Essays on ESG, Shareholder Activism and Voluntary Programs

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Essays on ESG, Shareholder Activism and Voluntary Programs

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Essays on Essays on ESG, Shareholder Activism and Voluntary Programs

Chapter 1 examines whether—in the absence of mandated disclosure requirements—shareholder activism can elicit greater disclosure of firms' exposure to climate change risks. We find that environmental shareholder activism increases the voluntary disclosure of climate change risks, especially if initiated by institutional investors, and even more so if initiated by long-term institutional investors. We also find that companies that voluntarily disclose climate change risks following environmental shareholder activism achieve a higher valuation post disclosure, suggesting that investors value transparency with respect to firms' exposure to climate change risks.

Chapter 2 studies the incredible investment challenge that common owners face: managing systematic risk. Because common owners hold shares in multiple firms across an industry, an action (or inaction) by one firm that affects industry peers is felt more severely by common owners than by non-common owners. Drawing on research showing that one firm's corporate social responsibility (CSR) can produce positive spillovers for peer firms and that its irresponsibility can harm its peers, we argue that common owners increase firms' CSR to produce spillovers that reduce systematic risk and multiply their investment returns. Consistent with our theory, we find that common ownership is positively associated with firm CSR. Unpacking that relationship, we find that increases in CSR are driven by common owners with long-term orientations and are concentrated in stake-holder sensitive industries, in which CSR spillovers are most economically impactful. We also find that common owners focus their efforts on financially material CSR over financially immaterial CSR. We use a natural experiment with a quasi-exogenous shock to rule out alternative explanations.

Chapter 3 studies the voluntary program called the OHSAS 18001 Occupational Health and Safety Management system standard. Millions of companies around the world have adopted management system standards like OHSAS 18001 to both convey superior operational performance and to improve their operations. Yet because these standards impose requirements on operational processes and procedures, it is largely unknown whether adopting these standards actually bears any relationship with operational performance. We examine this question in the context of OHSAS 18001. Analyzing proprietary certification data from some of the world's largest certification companies and injury microdata from the U.S. Bureau of Labor Statistics, we find that U.S. establishments certified to the OHSAS 18001 standard indeed tend to be safer workplaces. The OHSAS 18001 standard attracts establishments with fewer injury and illness cases than comparable non-adopters (a selection effect), and certification leads to subsequent declines in such cases (a treatment effect). These results provide rare evidence the adoption of a management system standard serves both as a credible indicator of superior operational performance, as well as a means to improve performance.

TABLE OF CONTENTS

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Shareholder Activism and Firms' Voluntary Disclosure of Climate Change Risks

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INTRODUCTION

Managers increasingly face shareholder pressure to disclose and manage their exposure to climate change risks. For example, in May 2017, the shareholders of ExxonMobil voted for a comprehensive assessment of risks related to climate change (*New York Times*, 2017*)*. Shareholders of Occidental Petroleum Corporation, PPL Corp, and many other companies have also demanded greater disclosure of climate change risks (*Wall Street Journal*, 2018a). More generally, companies faced a record number of climate-related shareholder proposals at their 2019 shareholder meetings (*Wall Street Journal*, 2019). This increase in shareholder pressure is not only reflected in the exploding number of shareholder proposals submitted, but also in the increasing shareholder support and approval rates (Flammer, 2015; *Wall Street Journal,* 2018a).

One reason for this surge in climate-related shareholder activism is the growing recognition of increased costs and risks associated with climate change (*New York Times*, 2018, 2020; World Economic Forum, 2020). Many companies—from Silicon Valley tech firms to European financial institutions—are increasingly bracing for the direct and indirect impacts of climate change on their bottom lines, as extreme weather conditions pose major risks to their operations and supply chains (CDP, 2016; *New York Times*, 2019).[1] Given the global reach of climate change, firms across industries and regions are exposed to climate change risks, regardless of their own emission levels.

[1] For example, flooding and fiercer storms recently disrupted U.S. drug maker Eli Lilly's manufacturing facilities in Puerto Rico after Hurricane Maria in 2017. The Japanese manufacturer Hitachi Ltd. reports that increased rainfall and flooding in Southeast Asia could disrupt its supply chain. Banco Santander Brasil, a large Brazilian bank, anticipates that increasingly severe droughts might hurt borrowers' ability to repay loans. Pacific Gas and Electric (PG&E),

The second reason for climate-related shareholder activism is the fact that, in many countries (including the U.S.), the disclosure of nonfinancial information is not mandated by law. For example, the U.S. Securities and Exchange Commission (SEC) currently merely recommends that companies disclose their climate change risks, but neither mandates such disclosure nor offers any guidance on what information to provide.[2] As a result, companies often provide limited (if any) information.[3]

For the above reasons, it is not surprising that investors incorporate the climate risk exposure of their portfolio companies into their decision-making and are increasingly vested in companies' disclosure of climate risks and their efforts to manage those risks (Ceres, 2018; *Financial Times*, 2017, 2018, 2020; Krueger, Sautner, and Starks, 2020; *New York Times*, 2017; *Wall Street Journal*, 2018a, 2019).[4] In fact, a recent survey of 439 institutional investors paints a

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California's largest electric utility, faces increased wildfire risk, partly driven by global warming. In fact, the company was held liable (facing at least $30 billion in fire liabilities) for the disastrous 2018 California wildfire—the deadliest to date—and filed for bankruptcy protection in early 2019 (*Forbes*, 2019). Google's parent company, Alphabet Inc., expects that rising temperatures could increase the cost of cooling its energy-intensive data centers. All these examples feature direct impacts of climate change. In addition, climate change may also hurt companies indirectly. For example, energy companies face a significant financial risk of so-called "stranded assets"—coal, oil, and gas reserves that companies list as part of their assets, but might in fact be worthless, since those reserves may never be drilled but instead be left stranded due to stricter regulations intended to curb climate change (e.g., *Financial Times*, 2015; *Fortune*, 2015). Such assets also include buildings in high-risk flood zones, power plants that may need to shut down, etc. (*New York Times*, 2019).

[2] While the SEC requested public feedback in 2016 about potentially changing the climate-related risks required for disclosure in SEC filings, action on this front has stalled since President Donald Trump's election that year. The discussion around mandatory disclosure of climate change risks has since regained traction with several Democratic presidential candidates in 2019 putting forward proposals on how to address climate change (*Politico*, 2019).

[3] As Ho (2018) highlights, federal securities law requires public companies to disclose in their annual reports "material risk factors, material impacts of risk events, and known future trends or uncertainties that are reasonably likely to affect the companies' financial performance" (p. 411). Hence, in principle, companies should already disclose nonfinancial information that is material to investors. Yet, as Ho further notes, "because these disclosure rules do not specifically address nonfinancial risk and because some issuers do not believe this information to be material to investors under any circumstances, investors increasingly are dissatisfied with the limited nonfinancial information companies currently provide in their financial reports" (p. 411).

[4] This increase in investors' interest in the disclosure of climate risk information—and ESG (environmental, social, and governance) information more generally—is also reflected in the rapid increase in the number of signatories of the United Nations' Principles for Responsible Investment (PRI) network. Launched in 2016, this network has grown to over 3,000 signatories and $100 trillion in assets under management in August 2020. Similarly, the Coalition for Environmentally Responsible Economies (Ceres) reports that concerns about environmental and social risks increasingly influence investors' decision-making—in 2016, responsible investment accounted for 26 percent, or $22.89 trillion, of all professionally managed assets globally—and investors pay close attention to corporate disclosure

striking picture: the majority believe that climate risk reporting is *as important as* financial reporting, and one-third believe that climate risk reporting is *even more important* (Krueger *et al*., 2020).

Despite the growing importance of climate change risks, little is known about companies' exposure to climate change risks, their disclosure of such risks, and what strategic actions they take to manage and mitigate those risks. Instead, scholarly attention has focused on the participation in voluntary initiatives (e.g., the Climate Leaders Program) and the disclosure of greenhouse gas emissions (e.g., Fisher-Vanden and Thorburn, 2011; Jira and Toffel, 2013; Kim and Lyon, 2011a, 2011b; Krueger, 2015a; Lewis, Walls, and Dowell, 2014; Lyon and Maxwell, 2011; Matisoff, 2013; Reid and Toffel, 2009). Yet, a firm's carbon footprint and participation in climate-related initiatives are very different from a firm's exposure to climate change risks. The latter pertains to the threat of damage, injury, liability, loss, or any other harm to the company that could be caused by climate-related events. In particular, climate change risks include physical risks (such as flooding, fierce storms, drought, and extreme temperatures), regulatory risks arising from current and expected governmental policies related to climate change (such as energy efficiency standards and carbon trading schemes), and other climate-related risks (such as reputation, changing consumer behavior, and increasing humanitarian demands).[5] Importantly, firms across industries face exposure to climate change risks, *regardless* of their own emission levels.[6]

This study advances the literature by focusing on firms' exposure to climate change risks. Specifically, we theoretically and empirically examine whether, in the absence of public governance, private governance—in the form of shareholder activism—can elicit greater

informing them about companies' climate risk exposure and strategies to address these risks (Ceres, 2018).
[5] See CDP (2016) for a detailed characterization of climate change risks.
[6] A case in point is the insurance industry, which faces tremendous exposure to climate change risks despite its low emission levels (see, e.g., *Wall Street Journal*, 2018b).

disclosure of firms' exposure to climate change risks along with information on how firms are managing those risks (henceforth "climate risk information").[7] We further explore the heterogeneity among shareholders, characterizing which shareholders are particularly effective in eliciting such disclosure. Finally, we examine the valuation implications to assess whether investors value the disclosure of climate risk information.

To conduct the analysis, we merge a novel proprietary dataset from CDP (formerly, the Carbon Disclosure Project) on the disclosure of climate risk information with the Institutional Shareholder Services (ISS) database that compiles information on shareholder activism. Consistent with our arguments, we find that environmental shareholder activism (measured by the number of environment-related proposals submitted by the firm's shareholders) induces managers to voluntarily disclose climate risk information. We further find that environmental shareholder activism is particularly effective if it is initiated by institutional investors, and even more so if it is initiated by institutional investors that have a long-term horizon. Finally, we find that companies that voluntarily disclose climate risk information following environmental shareholder activism achieve a higher valuation post disclosure, suggesting that investors value the voluntary disclosure of the firm's exposure to climate risks. Overall, our findings highlight shareholders' ability to elicit greater disclosure of climate risk information, and further indicate that such disclosure is valuable to investors.

In the analysis, we consider the potential endogeneity of environmental shareholder activism with respect to climate risk disclosure. Because environmental shareholder activism is

[7] Anecdotal evidence suggests that shareholder activism can indeed elicit the disclosure of climate risk information. For example, *CNN Business* (2017) describes the recent volte-face of ExxonMobil as follows: "ExxonMobil has agreed to reveal the risks it faces from climate change and the global crackdown on carbon emissions. It's a major reversal for the world's biggest publicly traded oil company. Exxon aggressively fought a shareholder proposal in May to disclose how the changing climate could hurt the company. The proposal wasn't binding, but 63% of shareholders supported it—a rare rebuke that forced Exxon to rethink its stance."

not randomly assigned to companies, it might be correlated with unobservables that also affect climate risk disclosure. To address this concern, we exploit the fact that shareholder activism often comes in "waves": a given shareholder adopts an agenda and submits the same proposal to all firms in her portfolio. In such cases, the active shareholder targets a wide set of firms (regardless of their characteristics)—that is, the targeting itself is plausibly exogenous with respect to any specific firm characteristics. Our results continue to hold when using such "waves" as instrument, suggesting that they are unlikely to be driven by endogeneity.

This study contributes to several strands of the literature. First, as mentioned above, by examining the disclosure of firms' *exposure to climate change risks*, we complement the literature that studies the disclosure of firms' *environmental impact* (e.g., Kim and Lyon, 2011b; Lewis *et al*., 2014; Marquis, Toffel, and Zhou, 2016). Second, by studying the *voluntary* disclosure of firms' climate change risk exposure, we add to the literature that examines the *mandatory* disclosure of firms' nonfinancial information (e.g., Ioannou and Serafeim, 2019; Krueger, 2015a). Third, this study contributes to the strategy and management literature that examines how shareholders shape corporate behavior (e.g., Chen and Feldman, 2019; DesJardine and Durand 2020; Reid and Toffel, 2009; Wiersema, Ahn, and Zhang, 2020). While this literature typically considers shareholders as one homogenous group, or only considers one specific subset of shareholders (e.g., hedge funds), our study accounts for the heterogeneity among shareholder types and examines how these differences influence corporate behavior.

Finally, the findings of this study have important implications for practice. In particular, they highlight investors' ability to elicit greater corporate transparency with respect to climate change risks and thereby contribute to their portfolio companies' governance. In absence of mandatory disclosure requirements, this greater ability also implies that investors have a greater

responsibility to be active owners and engage with their portfolio companies to elicit the disclosure of their climate risk exposure.

THEORY

Voluntary disclosure of climate risks as a governance issue

Disclosing climate risk information provides companies with several benefits, but also has downsides. First, one benefit is that transparency can increase firms' accountability in the public's eye and, as a result, strengthen their commitment to manage and mitigate these risks going forward. Second, transparency allows the firms' investors, business partners, and other stakeholders to engage with the disclosing firms in a more informed fashion, enabling them to be more effective in helping them manage and mitigate their climate risks. For example, they may advise firms to diversify their supplier base across geographic regions to minimize disruptions due to severe weather events, or advise them to shift their product mix towards energy-efficient products to cater to changing consumer preferences, improve their reputation, and comply with current or expected future governmental climate policies. Third, transparency can foster trust, allowing companies to strengthen their (long-term) relationships with investors and other stakeholders. As these examples illustrate, the disclosure of climate risk information—describing the firm's exposure to climate risks as well as the firm's efforts to manage and mitigate these risks—can improve the governance of the firm, which in turn can contribute to the firm's long-term value.

On the other hand, the disclosure of climate risk information also has potential downsides. In particular, it may reveal vulnerabilities that companies would prefer to keep from investors, competitors, customers, and other stakeholders. These vulnerabilities may include risks pertaining to the damage, injury, liability, loss, or any other climate-related harm to the company. For example, the disclosure may reveal the firm's exposure to extreme temperatures and weather

events (such as flooding, hurricanes, droughts, and wildfires) that can disrupt the firm's operations and supply chain, inhibit borrowers' ability to repay loans, increase costs for heating and cooling, and so forth (e.g., *Forbes*, 2019). Furthermore, the disclosure may reveal the firm's financial risk associated with so-called "stranded assets"—that is, assets that are listed in the books, but might in fact need to be written off or retired early as they may be left stranded due to stricter regulations intended to curb climate change. Such assets include buildings in high-risk flood zones, power plants that may need to be shut down, and fossil fuel reserves (coal, oil, and gas) that may never be drilled due to stricter regulations, among others (e.g., *Financial Times*, 2015; *Fortune*, 2015; *New York Times*, 2019).

In addition to revealing potential vulnerabilities, disclosing climate risk information entails direct costs. Firms need to dedicate human capital to compiling and reporting information about the climate change risks they face, along with their strategies to address them. Arguably these costs are especially high for firms that are not yet aware of their own climate risk exposure and need to first conduct a thorough assessment of the physical risks, regulatory risks, and market risks that climate change poses to their business, and then incorporate this assessment into their risk management and business plans to better manage and mitigate their climate risk exposure going forward.

From the management's perspective, another potential downside of disclosing climate change risks is that investors, business partners, and other stakeholders may respond to the disclosed information in a way that hurts the company. For example, investors might use this information to rebalance their portfolios, reallocating funds away from the disclosing company to other companies with more favorable risk-return profiles. Relatedly, suppliers and corporate clients might decide to sever their relationship with the disclosing company, and instead shift their focus

to other companies that are less exposed to climate risks and hence appear to be more viable business partners in the long run. In sum, considering the potential downsides of disclosure, managers might be reluctant to disclose their firm's exposure to climate risks.

We expect this reluctance to disclose climate change risks to be further accentuated by the temporal separation between the potential downsides (which tend to occur primarily in the short run) and upsides (which tend to materialize in the long run) of disclosing climate risk information. A large literature in psychology and economics suggests that individuals are "hyperbolic discounters," that is, they have an excessive preference for the present, preferring short-term rewards over long-term rewards even if the latter are substantially higher (e.g., Ainslie 1975; Frederick, Loewenstein, and O'Donoghue, 2002; Loewenstein and Prelec, 1992; O'Donoghue and Rabin, 1999; Thaler and Shefrin, 1981). This preference for short-term results is likely reinforced for executives as they face short-term pressures, such as career concerns (e.g., Gibbons and Murphy, 1992) and pressures to meet or beat analysts' quarterly earnings expectations (e.g., DeGeorge, Patel, and Zeckhauser, 1999). As a result, managers tend to favor investments that pay off in the short run at the expense of long-term investments (e.g., Graham, Harvey, and Rajgopal, 2005; Holmstrom, 1999; Stein, 1988, 1989). It follows that shareholders face a "time-based agency conflict" (Flammer and Bansal, 2017)—that is, managers have an excessive preference for the present, and hence might not act in shareholders' (long-term) best interest. This time-based agency conflict implies that managers will likely put more weight on the potential short-term downsides of climate risk disclosure, as opposed to the potential long-term upsides of managing and mitigating climate risks.

A second implication of this time-based agency conflict is that managers may focus their attention on stakeholders that have short-term financial performance implications (e.g., customers

and employees) at the expense of stakeholders that may be financially material to the company's operations in the long run but not necessarily in the short run (e.g., communities and the natural environment).[8] Accordingly, as managers devote less attention to the natural environment, they may simply be unaware of the risks climate change poses to their business.

Taken together, the above arguments suggest that, in the absence of public governance, managers may prefer to not disclose their company's exposure to climate change risks. In the following, we explore circumstances under which *private* governance—through pressure from different types of shareholders—might induce companies to nevertheless disclose their climate change risks.

Shareholder activism and the voluntary disclosure of climate risk information

To mitigate the gap between what investors demand and what companies provide, investors can exert pressure through shareholder activism demanding managerial actions such as the re-assessment of organizational practices and the disclosure of information. Indeed, investors often pressure managers to disclose and address social and environmental issues and this pressure has increased over the years (e.g., Flammer, 2015).

A priori, it is far from obvious whether shareholders can trigger myopic managers to voluntarily disclose climate risk information since most shareholder proposals receive little support at annual meetings.[9] In other words, the majority of shareholders tend to vote against shareholder-sponsored resolutions. Accordingly, one might expect management to pay little attention, if any, to the demands of those few shareholders sponsoring and supporting the

[8] For a similar characterization of the different types of stakeholders, see, for example, Eesley and Lenox (2006), Flammer, Hong, and Minor (2019), and Mitchell *et al*. (1997).
[9] This is a common feature of shareholder proposals. For example, Flammer (2015) finds that the average vote outcome for SRI (socially responsible investing) proposals is 13.5% (p. 2553). Similarly, Cuñat, Giné, and Guadalupe (2012) find that the average shareholder vote on governance proposals is 36.2% (p. 1949).

proposals, and instead maintain their practice of not disclosing the firm's exposure to climate change risks or how the firm is managing them. On the other hand, it could also be that—despite low support at annual meetings—environmental shareholder activism does trigger companies to disclose climate risk information. In the following, we discuss two potential reasons: environmental shareholder activism may (a) trigger a re-evaluation of the up- and downsides of climate risk disclosure, and (b) increase management's awareness of the firm's exposure to climate risks.

First, despite the low support that shareholder proposals garner, studies indicate that shareholder activism—pertaining to a wide range of subject matters (e.g., executive compensation, antitakeover provisions, social and environmental practices)—can nevertheless be impactful and induce management to re-evaluate and adjust their business practices in line with the aims of the proposals (e.g., Cuñat, Giné, and Guadalupe, 2012; Flammer, 2015; Flammer and Bansal, 2017; McDonnell, King, and Soule, 2015; Vasi and King, 2012).[10] In this spirit, environmental shareholder activism may induce managers to reassess the pros and cons of disclosing their company's climate risk exposure, putting more weight on the pros, and less weight on the cons.

In particular, following shareholders' demand for climate risk disclosure, managers may reconsider the potential upside of complying with the investors' demands, putting more weight on the benefits of communicating to investors the firm's exposure to climate risks and their strategic plans to better manage and mitigate these risks going forward. Such improved transparency is likely valued by investors, as it helps strengthen investors' trust and their relationship with the disclosing company, allowing them to engage with the management in an informed manner and

[10] Relatedly, other environmental activist campaigns (such as boycotts, protests, and private politics) are found to improve firms' environmental practices (Lenox and Eesley, 2009) and elicit greater corporate transparency (Reid and Toffel, 2009).

provide advice on how to best move forward in managing and mitigating these risks.

Similarly, when pressured by their shareholders, managers may put less weight on the downside of disclosing climate risk information and revealing potential vulnerabilities. Arguably, shareholders who express concerns about climate change risks and demand higher transparency in this regard may do so in a collaborative fashion, being primarily interested in knowing that the firm is indeed aware of its climate risk exposure and takes actions to mitigate these risks (as opposed to using this information to reallocate funds away from the company).

Second, environmental shareholder activism may increase managers' awareness of the firm's exposure to climate risks. Specifically, environmental shareholder activism may induce managers to pay (more) attention to the natural environment—a stakeholder that myopic managers might otherwise neglect (Flammer *et al*., 2019)—making them more aware of the firm's vulnerability to climate change risks. In turn, this could induce managers to conduct an assessment of the firm's exposure to climate change risks; incorporate these data into the firm's risk management and strategic plans to better manage and mitigate these risks going forward; and disclose the firm's climate risk information to the public.

Taken together, the above arguments suggest that companies are more likely to disclose climate risk information when facing shareholder pressure. This motivates our baseline hypothesis:

> *Hypothesis 1. Environmental shareholder activism increases companies' voluntary disclosure of climate change risk information.*

Heterogeneity in shareholders demanding climate risk disclosure

Investors are not one homogenous group. Rather, there is considerable heterogeneity in terms of their objectives, preferences, and time horizons, among others. These differences are likely to have important implications for their interactions with their portfolio companies. In the

following, we refine our arguments and explore how the effectiveness of shareholder activism to induce the disclosure of climate change risk information depends on the active shareholders' characteristics. That is, we decompose the effect of shareholder activism on the disclosure of climate change risks by investor type.

Institutional investors

A company's investor base consists of institutional and non-institutional investors. In contrast to non-institutional investors, institutional investors (such as asset management funds, hedge funds, mutual funds, and public pension funds) tend to hold large stakes in their portfolio companies—which makes them particularly vulnerable to their portfolio companies' climate risk exposure—and often have dedicated staff members who monitor them.

As such, institutional investors have both incentives and resources to identify governance issues, including those pertaining to the disclosure of climate change risks, raise these issues to the management's attention, and provide advice on how to address these issues. Moreover, they are better able to mobilize other shareholders and garner support for their proposals, further increasing their ability to pressure the management. For these reasons, we expect institutional investors to play an important role in their portfolio companies' decision to disclose climate risk information.

These arguments are in line with the existing literature's finding that institutional investors tend to actively monitor and engage with their portfolio companies, playing a leading role in shaping their governance (e.g., Bethel and Liebeskind, 1993; Chen, Dong, and Lin, 2020; Dimson, Karakas, and Li, 2015; Gillan and Starks, 2000; Ilhan *et al*., 2019; Krueger *et al*., 2020; Shleifer

and Vishny, 1986).[11] Furthermore, shareholder proposals initiated by institutional investors tend to receive more support among other shareholders (e.g., Flammer, 2015; Gillan and Starks, 2000).

In contrast, non-institutional investors have weaker incentives and often lack the necessary resources to monitor and actively engage with the management, as they tend to be smaller, more resource-constrained, and can free-ride on the monitoring and costly engagement of institutional investors (Grossman and Hart, 1980; Shleifer and Vishny, 1986). Moreover, even if they do actively engage with the management, they are likely less able to coordinate with other shareholders and garner broad support for their shareholder proposals (Gillan and Starks, 2000).

Taken together, these arguments suggest that institutional investors are likely to be more effective in inducing their portfolio companies to disclose climate-related risks. Their influence is likely reinforced by the potential downside of not addressing their demands. Failing to disclose climate risk information may lead institutional investors to sell their shares and rebalance their portfolios toward companies that are willing to disclose climate risk information. Even if disclosing climate risk information reveals vulnerabilities that the companies would prefer to keep private, the downside of not complying with the demands of institutional investors may be higher, tilting the balance closer towards disclosure.

In sum, we expect that environmental shareholder activism initiated by institutional investors is more likely to induce managers to report on the firm's climate risk information. This motivates the following hypothesis:

[11] See also the related literature on hedge fund activism that examines the various ways in which hedge funds pressure the management to rectify potential inefficiencies (e.g., Chen and Feldman, 2018; DesJardine and Durand, 2020; Wiersema *et al.*, 2020). As mentioned above, hedge funds are one specific example of institutional investors. A distinguishing feature of hedge fund activism is that hedge funds often acquire large ownership stakes in companies they believe are being mismanaged (and hence undervalued), and then pressure the management to take corrective action in an effort to increase the firm's valuation and hence generate high investment returns.

Hypothesis 2. Companies are more likely to voluntarily disclose climate change risk information if the environmental shareholder activism is initiated by institutional investors.

Institutional investors' time horizons

Institutional investors differ in their time horizons. In particular, "transient" investors tend to hold companies' stocks on a short-term basis (e.g., driven by speculation motives), while long-term investors hold stocks for a longer period of time, taking a vested interest in the companies' long-term success (Bushee, 1998, 2001; Gaspar, Massa, and Matos, 2005). In the following, we decompose the effect of institutional investors on the disclosure of climate change risks by the institutional investors' time horizon. We expect that shareholder activism initiated by long-term institutional investors is more effective in inducing the management to voluntarily disclose climate change risk information (compared to shareholder activism initiated by short-term institutional investors). The rationale is twofold.

First, when the activism is initiated by long-term institutional investors, we expect managers to put less weight on the short-term downsides of climate risk disclosure. As long-term institutional investors tend to hold stable portfolios, they are less likely to withdraw their funds in the short run upon the announcement of negative information (Starks, Venkat, and Zhu, 2017). Instead, they take a vested interest in improving the firms' business practices and are more inclined to actively engage with their portfolio companies in order to improve corporate governance and the long-term value of the firm (Krueger *et al*., 2020; Neubaum and Zahra, 2006). Building on these insights, we expect that long-term institutional investors are less likely to reallocate their holdings away from the disclosing companies in case the disclosure reveals unexpected vulnerabilities to climate risks. Accordingly, management is less likely to face an "exit" (that is, a divestment) of these investors in case the voluntarily disclosed information on climate risks sheds

a negative light on the company, which mitigates the potential downside of disclosing climate change risks. Moreover, managers are likely to put more weight on the long-term upsides of disclosure given that long-term institutional investors have a vested interest in the company's long-term success. When demanding the disclosure of climate change risk information, long-term institutional investors are more likely to do so for the sake of being informed and in an effort to help their portfolio companies develop strategies to manage and mitigate their climate risk exposure going forward. This, in turn, elevates the potential upside of disclosure.

Second, shareholder activism initiated by long-term institutional investors might trigger managers to pay more attention to the natural environment, thereby increasing their awareness of the potential impact of climate change on their organization, and inducing them to invest resources in the assessment, management, and disclosure of their climate risk exposure. Indeed, climate change is an especially complex issue and—despite extensive scientific evidence—it has been disputed by climate change deniers and other vocal critics.[12] Given the complex and contested nature of climate change, we expect that management is more likely to listen to shareholder demands and consider the disclosure of their climate risk information if brought forward by shareholders whose interests are more closely aligned with the firm's ability to thrive in the long run.

In sum, we posit that the requests of long-term institutional investors are likely more effective in eliciting the voluntary disclosure of climate change risk information. This leads to the following hypothesis:

[12] See, e.g., the scientific controversy as to whether East Antarctica is gaining or losing mass, summarized in *Scientific American* (2017).

Hypothesis 3. Companies are more likely to voluntarily disclose climate change risk information if the environmental shareholder activism is initiated by long-term institutional investors.

DATA

Data sources

Climate change risk disclosure

The data on climate change risk disclosure are obtained from CDP (formerly, Carbon Disclosure Project), a nonprofit organization based in London. Each year, CDP asks large public companies to disclose information about the risks and opportunities posed by climate change, their strategies to address them, and other environment-related information. By participating in this process, companies are able to voluntarily disclose information to investors in a structured fashion. In 2016, 67 percent of the S&P 500 companies disclosed at least some of this information to CDP. We obtained annual CDP data for the years 2010–2016, the time frame during which the CDP survey consistently asked about climate risk information. We focus on S&P 500 companies because this is the sole overlap between the coverage of CDP and that of Institutional Shareholder Services, described next.

Shareholder activism

The data on shareholder activism are obtained from the Institutional Shareholder Services (ISS) database. ISS compiles information about shareholder proposals that were submitted to S&P 1,500 companies from 1997 onward. The database distinguishes between shareholder proposals on governance topics and those on socially responsible investing (SRI) topics. For each proposal, the database provides a description of the proposal, the date of the annual meeting, the proposal's sponsor, the voting requirement, and several other attributes.

In our baseline analysis, we restrict the sample to firms that are targeted by SRI proposals

during the sample period. For each firm, we include the years within 2010–2016 that range from its earliest SRI proposal through its most recent one. This approach ensures that the firms in our sample face a credible risk of being the target of SRI-related shareholder activism.[13] Our baseline sample consists of 1,110 firm-year observations pertaining to 265 U.S. public firms.

Definition of variables

Dependent variable

In the CDP questionnaire (question CC5.1), companies are asked to disclose information on three types of climate change risks: 1) regulatory risks, 2) physical risks, and 3) other risks. *Regulatory risks* arise from current and expected (local, national, or global) governmental policy related to climate change; for example, the imposition of emissions limits, energy efficiency standards, and carbon trading schemes. *Physical risks* are those arising from extreme weather events or subtle changes in weather patterns. *Other risks* include, among others, reputation, changing consumer behavior, induced changes in human and cultural environments, fluctuating socio-economic conditions, and increasing humanitarian demands. (For more details on these three types of risk, see CDP, 2016.) For each type of climate risk they disclose, companies are asked to describe the risk and its potential impact; characterize its timeframe, likelihood, and magnitude of impact; estimate its financial implications before taking mitigating actions; and describe how the risk is being managed and the costs associated with those actions.

Our main dependent variable, *disclosure of climate change risks*, counts how many of these three climate change risks the company discloses (that is, it ranges from 0 to 3). In auxiliary

[13] Our results are not sensitive to this criterion. In robustness checks, we obtain similar results when we use the broader sample of firms that are targeted by either governance or SRI proposals. In principle, we could further expand the sample by including firms that are never targeted by shareholder proposals. Yet such firms are unlikely to provide an appropriate comparison group; for those firms, the notion "shareholder activism" is not well defined as they do not have active shareholders in the first place.

analysis, we examine each disclosure category separately by using individual indicator variables for the disclosure of regulatory, physical, and other climate change risks, respectively.

Independent variables

We measure *environmental shareholder activism* as the number of environment-related shareholder proposals a company faces in a given year. Specifically, we consider all shareholder proposals in ISS for which the field "resolution type" is "SRI" (socially responsible investment), and read the description of these proposals to determine which are environment-related. In our baseline sample, 33 percent of the 1,110 firm-year observations have at least one environment-related shareholder proposal (the maximum is five).

We also distinguish between environmental shareholder activism exerted by institutional investors—investors who tend to hold large stakes and actively monitor the companies they invest in—and by non-institutional investors, who are often smaller, individual investors. We code proposal sponsors as non-institutional if the field "sponsor type" in ISS is "individual," "union," "religious," or "other." All other sponsor types are coded as institutional; this includes public pension funds, SRI funds, special interest investors, and asset management funds.[14]

We further divide institutional investors into those with a long-term or short-term horizon. We categorized all SRI investors and special interest investors as long-term since they are unambiguously long-term given their mandate. For all other institutional investors (such as asset management funds), we use Thomson-Reuters 13F data to calculate investors' quarterly churn rate, which is the extent to which they rebalance their portfolio each quarter.[15] Intuitively, investors

[14] As a robustness test, we consider an alternative way of distinguishing between non-institutional and institutional investors. Specifically, we classify individuals as non-institutional (i.e., investors for which the field "sponsor type" in ISS is "individual"), and all other investors as institutional. This broader definition of institutional investors yields very similar results.

[15] The quarterly churn rate (CR) for investor *i* in quarter *t* is computed using the following formula (Gaspar *et al*., 2005, p. 143):

who frequently rebalance their portfolio (i.e., high churn rate) have a shorter holding period and hence a shorter time horizon. We then calculate each investor's annual average churn rate, and categorize those above the average churn rate as short-term investors, and those below as long-term investors (Gaspar *et al*., 2005).[16] For those institutional investors in the ISS data that could not be matched to the Thomson-Reuters 13F data, we create an additional category, "institutional shareholders with unknown temporal horizon."

It is important to note that most of the proposals are defeated in shareholder meetings. This is a common feature of shareholder-sponsored (as opposed to management-sponsored) proposals (see Cuñat *et al*., 2012; Flammer, 2015). Nevertheless, shareholders often submit proposals not so much because they expect them to pass, but rather to bring important issues to the attention of the management (Loss and Seligman, 2004). As such, the very act of submitting an environment-related proposal is intended to pressure management to disclose and address environmental issues.

Controls

All control variables are constructed from Compustat, which we merge to the ISS–CDP dataset by firm-year. *Size* is the natural logarithm of the book value of total assets. *Return on assets* (ROA) is the ratio of operating income before depreciation to the book value of total assets. *Market-to-book* is the ratio of the market value of common stock to its book value. *Leverage* is the

$$CR_{it} = \frac{\sum_{j \in Q} |N_{jit} P_{jt} - N_{jit-1} P_{jt-1} - N_{jit-1} \Delta P_{jt}|}{\sum_{j \in Q} \frac{N_{jit} P_{jt} + N_{jit-1} P_{jt-1}}{2}},$$

where P_{jt} and N_{jit} are the stock price of company j in quarter t, and the number of shares of company j held by investor i in quarter t, respectively.

[16] As a robustness test, we distinguish between short- and long-term institutional investors using Bushee's (2001) classification in lieu of the churn rate. Bushee differentiates between three types of investors: transient, quasi-indexer, and dedicated. We code as short-term institutional investors those that Bushee classifies as "transient," which he defines as institutional owners "characterized as having high portfolio turnover and highly diversified portfolio holdings […] reflect[ing] the fact that transient institutions tend to be short-term-focused investors whose interest in the firm's stock is based on the likelihood of short-term trading profits" (p. 214). Conversely, we code as long-term investors those Bushee classifies as "quasi-indexer" or "dedicated." This alternative approach yields very similar results as the churn rate. This is not surprising, since Bushee's coarser categorization is itself based on the churn rate.

ratio of debt (long-term debt plus debt in current liabilities) to the book value of total assets. *Cash holdings* is the ratio of cash and short-term investments to the book value of total assets. To mitigate the impact of outliers, all ratios are winsorized at their 5th and 95th percentiles.

Descriptive statistics

Table 1 reports summary statistics and correlations. We note the positive correlation between *environmental shareholder activism* and *disclosure of climate change risks*, which is suggestive of Hypothesis 1 (the correlation is 10%, with a *p*-value of 0.002).[17]

[17] Note that several variables are highly correlated in Table 1. For example *disclosure of climate change risks* has an 87% correlation with *disclosure of regulatory climate change risks*. However, none of these highly correlated variables are used in the same regression, which avoids multicollinearity issues.

Table 1. Summary statistics and correlations

		Mean	Std. dev.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Disclosure of climate change risks	2.206	1.161	0	3																				
2	Disclosure of regulatory climate change risks	0.761	0.427	0	1	0.87																			
3	Disclosure of physical climate change risks	0.760	0.427	0	1	0.88	0.65																		
4	Disclosure of other climate change risks	0.685	0.465	0	1	0.89	0.65	0.69																	
5	Environmental shareholder activism	0.341	0.682	0	5	0.10	0.09	0.05	0.11																
	Environmental shareholder activism by…																								
6	… non-institutional investors	0.118	0.407	0	4	0.12	0.10	0.08	0.13	0.68															
7	… institutional investors	0.223	0.505	0	3	0.03	0.05	0.00	0.04	0.81	0.11														
8	… institutional investors with long-term horizon	0.164	0.418	0	3	0.05	0.05	0.02	0.06	0.71	0.10	0.88													
9	… institutional investors with short-term horizon	0.053	0.228	0	2	-0.03	-0.01	-0.04	-0.04	0.40	0.02	0.52	0.08												
10	… institutional investors with unknown temporal horizon	0.006	0.079	0	1	0.04	0.04	0.02	0.05	0.24	0.12	0.24	0.08	0.03											
11	Environmental activism wave (5+ proposals)	0.037	0.189	0	1	0.06	0.05	0.03	0.07	0.28	0.07	0.32	0.29	0.14	0.11										
	Environmental activism wave (3+ proposals) by…																								
12	… non-institutional investors	0.008	0.090	0	1	0.03	0.03	0.00	0.04	0.09	0.20	-0.04	-0.04	-0.02	-0.01	0.36									
13	… institutional investors	0.070	0.256	0	1	0.04	0.05	0.01	0.05	0.42	0.01	0.56	0.51	0.26	0.11	0.58	-0.02								
14	… institutional investors with long-term horizon	0.058	0.233	0	1	0.06	0.06	0.03	0.06	0.38	-0.01	0.52	0.57	0.08	0.08	0.55	-0.02	0.90							
15	… institutional investors with short-term horizon	0.014	0.116	0	1	-0.05	-0.03	-0.06	-0.04	0.20	0.04	0.24	0.03	0.49	-0.01	0.18	-0.01	0.43	0.04						
16	… institutional investors with unknown temporal horizon	0.001	0.030	0	1	-0.01	0.02	-0.05	0.02	0.03	-0.01	0.05	-0.01	-0.01	0.38	0.15	0.00	0.11	-0.01	0.00					
17	Size	10.502	1.332	7.577	14.761	0.02	-0.02	0.05	0.03	0.14	0.18	0.05	0.07	-0.04	0.06	-0.02	0.05	-0.01	0.07	-0.04	0.06				
18	ROA	0.139	0.071	0.018	0.302	-0.03	-0.02	-0.07	0.00	0.05	0.03	0.04	0.02	0.05	0.01	0.07	0.05	0.06	0.02	0.05	0.01	-0.47			
19	Market-to-book	3.297	2.519	0.706	9.971	-0.11	-0.10	-0.12	-0.07	-0.01	-0.06	0.03	0.01	0.06	-0.02	0.04	0.01	0.08	0.01	0.06	-0.02	-0.33	0.60		
20	Leverage	0.256	0.140	0.002	0.579	0.16	0.18	0.09	0.14	0.00	-0.04	0.03	0.03	0.02	-0.03	0.01	0.01	0.05	0.03	0.02	-0.03	-0.04	-0.07	0.14	
21	Cash holdings	0.121	0.110	0.006	0.415	-0.05	-0.09	-0.03	-0.02	-0.14	-0.10	-0.11	-0.11	-0.03	-0.05	-0.02	-0.03	-0.08	-0.11	-0.03	-0.05	-0.02	0.20	0.15	-0.31

Notes. N = 1,110 firm-year observations.

In Table A1 of the Appendix, we report summary statistics for these two variables by industry (partitioned according to SIC divisions). As can be seen, *disclosure of climate change risks* tends to be greatest in mining, manufacturing, and utilities—all industries for which the natural environment is financially material to the firm's operations (based on the materiality scores of the Sustainability Accounting Standards Board (SASB)).[18,19] A similar pattern is found for *environmental shareholder activism*, with the interesting nuance that retail trade is also subject to a high degree of environmental shareholder activism (which likely reflects consumers' sensitivity to environmental issues).[20] Finally, Appendix Table A2 reports summary statistics for these two variables by year, which indicate that both the disclosure of climate change risks and environmental shareholder activism have become more prevalent over the years.

METHODOLOGY

Baseline regression

To examine whether environmental shareholder activism induces firms to voluntarily disclose climate change risks, we estimate the following regression:

$$\begin{aligned} &\textit{disclosure of climate change risks}_{it} \\ &= \alpha_i + \alpha_t + \beta \times \textit{environmental shareholder activism}_{it\text{-}1} + \boldsymbol{\gamma}'\mathbf{X}_{\boldsymbol{it\text{-}1}} + \varepsilon_{it}, \end{aligned} \tag{1}$$

where i indexes firms, t indexes years, α_i are firm fixed effects, and α_t are year fixed effects. All other right-hand-side variables are lagged by one year. **X** is the vector of control variables, which includes *size*, *ROA*, *market-to-book*, *leverage*, and *cash holdings*. ε is the error term. The

[18] For a description of the SASB data, see Khan, Serafeim, and Yoon (2016).
[19] Construction also displays a high disclosure of climate change risks, but represents only a small fraction of the sample.
[20] Note that institutional ownership (measured as the percentage of shares held by institutional owners from the 13F SEC filings) is similar among firms that are targeted by environmental shareholder activism and firms that are not. In our sample, the average institutional ownership is 74.3% for targeted firms, compared to 77.9% for non-targeted firms.

regression is estimated by ordinary least squares (OLS). To account for dependence across firms within the same industry, we cluster standard errors at the industry level. Throughout the analysis, industries are partitioned according to SIC divisions, using the company's primary SIC code from Compustat (which is based on the company's industry that has the largest revenues). The coefficient of interest is β, which captures the change in the voluntary disclosure of climate change risks following environmental shareholder activism.

The inclusion of control variables mitigates the possibility that our findings are driven by omitted variables. For example, it could be that larger companies are more likely to voluntarily disclose climate change risks (e.g., due to more intense public scrutiny) and be targeted by environmental shareholder activism. Controlling for size addresses this potential confound. Similarly, the other controls account for differences in performance (*ROA* and *market-to-book*) and financing policies (*leverage* and *cash holdings*) that may correlate with both the decision to disclose climate change risks and environmental shareholder activism. The inclusion of firm fixed effects accounts for unobserved heterogeneity at the firm level. The inclusion of year fixed effects accounts for any time trend that could influence both the voluntary disclosure of climate change risks and environmental shareholder activism.

Two-stage least squares (2SLS) regression

While the controls and fixed effects help address potential confounds, they do not rule out the possibility that *unobservable* time-varying firm characteristics might drive a spurious relationship between environmental shareholder activism and companies' disclosure of climate change risks.[21] In additional analyses, we alleviate this concern by using an instrumental variable.

[21] For example, firms that adopt a more transparent corporate culture are likely to disclose more information, while at the same time higher transparency might be conducive to more shareholder engagement. Or it could be that firms with better investment opportunities attract more attention from shareholders (who then submit more proposals), while at

To construct an instrument for environmental shareholder activism, we exploit the fact that shareholder activism often comes in "waves." That is, a particular shareholder (such as BlackRock or CalPERS) adopts an agenda (for example, requesting companies to provide a climate risk report) and then submits a similar proposal to all firms in which it has nontrivial holdings (e.g., Gillian and Starks, 2007; Yermack, 2010). In such a case, the active shareholder targets a wide range of firms across industries and geographies, and the shareholder's motive of doing so is orthogonal to (unobservable) characteristics of individual firms. In other words, environment-related proposals that are submitted as part of a wave are more likely to be exogenous with respect to any specific firm characteristics. See also Flammer and Bansal (2017), who use a similar instrument for the submission of long-term compensation proposals.

More precisely, our instrument is an indicator variable equal to one if the company is targeted by a shareholder who submits the same environment-related proposal to at least five companies in the same proxy season (*environmental activism wave*).[22] We then re-estimate model (1) by 2SLS, instrumenting *environmental shareholder activism* with *environmental activism wave* in the first stage.[23]

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the same time these firms can more easily afford to disclose information about their risk exposure.

[22] In robustness checks described below, we show that our results are not sensitive to the five-company cutoff.

[23] Specifically, in the first-stage specification, we regress environmental shareholder activism on the instrument:

$$\textit{environmental shareholder activism}_{it} = a_i + a_t + b \times \textit{environmental activism wave}_{it} + \mathbf{c'X_{it-1}} + e_{it}. \quad (2)$$

The predicted values from this regression provide *environmental shareholder activism (instrumented)*. In the second stage, we then re-estimate equation (1) using *environmental shareholder activism (instrumented)* in lieu of *environmental shareholder activism*:

$$\textit{disclosure of climate change risks}_{it} = \alpha_i + \alpha_t + \beta_{2SLS} \times \textit{environmental shareholder activism (instrumented)}_{it-1} + \boldsymbol{\gamma'}\mathbf{X_{it-1}} + \varepsilon_{it}. \quad (3)$$

Standard errors in the second stage are adjusted for the use of an estimated regressor from the first stage.

RESULTS

Shareholder activism and the voluntary disclosure of climate change risks

In columns (1) and (2) of Table 2, we estimate our baseline specification in equation (1) without and with controls. We find that environmental shareholder activism increases the voluntary disclosure of climate change risks. Specifically, the coefficient of *environmental shareholder activism* is 0.101 (SE = 0.043, *p*-value = 0.043) with controls and 0.103 (SE = 0.045, *p*-value = 0.046) without controls. Since companies in our sample report an average of 2.2 climate change risks (see Table 1), the coefficients of 0.101–0.103 imply that companies increase their voluntary disclosure of climate change risks by 4.6–4.7 percent following the submission of an environment-related shareholder proposal.[24] These results lend support to Hypothesis 1, predicting that environmental shareholder activism increases companies' voluntary disclosure of climate change risks.

[24] In Appendix Table A3, we report similar results when including industry-by-year fixed effects, thereby accounting for any unobservable industry-specific trend (e.g., in terms of stakeholder dependence, exposure to climate change risks, stakeholder awareness toward ESG) that could affect both shareholder activism and the disclosure of climate risk information.

Table 2. Shareholder-induced disclosure of climate change risks

Dependent variable:	Disclosure of climate change risks$_t$	
	(1)	(2)
Environmental shareholder activism$_{t-1}$	0.103	0.101
	(0.045)	(0.043)
Size$_{t-1}$		-0.206
		(0.280)
ROA$_{t-1}$		0.471
		(1.616)
Market-to-book$_{t-1}$		0.024
		(0.021)
Leverage$_{t-1}$		0.989
		(0.551)
Cash$_{t-1}$		1.443
		(0.989)
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Within R-squared	0.12	0.13
# Observations (firm-years)	1,110	1,110
# Firms	265	265

Notes. OLS estimates with standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions.

2SLS analysis

In Table 3, we estimate the 2SLS specification described earlier, using *environmental activism wave* as instrument. As discussed above, if a shareholder targets companies in a wave, the targeting itself is plausibly exogenous with respect to a given individual company.

Table 3. Shareholder-induced disclosure of climate change risks (2SLS)

	First stage		Second stage	
Dependent variable:	Environmental shareholder activism$_{t-1}$		Disclosure of climate change risks$_{t}$	
	(1)	(2)	(3)	(4)
Environmental shareholder activism (instr.)$_{t-1}$			0.337	0.350
			(0.148)	(0.126)
Environmental activism wave$_{t-1}$	0.911	0.913		
	(0.098)	(0.095)		
Size$_{t-1}$		-0.003		-0.196
		(0.073)		(0.227)
ROA$_{t-1}$		-0.234		0.553
		(0.441)		(1.389)
Market-to-book$_{t-1}$		0.016		0.020
		(0.014)		(0.018)
Leverage$_{t-1}$		-0.069		1.020
		(0.475)		(0.464)
Cash$_{t-1}$		0.249		1.435
		(0.625)		(0.834)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
F-statistic (instrument)	85.55	91.90	–	–
Within R-squared	0.11	0.11	0.09	0.10
# Observations (firm-years)	1,110	1,110	1,110	1,110
# Firms	265	265	265	265

Notes. 2SLS estimates with standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions.

We re-estimate the two specifications considered in Table 2 using 2SLS. The first-stage regressions are reported in columns (1) and (2) of Table 3. The coefficient on the instrument (*environmental activism wave*) is 0.911 (SE = 0.098, *p*-value = 0.000) and 0.913 (SE = 0.095, *p*-value = 0.000), respectively. Importantly, the instrument qualifies as "strong" in statistical terms; its *F*-statistic ranges from 85.6 to 91.9, well above the *F* = 10 threshold of Staiger and Stock (1997) and the critical values of Stock and Yogo (2005) for strong instruments.[25] The respective second-stage regressions are reported in columns (3) and (4). The coefficient on *environmental shareholder activism (instrumented)* is 0.337 (SE = 0.148, *p*-value = 0.022) and 0.350 (SE = 0.126, *p*-value = 0.006), respectively. The 2SLS estimates are larger in magnitude than the OLS estimates.[26] Overall, the 2SLS analysis confirms that our results are unlikely to be driven by endogeneity bias.

5.3 Types of voluntary climate change risk disclosure

To explore whether our results vary depending on what types of climate risk are disclosed, we re-estimate our baseline specification, decomposing the dependent variable into three dummy variables indicating the disclosure of climate risk information pertaining to (a) regulatory risks, (b) physical risks, and (c) other risks.

The results, reported in Table 4, indicate that the voluntary disclosure of all three types of climate risk increases in response to environmental shareholder activism. All three point estimates are within the same ballpark (ranging from 0.028 to 0.039, with SEs from 0.014 to 0.019, and *p*-values from 0.022 to 0.098).[27]

[25] Note that the predicted values lie within the range of values of the dependent variable in both specifications.
[26] The standard errors are larger as well, which is intuitive since we rely on a subset of the variation in environmental shareholder activism—namely, the variation triggered by the "wave" component of environmental shareholder activism—and hence we have less power in the regression.
[27] In Appendix Table A4, we report similar results when using logit regressions with conditional fixed effects.

Table 4. Shareholder-induced disclosure of various types of climate change risks

Dependent variable:	Disclosure of regulatory climate change risks$_t$	Disclosure of physical climate change risks$_t$	Disclosure of other climate change risks$_t$
	(1)	(2)	(3)
Environmental shareholder activism$_{t-1}$	0.028	0.039	0.035
	(0.015)	(0.014)	(0.019)
Size$_{t-1}$	-0.038	-0.100	-0.068
	(0.102)	(0.113)	(0.101)
ROA$_{t-1}$	0.278	0.310	-0.117
	(0.541)	(0.387)	(0.759)
Market-to-book$_{t-1}$	0.011	0.006	0.007
	(0.004)	(0.008)	(0.011)
Leverage$_{t-1}$	0.452	0.262	0.275
	(0.217)	(0.205)	(0.231)
Cash$_{t-1}$	0.399	0.447	0.597
	(0.215)	(0.345)	(0.576)
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Within R-squared	0.11	0.13	0.08
# Observations (firm-years)	1,110	1,110	1,110
# Firms	265	265	265

Notes. OLS estimates with standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions.

Shareholder pressure by shareholder type

To examine how the relationship between shareholder activism and climate risk disclosure varies depending on the type of shareholder who initiates the activism, we refine our baseline analysis by decomposing *environmental shareholder activism* by shareholder type.

Institutional versus non-institutional shareholders

In column (1) of Table 5, we distinguish between environment-related shareholder

proposals submitted by institutional versus non-institutional shareholders. The coefficient for institutional shareholders (0.118, with SE = 0.047 and *p*-value = 0.034) is about 17% larger than our baseline estimate in column (2) of Table 2, whereas the coefficient for non-institutional investors (0.062, with SE = 0.075 and *p*-value = 0.429) is about 39% smaller than the baseline estimate.[28] These results are consistent with Hypothesis 2, predicting that shareholder activism initiated by institutional investors is more effective in inducing the disclosure of climate risk information.

[28] Note that, while the difference is large in economic terms, it is less pronounced in statistical terms. The *p*-value of the difference between the two coefficients is 0.498. In the corresponding 2SLS specification provided in column (1) of Table 6, the *p*-value of the difference is 0.511.

Table 5. Shareholder-induced disclosure of climate change risks by type of shareholder

Dependent variable:	Disclosure of climate change risks$_t$	
	(1)	(2)
Environmental shareholder activism by…		
… non-institutional shareholders$_{t-1}$	0.062	0.063
	(0.075)	(0.075)
… institutional shareholders$_{t-1}$	0.118	
	(0.047)	
… institutional shareholders with long-term horizon$_{t-1}$		0.151
		(0.065)
… institutional shareholders with short-term horizon$_{t-1}$		-0.011
		(0.129)
… institutional shareholders with unknown temporal horizon$_{t-1}$		0.286
		(0.189)
Size$_{t-1}$	-0.201	-0.198
	(0.282)	(0.283)
ROA$_{t-1}$	0.502	0.590
	(1.626)	(1.662)
Market-to-book$_{t-1}$	0.024	0.024
	(0.021)	(0.022)
Leverage$_{t-1}$	1.011	1.046
	(0.559)	(0.560)
Cash$_{t-1}$	1.450	1.435
	(0.999)	(0.975)
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Within R-squared	0.13	0.14
# Observations (firm-years)	1,110	1,110
# Firms	265	265

Notes. OLS estimates with standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions.

Long-term versus short-term institutional shareholders

In column (2) of Table 5, we further distinguish between institutional shareholders with long- versus short-term horizons. For long-term institutional investors, the coefficient rises to 0.151 (SE = 0.065, *p*-value = 0.046), which is about 50% larger than our baseline estimate in column (2) of Table 2, while the coefficient is close to zero for short-term institutional investors (coefficient of -0.011, with SE = 0.129 and *p*-value = 0.936).[29] This is consistent with Hypothesis 3, predicting that shareholder activism initiated by long-term institutional investors is more effective in inducing the disclosure of climate risk information.

2SLS specification

In Table 6, we re-estimate the regressions from Table 5, but using 2SLS in lieu of OLS. For each shareholder group, we construct the corresponding wave instrument (using the waves initiated by the respective shareholder group). Given the finer-grained nature of this analysis, we code each wave instrument on the basis of 3+ proposals—as opposed to 5+ in the baseline—to ensure that we have enough waves for each shareholder group.[30] The 2SLS estimates are similar to the OLS results, and continue to lend support to Hypotheses 2 and 3.

[29] The *p*-value of the difference between the two coefficients is 0.327. In the corresponding 2SLS specification provided in column (2) of Table 6, the *p*-value of the difference is 0.167.

[30] In Appendix Table A5, we provide summary statistics for the wave instruments by shareholder groups. Not surprisingly, the bulk of the waves (about 90%) are initiated by institutional investors. Out of those, about 83% are initiated by long-term institutional investors.

Table 6. Shareholder-induced disclosure of climate change risks by type of shareholder (2SLS)

Dependent variable:	Disclosure of climate change risks$_t$	
	(1)	(2)
Environmental shareholder activism by…		
… non-institutional shareholders (instr.)$_{t-1}$	0.115	0.125
	(0.120)	(0.131)
… institutional shareholders (instr.)$_{t-1}$	0.203	
	(0.093)	
… institutional shareholders with long-term horizon (instr.)$_{t-1}$		0.329
		(0.105)
… institutional shareholders with short-term horizon (instr.)$_{t-1}$		-0.290
		(0.117)
… institutional shareholders with unknown temporal horizon (instr.)$_{t-1}$		-0.100
		(0.081)
Size$_{t-1}$	-0.194	-0.173
	(0.236)	(0.224)
ROA$_{t-1}$	0.545	0.817
	(1.375)	(1.399)
Market-to-book$_{t-1}$	0.022	0.021
	(0.018)	(0.020)
Leverage$_{t-1}$	1.032	1.120
	(0.495)	(0.495)
Cash$_{t-1}$	1.451	1.443
	(0.850)	(0.795)
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
F-statistics (instruments)	32.37	15.47
Within R-squared	0.13	0.12
# Observations (firm-years)	1,110	1,110
# Firms	265	265

Notes. 2SLS estimates with standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions.

Robustness

In Appendix A (and Tables A6-A9), we provide several robustness checks that are variants of the specifications in column (2) of Table 2 (pertaining to Hypothesis 1) and columns (1)-(2) of Table 5 (pertaining to Hypotheses 2 and 3), respectively. In a nutshell, we show that our results are robust i) when we consider the dynamics of the relationship between environmental shareholder activism and climate risk disclosure; ii) if we extend the sample to firms targeted by SRI proposals during the sample period; iii) if we use a Poisson regression in lieu of OLS; iv) if we control for firm age and the firm's environmental, social, and governance (ESG) ratings; and v) if we use alternative cutoffs (in terms of the number of proposals) for the wave instrument.

IMPLICATIONS FOR VALUATION

Our results so far indicate that environmental shareholder activism induces companies to disclose climate risk information, thereby improving transparency and mitigating information asymmetries between firms and investors. In this section, we examine how the stock market responds to the (shareholder-induced) disclosure of climate risk information.

Greater transparency about a firm's climate risk information may translate into higher valuation. Indeed, the argument that greater transparency brings about higher valuation has a long tradition in the accounting literature (for a survey, see Healy and Palepu, 2001). The rationale is intuitive—investors dislike uncertainty and are willing to pay a premium for less opaque companies. In this vein, greater transparency with respect to climate change risks can be valuable to investors, as it resolves uncertainty with regard to a potentially important source of risk.[31] Investors gain insights not only on the firm's assessment of its exposure to climate change risks

[31] This argument is in line with the findings of Ioannou and Serafeim (2019) and Krueger (2015a), who document higher valuations following the mandatory disclosure of nonfinancial information.

but also—and perhaps more importantly—on the actual steps it is taking to manage and mitigate its exposure going forward.[32] From this perspective, the stock market may respond positively to the disclosure of climate risk information.

While transparency per se is positively valued by shareholders, the valuation response also depends on whether the disclosed climate risk information (that is, the firm's exposure to climate change risks along with information on how the firm is managing those risks) is better or worse than what investors had anticipated—or simply put, whether the disclosed information is good or bad (unexpected) news. If the disclosed climate risk information is better than expected, investors will update their priors accordingly, which can amplify the positive valuation effect gained from greater transparency.

In contrast, if the disclosed climate risk information turns out to be worse than anticipated, this might dampen the positive valuation effect of greater transparency. Whether or not this will occur is ambiguous because there are two countervailing forces. On the one hand, investors will update upward their perception of the company's risk, which reduces the appeal of holding the company's stock. In fact, some investors (e.g., those that engage in "negative screening" practices) might even divest and reallocate their funds away from the disclosing companies to other companies with a less severe exposure to climate change risks and/or better risk mitigation plans.[33]

On the other hand, by disclosing (unfavorable) climate risk information, firms can convey to their investors that they are well aware of their vulnerability to climate change risks, and that

[32] For example, firms may report that they are diversifying their supplier base across regions to minimize disruptions in case of flooding and fierce storms. Or they may be shifting their product mix towards energy-efficient products to appeal to shifting consumer preferences, improve their reputation, and meet current or expected governmental climate policies. As these examples illustrate, resolving uncertainty about the firm's exposure to climate risks, and informing investors about the firm's efforts to manage and mitigate these risks, may be valuable to investors.

[33] "Negative screening" refers to those investors who exclude certain sectors or companies based on specific ESG criteria (e.g., tobacco or weapons manufacturing)—see, for example, Trinks and Scholtens (2017).

they are taking actions to mitigate these risks. Furthermore, by doing so, they allow their investors to engage with them in a more informed fashion, advise them on how to best move forward in managing and mitigating the risk exposure, and strengthen the trust and relationship between investors and the disclosing company. As the survey by Krueger *et al*. (2020) suggests, this is likely positively valued by investors who prefer to actively engage with their portfolio companies in order to manage and minimize climate risks, as opposed to divesting from firms with high risk exposure. Taken together, in situations where the disclosed climate risk exposure is more severe than anticipated, the net effect of these two countervailing forces need not be negative.

As these considerations illustrate, it is unclear how the stock market would respond, if at all, to the disclosure of climate change risks. In what follows, we examine this question empirically. To do so, we focus on the subsample of companies that disclose climate risk information after being targeted by environmental shareholder activism.[34] We then conduct an event study that quantifies the stock market response in a short window around the day on which the climate risk information is disclosed to the public. We code the event day ("day 0") as the day on which the CDP report is released for S&P 500 companies.[35]

In our main event window, denoted by [-10, 10], we include 10 days before and 10 days after the event day (i.e., 21 days in total). The inclusion of the preceding 10 days accounts for the possibility that information may have leaked to the market prior to the release of the CDP report; the inclusion of the subsequent 10 days accounts for the possibility that the stock market may under- or overreact on the event day, and need a few days to properly reflect the disclosed

[34] Formally, using the notation from equation (1), this corresponds to the subsample of 248 observations for which *environmental shareholder activism*$_{it\text{-}1}$ and *disclosure of climate change risks*$_{it}$ are both positive.

[35] This follows the methodology of Alsaifi, Elnahass, and Salama (2020) and Zamora-Ramirez and Gonzalez-Gonzalez (2015), who study how the stock market responds to the release of CDP reports for U.K. and Spanish companies, respectively.

information. Our choice of a [-10, 10] event window is guided by the finance literature that studies the stock market response to ESG-related events (e.g., Krueger, 2015b). For robustness, we also report the results in a shorter [-5, 5] event window.

Importantly, we also consider the [-50, -11] time window to assess potential pre-trends in stock prices (which would be symptomatic of omitted variables), and the [11, 51] time window to examine whether the stock market response is subsequently reversed. To the extent that the event study is well specified, one would not expect to find systematic patterns in stock returns several weeks before and after the events.

For each time window, we compute cumulative abnormal returns. Intuitively, abnormal returns capture stock returns in excess of the "normal" returns that are predicted by an asset pricing model. In the analysis, we use three different asset pricing models: i) the market model, ii) the three-factor model of Fama and French (1993), and iii) the four-factor model of Carhart (1997). The *cumulative abnormal returns* (CARs) are then obtained by summing up the daily abnormal returns across all days during the relevant time interval.

The results are presented in Table 7. For each of the three asset pricing models, the table reports the average CAR across all events, along with their standard errors. As can be seen, we find that stock prices increase by 0.94% to 1.21% during the [-10, 10] event window (with SEs ranging from 0.37 to 0.39, and *p*-values from 0.001 to 0.015), and by 0.43% to 0.54% during the [-5, 5] event window (with SEs ranging from 0.25 to 0.26, and *p*-values from 0.040 to 0.089). This indicates that the market responds positively to the (shareholder-induced) disclosure of climate risk information, assigning a higher valuation to these stocks. Moreover, we find no evidence for pre-trends (CARs are small in the [-51, -11] interval), nor do we find a reversal of the stock market response. If at all, CARs in the [11, 51] interval are positive, albeit small in economic terms.

Overall, these estimates indicate that targeted companies achieve a higher stock market valuation post disclosure, suggesting that investors value the (voluntary) disclosure of climate change risks.

Table 7. Stock market response following shareholder-induced disclosure of climate change risks

	CAR (%)		
	Market model (1-factor model)	Fama-French (3-factor model)	Fama-French-Momentum (4-factor model)
	(1)	(2)	(3)
Main event windows			
[-10, 10]	1.210	0.938	1.048
	(0.371)	(0.384)	(0.392)
[-5, 5]	0.460	0.433	0.536
	(0.260)	(0.254)	(0.260)
Pre- and post-periods			
[-50, -11]	0.391	-0.256	-0.266
	(0.483)	(0.447)	(0.458)
[11, 50]	0.444	0.417	0.510
	(0.590)	(0.630)	(0.614)

Notes. This table reports the average cumulative abnormal returns (CARs) across all 248 events in which companies disclose climate risks following environmental shareholder activism. Standard errors are reported in parentheses. The event day (day 0) is the day on which climate risk information is disclosed. CARs are computed using the market model, the three-factor model of Fama and French (1993), and the four-factor model of Carhart (1997), respectively.

Finally, we caution that the results in Table 7 need not warrant a causal interpretation. Indeed, while our results show that environmental shareholder activism triggers higher disclosure, and that higher disclosure is associated with a subsequent increase in valuation, higher disclosure per se need not *cause* higher valuation. For example, it could be that companies disclosing climate risk information are primarily those with lower risk exposure (compared to the market's ex ante

belief), which in turn could induce a positive stock market response. Addressing the latter is challenging, since i) doing so would require a separate instrument for disclosure (in addition to the instrument for shareholder activism), and ii) one cannot observe the information that the management decided not to disclose.[36]

DISCUSSION AND CONCLUSION

Can shareholder activism successfully induce firms to voluntarily disclose their exposure to climate change risks as well as their efforts to manage those risks? In this study, we shed light on this question and explore what types of shareholders are more effective in improving the voluntary disclosure of climate risk information. In addition, we examine how the stock market responds to such voluntary disclosure.

We find that companies are more likely to disclose climate risk information following environmental shareholder activism. Moreover, we find that environmental shareholder activism is especially effective if initiated by institutional investors, and even more so if initiated by long-term institutional investors. Finally, we find that companies that voluntarily disclose climate risk information following environmental shareholder activism achieve a higher stock market valuation post disclosure, consistent with the notion that investors value the voluntary disclosure of climate risk information. Overall, our findings indicate that active shareholders can elicit greater climate risk disclosure, thereby improving the governance of their portfolio companies.

This study contributes to several strands of the literature. First, by showing that shareholder activism can elicit greater corporate transparency with respect to climate risks, and that companies achieve higher valuation following this (shareholder-induced) increase in transparency, we

[36] In Appendix Table A10, we redo the above analysis focusing on firms that disclose climate risk information but were not targeted by environmental shareholder activism. Interestingly, the results mirror those in Table 7, suggesting that the disclosure of climate change risks is valued by the stock market regardless of what initiates the disclosure.

contribute to the literature on shareholder engagement (e.g., Aguilera *et al*., 2019; Dimson *et al*., 2015; Ferraro and Beunza, 2018; Gillan and Starks, 2000; Krueger *et al*., 2020). In particular, our study complements recent work on the value implications of the *mandatory* disclosure of nonfinancial information (e.g., Ioannou and Serafeim, 2019; Krueger, 2015a) by showing that—in absence of mandatory disclosure requirements—shareholder activism demanding the *voluntary* disclosure of *climate change risk information* has positive value implications, consistent with the notion that investors value the voluntary disclosure of the firm's exposure to climate change risks.

Second, we add to the literature that studies the voluntary disclosure of nonfinancial information. This literature focuses on the firms' *environmental performance* (as opposed to their *exposure* to climate risks) and mainly examines whether a firm discloses environmental information (such as greenhouse gas emissions) or participates in voluntary environmental initiatives (e.g., Jira and Toffel, 2013; Kim and Lyon, 2011a; Lewis, Walls, and Dowell, 2014; Lyon and Maxwell, 2011; Reid and Toffel, 2009). Our data allow us to go deeper: we explore how much and what type of environmental information—and more specifically what type of climate risk information—is disclosed.

More broadly, the disclosure of climate risk information has received surprisingly little attention in the academic literature.[37] Yet, it is a key concern for investors (e.g., *Financial Times*, 2018; Krueger *et al*., 2020). For example, in the aforementioned survey by Krueger *et al*. (2020), the majority of investors responded that climate risk reporting is as important as financial reporting, and about one-third reported that climate risk reporting is even more important. Accordingly—while this paper provides a first step in this direction—more research is needed to shed light on

[37] A firm's exposure to climate change risks is very different from a firm's environmental footprint. Firms across industries—whether emission-intensive or not—are exposed to climate change risks. As previously mentioned, climate change risks involve the threat of damage, injury, liability, loss, or any other harm to the company that is caused by climate-related events. They include physical risks, regulatory risks, and other climate-related risks.

the determinants and implications of the (voluntary) disclosure of climate risks. Making ground on these questions is both a promising and important avenue for future research.

Third, this study adds to the strategy and management literature by taking a finer-grained view at shareholders and their influence on corporate behavior. The existing literature that studies how shareholders help shape corporate behavior—e.g., Chen and Feldman (2019), David, Hitt, and Gimeno (2001), Lenox and Eesley (2009), Reid and Toffel (2009)—typically (a) considers shareholders as one homogenous group (instead of distinguishing between different types of shareholders), or (b) only considers one specific subset of shareholders (such as hedge funds). Yet, there are considerable differences among shareholders (e.g., in terms of their time horizons, preferences, and objectives), and these differences are likely to have important implications for their interactions with their companies. In this study, we account for the heterogeneity among shareholder types and examine how these differences influence corporate behavior (in the specific context of shareholders' ability to elicit greater corporate transparency). As such, our findings add to the small but burgeoning literature that highlights the importance of distinguishing between different types of shareholders in strategy and management research (e.g., Connelly *et al*., 2019; Hoskisson *et al*., 2002; Tihanyi *et al*., 2003).

Our findings have important implications for practice, as they highlight the ability of investors to elicit greater corporate transparency with respect to climate change risks—even in the absence of mandatory disclosure requirements—and thus contribute to their portfolio companies' governance. In absence of mandatory disclosure requirements imposed by the government, this greater ability also implies that investors (particularly, long-term institutional investors) have a greater responsibility to be *active* owners and engage with management to elicit the disclosure of climate change risks.

On this note, we caution that, while our results indicate that private governance (in the form of shareholder activism) is effective in eliciting the disclosure of climate change risks, it is unlikely to substitute for public governance (Ho, 2018; Light and Orts, 2015; Vandenbergh, 2013). Indeed—and this is speculative—the latter might be more effective in (a) improving the quantity and quality of disclosure, (b) fostering standardization of disclosure (thereby facilitating investors' assessments of their portfolio companies), and (c) ultimately making progress in the fight against climate change. Long-term institutional investors may therefore find it worthwhile to both pursue shareholder activism and engage with the government to mandate climate change risk disclosure. Understanding how to effectively engage with companies and governments to induce greater climate risk disclosure—and what the optimal combination of these engagements is—is fertile ground for future research.

A Rising Tide Lifts All Boats: The Effects of Common Ownership on Corporate Social Responsibility

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INTRODUCTION

The concentration of investor ownership has shifted immensely over the past century. Following insights from Berle and Means (1932), most U.S. publicly traded firms historically had widely dispersed ownership structures, comprised of many investors owning small stakes in a few firms, which became the basis for most managerialist theories of corporate governance. But more recently, as trillions of dollars have been directed into various institutional vehicles, asset managers have consolidated, and fewer companies have assumed public status, the ownership of publicly traded firms has become concentrated among fewer investors, mostly institutional investors that invest on behalf of others (Davis 2009a, 2010, Useem 1993). Indeed, with only so many firms in which to put their money, institutional investors are now more likely to hold a substantial stake in multiple firms out of sheer necessity, including firms in the same industry, creating what Davis (2008) calls a "latent network" of firms connected by single investors. We refer to investors that simultaneously own shares in two or more firms in the same industry as common institutional owners (or "common owners" for short).

While common ownership—and the power it bestows—may seem advantageous for investors, it has created a new investment challenge: When a single investor owns multiple firms in an industry, it becomes even more necessary to manage systematic risk[38]—the risk inherent in

[38] Systematic risk, also known as market risk, often refers to the risk inherent in the entire market or market segment. Given that our theory and empirics focus on common ownership within industries, we use the label

an industry—than it is for an investor that owns a single firm in the industry (Coffee 2021). Such risk is critical to manage because one firm's errant behavior can inflict harm on an entire industry of bystander firms (Paruchuri and Misangyi 2015), amplifying losses for the industry and its common owners. At the same time, systematic risk cannot be reduced by diversification (owning more firms in the industry would only increase it) or divestment (divesting entire industries could create other portfolio losses). As the usual strategies to mitigate risk become ineffective, common owners must find ways to manage spillovers between industry peers or else risk large losses to their portfolios. Therefore, as common owners contend with an elevated exposure to systematic risk, the question arises: *How can common owners use their unique boundary-spanning ownership positions in multiple firms to enact strategies that maximize their portfolio returns?*

Most research underscores the devious influence common owners have on corporate strategy and overlooks their systematic risk dilemma. A number of studies conclude that common owners engage firms to foster cooperation and anticompetitive behaviors (e.g., Azar et al. 2018, Gutiérrez and Philippon 2017), restricting firms from executing intra-industry, winner-take-most strategies. Inkpen and Sundaram (2021: 3) summarize the state of this literature: "Why is common ownership a concern? The argument goes as follows: Shareholders with concurrent investments in competing firms will maximize portfolio returns rather than individual firm returns leading to owners wanting firms to cooperate more and compete less; cooperating firms will increase prices for consumers and their own profitability, hurting consumer surplus and favoring producer surplus." We propose an alternative but overlooked strategy: Common owners impel firms in their portfolios to adopt corporate strategies that minimize negative externalities

"systematic risk" (rather than "industry-level risk" or a similar term) because it portrays the common owner's risk exposure to a particular market segment; specifically, an industry.

and create spillover benefits for other same-industry firms in their portfolios, amplifying their own investment returns in the process.

We test our "rising tide lifts all boats" theory in the context of corporate social responsibility (CSR). Studies have documented the spillover effects that one firm's social responsibility—or lack thereof—can have on industry peers (Shi et al. 2022). Corporate irresponsibility can undermine peer firms' reputations and attract stricter industry-wide regulation, depressing returns for all industry players (Jonsson et al. 2009). Conversely, pro-CSR activities can improve the industry's overall image, which helps peers build legitimacy and attracts better talent to the space (Burbano 2016). Given that common owners are exposed to these spillovers, which increase systematic risk, we predict that they will look to manage that risk and generate additional returns by encouraging firms to improve their CSR.

Using data from 1995–2018 and multiple estimation techniques, we document a positive association between common ownership and firm CSR. We account for three contingencies to better understand the mechanisms and motivations behind our theory of how common owners use CSR spillovers to manage systematic risk. We find the relation between common ownership and CSR is concentrated in long-term common ownership. We also find common owners' effect on CSR is stronger in stakeholder sensitive industries, in which CSR spillovers are most economically impactful. Lastly, supporting the idea that common owners are financially motivated, we find that they increase financially material CSR rather than financially immaterial CSR. We further corroborate our results and address endogeneity concerns by using a difference-in-differences methodology that exploits financial institution mergers to create variation in common ownership that is exogenous to firms' CSR.

Our study offers a new and opposing view of the common owner. Alongside the growth in common ownership, research on this topic has ballooned in recent years, but so far has focused almost exclusively on competitive moves and outcomes (Lewellen and Lowry 2021). From this angle, some have concluded that by fostering cooperation and anticompetitive practices among firms, common owners harm business and society (Azar et al. 2018, Cheng et al. 2021). Though some legal scholars have seen a need for common owners to account for negative externalities (Condon 2020b) and Coffee (2021) considers the potential for an "optimistic upside" of common ownership, the channels through which common owners could strengthen business and society remain undertheorized and research on them has been limited to the competitive dynamics lens that dominates the common ownership literature (Dai and Qiu 2021). By developing new theory about common owners' orientation to systematic risk and their propensity to look for spillovers, and by providing evidence that common ownership improves CSR across portfolio firms, we offer a new and contrasting view of common owners.

We further contribute to literature on the antecedents of CSR by showing how common owners can spur new investment in CSR. Researchers have shown how a firm's CSR practices are shaped by different types of investors, but these findings remain mixed, where some investors seem to impel firms to pursue socially responsible strategies (Flammer et al. 2021) and others do not (DesJardine and Durand 2020). To explain these differences, scholars have dissected investors' investment horizons and pro-social values to understand their attitudes toward CSR (e.g., DesJardine et al. 2021). We offer a different view by developing a "portfolio perspective" of CSR, which reasons that investors with boundary-spanning ownership structures are motivated to manage CSR because they stand to gain (and lose) more from each firm's social responsibility (and irresponsibility) than other, more isolated investors. By exploring how

common owners affect different types of CSR activity, we also contribute to recent management research on the distinction between financially material and immaterial CSR (Christophe and Lee 2020).

The practical implications of this study are significant. Based on evidence that common ownership induces firm cooperation and suppresses industry competition, there have been numerous proposals to more heavily regulate common ownership, including antitrust laws to scrutinize common owners' transactions and requirements that institutional investors either restrict common ownership positions or commit to not actively influencing firm practices (Posner et al. 2016). Both the Organisation for Economic Co-operation and Development (2017) and the U.S. Federal Trade Commission (2018) have warned about the anticompetitive effects of common owners. But before enforcing more restrictive policies, our study underscores the need to consider outcomes beyond firm competitive actions to form a fuller picture of common owners and their influence on business and society.

THEORETICAL BACKGROUND

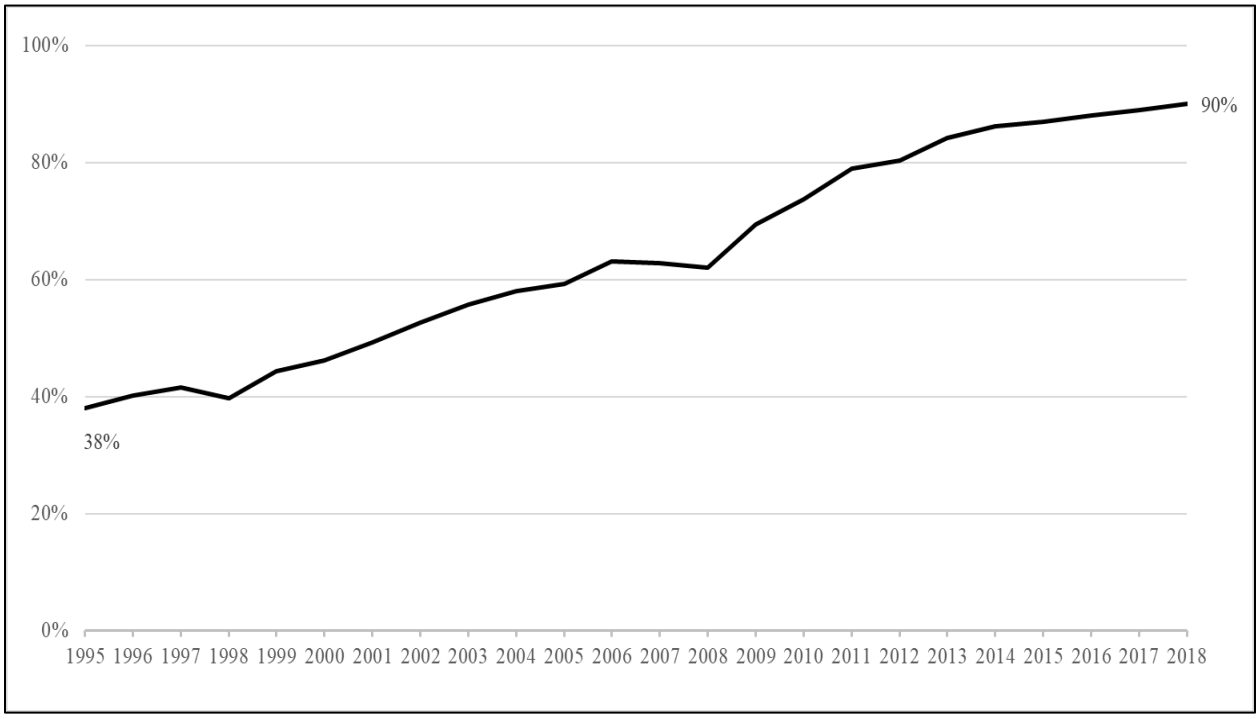
The common owner dilemma and strategies to manage systematic risk

We consider common owners as investors that simultaneously own shares in two or more firms in the same industry. Three clarifications of this definition are integral to our theory. First, we follow the tradition in the literature of defining common ownership within the same industry (Connelly et al. 2019), rather than between industries. Because our theory focuses on systematic risk within industries, studying common ownership *within* industries is most appropriate. Second, we follow studies that define common ownership as investing in two *or more* firms, rather than only two firms (Park et al. 2019). We do this because CSR is likely to spill over to many of the focal firm's peer firms, not just one, and common owners' incentives to encourage

CSR will be higher the more firms they own in the industry. Third, we underscore that common ownership is a *structural* property of an investor's holdings, not a particular type of investor. In this sense, common ownership is akin to block ownership, whereby an investor of any type (e.g., pension fund) is considered a blockholder when holding a nontrivial percentage of a firm's outstanding shares. Not all investors are common owners and an investor may be a common owner in one industry and not another. Consistent with the literature (e.g., Connelly et al. 2019), we bound our theory to institutional investors, since these are likely the most prevalent and influential common owners.

With the rising concentration of assets in recent decades (Davis 2009b), common ownership is steadily becoming commonplace. As shown in Figure 1, the fraction of U.S. public firms held by common owners increased from 38 percent in 1995 to 90 percent in 2018. Of course, by nature, the largest asset managers will almost always be common owners. But, given that there were 4,162 common owners in the U.S. at the end of 2018 managing at least $100 million in assets (the threshold to report holdings to securities regulators in the U.S.), common owners are a highly diverse group of investors. Dividing common owners into terciles based on the total market value of their equity holdings in 2018, the smallest common owners (e.g., Optimum Investment Advisors, Sowell Management Services, Vantage Financial Partners) had total holdings of $100,000 to $100 million; common owners in the middle group (e.g., Boston Financial Management, Gagnon Advisors, Valiant Capital Management) had $100 million to $1 billion; and the largest common owners (e.g., Bank of America, Berkshire Hathaway, BlackRock) had over $1 billion to several trillion dollars' worth of equity holdings.

FIGURE 1. Rise in common institutional ownership from 1995 to 2018
This figure plots the percentage of common institutional ownership from our sample period covering 1995 to 2018. The y-axis is the percentage of firms in our sample owned by at least one common owner (as defined herein).



As common ownership has become the new norm for many institutional investors, they now face a critical investment challenge: Managing systematic risk. Systematic risk, also known as "market risk," is the risk inherent to an entire market segment or industry. When an investor owns significant stakes in many firms across an industry, it becomes essential to manage systematic risk, though it cannot be done through further diversification (as it can for firm-specific risk). For common owners, firm-specific risk still matters, but not to the extent that systematic risk does. This is because one firm's actions that negatively affect an entire industry are felt far more severely by common owners in that industry than by non-common owners holding shares in only one firm in that industry. For example, as the CalPERS executive in our opening quote explains, one firm's carbon emissions can especially harm common owners by

increasing the climate risk among multiple other firms in their portfolios. Since further diversification is infeasible and ineffective for managing systematic risk, common owners need more novel strategies to enhance their risk-adjusted returns.

Empirical studies have largely overlooked common owners' systematic risk dilemma. By far, the dominant—and most-debated—perspective in the literature is that common owners coordinate interfirm actions that reduce industry competition. The objective for common owners is to have firms in their portfolio compete less aggressively with each other (Azar et al. 2018) or less directly with each other (Connelly et al. 2019), thereby increasing the returns of the firms in aggregate. But coordinating competition does not explain how common owners resolve their exposure to systematic risk; coordinating actions can be costly and, when deemed collusive or anticompetitive, pose severe regulatory penalties on investors, creating even bigger risks for these investors and leading scholars to question the idea that common owners orchestrate firm coordination (Gilje et al. 2020, Lewellen and Lewellen 2021). Offering a different view, we conjecture that common owners use more direct strategies to mitigate their exposure to systematic risk.

In order to manage that exposure, common owners could leverage one firm's resources to invest in practices that benefit other firms in the industry. Doing so, any individual firm may be worse off expending its resources on a given strategy, but if that investment nets gains across other firms that the common owner can capture, the strategy becomes sound from the common owner's portfolio perspective. For such a strategy to work, the common owner's portfolio value "need not be highly or even positively correlated with the value of any given focal firm" (Goranova and Ryan 2021: 6) because while the common owner may lose value by encouraging certain actions at a focal firm, the benefits returned to the common owner through value-

enhancements at other portfolio firms could outweigh those costs (Coffee 2021, Condon 2020b). In the same way that spillovers allow a single firm's errant behavior to doubly hurt a common owner, a single firm's positive behaviors, by benefiting industry peers, can multiply returns to the common owner and reduce their systematic risk. If so, we expect common owners will use CSR as a means to reduce negative spillovers and amplify positive ones.

Shareholder returns from corporate social responsibility

Corporate social responsibility refers to the voluntary integration of social and environmental practices in a firm's operations (Bansal and Song 2017). Firms that embrace CSR commit to internalizing social and environmental concerns; for instance, by developing practices and policies to curb climate change or enhance social equality.[39]

Some studies have shown that a firm's CSR can benefit shareholders by reducing firm-specific risks. Grounded in stakeholder theory, the insurance-based view of CSR suggests that socially responsible actions help firms earn the goodwill and support of stakeholders when facing negative events (Godfrey et al. 2009). Indeed, studies find that CSR mitigates firm risk (e.g., Sharfman and Fernando 2008) and that social irresponsibility increases it (e.g., Kölbel et al. 2017). Shareholders may therefore use CSR information to understand firm-specific risk (Amel-Zadeh and Serafeim 2018) and embrace CSR itself to reduce firm-specific risk (Krueger et al. 2020).

But given the costs, not all investors will reap equivalent rewards from increasing firms' CSR investments. Some studies find that the financial returns to CSR, on a firm-specific basis, can be negative (e.g., Chen et al. 2018, Manchiraju and Rajgopal 2017). And when financial

[39] We use the term "CSR" rather than "ESG" (environmental, social, and governance) because our theory concerns—and our measures include—social and environmental issues, but not governance issues such as shareholder rights and managerial entrenchment (e.g. dual-class shares and staggered boards).

returns do exist, they tend to arise in the long term (Bansal and DesJardine 2014), creating opportunities for investors to profit in the short term by reducing spending on socially responsible activities (DesJardine et al. 2021). So while various types of investors, such as foreign investors (Mun and Jung 2018) and institutional investors (Cobb 2015), may seek to propel firms' CSR for their own benefit, the returns remain subject to debate.

However, the returns to CSR—and the investment rationale for promoting CSR—become far more compelling when the spillover benefits from one firm's CSR practices are accounted for. Spillover refers to the "impact of a focal organization's event on the perceptions and decisions of peer organizations and their stakeholders" (Shi et al. 2022: 185). As we explain next, whereas one firm's social irresponsibility can create costly negative spillovers on industry peers, pro-CSR activities can produce positive spillovers for those peers. But to capture the spillover benefits from CSR, an investor needs to hold shares in peer firms. Fortunately for common owners, the same concentration of ownership within industries that amplifies their exposure to systematic risk also uniquely positions them to reap returns from CSR spillovers that are missed by non-common owners.

THEORETICAL DEVELOPMENT

A portfolio perspective of CSR: Why common owners realize greater returns from CSR

Compared to non-common owners, common owners stand to benefit more from improvements in firms' CSR. To understand why, it is necessary to consider the "portfolio perspective" taken by common owners and how CSR creates spillover benefits that reduce systematic risk and enhance value in common owners' portfolios. As noted, because common owners hold shares in multiple firms in an industry, they are concerned with systematic risk, in particular how a focal firm's actions can spill over onto an entire industry of bystander firms and

affect the *aggregate* value of those peer firms. Therefore, compared to non-common owners, common owners more highly value—and are more likely to push for—investments in CSR that produce limited benefits for a single firm (e.g., a small reduction in firm-specific risk) so long as they enhance the aggregate value of other industry peers in the investor's portfolio (e.g., a large reduction in systematic risk). In fact, as Coffee (2021: 604) explains, common owners "may knowingly accept, and even cause, losses at some firms in their portfolio if they expect that those losses will be outweighed by correlative gains at other portfolio firms." So even if CSR is loss-inducing for a focal firm, relative to non-common owners, common owners will be better off pushing for more CSR so long as the total value portfolio firms realize from a single firm's CSR exceeds the costs of that firm's investment. We unpack two risk-related reasons why the value of CSR is far greater when accounting for spillovers between peer firms.

First, a single firm's CSR can shape how stakeholders engage with other firms in an industry by altering their perceptions of that industry. External stakeholders, situated outside firm boundaries, rely on other firms' actions to make attributions about similar firms whose internal dynamics they cannot observe (Jonsson et al. 2009). Attributions occur between firms in the same industry because audiences tend to categorize firms in an industry together (Porac et al. 1999). Stakeholders—the media, customers, investors, and others—therefore tend to generalize a single firm's (ir)responsibility to other firms in the industry (Barnett and Hoffman 2008, Diestre and Rajagopalan 2014). As stakeholders "act based on perceptions, not objective reality" (Wry 2009: 156) and make attributions within industries, their engagements with firms will be shaped by other peer firms' approach to CSR, both in terms of positive responses to pro-social behaviors (which reduce systematic risk for the common owner) and negative responses for irresponsible actions (which exacerbate it). For example, when a bank adopts a profit-sharing initiative, it may

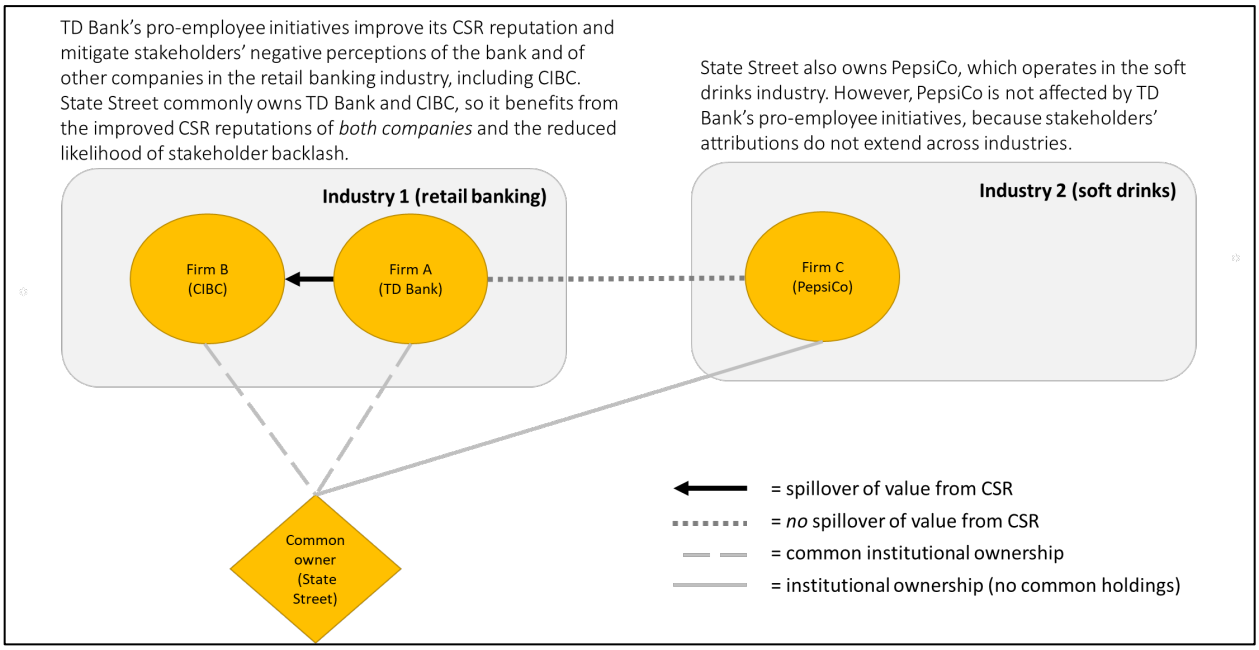
benefit other banks by shaping prospective employees' beliefs that the banking industry is employee friendly. Therefore, when a single firm improves its CSR, other industry peers can realize improved stakeholder perceptions, which reduces systematic risk for the common owner.

Second, because responsibility tends to be generalized across firms in an industry, one firm's CSR can also create spillovers for peer firms and mitigate systematic risk by reducing the likelihood of industry-wide regulation. Firms with socially responsible track records can help deter regulatory restrictions by improving an industry's image and legitimacy, whereas those with less responsibility will increase the likelihood that regulators and policymakers impose new regulations or sanctions on the industry, raising the costs and reducing the economic prospects for all industry players. For example, in their study of the 1984 chemical leak in Bhopal, India for which the Union Carbide Corporation was responsible, Blacconiere and Patten (1994) found evidence of a significant negative intra-industry reaction by investors as regulators imposed tighter regulations on all chemical firms. Negative intra-industry market reactions have been documented in other incidents for which a single firm was culpable, such as oil spills (Hsu et al. 2013) and product recalls (Borah and Tellis 2016), consistent with investors anticipating regulatory costs for the entire industry.

Given the potential for value created (or destroyed) by one firm's CSR action (or inaction) to spill over onto peer firms in an industry, the common owner's exposure to systematic risk stands to be impacted—either positively or negatively—from each firm's level of social responsibility. The amplified impacts of CSR on systematic risk arise because two conditions are met: 1) the common owner holds stock in multiple firms in an industry; and 2) the effects of CSR spill over between peer firms. Taking the illustrative example in Figure 2, when TD Bank adopts more generous paternal leave policies, job seekers will more likely be attracted to the industry as

TD Bank has made the industry appear friendly toward parents; likewise, if TD Bank were caught in a harassment scandal, then stakeholders may see not only the company but also its industry peers in a more negative light and regulators may enforce more stringent human resources regulations. By influencing firms' CSR, common owners can shape the nature of spillovers that occur within industries and thus manage their own systematic risk.

FIGURE 2. How common owners are affected by CSR spillovers



Common owners will therefore have a stronger preference than non-common owners for their portfolio firms to invest in CSR. In some cases, common owners will directly engage portfolio firms to improve their CSR; for instance, through private discussions with management (McCahery et al. 2016) and filing CSR-related resolutions (Flammer et al. 2021). In line with the opening quote by the CalPERS manager, several senior investment executives we interviewed explained that common owners develop teams tasked to "think about these [CSR] issues and intersect and deal with and engage with management" on CSR. As one interviewee explained, where non-common owners typically "don't bother with the [hard work] of engagement and

inquiry," many common owners do because they have an incentive to use CSR as a spillover mechanism to manage systematic risk. Therefore, "when it comes to issues of corporate social responsibility," anecdotal evidence suggests that common owners "are much more willing to trumpet their expectations [of] and influence" on firms (Condon 2020a). In other cases, common owners may not directly engage firms on CSR issues but rather "vote with their feet" (i.e., sell-off shares or threaten to do so), which can align management with investor preferences for CSR (Dikolli et al. 2009).

Non-common owners may also push firms to improve their CSR, but will have a less compelling financial rationale to do so. Able to manage their portfolio risk through divestment and unable to capture the spillover benefits from one firm's CSR, non-common owners stand to gain or lose less from intervening in each individual firm's CSR. In sum, realizing that common owners are highly motivated to reduce their systematic risk and that CSR is a primary channel through which they can both lower this risk and capture additional spillover benefits, we expect common owners to improve portfolio firms' CSR activities. We therefore hypothesize:

Hypothesis 1 (H1): *Common ownership is positively associated with CSR.*

Our central hypothesis hinges on the assumption that common owners encourage responsibility and discourage irresponsibility because of the impact of CSR spillovers on the common owners' systematic risk. If this is the case, we would expect the positive relationship between common ownership and CSR to be concentrated in: 1) common owners with long investment horizons; 2) stakeholder sensitive industries; and 3) CSR investments with more certain financial returns.

What types of common owners care most about CSR?

As noted, a single firm's CSR activities can have considerable spillover effects on its peers, making CSR a useful strategic tool for managing systematic risk. However, many investments in CSR are likely to produce benefits predominantly in the long run, making a long investment horizon helpful to see the returns to CSR (Bansal and DesJardine 2014). Continuing with our example, the benefits of investing in parental-friendly workplace policies are likely to take time to manifest and even more time before spillover benefits materialize for industry peers, which is the driving force for common owners looking to reduce their systematic risk. Thus, CSR will primarily benefit common owners that hold stocks long enough for CSR spillovers to manifest. It is in this spirit that we theorize about *long-term common owners*.

We define long-term common owners as those with stable portfolios that hold positions in companies for long periods of time. Using Bushee's (1998) classification, prior studies (DesJardine and Bansal, 2019; Flammer et al. 2021) classify long-term investors as dedicated and quasi-index institutional investors, both of which have long holding periods. They differ, however, in their investment strategies: Dedicated institutional investors typically hold concentrated positions in relatively few companies (Connelly et al. 2010), while quasi-index institutional investors typically hold diversified positions in many companies, since their investment strategy requires them to track general indexes (Appel et al. 2016).[40] Still, when they

[40] Dedicated and quasi-index institutional investors also differ in how active/passive they are in their *trading*, although, as prior research demonstrates, both tend to engage and influence firms (Connelly et al. 2010, Appel et al. 2016). "Active" investors are those that "accumulate shares and make demands upon managers or exit when managers perform poorly" while "passive" investors "do not actively buy or sell shares to influence managerial decisions" (Appel et al. 2016: 111–112). Because dedicated investors buy and sell stocks (albeit infrequently) depending on their preferences and investment goals, they are considered "active" investors (Bushee 1998). By comparison, because quasi-index investors aim to replicate the returns of a benchmark index, they buy and sell stocks in line with the index and are considered "passive" investors. However, as Appel et al. (2016) demonstrate, passive trading does not mean that quasi-index investors are passive (or non-activist) in engaging companies and exerting influence over their decisions and strategies. In fact, because quasi-index investors cannot divest from certain companies, they may be the most "activist" of all common owners in engaging companies so as to manage

have common ownership, their long horizons will bestow both types with the patience needed to benefit from CSR spillovers and will therefore be highly likely to use CSR as a tool to mitigate systematic risk in their portfolios. Thus, we account for both dedicated and quasi-index common owners in the following hypothesis:

Hypothesis 2 (H2): *Long-term common ownership is positively associated with CSR.*

Where do common owners matter most?

CSR spillovers occur because stakeholders categorize firms together and attribute (or generalize) one firm's behavior to other firms in the same industry (Diestre and Rajagopalan 2014). However, the financial impact of stakeholders' attributions on firms and their common owners is likely to be particularly strong in industries where stakeholders will be more inclined to act on their attributions. We refer to these as stakeholder sensitive industries and theorize that they manifest in two distinct ways.

First, CSR spillovers will matter more to common owners in industries where stakeholder trust and corporate reputation are most valuable for business. Prior research shows that one firm's reputation and trustworthiness impacts that of other firms in the same industry (Barnett and Hoffman 2008, Jonnson et al. 2009). Yet, such generalizations will more strongly impact common owners' systematic risk when the reputations of firms in an industry have a meaningful impact on their bottom lines. For this to happen, reputational spillovers caused by one firm's socially responsible or errant behavior needs to influence how stakeholders engage with the firm and its peers. Research finds that reputation matters mostly in industries that interact with, deal with, or sell directly to end-consumers, because end-consumers are sensitive to firm reputation

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their own systematic risk exposure. In summary, common owners range on the passive-active trading dimension and our theory encompasses both types, since we expect common owners will engage firms to influence their decisions and strategies even if they are not "active" traders.

and can reward socially responsible firms by buying their products or services, and penalize irresponsible firms by not doing so (e.g., Dyreng et al. 2016). Reputation is also highly important for industries that depend on support from local communities, because the risks inherent to certain industrial activities requires firms to build trust to obtain a 'social license to operate' (Brammer and Millington 2004).

Second, CSR spillovers are more likely to matter to common owners in industries where regulators respond strongly to errant behaviors. In industries where firm actions do not carry a high risk of serious damage to the public, regulators will be less likely to penalize the entire industry with costly regulation when one firm behaves poorly. In such industries, lawmakers may instead deal with the irresponsible firm in isolation, allowing peer firms to escape penalties spilling over onto their business (Huang et al. 2017). However, in industries where irresponsibility can cause significant harm to the public, regulators tend to be less forgiving; consistent with this, certain industries, such as those involved in resource extraction, attract higher public attention and scrutiny and are therefore easier targets of political action (Liang and Renneboog 2017). Because accidents in these industries are especially costly to the environment and/or society, one firm's errant behavior is more likely to draw stricter regulations intended to deter other peers from engaging in similar behavior. As an Amoco executive lamented, "We still have to live with the sins of our brothers. We were doing fine until Exxon spilled all that oil. Then we were painted with the same brush as them" (Hoffman 2001: 189). On the other hand, by behaving well (for instance, instituting compliance programs designed to reduce environmental accidents), firms may benefit from more relaxed regulatory monitoring and oversight. Thus, in industries that garner strong regulatory responses, one firm's errant behavior can reduce the

economic prospects of all industry firms, while good behavior can reduce the costs associated with regulation.

In their effort to manage systematic risk, common owners will be especially attuned to firm behaviors in stakeholder sensitive industries where these types of reputational and regulatory spillovers are most likely to manifest. In such industries, common owners stand to lose or benefit most from one firm's CSR affecting the actions of key stakeholders. Common owners will therefore more intensely influence firms to improve CSR in industries that are particularly sensitive to stakeholder influence. We therefore hypothesize:

> **Hypothesis 3 (H3)**: *The positive association between common ownership and CSR is stronger in stakeholder sensitive industries than in other industries.*

What types of CSR do common owners impact most?

Financially material CSR ("material CSR") refers to CSR issues that are most value-relevant for firm financial performance, whereas financially immaterial CSR ("immaterial CSR") refers to CSR issues that are unlikely to produce financial value. The financial materiality of a CSR issue depends on how central it is to the industry (Grewal et al. 2020). For example, greenhouse gas emissions can be a material issue for energy firms, but immaterial for firms in the financial services industry, which are relatively low emitters. The most widely used framework for distinguishing material and immaterial CSR issues from an investor viewpoint is that of the Sustainability Accounting Standards Board (SASB). Using SASB's standards, research documents that material CSR investments have meaningful predictive power over firms' future financial performance (Khan et al. 2016). However, CSR being "immaterial" does not mean it is irrelevant or unimportant; SASB's focus is on investors, but a CSR issue immaterial to investors may still be important or valuable to other stakeholders. For instance, a large bank's reduction of its emissions could help a country achieve its climate change objectives (e.g., carbon neutrality

of the financial sector) and therefore be important to politicians, regulators, and the government while having a limited effect on the bank's bottom line.

If common owners encourage CSR for financial reasons, then increases in CSR should be driven mostly by improvements in material CSR. Material CSR has the highest potential for financial impacts between firms—and therefore potential benefit for the common owner—because such investments touch on financially-relevant CSR issues in an industry. Common owners, with sizable stakes in multiple same-industry firms, are in a unique position to learn which CSR issues are most material to an industry. They thus have greater incentive and opportunity than non-common owners do to evaluate each CSR issue "on its merits in the context of materiality to the company's long-term financial performance" (Federal Trade Commission 2018: 74). In turn, they can understand which forms of CSR are most likely to have spillover effects within the industry and can focus their efforts on altering these material CSR activities in order to manage systematic risk. While many non-common owners will also be financially motivated to support material CSR over immaterial CSR, common owners will be even more compelled to do so given their sensitivity to systematic risk and the substantial spillover effects produced by material CSR. By comparison, due to firms' resource limitations and the limited potential for financially-relevant spillovers, common owners are unlikely to encourage increases in immaterial forms of CSR, and may even discourage such. In closing, we hypothesize:

> **Hypothesis 4 (H4)**: *The change in CSR associated with changes in common ownership is driven by financially material CSR rather than by financially immaterial CSR.*

METHODS

Sample

Our primary data source is the Thomson Reuters Institutional Holdings (13F) database, which consolidates 13F filings (containing details of equity ownership required by the Securities and Exchange Commission) for investment managers with over $100 million in holdings in publicly traded U.S. firms. We collected institutional ownership data for the 22,665 firms with a non-missing CUSIP identifier and four-digit SIC code from 1995 onwards. We then merged in CSR data from Morgan Stanley Capital International's (MSCI) Kinder, Lyndenberg, & Domini (KLD) dataset, which provides data until 2018 and thus defines the end of our sample period. This left us with 5,887 firms with non-missing CSR data. Lastly, we collected financial data from Compustat, corporate misconduct data from Violation Tracker, and the Reputation Risk (RepRisk) Index from WRDS. Our final sample includes 4,769 firms, held by 2,396 distinct common owners and encompassing 31,024 firm-year observations between 1995 and 2018.

Dependent variables

CSR performance

Following prior research (e.g., DesJardine et al. 2021), we use data from KLD to measure CSR. Among CSR data providers, KLD works well for our study since it covers U.S. firms over a long period of time (since 1995). KLD assesses firms on strength and concern topics using a binary system; for each topic, firms are assigned a value of 1 indicating the presence of that criterion, or 0 indicating its absence. Although KLD strengths and concerns can capture positive CSR (e.g., a diverse workforce) and negative CSR (e.g., involvement in a child labor-related legal case), our theory relates to both dimensions—the existence of strengths *and* mitigation of concerns—leading us to follow prior studies by constructing a net measure of CSR (Barnett and

Salomon 2012) that deducts KLD concerns from strengths in the environment, community, employee relations, diversity, product, and human rights categories. Since the maximum number of strengths and concerns varies over time, we follow prior research (Lins et al. 2017) and divide the number of strengths (or concerns) a firm has in a given category by the maximum possible number of strengths (or concerns) in that category-year. This results in indices with a range of 0 to 1 for each category-year, across both strengths and concerns. Next, we compute a net CSR index for each category-year that subtracts the concern index from the strength index and thus ranges from -1 to +1. Finally, we sum the net CSR indices across the six categories to calculate our primary dependent variable *CSR performance*. We also separate this measure into strengths (*CSR strengths*) and concerns (*CSR concerns*) by taking the sum of the respective indices across the six categories.

Material and immaterial CSR performance

We further separate our measure of CSR performance into CSR that is investor-relevant (financially material) and CSR that matters more to non-equity stakeholders (financially immaterial) (Khan et al. 2016). SASB classifies material and immaterial CSR topics by industry. We follow prior research and use SASB's industry-specific standards to map the 53 KLD subcategories as material or immaterial for the 11 sectors (representing 77 industries) covered by SASB. For each firm-year, we measure *material CSR performance* by subtracting an index of material concerns from an index of material strengths (using the process described in the previous section) and *immaterial CSR performance* using the same method for the immaterial categories.

Independent variables

Common institutional ownership

We follow prior literature that defines common ownership as occurring when an institutional investor simultaneously owns at least two firms operating in the same primary four-digit SIC industry (Connelly et al. 2019). Although researchers have developed different ways to operationalize this definition, we adopt that of Connelly et al. (2019). Specifically, our independent variable of interest—*common institutional ownership* (*CIO*)—is a ratio of which the numerator is the sum of an institutional investor's fractional holdings in two firms operating in the same industry (common fractional holdings) and the denominator is the sum of the fractional holdings of the pair's non-common institutional investors plus the sum of the common fractional holdings (i.e., the numerator), aggregated across all of the pair's common institutional investors.[41] We aggregate this firm-pair measure across all of a firm's same-industry peers to form a firm-level continuous measure capturing each firm's common ownership (Lewellen and Lowry 2021). Importantly, following Connelly and colleagues, to ensure they have sufficient influence, we require that a common owner has a blockholding (>1% ownership) stake in each firm.[42]

Relative to other measures in the literature, the Connelly et al. (2019) measure ("Connelly measure") is desirable for two reasons. First, "count" measures that count the unique number of investors that own a focal firm and any of its same-industry peers or that count the number of same-industry peers that share at least one investor with the focal firm (He and Huang

[41] The formula between firms *i* and *j* is *Common Ownership* = $\sum_k^{C_{ij}} COH_k / (\sum_k^{C_{ij}} COH_k + \sum_k^{D_{ij}} DOH_l)$, where *k* is the number of commonly held firms in a 4-digit SIC industry-quarter, *l* is the number of non-commonly held firms in a 4-digit SIC industry-quarter, *Cij* is the number of common institutional owners between firms *i* and *j*, *Dij* is the number of non-common institutional owners between firms *i* and *j*, *COH* is the percentage of common ownership holdings, and *DOH* is the percentage of non-common institutional ownership holdings.

[42] Our results are robust to (1) excluding the "Big Three" institutional investors (i.e., Blackrock, State Street, and Vanguard) from *CIO*, and (2) using a count measure of the number of common owners which gives common owners with less ownership equivalent weight as common owners with more ownership. These results help assuage the concern that our findings are driven by only the largest common owners.

2017, Park et al. 2019) are intuitive, but fail to reflect the decomposition of ownership between two firms (e.g., the value of such a measure would be the same whether an investor owned one share or all of the shares of a commonly owned firm). The Connelly measure, however, reflects the *degree* of ownership held by each common owner. Second, "average" measures, which take the arithmetic or product-based average of an investor's ownership in commonly owned firms (Gilje et al. 2020, Lewellen and Lowry 2021), do not account for the proportion of common institutional ownership relative to total institutional ownership, which the Connelly measure does. Scaling common ownership in this way is important because it accounts for the overall influence of common owners relative to other (non-common) investors. Despite these advantages of the Connelly measure, we compute alternate measures of *CIO*, which we discuss below.

Long-term and short-term common ownership

To measure common ownership by long-term investors, we map Bushee's (1998) investor classification data to our institutional investor holdings (13F) data. We consider long-term investors as those Bushee classifies as dedicated and quasi-index and short-term investors as those classified as transient (Brochet et al. 2015, Flammer et al. 2021). Therefore, we compute *dedicated (quasi-index) CIO* as the sum of a dedicated (quasi-index) institutional investor's fractional holdings in two firms operating in the same industry (the numerator), divided by the numerator plus the sum of the fractional holdings of the pair's non-common institutional investors (the denominator), aggregated across all of the pair's dedicated common institutional investors.[43] We again form a firm-level measure by aggregating the firm-pair measure across all

[43] For example, the formula between firms *i* and *j* is *Dedicated Common Ownership* = $\sum_k^{DedC_{ij}} DEDCOH_k / (\sum_k^{DedC_{ij}} DEDCOH_k + \sum_k^{D_{ij}} DOH_l)$, where *k* is the number of commonly held firms in a 4-digit SIC industry-quarter, *l* is the number of non-commonly held firms in a 4-digit SIC industry-quarter, *DedCij* is the number of dedicated common institutional owners between firms *i* and *j*, *Dij* is the number of non-common institutional owners between firms *i* and *j*, *DEDCOH* is the percentage of dedicated common ownership holdings,

of a firm's same-industry peers. Our measure of *transient CIO* is measured in the same way, but uses the holdings of transient institutional investors.

Stakeholder sensitive industries

We examine whether the relation between common ownership and CSR is particularly strong in industries that are most sensitive to stakeholder attributions. We create an indicator variable, *stakeholder sensitive industry,* that equals 1 for firms belonging to industries that bear high financial impact from regulatory or reputational attributions, and 0 otherwise. To construct this measure, we follow Brammer and Millington (2004) (hereafter, B&M), who identify 41 industries with a high "risk of regulatory interference" and 21 industries for which reputation is most valuable because firms are consumer-facing or require public trust to maintain their social license to operate. Under both classifications, the "potentially significant environmental or social consequences" (B&M: 1417) of certain industries intensifies stakeholders' responses to firm behaviors.[44]

To assess the validity of the 41 industries that are sensitive to regulation, we download data on environmental and social penalties from Violation Tracker from 2000–2021. Consistent with our focus on regulatory costs stemming from regulatory actions, Violation Tracker collects penalty data from regulatory agencies and related sources.[45] We calculate the average dollar amount of social penalties (from "employment-related offences" and "safety-related offenses") and environmental penalties (from "environment-related offences") for each industry. We find

and *DOH* is the percentage of non-common institutional owners holdings. The formula is parallel for quasi-index and transient common institutional owners.

[44] Huang and Kung (2010) also classify 31 industries as highly sensitive to environmental regulation, all of which are included in the B&M list.

[45] See https://www.goodjobsfirst.org/violation-tracker.

considerable overlap between the 41 industries in the B&M list and the industries with the highest (i.e., 95th percentile) environmental or social penalties according to Violation Tracker.[46]

To assess the list of 21 industries where reputation and trust are most valuable, we download RepRisk data from WRDS. Consistent with our focus on industry vulnerability to consumer and public perceptions, RepRisk uses media and news sources to calculate an index that measures a firm's reputational risk exposure to CSR issues.[47] We average the RepRisk Index for each industry from 2000 to 2016 (the last year for which RepRisk data is available on WRDS). Again, we find considerable overlap between the 21 industries in the B&M list and the industries with the highest (i.e., 95th percentile) CSR-related reputational risks per the RepRisk Index.[48]

Given these results, we code firms in SIC codes 1000–1499 (Mining and Oil & Gas), 2600–2699 (Pulp & Paper), 2800–2899 (Chemicals), 4400–4499 and 1781 (Water Sourcing and Distribution), 2900–2999 (Energy Production), 4600–4699 and 4900–4939 (Utilities), 2100–2199 (Tobacco), and 5181–5182, 5813, 2084, and 2085 (Alcohol) as operating in a *stakeholder sensitive industry*.

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[46] There are 401 four-digit SIC industries, so 20 industries are in the 95th percentile for environmental penalties and 20 industries are in the 95th percentile for social penalties. Three industries are in the 95th percentile of *both* environmental and social penalties and 17 are in the 95th percentile of one or the other. Thus, there are 37 unique industries (3 + 17 + 17 = 37) to compare to B&M's list of 41 industries. Of these 37 industries, 35 are included in B&M's list (95% = 35/37). That list includes six additional industries not in the top 95th percentile of penalties and excludes two that are. Our results are not sensitive to excluding the six "additional" B&M industries or including the two "excluded" ones.

[47] See https://www.reprisk.com/news-research/resources/methodology.

[48] Again, because there are 401 four-digit industries in total, 20 industries are in the 95th percentile of the RepRisk Index, 18 (90% = 18/20) of which are included in B&M's list. B&M include three additional industries not in the top 95th percentile of reputation risk and excludes two that are. Again, our results are not sensitive to excluding the three "additional" B&M industries or including the two "excluded" ones.

Control variables

We include control variables to mitigate the possibility that our results are driven by confounding factors. Foremost, since blockholder ownership has been shown to impact CSR performance (Neubaum and Zahra 2006), we control for this variable while taking care to exclude common institutional ownership to ensure that we do not conflate this measure with our common ownership predictor of interest. Specifically, *non-common blockholder ownership* is the percentage of a firm's outstanding shares held by a firm's non-common blockholders (that own at least 1% of the firm).[49]

To control for the influence of firm size on CSR, we include *firm size* as 1 plus the natural logarithm of the book value of total assets. Because firms that perform better may also have greater capacity to invest in CSR, we include three performance measures: *return on assets (ROA),* measured as income before extraordinary items over total assets; *market-to-book ratio*, measured as the ratio of the market value to the book value of total assets; and *earnings volatility*, measured as the standard deviation of the return on assets over the prior five years. Firms with a greater capacity to take on new debt may also invest more in new CSR initiatives. We thus consider differences in financing by including *leverage* as the ratio of total debt to total assets. Finally, we include *sales growth*, measured as the annual percentage change in sales, to control for the possibility that growing firms invest more in CSR and also attract common owners.

[49] Institutional ownership has also been shown to impact CSR (Neubaum and Zahra, 2006), but we control for non-common institutional ownership in the denominator of our independent variable of interest, *CIO*. Hence, we do not include a separate control variable for non-common institutional ownership, though our results are virtually unchanged if we do.

Analyses

Our main analyses use OLS regressions with firm fixed effects that control for observed and unobserved time-invariant firm characteristics, and year fixed effects that control for common macroeconomic shocks that affect all firms. The results, reported in Table B1 (Columns 4-6) of the Appendix, are similar if we lag the independent variables by one year. We winsorize all continuous variables at the one-percent level to control for extreme outliers. Robust standard errors are clustered by firm to account for autocorrelation in the data within firms across time.

RESULTS

Table 1 reports descriptive statistics and correlations and Tables 2 and 3 report our main results. H1 predicts that common ownership is positively related to CSR. In Model 1 of Table 2, the coefficient estimate of *CIO* is 0.001 ($p < 0.001$), consistent with H1. In terms of economic significance, increasing *CIO* by one standard deviation increases *CSR performance* by 0.06 units (practically speaking, firms engage in 0.06 more strength than concern activities).[50] Given that the average CSR performance in our sample is -0.04 (negative because the number of concerns slightly exceeds the number of strengths), a 0.06-unit increase shifts the average firm's net negative CSR score to a net positive score of 0.02; this increase is 9% of the standard deviation of CSR performance.[51] Models 2 and 3 show that the increase in CSR performance is driven by

[50] 0.06 = 0.001 × 62.07 (SD of *CIO*).

[51] This effect is economically significant and on par with prior studies using a net-KLD score to measure CSR. For instance, Di Giuli et al. (2014) and Flammer (2018) both document an increase in net-KLD equal to 10% of its standard deviation and DesJardine and Durand (2020) document an effect of 8–10% of the standard deviation of net-KLD. Using two alternative measures of CSR from data sources other than KLD (see Table B1), the economic magnitude of the results remains meaningful. Specifically, the coefficient estimate in Column 2 of Table B1 suggests that a one standard deviation increase in *CIO* translates into a 3.66-unit increase in ASSET4's E+S score, representing approximately 15% (13%) of its mean (standard deviation). Similarly, the estimate in Column 3 implies a 3.21-unit increase in MSCI's ESG score from a one standard deviation increase in *CIO*, which is approximately 17% (15%) of its mean (standard deviation).

an increase in *CSR strengths* ($\beta = 0.001, p < 0.001$) rather than by a decrease in *CSR concerns* (the coefficient in Model 3 is close to zero and insignificant).

To make our main results more concrete, we use a recently developed methodology from the finance literature (Di Giuli and Kostovetsky 2014) to translate the increase in *CSR performance* into dollar terms. We find that the estimated CSR expenditures associated with a one standard deviation increase in common ownership amount, on average, to 2.7% of firms' net income.

TABLE 1. Descriptive statistics and correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. CSR performance																	
2. CSR strengths	**0.71**																
3. CSR concerns	**-0.58**	**0.17**															
4. Common institutional ownership (CIO)	**0.09**	0.00	**-0.13**														
5. Dedicated CIO	**0.14**	**0.07**	**-0.11**	**0.65**													
6. Quasi-index CIO	**0.04**	**-0.03**	**-0.10**	**0.89**	**0.30**												
7. Transient CIO	0.00	**-0.03**	**-0.03**	**0.30**	**0.15**	**0.18**											
8. Stakeholder sensitive industry	**-0.02**	**0.13**	**0.18**	**-0.10**	**-0.06**	**-0.09**	**-0.03**										
9. Material CSR performance	**0.78**	**0.64**	**-0.31**	**0.06**	**0.06**	**0.06**	**-0.04**	0.00									
10. Immaterial CSR performance	**-0.51**	**-0.19**	**0.43**	**-0.03**	0.01	**-0.03**	**-0.04**	**0.18**	**-0.18**								
11. Non-common blockholder ownership	**-0.11**	**-0.12**	0.01	**-0.34**	**-0.20**	**-0.32**	**-0.12**	**-0.06**	**-0.07**	**-0.02**							
12. Firm size	**0.26**	**0.48**	**0.19**	**0.15**	**0.13**	**0.12**	**0.06**	**0.17**	**0.19**	**0.15**	**-0.17**						
13. ROA	**0.04**	**0.06**	**0.02**	**-0.15**	**-0.10**	**-0.13**	**-0.03**	0.00	**0.08**	0.00	0.00	**0.16**					
14. Market-to-book ratio	**0.07**	**0.02**	**-0.07**	**-0.04**	**0.03**	**-0.07**	**-0.03**	**-0.11**	**0.05**	**-0.09**	**-0.08**	**-0.30**	**0.01**				
15. Earnings volatility	**-0.07**	**-0.07**	0.01	**-0.03**	**-0.02**	**-0.03**	-0.01	-0.01	**-0.09**	**-0.02**	**0.01**	**-0.34**	**-0.39**	**0.25**			
16. Leverage	**0.07**	**0.12**	**0.03**	**0.22**	**0.11**	**0.21**	**0.05**	**0.06**	**0.03**	**0.09**	0.00	**0.48**	**-0.11**	**-0.21**	**-0.14**		
17. Sales growth	-0.01	**-0.04**	**-0.04**	**0.04**	**0.05**	**0.02**	0.00	**-0.03**	**-0.02**	**-0.03**	**-0.05**	**-0.04**	**0.15**	**0.16**	**-0.03**	**-0.05**	
Mean	-0.04	0.33	0.37	36.40	7.63	23.46	5.20	0.10	-0.11	0.07	0.10	21.36	0.02	1.98	0.05	0.56	0.06
SD	0.64	0.53	0.46	62.07	23.23	40.88	23.45	0.29	0.65	0.56	0.12	1.68	0.13	1.41	0.09	0.25	0.23
Min	-3.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.67	-2.10	0.00	15.56	-1.14	0.60	0.00	0.04	-1.40
Max	4.05	4.80	4.47	337.37	179.83	255.98	344.48	1.00	2.34	3.23	1.00	26.02	0.28	10.81	0.91	1.31	0.78

Note: Boldface indicates significance at the 10% level or lower.

TABLE 2. OLS regressions for common institutional ownership and CSR performance

	CSR perf.	CSR strengths	CSR concerns	CSR perf.	CSR strengths	CSR concerns
Variables	(1)	(2)	(3)	(4)	(5)	(6)
CIO	0.001***	0.001***	-0.000			
	(0.000)	(0.000)	(0.000)			
Dedicated CIO				0.001***	0.001***	0.000
				(0.000)	(0.000)	(0.000)
Quasi-index CIO				0.002***	0.001***	-0.001**
				(0.000)	(0.000)	(0.000)
Transient CIO				0.000	0.000	-0.000
				(0.000)	(0.000)	(0.000)
Non-common blockholder ownership	0.009	-0.041	-0.050	0.013	-0.049	-0.062
	(0.061)	(0.048)	(0.044)	(0.061)	(0.048)	(0.044)
Firm size	-0.022	0.062***	0.083***	-0.021	0.062***	0.083***
	(0.017)	(0.013)	(0.013)	(0.017)	(0.013)	(0.013)
Profitability	-0.009	-0.051+	-0.041	-0.010	-0.050+	-0.040
	(0.041)	(0.028)	(0.028)	(0.041)	(0.028)	(0.028)
Market-to-book ratio	-0.008	-0.004	0.004	-0.007	-0.004	0.004
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
Earnings volatility	-0.168*	0.057	0.225***	-0.165*	0.055	0.220***
	(0.083)	(0.064)	(0.062)	(0.083)	(0.065)	(0.062)
Leverage	-0.028	-0.026	0.002	-0.030	-0.025	0.005
	(0.043)	(0.032)	(0.029)	(0.043)	(0.032)	(0.029)
Sales growth	0.015	-0.024*	-0.039***	0.016	-0.024*	-0.041***
	(0.015)	(0.011)	(0.010)	(0.015)	(0.011)	(0.010)
Constant	0.387	-1.121***	-1.508***	0.376	-1.114***	-1.490***
	(0.345)	(0.267)	(0.259)	(0.344)	(0.267)	(0.259)
Observations	31,024	31,024	31,024	31,024	31,024	31,024
Firm fixed effects	Included	Included	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included	Included	Included
Adjusted R-squared	0.545	0.661	0.566	0.545	0.662	0.566

Note: Standard errors clustered by firm in brackets. + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

H2 predicts that long-term common ownership is positively associated with CSR. In Models 4–6, we replace *CIO* with *dedicated CIO*, *quasi-index CIO,* and *transient CIO*. In line with H2, the coefficient estimates on *dedicated CIO* and *quasi-index CIO*, both of which capture long-term common ownership, are positive and significant in Models 4 and 5, which use *CSR performance* and *CSR strengths*, respectively, as the dependent variable. In Model 6, where *CSR concerns* is the dependent variable, the coefficient estimate on *dedicated CIO* is close to zero and insignificant, while it is negative and significant for *quasi-index CIO*. The estimates in Model 4

suggest that increasing *dedicated CIO* ($\beta = 0.001, p < 0.001$) and *quasi-index CIO* ($\beta = 0.002, p < 0.001$) each by one standard deviation increases *CSR performance* by 0.1 units—nearly 16% of its standard deviation.[52] Moreover, as its coefficient estimates in Models 4–6 are close to zero and insignificant, *transient CIO* has a negligible relation with *CSR performance*. F-tests find that the coefficient estimates on *dedicated CIO* and *quasi-index CIO* in Models 4 and 5 are significantly larger than the coefficient estimates on *transient CIO* ($p < 0.001$).

H3 predicts that the positive relationship between common ownership and CSR is stronger in stakeholder sensitive industries than in other industries. In line with this prediction, as reported in Model 7 of Table 3, the coefficient estimate of the interaction of *CIO* × *stakeholder sensitive industry* is 0.02 ($p < 0.001$). Given the coefficient on the interaction term, the relationship between *CIO* and *CSR performance* strengthens so that increasing common ownership by one standard deviation increases CSR performance by 1.30 units, or shifts the average firm's *CSR performance* from -0.04 net CSR concerns to 1.26 net CSR strengths.[53] Again, the coefficients on the interaction terms in Models 8 and 9 are consistent with a statistically significant increase in *CSR strengths* ($\beta = 0.014, p < 0.001$) and decrease in *CSR concerns* ($\beta = -0.006, p < 0.05$).

H4 posits that common owners increase firms' material CSR more than their immaterial CSR. Model 10 of Table 3 uses the same specification as Model 1 of Table 2 but uses *material CSR performance* as the dependent variable. The coefficient estimate of 0.002 ($p < 0.05$) indicates that *CIO* has a positive and significant relation with financially material CSR. In Model 11, however, where *immaterial CSR performance* is the dependent variable, the coefficient on

[52] 0.1 = 0.001 × 23.23 (SD of *dedicated CIO*) + 0.002 × 40.88 (SD of *quasi-index CIO*). 0.1/0.64 (SD of *CSR performance*) = 15.6%.
[53] 1.30 = (0.020 + 0.001) × 62.07 (SD of *CIO*).

CIO is -0.002 ($p < 0.01$), indicating that *CIO* is negatively and significantly related to financially immaterial CSR. Based on a system of seemingly unrelated regressions, which uses a common sample for the two regressions to test whether the coefficients differ, the coefficients on *CIO* across the two models are statistically significantly different ($p < 0.001$).

TABLE 3. Stakeholder sensitive industry and material versus immaterial CSR performance

	CSR perf.	CSR strengths	CSR concerns	Material CSR	Immaterial CSR
Variables	(7)	(8)	(9)	(10)	(11)
CIO	0.001***	0.001***	0.000	0.002*	-0.002**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
CIO × Stakeholder sensitive industry	0.020***	0.014***	-0.006*		
	(0.005)	(0.003)	(0.002)		
Non-common blockholder ownership	0.026	-0.028	-0.055	-0.177*	-0.127+
	(0.061)	(0.048)	(0.044)	(0.082)	(0.077)
Firm size	-0.026	0.059***	0.085***	-0.028	0.087**
	(0.017)	(0.013)	(0.013)	(0.027)	(0.029)
Profitability	-0.007	-0.049+	-0.042	-0.017	-0.016
	(0.041)	(0.029)	(0.028)	(0.052)	(0.039)
Market-to-book ratio	-0.008	-0.004	0.004	-0.008	0.009
	(0.005)	(0.004)	(0.004)	(0.009)	(0.007)
Earnings volatility	-0.195*	0.038	0.233***	-0.297**	0.314**
	(0.082)	(0.063)	(0.062)	(0.111)	(0.113)
Leverage	-0.019	-0.020	-0.001	-0.143*	-0.033
	(0.042)	(0.031)	(0.029)	(0.061)	(0.057)
Sales growth	0.014	-0.025*	-0.039***	0.016	-0.028
	(0.015)	(0.011)	(0.010)	(0.022)	(0.022)
Constant	0.451	-1.075***	-1.527***	0.549	-1.785**
	(0.345)	(0.264)	(0.260)	(0.545)	(0.587)
Observations	31,024	31,024	31,024	14,901	14,901
Firm fixed effects	Included	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included	Included
Adjusted R^2	0.547	0.663	0.566	0.545	0.416

Note: Standard errors clustered by firm in brackets. + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Supplementary analyses

Natural Experiment to Address Endogeneity

A central concern of our main results is that an omitted variable simultaneously drives common ownership and CSR. For instance, board members can influence decisions that attract higher investment from common owners, while also influencing investments in CSR. Another

concern is the potential for stock selection, namely, common owners are attracted to firms that invest heavily in CSR. Still another possibility is that our results are attributable to firms imitating other firms' CSR (Cao et al. 2019). We address these endogeneity concerns by using mergers between financial institutions to generate exogenous variation in common ownership that is independent of firms' CSR. Such mergers, largely due to financial sector deregulation and exogenous to any portfolio firm attributes, increase common ownership for same-industry firms owned by either of the merging institutions.

Following He and Huang (2017), we identify 14 financial institution mergers during our sample period.[54] A firm is included in the treatment group (i.e., experienced an increase in common ownership) if, in the quarter immediately preceding the merger's announcement, the firm is blockheld by one of the merging institutions and the other merging institution does not blockhold that firm but does blockhold at least one *other* firm in the same industry. A firm is included in the control group (i.e., experienced no increase in common ownership) if, in the quarter before the merger's announcement, the firm is blockheld by a financial institution that blockholds a treated firm and the other merging institution does not blockhold any of its same-industry peers (see Figure A1). Because control firms experience no change in common ownership, but are still owned by one of the merging institutions, there is little possibility that differences in the merging institutions' stock selection and investment preferences confound our results.

We estimate a DID model in the three years before and after each merger. The variable of interest is *treat* × *post*, which captures the effect of the exogenous change in common ownership on the CSR of treated firms, compared to its effect on the control firms. We include all prior

[54] Lewellen and Lowry (2021) raise concerns about mergers in 2008-2009 as the post-merger period coincides with the financial crisis. In an untabulated analysis, we find our results are robust to removing mergers from 2008–2009.

control variables and year fixed effects, as well as firm-merger fixed effects. We cluster standard errors at the firm level. In untabulated analyses, we find validity for the parallel trends assumption.

In line with H1, results from Model 12 in Table 4 show a positive and significant relationship between *CIO* and *CSR performance* ($\beta = 0.226, p < 0.10$), attributable largely to increases in *CSR strengths* (Model 13) and not reductions in *CSR concerns* (Model 14). In support of H2, long-term common owners push for CSR (the coefficient of *dedicated CIO* is positive and significant in Model 15), driven by increases in *CSR strengths* (the coefficients of *dedicated CIO* and *quasi-index CIO* are both positive and significant at the 10% level in Model 16). Once again, we find no significant relation between *transient CIO* and CSR.

We next find that the positive relation between CIO and CSR is stronger in stakeholder sensitive industries. The coefficient estimate of *treat × post × stakeholder sensitive industry* in Model 18 is positive and significant ($\beta = 0.808, p < 0.05$), again attributable to both increases in *CSR strengths* (Model 19: $\beta = 0.562, p < 0.01$) and decreases in *CSR concerns* (Model 20: $\beta = -0.247, p < 0.10$). Finally, results in Models 21 and 22 show that the main relation between CIO and CSR is positive for *material CSR performance* ($\beta = 0.104, p < 0.10$) and negative for *immaterial CSR performance* ($\beta = -0.186, p < 0.10$).

TABLE 4. Difference-in-differences analyses using financial institution mergers

	CSR perf.	CSR strengths	CSR concerns	CSR perf.	CSR strengths	CSR concerns	CSR perf.	CSR strengths	CSR concerns	Material CSR	Immaterial CSR
Variables	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**(19)**	**(20)**	**(21)**	**(22)**
Treat × Post	0.226+	0.195*	-0.031				-0.003	0.037	0.039	0.104+	-0.186+
	(0.131)	(0.089)	(0.056)				(0.094)	(0.067)	(0.053)	(0.062)	(0.102)
Treat x Post × Dedicated CIO				0.009+	0.005+	-0.004					
				(0.005)	(0.003)	(0.003)					
Treat x Post × Quasi-index CIO				0.004	0.004+	-0.000					
				(0.002)	(0.002)	(0.001)					
Treat x Post × Transient CIO				0.010	0.006	-0.004					
				(0.007)	(0.005)	(0.004)					
Treat × Post × Stakeholder sensitive industry							0.808*	0.562**	-0.247+		
							(0.330)	(0.215)	(0.133)		
Post	-0.073*	-0.039*	0.035	-0.067*	-0.035*	0.032	-0.068*	-0.036*	0.032	0.002	0.012
	(0.033)	(0.018)	(0.025)	(0.032)	(0.017)	(0.025)	(0.032)	(0.018)	(0.025)	(0.051)	(0.072)
Non-common blockholder ownership	-0.001	-0.001	0.000	-0.001	-0.001	0.000	-0.001+	-0.001+	0.000	-0.128	0.155
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.134)	(0.189)
Stakeholder sensitive industry							-0.239	-0.329	-0.090		
							(0.202)	(0.205)	(0.139)		
Firm size	-0.020	0.060**	0.080***	-0.024	0.058**	0.081***	-0.025	0.056**	0.081***	-0.126***	0.176***
	(0.027)	(0.019)	(0.016)	(0.027)	(0.019)	(0.016)	(0.028)	(0.019)	(0.016)	(0.025)	(0.036)
Profitability	0.041	-0.040	-0.080+	0.049	-0.036	-0.084+	0.057	-0.027	-0.084+	0.028	-0.003
	(0.075)	(0.049)	(0.047)	(0.075)	(0.049)	(0.047)	(0.073)	(0.048)	(0.047)	(0.107)	(0.152)
Market-to-book ratio	0.015	0.014*	-0.001	0.013	0.013+	-0.000	0.014	0.013+	-0.001	-0.005	0.008
	(0.010)	(0.007)	(0.006)	(0.010)	(0.007)	(0.006)	(0.010)	(0.007)	(0.006)	(0.013)	(0.019)
Earnings volatility	-0.217+	0.067	0.283***	-0.221+	0.064	0.285***	-0.244*	0.041	0.286***	-0.648***	0.917***
	(0.120)	(0.087)	(0.082)	(0.121)	(0.088)	(0.082)	(0.116)	(0.081)	(0.082)	(0.170)	(0.240)
Leverage	-0.137+	-0.094+	0.042	-0.133+	-0.092+	0.040	-0.114	-0.073	0.041	0.073	-0.064
	(0.077)	(0.054)	(0.048)	(0.078)	(0.054)	(0.048)	(0.078)	(0.052)	(0.048)	(0.088)	(0.124)
Sales growth	0.039	-0.028	-0.067***	0.043	-0.026	-0.069***	0.044	-0.025	-0.069***	0.082+	-0.124*
	(0.029)	(0.020)	(0.019)	(0.029)	(0.019)	(0.019)	(0.027)	(0.018)	(0.019)	(0.042)	(0.060)
Constant	0.195	-0.151	-0.346*	0.236	-0.122	-0.358*	0.255	-0.091	-0.346*	1.092***	-1.552***
	(0.200)	(0.135)	(0.149)	(0.200)	(0.136)	(0.150)	(0.202)	(0.139)	(0.150)	(0.230)	(0.324)
Observations	11,669	11,669	11,669	11,669	11,669	11,669	11,669	11,669	11,669	6,176	6,176
Firm-by-merger fixed effects	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Adjusted R^2	0.475	0.574	0.573	0.476	0.574	0.574	0.479	0.577	0.574	0.495	0.487

Note: Standard errors clustered by firm in brackets. + $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Robustness checks

To ensure the robustness of our findings, we took the following steps, tabulated in the Appendix.

Alternative measures of CSR

We computed three alternate measures of *CSR performance*. The first is similar to our main measure, but includes the corporate governance category from KLD (*CSR perf + GOV*). The second is the sum of the environmental and social pillar scores from Thomson Reuters ASSET4 (*ASSET4 E+S)*. The third uses the "Overall ESG Score" from MSCI's Intangible Value Added database (*MSCI ESG Score)*. As shown in Columns 1-3 of Table B1, the results from using these alternate measures of CSR performance align with our main findings.

Alternative measures of common ownership

In constructing our main measure, we excluded common owners with less than one percent ownership, consistent with Connelly et al. (2019) and others (e.g., Gilje et al. 2020), to ensure that common owners have significant incentives to engage and influence firms. However, we also tested our results using a more restrictive blockholding threshold that requires institutional investors to own at least five percent of a firm's outstanding shares (e.g., He and Huang 2017). We also calculated a product-based Connelly measure that uses the product of the common fractional holdings (rather than the summation); this approach helps to account for symmetry in the extent to which an investor owns a similar stake in both firms (Lewellen and Lowry 2021).[55] Re-estimating our main models using these alternative measures, we found no material changes in the results, as shown in Table B2.

[55] The product-based measure is higher when a shareholder's holdings are more symmetrically divided between the two firms. For example, if an investor owns 50% of Firm 1 and 50% of Firm 2, the product *CIO* = 0.5 × 0.5 = 0.25. If an investor owns 20% of Firm 1 and 80% of Firm 2, the product *CIO* = 0.2 × 0.8 = 0.16. By contrast, the summation (that we use in the numerator for our main measure) is 1.0 for both examples: (0.5 + 0.5) and (0.8 + 0.2).

Sub-dimensions of stakeholder sensitive industry moderator

To ascertain whether our results for H3 hold for both sub-dimensions of *stakeholder sensitive industry*, we split the measure into its two components: *reputation sensitive industries* that are most impacted by reputational attributions and *regulation sensitive industries* that are most impacted by regulatory attributions.[56] In Table B3, we find that both components are important moderators (statistically and economically) of the relation between common ownership and CSR performance.

DISCUSSION

Our study takes a new look at the investment priorities and corporate influence of common owners. The vast rise of common ownership, driven by fewer investors each expanding their stakes in more and more companies (Davis 2010), has created a new investment challenge for the common owner: How to manage systematic risk. By owning multiple firms across an industry, common owners bear unparalleled exposure to the risks that can result when one firm's actions affect the value of industry peers, amplifying gains or losses to the common owner's portfolio. We theorize that common owners seek to protect themselves from systematic risk and to enhance their returns by improving CSR among portfolio firms. Common owners stand to gain far more than non-common owners do from one firm's CSR investment because it can mitigate negative externalities and create positive spillovers for other firms in their portfolios.

We find, in support of our theory, that common ownership has a positive association with CSR. Our main results show that a one standard deviation increase in common ownership is

[56] *Reputation sensitive industry* is coded 1 for SIC codes 1300–1399 (Oil & Gas), 2100–2199 (Tobacco), 2900–2999 (Energy Production), 4400–4499 and 1781 (Water Sourcing and Distribution), and 5181–5182, 5813, 2084 and 2085 (Alcohol), and 4600–4699 and 4900–4939 (Utilities). *Regulation sensitive industry* is coded 1 for SIC codes 1000–1499 (Mining and Oil & Gas), 2600–2699 (Pulp & Paper), 2800–2899 (Chemicals), 4400–4499 and 1781 (Water Sourcing and Distribution), 2900–2999 (Energy Production), and 4600–4699 and 4900–4939 (Utilities).

associated with a 0.06-unit increase in CSR, or 9% of the standard deviation of our focal KLD-based CSR performance measure. We find statistically and economically similar results using alternate CSR measures constructed from ASSET4 and MSCI ESG data. We also find that the main relation between common ownership and CSR is attributable to common owners with long investment horizons and becomes stronger in stakeholder sensitive industries, where CSR spillovers are most economically impactful. Moreover, we find that common ownership is most strongly associated with increases in financially material CSR rather than financially immaterial CSR. Acknowledging that the relationship between common ownership and CSR is potentially endogenous and that other explanations may exist, we apply a DID approach that exploits exogenous variation in common ownership and find further support for our main findings. We believe our findings contribute to several streams of research, which we now discuss.

Theoretical implications

Foremost, our study offers a new perspective on the motives common owners have to shape firms' strategic actions. By far, the most popular focus in the literature has been to approach common ownership from a competitive angle. Debate rages among academics (Goranova and Ryan 2021, Lewellen and Lowry 2021) and practitioners (OECD 2017) as to whether common owners seek to improve their returns by coordinating actions among portfolio firms in order to soften industry competition. Yet, manipulating competitive dynamics does not explain how common owners address an arguably greater investment challenge: Managing systematic risk. Motivated by this investment dilemma, our study reveals a new strategy that common owners use to manage systematic risk—leveraging CSR. By encouraging firms in their portfolio to be more socially responsible, and discouraging irresponsible or deviant behaviors, common owners can manage spillovers in ways that mitigate systematic risk and improve their

overall portfolio value. While some legal scholars have recently discussed the need for common owners to manage firm externalities (Condon 2020b) and a potential "upside" of common ownership (Coffee 2021), we are the first to venture beyond competitive dynamics (Dai and Qiu 2021) to provide empirical evidence on these matters.[57] Our study shows that common owners are motivated to use CSR as a tool to manage systematic risk and maximize portfolio returns. By showing the positive effects common owners have on CSR, our study also contrasts sharply with the view that common owners harm society and the economy by encouraging corporate collusion (Federal Trade Commission 2018).

Second, our study contributes to the burgeoning literature on the role of investors in shaping firm CSR. Prior studies have linked CSR-related outcomes to ownership by various types of investors, including, among others, activist hedge funds (DesJardine and Durand, 2020) and short- and long-term investors (Cobb 2015). While prior studies have been useful in uncovering how different types of investors impact firms' CSR, we so far know little about the role of common owners. This is surprising not only because common owners arguably have the strongest incentives of all investors to control negative corporate externalities, but also because research has already shown that common owners can profoundly impact a variety of corporate practices and strategies, such as competitive actions (Connelly et al. 2019) and M&A deals (Goranova et al. 2010). Integrating CSR research with studies on common ownership in management, law, accounting, and finance, we offer theory and supportive evidence on how common owners enhance the CSR activities of their portfolio firms.

[57] Dai and Qiu (2021) also find a positive association between common ownership and CSR. Our paper differs in several key ways, including the theory (they use a Cournot competition model that focuses on explaining consumer surplus) and empirics (they measure common ownership as the weight that a firm puts on its industry rivals' profits).

Approaching CSR from a portfolio perspective, which accounts for spillover effects, provides new insight on the financial rationale some investors have to promote socially responsible corporate activities and to discourage irresponsible ones. Prior studies typically attribute investors' promotion of CSR to one of two rationales: Either investors are socially motivated to impose their social preferences on firms (e.g., Guay et al. 2004) or they are financially motivated to use CSR as a strategy to improve firm-specific profits (e.g., DesJardine and Durand, 2020). Our study presents evidence for a third and entirely overlooked rationale: Investors promote CSR to reap the spillover benefits to their portfolios and maximize portfolio returns. Scholars have long debated investors' financial motives for CSR, but this conversation has remained almost exclusively at the firm level, asking for each individual firm, "Does it pay to be green?" We inform this discussion by revealing how the financial rationale for CSR becomes far more persuasive when approached from a portfolio perspective, rather than any individual firm's perspective.

We also contribute to research on financially material and immaterial CSR. Management scholars have long warned that research should not treat CSR as a monolithic construct, but rather should think about how CSR can be partitioned to capture its various dimensions. While some studies have considered specific CSR actions, such as the adoption of environmental standards (Dowell et al. 2000), others have disaggregated CSR into internal and external CSR (Hawn and Ioannou 2016), primary and secondary CSR (Hillman and Keim 2001), tactical and strategic CSR (DesJardine et al. 2019), responsibility and irresponsibility (Kölbel et al. 2017), and various dimensions that capture separate CSR activities (Flammer 2015). Although recent accounting and finance research has considered CSR that is material and immaterial from an investor standpoint (Grewal et al. 2020, Khan et al. 2016), few management studies have made

this distinction. We contribute by considering how common owners' emphasis on their portfolio value leads to changes in CSR driven primarily by increases in material CSR and decreases in immaterial CSR. By making this distinction, we also provide further evidence that common owners concern themselves with CSR for financial reasons.

Practical implications

Our results show that common owners encourage CSR to reduce their exposure to systematic risk and maximize their portfolio returns. Given the vast sums invested in ESG funds and other socially responsible investment vehicles, our study illuminates an important driver behind the mainstream investment community's recent push for improved CSR among publicly traded companies. And, while critics argue that ESG-investing does not improve CSR outcomes but mainly serves to pre-empt and delay necessary regulation, we show that common owners' need to manage systematic risk creates a potent market mechanism that forces firms to internalize their negative externalities, thereby improving the CSR of firms held in common owners' portfolios. Rather than replace regulation, common owners' incentives to maximize positive CSR spillovers and minimize negative ones can help society better manage CSR issues, including climate change, particularly in jurisdictions in which such regulation has been lacking. Relatedly, given the benefits common ownership can have on the environment and society by improving firms' CSR practices, our findings suggest that policymakers may not want to be too hasty in restricting common ownership amid suggestions that common owners incentivize anticompetitive behaviors (e.g., Azar et al. 2018).

For other stakeholders wanting to see improved CSR, including governments, consumers, and employees, our study suggests that faster progress can be made by supporting common owners. In particular, socially oriented investors without common ownership may advance their

non-financial objectives by supporting the pro-CSR agendas of common owners, for instance, by voting in support of their pro-CSR shareholder resolutions. Finally, an executive who sees the value of CSR but faces investor pushback can use our study to appeal to the firm's common owners and demonstrate how the returns to CSR for these investors are uniquely amplified when the spillover benefits from CSR are accounted for.

Limitations and directions for future research

We acknowledge several limitations of our work, which we hope present opportunities for future research. First, a limitation of our empirical approach is that we did not observe the common owners' actual engagements with managers. The closest we came is through our interviews, drawing on anecdotal evidence, and through prior studies showing that common owners do engage managers, and influence firms via the threat of exit. Future research could use a more observational approach and go "behind closed doors" to better understand how common owners' influence over managers unfolds. Second, although we looked at common owners' investment horizons, common owners may be further subdivided by, for example, investor type (such as pension funds and foundations) and geographic location. Beyond their investment horizons, do common owners in different places and with different investment styles differentially affect CSR? Third, we assume that common owners are uniquely positioned to capture the financial spillovers from one firm's CSR onto industry peers. Future research could directly test this assumption by using portfolio-level return models to compare the financial returns of CSR to common owners versus non-common owners.

CONCLUSION

Common owners have received considerable criticism over concerns that they limit competition. But looking more broadly, we see how they can benefit society by promoting

corporate social activities. A unique feature of our theory regarding common owners' exposure to systematic risk is that it is not bound to CSR, but can guide inquiries into the other ways that common owners might benefit business and society by helping firms internalize their externalities when other governance mechanisms, such as independent directorships and regulatory penalties, fail to do so. Without incentives to see the bigger landscape, some firms will myopically advance their own agendas at the expense of all others in a "tragedy of the commons." By having to account for the impact of each firm's actions on the larger system, common owners can incentivize firms to internalize their externalities.

Do Safety Management System Standards Indicate Safer Operations? Evidence from the OHSAS 18001 Occupational Health and Safety Standard

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INTRODUCTION

Workers in U.S. companies suffered 2.7 million workplace injuries and illnesses in 2020 (U.S. Bureau of Labor Statistics 2021). Workplace injuries in 2020 are estimated to have cost $164 billion, including wage and productivity losses ($45 billion), medical expenses ($35 billion), administrative expenses ($61 billion), and employers' uninsured costs ($13 billion) (National Safety Council 2022).

Despite the persistence and substantial costs of workplace injuries, occupational safety "has been virtually ignored in the operations literature" (Pagell et al. 2014: 1161), which is surprising given many operational factors can affect occupational safety, including (a) the design of production processes and equipment and (b) the deployment of safety devices (Vincent et al. 2004), hazard-reducing systems (de Koster, Stam, and Balk 2011), and training and reinforcement (Komaki et al. 1980; Choudhary et al. 2022). Indeed, firms and industries recognize that organizational practices are central to safety performance. Some have developed "best-practice" policies and procedures to improve occupational health and safety; as one example, the chemical manufacturing industry developed the Responsible Care program in the wake of an accident at a Union Carbide plant in Bhopal that killed thousands. Government agencies have also launched voluntary programs to encourage companies to implement procedures to assure worker safety. For example, the U.S. Occupational Safety and Health

Administration's (OSHA) Voluntary Protection Programs offers incentives to encourage companies to implement "comprehensive safety and health management system[s]" (U.S. Department of Labor 2020a).

Management system standards—certification to which requires implementing a set of organizational procedures—are an oft-touted organizational practice that is *assumed* to signal or foster superior performance. Initially focused on quality management (ISO 9001) and subsequently on environmental management (ISO 14001) and other domains, this approach has more recently been applied to health and safety. Intended to encourage companies to adopt best practices for occupational health and safety, the OHSAS 18001 Occupational Health and Safety Management standard was developed by a consortium of national standard bodies, accreditation agencies, certification companies, and occupational health and safety (OH&S) organizations. Initiated in 1999, it became an official British Standard in 2007 and, within a decade, more than 90,000 organizations in 127 countries had become certified to OHSAS 18001 (National Quality Assurance 2020), making it "the benchmark for OH&S" (International Organization for Standardization 2022a). In 2018, the International Organization for Standardization launched ISO 45001, an international standard based on OHSAS 18001, and urged establishments that had adopted OHSAS 18001 to migrate to the new standard before 2021, when OHSAS 18001 would be phased out. According to certification industry experts, not only have the vast majority of OHSAS 18001 certified establishments migrated to ISO 45001, but many other establishments have become certified to ISO 45001 because it is an international standard (rather than just a British Standard) and is organized like other leading ISO standards, which facilitates adoption.[58] Indeed, ISO 45001 has quickly become the world's third-most popular management system

[58] Author conversations with managers of several leading certification bodies, June 2022.

standard, trailing only ISO 9001 (launched in 1987) and ISO 14001 (launched in 1996). By 2020, just two years after ISO 45001 launched, 190,481 companies covering 251,191 establishments had already become certified, milestones that took the ISO 9001 and ISO 14001 standards at least a decade to achieve (International Organization for Standardization 2022c).

OHSAS 18001—and, subsequently, ISO 45001—specify a series of best practices for managing occupational health and safety, including establishing processes and procedures to enable organizations to control health and safety risks. Like other management system standards, they do not require any threshold level or improvement in safety *performance*. Instead, becoming certified (and recertified every three years) to these standards requires implementing their processes and procedures.

Enthusiasts tout two *presumed* benefits of health and safety management system standards such as OHSAS 18001 and ISO 45001—and of many other management system standards. The first presumed benefit is essentially a *signaling* effect stemming from information asymmetry: companies know much more about their own safety culture, practices, and performance than their buyers, regulators, and potential employees do. Because certification to a health and safety management system standard requires implementing the standard's set of best practices, certification signals superior safety performance as long as implementing these processes and procedures is less costly for companies with better safety performance, driving a selection effect. We therefore contend that safer establishments will be more likely to become certified to the standard. One leading certification body—an organization that certifies companies' adherence to various management system standards—bolsters this impression in its marketing claim that becoming certified to a safety management system standard "helps you to publicly demonstrate you have a positive health and safety culture, differentiate your

organization and put you in a strong position when competing for contracts" (British Standards Institute 2018).

The second potential benefit of adopting a health and safety management system standard is that implementing its required processes and procedures could *improve* safety performance. The British Standards Institute (BSI) Group notes that most establishments that became certified to OHSAS 18001 reported that implementing the standard's procedures helped them remain in regulatory compliance, reduce business risk, and reduce the likelihood of mistakes (British Standards Institute 2018). Similarly, Certification Europe, another certification body, notes that "[e]ffectively implementing the [OHSAS 18001] standard results in a safer working environment for your workforce" (Certification Europe 2020), while the International Organization for Standardization touts ISO 45001 as being suitable "[f]or organizations that are serious about improving employee safety, reducing workplace risks and creating better, safer working conditions" (International Organization for Standardization 2022b).

Marketing aside, it is unclear whether these alleged benefits are systematically realized in practice, questions that similarly arose with the earlier introduction of management system standards governing quality (Sroufe and Curkovic 2008; Levine and Toffel 2010) and environmental management (Corbett and Kirsch 2001). But assessing the two touted performance benefits poses several empirical challenges given the absence of publicly available data on (a) which establishments have been certified (and when) and (b) establishment-level occupational health and safety performance over time.

While it is too early to evaluate the ISO 45001 standard, given the lack of data on post-certification performance, we overcame these challenges to investigate these potential benefits to workplace safety associated with OHSAS 18001. First, we obtained rare access to establishment-

level safety panel data by gaining special approval to analyze microdata on injury and illness incidents reported in the Survey of Occupational Injuries and Illnesses (SOII) conducted by the U.S. Bureau of Labor Statistics (BLS). Second, we signed data-sharing agreements with 10 major certification bodies which provided data on all U.S. establishments that they had certified to OHSAS 18001. The availability of U.S.-establishment–level safety panel data—rare as it is—makes the U.S. an excellent empirical context despite being a relatively small market for such certifications. For example, comparing our data to that in International Organization for Standardization (2020c), we found that in 2020, just 0.8% of sites around that world that were certified to ISO 45001 were in the U.S., 1.4% for ISO 14001, and 2.6% for ISO 9001. Moreover, one of the certification bodies in our dataset indicated that just 2% of their overall OHSAS 18001 certifications in 2017 were for U.S. workplaces. Moreover, because the U.S. has relatively robust government regulatory and liability regimes that incentivize managing workplace safety, the effects of adopting and becoming certified to safety management system standards might be lower in the U.S. than in countries with weaker regulator regimes that tend to have worse occupational health and safety performance (International Labor Organization 2003; Liu et al. 2022), and where safety management system standards are more popular, such as China (where 60 times more establishments have been certified to ISO 45001 than in the U.S.) and India (3 times).

Our analysis reveals that OHSAS 18001 attracted safer establishments—those with fewer worker injuries and illnesses. Conditional on industry, size, and other establishment characteristics, each additional injury and illness case was associated with a 21-percent decline in the odds that an establishment was certified to OHSAS 18001 in the following two years. Each of the most severe cases--those resulting in days away from work—was associated with an even

larger 36-percent decline in the odds of certification. These results indicate that OHSAS 18001 certification is indeed a signal of superior *ex ante* performance.

We then assess whether being certified to OHSAS 18001 was associated with subsequent safety improvement by estimating difference-in-differences models on matched samples constructed via propensity score matching. Those results indicate that certified establishments subsequently had 20-percent fewer injury and illness cases than the matched control group over the next six years. These results indicate that OHSAS 18001 certification leads to improved safety performance.

This study contributes to the literature on the effects of other management standards. Studies have found that becoming certified to ISO 9001 has (a) been rewarded by buyers and NGOs (Christmann and Taylor 2002), (b) accelerated organizational growth (Terlaak and King 2006), (c) led to improved financial performance and growth (Corbett et al. 2005; Terlaak and King 2006; Levine and Toffel 2010), and (d) to improved regulatory compliance (Gray et al. 2015). Similarly, research has shown that becoming certified to ISO 14001 has reduced toxic chemical emissions and improved environmental regulatory compliance (Dasgupta, Hettige, and Wheeler 2000; Potoski and Prakash 2005a, 2005b), and that its pollution reduction effects can come at the expense of energy efficiency (Jeong and Lee 2022). Our work complements studies analyzing OHSAS 18001, including Abad et al. (2013) and Lo et al. (2014), which relied on employee surveys or explored regulatory compliance (described below).

RELATED LITERATURE

A few studies examined the effectiveness of the OHSAS 18001 health and safety management system. A survey-based study by Vinodkumar and Bhasi (2011) found that employees of two chemical companies in India that were certified to OHSAS 18001 reported

more safety training and safety procedures than those at six noncertified companies, but the study did not discern whether those differences already existed before certification.

Several other studies have investigated selection effects, with conflicting findings. Abad et al. (2013) compared 124 firms certified to OHSAS 18001 to 25 noncertified firms—all in Spain—and found that those with worse accident rates (accidents per employee) were more likely to become certified, but found no evidence that number of work days lost to injuries predicted certification. Heras-Saizarbitoria et al.'s (2019) sector-level analysis of firms in Spain found that OHSAS 18001 certification was more prevalent in *sectors* with more accidents. In contrast, Lo et al. (2014) found that U.S. manufacturing firms with at least one OHSAS 18001 certified site had fewer firm-wide health and safety regulatory compliance violations than a matched set of firms with no OHSAS 18001 certified sites.

A few firm-level studies examined the treatment effects of becoming certified to OHSAS 18001. Abad et al.'s (2013) analysis of 149 firms in Spain found that OHSAS 18001 adoption was associated with a 1.4-percentage-point decline in accident rate. Yang et al. (2021) found subsequent improvement in financial performance (return on assets) and labor productivity for manufacturing companies in China that had been certified to OHSAS 18001 in 2002–2011) but not for those certified in 2012–2014. Ghahramania and Salminen (2019) compared three OHSAS 18001 certified manufacturing firms in Iran to three noncertified ones and found that certified firms had more health and safety policies and procedures, but found no evidence of reduced injury rates.

Our paper improves upon these studies in several ways. First, it is the first to estimate the impact of OHSAS 18001 certification on establishment-level safety using longitudinal injury and illness data that establishments are legally required to report. This approach improves upon past

efforts that used proxies for safety performance such as OH&S regulatory compliance (e.g., Lo et al. 2014) or that used firm-level data on accident rates but over a short period (Abad et al. 2013).

Second, our collection of proprietary lists and certification dates of the U.S. establishments certified by 10 major certification bodies enables us to avoid relying on very small samples (e.g., Vinodkumar and Bhasi 2011; Ghahramania and Salminen 2019), firm-level inferences about establishment-level certification effects (e.g., Lo et al. 2014; Ghahramania and Salminen 2019; Yang et al. 2021), or conducting sector-level analysis (Heras-Saizarbitoria et al. 2019). Conducting our empirical analysis at the establishment level enables us to align establishment-level outcomes and control variables with the fact that the OHSAS 18001 standard is typically adopted and certified at the establishment level. In contrast, classifying an entire firm based on a single site having been certified risks mismeasuring the deployment of the health and safety management practices that the standard requires.

Third, our data enable us to use extensive controls to estimate selection effects, and to also rely on matching methods to construct comparable treatment and control groups and difference-in-differences models to estimate treatment effects, in contrast to studies that analyzed a small group of companies (e.g., Vinodkumar and Bhasi 2011; Ghahramania and Salminen 2019) or that provided little evidence that the two groups were reasonably similar (Abad et al. 2013). Our larger sample size and rich set of controls enables us both to control for potentially confounding factors influencing the decision to become certified and to identify a set of noncertified establishments sharing such characteristics to serve as our comparison group to estimate treatment effects.

THEORY AND HYPOTHESIS

Will Safer Establishments Adopt Safety Management System Standards?

Because stakeholders cannot directly observe establishments' safety performance, being certified to the OHSAS 18001 standard might enable establishments to convey to stakeholders their superior safety performance. Spence's (1973) seminal paper described an information asymmetry problem whereby employers, lacking information on job applicants' productivity, could rely on a college degree as a credible signal of productivity. This held because the cost of earning a degree was lower for more-productive individuals, which led to a positive selection effect to attend and graduate college. As a result, even if college did not improve their productivity, college applicants' higher productivity would be signaled to the job market by their college degree.

This logic applies to management system standards. Terlaak and King (2006) argued that the ISO 9001 Quality Management System Standard could be a credible signal of superior performance. This signaling works only if ISO 9001 disproportionately attracts companies with superior quality management practices in the first place because the implementation process would be less onerous for them "because they need to undertake fewer adjustments" (Terlaak and King 2006: 582). Similarly, the former head of the chemical company DuPont's Quality Management and Technology Center argued that the cost of implementing the ISO 9001 standard's requirements depends on "where you start… If you've just won a [Malcolm] Baldrige [National Quality] Award, registration of a plant or business may take you a few days. But if your quality system needs to be improved or created from the ground up the process can take as long as a year" (Marquardt 1992: 52). Such a cost differential "encourages high quality organizations to certify and that inhibits lower quality ones from following suit" (Terlaak and King 2006: 582). Darnall and Edwards (2006) examined this effect in the context of

environmental management and found that companies that had already implemented more environmental programs incurred lower costs in meeting the requirements of the ISO 14001 Environmental Management System Standard.

Applied to the domain of occupational safety, this logic implies that OHSAS 18001 certification would be a credible signal of superior workplace safety if organizations with above-average safety records faced lower costs of implementing the standard's requirements, and were thus disproportionately likely pursue certification. Why might this be so? As with the ISO 9001 and ISO 14001 management system standards, the OHSAS 18001 standard requires establishing establishment-wide safety policies, evaluating risks and opportunities, setting improvement objectives and goals, establishing safety procedures, and designing employee training programs. It also requires conducting internal auditing to assess procedural adherence, implementing corrective actions when needed, monitoring progress against goals, and periodically engaging in a management review process to assess overall progress and set new goals. The "policies, procedures and controls" required by OHSAS 18001 were based on "internationally recognized best practice" to promote health and safety performance (British Standards Institute 2020). Because establishments with better safety culture (which may therefore have already implemented many of these best practices) face a lower cost of meeting the OHSAS 18001's requirements, we anticipate that organizations that had already been operating with these practices—and plausibly exhibiting better health and safety performance—would be more likely to become certified to a safety management system standard. Thus, we predict:

Hypothesis 1: Establishments with superior occupational health and safety performance are more likely to become certified to the OHSAS 18001 Occupational Health and Safety Management System standard.

Will Adopting Safety Management System Standards Lead to Safer Establishments?

The OHSAS 18001 standard entails a stringent certification process that requires establishments to implement a proactive, systematic approach to managing occupational health and safety, including identifying risks and developing and deploying safety policies and procedures to manage those risks, training programs to promote implementation of those policies and procedures, accident preparedness, and procedures to remedy nonconformities. Such training programs seek to heighten employee and managerial attention to health and safety practices and hazards (Ghahramani 2016). Moreover, the standard requires periodic internal audits to evaluate the extent to which the organization's health and safety objectives are met. The OHSAS 18001 standard also requires certified establishments to engage in continuous improvement activities (though improved *performance* is not required); organizations must "implement, maintain and continually improve their organizational health and safety management system" (British Standards Institute 1999). The standard uses the Plan-Do-Check-Act cycle to systematically improve performance, which encourages establishments to set goals and assess current risks (plan), implement plans with direction from management (do), monitor and audit performance (check), and take corrective action and improve (act) (British Standards Institute 2013). The Plan-Do-Check-Act model was designed to improve performance (Coglianese and Nash 2020). As one company's OHSAS 18001 coordinator explained, "Although we have now been awarded certification to BS OHSAS 18001, this is where the real hard work begins. As per the requirements of the standard, we are striving to constantly improve our safety record at both our sites and will continue to adapt our processes and procedures accordingly" (British Standards Institute 2013).

The OHSAS 18001 standard also features a robust monitoring and sanctions system. Certification determinations are made by accredited, independent third-party certification bodies

and periodic recertification is required to confirm that all of the standard's elements continue to be met. If noncompliances, whether major or minor, are found, they must be fixed; failure to do so results in the loss of certification. This "substantive" management system standard—demanding specific health and safety practices with independent recertification—stands in contrast to "symbolic" self-regulatory programs such as the Responsible Care and Sustainable Slopes programs, which lack independent certification and have been shown to attract worse-than-average performers and fail to stimulate improvement (King and Lenox 2000; Rivera and De Leon 2004; Christmann and Taylor 2006).

Coglianese and Nash (2020) theorize that management systems lead organizations to improve compliance by reducing ignorance, aligning incentives, and increasing the legitimacy of rules. We believe these factors apply to how implementing the procedures required by OHSAS 18001 leads firms to improve safety performance. OHSAS 18001 requires establishments to develop and implement safety training programs that focus on identifying and reporting workplace hazards, thus reducing employees' ignorance of safe and healthy work practices. It requires top-management buy-in and requires documentation, risk assessment practices, and audits that create incentives for employees to work according to the establishment's health and safety policies. Finally, the company's certification to OHSAS 18001 signals to employees that management values health and safety best practices, lending legitimacy to employees engaging in such practices, which might otherwise be sacrificed to short-term production demands. In short, we predict that OHSAS 18001 certification will create a culture of workplace accountability that leads employees to engage in safer work practices, which will in turn lead to improved safety performance. We therefore hypothesize:

Hypothesis 2: Being certified to the OHSAS 18001 Occupational Health and Safety Management System standard will lead establishments to improve their occupational health and safety performance.

DATA AND MEASURES

Data

We obtained annual establishment-level injury data spanning 1995 to 2016, the most recent year available, from the U.S. Bureau of Labor Statistics Survey of Occupational Injuries and Illnesses (SOII). Each year, BLS sends the SOII survey to nearly 230,000 establishments, randomly selected according to location, industry, and number of employees in order to provide a representative sample of U.S. establishments (U.S. Bureau of Labor Statistics 2019). All private sector establishments that receive the survey are legally required to respond. We accessed SOII data by becoming authorized by BLS as temporary agents and visiting researchers, attaining Special Sworn Status by the Census Bureau, and working in a Federal Statistical Research Data Center.

We signed data-sharing agreements with 10 major international certification bodies, all accredited by the ANSI National Accreditation Board (ANAB), which provides independent validation to ensure they "demonstrate competence to audit and certify organizations conforming to management systems standards" (ANSI National Accreditation Board 2022). We obtained from these certification bodies the name, address, and certification date of all 1,381 U.S. establishment that they had certified to OHSAS 18001 between 1995 and 2018 and data on certification to the ISO 9001 and ISO 14001 standards. Annual tallies of OHSAS 18001 certifications were never collected or published,[59] but assuming that these 10 certification bodies had the same 20-percent market share of OHSAS 18001 certifications in the U.S. as they did for

[59] Author conversation with BSI Group, May 2022.

the ISO 9001 and ISO 14001 certifications conducted in the U.S. during 2010–2016 (from our comparing our data to the ISO Survey annual reports during that period), we estimate that roughly 6,900 OHSAS 18001 certifications occurred in the U.S. between 1995 and 2018. Furthermore, U.S. workplaces constituted 2.6% of the world's ISO 9001 certifications and 1.4% of the world's ISO 14001 certifications in 2020 (International Organization for Standardization 2022c), and one of the certification bodies that provided us data indicated that U.S. workplaces constituted 2% of their global OHSAS 18001 certifications in 2017. Thus, assuming that the U.S. market similarly represented just two percent of the world's OHSAS 18001 certifications suggests that as many as 345,000 OHSAS 18001 certifications would have occurred worldwide between 1995 and 2018. (By 2020, two years after ISO 45001 was launched to replace OHSAS 18001, 19,0481 organizations had been certified, affecting 251,191 establishments (International Organization for Standardization 2022d)). We also obtained Dun and Bradstreet data from the 2014 National Establishment Time Series (NETS) Manufacturing Database, which includes all establishments that reported manufacturing as their primary industry and all other establishments associated with these manufacturers' headquarters. This database includes annual establishment-level data from 1995 to 2014 on employment and industry identifiers, as well as the following establishment characteristics: whether it was a headquarters, branch, or standalone organization ("standalone" meaning it had no parent company, subsidiaries, or branch/division locations); whether it was foreign-owned, publicly owned (owned by a public company), and/or a government contractor; and the year it was established. (We used 2014 values for 2015–2016.)

Because the SOII, certification, and NETS datasets lack a common unique identifier, we linked establishments via their names and addresses using a combination of (a) fuzzy matching via matchit software and Stata's *reclink2* function, (b) geocode matching via ArcGIS, and (c)

manual assessment. Of the 1,381 establishments certified to OHSAS 18001 in our certification data, we identified 578 that had records in SOII and 522 that had records in both SOII and NETS.

Measures

From SOII, we obtained establishment-year counts of *all injury and illness cases*, our primary measure of safety performance, and three severity levels—namely, cases associated with (a) days away from work (*DAFW injury and illness cases*), (b) days of job transfers or restrictions (*DJTR injury and illness cases*), and (c) *other injury and illness cases* that triggered neither DAFW nor DJTR. We also obtained from SOII establishment-year counts of *all injury cases* and of *all illness cases,* each establishment's *total hours worked*, and each establishment's *average annual employment*, which we logged to reduce skew.

From the lists of certified establishments obtained from the 10 certification bodies, we created the dummy variables *OHSAS 18001 certified*, *ISO 9001 certified*, and *ISO 14001 certified,* coded 1 for every year during which an establishment was certified to that standard, and 0 otherwise.

From the Dun & Bradstreet data in the NETS dataset, we created dummies to denote whether each establishment was a *headquarters, branch,* or *standalone* organization; *foreign owned*; *publicly owned*; and a *government contractor*. We created *establishment age* by subtracting the establishment's "first year" (from NETS) from the current year.[60]

EMPIRICAL SPECIFICATIONS AND RESULTS

Selection Model

[60] For 5.0% of the selection regression estimation sample, this measure of *establishment age* was a negative number, which might be due to measurement error in NETS (miscoding "first year") and/or our imperfectly matching SOII and NETS records. Our regression models use a version of this variable in which we recoded missing values to 0 and included a dummy indicating when we had done so.

To assess whether the safety performance of OHSAS 18001 certified establishments differed from that of noncertified ones at the time the former became certified, we estimate several selection models that predict OHSAS 18001 certification. Once an establishment becomes certified, we omit it from the selection model sample in subsequent years because it is no longer at risk of certification.

We estimate the model depicted in Equation 1:

$$OHSAS_{i,j,t} = \square + \beta \times injury\ and\ illness\ cases_{i,t\text{-}1\&2} + \boldsymbol{\gamma}'\mathbf{X}_{it} + \delta_j + \delta_t + \varepsilon_{i,j,t}. \quad (1)$$

This model predicts that establishment *i* will become certified to the OHSAS 18001 standard in year *t* ($OHSAS_{i,t}$) as a function of its health and safety performance over the prior two years ($injury\ and\ illness\ cases_{i,t\text{-}1\&2}$) and a vector of controls ($\mathbf{X}_{it}$), as described below. (We find similar results (not reported) when we use the average of the prior five years instead of two years in order to account for sparsity of our data due to variable SOII sampling across years). We also include fixed effects for three-digit NAICS code industry dummies (δ_j) to account for potential differences in certification propensity across industries, and year dummies (δ_t) to flexibly allow for temporal-specific factors that might affect companies' propensity to seek certification.

$\mathbf{X}_{it}$ includes the following controls. We control for establishment size (employees) because larger firms might be more likely to become certified to OHSAS 18001 given that they have more resources and that larger firms have been found more likely to become certified to other management standards (Potoski and Prakash 2005a; Levine and Toffel 2010). We control for whether an establishment was a standalone firm, headquarters, or branch of a multi-establishment firm, as the type of establishment might affect how easily it can get buy-in from top management to adopt and become certified to OHSAS 18001. We control for whether an establishment was (a) foreign owned because those establishments might face more internal

pressure to become certified in order to bridge intra-organizational information asymmetries, (b) owned by a public company because public and private companies might face different incentives to become certified, and (c) a government contractor which might face government customers prone to require suppliers be certified to standards.

We then substitute *all injury and illness cases* with (a) both of its components—*injury cases* and *illness cases*—and then, in another model, with (b) three subtotals based on different severity levels—*DAFW injury and illness cases, DJTR injury and illness cases,* and *other injury and illness cases*. We also estimate versions of these models that control for whether each establishment has previously been certified to the ISO 9001 quality and/or ISO 14001 environmental management system standard, which, in either case, might make it easier to become certified to OHSAS 18001, given some overlapping requirements such as the recordkeeping for training and internal auditing. Moreover, implementing the requirements of ISO 9001 and OHSAS 18001 might result in complementary routines that make these standards more effective in improving quality and safety (Pagell et al. 2015) akin to complementarities found among ISO 9001 and ISO 14001 (Corbett and Kirsch 2001).

Estimating this selection model (a) restricts our sample to establishments found in both the SOII and NETS datasets that had reported injury data in at least one of the prior two years and (b) excludes OHSAS 18001 certified establishments' annual observations after the certification year. The resulting estimation sample for our selection model is 107,513 establishments, including 279 certified to OHSAS 18001, for a total of 461,478 establishment-years. (To the extent that any of the establishment-year observations in our sample that we classified as noncertified were in fact certified by certification bodies other than those 10 that provided our certification data, that would represent a bias against a result.) Table 1 reports the

selection model's summary statistics. The industry distribution and correlations are reported in Tables A-1 and A-2 in the Appendix.

Table 1. Summary Statistics of Selection Analysis Sample

	Mean	Std. dev.
OHSAS 18001 certified	0.0006	0.0246
All injury and illness cases †	1.42	1.30
DAWF injury and illness cases †	0.69	0.87
DJRT injury and illness cases †	0.65	0.99
Other injury and illness cases †	0.94	1.07
All injury cases †	1.37	1.26
All illness cases †	0.27	0.67
Average annual employment †	4.19	1.52
Establishment age (years)	14.35	7.26
Standalone (dummy)	0.44	0.50
Branch (dummy)	0.37	0.48
Publicly owned (dummy)	0.22	0.42
Foreign owned (dummy)	0.10	0.31
Government contractor (dummy)	0.10	0.31
ISO 9001 certified, prior year (dummy)	0.05	0.22
ISO 14001 certified, prior year (dummy)	0.01	0.11

Notes. *DAFW injury and illness cases* are those causing at least one day away from work. *DJTR injury and illness cases* refers to those causing a job transfer or restriction. *Other injury and illness cases* refers to those that did not cause DAWF or DJTR. U.S. Bureau of Labor Statistics confidentiality concerns prevent us from reporting minimum and maximum values of the variables based on SOII microdata (all injury and illness variables and *average annual employment*). *Establishment age* ranges from 0 to 25 years; all other control variables are dummies. Missing values of *establishment age* were recoded to 0. N = 461,478 establishment-years from 107,513 establishments.

† Averaged over the two years before the SOII survey year, then logged after adding 1.

Selection Analysis Results

We estimate our selection models using logistic regressions and report results in Table 2.

Table 2. Selection Model Results

Dependent variable: OHSAS 18001 certified

	(1)	(2)	(3)	(4)	(5)	(6)
All injury and illness cases†	-0.209**			-0.202**		
	[0.071]			[0.075]		
All injury cases†		-0.267**			-0.246**	
		[0.077]			[0.084]	
All illness cases†		0.036			-0.006	
		[0.085]			[0.090]	
DAFW injury and illness cases†			-0.358**			-0.339**
			[0.096]			[0.099]
DJTR injury and illness cases†			0.019			0.038
			[0.074]			[0.079]
Other injury and illness cases†			0.003			-0.024
			[0.079]			[0.082]
Annual employment†	0.550**	0.570**	0.541**	0.441**	0.467**	0.438**
	[0.072]	[0.071]	[0.070]	[0.077]	[0.076]	[0.074]
Establishment age	-0.005	-0.005	-0.005	-0.014	-0.014	-0.014
	[0.009]	[0.009]	[0.009]	[0.010]	[0.010]	[0.010]
Standalone	-0.347+	-0.351+	-0.351+	-0.243	-0.242	-0.250
	[0.210]	[0.211]	[0.209]	[0.212]	[0.213]	[0.212]
Branch	0.327*	0.316*	0.306+	0.242	0.237	0.226
	[0.160]	[0.161]	[0.161]	[0.164]	[0.164]	[0.164]
Publicly owned	0.677**	0.665**	0.675**	0.637**	0.628**	0.631**
	[0.153]	[0.154]	[0.153]	[0.162]	[0.162]	[0.160]
Foreign owned	1.830**	1.821**	1.812**	1.597**	1.589**	1.576**
	[0.151]	[0.151]	[0.152]	[0.161]	[0.161]	[0.161]
Government contractor	-0.098	-0.103	-0.091	-0.066	-0.072	-0.066
	[0.215]	[0.215]	[0.215]	[0.218]	[0.218]	[0.217]
ISO 9001 certified, prior year				1.332**	1.333**	1.340**
				[0.160]	[0.160]	[0.160]
ISO 14001 certified, prior year				2.068**	2.066**	2.063**
				[0.185]	[0.185]	[0.183]
Industry dummies (3-digit NAICS)	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies (1997-2016)	Yes	Yes	Yes	Yes	Yes	Yes

Notes. Logistic coefficients, with standard errors clustered by establishment in brackets. *DAFW injury and illness cases* are those causing at least one day away from work. *DJTR injury and illness cases* refers to those causing a job transfer or restriction. *Other injury and illness cases* refers to those that did not cause DAWF or DJTR. Missing values of *establishment age* were recoded to 0 and all models include a dummy variable indicating recoding. N = 461,478 establishment-year observations of 107,513 establishments.

† Averaged over the two years before the SOII survey year, then logged after adding 1.

** p<0.01, * p<0.05, + p<0.10.

We find a positive selection effect: establishments with fewer total injury and illness cases were more likely to pursue certification. The results of Model 1 indicate that each additional injury and illness case in the two years before certification was associated with a 21-percent decline in the odds that an establishment was certified to OHSAS 18001 (β = -0. 21, p < 0.01). We plot the predictive margins with 95-percent confidence intervals in Figure A-1, further illustrating that less-injurious establishments are more likely to become certified. Model 2 reveals that this relationship is driven entirely by injury cases (β = -0.27, p < 0.01); illness cases have no predictive power for OHSAS 18001 certification (β = 0.04, p = 0.67).

Model 3 results indicate that more severe injuries—DAFW injury and illness cases—drive the overall relationship between OHSAS certification and *ex ante* safety performance. Specifically, each injury and illness case with days away from work decreased the establishment's odds of pursuing OHSAS certification by 36 percent (β = -0.36, p < 0.01). We found, however, no evidence that the decision to pursue certification was affected by the less-serious cases with days of job transfer or restriction (DJTR) (β = 0. 02, p = 0.79) or by other injury or illness cases (β = 0.03, p = 0.96). One possible reason why less-serious injuries do not predict OHSAS 18001 adoption is that they are more vulnerable to underreporting (Boden et al. 2010). If certified establishments have better reporting practices than noncertified ones, then they might report a larger *share* of their less-serious injuries to BLS, even if they experience fewer *actual* injuries. Models 4–6, which also control for ISO 9001 and ISO 14001 certification, yield nearly identical results.

Turning to controls, we find evidence that larger establishments (more employees) were more likely to become OHSAS 18001 certified, as were establishments that were publicly owned, owned by a foreign entity, or already certified to ISO 9001 or ISO 14001.

Robustness tests

Our selection results are robust to several plausible alternative specifications, including (a) a series of year × industry interaction terms to allow for the possibility that certification propensity varied over time differently across industries, (b) state dummies to account for regional differences that could affect certification propensity, and (c) a series of year × state interaction terms to allow for these state-level factors to vary differentially over time. These alternative specifications, reported in Table C-3 in the Appendix, yield results similar to our main results, alleviating this concern.

One potential concern of our selection model is that if, in the two years before certification, establishments preparing for certification make substantial safety improvements that yield fewer injuries and illnesses in those pre-certification years, we might be misinterpreting those improvements as a selection effect rather than a treatment effect. We therefore estimate a variation of Equation (1) using averages of an establishment's four- and three-year lagged values of injuries and illnesses rather than of their two- and one-year lagged values. (That is, we replace *injury and illness cases*$_{i,t\text{-}1\&2}$ with *injury and illness cases*$_{i,t\text{-}3\&4}$.) These models yield results, reported in Table C-4 in the Appendix, similar to our main results, alleviating this concern.

Overall, these results support Hypothesis H1: becoming certified to the OHSAS 18001 standard was indeed an indicator of superior safety performance. We next evaluate H2: whether being certified to the standard led to subsequent safety performance improvement.

Treatment Effect Analysis

We develop a matched sample and then estimate a differences-in-differences model to evaluate the extent to which being certified to the OHSAS 18001 standard had a causal effect on annual injury and illness cases.

Developing a matched sample

To yield causal inferences, the difference-in-differences approach relies on an identifying assumptions that the treatment and control group would have responded similarly to becoming certified, and that control group's post-certification average trend is a plausible proxy for the treatment group's if it had not become certified. To bolster this assumption's credibility, we use propensity-score matching to develop a matched sample that is balanced on observable determinants of certification. This approach, used by others (e.g., Levine and Toffel 2010, Fisher, Gallino, and Netessine 2021, Akturk and Ketzenberg 2022), assumes that assignment to treatment is based on the observable variables in our model and that other unobservable factors represent random noise (that is, are uncorrelated with certification and safety performance). We go one step further by ensuring balance on levels of the outcome variable during the pre-treatment period.

We start with the SOII dataset and estimate a model that predicts OHSAS 18001 certification based on all variables in our selection model, similar to the models reported in Table 2 but with several differences. First, because the SOII survey targets many establishments only once every few years, we use values averaged over the prior five years (instead of the two-year averages used in the selection model). Second, we increase the richness of our specification by including five SOII sub-tallies as predictors: *DAFW injury and illness cases*, *DJTR injury and illness cases*, *other injury and illness cases*, *all injury cases*, and *all illness cases*. Third, in order to avoid losing statistical power, we include even those SOII establishments that we could not link to NETS data. We therefore use NETS variables in which missing values are recoded to 0 (and include dummies denoting when we do this). We estimate this model using logistic regression on observations starting in 2005 because very few certifications in our dataset

occurred before then (see results in Table C-5 in the Appendix) and use predicted values as propensity scores. Restricting to establishments found in SOII to those with non-missing propensity scores reduces the number of OHSAS 18001 certified establishments in our sample from 578 (Table C-6, Row 2) to 393 (Row 3).

To develop our matched sample, among certified establishments we focus only on those that also have at least one SOII record after their certification year—a restriction required to assess changes in safety associated with being certified. This restriction reduces our set of certified establishments from 393 to 274 (Table C-6, Row 4). When identifying potential matching candidates among noncertified establishments, we similarly restrict attention to those with at least one SOII record after the treatment establishment's certification year. We use propensity scores to conduct single-nearest-neighbor matching without replacement, conditional on exact matching on each treatment establishment's OHSAS 18001 certification year. This led us to identify 274 pairs of certified (treatment) and noncertified (control) establishments for the difference-in-differences model. Our results are robust to two alternative matching approaches, described below as robustness tests.

These treatment and control establishments were from comparable industries: the two groups were balanced respect to their distribution of 3-digit NAICS industry codes (chi-square = 25.28; p-value = 0.79). We also assessed the quality of our matching process by conducting t-tests to compare the matched treatments and controls along a wide array of covariates. None of the 26 covariates in the injury and illness matched sample exhibit statistically significant or economically meaningful differences between the treatments and controls (see Table C-7), a dramatic improvement over the imbalance of the full sample, for which there were statistically

significant and qualitatively large differences for all variables (Columns 1–4). Table C-8 reports summary statistics for the matched sample used in the difference-in-difference analysis.

Evaluation model

We use the following difference-in-differences model to estimate the effect of being certified to OHSAS 18001 on establishments' injury and illness cases:

$$Y_{i,t} = \beta_1\, OHSAS_{i,t} + \beta_2\, total\ hours\ worked\ (log)_{i,t} + \gamma_t + \square_{i,t} + \alpha_i + \varepsilon_{i,t}. \quad (2)$$

$Y_{i,t}$ refers to establishment i's number of *injury and illness cases* in year t (or *DAFW injury and illness cases*, *DJTR injury and illness cases*, and *other injury and illness cases*). Our primary independent variable of interest is $OHSAS_{it}$. For treatment establishment i, it is coded 1 for all years beginning with the year of certification to OHSAS 18001, and 0 before. For control establishments, it is always 0.

We control for *total hours worked (log)* to account for the possibility that treatment and control establishments might grow at different rates in the post period. We include year fixed effects (γ_t) to account for unobservable shocks that might be correlated with time-varying trends in injuries across calendar years. We create *post-period dummy* ($\square_{i,t}$) to denote an establishment's match year—the OHSAS 18001 certification year for each treatment establishment and its matched control—and all years thereafter. This acknowledges that other factors besides OHSAS 18001 certification might affect both treatments and controls after the match year. Finally, we include establishment fixed effects ($\square_i$) to control for establishments' time-invariant attributes.

We estimate our difference-in-difference models using fixed-effects Poisson regression and report standard errors clustered by establishment. We use Poisson regression instead of negative binomial regression because the former (unlike the latter) can include establishment fixed effects and is robust to overdispersion (Wooldridge 2010). We use all available observations ranging

from six years before to six years after the match year, recalling that the SOII data is unbalanced due to its sample varying every year.

Treatment Effect Results

Model 1 in Table 3 reports our main estimates of the treatment effect of OHSAS 18001 certification on *all injury and illness cases*; we find that OHSAS certification reduces all illness and injury cases by 20 percent (β = -0.22, p < 0.01; incident rate ratio = 0.80).

Table 3. Difference-in-Differences Treatment Effects Analysis of OHSAS 18001 on Injuries and Illness Cases: Main Results

	(1) All injury and illness cases	(2) DAFW injury and illness cases	(3) DJTR injury and illness cases	(4) Other injury and illness cases
OHSAS 18001 certified, prior year	-0.220**	-0.214	-0.277**	-0.159+
	[0.070]	[0.139]	[0.089]	[0.083]
Log total hours worked	1.005**	1.013**	1.099**	0.921**
	[0.068]	[0.149]	[0.089]	[0.076]
Establishment-level conditional fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Post-period dummy	Yes	Yes	Yes	Yes
Observations (establishment-years)	3,239	3,067	3,024	3,161
Establishments (certified/noncertified)	263 / 261	240 / 234	235/231	256/247
Mean dependent variable	20.7	4.7	8.5	8.7

Notes. Poisson regression coefficients, with standard errors clustered by establishment in brackets. *DAFW injury and illness cases* are those causing at least one day away from work. *DJTR injury and illness cases* refers to those causing a job transfer or restriction. *Other injury and illness cases* refers to those that did not cause DAWF or DJTR.
** p<0.01, * p<0.05, + p<0.10.

The remaining columns of this table report how OSHAS 18001 certification affects injury and illness cases of different severity. Model 2 provides a point estimate indicating that OHSAS 18001 certification leads to a 19 percent decline in *DAFW injury and illness cases* (ß = -0.21, p = 0.13; incident rate ratio = 0.81), but is (barely) not statistically significant at the 10-percent level.

Model 3 indicates that OHSAS 18001 certification leads to a 24 percent decline in *DJTR injury and illness cases* (that is, less-severe cases) (ß = -0.28, $p < 0.01$; incident rate ratio = 0.76). Model 4 indicates that certification leads to a 15 percent decline in *other injury and illness cases* (ß = -0.16, $p = 0.06$; incident rate ratio = 0.85). Thus, OHSAS 18001 certification reduces a range of injuries.

As a robustness check, we assess whether our results vary depending on the time window. Our primary approach is based on a window spanning six years before and six years after the match year. We reestimated the models reported in Table 3 on a narrower window (three years before and after the match year). The results, reported results in Table C-9 in the Appendix, tend to show similar but sometimes slightly smaller effect sizes. We find that OHSAS 18001 certification prompts a 16-percent decline in *all injury and illness cases* ($\beta = -0.18$, $p < 0.01$; incident rate ratio [IRR] = 0.84) over the three years after certification compared to the three years before, a 15-percent decline in *DAFW injury and illness cases* (ß = -0.17, $p = 0.14$; IRR = 0.85), a 20-percent decline in *DJTR injury and illness cases* (ß = -0.23, $p = 0.01$; IRR = 0.80), and a 14-percent decline in *other injury and illness cases* (ß = -0.15, $p = 0.05$; IRR = 0.86).

While our matched sample is balanced in terms of the number of establishments having previously been certified to ISO 9001 quality and/or ISO 14001 environmental management system standards, it is possible that the post-match addition or loss of such certifications might occur at different rates for our matched treatments and controls. The models in Table C-10 therefore add controls for ISO 9001 and ISO 14001 to the models in Table 3, yielding estimates very similar in magnitude and statistical significance to those of our primary models except that OHSAS 18001 certification has a larger and now statistically significant effect on *DAFW injury*

and illness cases. Specifically, the results in Table C-10 indicate that, controlling for ISO 9001 and ISO 14001 certification, OHSAS 18001 certification leads to a 21 percent decline in *all illness and injury cases* (Model 1: β = -0.23, p < 0.01; IRR = 0.79), a 26 percent decline in *DAFW illness and injury cases* (Model 2: β = -0.30, p = 0.03; IRR = 0.74), a 24 percent decline in *DJTR illness and injury cases* (Model 3: β = -0.27, p < 0.01; IRR = 0.76), and a 14 percent decline in *other illness and injury cases* (Model 4: β = -0.15, p = 0.10; IRR = 0.86).

Dynamic effects

Our difference-in-difference estimates indicate that establishments that became OHSAS-certified went on to have significantly fewer injuries and illnesses than a matched control group. However, these estimates have two limitations. First, the estimate of β_1 from Equation (2) could be contaminated by pre-trends; that is, establishments that achieve OHSAS 18001 certification might already have had greater injury improvement trends than their matched controls, even before being certified. We view this risk as minimal in our setting, since our matching process ensured that the *level* of prior injury rates for our certified and matched noncertified establishments was balanced. Still, it is possible that the *trends* are imbalanced, even if the *levels* are not. Second, the estimate of β_1 from Equation (2) estimates a single average treatment effect over time, but these effects could be dynamic; that is, the safety benefits of OHSAS 18001 certification might take time to materialize or they might be short-lived if certification does not result in permanent changes.

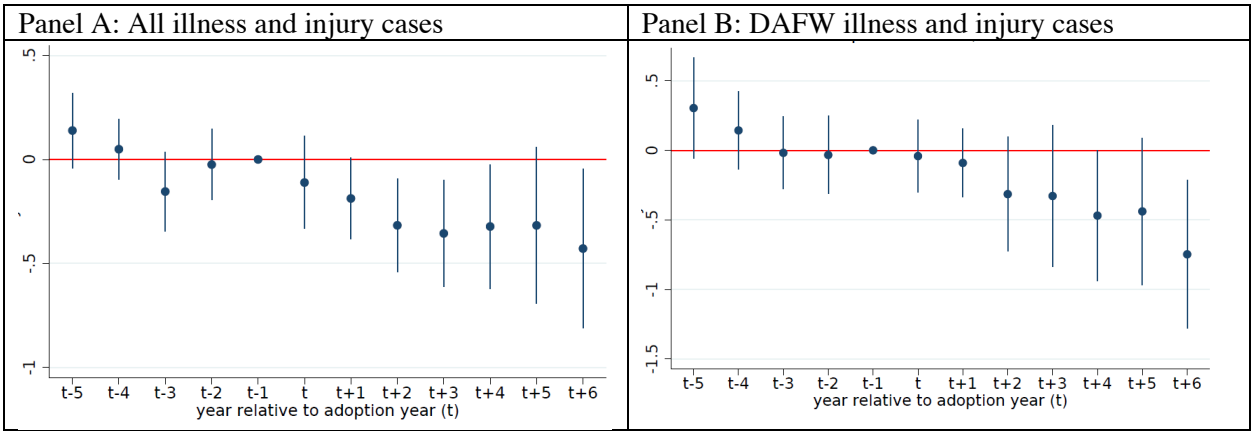
We therefore amend Equation (2) to formulate an event-study specification that estimates the difference in injury rates between certified establishments and their matched counterparts for each year τ relative to the "focal year (the certified establishment's year of certification):

$$Y_{i,t} = \sum_{\tau \in \{-6,6\}} \beta_\tau OHSAS_i * \mathbb{1}(t = \tau) + \beta_2 \, total\ hours\ worked\ (log)_{i,t} + \gamma_t + \alpha_i + \varepsilon_{i,t}, \qquad (3)$$

where all comparable terms are defined in Equation (2), but here $\mathbb{1}(\,)$ is an indicator function and we let τ range from -6 to 6. Thus $\mathbb{1}(t = \tau)$ is a series of 13 dummy variables indicating that an observation in year *t* is τ years relative to the focal year. If there is indeed a causal treatment effect of OHSAS certification on injuries, we expect β_τ to hover around 0 for $\tau < 0$. The magnitudes of the β_τ coefficients for $\tau \geq 0$ indicate the dynamic effects of certification over time.

Figure 1 shows the estimates of the β_τ coefficients when estimating *all illness and injury cases* and *DAFW illness and injury cases*. To avoid collinearity, we drop two pre-period variables (τ=-1 and τ =-6) so that the coefficients are normalized relative to these years (Borusyak et al. 2021). Reassuringly, the pre-period coefficients all hover around 0, indicating that injury rates of certified establishments and their matched counterparts were not already on different trends. The coefficients in the post-period are all negative, grow in magnitude over time, and are mostly statistically significant.

Figure 1. Dynamic Effects of OHSAS 18001 Certification on Establishments' Injury and Illness Rates



Notes: This figure shows coefficients and 95% confidence intervals from Equation (3). Each coefficient estimates the difference in total illness and injury cases (Panel A) or DAFW illness and injury case (Panel B) between treatments (OHSAS-certified establishments) and their matched controls for each year relative to the match year (the treatment's certification year). The coefficients are normalized by years *t-1* and *t-6*. See text for details.

Robustness to alternative matching

Our treatment analysis is based on difference-in-differences regressions estimated on a matched sample of certified and noncertified establishments that was constructed using nearest-neighbor propensity score matching. To ensure our results were not driven by the particular matching strategy we employed, we constructed an alternative matching approach. In our main analysis, our logistic model that generated propensity scores (Table C-5) included variables from the SOII, certification, and NETS databases. For those establishments in the SOII database for which we could not link to corresponding NETS records, we recoded those NETS variables from missing to 0; we did this to maximize the number of establishments eligible for matching, but it might have inadvertently created poor matches among those establishments missing NETS data. We therefore developed an alternative model to generate propensity scores that omitted all NETS variables. Doing so entails a tradeoff: while it ensures that all establishments' propensity scores are generated using the same set of fully-populated variables (the SOII and ISO certification variables), omitting NETS variables—some of which were statistically significant predictors of OHSAS 18001 adoption—creates the risk that the resulting propensity scores are noisier estimates of the probability that an establishment adopts OHSAS 18001. This yielded a matched sample that is balanced on the SOII and certification variables (Table C-11, Panel A, part 1) but only partially balanced for the NETS variables (part 2), which is unsurprising given the former but not the latter were included in this alternative model that generated the propensity scores used to construct this alternative matched sample. That several of the NETS variables were balanced despite our excluding NETS from the propensity score model might be due to ISO 9001 and ISO 14001 certification being correlated with several NETS variables, as indicated in Table C-2 and in Levine and Toffel (2010). Estimating our difference-in-differences model on

this alternative matched sample yields results (Table C-11, Panel B) that are very similar to our primary results (Table 3), indicating that our treatment results are robust to this alternative matching approach.

DISCUSSION

We find that U.S. establishments that became certified to OHSAS 18001 tended to already be safer than comparable workplaces. Each additional injury and illness case was associated with a 21-percent decline in the odds that an establishment became certified to OHSAS 18001 and each additional case of the most severe type of injury and illness we studied—those resulting in days away from work—is associated with a 36-percent decline in the odds of becoming certified. This positive selection effect indicates that OHSAS 18001 certification is a credible signal of *ex ante* superior safety performance.

We also find that establishments certified to OHSAS 18001 subsequently became safer workplaces by reducing injuries to a greater extent than a matched set of noncertified establishments, revealing a treatment effect. OHSAS 18001 certification reduces the total number of illness and injury cases by 20 percent and the number of illness and injury cases associated with job transfers or restrictions by 24 percent. We find some evidence that OHSAS 18001 also reduces the most severe injuries and illnesses—those that lead to days away from work—by a similar magnitude, though this estimate was somewhat imprecise.

Finding both the selection and the treatment effect of OHSAS 18001 certification reveals it to be a credible indicator of superior average safety performance, an important insight for regulators and for buyers interested in procuring from safer workplaces, especially given the tendency for management systems standards to diffuse through supply chains (Corbett 2006). We have shared our results with several certification bodies, who appreciated our providing rare

large-scale quantitative evidence about the benefits of certification to safety management system standards and indicated that our results will inform their strategy and outreach to clients and regulators.

Cost-constrained regulatory agencies like U.S. OSHA and its state-level counterparts should consider whether to reduce scrutiny over OHSAS 18001 certified establishments and divert monitoring resources elsewhere. That said, heterogeneous effects likely underlie the average effects we found and more research is needed to ascertain which types of certified establishments are especially likely to exhibit superior safety performance and which types might not be safer at all.

Our study is the first to directly examine the effects of the OHSAS 18001 standard on establishment-level safety performance using longitudinal injury and illness data and leveraging a sample large enough to let us identify appropriate comparison groups. Our results supplement other studies of the effect of OHSAS 18001 certification on regulatory compliance (Lo et al. 2014), accident rates (Abad et al. 2013), and financial performance (Yang et al. 2021). Our findings complement studies that found safety to be a spillover benefit of becoming certified to the ISO 9000 quality management system standard. Specifically, Naveh and Marcus (2007) found that certification to the ISO 9002 quality standard reduced accident rates among trucking companies and Levine and Toffel (2010) found some evidence that ISO 9001 quality standard certification increased California manufacturers' propensity to be injury free.

We also contribute to the safety performance literature, which has focused on the importance of safety leadership, safety routines, and high reliability, and the challenge of accidents being viewed as "normal" (e.g., Komaki et al. 1980; Roberts 1990; Perrow 1999;

Vincent et al. 2004; de Koster et. al. 2011). We add to this literature by showing that an occupational health and safety management system can also improve safety performance.

Our study has several limitations. Qualitative studies can complement our work by revealing—as our quantitative approach cannot do—the mechanisms by which implementing the practices required by management system standards actually change how work is conducted, which our quantitative approach cannot do. Also, our analysis is limited to U.S. establishments; results might differ in Europe and Asia, where management system standard certification is especially prevalent. Future studies that focus on management system standards with many more certified establishments can use their greater statistical power to go beyond estimating average effects by exploring heterogeneous effects across industries, organizational size, and other institutional and organizational factors.

Given that OHSAS 18001 is the basis for the new ISO 45001 Occupational Health and Safety Management Systems standard that was launched in 2018 and already adopted by more than 250,000 establishments—quickly becoming the world's third-most popular management system standard worldwide—our study provides promising evidence that this new standard will also prove effective in distinguishing safer workplaces. As this new standard is structured to be more aligned and thus easier to integrate with other management system standards, such as ISO 9001 (quality) and ISO 14001 (environment), which could prompt many more companies to implement the management processes and procedures that OHSAS 18001 has specified—which our study has demonstrated led to improved workplace safety. ISO 45001 adds some requirements beyond what OHSAS 18001 stipulated—such as greater senior management engagement in health and safety—and a broader set of health and safety activities to promote a safety culture—such as conducting more-transparent accident investigations and incorporating

safety into performance appraisal systems and recruiting efforts (Pavlovic 2020). The greater emphases on senior leadership engagement and safety culture might mean that our results underestimate the safety benefits this new standard might yield, but research is needed to evaluate the effects of ISO 45001 once time passes and sufficient post-certification safety performance data become available. Such data will also enable investigations of heterogeneous effects, akin to work on other management system standards (e.g., Lo et. al 2013).

CONCLUSION

Safety management system standards have been implemented by hundreds of thousands of companies around the world, yet it has remained unclear whether certified organizations exhibit better safety performance than others and whether being certified actually improves an establishment's own safety performance. Companies considering certification to an occupational health and safety management system standard have a clear interest in knowing whether it tends to improve safety. And companies that preferentially procure from certified establishments might do so based on the presumption that certification is a credible signal of safer workplaces that, in turn, might reduce the risk of disruption and reputation spillover due to sourcing from unsafe suppliers.

Our study examines the first health and safety management system standard that calls for implementing a set of best practices. Our results confirm that, when establishments became certified to OHSAS 18001, they were already safer workplaces—reporting fewer injuries and illnesses—than comparable establishments. Moreover, we find that certification led to subsequent safety improvement—significant declines in injury and illness—compared to a matched set of noncertified establishments. This finding is particularly important for managers given the enormous costs that occupational injuries impose on companies. Together, our finding

both a selection effect and a treatment effect reveals that OHSAS 18001 certification is a credible indicator of superior average safety performance, an important insight for buyers interested in procuring from safer workplaces and regulators determining where to allocate scarce inspection resources.

These results have wide implications for thousands of companies around the world, including those certified to OHSAS 18001 and to its successor ISO 45001 and those considering ISO 45001 certification. Our results also have ramifications for both buyers and regulators, who now have credible evidence that OHSAS 18001 certification both signals superior *ex ante* health and safety performance and typically leads to further safety improvement.

Our study is also one of few that directly examine the effects of management system standards on their domain's performance, such as the few studies that examined the impact of ISO 14001 on environmental performance measured by toxic chemical emissions (Potoski and Prakash 2005a) and environmental compliance (Potoski and Prakash 2005b). Our results lend credence to those advocating management system standards as a tool to improve performance and provides encouragement to those that are creating and become certified to management system standards in other domains.

REFERENCES

Abad, J., Lafuente, E., and Vilajosana, J. 2013. An assessment of the OHSAS 18001 certification process: Objective drivers and consequences on safety performance and labour productivity. *Safety Science* 60: 47–56.

Aguilera RV, Bermejo VJ, Capapé J, Cuñat V. 2019. The firms' reaction to changes in the governance preferences of active institutional owners. Working paper, Northeastern University.

Ainslie G. 1975. Specious reward: a behavioral theory of impulsiveness and impulse control. *Psychological Bulletin* **82**(4): 463–496.

Akturk, M.S., and Ketzenberg, M. 2022. Exploring the competitive dimension of omnichannel retailing. *Management Science* 68(4): 2377–3174.

Alsaifi K, Elnahass M, Salama A. 2020. Carbon disclosure and financial performance: UK environmental policy. *Business Strategy and the Environment* **29**(2): 711–726.

Amel-Zadeh, A., G. Serafeim. 2018. Why and how investors use ESG information: Evidence from a global survey. *Financial Analysts Journal* **74**(3) 87-103.

ANSI National Accreditation Board. 2022. ANSI National Accreditation Board—How to become an ANAB-accredited certification body. https://anab.ansi.org/management-systems-accreditation/become-a-cb, accessed June 2022.

Appel, I.R., T.A. Gormley, D.B. Keim. 2016. Passive investors, not passive owners. *Journal of Financial Economics* **121**(1) 111-141.

Azar, J., M.C. Schmalz, I. Tecu. 2018. Anticompetitive effects of common ownership. *The Journal of Finance* **73**(4) 1513-1565.

Bansal, P., DesJardine, M.R. 2014. Business sustainability: It is about time. *Strategic Organization* **12**(1) 70-78.

Bansal, P., H.-C. Song. 2017. Similar but not the same: Differentiating between corporate sustainability and corporate responsibility. *Academy of Management Annals* **11**(1) 105-149.

Barnett, M.L., A.J. Hoffman. 2008. Beyond corporate reputation: Managing reputational interdependence. *Corporate Reputation Review* **11**(1) 1-9.

Barnett, M.L., R.M. Salomon. 2012. Does it pay to be really good? Addressing the shape of the relationship between social and financial performance. *Strategic Management Journal* **33**(11) 1304-1320.

Berle, A.A., G.G.C. Means. 1932. *The modern corporation and private property*. Macmillan: New York.

Bethel JE, Liebeskind J. 1993. The effects of ownership structure on corporate restructuring. *Strategic Management Journal* **14**(Special Issue): 15–31.

Blacconiere, W.G., D.M. Patten. 1994. Environmental disclosures, regulatory costs, and changes in firm value. *Journal of Accounting and Economics* **18**(3) 357-377.

Boden, L.I., Nestoriak, N., and Pierce, B. 2010. Using capture-recapture analysis to identify factors associated with differential reporting of workplace injuries and illnesses. *2010 JSM Proceedings, Statistical Computing Section*. Alexandria, VA: American Statistical Association. http://www.asasrms.org/Proceedings/

Borah, A., G.J. Tellis. 2016. Halo (spillover) effects in social media: Do product recalls of one brand hurt or help rival brands? *Journal of Marketing Research* **53**(2) 143-160.

Borusyak, K., Jaravel, X., and Spiess, J. 2021. Revisiting event study designs: Robust and efficient estimation. Working Paper, https://arxiv.org/abs/2108.12419

Brammer, S., A. Millington. 2004. The development of corporate charitable contributions in the UK: A stakeholder analysis. *Journal of Management Studies* **41**(8) 1411-1434.
British Standards Institute. 1999. *OHSAS 18001: 1999 Occupational Health and Safety Management Systems—Specification*. London: British Standards Institute.
British Standards Institute. 2013. BS OHSAS 18001 occupational health and safety management—It's your duty. https://www.bsigroup.com/LocalFiles/nl-nl/bs-ohsas-18001/resources/BSI-BS-OHSAS%2018001-Implementing-Guide-EN-NL.pdf, accessed December 2018.
British Standards Institute. 2018. OHSAS 18001—How your organization will benefit—Executive briefing. https://www.bsigroup.com/LocalFiles/en-US/Brochures/OHSAS/OHSAS-18001-ceo-briefing.pdf, accessed August 2018.
British Standards Institute. 2020. What is OHSAS 18001? https://www.bsigroup.com/en-US/OHSAS-18001-Occupational-Health-and-Safety/, accessed August 2020.
Brochet, F., M. Loumioti, G. Serafeim. 2015. Speaking of the short-term: Disclosure horizon and managerial myopia. *Review of Accounting Studies* **20**(3) 1122-1163.
Burbano, V.C. 2016. Social responsibility messages and worker wage requirements: Field experimental evidence from online labor marketplaces. *Organization Science* **27**(4) 1010-1028.
Bushee B. 1998. The influence of institutional investors on myopic R&D investment behavior. *Accounting Review* **73**(3): 305–333.
Bushee B. 2001. Do institutional investors prefer near-term earnings over long-run value? *Contemporary Accounting Research* **18**(2): 207–246.
Bushee, B.J. 1998. Investors on myopic R&D investment behavior. *The Accounting Review* **73**(3) 305-333.
Cao, J., H. Liang, X. Zhan. 2019. Peer effects of corporate social responsibility. *Management Science* **65**(12) 5487-5503.
Carhart MM. 1997. On persistence in mutual fund performance. *Journal of Finance* **52**(1): 57–82.
CDP. 2016. Guidance for companies reporting on climate change on behalf of investors & supply chain members 2016. White paper, Carbon Disclosure Project.
Ceres. 2018. Disclose what matters: bridging the gap between investor needs and company disclosures on sustainability. White paper, Ceres.
Certification Europe. 2020. Certification—OHSAS 18001:2007 occupational health and safety management certification. https://www.certificationeurope.com/certification/ohsas-18001-occupational-health-and-safety-management/, accessed February 2020.
Chen S, Feldman ER. 2019. Activist-impelled divestitures and shareholder value. *Strategic Management Journal* **39**(10): 2726–2744.
Chen, Y.-C., M. Hung, Y. Wang. 2018. The effect of mandatory CSR disclosure on firm profitability and social externalities: Evidence from China. *Journal of Accounting and Economics* **65**(1) 169-190.
Cheng, X., H.H. Wang, X. Wang. 2021. Common institutional ownership and corporate social responsibility. *Journal of Banking & Finance* **136** 106218.
Choudhary, V., Shunko, M., Netessine, S., and Koo, S. 2022. Nudging drivers to safety: Evidence from a field experiment. *Management Science* 68(6): 4196–4214.
Christmann, P., and Taylor, G. 2002. Globalization and the environment: Strategies for international voluntary environmental initiatives. *Academy of Management Perspectives* 16(3): 121–135.

Christmann, P., and Taylor, G. 2006. Firm self-regulation through international certifiable standards: Determinants of symbolic versus substantive implementation. *Journal of International Business Studies* 37(6): 863–878.

Christophe, S.E., H. Lee. 2020. Material and immaterial corporate social responsibility and financial performance: Evidence from IPOs. *Academy of Management Discoveries* **7**(3) 406-418.

CNN Business. 2017. Exxon gives up major climate change fight. 12 December, https://money.cnn.com/2017/12/12/investing/exxon-climate-change-risk/index.html, accessed August 2020.

Cobb, J.A. 2015. Risky business: The decline of defined benefit pensions and firms' shifting of risk. *Organization Science* **26**(5) 1332–1350.

Coffee, J.C. 2021. The future of disclosure: ESG, common ownership, and systematic risk. *Columbia Business Law Review* **2021**(2) 602-650.

Coglianese, C., and Nash, J. 2020. Compliance management systems: Do they make a difference? In Sokol, D., and van Rooij, B., eds., *Cambridge Handbook of Compliance*. Cambridge, UK: Cambridge University Press, 20–35.

Condon, M. 2020a. Climate change's new ally: Big Finance. *Boston Review*. **16** 97-109

Condon, M. 2020b. Externalities and the common owner. *Washington Law Review* **95**(1) 1-81.

Connelly BL, Shi W, Hoskisson RE, Koka BR. 2019. Shareholder influence on joint venture exploration. *Journal of Management*, forthcoming.

Connelly, B.L., K.B. Lee, L. Tihanyi, S.T. Certo, J.L. Johnson. 2019. Something in common: Competitive dissimilarity and performance of rivals with common shareholders. *Academy of Management Journal* **62**(1) 1-21.

Connelly, B.L., L. Tihanyi, S.T. Certo, M.A. Hitt. 2010. Marching to the beat of different drummers: The influence of institutional owners on competitive actions. *Academy of Management Journal* **53**(4) 723-742.

Corbett, C.J. 2006. Global diffusion of ISO 9000 certification through supply chains. *Manufacturing & Service Operations Management* 8(4): 330–350.

Corbett, C.J., and Kirsch, D.A. International diffusion of ISO 14000 certification. *Production and Operations Management* 10(3): 327–342.

Corbett, C.J., Montes-Sancho, M.J., and Kirsch, D.A. 2005. The financial impact of ISO 9000 certification in the United States: An empirical analysis. *Management Science* 51(7): 1046–1059.

Cuñat V, Giné M, Guadalupe M. 2012. The vote is cast: the effect of corporate governance on shareholder value. *Journal of Finance* **67**(5): 1943–1977.

Dai, X., Y. Qiu. 2021. Common ownership and corporate social responsibility. *The Review of Corporate Finance Studies* **10**(3) 551-577.

Darnall, N., and Edwards Jr., D. 2006. Predicting the cost of environmental management system adoption: The role of capabilities, resources and ownership structure. *Strategic Management Journal* 27(4): 301–320.

Dasgupta, S., Hettige, H., and Wheeler, D. 2000. What improves environmental compliance? Evidence from Mexican industry. *Journal of Environmental Economics and Management* 39(1): 39–66.

David P, Hitt MA, Gimeno J. 2001. The influence of activism by institutional investors on R&D. *Academy of Management Journal* **44**(1): 144–157.

Davis, G.F. 2008. A new finance capitalism? Mutual funds and ownership re-concentration in the United States. *European Management Review* **5**(1) 11-21.
Davis, G.F. 2009a. *Managed by the markets: How finance re-shaped America*. Oxford University Press: Oxford, UK.
Davis, G.F. 2009b. The rise and fall of finance and the end of the society of organizations. *The Academy of Management Perspectives* **23**(3) 27-44.
Davis, G.F. 2010. The twilight of the Berle and Means corporation. *Seattle University Law Review* **34**(4) 1121-1138.
de Koster, R.B.M., Stam, D., and Balk, B.M. 2011. Accidents happen: The influence of safety-specific transformational leadership, safety consciousness, and hazard reducing systems on warehouse accidents. *Journal of Operations Management* 29(7–8): 753–765.
DeGeorge F, Patel J, Zeckhauser R. 1999. Earnings management to exceed thresholds. *Journal of Business* **72**(1): 1–33.
DesJardine MR, Durand R. 2020. Disentangling the effects of hedge fund activism on firm financial and social performance. *Strategic Management Journal* **41**(6): 1054–1082.
DesJardine, M.R, P. Bansal. 2019. One step forward, two steps back: How negative external evaluations can shorten organizational time horizons. *Organization Science* **30**(4) 761-780.
DesJardine, M.R., E. Marti, R. Durand. 2021. Why activist hedge funds target socially responsible firms: The reaction costs of signaling corporate social responsibility. *Academy of Management Journal* **64**(3) 851-872.
DesJardine, M.R., P. Bansal, Y. Yang. 2019. Bouncing back: Building resilience through social and environmental practices in the context of the 2008 Global Financial Crisis. *Journal of Management* **45**(4) 1434-1460.
DesJardine, M.R., R. Durand. 2020. Disentangling the effects of hedge fund activism on firm financial and social performance. *Strategic Management Journal* **41**(6) 1054-1082.
Di Giuli, A., L. Kostovetsky. 2014. Are red or blue companies more likely to go green? Politics and corporate social responsibility. *Journal of Financial Economics* **111**(1) 158-180.
Diestre, L., N. Rajagopalan. 2014. Toward an input-based perspective on categorization: Investor reactions to chemical accidents. *Academy of Management Journal* **57**(4) 1130-1153.
Dikolli, S.S., S.L. Kulp, K.L. Sedatole. 2009. Transient Institutional Ownerhip and CEO Contracting. *Accounting Review* **84**(3) 737-770.
Dimson E, Karakas O, Li X. 2015. Active ownership. *Review of Financial Studies* **28**(12): 3225–3268.
Dowell, G., S. Hart, B. Yeung. 2000. Do corporate global environmental standards create or destroy market value? *Management Science* **46**(8) 1059-1074.
Dyreng, S.D., J.L. Hoopes, J.H. Wilde. 2016. Public pressure and corporate tax behavior. *Journal of Accounting Research* **54**(1) 147-186.
Eesley C, Lenox MJ. 2006. Firm responses to secondary stakeholder action. *Strategic Management Journal* **27**(8): 765–781.
Fama EF, French KR. 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* **33**(1): 3–56.
Federal Trade Commission. 2018. Hearings on competition and consumer protection in the 21st century. https://www.ftc.gov/news-events/events-calendar/ftc-hearing-8-competition-consumer-protection-21st-century.
Ferraro F, Beunza D. 2018. Creating common ground: a communicative action model of dialogue in shareholder engagement. *Organization Science* **29**(6): 1187–1207.

Financial Times. 2015. Mark Carney warns investors face "huge" climate change losses. 29 September, https://www.ft.com/content/622de3da-66e6-11e5-97d0-1456a776a4f5, accessed August 2020.

Financial Times. 2017. Top investment groups push for action on climate risks. 1 October, https://www.ft.com/content/48ad5476-a6aa-11e7-ab55-27219df83c97, accessed August 2020.

Financial Times. 2018. Money managers: the new warriors of climate change. 26 December, https://www.ft.com/content/c245af4a-f875-11e8-af46-2022a0b02a6c, accessed August 2020.

Financial Times. 2020. Climate change: asset managers join forces with the ecowarriors. 26 July, https://www.ft.com/content/78167e0b-fdc5-461b-9d95-d8e068971364, accessed August 2020.

Fisher-Vanden K, Thorburn KS. 2011. Voluntary corporate environmental initiatives and shareholder wealth. *Journal of Environmental Economics and Management* **62**(3): 430–445.

Fisher, M., Gallino, S., and Netessine, S. 2021. Does online training work in retail? *Manufacturing & Service Operations Management* 23(4): 876–894.

Flammer C, Bansal P. 2017. Does long-term orientation create value? Evidence from a regression discontinuity. *Strategic Management Journal* **38**(9): 1827–1847.

Flammer C, Hong B, Minor D. 2019. Corporate governance and the rise of integrating corporate social responsibility criteria in executive compensation: effectiveness and implications for firm outcomes. *Strategic Management Journal* **40**(7): 1097–1122.

Flammer C. 2015. Does corporate social responsibility lead to superior financial performance? A regression discontinuity approach. *Management Science*, **61**(11): 2549–2568.

Flammer, C. 2015. Does product market competition foster corporate social responsibility? Evidence from trade liberalization. *Strategic Management Journal* **36**(10) 1469–1485.

Flammer, C. 2018. Competing for government procurement contracts: The role of corporate social responsibility. *Strategic Management Journal* **39**(5) 1299-1324.

Flammer, C., M.W. Toffel, K. Viswanathan. 2021. Shareholder activism and firms' voluntary disclosure of climate change risk. *Strategic Management Journal* **42**(1) 1850–1879.

Forbes. 2019. Part I: PG&E gets burned for California wildfires. 7 February, https://www.forbes.com/sites/arielcohen/2019/02/07/part-1-pge-gets-burned-for-california-wildfires/, accessed August 2020.

Fortune. 2015. Energy companies face big risks from Paris climate deal. 17 December, https://fortune.com/2015/12/17/energy-companies-feel-the-burn-from-paris-climate-deal/, accessed August 2020.

Frederick S, Loewenstein G, O'Donoghue T. 2002. Time discounting and time preference: a critical review. *Journal of Economic Literature* **40**(2): 351–401.

Gaspar JM, Massa M, Matos P. 2005. Shareholder investment horizons and the market for corporate control. *Journal of Financial Economics* **76**(1): 135–165.

Ghahramani, A. 2016. Factors that influence the maintenance and improvement of OHSAS 18001 in adopting companies: A qualitative study. *Journal of Cleaner Production* 137: 283–290.

Ghahramania, A., and Salminen, S. 2019. Evaluating effectiveness of OHSAS 18001 on safety performance in manufacturing companies in Iran. *Safety Science* 112: 206–212.

Gibbons R, Murphy KJ. 1992. Optimal incentive contracts in the presence of career concerns: theory and evidence. *Journal of Political Economy* **100**(3): 468–505.
Gilje, E.P., T.A. Gormley, D. Levit. 2020. Who's paying attention? Measuring common ownership and its impact on managerial incentives. *Journal of Financial Economics* **137**(1) 152-178.
Gillan SL, Starks LT. 2000. Corporate governance proposals and shareholder activism: the role of institutional investors. *Journal of Financial Economics* **57**(2): 275–305.
Gillan SL, Starks LT. 2007. The evolution of shareholder activism in the United States. *Journal of Applied Corporate Finance* **19**(1): 55–73.
Godfrey, P.C., C.B. Merrill, J.M. Hansen. 2009. The relationship between corporate social responsibility and shareholder value: An empirical test of the risk management hypothesis. *Strategic Management Journal* **30**(4) 425-445.
Goranova, M., L.V. Ryan. 2014. Shareholder activism: A multidisciplinary review. *Journal of Management* **40**(5) 1230-1268.
Goranova, M., L.V. Ryan. 2021. The corporate objective revisited: The shareholder perspective. *Journal of Management Studies* **59**(2) 526-554.
Goranova, M., R. Dharwadkar, P. Brandes. 2010. Owners on both sides of the deal: Mergers and acquisitions and overlapping institutional ownership. *Strategic Management Journal* **31**(10) 1114-1135.
Graham JR, Harvey CR, Rajgopal S. 2005. The economic implications of corporate financial reporting. *Journal of Accounting and Economics* **40**(1–3): 3–73.
Gray, J. V., Anand, G., and Roth, A.V. 2015. The influence of ISO 9000 certification on process compliance. *Production and Operations Management* 24(3): 369-382.
Grewal, J., C. Hauptmann, G. Serafeim. 2020. Material sustainability information and stock price informativeness. *Journal of Business Ethics* **171**(3) 513-544.
Grossman SJ, Hart OD. 1980. Takeover bids, the free-rider problem, and the theory of the corporation. *Bell Journal of Economics* **11**(1): 42–64.
Guay, T., J.P. Doh, G. Sinclair. 2004. Non-governmental organizations, shareholder activism, and socially responsible investments: Ethical, strategic, and governance implications. *Journal of Business Ethics* **52**(1) 125-139.
Gutiérrez, G., T. Philippon. 2017. Declining competition and investment in the US. National Bureau of Economic Research.
Hawn, O., A. Chatterjee, W. Mitchell. 2018. Do investors actually value sustainability? New evidence from investor reactions to the Dow Jones Sustainability Index (DJSI). *Strategic Management Journal* **39**(4) 949-976.
Hawn, O., I. Ioannou. 2016. Mind the gap: The interplay between external and internal actions in the case of corporate social responsibility. *Strategic Management Journal* **37**(13) 2569–2588.
He, J.J., J. Huang. 2017. Product market competition in a world of cross-ownership: Evidence from institutional blockholdings. *The Review of Financial Studies* **30**(8) 2674-2718.
Healy PM, Palepu KG. 2001. Information asymmetry, corporate disclosure, and the capital markets: a review of the empirical disclosure literature. *Journal of Accounting and Economics* **31**(1–3): 405–440.
Heras-Saizarbitoria, I., Boiral, O., Arana, G., and Allur, E. 2019. OHSAS 18001 certification and work accidents: Shedding light on the connection. *Journal of Safety Research* 68: 33–40.
Hillman, A.J., G.D. Keim. 2001. Shareholder value, stakeholder management, and social issues: What's the bottom line? *Strategic Management Journal* **22**(2) 125-139.

Ho VH. 2018. Nonfinancial risk disclosure and the costs of private ordering. *American Business Law Journal* **55**(3): 407–474.
Hoffman, A.J. 2001. *From heresy to dogma: An institutional history of corporate environmentalism*. Stanford University Press: Stanford, CA.
Holmstrom B. 1999. Managerial incentive problems: a dynamic perspective. *Review of Economic Studies* **66**(1): 169–182.
Hoskisson RE, Hitt MA, Johnson RA, Grossman W. 2002. Conflicting voices: the effects of institutional ownership heterogeneity and internal governance on corporate innovation strategies. *Academy of Management Journal* **45**(4): 697–716.
Hsu, Y.-S., C.Z. Liu, Y.-J. Yang, Y.-Y. Chou. 2013. Implications of the British Petroleum oil spill disaster for its industry peers—Evidence from the market reaction and earnings quality. *Asia-Pacific Journal of Accounting & Economics* **20**(3) 281-296.
Huang, C.-L., F.-H. Kung. 2010. Drivers of environmental disclosure and stakeholder expectation: Evidence from Taiwan. *Journal of Business Ethics* **96**(3) 435-451.
Huang, J., H. Li, G. Zhu. 2017. Environmental disclosure as a proactive tool to intra-industry market reaction in China. *Applied Economics Letters* **24**(10) 686-689.
Ilhan E, Krueger P, Sautner Z, Starks LT. 2019. Institutional investors' views and preferences on climate risk disclosure. Working paper, University of Geneva.
Inkpen, A.C., A.K. Sundaram. 2021. The endurance of shareholder value maximization as the preferred corporate objective. *Journal of Management Studies* **59**(2) 555-568.
International Labor Organization. 2003. Work-related mortality in the EU-27, EFTA/EEA, candidate and preaccession countries. https://www.ilo.org/moscow/areas-of-work/occupational-safety-and-health/WCMS_249278/lang--en/index.htm, accessed November 2022.
International Organization for Standardization. 2022a. ISO 45001—All you need to know. https://www.iso.org/news/ref2271.html, accessed June 2022.
International Organization for Standardization. 2022b. ISO 45001 family—Occupational health and safety. https://www.iso.org/iso-45001-occupational-health-and-safety.html, accessed June 2022.
International Organization for Standardization. 2022c. ISO survey 2020. https://www.iso.org/the-iso-survey.html, accessed June 2022.
International Organization for Standardization. 2022d. ISO survey: Survey results before 2018. https://isotc.iso.org/livelink/livelink?func=ll&objId=21413346&objAction=browse&viewType=1, accessed June 2022.
Ioannou I, Serafeim G. 2019. The consequences of mandatory corporate sustainability reporting. In *Oxford Handbook of Corporate Social Responsibility: Psychological and Organizational Perspectives*, Oxford University Press: Oxford, UK, forthcoming.
Jeong, S., and Lee, J. 2022. Environment and energy? The impact of environmental management systems on energy efficiency. *Manufacturing & Service Operations Management* 24(3): 1311–1328.
Jira, C, Toffel MW. 2013. Engaging supply chains in climate change. *Manufacturing & Service Operations Management* **15**(4): 559–577.
Jonsson, S., H.R. Greve, T. Fujiwara-Greve. 2009. Undeserved loss: The spread of legitimacy loss to innocent organizations in response to reported corporate deviance. *Administrative Science Quarterly* **54**(2) 195-228.

Khan M, Serafeim S, Yoon A. 2016. Corporate sustainability: first evidence on materiality. *Accounting Review* **91**(6): 1697–1724.

Khan, M., G. Serafeim, A. Yoon. 2016. Corporate sustainability: First evidence on materiality. *The Accounting Review* **91**(6) 1697-1724.

Kim EH, Lyon T. 2011a. When does institutional investor activism increase shareholder value? The Carbon Disclosure Project. *B.E. Journal of Economic Analysis & Policy* **11**(1).

Kim EH, Lyon T. 2011b. Strategic environmental disclosure: evidence from the DOE's voluntary greenhouse gas registry. *Journal of Environmental Economics and Management* **61**(3): 311–326.

King, A.A., and Lenox, M.J. 2000. Industry self-regulation without sanctions: The chemical industry's responsible care program. *Academy of Management Journal* 43(4): 698–716.

King, A.A., Lenox, M.J., and Terlaak A. 2005. The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard. *Academy of Management Journal* 48(6): 1091–1106.

Kölbel, J.F., T. Busch, L.M. Jancso. 2017. How media coverage of corporate social irresponsibility increases financial risk. *Strategic Management Journal* **38**(11) 2266-2284.

Komaki, J., Heinzmann, A.T., and Lawson, L. 1980. Effect of training and feedback: Component analysis of a behavioral safety program. *Journal of Applied Psychology* 65(3): 261–270.

Krueger P, Sautner Z, Starks LT. 2020. The importance of climate risks for institutional investors. *Review of Financial Studies* **33**(3): 1067–1111.

Krueger P. 2015a. Climate change and firm valuation: evidence from a quasi-natural experiment. Working paper, University of Geneva.

Krueger P. 2015b. Corporate goodness and shareholder wealth. *Journal of Financial Economics* **115**(2): 304–329.

Krueger, P., Z. Sautner, L.T. Starks. 2020. The importance of climate risks for institutional investors. *The Review of Financial Studies* **33**(3) 1067-1111.

Lenox MJ, Eesley CE. 2009. Private environmental activism and the selection and response of firm targets. *Journal of Economics & Management Strategy* **18**(1): 45–73.

Levine, D.I., and Toffel, M.W. 2010. Quality management and job quality: How the ISO 9001 standard for quality management systems affects employees and employers. *Management Science* 56(6): 978–996.

Lewellen, K., M. Lowry. 2021. Does common ownership really increase firm coordination? *Journal of Financial Economics* **141**(1) 322-344.

Lewis, BW, Walls JL, Dowell GWS. 2014. Difference in degrees: CEO characteristics and firm environmental disclosure. *Strategic Management Journal* **35**(5): 712–722.

Liang, H., L. Renneboog. 2017. On the foundations of corporate social responsibility. *The Journal of Finance* **72**(2) 853-910.

Light SE, Orts EW. 2015. Parallels in public and private environmental governance. *Michigan Journal of Environmental and Administrative Law* **5**(1): 1–72.

Lins, K.V., H. Servaes, A. Tamayo. 2017. Social capital, trust, and firm performance: The value of corporate social responsibility during the Financial Crisis. *The Journal of Finance* **72**(4) 1785-1824.Manchiraju, H., S. Rajgopal. 2017. Does corporate social responsibility (CSR) create shareholder value? Evidence from the Indian Companies Act of 2013. *Journal of Accounting Research* **55**(5) 1257-1300.

Liu, X. , Mishra, A., Goldstein, S., and Sinha, K.K. 2019. Toward improving factory working conditions in developing countries: An empirical analysis of Bangladesh ready-made garment factories. *Manufacturing & Service Operations Management* 21(2): 379–397.

Lo, C. K. Y., Wiengarten, F., Humphreys, P., Yeung, A. C. L., & Cheng, T. C. E. (2013). The impact of contextual factors on the efficacy of ISO 9000 adoption. *Journal of Operations Management* 31(5): 229–235.

Lo, C.K., Pagell, M., Fan, D., Wiengarten, F., and Yeung, A.C. 2014. OHSAS 18001 certification and operating performance: The role of complexity and coupling. *Journal of Operations Management* 32(5): 268–280.

Loewenstein G, Prelec D. 1992. Anomalies in intertemporal choice: evidence and an interpretation. *Quarterly Journal of Economics* **107**(2): 573–597.

Loss L, Seligman J. 2004. *Fundamentals of Securities Regulation*. Aspen Publishers: New York, NY.

Lyon TP, Maxwell JW. 2011. Greenwash: corporate environmental disclosure under threat of audit. *Journal of Economics and Management Strategy* **20**(1): 3–41.

Marquardt, D. 1992. ISO 9000: A universal standard of quality. *Management Review* 81(1): 50–52.

Marquis C, Toffel MW, Zhou Y. 2016. Scrutiny, norms, and selective disclosure: a global study of greenwashing. *Organization Science* **27**(2): 483–504.

Matisoff DC. 2013. Different rays of sunlight: understanding information disclosure and carbon transparency. *Energy Policy* **55**(4): 579–592.

McCahery, J.A., Z. Sautner, L.T. Starks. 2016. Behind the scenes: The corporate governance preferences of institutional investors. *The Journal of Finance* **71**(6) 2905-2932.

McDonnell MH, King BG, Soule SA. 2015. A dynamic process model of private politics: activist targeting and corporate receptivity to social challenge. *American Sociological Review* **80**(3): 654–678.

Mitchell RK, Agle BR, Wood DJ. 1997. Toward a theory of stakeholder identification and salience: defining the principle of who and what really counts. *Academy of Management Review* **22**(4): 853–886.

Mun, E., J. Jung. 2018. Change above the glass ceiling: Corporate social responsibility and gender diversity in Japanese firms. *Administrative Science Quarterly* **63**(2) 409-440.

National Quality Assurance. 2020. Health and safety management: OHSAS 18001. https://www.nqa.com/en-us/certification/standards/ohsas-18001, accessed February 2020.

National Safety Council. 2022. Work injury costs. https://injuryfacts.nsc.org/work/costs/work-injury-costs/, accessed June 2022.

Naveh, E., and Marcus, E. 2007. Financial performance, ISO 9000 standard and safe driving practices effects on accident rate in the U.S. motor carrier industry. *Accident Analysis & Prevention* 39(4): 731–742.

Neubaum DO, Zahra SA. 2006. Institutional ownership and corporate social performance: the moderating effects of investment horizon, activism and coordination. *Journal of Management* **32**(1): 108–131.

Neubaum, D.O., S.A. Zahra. 2006. Institutional ownership and corporate social performance: The moderating effects of investment horizon, activism, and coordination. *Journal of Management* **32**(1) 108-131.

New York Times. 2017. Exxon Mobil shareholders demand accounting of climate change policy risks. 31 May, https://www.nytimes.com/2017/05/31/business/energy-environment/exxon-shareholders-climate-change.html, accessed August 2020.

New York Times. 2018. Major climate report describes a strong risk of crisis as early as 2040. 7 October, https://www.nytimes.com/2018/10/07/climate/ipcc-climate-report-2040.html, accessed August 2020.

New York Times. 2019. Companies see climate change hitting their bottom lines in the next 5 years. 4 June, https://www.nytimes.com/2019/06/04/climate/companies-climate-change-financial-impact.html, accessed August 2020.

New York Times. 2020. Climate change poses 'systemic threat' to the economy, big investors warn. 21 July, https://www.nytimes.com/2020/07/21/climate/investors-climate-threat-regulators.html, accessed August 2020.

O'Donoghue T, Rabin M. 1999. Doing it now or later. *American Economic Review* **89**(1): 103–124.

Organisation for Economic Co-operation and Development. 2017. Common ownership by institutional investors and its impact on competition. 6 December, https://www.oecd.org/competition/common-ownership-and-its-impact-on-competition.htm, accessed August 2021.

Pagell, M., Johnston, D., Veltri, A., Klassen, R., and Biehl, M. 2014. Is safe production an oxymoron? *Production and Operations Management* 23(7): 1161–1175.

Pagell, M., Klassen, R., Johnston, D., Shevchenko, A., and Sharma, S. 2015. Are safety and operational effectiveness contradictory requirements: The roles of routines and relational coordination. *Journal of Operations Management* 36(1): 1–14.

Park, J., J. Sani, N. Shroff, H. White. 2019. Disclosure incentives when competing firms have common ownership. *Journal of Accounting and Economics* **67**(2-3) 387-415.

Paruchuri, S., V.F. Misangyi. 2015. Investor perceptions of financial misconduct: The heterogeneous contamination of bystander firms. *Academy of Management Journal* **58**(1) 169-194.

Pavlovic, A. 2020. The 8 key differences between OHSAS 18001 and ISO 45001. https://quality.eqms.co.uk/blog/the-8-key-differences-between-ohsas-18001-and-iso-45001, accessed August 2020.

Perrow, C. 1999. *Normal Accidents: Living with High-risk Technologies*. Princeton, NJ: Princeton University Press.

Politico. 2019. Democrats want companies to disclose their climate risks—and fossil fuel industry is worried. 17 June, https://www.politico.com/story/2019/06/17/democrats-energy-industry-climate-risk-1483586, accessed August 2020.

Porac, J.F., J.B. Wade, T.G. Pollock. 1999. Industry categories and the politics of the comparable firm in CEO compensation. *Administrative Science Quarterly* **44**(1) 112-144.

Posner, E.A., F.M. Scott Morgan, E.G. Weyl. 2016. A proposal to limit the anticompetitive power of institutional investors. *Antitrust Law Journal* **81**(3) 669-728.

Potoski, M., and Prakash, A. 2005a. Covenants with weak swords: ISO 14001 and facilities' environmental performance. *Journal of Policy Analysis and Management* 24(4): 745–769.

Potoski, M., and Prakash, A. 2005b. Green clubs and voluntary governance: ISO 14001 and firms' regulatory compliance. *American Journal of Political Science* 49(2): 235–248.

Reid EM, Toffel MW. 2009. Responding to public and private politics: corporate disclosure of climate change strategies. *Strategic Management Journal* **30**(11): 1157–1178.
Rivera, J., and De Leon, P. 2004. Is greener whiter? Voluntary environmental performance of Western ski areas. *Policy Studies Journal* 32(3): 417–437.
Roberts, K.H. 1990. Managing high reliability organizations. *California Management Review* 32(4): 101–113.
Scientific American. 2017. What to believe in Antarctica's great ice debate. 6 July, https://www.scientificamerican.com/article/what-to-believe-in-antarctica-rsquo-s-great-ice-debate/, accessed August 2020.
Sharfman, M.P., C.S. Fernando. 2008. Environmental risk management and the cost of capital. *Strategic Management Journal* **29**(6) 569-592.
Shi, W., D. Wajda, R.V. Aguilera. 2022. Interorganizational spillover: A review and a proposal for future research. *Journal of Management* **48**(1) 185-210.
Shleifer A, Vishny RW. 1986. Large shareholders and corporate control. *Journal of Political Economy* **94**(3): 461–488.
Spence, M. 1973. Job market signaling. *Quarterly Journal of Economics* 87(3): 355–374.
Sroufe, R., and Curkovic, S. 2008. An examination of ISO 9000:2000 and supply chain quality assurance. *Journal of Operations Management* 26: 503–520.
Staiger DO, Stock JH. 1997. Instrumental variables regression with weak instruments. *Econometrica* **65**(3): 557–586.
Starks LT, Venkat P, Zhu Q. 2017. Corporate ESG profiles and investor horizons. Working paper, University of Texas at Austin.
Stein JC. 1988. Takeover threats and managerial myopia. *Journal of Political Economy* **96**(1): 61–80.
Stein JC. 1989. Efficient capital markets, inefficient firms: a model of myopic corporate behavior. *Quarterly Journal of Economics* **104**(4): 655–669.
Stock JH, Yogo M. 2005. Testing for weak instruments in linear IV regression. In *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*, Andrews DWK, Stock JH (eds). Cambridge University Press: Cambridge, UK; 80–108.
Suchman MC. 1995. Managing legitimacy: strategic and institutional approaches. *Academy of Management Review* **20**(3): 571–610.
Terlaak, A., and King, A.A. 2006. The effect of certification with the ISO 9000 quality management standard: A signaling approach. *Journal of Economic Behavior & Organization* 60(4): 579–602.
Thaler RH, Shefrin HM. 1981. An economic theory of self-control. *Journal of Political Economy* **89**(2): 392–406.
Tihanyi L, Johnson RA, Hoskisson RE, Hitt MA. 2003. Institutional ownership differences and international diversification: the effects of boards of directors and technological opportunity. *Academy of Management Journal* **46**(2): 195–211.
Trinks PJ, Scholtens B. 2017. The opportunity cost of negative screening in socially responsible investing. *Journal of Business Ethics* **140**(2): 193–208.
U.S. Bureau of Labor Statistics. 2019. Nonfatal occupational injuries and illnesses. https://www.bls.gov/opub/hom/soii/concepts.htm#BLS_table_footnotes, accessed December 2019.

U.S. Bureau of Labor Statistics. 2021. Press release: Employer-reported workplace injuries and illnesses, 2020 (Nov. 3, 2021). https://www.bls.gov/news.release/osh.nr0.htm, accessed June 2022.
U.S. Department of Labor. 2020a. All about VPP. https://www.osha.gov/vpp/all-about-vpp, accessed February 2020.
Useem, M. 1993. *Executive defense: Shareholder power and corporate reorganization*. Harvard University Press: Cambridge, MA.
Vandenberg MP. 2013. Private environmental governance. *Cornell Law Review* **99**(1): 129–200.
Vasi IB, King B. 2012. Social movements, risk perceptions, and economic outcomes: the effect of primary and secondary stakeholder activism on firms' perceived environmental risk and financial performance. *American Sociological Review* **77**(4): 573–596.
Vincent, C., Moorthy, K., Sarker, S.K., Chang, A., and Darzi, A.W. 2004. Systems approaches to surgical quality and safety: From concept to measurement. *Annals of Surgery* 239(4): 475-482.
Vinodkumar, M., and Bhasi, M. 2011. A study on the impact of management system certification on safety management. *Safety Science* 49(3): 498–507.
Wall Street Journal. 2018a. More shareholder proposals spotlight climate change. 8 February, https://blogs.wsj.com/riskandcompliance/2018/02/08/more-shareholder-proposals-spotlight-climate-change/, accessed August 2020.
Wall Street Journal. 2018b. Climate change is forcing the insurance industry to recalculate. 2 October, https://www.wsj.com/graphics/climate-change-forcing-insurance-industry-recalculate/, accessed August 2020.
Wall Street Journal. 2019. Show us your climate risks, investors tell companies. 28 February, https://www.wsj.com/articles/show-us-your-climate-risks-investors-tell-companies-11551349800, accessed August 2020.
Wiersema M, Ahn A, Zhang Y. 2020. Activist hedge fund success: the role of reputation. *Strategic Management Journal* **41**(13): 2493–2517.
Wooldridge, J.M. 2010. *Econometric Analysis of Cross Section and Panel Data*. Cambridge MA: MIT Press.
World Economic Forum. 2020. The heat is on businesses to respond to climate change. 15 January, https://www.weforum.org/agenda/2020/01/climate-change-business-response-risks/, accessed August 2020.
Wry, T.E. 2009. Does business and society scholarship matter to society? Pursuing a normative agenda with critical realism and neoinstitutional theory. *Journal of Business Ethics* **89**(2) 151-171.
Yang, Y., Jia, F., Chen, L., Wang, Y., and Xiong, Y. 2021. Adoption timing of OHSAS 18001 and firm performance: An institutional theory perspective. *International Journal of Production Economics* 231: Article 107870.
Yermack D. 2010. Shareholder voting and corporate governance. *Annual Review of Financial Economics* **2**(1): 103–125.
Zamora-Ramirez C, Gonzalez-Gonzalez JM. 2015. The value of climate change reporting of firms: The Spanish case. *International Journal of Social Ecology and Sustainable Development* **6**(4): 91–104

Supplemental Information for

Essays on Essays on ESG, Shareholder Activism and Voluntary Programs

A dissertation presented

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Table A1. Disclosure of climate change risks and environmental shareholder activism by industry

		Disclosure of climate change risks				Environmental shareholder activism			
	N	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
Agriculture, forestry, and fishing	7	2.14	1.46	0	3	1.00	0.82	0	2
Construction	2	3.00	0.00	3	3	0.00	0.00	0	0
Finance, insurance, and real estate	191	1.95	1.20	0	3	0.13	0.35	0	2
Manufacturing	412	2.39	1.07	0	3	0.37	0.81	0	5
Mining	72	2.42	0.82	1	3	0.61	0.85	0	4
Retail trade	116	1.83	1.33	0	3	0.53	0.67	0	2
Services	84	2.21	1.17	0	3	0.20	0.46	0	2
Utilities	197	2.34	1.12	0	3	0.30	0.59	0	3
Wholesale trade	16	1.94	1.24	0	3	0.25	0.45	0	1
Nonclassifiable	13	0.69	1.32	0	3	0.62	0.65	0	2
All	1,110	2.21	1.16	0	3	0.34	0.68	0	5

Notes. N refers to the number of firm-year observations. Industries are partitioned according to SIC divisions. The SIC divisions (and the corresponding 2-digit SIC codes) are as follows: agriculture, forestry and fishing (SIC 00-09); mining (SIC 10-14); construction (SIC 15-19); manufacturing (SIC 20-39); utilities (SIC 40-49); wholesale trade (SIC 50-51); retail trade (SIC 52-59); finance, insurance, and real estate (SIC 60-69); services (SIC 70-89); public administration (SIC 90-98, not represented in our sample); and non-classifiable industries (SIC 99).

Table A2. Disclosure of climate change risks and environmental shareholder activism by year

		Disclosure of climate change risks				Environmental shareholder activism			
	N	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
2010	167	1.77	1.28	0	3	0.28	0.71	0	5
2011	174	2.06	1.25	0	3	0.30	0.66	0	4
2012	171	2.17	1.19	0	3	0.26	0.58	0	4
2013	175	2.27	1.12	0	3	0.31	0.69	0	5
2014	165	2.33	1.07	0	3	0.42	0.72	0	4
2015	145	2.42	1.02	0	3	0.43	0.72	0	4
2016	113	2.56	0.94	0	3	0.42	0.69	0	2
All	1,110	2.21	1.16	0	3	0.34	0.68	0	5

Notes. N refers to the number of firm-year observations.

Table A3. Shareholder-induced disclosure of climate change risks, accounting for industry-specific time trends

Dependent variable:	Disclosure of climate change risks$_t$
	(1)
Environmental shareholder activism$_{t-1}$	0.078
	(0.040)
Size$_{t-1}$	-0.316
	(0.265)
ROA$_{t-1}$	-0.457
	(1.770)
Market-to-book$_{t-1}$	0.018
	(0.026)
Leverage$_{t-1}$	0.838
	(0.569)
Cash$_{t-1}$	1.449
	(0.939)
Firm fixed effects	Yes
Industry × year fixed effects	Yes
Within R-squared	0.23
# Observations (firm-years)	1,110
# Firms	265

Notes. OLS estimates with standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions.

Table A4. Shareholder-induced disclosure of various types of climate change risks, estimated via logit regressions with conditional fixed effects

Dependent variable:	Disclosure of regulatory climate change risks$_t$	Disclosure of physical climate change risks$_t$	Disclosure of other climate change risks$_t$
	(1)	(2)	(3)
Environmental shareholder activism$_{t-1}$	0.632	0.796	0.315
	(0.272)	(0.253)	(0.233)
Size$_{t-1}$	1.217	-0.944	-0.063
	(2.850)	(2.588)	(1.354)
ROA$_{t-1}$	-3.064	16.516	1.661
	(16.616)	(9.124)	(8.972)
Market-to-book$_{t-1}$	0.378	0.181	0.226
	(0.233)	(0.204)	(0.253)
Leverage$_{t-1}$	14.774	8.619	4.782
	(5.591)	(4.384)	(3.944)
Cash$_{t-1}$	8.149	10.652	7.828
	(2.948)	(5.273)	(4.246)
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Pseudo R-squared	0.40	0.49	0.23
# Observations (firm-years)	306	317	360

Notes. Estimates from logit regressions with conditional fixed effects (log-odds ratios) with standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions.

Table A5. Waves of environmental shareholder activism by type of shareholder

	N	Mean	Std. dev.	Min	Max
Waves of 3+ proposals	1,110	0.078	0.269	0	1
Waves of 3+ proposals initiated by institutional investors	1,110	0.070	0.256	0	1
Waves of 3+ proposals initiated by non-institutional investors	1,110	0.008	0.090	0	1
Waves of 3+ proposals initiated by long-term institutional investors	1,110	0.058	0.233	0	1
Waves of 3+ proposals initiated by short-term institutional investors	1,110	0.014	0.116	0	1
Waves of 3+ proposals initiated by institutional investors with unknown temporal horizon	1,110	0.001	0.030	0	1

Table A6. Shareholder-induced disclosure of climate change risks: Robustness

Dependent variable:	Disclosure of climate change risks$_t$				
	Dynamics	Broader ISS sample	Poisson regression	2SLS – Activism wave based on 4+ proposals	2SLS – Activism wave based on 6+ proposals
	(1)	(2)	(3)	(4)	(5)
Environmental shareholder activism$_{t+1}$	-0.002				
	(0.066)				
Environmental shareholder activism$_t$	0.060				
	(0.064)				
Environmental shareholder activism$_{t-1}$	0.114	0.064	0.043		
	(0.044)	(0.032)	(0.015)		
Environmental shareholder activism$_{t-2}$	0.050				
	(0.038)				
Environmental shareholder activism (instr.)$_{t-1}$				0.235	0.331
				(0.053)	(0.195)
Size$_{t-1}$	-0.332	-0.058	-0.088	-0.201	-0.197
	(0.306)	(0.205)	(0.117)	(0.237)	(0.226)
ROA$_{t-1}$	-0.735	-0.402	0.345	0.515	0.547
	(2.032)	(1.572)	(0.621)	(1.413)	(1.372)
Market-to-book$_{t-1}$	0.033	0.012	0.012	0.022	0.021
	(0.019)	(0.009)	(0.007)	(0.019)	(0.017)
Leverage$_{t-1}$	0.809	0.916	0.391	1.006	1.018
	(0.534)	(0.526)	(0.216)	(0.465)	(0.467)
Cash$_{t-1}$	1.504	0.770	0.794	1.439	1.436
	(0.918)	(0.917)	(0.450)	(0.841)	(0.837)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.13	0.14	–	0.12	0.11
# Observations (firm-years)	997	1,631	1,110	1,110	1,110
# Firms	254	346	265	265	265

Notes. OLS estimates in columns (1) and (2); Poisson estimates in column (3); and 2SLS estimates in columns (4) and (5). Standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions. The sample is smaller in column (1) because this specification includes one-year forward and two-year lagged values of *environmental shareholder activism*, which excludes some observations.

Table A7. Shareholder-induced disclosure of climate change risks: Robustness (continued)

Dependent variable:	Disclosure of climate change risks$_t$		
	Controlling for age	Controlling for ESG scores	Controlling for age and ESG scores
	(1)	(2)	(3)
Environmental shareholder activism$_{t-1}$	0.102	0.107	0.105
	(0.043)	(0.053)	(0.051)
Size$_{t-1}$	-0.203	-0.290	-0.295
	(0.279)	(0.397)	(0.385)
ROA$_{t-1}$	0.503	0.635	0.609
	(1.585)	(1.680)	(1.639)
Market-to-book$_{t-1}$	0.023	0.027	0.030
	(0.020)	(0.017)	(0.018)
Leverage$_{t-1}$	1.021	0.996	0.962
	(0.534)	(0.564)	(0.527)
Cash$_{t-1}$	1.446	1.281	1.271
	(0.981)	(1.015)	(1.014)
Log(age)$_{t-1}$	-0.186		0.228
	(0.321)		(0.605)
ASSET4 Environmental score$_{t-1}$		0.026	0.031
		(0.254)	(0.254)
ASSET4 Social score$_{t-1}$		0.310	0.307
		(0.232)	(0.235)
ASSET4 Governance score$_{t-1}$		-0.243	-0.271
		(0.562)	(0.552)
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Within R-squared	0.13	0.14	0.14
# Observations (firm-years)	1,110	976	976
# Firms	265	230	230

Notes. OLS estimates with standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions. The coefficients and standard errors of *ASSET4 environmental score*, *ASSET4 social score*, and *ASSET4 governance score* are multiplied by 100 for ease of exposition. The sample is smaller in columns (2) and (3) due to the more restrictive coverage of Thomson Reuters' ASSET4.

Table A8. Shareholder-induced disclosure of climate change risks by type of shareholder: Robustness

Dependent variable:	Disclosure of climate change risks$_t$					
	Dynamics		Broader ISS sample		Poisson regression	
	(1)	(2)	(3)	(4)	(5)	(6)
Environmental shareholder activism by…						
… non-institutional shareholders$_{t+1}$	0.024	0.024				
	(0.083)	(0.096)				
… non-institutional shareholders$_t$	0.010	0.014				
	(0.102)	(0.104)				
… non-institutional shareholders$_{t-1}$	0.052	0.057	0.022	0.022	0.027	0.027
	(0.080)	(0.084)	(0.059)	(0.059)	(0.030)	(0.030)
… non-institutional shareholders$_{t-2}$	-0.009	0.001				
	(0.071)	(0.048)				
… institutional shareholders$_{t+1}$	-0.004					
	(0.073)					
… institutional shareholders$_t$	0.090					
	(0.067)					
… institutional shareholders$_{t-1}$	0.136		0.082		0.052	
	(0.058)		(0.032)		(0.018)	
… institutional shareholders$_{t-2}$	0.087					
	(0.066)					
… institutional shareholders with long-term horizon$_{t+1}$		0.020				
		(0.117)				
… institutional shareholders with long-term horizon$_t$		0.181				
		(0.104)				
… institutional shareholders with long-term horizon$_{t-1}$		0.158		0.136		0.067
		(0.083)		(0.052)		(0.028)
… institutional shareholders with long-term horizon$_{t-2}$		0.051				
		(0.075)				
… institutional shareholders with short-term horizon$_{t+1}$		-0.102				
		(0.127)				
… institutional shareholders with short-term horizon$_t$		-0.208				
		(0.125)				
… institutional shareholders with short-term horizon$_{t-1}$		0.029		-0.078		-0.015
		(0.153)		(0.077)		(0.057)
… institutional shareholders with short-term horizon$_{t-2}$		-0.069				
		(0.084)				
… institutional shareholders with unknown temporal horizon$_{t+1}$		-0.286				
		(0.222)				
… institutional shareholders with unknown temporal horizon$_t$		-0.035				
		(0.241)				
… institutional shareholders with unknown temporal horizon$_{t-1}$		0.082		0.174		0.123
		(0.240)		(0.164)		(0.077)
… institutional shareholders with unknown temporal horizon$_{t-2}$		0.148				
		(0.157)				
Size$_{t-1}$	-0.317	-0.266	-0.054	-0.049	-0.084	-0.084
	(0.304)	(0.339)	(0.204)	(0.199)	(0.120)	(0.121)
ROA$_{t-1}$	-0.617	-0.417	-0.374	-0.310	0.366	0.421
	(2.016)	(2.197)	(1.571)	(1.567)	(0.633)	(0.676)
Market-to-book$_{t-1}$	0.031	0.038	0.012	0.012	0.012	0.012
	(0.019)	(0.018)	(0.009)	(0.010)	(0.007)	(0.007)
Leverage$_{t-1}$	0.909	0.954	0.927	0.968	0.402	0.431
	(0.504)	(0.516)	(0.523)	(0.529)	(0.219)	(0.222)
Cash$_{t-1}$	1.468	1.517	0.780	0.778	0.795	0.785
	(0.902)	(0.887)	(0.919)	(0.905)	(0.455)	(0.444)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.14	0.15	0.14	0.14	–	–
# Observations (firm-years)	997	997	1,631	1,631	1,110	1,110
# Firms	254	254	346	346	265	265

Notes. OLS estimates in columns (1)-(4); and Poisson estimates in column (5) and (6). Standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions. The sample is smaller in columns (1)-(2) because those specifications includes one-year forward and two-year lagged variables, which excludes some observations.

Table A9. Shareholder-induced disclosure of climate change risks by type of shareholder: Robustness (continued)

Dependent variable:	Disclosure of climate change risks$_t$					
	Controlling for age		Controlling for ESG scores		Controlling for age and ESG scores	
	(1)	(2)	(3)	(4)	(5)	(6)
Environmental shareholder activism by…						
… non-institutional shareholders$_{t-1}$	0.065	0.065	0.084	0.084	0.080	0.080
	(0.076)	(0.076)	(0.076)	(0.077)	(0.080)	(0.081)
… institutional shareholders$_{t-1}$	0.118		0.116		0.115	
	(0.047)		(0.061)		(0.059)	
… institutional shareholders with long-term horizon$_{t-1}$		0.152		0.158		0.157
		(0.065)		(0.078)		(0.076)
… institutional shareholders with short-term horizon$_{t-1}$		-0.010		-0.051		-0.052
		(0.130)		(0.184)		(0.184)
… institutional shareholders with unknown temporal horizon$_{t-1}$		0.286		0.318		0.319
		(0.191)		(0.203)		(0.199)
Size$_{t-1}$	-0.198	-0.196	-0.289	-0.286	-0.294	-0.291
	(0.281)	(0.281)	(0.397)	(0.397)	(0.385)	(0.384)
ROA$_{t-1}$	0.531	0.618	0.652	0.768	0.626	0.741
	(1.594)	(1.628)	(1.700)	(1.750)	(1.658)	(1.708)
Market-to-book$_{t-1}$	0.022	0.023	0.027	0.028	0.030	0.031
	(0.021)	(0.021)	(0.017)	(0.017)	(0.018)	(0.017)
Leverage$_{t-1}$	1.039	1.074	1.012	1.062	0.977	1.027
	(0.541)	(0.539)	(0.580)	(0.581)	(0.538)	(0.537)
Cash$_{t-1}$	1.453	1.438	1.281	1.258	1.271	1.248
	(0.991)	(0.967)	(1.018)	(0.994)	(1.018)	(0.994)
Log(age)$_{t-1}$	-0.173	-0.168			0.236	0.242
	(0.328)	(0.330)			(0.625)	(0.627)
ASSET4 Environmental score$_{t-1}$			0.025	0.022	0.029	0.027
			(0.253)	(0.244)	(0.253)	(0.243)
ASSET4 Social score$_{t-1}$			0.312	0.308	0.309	0.306
			(0.233)	(0.226)	(0.237)	(0.229)
ASSET4 Governance score$_{t-1}$			-0.235	-0.234	-0.264	-0.263
			(0.564)	(0.559)	(0.552)	(0.546)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.13	0.14	0.14	0.15	0.14	0.15
# Observations (firm-years)	1,110	1,110	976	976	976	976
# Firms	265	265	230	230	230	230

Notes. OLS estimates with standard errors clustered at the industry level in parentheses. Industries are partitioned according to SIC divisions. The coefficients and standard errors of *ASSET4 environmental score*, *ASSET4 social score*, and *ASSET4 governance score* are multiplied by 100 for ease of exposition. The sample is smaller in columns (2)-(6) due to the more restrictive coverage of Thomson Reuters' ASSET4.

Table A10. Stock market response following non-shareholder-induced disclosure of climate change risks

	CAR (%)		
	Market model (1-factor model)	Fama-French (3-factor model)	Fama-French-Momentum (4-factor model)
	(1)	(2)	(3)
Main event windows			
[-10, 10]	0.995	0.938	0.920
	(0.260)	(0.260)	(0.267)
[-5, 5]	0.406	0.430	0.443
	(0.188)	(0.181)	(0.182)
Pre- and post-periods			
[-50, -11]	-0.231	-0.545	-0.549
	(0.343)	(0.342)	(0.342)
[11, 50]	0.353	0.566	0.342
	(0.365)	(0.363)	(0.359)

Notes. This table reports the average cumulative abnormal returns (CARs) across all 670 events in which companies disclosed climate risks without previous environmental shareholder activism. Standard errors are reported in parentheses. The event day (day 0) is the day on which climate risk information is disclosed. CARs are computed using the market model, the three-factor model of Fama and French (1993), and the four-factor model of Carhart (1997), respectively.

TABLE B1. Alternative measures of CSR performance

	CSR perf + GOV	ASSET4 E+S Score	MSCI ESG Score	CSR perf (t+1)	CSR strengths (t+1)	CSR concerns (t+1)
Variables	(1)	(2)	(3)	(4)	(5)	(6)
CIO	0.0010**	0.0591+	0.0517*	0.0011***	0.0010***	-0.0001
	(0.0003)	(0.0344)	(0.0211)	(0.0003)	(0.0002)	(0.0002)
Non-common blockholder ownership	-0.0704	-9.1766+	0.7152	0.0076	-0.0426	-0.0502
	(0.0706)	(5.4746)	(3.0739)	(0.0594)	(0.0434)	(0.0418)
Firm size	-0.0612**	6.8836***	0.3009	-0.0123	0.0699***	0.0821***
	(0.0203)	(1.6927)	(0.9243)	(0.0164)	(0.0129)	(0.0125)
Profitability	0.0140	0.2233	3.4881	-0.0113	-0.0480+	-0.0367
	(0.0486)	(3.8292)	(2.4104)	(0.0444)	(0.0284)	(0.0323)
Market-to-book ratio	-0.0120+	1.1587*	-1.0208**	-0.0022	0.0014	0.0036
	(0.0066)	(0.4599)	(0.3232)	(0.0053)	(0.0045)	(0.0037)
Earnings volatility	-0.1427	1.9389	6.7058	-0.1912*	-0.0072	0.1839**
	(0.1019)	(11.3775)	(4.5798)	(0.0802)	(0.0642)	(0.0609)
Leverage	-0.0654	3.0478	4.8551*	-0.0291	-0.0371	-0.0080
	(0.0515)	(4.5079)	(2.4023)	(0.0438)	(0.0321)	(0.0306)
Sales growth	0.0393*	-1.0787	-1.1077	-0.0119	-0.0257*	-0.0138
	(0.0187)	(1.0977)	(0.7714)	(0.0146)	(0.0101)	(0.0113)
Constant	1.231**	-154.289***	-4.356	0.0825	-1.230***	-1.313***
	(0.4154)	(37.3038)	(19.8678)	(0.3365)	(0.2654)	(0.2554)
Observations	31,024	12,062	9,200	29,221	29,221	29,221
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.501	0.847	0.778	0.548	0.662	0.571

Note: Standard errors clustered by firm in brackets. Main coefficients of interest rounded to four decimals.
+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

TABLE B2. Alternate measures of common institutional ownership

	CSR perf.	CSR strengths	CSR concerns	CSR perf.	CSR strengths	CSR concerns
Variable	(1)	(2)	(3)	(4)	(5)	(6)
CIO (5% blockholding threshold)	0.0008**	0.0009***	0.0002			
	(0.0003)	(0.0002)	(0.0002)			
CIO (product-based)				0.0014*	0.0009*	-0.0005
				(0.0006)	(0.0004)	(0.0004)
Non-common blockholder ownership	-0.0003	-0.0475	-0.0472	-0.0079	-0.0583	-0.0504
	(0.0607)	(0.0477)	(0.0439)	(0.0605)	(0.0474)	(0.0436)
Firm size	-0.0197	0.0632***	0.0829***	-0.0178	0.0657***	0.0835***
	(0.0168)	(0.0129)	(0.0126)	(0.0168)	(0.0129)	(0.0126)
Profitability	-0.0089	-0.0504+	-0.0415	-0.0092	-0.0505+	-0.0413
	(0.0410)	(0.0283)	(0.0284)	(0.0410)	(0.0285)	(0.0284)
Market-to-book ratio	-0.0079	-0.0040	0.0039	-0.0071	-0.0034	0.0037
	(0.0054)	(0.0044)	(0.0040)	(0.0054)	(0.0044)	(0.0040)
Earnings volatility	-0.1715*	0.0529	0.2244***	-0.1641*	0.0602	0.2243***
	(0.0834)	(0.0653)	(0.0615)	(0.0836)	(0.0658)	(0.0616)
Leverage	-0.0271	-0.0244	0.0028	-0.0338	-0.0313	0.0025
	(0.0427)	(0.0318)	(0.0295)	(0.0427)	(0.0318)	(0.0294)
Sales growth	0.0157	-0.0235*	-0.0393***	0.0160	-0.0234*	-0.0393***
	(0.0153)	(0.0108)	(0.0105)	(0.0153)	(0.0108)	(0.0105)
Constant	0.3794	-1.1195***	-1.4989***	0.3343	-1.1710***	-1.5053***
	(0.3449)	(0.2678)	(0.2589)	(0.3450)	(0.2672)	(0.2586)
Observations	31,024	31,024	31,024	31,024	31,024	31,024
Firm fixed effects	Included	Included	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included	Included	Included
Adjusted R-squared	0.545	0.661	0.566	0.545	0.660	0.566

Note: Standard errors clustered by firm in brackets. Main coefficients of interest rounded to four decimals.
+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

TABLE B3. Separate components of stakeholder sensitive industry

	CSR perf.	CSR strengths	CSR concerns	CSR perf.	CSR strengths	CSR concerns
Variables	(1)	(2)	(3)	(4)	(5)	(6)
CIO × Reputation sensitive industry	0.0176***	0.0103***	-0.0073**			
	(0.0043)	(0.0026)	(0.0025)			
CIO × Regulation sensitive industry				0.0191***	0.0135***	-0.0055*
				(0.0046)	(0.0035)	(0.0024)
CIO	0.0010***	0.0011***	0.0000	0.0010***	0.0011***	0.0000
	(0.0003)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
Non-common blockholder ownership	0.0238	-0.0321	-0.0558	0.0253	-0.0291	-0.0544
	(0.0607)	(0.0478)	(0.0439)	(0.0608)	(0.0479)	(0.0439)
Firm size	-0.0251	0.0598***	0.0849***	-0.0259	0.0588***	0.0847***
	(0.0168)	(0.0129)	(0.0127)	(0.0169)	(0.0128)	(0.0127)
Profitability	-0.0069	-0.0493+	-0.0424	-0.0075	-0.0495+	-0.0419
	(0.0413)	(0.0284)	(0.0285)	(0.0414)	(0.0285)	(0.0285)
Market-to-book ratio	-0.0081	-0.0040	0.0041	-0.0080	-0.0040	0.0040
	(0.0054)	(0.0044)	(0.0040)	(0.0054)	(0.0044)	(0.0040)
Earnings volatility	-0.1903*	0.0441	0.2344***	-0.1951*	0.0380	0.2331***
	(0.0822)	(0.0637)	(0.0617)	(0.0822)	(0.0629)	(0.0616)
Leverage	-0.0207	-0.0221	-0.0013	-0.0191	-0.0199	-0.0009
	(0.0419)	(0.0312)	(0.0293)	(0.0418)	(0.0310)	(0.0293)
Sales growth	0.0139	-0.0248*	-0.0387***	0.0137	-0.0251*	-0.0388***
	(0.0153)	(0.0108)	(0.0105)	(0.0152)	(0.0108)	(0.0105)
Constant	0.4372	-1.0914***	-1.5286***	0.4518	-1.0747***	-1.5265***
	(0.3445)	(0.2670)	(0.2593)	(0.3450)	(0.2637)	(0.2597)
Observations	31,024	31,024	31,024	31,024	31,024	31,024
Firm fixed effects	Included	Included	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included	Included	Included
Adjusted R-squared	0.547	0.662	0.566	0.547	0.663	0.566

Note: Standard errors clustered by firm in brackets. Main coefficients of interest rounded to four decimals.
+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table C-1. Industry Distribution of Selection Analysis Sample

Industry (3-digit NAICS code)		Establishment-years	
		Number	Percent
236	Construction of Buildings	3,399	<1%
238	Specialty Trade Contractors	14,376	3%
311	Food Manufacturing	29,802	6%
312	Beverage and Tobacco Product Manufacturing	5,041	1%
313	Textile Mills	6,272	1%
322	Paper Manufacturing	13,906	3%
323	Printing and Related Support Activities	20,914	5%
324	Petroleum and Coal Products Manufacturing	2,767	<1%
325	Chemical Manufacturing	20,091	4%
326	Plastics and Rubber Products Manufacturing	20,341	4%
327	Nonmetallic Mineral Product Manufacturing	14,950	3%
331	Primary Metal Manufacturing	14,799	3%
332	Fabricated Metal Product Manufacturing	53,386	12%
333	Machinery Manufacturing	37,059	8%
334	Computer and Electronic Product Manufacturing	22,279	5%
335	Electrical Equipment, Appliance, and Component Manufacturing	11,786	3%
336	Transportation Equipment Manufacturing	30,316	7%
339	Miscellaneous Manufacturing	17,607	4%
423	Merchant Wholesalers, Durable Goods	27,719	6%
424	Merchant Wholesalers, Nondurable Goods	17,369	4%
425	Wholesale Electronic Markets and Agents and Brokers	6,867	1%
488	Support Activities for Transportation	4,001	<1%
493	Warehousing and Storage	6,557	1%
517	Telecommunications	5,880	1%
541	Professional, Scientific, and Technical Services	19,105	4%
551	Management of Companies and Enterprises	9,730	2%
561	Administrative and Support Services	13,222	3%
562	Waste Management and Remediation Services	3,785	<1%
811	Repair and Maintenance	8,152	2%
	Total:	**461,478**	

Notes. N = 461,478 establishment-years from 107,513 establishments.

Table C-2. Correlations of Selection Analysis Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) OHSAS 18001 certified	1.00														
(2) All injury and illness cases†	0.01	1.00													
(3) DAFW injury and illness cases†	0.01	0.83	1.00												
(4) DJTR injury and illness cases†	0.01	0.79	0.60	1.00											
(5) Other injury and illness cases†	0.01	0.90	0.68	0.63	1.00										
(6) All injury cases†	0.01	0.99	0.83	0.79	0.89	1.00									
(7) All illness cases†	0.01	0.61	0.54	0.58	0.63	0.55	1.00								
(8) Average annual employment†	0.02	0.74	0.60	0.59	0.66	0.73	0.47	1.00							
(9) Establishment age	0.00	-0.10	-0.10	-0.07	-0.11	-0.09	-0.09	-0.05	1.00						
(10) Standalone	-0.01	-0.24	-0.19	-0.21	-0.20	-0.23	-0.16	-0.36	0.06	1.00					
(11) Branch	0.01	0.16	0.12	0.16	0.13	0.16	0.14	0.26	-0.21	-0.68	1.00				
(12) Publicly owned	0.01	0.15	0.12	0.15	0.13	0.14	0.15	0.29	-0.07	-0.34	0.36	1.00			
(13) Foreign owned	0.03	0.08	0.06	0.08	0.07	0.08	0.07	0.14	-0.03	-0.17	0.14	-0.16	1.00		
(14) Government contractor	0.00	0.02	0.02	-0.01	0.02	0.02	0.00	0.07	0.12	-0.03	-0.14	0.02	0.00	1.00	
(15) ISO9k certified, prior year	0.04	0.09	0.05	0.07	0.08	0.08	0.06	0.14	0.06	-0.06	0.04	0.06	0.06	0.05	1.00
(16) ISO14k certified, prior year	0.08	0.08	0.05	0.08	0.07	0.07	0.07	0.10	0.04	-0.05	0.04	0.02	0.10	-0.01	0.18

Notes. *DAFW injury and illness cases* are those causing at least one day away from work. *DJTR injury and illness cases* refers to those causing a job transfer or restriction. *Other injury and illness cases* refers to those that did not cause DAWF or DJTR. Missing values of *establishment age* were recoded to 0. N = 461,478 establishment-year observations from 107,513 establishments.

† Averaged over the two years before the SOII survey year, then logged after adding 1.

Table C-3. Selection Model Robustness Tests Results
Dependent variable: OHSAS 18001 certified

	(1a)	(2a)	(3a)	(1b)	(2b)	(3b)	(1c)	(2c)	(3c)
		Include state fixed effects			Include year x industry fixed effects			Include year x state fixed effects	
All injury and illness cases†	-0.222**			-0.218**			-0.214**		
	[0.072]			[0.071]			[0.073]		
All injury cases†		-0.279**			-0.269**			-0.271**	
		[0.079]			[0.078]			[0.079]	
All illness cases†		0.031			0.015			0.034	
		[0.085]			[0.087]			[0.085]	
DAFW injury and illness cases†			-0.325**			-0.361**			-0.332**
			[0.099]			[0.096]			[0.100]
DJTR injury and illness cases†			0.008			0.029			0.015
			[0.075]			[0.075]			[0.075]
Other injury and illness cases†			-0.031			-0.015			-0.02
			[0.080]			[0.080]			[0.082]
Annual employment†	0.561**	0.582**	0.554**	0.564**	0.586**	0.554**	0.563**	0.583**	0.555**
	[0.074]	[0.074]	[0.073]	[0.072]	[0.071]	[0.069]	[0.075]	[0.075]	[0.073]
Establishment age	-0.006	-0.006	-0.005	-0.004	-0.005	-0.004	-0.005	-0.006	-0.005
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.010]	[0.010]	[0.010]
Standalone	-0.384+	-0.387+	-0.384+	-0.339	-0.341	-0.339	-0.392+	-0.394+	-0.391+
	[0.210]	[0.211]	[0.210]	[0.210]	[0.211]	[0.209]	[0.211]	[0.211]	[0.211]
Branch	0.295+	0.285+	0.283+	0.327*	0.318*	0.307+	0.296+	0.286+	0.282+
	[0.163]	[0.163]	[0.163]	[0.160]	[0.161]	[0.161]	[0.163]	[0.163]	[0.164]
Publicly owned	0.684**	0.671**	0.682**	0.685**	0.675**	0.681**	0.694**	0.682**	0.692**
	[0.153]	[0.154]	[0.153]	[0.155]	[0.156]	[0.155]	[0.155]	[0.156]	[0.154]
Foreign owned	1.840**	1.830**	1.826**	1.837**	1.827**	1.820**	1.860**	1.848**	1.849**
	[0.152]	[0.152]	[0.152]	[0.152]	[0.152]	[0.153]	[0.153]	[0.153]	[0.154]
Government contractor	-0.077	-0.082	-0.077	-0.089	-0.093	-0.078	-0.089	-0.095	-0.088
	[0.218]	[0.219]	[0.218]	[0.215]	[0.215]	[0.215]	[0.219]	[0.220]	[0.219]
Industry dummies (3-digit NAICS codes)	Yes	Yes	Yes				Yes	Yes	Yes
Year dummies (1997–2016)	Yes	Yes	Yes						
Year x industry dummies				Yes	Yes	Yes			
State dummies	Yes	Yes	Yes						
Year x state dummies							Yes	Yes	Yes

Notes. Logistic regression coefficients, with standard errors clustered by establishment in brackets. ** p<0.01, * p<0.05, + p<0.10 Since logit drops observations corresponding to fixed effects that perfectly predict failure and as the fixed effects get more granular, there are more observations that get dropped. Models 1A-3A: N = 437,081 establishment-year observations of 102,107 establishments, including 279 OHSAS 18001 certified establishments. Models 1B-3B: N = 172,504 establishment-year observations of 65,352 establishments, including 279 OHSAS 18001 certified establishments. Models 1c-3c: N = 154,108 establishment-year observations of 69,594 establishments, including 279 OHSAS 18001 certified establishments. † Averaged over the two years before the SOII survey year, then logged after adding 1.

Table C-4. Selection Model Results Using Earlier Injury and Illness Cases

Dependent variable: OHSAS 18001 certified

	(1)	(2)	(3)
All injury and illness cases ♦	-0.178*		
	[0.073]		
All injury cases ♦		-0.169*	
		[0.079]	
All illness cases ♦		-0.065	
		[0.079]	
DAFW injury and illness cases ♦			-0.336**
			[0.094]
DJTR injury and illness cases ♦			0.101
			[0.078]
Other injury and illness cases ♦			-0.074
			[0.084]
Annual employment ♦	0.554**	0.567**	0.567**
	[0.079]	[0.079]	[0.078]
Establishment age	0.006	0.006	0.007
	[0.010]	[0.010]	[0.010]
Standalone	-0.608**	-0.603**	-0.606**
	[0.229]	[0.230]	[0.229]
Branch	0.25	0.252	0.228
	[0.162]	[0.163]	[0.162]
Publicly owned	0.808**	0.806**	0.792**
	[0.157]	[0.157]	[0.158]
Foreign owned	1.903**	1.899**	1.875**
	[0.154]	[0.154]	[0.155]
Government contractor	0.079	0.078	0.095
	[0.210]	[0.210]	[0.209]
Industry dummies (3-digit NAICS codes)	Yes	Yes	Yes
Year dummies (1997–2016)	Yes	Yes	Yes

Notes. Logistic regression coefficients, with standard errors clustered by establishment in brackets. *DAFW injury and illness cases* are those causing at least one day away from work. *DJTR injury and illness cases* refers to those causing a job transfer or restriction. *Other injury and illness cases* refers to those that did not cause DAWF or DJTR. Missing values of *establishment age* were recoded to 0 and all models include a dummy variable indicating observations when this recoding occurred. N = 409,820 establishment-year observations of 100,162 establishments, including 259 OHSAS 18001 certified establishments.

♦ Averaged over the third and fourth years before the SOII survey year, then logged after adding 1.

** p<0.01, * p<0.05, + p<0.10.

Table C-5. Logistic Regression Results of Model Generating Propensity Scores

Dependent variable: OHSAS 18001 certified

	(1)
Total injury and illness cases♦	0.121*
	[0.058]
Total injury cases ♦	-0.132*
	[0.057]
Total illness cases ♦	-0.133*
	[0.056]
DJTR injury and illness cases	0.012
	[0.012]
Other injury and illness cases♦	0.007
	[0.010]
Annual employment♦	0.000**
	[0.000]
Establishment age	-0.020*
	[0.009]
Standalone	-0.559**
	[0.189]
Branch	0.158
	[0.147]
Publicly owned	0.975**
	[0.143]
Foreign owned	1.790**
	[0.145]
Government contractor	0.151
	[0.186]
ISO 9001 certified in prior year	1.673**
	[0.150]
ISO 14001 certified in prior year	2.241**
	[0.163]
Industry dummies (3-digit NAICS codes)	Yes
Year dummies (1997–2016)	Yes

Notes. Logistic regression coefficients, with standard errors clustered by establishment in brackets. *DJTR injury and illness cases* refers to those causing a job transfer or restriction. *Other injury and illness cases* refers to those that did not cause DAWF or DJTR. Missing values were recoded to 0 for *establishment age*, *standalone*, *branch*, *publicly owned*, *foreign owned* and *government contractor* and the model includes corresponding dummy variables indicating observations when this recoding occurred. N = 3,277,417 establishment-year observations of 602,687 establishments, including 429 that became certified to OHSAS 18001.

♦ Averaged over five years before SOII survey year, then logged after adding 1.

** p<0.01, * p<0.05, + p<0.10.

Table C-6: Pipeline Table: Constructing the Primary Matched Sample

	OHSAS 18001 certified establishments		Noncertified establishments	
	N	*% of row above*	N	*% of row above*
1. Establishments certified to OHSAS 18001 in certification data	1,381			
2. And have any SOII data	578		2,187,431	
3. And with predicted propensity scores (uses values averaged over the prior five years)	393	*68.0*	602,653	*27.6*
4. And have SOII data in both pre- and post-periods	274	*69.7*	602,527	*99.9*
5. And that matched to one treatment or control establishment	274	*100.0*	274	*0.05*

Table C-7. Balancing Tests for Primary Matched Sample

	Sample eligible for matching (establishment-years in the sample to generate propensity scores)				Primary matched sample (establishment-year in the matched year)			
	Certified (mean)	Non-certified (mean)	Diff in means ♠	t-test p-value	Matched certified (mean)	Matched non-certified (mean)	Diff in means ♠	t-test p-value
All injury and illness cases (log) ♦	2.11	0.71	197%	0.00 *	2.18	2.14	2%	0.68
All injury and illness cases ♦	17.40	3.80	358%	0.00 *	16.03	18.27	-12%	0.47
DAFW injury and illness cases (log) ♦	0.99	0.35	183%	0.00 *	1.00	1.02	-2%	0.82
DAFW injury and illness cases♦	3.47	1.15	202%	0.00 *	3.34	3.33	0%	0.98
DJTR injury and illness cases (log) ♦	1.25	0.26	381%	0.00 *	1.30	1.23	6%	0.45
DJTR injury and illness cases ♦	6.81	1.02	568%	0.00 *	6.16	7.08	-13%	0.58
Other cases (log) ♦	1.45	0.44	230%	0.00 *	1.49	1.45	3%	0.66
Other cases ♦	7.12	1.63	337%	0.00 *	6.53	7.86	-17%	0.28
All injury cases (log) ♦	2.03	0.69	194%	0.00 *	2.07	2.05	1%	0.86
All injury cases ♦	15.17	3.46	338%	0.00 *	13.67	14.79	-8%	0.58
All illness cases (log) ♦	0.51	0.09	467%	0.00 *	0.60	0.58	4%	0.79
All illness cases ♦	2.23	0.34	556%	0.00 *	2.35	3.49	-32%	0.41
Average annual employment (log) ♦	5.33	3.16	69%	0.00 *	5.58	5.42	3%	0.08
Average annual employment ♦	381.42	85.98	344%	0.00 *	442.29	434.50	2%	0.89
Establishment age	13.90	3.26	326%	0.00 *	14.59	15.65	-7%	0.13
Establishment age missing	0.12	0.81	-85%	0.00 *	0.09	0.07	25%	0.34
Standalone	0.14	0.09	56%	0.00 *	0.15	0.15	3%	0.90
Standalone missing	0.07	0.80	-91%	0.00 *	0.06	0.04	33%	0.44
Branch	0.58	0.07	729%	0.00 *	0.59	0.61	-2%	0.73
Branch missing	0.07	0.80	-91%	0.00 *	0.06	0.04	33%	0.44
Publicly owned	0.32	0.04	700%	0.00 *	0.35	0.39	-10%	0.33
Publicly owned missing	0.07	0.80	-91%	0.00 *	0.06	0.04	33%	0.44
Foreign owned	0.41	0.02	1950%	0.00 *	0.42	0.42	0%	1.00
Foreign owned missing	0.07	0.80	-91%	0.00 *	0.06	0.04	33%	0.44
Government contractor	0.09	0.02	350%	0.00 *	0.12	0.09	31%	0.27
Government contractor missing	0.07	0.80	-91%	0.00 *	0.06	0.04	33%	0.44
ISO 9001 certified, prior year	0.31	0.01	3000%	0.00 *	0.41	0.46	-13%	0.17
ISO 14001 certified, prior year	0.19	0.00	n/a	0.00 *	0.32	0.30	10%	0.46

Notes. This table reports variable means and p-values from two-sample t-tests comparing the means. The *sample eligible for matching* refers to the sample used to generate propensity scores. This includes all certified establishments' establishment-years between 2005 and their certification year (N = 2,474) and all noncertified establishments' establishment-years starting in 2005 (N=3,274,943). The *matched sample* columns report averages of the 274 certified establishments' observations and the 274 noncertified establishments' observations in their match year. The match year for the former (treatments) is their OHSAS 18001 certification year. The match year for each noncertified establishment (control) is the certification year of the treatment establishment to which it was matched.

♦ Averaged over prior five years, then logged after adding 1.

♠ Difference in means is calculated as difference between the certified and noncertified establishments' means, divided by the latter's mean.

Table C-8. Primary Matched Sample Summary Statistics

	Mean	Std. dev.
All injury and illness cases	20.39	43.12
DAFW injury and illness cases	4.40	11.40
DJTR injury and illness cases	7.67	21.59
Other injury and illness cases	8.33	16.49
Total hours worked (log)	13.42	1.10
OHSAS 18001 certified, prior year	0.19	0.39

Notes. N = 3,295 establishment-years from 548 establishments (274 certified and 274 noncertified). U.S. Bureau of Labor Statistics confidentiality concerns prevent us from reporting minimum and maximum values of the injury and illness variables, which are based on SOII microdata.

Table C-9. Difference-in-Differences Treatment Effects Analysis of OHSAS 18001 on Injuries and Illness Cases: Narrower Sample Window

	(1)	(2)	(3)	(4)
	All injury and illness cases	DAFW injury and illness cases	DJRT injury and illness cases	Other injury and illness cases
OHSAS 18001 certified by prior year	-0.179**	-0.167	-0.229**	-0.146+
	[0.059]	[0.112]	[0.085]	[0.075]
Log total hours worked	1.023**	1.115**	1.023**	0.953**
	[0.097]	[0.145]	[0.134]	[0.098]
Establishment-level conditional fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Post-period dummy	Yes	Yes	Yes	Yes
Observations (establishment-years)	2,028	1,840	1,834	1,979
Establishments (certified/noncertified)	239/235	208/200	209/197	232/223
Mean dependent variable	19.0	4.7	7.9	7.8

Notes. Poisson regression coefficients, with standard errors clustered by establishment in brackets. Estimated on the primary matched sample, using the narrower window of observations 3 years before through 3 years after the match year.

** p<0.01, * p<0.05, + p<0.10.

Table C-10: Difference-in-Differences Treatment Effects Analysis of OHSAS 18001 on Injuries and Illness Cases: Controlling for ISO Certifications

	(1)	(2)	(3)	(4)
	All injury and illness cases	DAFW injury and illness cases	DJRT injury and illness cases	Other injury and illness cases
OHSAS 18001 certified, prior year	-0.232**	-0.304*	-0.271**	-0.151+
	[0.072]	[0.136]	[0.095]	[0.091]
Log total hours worked	1.007**	1.015**	1.095**	0.919**
	[0.068]	[0.148]	[0.090]	[0.077]
ISO9k certified by prior year	0.029	-0.106	0.116	-0.037
	[0.084]	[0.109]	[0.121]	[0.102]
ISO14k certified by prior year	0.02	0.229*	-0.038	-0.017
	[0.059]	[0.089]	[0.082]	[0.081]
Establishment-level conditional fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Post-period dummy	Yes	Yes	Yes	Yes
Observations (establishment-years)	3,239	3,067	3,024	3,161
Establishments (certified/noncertified)	263 / 261	240 / 234	235/231	256/247
Mean dependent variable	20.7	4.7	8.4	8.7

Notes. Poisson regression coefficients, with standard errors clustered by establishment in brackets. *DAFW injury and illness cases* are those causing at least one day away from work. *DJTR injury and illness cases* refers to those causing a job transfer or restriction. *Other injury and illness cases* refers to those that did not cause DAWF or DJTR.
** p<0.01, * p<0.05, + p<0.10.

Table C-11. Analysis of OHSAS 18001 on Injuries and Illness Cases: Alternative Matched Group

Alternative matched group created via nearest-neighbor matching of propensity scores generated from a model that omits the NETS variables from the primary specification reported in Table A-5.

Panel A: Balance Table

	Matched certified (mean)	Matched non-certified (mean)	Diff in means ♠	t-test p-value	
Part 1: Variables included in alternative logistic regression model that generated propensity scores for this robustness test					
All injury and illness cases (log) ♦	2.18	2.26	-4%	0.44	
All injury and illness cases ♦	16.03	17.88	-11%	0.43	
DAFW injury and illness cases (log) ♦	1.00	1.01	-1%	0.91	
DAFW injury and illness cases♦	3.34	3.73	-11%	0.52	
DJTR injury and illness cases (log) ♦	1.30	1.35	-4%	0.61	
DJTR injury and illness cases ♦	6.16	6.16	0%	0.99	
Other cases (log) ♦	1.49	1.57	-5%	0.35	
Other cases ♦	6.53	7.98	-22%	0.20	
All injury cases (log) ♦	2.07	2.13	-3%	0.54	
All injury cases ♦	13.67	15.27	-12%	0.37	
All illness cases (log) ♦	0.60	0.65	-9%	0.46	
All illness cases ♦	2.35	2.60	-10%	0.76	
Average annual employment (log) ♦	5.58	5.62	-1%	0.68	
Average annual employment ♦	442.29	417.48	6%	0.57	
ISO 9001 certified, prior year	0.41	0.41	-1%	0.93	
ISO 14001 certified, prior year	0.32	0.29	10%	0.41	
Part 2:Variables excluded from the alternative logistic regression model that generated propensity scores for this robustness test					
Establishment age	16.64	17.30	-4%	0.38	
Standalone	0.16	0.22	-38%	0.14	
Branch	0.64	0.56	13%	0.11	
Publicly owned	0.39	0.38	1%	0.91	
Foreign owned	0.44	0.26	41%	0.00	*
Government contractor	0.14	0.06	56%	0.01	*

Notes. This table reports variable means and p-values from two-sample t-tests comparing the means. In Part 1, the *matched sample* columns report averages of the 274 certified establishments' observations and the 274 noncertified establishments' observations in their match year. The match year for the former (treatments) is their OHSAS 18001 certification year. The match year for each noncertified establishment (control) is the certification year of the treatment establishment to which it was matched. *DAFW injury and illness cases* are those causing at least one day away from work. *DJTR injury and illness cases* refers to those causing a job transfer or restriction. *Other injury and illness cases* refers to those that did not cause DAWF or DJTR. Part 2 reports comparisons of NETS variables that were omitted from the alternative logistic regression model used to generate propensity scores for this robustness test, for the subset of the matched group where both paired members have NETS data (N=180 pairs for all but age, where N = 172 pairs)

♦ Averaged over prior five years, then logged after adding 1.

♠ Difference in means is calculated as difference between the certified and noncertified establishments' means, divided by the latter's mean.

* $p < 0.05$.

Panel B: Difference-in-Differences Treatment Effects Analysis of OHSAS 18001 on Injuries and Illness Cases: Alternative Matched Groups

	(A-1)	(A-2)	(A-3)	(A-4)
	All injury and illness cases	DAFW injury and illness cases	DJRT injury and illness cases	Other injury and illness cases
OHSAS 18001 certified by prior year	-0.141+	-0.077	-0.210*	-0.120
	[0.074]	[0.130]	[0.093]	[0.088]
Log total hours worked	0.882**	0.756**	1.125**	0.746**
	[0.075]	[0.128]	[0.106]	[0.095]
Establishment-level conditional fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Post-period dummy	Yes	Yes	Yes	Yes
Observations (establishment-years)	3385	3234	3134	3321
Establishments (certified/noncertified)	263 / 262	240 / 241	235 / 232	256 / 253
Mean dependent variable	20.0	4.5	7.7	8.7