional investors. We find that board representation by institutional investors is relatively rare, and that common institutional shareholdings seldom extend to joint representation on the boards of rival firms.[8] Taken together, this evidence indicates that the effects of board overlap among public firms in this study do not stem from common ownership. Instead, board overlap can independently facilitate firm coordination without the involvement of common owners.

The selection of board overlap could potentially be influenced by the intrinsic quality of directors. Various research considers high-quality directors valuable for their monitoring and advising role (Field, Lowry, and Mkrtchyan, 2013; Adams and Fereira, 2007; Coles, Daniel, and Naveen, 2008; Linck, Netter, and Yang, 2008). The reduced cost of board overlap due to COWs may facilitate greater access to highly qualified directors. Since R&D-intensive firms often require specialized technical knowledge, directors with such expertise may be in limited supply. Therefore, the increased availability of qualified directors could be particularly valuable for R&D-intensive firms. To explore the possibility that intrinsic director quality drives our results, we examine "outbound board overlap," which occurs when a focal firm allows one of its incumbent directors to serve on its rival's board. Since outbound board overlap does not alter the board composition of the focal firm, it is unlikely to impact board quality. Yet, we still observe improved firm profitability and reduced investment under outbound board overlap, which is inconsistent with the hypothesis that

[8] Eldar, Nili, and Xu (2025) document a positive relationship between common ownership and board overlap for certain types of activist investors, such as hedge funds. But they also confirm that for the dominant institutional investors like Vanguard, Blackrock, or State Street, no such linkage exists.

enhanced board quality causes the observed performance improvements. Furthermore, Field *et al.* (2013), show that, despite the general monitoring deficiencies of interlocked directors, they exhibit valuable advisory functions but only for newly IPO firms, which have limited experience with strict regulatory requirements and complex investor relations. Our findings remain robust even after excluding these newly IPO firms from our sample. In sum, we conclude that interlocked directors' improved monitoring and advisory roles are not the primary drivers behind our findings.

Several prior studies examine how reductions in the personal liability of managers and directors affect shareholder value, but their findings are mixed. Donelson and Yust (2014) analyze a legal reform of 2001 in Nevada that substantially limited directors' liability for breaches of loyalty and other fiduciary duties. They document declines in firm value and operating performance, particularly among firms in jurisdictions with weak investor protection. Eldar (2018) studies the same event, but explicitly controls for firms' governance provisions. His conditional analysis finds no harm to shareholders and possibly enhanced firm value. A more recent debate centers on COW statutes. Fich, Harford, and Tran (2023) report that COW laws across nine states reduce shareholder value and attribute the decline to managerial disloyalty enabled by these laws. In contrast, Geng, Hau, and Liu (2025) examine the same events and show that the negative valuation effects arise primarily from Delaware-incorporated firms, where COW enactments coincided with the burst of the dot-com bubble. After controlling for this confounding event, they find no evidence that COW legislation reduces shareholder value.

Cabezon and Hoberg (2025) find that a larger entanglement of firms in overlapping director networks relates to less firm similarity in the product space, a higher ROA, and

a higher market-to-book ratio. This descriptive pattern is consistent with the evidence in this paper on the effect of new board overlap induced by COW laws.[9] However, their main argument is that overlapping directors can lead to the leakage of intellectual property to rival firms. By contrast, the main finding in our paper is that overlapping board members matter more in terms of competitive rather than technological externalities. Following the adoption of the COW law, new board overlap is observed primarily among product market rivals, which coordinate product and investment policies.

2 Institutional Background and Research Design

2.1 Corporate Law Reform as a Quasi-Natural Experiment

A cornerstone of U.S. corporate law has been the fiduciary duty of loyalty by directors towards the company they serve. As defined in the "Corporate Opportunity Doctrine," this fiduciary obligation has long been viewed as an underpinning of credible conflict-of-interest management barring directors from pursuing or representing outside interests that can diverge from the company's commercial interests. This doctrine can create serious legal conflicts for interlocked corporate directors serving on multiple corporate boards if the respective companies pursue similar lines of business.

To illustrate the potential conflict of interest, consider a director who simultaneously serves on the boards of competing firms A and B, which have overlapping business lines. If a business opportunity arises and the director prioritizes firm B's interests over firm A's

[9] Cabezon and Hoberg (2025) do not use the introduction of COW laws as an instrumental variable to predict exogenous variation in board overlap. Instead, they focus on their causal analysis of a change in policy of the Institutional Shareholder Services (ISS) group regarding overlapping directors. Starting in 2024, the ISS recommended withholding proxy votes from directors serving on more than six company boards, which represents a distinct director type.

by exploiting the opportunity for firm B, it would undermine its fiduciary duty to firm A. Conversely, if the director prioritizes firm A's interests, it would neglect its duty to firm B. As such, the fiduciary duty of loyalty creates a backstop for intra-industry board overlap because of the legal liability that could ensue.

It is important to note that the conflict of interest only concerns board overlap between firms with an overlapping business line or within the same industry (Nili, 2019). If firms A and B do not have overlapping business lines, an opportunity exploited by firm B is considered irrelevant to firm A. This assessment is related to a four-factor model used by courts to determine whether a business opportunity belongs to a corporation. In particular, the courts examine whether (1) the corporation had adequate financial resources to undertake the opportunity, (2) the opportunity was within the lines of business for the corporation, (3) the corporation had an interest and reasonable expectancy in the opportunity, and (4) the director's interest conflicts with that of the corporation if the director pursues the opportunity. Condition (2) is more likely to be met if interlocked directors occur between firms in the same industry.

In legal practice, the courts constantly encountered difficulties in delineating corporate opportunities in the context of fiduciary duty (e.g., Clark, 1986). For example, Walter F. Rogosheske wrote in the case of *Miller v. Miller*: "We have searched the case law and commentary in vain for an all-inclusive or 'critical' test or standard by which a wrongful appropriation can be determined and are persuaded that the doctrine is not capable of precise definition." In his textbook of corporate law, Clark (1986) claims that "the traditional tests are extremely ambiguous and uncertain in their application." More recent work by Rauterberg and Talley (2017) remarks that "The law's attempt to regulate fiduciaries' in-

dependent pursuit of business opportunities has produced a doctrine of startling complexity and unpredictability."

To eliminate the legal liabilities for the breaches of the corporate opportunity doctrine, some companies attempted to contract on the fiduciary duty privately. But this practice quickly met a legal challenge. In the famous case *Siegman v. Tri-Star Pictures, Inc.* in 1989, a Delaware court ruled against the private contractual suspension of the corporate opportunity doctrine on the basis that the duty of loyalty should be "immutable"—immune to private efforts to dilute or eliminate it.

The verdict in *Siegman v. Tri-Star Pictures, Inc.* thus maintained the corporate opportunity doctrine with its inherent ambiguities in situations where board overlap is not avoided. A typical example is a small private firms controlled by a venture capital or private equity firms. These investors usually seek representation on the board of their portfolio firms. Without waiving the corporate opportunity doctrine, these investors find it hard to invest in multiple firms in the same industry. The challenge posed by the corporate opportunities in the situation of overlapping boards was also recognized in the opinions of two Delaware cases (*Thorpe v. CERBCO* and *In Re Digex*), which are considered a catalyst for the law change examined in this paper.

In 2000, Delaware dramatically departed from this tradition by allowing companies to contract on and limit directors' fiduciary duties. In particular, they could wave the requirement of loyalty concerning corporate opportunities, thereby lowering the legal standard to which directors were held with respect to conflicts of interest. Over the next two decades, other states followed the example of Delaware and made a previously "immutable" fiduciary standard contractible. Table 1 provides an overview of the statutory changes enabling cor-

porations to waive the corporate opportunity doctrine for directors and officers by changes in their corporate charter or bylaws. The corporate law reforms had a narrow scope in the sense that they were only concerned with this particular option to waive the fiduciary liability of directors, corporate officers, or shareholders.

The opportunity of granting directors a corporate opportunity waiver was widely embraced by U.S. corporations, as documented by Rauterberg and Talley (2017). For example, Delaware had an adoption rate for COWs of approximately 52% of corporations. As Delaware incorporates a large share of all American corporations, the new contractibility of fiduciary standards represents a significant "regime change" for a large number of firms across all industries. We document that this law change lowered the barriers for intra-industry board overlap. On average, intra-industry board overlap made up 4.4% of board directors in the year before the legislation and almost doubled to 8.2% five years after the legislation. In contrast, the increase in inter-industry board overlap was smaller in relative terms: The average inter-industry board overlap increased from 37% to 41.6% over the same period.

2.2 Section 8 of the Clayton Act

Section 8 of the Clayton Act is another law that independently prohibits interlocked directors between direct rivals on antitrust grounds. Despite this statutory prohibition, enforcement action had been sporadic and ineffective until 2022. According to a staff report by the Antitrust Subcommittee of the House Judiciary Committee in 1965, the Federal Trade Commission (FTC) filed only 13 complaints under Section 8 of the Clayton Act in the first 50 years after the law's enactment in 1914, of which one complaint resulted in a cease-

and-desist order. The Department of Justice (DOJ) undertook its first investigation with respect to Section 8 only in 1952. In the following decades, enforcement of the Clayton Act hardly improved and even declined in the late 1970s. Insufficient enforcement persisted until the most recent years. In a legal briefing, Bailey (2020) highlights that the FTC only occasionally investigates and pursues violations of Section 8 of the Clayton Act. As admitted by Assistant Attorney General Jonathan Kanter of DOJ in 2022, "Section 8 [of the Clayton Act] is an important, but underenforced, part of our antitrust laws." And he continues: "For too long, [DOJ's] Section 8 enforcement has essentially been limited to our merger review process."[10]

2.3 Sample Selection and Summary Statistics

We retrieve board director information of publicly listed U.S. firms in the period 1998–2019 from the BoardEx database. BoardEx covers the educational background, prior employment, and connections of directors and executives for publicly listed firms and notable private firms across the globe. The database has been widely used in prior studies for research related to corporate board directors (see, e.g., Cohen, Frazzini, and Malloy, 2008; Adams and Kirchmaier, 2016). The director employment information permits the identification of cases where a firm's board director sits concurrently on the boards of external firms. For example, from the database, we can see Marc Andreessen (director id: 337150) simultaneously sat on the boards of Facebook and eBay in the years 2012–2014. Aggregating the individual director information to the firm level, we construct firm-level board overlap.

Our baseline data set comes from the intersection of Compustat and BoardEx. After

[10] Sources: https://www.justice.gov/opa/speech/assistant-attorney-general-jonathan-kanter-delivers-opening-remarks-2022-spring-enforcers; and https://www.justice.gov/opa/pr/directors-resign-boards-five-companies-response-justice-department-concerns-about-potentially

we drop financial firms (SIC: 6000-6999) and utility firms (SIC: 4900-4999), the baseline sample comprises 49,957 firm-year observations of 4,251 distinct firms covering the period 1998–2019. Table 2, Panel A, reports the summary statistics. The median firm observation has US$491 million in assets [$ln(Assets) = 6.133$], an operating margin of 6.8%, and an ROA of 11.1%.

In light of the variation in board size, we define various measures of board overlap as the ratio of the number of external board seats by board members and board size. Otherwise, larger boards are (*eo ipso*) more likely to feature interlocked board members. The overall board overlap (*All_ OvLapDir*) is defined as the number of all (intra- and inter-industry) external board seats by all board members relative to board size. If a single board member is affiliated with multiple other boards, we count each overlap separately. The overall board overlap (*All_ OvLapDir*) has a mean value of 45%, for which intra-industry board overlap (*Intra_ OvLapDir)* constitutes 6.8% and inter-industry board overlap (*Inter_ OvLapDir)* 38.1%. Inter-industry director overlap is thus five times more common than intra-industry director overlap. We provide detailed variable description in Table A6 of the Internet Appendix.

2.4 Board Overlap and R&D Intensity

First, we investigate the unilateral relation between board overlap and R&D intensity. To this end, we sort firms into four quartiles by their R&D intensity. The three industries with the largest number of firms in the top quartile (Q4) are Drugs, Computer and Data Processing Services, and Electronic Components and Accessories (see Table A1 of the Internet Appendix for details). Table 2, Panel B, shows that intra-industry board overlap is

strongly conditioned by the level of R&D intensity. As firms feature progressively more R&D intensity in quartiles Q1 to Q4, the mean intra-industry board overlap (*Intra_ OvLapDir*) increases monotonically from a relatively low 2.2% in Q1 and Q2, to 5.8% in Q3, and finally to 20.9% in Q4. This suggests that the top 25% of R&D-intensive firms have about nine times more intra-industry board overlap than the bottom 25%.

To better characterize those firms in Q4, we further compare the R&D-intensive firms in Q4 to those in Q3: Their average *R&D intensity* is four times larger, their average value for $ln(Assets)$ is 17% lower, their average market-to-book ratio (*MTB ratio*) is 51% higher, and their average *operating margin* is only −13.5% compared with 5.9% for firms in Q3. These accounting measures indicate that firms in Q4 (despite their stock market listing) appear to be in an early development phase with high growth potential indicated by their higher market-to-book value (MTB *Ratio*), but a precarious negative operating performance.

Table 2, Panel B, Columns (7) and (8) condition the Q4 firm sample further on the existence of intra-industry board overlap and its absence, respectively. We find that firms with intra-industry board overlap show a very negative *operating margin* at −16.5% compared with −9.8% for firms without it. We conclude that a lack of profitability and a high level of R&D investment are important covariates for the prevalence of intra-industry board overlap. This also suggests that intra-industry board overlap represents an endogenous choice contingent on firm profitability. Simple panel regressions are likely to capture causal linkages between board overlap and firm performance that can operate in both directions. This motivates our instrumental variable approach that uses COW legislation as an exogenous trigger to more intra-industry board overlap.

2.5 Empirical Design

Our empirical specification combines a staggered difference-in-difference design with a two-stage least squares (2SLS) model. The first-stage regression examines how the staggered adoption of COW legislation across nine U.S. states changed the incidence of intra-industry board overlap. The second stage then explores how the predicted changes in intra-industry board overlap affect firm outcomes.

The first-stage regression estimates the following triple-difference specification

$$Intra\_OvLapDir_{i,t} = \alpha_1 R\&D\_Q4_i \times COW_{k,t} + \alpha_2 COW_{k,t} + Z_{i,t}\gamma' + \eta_{I\times t} + \theta_i + \epsilon_{i,t}, \quad (1)$$

where i indexes firms, I indexes industries, k indexes states of incorporation, and t indexes time. The dependent variable $Intra\_OvLapDir_{i,t}$ denotes the ratio of interlocked director positions with other companies in the same three-digit SIC industry relative to the firm's board size. The variable $COW_{k,t}$ equals one (and zero otherwise) if state k adopts the corporate opportunity waiver in year t.[11] We interact $COW_{k,t}$ with a set of dummies $R\&D\_Qx_i$ marking the x-th quartile of a firm's R&D intensity. For example, $R\&D\_Q4_i$ denotes the fourth firm quartile of R&D intensity. To alleviate concerns that the sorting by R&D could itself be influenced by changes related to the corporate law changes, we sort firms by their initial R&D intensity in the first sample year of 1998 (or when they enter the sample) and then leave the quartile affiliation unchanged.[12] As a result, separate $R\&D\_Qx_i$ dummies are absorbed by firm fixed effects.

[11] We follow the suggestion of Baker, Larcker, and Wang (2022) and include firms incorporated in U.S. states that have never adopted COW legislation for the estimation period.

[12] We confirm that annual dynamic updating of the quartiles yields quantitatively similar results. This suggests that the endogeneity concern with respect to quartile classification is of minor quantitative importance.

Our key instrumental variable is the interaction term $R\&D\_Q4_i \times COW_{k,t}$, which defines a triple difference. Its coefficient α_1 measures the incremental effect of COW legislation on intra-industry board overlap for the top 25% of R&D-intensive firms (marked by $R\&D\_Q4_i = 1$) compared to the baseline effect for all firms affected by COWs. This baseline effect, as captured by the coefficient α_2, is statistically indistinguishable from zero, suggesting that the COW legislation has little or no impact on ordinary firms that do not feature a high R&D intensity.[13]

The vector of lagged control variables $Z_{i,t-1}$ comprises the log assets [*ln(Assets)*], asset tangibility (*Tangibility*), the market-to-book ratio (*MTB ratio*), and R&D relative to total assets (*R&D Intensity*). We denote by $\eta_{I\times t}$ and θ_i industry-by-year and firm fixed effects, respectively. Our results are also robust to including headquarter-state-by-year fixed effects that control for time-variant unobservables operating at the headquarter-state level.

The second-stage regression examines the effect of intra-industry board overlap on firm profitability, namely *ROA*, and *Operating Margin*. Formally,

$$y_{i,t} = \delta_1 \widehat{Intra\_OvLapDir}_{i,t} + \delta_2 COW_{k,t} + Z_{i,t-1}\gamma' + \eta_{I\times t} + \theta_i + \vartheta_{i,t}. \tag{2}$$

$\widehat{Intra\_OvLapDir}$ represents the instrumented intra-industry board overlap. The control variables and fixed effects are the same as those in Eq. (1).

Board overlap always concerns two firms. As the dummy instrument $R\&D\_Qx$ marks only one firm conditional on high R&D intensity in quartile Q4, it is natural to ask about the research intensity of the second (or partner) firm. Figure A1 respectively shows the

[13] This means that, in our setting, the triple-difference coefficient estimate should be very close to the estimate from a difference-in-difference regression involving R&D-intensive firms only. The latter is confirmed empirically.

histogram of the research intensity for (i) all firms with $R\&D\_Qx \times COW = 1$ in Panel A, (ii) partner firms with which board overlap occurs in Panel B, and (iii) the entire sample of firms under study in Panel C. Partner firms feature a considerably higher mean (median) R&D intensity at 15.67% (10.52%) compared with 8.13% (1%) in the full firm sample. We conclude that the observed board overlap increase occurs primarily between firm pairs in which *both* firms feature high R&D intensity.

2.6 Exclusion Restriction

Our identification strategy uses the staggered adoption of the COW legislation in nine U.S. states. For the setting to be valid, the introduction of the COW legislation in any given state needs to be exogenous to the public firms featuring in our analysis and unrelated to any cyclical economic variable that could simultaneously influence firm performance. The 2SLS approach we adopt also assume that the economic effect of COW legislation operate through board composition and the COW laws have no other direct consequences for firm performance.

The adoption of COW legislation in Delaware resulted from specific legal events. This makes the required temporal exogeneity highly plausible. According to Rauterberg and Talley (2017), the introduction of COW legislation in Delaware represents a reaction to judicial decisions by a Delaware court. As recognized in court opinions, the two cases *Thorpe v. CERBCO* and *In Re Digex* highlight the intractable challenges posed by corporate opportunity claims in cases involving overlapping ownership and boards. Both cases made apparent the need for a law change to explicitly allow parties to waive corporate opportunities. The same case-based judicial developments could have occurred 10 or 15 years later. The consec-

utive COW legislation in eight other states appears to fit with a general pattern of corporate law diffusion across U.S. states: Delaware advances a legal innovation, which is subsequently copied by some other states (Romano, 2006). However, our baseline results are robust to excluding subsequent COW adoptions by other states.

We also note that the legislator was *not* concerned about board overlap between public firms. Instead, the primary intent of the law change was to facilitate the financing for small privately held companies, which are usually invested by venture capital or private equity firms (Grossman, 2009; Rauterberg and Talley, 2017). These investors often hold overlapping ownership or overlapping boards in multiple firms, making compliance with the corporate opportunity doctrine highly challenging. By contrast, institutional investment in public firms rarely comes with board representation (Geng *et al.*, 2022). Thus the legal intent behind COW legislation was unrelated to public firms.

Examining the lobbying transcripts, Eldar and Grennan (2024) find little evidence of corporate lobbying before the law change, which further alleviates the concern that specific interests of public firms triggered the COW legislation. Their findings support that the legal repercussions for public firms occurred in an unintended and accidental manner.

3 Main Results

3.1 Corporate Law Reform and Its Impact on Board Overlap

First, we discuss the first-stage results that examine the effect of COW legislation on board overlap between firms in the same industries. In Table 3, we present the first-stage regression with intra-industry board overlap ($Intra\_OvLapDir$) as the dependent variable. For

notational convenience, we scale up the outcome variable (i.e., the share of board members with other board seats) by a factor of 100. The first two regressions in Columns (1) and (2) show the effect of the COW legislation for firms in each R&D quartile. The positive coefficient for the term $COW \times R\&D\_Q4$ is statistically significant and implies an increase in intra-industry board overlap for firms with high research intensity (i.e., $R\&D\_Q4$). By contrast, no statistically significant change is observed for firms of lower research intensity (i.e., $R\&D\_Q1$ to $R\&D\_Q3$).

Columns (3) and (4) report the more parsimonious specification as in Eq. (1). Here, we distinguish firms of high research intensity in Q4 (in a triple difference) and include a COW dummy, which captures the baseline effect of the COW legislation. We use this parsimonious specification for the subsequent second-stage analyses, as COW's impact is concentrated among Q4 firms only.

The first-stage result is economically sizable. For example, in Column (4), the point estimate for the interaction term $COW \times R\&D\_Q4$ implies an intra-industry board overlap increase of 2.75 percentage points after COWs. As a median board has 8 members, a 2.75 percentage point increase in overlap per average board member aggregates to 22% ($= 0.0275 \times 8$) at the firm level, or roughly one new interlocked board member for every fifth firm.

Columns (5) and (6) report the regression results for inter-industry overlap ($Inter\_OvLapDir$) and overall board overlap ($All\_OvLapDir$), respectively. Inter-industry board overlap remains relatively unchanged following the COW legislation, whereas overall board overlap shows a weak increase.

An important validity check for our empirical design is the absence of diverging trends

in intra-industry board overlap between treated and non-treated firms prior to the COW legislation. Any differential surge in intra-industry board overlap (among treated firms in quartile Q4) should occur only after the COW legislation is passed. To empirically check the pre-trending of board overlap, we run a dynamic version of the first-stage regression given by

$$Intra\_OvLapDir_{i,t} = \sum_{T=-4}^{7} \alpha_T \; R\&D\_Q4_i \times COW_{k,t}(T) + \delta COW_{k,t} + Z_{i,t}\gamma' + \eta_{I\times t} + \theta_i + \epsilon_{i,t}, \quad (3)$$

where the dummy $COW_{k,t}(T)$ is equal to one if firms incorporated in state k become subject to COW legislation T ($-T$) years after (before) its introduction in year t and zero otherwise. Firm observations that concern years more than three years prior to the COW legislation are pooled as $T = Before$, and those more than six years later are pooled as $T = After$. For firms incorporated in states without any COW legislation, the dummy $COW_{k,t}(T)$ is always zero. Like the specification in Eq. (1), this dynamic model controls for the same set of control variables $Z_{i,t}$ and the same interacted industry-year fixed effects $\eta_{I\times t}$ and individual firm fixed effects θ_i.

Figure 1 describes the dynamic evolution of intra-industry board overlap relative to the reference year of its introduction in year $T = 0$, by depicting in solid red dots the point estimates $\widehat{\alpha}_T$. The vertical bars around each point estimate $\widehat{\alpha}_T$ represent a 95% confidence interval. We find that the coefficient estimates in the pre-legislation period are statistically indistinguishable from zero. For years $T = -3$ and before, we obtain large standard errors due to a lack of observations used for estimating $\widehat{\alpha}_T$, as illustrated by the height of grey-shaded bars. As the coverage of high-quality director information in BoardEx only extends

to 1998, only two-year observations are available for firms incorporated in Delaware, which accounts for a significant share of sample firms and passed the law in 2000. Yet, the estimates for $T = -3$ and before are still *not* significantly different from zero in a statistical sense. Also, excluding observations for $T = -3$ and before would not alter the parallel trend and regression estimates. In sum, we conclude that the parallel trend assumption is satisfied in our setting.

Figure 1 also shows that board overlap gradually picks up after $T = 0$ and steadies only in year $T = 4$ and thereafter, suggesting a slow adoption to the new legal environment. The sluggish adjustment of board overlap is consistent with the observation by Rauterberg and Talley (2017) of delayed firm-level adoptions of COWs. Such a delayed response is not surprising, given the inherent implementation lags associated with amending corporate statutes and appointing new board members.

Overall, the evidence indicates that the surge of intra-industry board overlap occurs for firms with high R&D intensity. The consequences of this surge in board overlap are explored next.

3.2 Board Overlap Effects on Firm Outcomes

Does the increased board overlap result in different firm outcomes? To answer this question, we use the instrumented intra-industry board overlap obtained from Eq. (1) and relate it to a set of firm-level variables, including return on assets (*ROA*), *Operating Margin*, *Sales Growth*, and the growth of cost of goods sold (*COGS Growth*).

The second-stage regression results are reported in Table 4. Table 4, Column (1b), reports a statistically significant increase in *ROA* by 1.88 percentage points for every one-

percentage-point increase in intra-industry board overlap. If one out of ten board members becomes a new overlapping board member, board overlap is augmented by 10 percentage points, and the corresponding *ROA* increase is 18.8 percentage points. The Montiel Olega-Pflueger effective F-statistics is above 20, suggesting that our estimation does not suffer from a weak instrument problem.

This profitability improvement following intra-industry board overlap is economically very large and requires further discussion. Our analysis shows that firms adopting board overlap are often financially distressed, with an average ROA of -16.6 percentage points in the year preceding the establishment of board overlap. It is not surprising that these distressed firms face strong incentives to coordinate in order to achieve a profit turnaround. As we discuss in Section 5.2, a significant portion of the ROA improvement can be attributed to a marked decrease in R&D expenditure, which can result from reduced duplicative investments or cost-sharing between collaborating firms. Reduced *R&D Intensity*—defined as the ratio of R&D expenditure to assets—accounts for 16.3 percentage points, or 86.7 percent, of the observed ROA improvements. Thus, the large profitability effect of new board overlap has to be understood in light of the unique economic situations faced by public firms: the new board overlap tends to coordinate the suspension of a costly R&D race between two firms.

While our estimated profitability effects associated with board overlap are economically large, they are still lower than those associated with strategic alliances found in a related study by Allen and Phillips (2003). They report (in Table 5) an average increase in operating cash flow relative to total net assets of 36.4 percentage points for firms in high R&D sectors.

Consistent with the evidence of increased *ROA*, Columns (2a)-(2b) indicate that intra-

industry board overlap leads to improved *Operating Margin*. The increased profitability does not appear to result from the growth of sales revenue, as board overlap features little statistical power in explaining *Sales Growth* in Columns (3a)-(3b). But there is evidence of a modest decrease in costs of goods sold in Columns (4a)-(4b), which contributes to the profitability surge.

It is also insightful to undertake reduced-form regressions, which directly relate *ROA* and *Operating Margin* to the treatment dummy $COW \times R\&D\_Q4$. The economic magnitude of the profitability effect reported in Table A2 of the Internet Appendix is at 5.2 percentage points for the ROA increase smaller than for the 2SLS regressions, but economically still substantial. While the reduced form estimate captures the average profitability effect among all treated firms subject to the COW laws, the 2SLS coefficient measures the profitability improvement among the treated firms selected to have a new interlocked director. Selection here could mean that overlapping directors are installed if the urgency of a profitability turnaround is particular dire, which explains the large magnitude of the profit improvement. These results reported in Table A2 again confirm that firm outcome changes are concentrated in the high-R&D-intensity quartile $R\&D\_Q4$, as the treatment dummy *COW* itself is small and statistically insignificant. This shows again that only firms with high R&D intensity experience any change in firm performance as a consequence of the COW legislation.

Lastly, we report in Internet Appendix, Table A3, OLS regression coefficients for $Intra\_OvLapDir \times R\&D\_Q4$, which are different from the 2SLS estimates and statistically insignificant. These OLS regressions capture the equilibrium relationship between board overlap and firm profitability. We note that low profitability makes the endogenous choice of board overlap potentially more pressing and prevalent. This reverse causality can con-

siderably attenuate the positive relationship between board overlap and profitability among research-intensive firms and can account for the qualitative difference between the 2SLS and OLS estimates. The 2SLS regression results provide the correct inference on the causal impact of new board overlap on firm performance.

In sum, we document that the introduction of COW legislation triggers frequent incidences of intra-industry board overlap for research-intensive firms. Reduced-form and 2SLS estimates consistently show that firms with new intra-industry board overlap also experience higher profitability and operating margins, which suggests that more unconstrained board overlap has a real effect on firm behaviors.

4 Which Spillovers Matter?

4.1 Competitive versus Technology Spillover

The previous Section 4 documents an increase in board overlap among R&D-intensive firms following the enactment of COW legislation (Table 3), and demonstrates that this new board overlap is associated with increased firm profitability (Table 4). Next, we explore the underlying mechanisms by examining more precisely which firm pairs initiate board overlap, which sheds light on the source of the board overlap benefits. We will focus on distinguishing between competitive and technology spillovers within firm pairs. Following the methodologies of Bloom *et al.* (2013) and Antón *et al.* (2024), we construct empirical measures for both types of spillovers at the firm pair level.

For *competitive spillovers*, we begin with a measure of product similarities, which uses data from Hoberg and Phillips (2016). These pairwise similarities measure the degree of

product market overlap between firms based on the cosine similarity of the words contained in the Business Description section of their 10-K filings. Formally,

$$HP_{i,j,t} = \frac{W_{i,t}W'_{j,t}}{(W_{i,t}W'_{i,t})^{1/2}(W_{j,t}W'_{j,t})^{1/2}}, \tag{4}$$

where $W_{i,t}$ and $W_{j,t}$ each represents a vector of dummies for words (within a list of 61,146 distinct product words) found in the 10-K filings of firms i and j in year t, respectively.

We define the pairwise competitive spillover between firms i and j as

$$Pair\ SpillHP_{i,j,t} = HP_{i,j,t}(G_{i,t} + G_{j,t})/2, \tag{5}$$

where $HP_{i,j}$ represents the product similarities between firms i and j, as identified by Hoberg and Phillips. $G_{i,t}$ and G_j denote the R&D stock of firms i and j, respectively and are calculated as

$$G_{i,t} = R\&D_{i,t} + (1-\delta)\,G_{i,t-1} \quad \text{and} \quad G_{j,t} = R\&D_{j,t} + (1-\delta)\,G_{j,t-1}, \tag{6}$$

where $R\&D_{i/j,t}$ represents R&D expenditure of the respective firm in year t, and δ the depreciation rate of the R&D stock set at $\delta = 0.15$.

The construction of *technology spillovers* begins with a technology similarity measure between firms i and j, using the method outlined in Jaffe (1988). Formally,

$$TECH_{i,j} = \frac{T_i T'_j}{(T_i T'_i)^{1/2}(T_j T'_j)^{1/2}}, \tag{7}$$

where T_i denotes a vector of the share of patents of firm i in any given technology field. Here,

we consider all patents filed by firm i throughout the sample period so the resulting $TECH_{i,j}$ is time-invariant. We classify patents according to the Cooperative Patent Classification (CPC) system. Each technology field corresponds to a CPC subclass, similar in granularity to the US Patent Classification used by Jaffe (1988).[14] The pairwise technology spillover between firms i and j is defined as

$$Pair\ SpillTECH_{i,j,t} = TECH_{i,j}(G_{i,t} + G_{j,t})/2. \tag{8}$$

Next, we explore how competitive spillovers ($Pair\ SpillHP_{i,j}$) and technology spillovers ($Pair\ SpillTECH_{i,j}$) among intra-industry firm pairs influence the creation of board overlap. The more each type of spillover matters, the more it should (endogenously) determine the creation of new board overlap following the (exogenous) decrease in litigation risk due to the COW legislation. Thus, the COW legislation essentially creates a "revealed benefit" experiment, allowing us to discern which type of spillover—competitive or technology—is more relevant for R&D-intensive firms when it comes to the benefits of board overlap.

In order to reduce the confounding effects in terms of industry affiliation and asset size, we employ a detailed matching procedure. First, we select all firm pairs $[F_1, F_2]$ with bilateral board overlap in any year. Second, we perform a one-to-one match by finding a matching firm F_1' for F_1 as well as a matching firm F_2' for F_2. These matched firms must be in the same industry and closest in terms of asset size. Third, we construct control firm pairs $[F_1, F_2']$ and $[F_1', F_2]$ that involve an original firm and a matched firm. We do not consider the pair $[F_1', F_2']$ involving matched firms only as a control pair. Fourth, if a control pair exhibits any bilateral intra-industry board overlap throughout the sample period, we

[14] The US Patent Office began using the Cooperative Patent Classification (CPC) system to classify patents in 2012, replacing the US Patent Classification system.

replace the affected matched firm (F_1' or F_2') with the next best match until there is no intra-industry board overlap in the constructed control pair. As a result of the one-to-one matching, each original firm pair $[F_1, F_2]$ with board overlap (at some point in time) has up to two control firm pairs without board overlap. The matching of firm characteristics is done with respect to the year when the original firm pair forms an intra-industry board overlap.

Table 5, Panel A shows descriptive statistics for intra-industry firm pairs, comparing those with board overlap to matched pairs without board overlap. On average, firm pairs with board overlap exhibit competitive spillovers that are more than twice as large as those for matched firm pairs without board overlap. However, no significant difference is observed in technology spillover between the two groups. This comparison suggests that intra-industry board overlap is more prevalent among firms experiencing high competitive spillovers, rather than those with significant technology spillovers.

To conduct the same comparison more rigorously (i.e., conditional on the exogenous variation of COW legislation), we perform pair-level regressions of intra-industry board overlap on two spillover measures, which are interacted with a first dummy (*Pair COW*) that marks firm pairs with both firms located in (treated) states with COW legislation, and a second dummy (*Pair R&D_Q4*) that marks firm pairs of R&D-intensive firms each in quartile Q4. These regressions are detailed in Table 5, Panel B.

First, we do not condition on the research intensity of the treated firms. Columns (1) and (2) show that the presence of intra-industry board overlap features a statistically significant and positive correlation with competitive spillover (*Pair SpillHP*$_{i,j}$), but only for firm pairs where both firms are located in states with prior COW legislation. In contrast, technology

spillover ($Pair\ SpillTECH_{i,j}$) shows very limited predictive power for intra-industry board overlap.

Second, we condition the board overlap effect on the R&D intensity of the treated firms by including the interacted dummy *Pair R&D_ Q4.* The corresponding results in Columns (3) and (4) reveal that the likelihood of board overlap increases by a factor of more than three when we focus on R&D-intensive firms with competitive spillovers. Again, technological spillovers appear not to matter and are statistically insignificant for the prevalence of new board overlap after COW legislation.

In summary, our findings indicate that the primary motivation for adopting intra-industry board overlap is to attenuate competitive spillovers. This effect is concentrated among research-intensive firm pairs. In contrast, technology spillovers, despite their potential for improved management through board overlap, do not significantly influence the distribution or creation of new board overlaps following the COW legislation.

4.2 Investment and R&D Expenditure

To further substantiate the motivation for new board overlap and its influence on firm outcomes, we examine the consequences of intra-industry board overlap on investment. Competitive and technology spillovers have distinct implications for investment decisions. Specifically, high competitive spillovers often arise from relentless R&D competition, where the "winner" (e.g., the first to patent) can capture market share from competitors by offering superior product quality or introducing innovative new products. Interlocked directors may mitigate this competition by coordinating a reduction in new R&D investments, thereby decreasing competitive spillovers. Consequently, a reduction in competitive spillover after

board overlap is typically associated with reduced investment levels.

By contrast, technology spillovers can lead to inefficient underinvestment due to concerns over free-riding. Here, firms hesitate to invest strongly in R&D out of fear that the competitors could benefit from knowledge diffusion without bearing the development costs. Board overlap could address this free-riding issue by facilitating shared R&D ventures or by establishing formal agreements among interlocked firms to invest proportionally in joint development projects. As the free-riding issue is alleviated under board overlap, we expect to see a subsequent increase in firm investment.

We examine investment in both tangible and intangible assets. The former is measured by Capex relative to assets (*Capex/Assets*) and the latter by R&D expenditure relative to assets (*R&D Intensity*). We find that board overlap has an economically and statistically strong negative effect on tangible and intangible capital investment. The regression results in Table 6 indicate that, for firms in the high-R&D-intensity quartile Q4, a ten-percentage-point increase in intra-industry board overlap leads to a decrease in capital expenditure by 2.24% to 2.58% of total assets and a decline in R&D expenditure by 16.3% to 16.5% of total assets. This substantial reduction in R&D investment contributes to the majority of the *ROA* improvement found in Table 4, Column (1b). Unlike general capital expenditure that gradually depreciates over time, R&D investments are expensed and thus have a more direct impact on firm profitability.

An alternative explanation for reduced investments is that board overlap enables firms to eliminate wasteful spending (i.e., empire building) and increase investment efficiency. However, this presupposes that R&D-intensive firms examined in this study have greater free cash flows that are conducive to overinvestment problems (Jensen and Meckling, 1976).

But this is not the case. Additional analyses in Table A4 show that the increased intra-industry board overlap and decreased investments documented earlier do not appear to vary systematically with free cash flows, alleviating the concern that reduced investments reflect the elimination of wasteful spending.

4.3 Board Overlap and Growth of Product Offerings

Another implication of reduced competitive spillovers is diminished product innovation and reduced product offerings. If board overlap indeed mitigates the competitive spillover, we would expect to see a negative relationship between board overlap and the expansion of a firm's product offering over time. We use data on the growth of firm product offerings provided by Hoberg and Phillips (2017). Specifically, the authors use the size of a firm's 10-K business description to measure the breadth and depth of its product offerings in any given year. The growth in the product offering is calculated as the change in the size of a firm's business description from one year to the next.

Table 7 presents 2SLS regression results, where the dependent variable is the growth of a firm's product description, defined as the natural logarithm of the ratio of the number of words in the firm's business description in one year to that in the previous year. Consistent with our expectations, we find that board overlap is associated with a reduced growth rate in product offerings. The effect is again economically significant: a ten-percentage-point increase in intra-industry board overlap leads to a decrease in the *Growth of Product Offering* by 13%. This finding further confirms our hypothesis that board overlap primarily reduces competitive spillovers, leading to decreased product innovation. In contrast, if board overlap were enhancing technology spillovers, we would expect an increase in product innovation

and creation, which we do not observe.

4.4 Board Overlap and Product Differentiation

Another channel of firm coordination under board overlap is the product development agenda. Competitive spillovers decrease if rival firms reduce overlaps in their business lines. To test this prediction, we use product similarity data provided by Hoberg and Phillips (2016), which allows us to accurately measure a change in product differentiation between any firm pair. A higher *HP* index number represents more product similarity and less product differentiation at the granular firm-pair level.

Using the firm-pair sample constructed in Section 5.1 (Table 5), we estimate again a 2SLS model, with the first and second stage taking the form

$$Pair\ Intra\_OvLapDir_{p,t} = \beta_1\ Pair\ R\&D\_Q4_p \times Pair\ COW_{p,t} + \beta_2 Pair\ COW_{p,t} + \theta_p + \epsilon_{p,t} \tag{4a}$$

$$HP_{p,t} = \beta_3\ Pair\ \widehat{Intra\_OvLapDir}_{p,t} + \beta_4 Pair\ COW_{p,t} + \theta_p + \vartheta_{p,t}, \tag{4b}$$

respectively. In Eq. (4a), $Pair\ Intra\_OvLapDir_{p,t}$ denotes the number of interlocked directors between firms in pair p relative to the total board size of both firms. The dummy variable $Pair\ R\&D\_Q4_p$ indicates whether the average R&D intensity in pair p is in the top 25% quartile of all firm pairs in the sample. Again, we measure R&D intensity in 1998 or the first year a firm enters the sample. The dummy $Pair\ COW_{p,t}$ is one if the COW legislation covers both firms of pair p in year t and zero otherwise. Pair-level control variables include the log of the combined total assets of both firms in the pair (*Pair ln(Assets)*),

the equal-weighted average of *Tangibility* of both firms in the pair (*Pair Tangibility*), the equal-weighted average of the market-to-book ratio of both firms in the pair (*Pair MTB*), and the equal-weighted average of R&D intensity of both firms in the pair (*Pair R&D Intensity*). The regression features firm pair fixed effects θ_p (i.e., separate dummies for each firm pair with bilateral board overlap and its matched firm pairs) to absorb any time-invariant difference in the outcome variable explained by pair differences and imperfect matching.

The variable $Pair\ \widehat{Intra\_OvLapDir}_{p,t}$ in Eq. (4b) represents the instrumented board overlap predicted by the first stage regression. *HP* is the text-based pairwise product similarity obtained from the Hoberg-Phillips data library.[15] A higher similarity score indicates that two firms commercialize more similar products.

Table 8, Panel A reports summary statistics for all variables used in the pair analysis, and Panel B tabulates the 2SLS regression results. In Panel B, Columns (1) and (2) report first-stage regressions with and without control variables, respectively. Similar to the firm-level regressions in Table 3, the COW legislation significantly increases intra-industry board overlap for firm pairs with high R&D intensity. No statistically significant effect is found for the remaining firm pairs, as indicated by the coefficient *Pair COW* marking all firm pairs subject to COW legislation.

Columns (3) and (4) in Panel B relate the proxy for product similarity to the (instrumented) board overlap. Pairwise intra-industry board overlap shows a negative effect on product similarity. For example, the coefficient of -0.4895 in Column (4) suggests that the COW legislation decreases product similarity by -0.79 percentage points ($= -0.4895 \times 0.0162$) on average for all research intensive firm pairs (i.e. with *Pair*

[15] The data library is availabe at: https://hobergphillips.tuck.dartmouth.edu.

$R\&D = 1$) covered by COW legislation (i.e. with $Pair\ COW = 1$) , equivalent to 20.8% ($= -0.0079/0.038$) of the mean of the dependent variable *HP*. As reduced product similarity implies enhanced market power, this result is consistent with the evidence of higher profit margins in Section 4.

5 Additional Explanations

5.1 Board Overlap and Board Quality

A human capital view of board overlap suggests that board overlap emerges due to a limited supply of highly qualified industry experts. Therefore, when COWs allow more firms to share the expertise of high-quality directors, the change in board quality induced by board overlap constitutes an alternative explanation for our observation of improved firm performance. We address this alternative hypothesis as follows.

First, we highlight that board quality should not change if board overlap occurs due to the partner firm appointing a director from the focal firm. This type of board overlap, which leaves the focal firm's board composition unchanged, is referred to as *outbound* board overlap. If improved board quality is the source of higher firm performance, we expect to see no improvement to firm performance for such outbound intra-industry board overlap denoted $Intra\_OvLapDir^{Out}$. Yet, the 2SLS regressions based only on such instrumented outbound board overlap reported in Table 9 show a similarly large performance increase for the *ROA* and the *Operating Margin* as those in Table 4. This finding of improved profitability for both firms contradicts the prediction of improved board quality but aligns with the firm coordination hypothesis, which is independent of whether board overlap leads

to changes in board composition or not.

5.2 Board Overlap and Common Ownership

Does new board overlap associated with the COW legislation reflect increased shareholder overlap, or does board overlap constitute an independent phenomenon? The recent finance literature has linked the rise of common (institutional) ownership to increased firm profitability and reduced investment and R&D expenditure (Azar, *et al.*, 2018; Anton *et al.*, 2024, Elhauge, 2017; Dallas, 2018). The similarity with our findings for board overlap raises questions about the distinctness of common ownership and board overlap.

A recent study by Geng, *et al.* (2022) directly examines the employment relationship between interlocked directors and common shareholders. They find that common institutional and non-institutional investors are seldom represented on the boards of industry rivals, suggesting board overlap in our analysis is rather independent of the influence of common shareholders. However, Eldar, Nili, and Xu (2025) document a positive relationship between increased common ownership and board overlap for certain types of activist investors like hedge funds.

In the Internet Appendix, Table A5, we augment the 2SLS regressions with common ownership measures as additional control variable. The empirical measure for common ownership follows Koch, Panayides, and Thomas (2021). The results presented in Table A5 remain quantitatively robust, which suggests that common ownership does not have any confounding effects on our analysis.

6 Conclusion

The evidence presented in this paper addresses a long-standing question about the economic consequences of board overlap between rival firms. Using the staggered adoption of Corporate Opportunity Waiver legislation as a quasi-natural experiment, we demonstrate that legal barriers to board overlap have material effects on firm coordination, particularly among research-intensive companies. The substantial increase in intra-industry board overlap following COW adoption—concentrated almost exclusively among firms with high R&D intensity—suggests that legal constraints, rather than market forces alone, previously limited governance structures that potentially increase shareholder value.

Our findings carry important implications for antitrust policy and corporate governance regulation. The Department of Justice's recent enforcement actions targeting interlocked directors under Section 8 of the Clayton Act have focused predominantly on R&D-intensive firms. Our analysis suggests this focus may be warranted, but the underlying mechanisms merit careful consideration. We find that board overlap among research-intensive firms primarily serves to attenuate competitive spillovers rather than manage technology spillovers. The observed reductions in investment, product offerings, and product similarity—coupled with increased profitability—indicate that board overlap facilitates coordination that dampens competition in product markets rather than enhancing collaborative innovation.

These results present policymakers with a complex trade-off. On one hand, the substantial profitability improvements we document suggest that board overlap creates private value for shareholders of interlocked firms. On the other hand, the mechanisms driving these gains—reduced investment, curtailed product development, and enhanced product differentiation—raise concerns about potential welfare losses to consumers and broader in-

novation ecosystems. The fact that competitive spillovers, rather than technology spillovers, primarily drive board overlap formation suggests that current antitrust concerns may be well-founded.

From a methodological perspective, our study demonstrates the value of examining corporate governance through the lens of state-level legal variation. The COW legislation provides rare experimental variation in board composition that would be difficult to obtain otherwise, given the endogenous nature of director selection. Future research could extend this framework to examine other dimensions of inter-firm coordination, including the role of common ownership and strategic alliances, to develop a more complete understanding of how modern corporations manage competitive and collaborative relationships.

Our analysis also highlights an unintended consequence of corporate law reform. Delaware's 2000 COW legislation was designed primarily to facilitate venture capital financing for private startups, yet it triggered substantial changes in board composition among public firms—a group largely absent from policy discussions preceding the reform. This disconnect between legislative intent and ultimate impact underscores the importance of careful empirical evaluation of corporate law changes and suggests that policymakers should anticipate broader applications of governance innovations beyond their intended scope.

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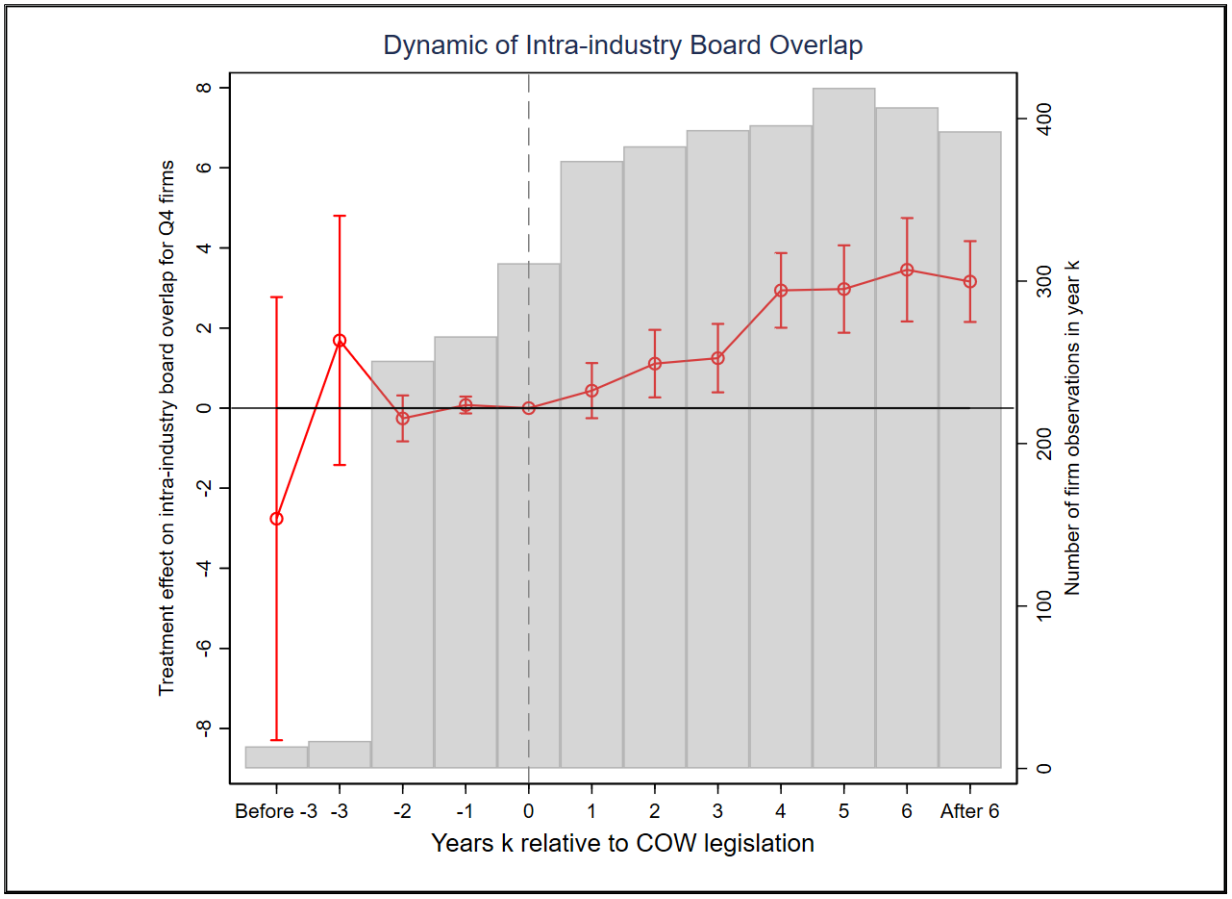

Figure 1: We plot the dynamics of intra-industry board overlap for firms with high R&D intensity (Q4) relative to the year $k = 0$ when COW legislation was introduced into U.S. state corporate law. Depicted by the red line is the coefficient estimate $\widehat{\alpha}_k$ in Eq. (3) with the vertical bars representing a 95% confidence interval. The grey histogram in the background represents the number of firm observations entering the estimation of $\widehat{\alpha}_k$.

Table 1: Corporate Law Changes by State

We list changes in state law that allow for corporate opportunity waivers relaxing the fiduciary duties of board members. Listed are the state, the specific statute, the date of effectiveness of corporate law changes, and the scope or coverage of the waiver. Rauterberg and Talley (2017) is the source for the information.

Corporate Law Change			Scope/Coverage (of)		
State	Statute	Date	Directors	Officers	Shareholders
(1)	(2)	(3)	(4)	(5)	(6)
DE	Code Ann. tit. 8, §122(17)	01/07/2000	Yes	Yes	Yes
OK	Ann. tit. 18, §1016(17)	01/11/2001	Yes	Yes	Yes
MO	Ann. Stat. §351.385(16)	01/10/2003	Yes	Yes	Yes
KS	Stat. Ann. §17-6102 (17)	01/01/2005	Yes	Yes	Yes
TX	Bus. Orgs. Code Ann. §2.101(21)	01/01/2006	Yes	Yes	Yes
NV	Rev. Stat. Ann. §78.070(8)	01/10/2007	Yes	Yes	No
NJ	Stat. Ann. 14A:3-1(q)	11/03/2011	Yes	Yes	Yes
MD	Code Ann., Corps. & Ass'ns §2-103(15)	01/10/2014	Yes	Yes	Yes
WA	Code Ann. §23B.02.020(5)(k)	01/01/2016	Yes	Yes	Yes

Table 2: Descriptive Statistics

Panel A reports summary statistics on all variables. The accounting variables are return on assets (*ROA*), *Operating Margin* (i.e. *Operating Profit/Sales*), *Sales Growth*, the growth of cost of goods sold (*COGS Growth*), capital expenditure divided by total assets (*Capex/Assets*), the ratio of R&D expenditure and assets (*R&D Intensity*), *Product Offering Growth*, log assets [*ln(Assets)*], asset tangibility (*Tangibility*), and the market-to-book ratio (*MTB Ratio*). The governance variables comprise the number of board members (*Board Size*), the overall percentage of overlapping directors on a firm board (*All_ OvLapDir*), the percentage of intra-industry overlapping directors (*Intra_ OvLapDir*), and the percentage of inter-industry overlapping directors (*Inter_ OvLapDir*). In Panel B, we report mean values of all variables for the full sample and subsamples sorted according to *R&D Intensity* into quartiles Q1 to Q4 capturing different degrees of R&D expdentitures. Column (6) provides the variable difference between the mean of Q4 and Q1, and tests for statistical difference based on a non-parametric rank test. Columns (7) and (8) split the sample Q4 of firms subject to high R&D intensity into those with (*Intra_ OvLapDir* > 0) and without (*Intra_ OvLapDir* $= 0$) intra-industry board overlap. See detailed variable description in Table A6 of the Internet Appendix.

Panel A: Summary Statistics

	Obs. (1)	Mean (2)	S.D. (3)	Median (4)	P25 (5)	P75 (6)
Accounting						
ROA	49,957	0.068	0.211	0.111	0.049	0.166
Operating Margin	49,957	0.030	0.204	0.068	0.006	0.133
Sales Growth	49,741	0.090	0.301	0.072	−0.020	0.185
COGS Growth	49,778	0.082	0.297	0.071	−0.024	0.185
Capex/Assets	49,957	0.049	0.054	0.031	0.016	0.060
R&D Intensity	49,957	0.059	0.117	0.007	0.000	0.071
Product Offering Growth	45,251	−0.001	0.395	0.01	−0.055	0.079
ln(Assets)	49,957	6.198	1.987	6.133	4.763	7.547
Tangibility	49,957	0.243	0.224	0.166	0.072	0.344
MTB Ratio	49,957	1.859	1.660	1.315	0.877	2.166
Governance						
Board Size	49,587	8.509	2.57	8	7	10
All_ OvLapDir	49,587	0.450	0.401	0.375	0.143	0.667
Intra_ OvLapDir	49,587	0.068	0.178	0	0	0
Inter_ OvLapDir	49,587	0.381	0.371	0.286	0.100	0.583

Panel B: Firm Variables Means by Level of *R&D Intensity*

	Full Sample	Subsamples by *R&D Intensity* Quartiles				Difference	Q4 Split	
		Q1 (Low)	Q2	Q3	Q4 (High)	Q4-Q1	*Intra_ OvLapDir* > 0 Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Accounting								
ROA	0.068	0.123	0.119	0.097	−0.117	−0.240***	−0.143	−0.086
Operating Margin	0.030	0.076	0.079	0.059	−0.135	−0.211***	−0.165	−0.098
Sales Growth	0.090	0.083	0.065	0.080	0.132	0.049***	0.149	0.111
COGS Growth	0.082	0.083	0.061	0.074	0.101	0.018***	0.113	0.086
Capex/Assets	0.049	0.063	0.042	0.039	0.030	−0.033***	0.028	0.034
R&D Intensity	0.059	0.002	0.012	0.055	0.217	0.216***	0.242	0.187
Product Offering Growth	−0.001	0.005	−0.001	−0.001	−0.014	−0.020***	−0.020	−0.008
ln(Assets)	6.198	6.520	6.966	6.209	5.144	−1.377***	5.473	4.740
Tangibility	0.243	0.337	0.255	0.179	0.101	−0.237***	0.091	0.113
MTB Ratio	1.859	1.445	1.463	1.916	2.900	1.455***	3.060	2.703
Governance								
Board Size	8.509	8.704	9.123	8.573	7.741	−0.963***	8.196	7.183
All_ OvLapDir	0.450	0.388	0.508	0.500	0.504	0.115***	0.672	0.296
Intra_ OvLapDir	0.068	0.022	0.022	0.058	0.209	0.187***	0.379	0.000
Inter_ OvLapDir	0.381	0.367	0.486	0.442	0.295	−0.072***	0.294	0.296

Table 3: Corporate Law Change and New Board Overlap

We report first-stage regressions for various types of board overlap. The dummy *COW* marks firm i incorporated in states that in a given year t are allowed for a corporate opportunity waiver for board members ($COW = 1$). The dummy is equal to zero if the state law does not provide this option ($COW = 0$). We measure the treatment effect for different quartiles Qx of R&D intensity by using the interaction term *R&D_ Qx*×*COW*. The quartile dummy *R&D_ Qx* equals one for firms in the x-th quartile of the R&D intensity. The R&D intensity used to construct *R&D_ Qx* is measured at the year when a firm first appears in the sample. The missing R&D is replaced to zero and marked by a dummy. The interaction of the missing R&D dummy and *COW* is included in all specifications. Columns (1)-(4) report regressions of the share of intra-industry overlapping directors on a firm's board (*Intra_ OvLapDir*), and Columns (5)-(6) report regressions of the share of inter-industry overlapping directors (*Inter_ OvLapDir*) and the overall share of overlapping directors on a firm board (*All_ OvLapDir*). All dependent variables are expressed in percentages (×100). Lagged control variables include the log of total assets [*ln(Assets)*], the asset tangibility (*Tangibility*) (i.e., property, plant, and equipment relative to total asset), the market-to-book ratio (*MTB ratio*), and *R&D intensity*. All specifications control firm fixed effects and industry-by-year fixed effects. The robust standard errors are clustered at the state level. ***, **, and * denote the 1%, 5%, and 10% significance level, respectively. See detailed variable description in Table A6 of the Internet Appendix.

Dep. Variables:	*Intra_ OvLapDir*				*Inter_ OvLapDir*	*All_ OvLapDir*
	(1)	(2)	(3)	(4)	(5)	(6)
COW×*R&D_ Q4*	2.8024***	2.9212***	2.6256***	2.7476***	−0.9594	1.7882*
	(0.5871)	(0.5581)	(0.5810)	(0.5324)	(0.7028)	(0.9171)
COW×*R&D_ Q3*	0.2756	0.2901				
	(0.4427)	(0.4501)				
COW×*R&D_ Q2*	−0.2319	−0.2831				
	(0.7879)	(0.7843)				
COW×*R&D_ Q1*	0.1656	0.1365				
	(0.3749)	(0.3627)				
COW			0.1663	0.1591	−1.8620*	−1.7029
			(0.4213)	(0.4230)	(1.0796)	(1.2522)
Controls						
ln(Assets)	0.8643***	0.9715***	0.8648***	0.9716***	3.4536***	4.4252***
	(0.1164)	(0.1530)	(0.1169)	(0.1537)	(0.2146)	(0.2704)
Tangibility		1.2272*		1.2163*	−4.4722*	−3.2558
		(0.7267)		(0.7166)	(2.2539)	(2.7269)
MTB Ratio		0.1194		0.1188	−0.0247	0.0941
		(0.0846)		(0.0849)	(0.0923)	(0.1691)
R&D Intensity		1.7388**		1.7385**	5.7829***	7.5214***
		(0.7296)		(0.7282)	(0.8465)	(1.2228)
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Industry-by-year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.746	0.746	0.746	0.746	0.716	0.707
Observations	49,957	49,957	49,957	49,957	49,957	49,957

Table 4: Corporate Law Change and Firm Performance

We report second-stage regressions on how firm performance responds to predicted change in intra-industry board overlap $\widehat{Intra\_OvLapDir}$ estimated in Table 3, Panel A. The dependent variables are the return on assets (*ROA*), the *Operating Margin*, *Sales Growth*, and the growth of cost of goods sold (*COGS Growth*). Specifications (1a)-(4a) only include *In(Assets)* as the control variable and (1b)-(4b) include the all control variables. The variable of interest is the predicted (instrumented) intra-industry board overlap ($Intra\_OvLapDir_{i,t}$). The corresponding first-stage regressions with partial control variables and full control variables are separately stated in Table 3, Panel A, Columns (3) and (4). We report the Montiel Olea-Pflueger (MOP) effective F-statistics as a test for weak instruments. The robust standard errors are clustered at the state level. ***, **, and * denote the 1%, 5%, and 10% significance level, respectively. See detailed variable description in Table A6 of the Internet Appendix.

Dep. Variables:	*ROA*		*Operating Margin*		*Sales Growth*		*COGS Growth*	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
$\widehat{Intra\_OvLapDir}$	2.5810***	1.8813***	2.2964***	1.9927***	−0.3328	−0.0892	−0.5081	−0.9146**
(instrumented)	(0.5882)	(0.3742)	(0.5192)	(0.4010)	(0.5836)	(0.5883)	(0.4663)	(0.3598)
COW	−0.0199*	−0.0128	−0.0107	−0.0061	−0.0092	−0.0049	−0.0120*	−0.0028
	(0.0107)	(0.0080)	(0.0096)	(0.0082)	(0.0075)	(0.0075)	(0.0064)	(0.0067)
Controls								
ln(Assets)	−0.0135	−0.0175**	−0.0106	−0.0115	−0.0578***	−0.0517***	−0.0240***	−0.0241***
	(0.0084)	(0.0072)	(0.0089)	(0.0083)	(0.0065)	(0.0060)	(0.0049)	(0.0046)
Tangibility		0.0344		−0.0330		−0.1238***		−0.1282***
		(0.0240)		(0.0287)		(0.0132)		(0.0191)
MTB Ratio		0.0130***		0.0146***		0.0346***		0.0354***
		(0.0031)		(0.0026)		(0.0014)		(0.0016)
R&D Intensity		−0.5102***		−0.2925***		−0.1202***		−0.5279***
		(0.0154)		(0.0176)		(0.0296)		(0.0283)
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind.-by-year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49,957	49,957	49,957	49,957	49,741	49,741	49,778	49,778
MOP eff. F-stats	20.42	26.63	20.42	26.63	22.45	29.19	23.42	30.77

Table 5: Competitive Spillover, Technology Spillover, and Board Overlap

We compare competitive and technology spillovers for intra-industry firm pairs with and without board overlap. The comparison is conducted in a matched firm pair sample, where an intra-industry firm pair with board overlap is matched to two intra-industry firm pairs that have never had board overlap based on industry affiliation and asset size. Panel A reports descriptive statistics and Panel B provides a regression analysis. *Pair SpillHP* and *Pair SpillTECH* measures competitive and technology spillovers within a firm pair, respectively. *Pair HPSS* represents the pairwise Holberg-Phillips product similarity measure. The dummy *Pair COW* equals one if both firms in a pair are incorporated in states that have adopted corporate opportunity waivers (COWs) in a year. The dummy *Pair R&D_ Q4* equals one if a firm pair is sorted to the 4-th quartile by the average R&D intensity of both firms measured at the beginning of the sample period or the earliest year when both firms are in the sample. Missing R&D observations are replaced by a zero and the respective firm pair is marked by a separate dummy. The dummy *Pair Intra_ OvLapDir* equals one if a pair shares an intra-industry overlapping director. For regressions in Panel B, the control variables comprise *Pair ln(Assets)*, *Pair Tangibility*, *Pair MTB Ratio, Pair R&D Intensity,* and *Pair Common Ownership.* Firm pair and year fixed regressions are included in all regressions.

Panel A: Descriptive Statistics

	Full Sample		Intra-Industry Board Overlap? No		Intra-Industry Board Overlap? Yes		Mean Difference
	Obs. (1)	Mean (2)	Obs. (3)	Mean (4)	Obs. (5)	Mean (6)	(6)−(4) (7)
Competitive Spillover							
Pair SpillHP	22,954	16.199	18,299	12.671	4,655	30.065	17.394***
Pair ln(1+SpillHP)	22,954	1.337	18,299	1.130	4,655	2.150	1.020***
Technology Spillover							
Pair SpillTECH	22,954	174.936	18,299	173.694	4,655	179.819	6.125
Pair ln(1+SpillTECH)	22,954	2.963	18,299	2.966	4,655	2.949	−0.017
HP Prodcut Similarity							
Pair HPSS	22,954	0.038	18,299	0.030	4,655	0.072	0.041***

Panel B: Regression Analyses

Dep. Var.	*Pair Intra_ OvLapDir*			
	(1)	(2)	(3)	(4)
Pair COW×Pair R&D_ Q4×Pair ln(1+SpillHP)			0.0351***	0.0346***
			(0.0132)	(0.0126)
Pair COW×Pair R&D_ Q4×Pair ln(1+SpillTECH)			0.0191	0.0184
			(0.0240)	(0.0247)
Pair COW×Pair ln(1+SpillHP)	0.0102***	0.0086**	0.0003	−0.0009
	(0.0038)	(0.0041)	(0.0057)	(0.0064)
Pair COW×Pair ln(1+SpillTECH)	−0.0019	−0.0020	−0.0032	−0.0032
	(0.0051)	(0.0052)	(0.0039)	(0.0040)
Pair R&D_ Q4×Pair ln(1+SpillHP)			−0.0117	−0.0104
			(0.0134)	(0.0126)
Pair R&D_ Q4×Pair ln(1+SpillTECH)			−0.0028	−0.0070
			(0.0324)	(0.0319)
Pair ln(1+SpillHP)	−0.0008	0.0003	0.0027	0.0034
	(0.0043)	(0.0045)	(0.0059)	(0.0063)
Pair ln(1+SpillTECH)	0.0047	−0.0005	0.0016	−0.0020
	(0.0148)	(0.0134)	(0.0120)	(0.0115)
Pair COW×Pair R&D_ Q4			−0.1247*	−0.1206*
			(0.0675)	(0.0707)
Pair COW	0.0094	0.0108	0.0204	0.0215
	(0.0158)	(0.0170)	(0.0157)	(0.0167)
Control Vars.	No	Yes	No	Yes
Firm FEs	Yes	Yes	Yes	Yes
Industry-by-year FEs	Yes	Yes	Yes	Yes
Adjusted R^2	0.560	0.561	0.561	0.561
Observations	22,954	22,954	22,954	22,954

Table 6: Firm Investment and Board Overlap

We report the second-stage regression on how firm outcomes respond to predicted change in intra-industry board overlap (*Intra_ OvLapDir*). The dependent variables are capital expenditure divided by total assets (*Capex/Assets*) and R&D expenditure divided by total assets (*R&D Intensity)*. The variable of interest is the predicted (instrumented) intra-industry board overlap (*Intra_ OvLapDir*). The corresponding first-stage regression with full control variables is stated in Table 3, Panel A, Column (4) for all regressions in this table except the one in Column (2b), where we do not control for lagged *R&D Intensity*. We report the Montiel Olea-Pflueger (MOP) effective F-statistics as a test for weak instruments. The robust standard errors are clustered at the state level. ***, **, and * denote the 1%, 5%, and 10% significance level, respectively. See detailed variable description in Table A6 of the Internet Appendix.

Dep. Variables:	*Capex/Assets*		*R&D Intensity*	
	(1a)	(1b)	(2a)	(2b)
$\widehat{Intra\_OvLapDir}$	-0.2584^{***}	-0.2239^{***}	-1.6489^{***}	-1.6318^{***}
(instrumented)	(0.0629)	(0.0507)	(0.5198)	(0.4896)
COW	0.0024	0.0027^{**}	0.0126	0.0126^{*}
	(0.0015)	(0.0013)	(0.0076)	(0.0075)
Controls				
ln(Assets)	−0.0011	−0.0001	0.0001	0.0008
	(0.0016)	(0.0016)	(0.0057)	(0.0059)
Tangibility		0.0214^{***}		0.0424^{***}
		(0.0037)		(0.0101)
MTB Ratio		0.0037^{***}		0.0012
		(0.0003)		(0.0019)
R&D Intensity		-0.0159^{***}		
		(0.0030)		
Firm FEs	Yes	Yes	Yes	Yes
Industry-by-year FEs	Yes	Yes	Yes	Yes
Observations	49,957	49,957	49,957	49,957
MOP effective F-stats	23.72	26.63	20.42	23.51

Table 7: Growth of Product Offering and Board Overlap

This table reports the second-stage regression on the effect of intra-industry board overlap (*Intra_ OvLapDir*) on the growth of the product offering, which is measured using the growth of product description length relative to the previous year. The variable of interest is the predicted (instrumented) intra-industry board overlap (*Intra_ OvLapDir*). The corresponding first-stage regression with full control variables is stated in Table 3, Panel A, Column (4). We report the Montiel Olea-Pflueger (MOP) effective F-statistics as a test for weak instruments. The robust standard errors are clustered at the state level. ***, **, and * denote the 1%, 5%, and 10% significance level, respectively. See detailed variable description in Table A6 of the Internet Appendix.

Dep. Var.	*Growth of Product Offering*	
	(1)	(2)
$\widehat{Intra\_OvLapDir}$	-1.3371^{***}	-1.2999^{***}
(instrumented)	(0.4605)	(0.3685)
COW	0.0050	0.0051
	(0.0103)	(0.0097)
Controls		
ln(Assets)	−0.0065	−0.0053
	(0.0040)	(0.0045)
Tangibility		0.0340^{***}
		(0.0111)
MTB Ratio		0.0030^{***}
		(0.0011)
R&D Intensity		−0.0038
		(0.0476)
Firm FEs	Yes	Yes
Industry-by-year FEs	Yes	Yes
Observations	41,357	41,357
MOP effective F-stats	21.90	34.20

Table 8: Firm Pair Regressions on Product Differentiation

Panel A provides summary statistics on the sample of firm pairs. The detail of the pair sample construction is provided in Section 5.1. Panel B reports 2SLS regressions capturing the effect of COW legislation on pairwise intra-industry board overlap in Columns (1)-(2), and the consecutive effect of predicted pairwise board overlap on bilateral product market differentiation in Columns (3)-(4). The dummy *Pair COW* equals one if both firms in a pair are incorporated in states that have adopted corporate opportunity waivers (COWs) in a year. The dummy *Pair R&D_ Q4* equals one if a firm pair is sorted to the 4-th quartile by the average R&D intensity of both firms measured at the beginning of the sample period or the year when a firm enters the sample. Missing R&D is replaced by a zero and the respective firm pair is marked by a separate dummy. The dummy *Pair Intra_ OvLapDir* equals one if a pair shares an intra-industry overlapping director. *HP* is the pairwise Holberg-Phillips product similarity measure between firms in a pair. The control variables comprise *Pair ln(Assets)*, *Pair Tangibility*, *Pair MTB Ratio,* and *Pair R&D Intensity.* We include firm pair and year fixed regressions in all specifications. We report the Montiel Olea-Pflueger (MOP) effective F-statistics as a test for weak instruments. The robust standard errors are clustered at the state level. ***, **, and * denote the 1%, 5%, and 10% significance level, respectively. See detailed variable description in Table A6 of the Internet Appendix.

Panel A: Summary Statistics

	Obs.	Mean	Median	S.D.
	(1)	(2)	(3)	(4)
HP	22,954	0.038	0.015	0.057
Pair Intra_ OvLapDir	22,954	0.203	0.000	0.402
Pair COW	22,954	0.688	1.000	0.463
Pair ln(Assets)	22,954	6.610	6.414	1.483
Pair Tangibility	22,954	0.145	0.101	0.160
Pair MTB Ratio	22,954	2.848	2.353	1.822
Pair R&D Intensity	22,954	0.182	0.139	0.156

Panel B: 2SLS Regressions

	First Stage		Second Stage	
Dep. Variables:	*Pair Intra_ OvLapDir*		*HP*	
	(1)	(2)	(3)	(4)
Pair COW×*Pair R&D_ Q4*	0.0231***	0.0162**		
	(0.0075)	(0.0070)		
$\widehat{\textit{Pair Intra\_ OvLapDir}}$			−0.3820**	−0.4895*
			(0.1681)	(0.2745)
Pair COW	0.0115	0.0106	0.0049	0.0058
	(0.0112)	(0.0113)	(0.0055)	(0.0074)
Pair ln(Assets)		0.0088		0.0046
		(0.0084)		(0.0043)
Pair Tangibility		0.0909***		0.0205
		(0.0196)		(0.0250)
Pair MTB Ratio		−0.0002		0.0005
		(0.0009)		(0.0006)
Pair R&D Intensity		−0.0148		−0.0004
		(0.0136)		(0.0112)
Firm pair FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	22,954	22,954	22,954	22,954
MOP effective F-stats			9.409	5.374

Table 9: Outbound Board Overlap and Firm Outcomes

This table reports the second stage regression results for outbound board overlap ($Intra\_OvLapDir^{Out}$), which refers to a firm's director is appointed to another firm's board (outbound). The control variables are the same as in Table 3; we include firm and industry-by-year fixed effects in all specifications. We report the Montiel Olea-Pflueger (MOP) effective F-statistics as a test for weak instruments. Robust standard errors are clustered at the state level. ***, **, and * denote the 1%, 5%, and 10% significance level, respectively. See detailed variable description in Table A6 of the Internet Appendix.

Dep. Variables:	*ROA*		*Operating Margin*	
	(1a)	(1b)	(2a)	(2b)
$\widehat{Intra\_OvLapDir}^{Out}$	3.5841***	2.5325***	3.1889***	2.6825***
(instrumented)	(0.7387)	(0.4395)	(0.6719)	(0.5000)
COW	−0.0159	−0.0097	−0.0071	−0.0027
	(0.0104)	(0.0078)	(0.0086)	(0.0072)
Controls				
ln(Assets)	−0.0131	−0.0178**	−0.0103	−0.0119
	(0.0086)	(0.0071)	(0.0092)	(0.0084)
Tangibility		0.0304		−0.0372
		(0.0245)		(0.0290)
MTB ratio		0.0122***		0.0137***
		(0.0035)		(0.0031)
R&D Intensity		−0.5370***		−0.3208***
		(0.0238)		(0.0237)
Firm FEs	Yes	Yes	Yes	Yes
Industry-by-year FEs	Yes	Yes	Yes	Yes
Observations	49,957	49,957	49,957	49,957
MOP effective F-stats	23.23	30.30	23.23	30.30

Internet Appendix

Not for Journal Publication

Table A1: Top Ten R&D-Intensive Industries

This table reports the top 10 three-digit SIC industries according to the number of firms assigned to R&D quartile Q4. For each industry tabulated in Column (1), Column (2) reports the total number of firm-years in the sample during 1998–2019, Column (3) the number of firm-years assigned to quartile Q4, and Column (4) the share of R&D-intensive firms (= (3)/(2)).

Industry (1)	All firms-year obs. (2)	R&D-intensive firms-year obs. (3)	Percentage share (4)
Drugs	4,202	3,158	75%
Computer and data processing services	5,418	2,308	43%
Electronic components and accessories	2,522	955	38%
Medical instruments and supplies	2,034	723	36%
Measuring and controlling devices	1,514	615	41%
Computer and office equipment	1,224	566	46%
Communications equipment	1,095	530	48%
Special industry machinery	570	270	47%
Research, development, and testing services.	366	128	35%
Electrical industrial apparatus	306	54	18%

Table A2: Reduced Form Estimates for Firm Outcomes

We report the reduced form regressions of firm outcomes directly on *COW*×*R&D_ Q4*. The dependent variables are the return on assets (*ROA*) and the *Operating Margin*. Specifications (1a)-(2a) only include *ln(Assets)* as the control variable and (1b)-(2b) include the all control variables. The variable of interest is *COW*×*R&D_ Q4*. The robust standard errors are clustered at the state level.***, **, and * denote the 1%, 5%, and 10% significance level, respectively.

Dep. Variables:	*ROA*		*Operating Margin*	
	(1a)	(1b)	(2a)	(2b)
COW×*R&D_ Q4*	0.0678***	0.0517***	0.0603***	0.0548***
	(0.0052)	(0.0054)	(0.0044)	(0.0041)
COW	−0.0156***	−0.0098*	−0.0069	−0.0029
	(0.0053)	(0.0049)	(0.0047)	(0.0044)
Controls				
ln(Assets)	0.0088***	0.0008	0.0092***	0.0078***
	(0.0019)	(0.0021)	(0.0025)	(0.0022)
Tangibility		0.0573***		−0.0087
		(0.0144)		(0.0198)
MTB ratio		0.0153***		0.0170***
		(0.0013)		(0.0007)
R&D Intensity		−0.4775***		−0.2578***
		(0.0220)		(0.0174)
Firm FEs	Yes	Yes	Yes	Yes
Industry-by-year FEs	Yes	Yes	Yes	Yes
Adjusted R^2	0.702	0.721	0.700	0.712
Observations	49,957	49,957	49,957	49,957

Table A3: OLS Regressions of Firm Outcomes on Board Overlap

This table reports the OLS regressions relating firm outcomes to intra-industry board overlap. The dependent variables are the return on assets (*ROA*) and the *Operating Margin*. Specifications (1a)-(2a) only include *In(Assets)* as the control variable and (1b)-(2b) include the all control variables. The variable of interest is $Intra\_OvLapDir \times R\&D\_Q4$. The robust standard errors are clustered at the state level.***, **, and * denote the 1%, 5%, and 10% significance level, respectively.

Dep. Variables:	*ROA*		*Operating Margin*	
	(1a)	(1b)	(2a)	(2b)
$Intra\_OvLapDir \times R\&D\_Q4$	0.0183	0.0106	0.0202	0.0135
	(0.0261)	(0.0240)	(0.0262)	(0.0254)
$Intra\_OvLapDir$	-0.0147	-0.0102	-0.0169	-0.0139
	(0.0183)	(0.0173)	(0.0204)	(0.0199)
ln(Assets)	0.0095***	0.0011	0.0099***	0.0082***
	(0.0029)	(0.0025)	(0.0029)	(0.0029)
Tangibility		0.0578***		-0.0082
		(0.0153)		(0.0182)
MTB ratio		0.0151***		0.0168***
		(0.0012)		(0.0011)
R&D Intensity		-0.4860***		-0.2670***
		(0.0334)		(0.0266)
Firm FEs	Yes	Yes	Yes	Yes
Industry-by-year FEs	Yes	Yes	Yes	Yes
Adjusted R^2	0.701	0.720	0.699	0.712
Observations	49,957	49,957	49,957	49,957

Table A4: Free Cash Flows and the Heterogeneous Effect of COWs

This table reports reduced-form regression results on how free cash flows influence the effect of COW legislations on intra-industry board overlap and firm investments. The dummy variable *HighFCF* is equal to one if a firm's free cash flow is greater than the median value in a year and zero otherwise. The free cash flow is calculated as the operating profit plus depreciation and then divided by total assets. Dependent variables are the percentage of intra-industry overlapping directors on a firm boards (*Intra_ OvLapDir*), the capital expenditure divided by total assets [*Capex/Assets*], the R&D expenditure divided by total assets [*R&D Intensity*]. The robust standard errors are clustered at the state level. ***, **, and * denote the 1%, 5%, and 10% significance level, respectively.

Dep. Variables:	*Intra_ OvLapDir*	*Capex/Assets*	*R&D Intensity*
	(1)	(2)	(3)
COW×*R&D_ Q4*×*HighFCF*	0.0121	−0.0021	−0.0077
	(0.0094)	(0.0036)	(0.0047)
COW×*HighFCF*	−0.0016	0.0037	0.0001
	(0.0016)	(0.0028)	(0.0009)
COW×*R&D_ Q4*	0.0227***	−0.0032	−0.0344***
	(0.0038)	(0.0021)	(0.0049)
R&D_ Q4×*HighFCF*	−0.0121	0.0064**	−0.0415***
	(0.0084)	(0.0026)	(0.0047)
HighFCF	0.0014	−0.0184***	−0.0015**
	(0.0016)	(0.0020)	(0.0007)
COW	0.0020	0.0006	0.0093***
	(0.0046)	(0.0017)	(0.0016)
Control			
ln(Assets)	0.0099***	−0.0022**	−0.0136***
	(0.0016)	(0.0008)	(0.0010)
Tangibility	0.0122	0.0175***	0.0203***
	(0.0073)	(0.0042)	(0.0047)
MTB ratio	0.0013	0.0037***	−0.0004*
	(0.0008)	(0.0001)	(0.0002)
R&D Intensity	0.0178**	−0.0231***	
	(0.0076)	(0.0023)	
Firm FEs	Yes	Yes	Yes
Industry-by-year FEs	Yes	Yes	Yes
Adjusted R^2	0.746	0.676	0.802
Observations	49,772	49,772	49,772

Table A5: Corporate Law Change and Firm Performance with Common Ownership

We report the second-stage regressions on how firm performance respond to predicted change in intra-industry board overlap. We extend the regressions in Table 4 by controlling for the common ownership *CO*. We follow Koch, Panayides, and Thomas (2021) and define *CO* as percentage of intra-industry firm pairs with at least one common shareholder. We define a common shareholder as the shareholder holding at least 1% equity ownership in any firm of a pair. The dependent variables are the return on assets (*ROA*) and the *Operating Margin*. Specifications (1a)-(2a) only include *In(Assets)* as the control variable and (1b)-(2b) include the all control variables. The variable of interest is the predicted (instrumented) intra-industry board overlap ($Intra\_OvLapDir_{i,t}$). The corresponding first-stage regressions with partial control variables and full control variables are separately stated in Table 3, Panel A, Columns (3) and (4). We report the Montiel Olea-Pflueger (MOP) effective F-statistics as a test for weak instruments. The robust standard errors are clustered at the state level. ***, **, and * denote the 1%, 5%, and 10% significance level, respectively.

Dep. Variables:	*ROA*		*Operating Margin*	
	(1a)	(1b)	(2a)	(2b)
$\widehat{Intra\_OvLapDir}$	2.5810***	2.0614***	2.2964***	2.1922***
(instrumented)	(0.5882)	(0.4482)	(0.5192)	(0.4675)
COW	−0.0199*	−0.0154*	−0.0107	−0.0083
	(0.0107)	(0.0081)	(0.0096)	(0.0084)
Controls				
ln(Assets)	−0.0135	−0.0208**	−0.0106	−0.0149
	(0.0084)	(0.0081)	(0.0089)	(0.0090)
Tangibility		0.0196		−0.0365
		(0.0242)		(0.0280)
MTB ratio		0.0124***		0.0141***
		(0.0034)		(0.0028)
R&D Intensity		−0.5092***		−0.3024***
		(0.0164)		(0.0175)
CO		0.0082		0.0043
		(0.0082)		(0.0072)
Firm FEs	Yes	Yes	Yes	Yes
Industry-by-year FEs	Yes	Yes	Yes	Yes
Observations	49,957	44,891	49,957	44,891
MOP effective F-stats	20.42	20.42	20.42	20.42

Table A6: Variable Definitions

Variable	Description
ROA	The return on assets is calculated as operating income before depreciation (OIBDP) divided by total assets (AT). Source: Compustat
Operating Margin	The ratio of operating profit to sales. Operating profit is defined as sales (SALES) - cost of goods sold (COGS) - SG&A (XSGA) - depreciation (DP). Source: Compustat
Sales Growth	The log of sales in current year (SALES) minus the log of sales in the previous year. Source: Compustat
COGS Growth	The log of cost of goods sold (COGS) in current year minus the log of COGS in the previous year. Source: Compustat
Capex/Assets	The capital expenditure (CAPEX) divided by total assets. Source: Compustat
R&D Intensity	The amount of R&D expenditure (XRD) divided by total assets (AT). Source: Compustat
R&D_ Qx	A quartile dummy set equal to one for firms assigned to the x-th quartile of the R&D intensity, and set to 0 otherwise. Source: Compustat
Product Offering Growth	The natural logarithm of the ratio of the number of words in the firm's business description in year t + 1 to the number of words in the firm's business description in year t.
COW	A dummy variable that equals to one for firms incorporated in states that have already passed COW legislation in a given year. Source: Compustat
ln(Assets)	The natural logarithm of total assets (AT). Source: Compustat
ln(Assets)	The natural logarithm of total assets (AT). Source: Compustat
Tangibility	It is defined as net fixed assets (PPENT) divided by total assets (AT). Source: Compustat
MTB ratio	Market to book ratio. It is defined as the market value of assets divided by the book value of assets (AT). The market value of assets is the sum of short-term debt (DLC) , long-term debt (DLTT), preferred stock (PSTK), and market value of equity (MKVALT) and then minus deferred taxes and investment tax credit (TXDITC). Source: Compustat
All_ OvLapDir	The overall percentage of overlapping directors on a firm board. We first count external board director positions concurrently held by a firm's board directors, and then divide the count by the number of board directors on the firm's board. Source: BoardEx
Intra_ OvLapDir	The percentage of intra-industry overlapping directors on a firm board. It is calculated as the number of overlapping directorships a firm has with external firms assigned to the same three-digit SIC code, then divided by the number of board directors on the firm's board. Source: BoardEx and Compustat
Intra_ OvLapDir^{Out}	The percentage of outbound overlapping director positions with other same-industry (based on 3-digit SIC code) companies relative to the firm's board size. The outbound overlapping director is the board member who is appointed to the board of the focal firm before joining the board of other firms. Source: BoardEx and Compustat
Inter_ OvLapDir	The percentage of inter-industry overlapping directors on a firm board. It is calculated as the number of overlapping directorships a firm has with external firms assigned to different three-digit SIC code, then divided by the number of board directors on the firm's board. Source: BoardEx and Compustat
CO	The percentage of intra-industry firm pairs with at least one common shareholder, which is defined as holding at least 1% of equity ownership in any firm of a pair. Source: Thomson Reuters 13F
Pair HPSS	Product similarity is developed in Hoberg and Phillips (2016, 2018). It is based on the textual similarity of product description in regulatory filings of two firms in a pair. Source: Hoberg and Phillips (2016, 2018)
Pair SpillHP	Competitive spillovers within a firm pair. It is calculated as the product similarity multiplied by the average R&D stock of two firms in a pair. Product similarity is developed in Hoberg and Phillips (2016, 2018). It is based on the textual similarity of product description in regulatory filings of two firms in a pair. Source: Hoberg and Phillips (2016, 2018) and Compustat
Pair SpillTECH	Technology spillovers within a firm pair. It is calculated as the technology similarities multiplied by the average R&D stock of two firms in a pair. Technology similarities is estimated using the method outlined in Jaffe (1988). It is based on the share of patents of two firm in any given technology field. Source: Kogan *et al* (2017) and Compustat
Pair Intra_ OvLapDir	A dummy variable that is one if a pair shares an intra-industry overlapping director. Source: BoardEx and Compustat.
Pair COW	A dummy variable that is one if the incorporating states of both firms in a pair are covered by the COW legislation in a year. Source: Compustat
Pair ln(Assets)	The log of the combined total assets of both firms in a year. Source: Compustat
Pair Tangibility	The equal-weighted average of *Tangibility* of both firms in a pair. Source: Compustat
Pair MTB Ratio	The equal-weighted average of *MTB Ratio* of both firms in a pair. Source: Compustat
Pair R&D Intensity	The equal-weighted average of *R&D Intensity* of both firms in a year. Source: Compustat

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T +41 22 379 84 71, rps@sfi.ch, www.sfi.ch

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