

The Eco-Gender Gap in Boardrooms

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Keywords: female directors, board diversity, corporate environmental performance, environmental news, pollution prevention, emissions

JEL Classification: G30, G38, G41

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To examine what women bring to the boardroom table, we first show a significant gender gap in viewing the tradeoff between environmental and economic benefits using the Gallup Poll. We next demonstrate that such a gender gap extends into boardrooms: Having female directors is associated with more environmentally friendly business operations, but also with higher investment in environmental protection at the same time. Results from an analysis using a California law change that imposed board gender quotas point to a potentially causal effect of female directors. Employing a rich set of director demographics and board characteristics, we show that none consistently supersedes the share of female directors in explaining corporate environmental performance, suggesting that female directors play a unique role in explaining firms' investment in environmental protection.

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“This is the age of the female director. . . . there is little doubt that they will influence firm and societal outcomes. To characterize this influence we need a better understanding of what women bring to the boardroom table and how diversity affects firm outcomes.”

– Renée Adams (2016, *Leadership Quarterly*, p. 384)

“Boards with a diverse mix of genders, ethnicities, career experiences, and ways of thinking have, as a result, a more diverse and aware mindset. They are less likely to succumb to groupthink or miss new threats to a company’s business model. And they are better able to identify opportunities that promote long-term growth.”

– BlackRock CEO Larry Fink’s *Annual Letter to CEOs*, January 19, 2018

1. Introduction

New data from the Gallup Poll Social Series show that female respondents value environmental protection more than male respondents, whereas male respondents value economic growth and energy supplies significantly more. In this paper, we examine whether such a gender gap in viewing the tradeoff between environmental and economic benefits extends to corporate decision-making inside boardrooms. For identification, we resort to a law change in California during our sample period that imposed board gender quotas on locally headquartered firms. Using a rich set of director demographic variables and board qualification, diversity, and governance measures, we then explore how female directors play a role in corporate environmental performance. Our paper sheds new light on what female directors bring to the boardroom table and provides new evidence on the important interactions across corporate environmental, social, and governance (ESG) dimensions.

Investments in corporate environmental performance are characterized by a prolonged period of resource commitment that generates positive externalities to stakeholders, the community, and the natural environment, potentially reducing firms’ environmentally related regulatory risk. The cost-benefit tradeoff might be firm-specific or even hard to quantify. This begs the question of what prompts modern corporations to engage in environmentally

friendly operations. We try to answer this question from corporate governance and social performance perspectives,¹ with a particular focus on board gender diversity.

On the one hand, as the two opening quotations suggest, adding more female directors to typically male-dominated corporate boardrooms could broaden boards' perspectives on environmental issues, especially regarding the tradeoff between short-term economic costs and long-term environmental benefits. PwC's Annual Corporate Directors Survey (2022) shows that 66% of surveyed female directors are more likely to prioritize reducing the impact of climate change, even if it impacts short-term financial performance, compared to only 45% of surveyed male directors. In addition, Malenko (2014) shows that more diverse boards communicate more effectively, leading to efficient decision-making.

On the other hand, self-selection and professional expertise might reduce, or even eliminate, gender differences in personal values and preferences inside the boardroom (Adams and Funk 2012; Lewellen 2022). Moreover, from a theoretical perspective, a diverse board could also be less effective in some settings (Baranchuk and Dybvig 2009; Garlappi, Giammarino, and Lazrak 2017), for example, in a dynamic framework (Donaldson, Malenko, and Piacentino 2020).

What women bring to the boardroom table and how board gender diversity influences corporate environmental performance remain important questions that have yet to be thoroughly examined empirically. Section 2 summarizes mixed findings from the prior literature, possibly due to identification challenges and data limitations (such as missing micro-level evidence or individual director characteristics). We address these challenges

¹ Prior literature has largely examined the role of shareholders and creditors. See, for example, Cao, Liang, and Zhan (2019), Krueger, Sautner, and Starks (2020), Cao, Titman, Zhan, and Zhang (2023), and Hoepner, Oikonomou, Sautner, Starks, and Zhou (2024) on the role of shareholders, as well as surveys by Matos (2020) and Gillan, Koch, and Starks (2021). The influence of creditors on firms' toxic emissions is examined by Akey and Appel (2021), Kacperczyk and Peydro (2022), Bellon (2022), and Ivanov, Kruttli, and Watugala (2024). Other important stakeholders playing a role include customers (Aghion, Bénabou, Martin, and Roulet 2023) and governments (Wu, You, Yu, and Zhou 2024).

using an array of data sources, including the Environmental Protection Agency (EPA) and RepRisk, to provide a multifaceted view of firms' environmental performance, as well as a quasi-natural experiment (Senate Bill 826 in California) specific to board gender diversity for identification.

Using Refinitiv's environmental ratings, the EPA's source reduction practices, and RepRisk's negative environmental news as measures of corporate environmental performance, we first document a positive and significant association between board gender diversity and corporate environmental performance. At the same time, strong environmental performance requires more investments, which is supported by a positive association between the share of female directors on a firm's board and its sales, general, and administrative expenses. These results echo the survey evidence on the willingness to trade environmental actions against economic costs by the female population broadly and female directors specifically.

To establish the causal effect of female directors on corporate environmental performance, we take advantage of California's Senate Bill (SB) 826 in 2018 which mandated at least one female director for public firms headquartered in the state. We employ a difference-in-differences specification, comparing changes in environmental performance between a) treated firms and a matched control sample outside California (both without any female directors before 2018), and b) treated firms and an alternative matched control sample of firms in California with at least two female directors in 2018. We note that the vast majority (89%) of treated firms added at least one female director in the first year after SB 826 went into effect, at a significantly higher rate than those for the two control samples. Importantly, compared to control firms, treated firms experienced significant increases in their environmental performance after (but not before) the bill's passage. Overall, these two

different control samples help establish the causal effect of *increasing* the female director ratio on improving corporate environmental performance.

To examine firms' investments and actions in improving environmental performance, we employ facility-level data from the EPA's Toxic Release Inventory database, which covers both source reduction practices and the production of toxic chemicals. Our facility-level analysis suggests that an increase in the share of female directors leads to more source reduction practices, and a drop in the amount of toxic pollutants produced, both of which are consistent with our firm-level evidence. These findings support the notion that firms with female directors make more investments and/or take more actions to prevent industrial pollution, despite the associated financial costs in the short run. They also provide micro-level evidence for some real effects of female directors.

To determine whether improved corporate environmental performance stems from female directors' demographic characteristics, skills or experience, specific facets of board diversity or governance they contribute to, we conduct several exploratory analyses.

Using detailed director- and board-level data, we first show that, in the same firm-year, compared to male directors, female directors are younger, have shorter board tenure, are less likely to possess industry experience, and are more likely to have professional experience in non-business sectors, exposure to environmental regulations, and expertise related to sustainability and risk management. They are less likely to have backgrounds or expertise traditionally valued by boards such as general management, entrepreneurship, and mergers and acquisitions (M&As) (e.g., Kim and Starks 2016; Field, Souther, and Yore 2020). Next, we turn to various board diversity measures that female directors could potentially contribute to. We find that the share of female directors is positively associated with board diversity measures covering age, board tenure, educational background, skill, and undergraduate college. Finally, we show that compared to male directors, female directors are more likely to

sit on sustainability-related committees if these exist, and on key monitoring committees. Moreover, firms with female directors are more likely to link executive pay to corporate ESG performance and to provide E&S reporting.

Importantly, when we run a horse race between the share of female directors and the director qualification, board diversification, and governance measures, none of the director demographics and board characteristics consistently supersedes the share of female directors in explaining corporate environmental performance. The evidence suggests that director gender could be a holistic measure of some female directors' values and perspectives—even if these are hard to measure precisely due to the lack of granular data and disclosure on boardroom deliberations—which add to diversity of thought. Our results also echo the findings from PwC's Annual Corporate Directors Surveys over the last five years, which have highlighted gender diversity as the top factor (compared to race, age, tenure, socioeconomic background, etc.) in creating diversity of thought inside a boardroom.

Our paper makes three contributions. First, we highlight how directors' personal values and preferences matter in corporate environmental performance. Such a “real effect” of board gender diversity has implications for not only financial markets but also governments and policymakers with mandates to mitigate the negative externalities of economic activities. As such, our paper complements the emerging literature on how financial markets and their participants can influence firms' production and resultant pollution, which largely focuses on the role of shareholders and creditors. Moreover, our paper finds positive externalities across corporate ESG dimensions, which are largely overlooked by prior studies.² Our results suggest that policies targeting social issues, such as

² There are two notable exceptions. In a cross-country study, Dyck et al. (2023) show that board renewal could be an important governance channel through which investors' preferences for sustainability are materialized into better corporate environmental performance. In contrast, Farzamfar, Foroughi, and Ng (2022) highlight a tradeoff, showing that U.S. firms invest more to address their environmental concerns at the expense of their social performance.

board gender diversity, could have a spillover effect on corporate environmental performance, with governance mechanisms as one potential channel. This spillover effect is important, because regulating environmental practices directly, such as limiting carbon emissions, has faced significant pushback from the business community, and may even backfire (see, for example, Herweg and Schmidt (2022)).

Second, we provide novel evidence on the important question of what women bring to the boardroom table. Combining new data from the Gallup Poll with firm- and facility-level data on corporate environmental performance, we show that when it comes to making the tradeoff between environmental and economic benefits, women in the general population and women inside boardrooms are (closely) aligned. As such, our paper contributes to the large literature on gender differences in values and preferences based on experimental and survey evidence (e.g., Croson and Gneezy 2009; Bertrand 2011; Adams and Funk 2012) and their implications for firm outcomes (e.g., Adams and Ferreira 2009; Huang and Kisgen 2013; Faccio, Marchica, and Mura 2016; Dyck et al. 2023; Ginglinger and Raskopf 2023; Biggerstaff, Campbell, and Goldie 2024).

Finally, we identify several factors that could be potential channels for the role of female directors, such as their unique skills and governance roles. However, none of them can consistently supersede the share of female directors in explaining corporate environmental performance, suggesting that director gender is unique in explaining firms' environmental engagement, a point further bolstered by the causal effect of female directors through the analysis using SB 826 in California. As such, our paper contributes to the growing literature on board diversity by highlighting that director gender is a holistic measure of different values and perspectives that female directors bring to the table.³

³ Using a rich set of board diversity measures, Anderson, Reeb, Upadhyay, and Zhao (2011) find a positive association between their board diversity index and firm performance, whereas Adams, Akyol, and Verwijmeren (2018) find that boards with greater skill diversity do not perform better. Bernile, Bhagwat, and Yonker (2018) show that greater board diversity leads to lower firm risk and better performance. Using Korean

2. Prior Literature and Recent Survey Evidence

Our review of the literature suggests that most of the early work in this area uses small or industry-specific samples (e.g., Post, Rahman, and McQuillen 2015; Francoeur, Labelle, Balti, and Bouzaidi 2019; García-Sánchez, Suárez-Fernández, and Martínez-Ferrero 2019) or takes a snapshot (Liao, Luo, and Tang 2015), and often only uses strength and weakness scores from the KLD data. There is also mixed evidence on the relation between board gender diversity and corporate environmental performance. For example, Glass, Cook, and Ingersoll (2016), Alazzani, Hassanein, and Al-Janadi (2017), and Birindelli, Iannuzzi, and Savioli (2019) find either no relation or a non-linear relation. Liu (2018) is the first study that employs a comprehensive panel data set, and studies the correlations between board gender diversity and the number of lawsuits for environmental infringement. In addition, this literature encounters identification challenges (e.g., reverse causality and omitted variables), highlighting the importance of using a quasi-natural experiment to establish the causal effect. Moreover, this literature lacks granular data to delve into the underlying mechanisms (such as compensation policy and CSR committee) and/or present direct evidence (such as female directors' skills and educational background) for the influence of board gender diversity.

Using France's 2011 board gender quota⁴ (the Copé-Zimmermann law) for identification, Ginglinger and Raskopf (2023) show that female directors increase firms' environmental and social (E&S) performance, mainly through their governance role and E&S expertise. Our paper differs from their study in the following ways. First, we focus on U.S. firms that are less subject to ESG regulations than their European counterparts and are used as control firms in their and other international studies. In the U.S., societal views about

data, Kang, Kim, and Oh (2022) show that board demographic diversity is associated with more effective monitoring and higher firm value.

⁴ For studies employing board gender quotas in Europe to study the causal effect of female directors on firm performance and labor market outcomes, see Ahern and Dittmar (2012), Matsa and Miller (2013), Bertrand, Black, Jensen, and Lleras-Muney (2019), Eckbo, Nygaard, and Thorburn (2022), and Bian, Li, and Li (2025).

environmental issues have become increasingly polarized over time (Chinn, Hart, and Soroka 2020). Second, we provide micro-level evidence at the facility level: facilities of firms with more female directors increase pollution prevention activities and emit less. These objective measures mitigate the concern about greenwashing or firms' manipulation of ESG ratings. Third, we explore how board diversity shapes corporate environmental performance using a richer set of director demographics, board qualifications, and diversity measures than theirs, which allows us to discuss channels and examine the unique role of female directors. An important and unique message from our findings is that, none of these potential channels can consistently supersede the share of female directors in explaining corporate environmental performance in the U.S. setting. While speculative, cross-country institutional differences could lead to different influence channels of female directors (e.g., through formal governance mechanisms in France versus through informal cultural changes in the U.S.). Fourth, for identification, the regulatory change in California has a tighter event window—Public firms in California were required to meet the first phase of SB 826 within 15 months of the bill's passage (by the end of 2019)—compared to French firms having three years (by 2014) to meet the first phase of their mandate. The shorter compliance window from SB 826 provides a cleaner quasi-natural experiment for identification, and mitigates the impact of unrelated macroeconomic factors or other policy changes that could confound our findings.

Our empirical analysis of the relation between board gender diversity and corporate environmental performance is motivated by new survey evidence from the Gallup Poll Social Series (GPSS) and PwC's Annual Corporate Directors Survey on gender differences in prioritizing environmental protection over economic growth.⁵

⁵ See the poll at: <https://www.gallup.com/175307/gallup-poll-social-series-methodology.aspx>. See the survey at: <https://www.pwc.com/us/en/services/governance-insights-center/assets/pwc-2022-annual-corporate-directors-survey.pdf>.

Introduced in 2001, GPSS is a set of public opinion surveys designed to monitor U.S. adults' views on numerous social, economic, and political topics. We use the two questions under the "trade-offs" category, about trading off environmental protection and economic growth (or energy production). Section IA1 in the Internet Appendix provides details on the survey and these questions. Table 1 presents the survey results. Panel A reports the raw survey responses grouped by a respondent's gender, and Panel B reports the survey responses grouped by a respondent's gender, controlling for age, education, political party, year, and zip code fixed effects.⁶ We find that in both panels, female respondents on average value environmental protection more, while male respondents on average value economic growth and energy supplies more. Interestingly, when focusing on high-income respondents only, male respondents exhibit an even stronger preference for economic growth (energy supplies) over environmental protection compared to female respondents, making the gender difference much larger. In contrast, female respondents in the high-income subsample exhibit a similar preference for environmental protection as female respondents in the full sample.

PwC's Annual Corporate Directors Survey asks directors from S&P 500 and Russell 3,000 firms on a variety of issues including ESG, crisis management, board diversity, board effectiveness, among other areas.⁷ The survey in 2022 finds that 66% of surveyed female directors are more likely to prioritize reducing the impact of climate change, even if it impacts short-term financial performance, compared to 45% of surveyed male directors. In addition, 65% of female directors agree that ESG issues are linked to company strategy, compared to 55% of male directors.

On the one hand, as the survey evidence together with the two opening quotations suggests, having more female directors in corporate boardrooms could broaden boards'

⁶ Using international data, Dechezleprêtre et al. (2023) find that besides gender, a respondent's age, education, and political attitudes also explain how much they worry about unabated climate change.

⁷ Recent surveys include responses from 600 to 800 public company directors.

perspectives on environmental issues. Moreover, Malenko (2014) shows that more diverse boards communicate more effectively, leading to efficient decision-making. As a result, it seems reasonable to expect a positive association between board gender diversity and corporate environmental performance.

On the other hand, Adams and Funk (2012) and Lewellen (2022) provide evidence suggesting that self-selection and professional expertise reduce, or even eliminate, some gender differences in personal values and preferences (e.g., risk attitudes). Moreover, from a theoretical perspective, it is not clear whether a diverse board is more effective in all dimensions. Baranchuk and Dybvig (2009) develop a model of board decision-making and show that directors with different information sets disagree more, suggesting that the decision-making process of more diverse boards entails more debate than more homogeneous ones, potentially affecting corporate investments in environment-friendly operations. Donaldson, Malenko, and Piacentino (2020) model board deadlock, which is the inability of a board to make decisions. Their dynamic model predicts that board diversity (with directors having heterogeneous preferences) exacerbates board deadlock, resulting in no decision-making. Garlappi, Giammarino, and Lazrak (2017) model how group disagreement leads to inefficiency in corporate investments. Ultimately, whether board gender diversity results in improved corporate environment performance remains an empirical question.

3. Data and Sample Formation

We employ a number of data sources to measure corporate environmental performance. We introduce them briefly here, and leave the details in Section IA2 in the Internet Appendix. Our first data source is Refinitiv's emissions reduction, innovation, and resource use scores.⁸ We use the average across these three scores to capture a firm's overall

⁸ This data has been used in many ESG studies, see, for example, Dai, Liang, and Ng (2021), Li, Liu, Mai, and Zhang (2021), and Dyck et al. (2023). We first downloaded the Refinitiv ESG data on July 1, 2022. To extend

performance (*E score*) from 2002 to 2021. Our second source is the EPA's Toxics Release Inventory (TRI) database. *#Source reduction practices* is the number of a facility's source reduction practices weighted by the number of toxic chemicals to which a specific practice is applied (Akey and Appel 2021; Bellon 2022), summed across all facilities of a firm in a year. The sample period is from 2002 to 2020. Our third data source is RepRisk.⁹ *Environmental news* is the number of negative environmental news items, classified by the United Nations Global Compact (UNGC) and weighted by severity and reach scores, about a firm in a year. The sample period is from 2007 to 2020. Table IA1 in the Internet Appendix provides detailed variable definitions.

BoardEx contains information such as board composition, committee composition, and biographic and professional background (in free-form text) of directors for more than 20,000 companies since 1999.¹⁰ Its data coverage is more comprehensive after 2000, which explains why our sample period begins in 2001. We supplement BoardEx data with board and director data from the Refinitiv ESG Board Member data set.

We collect firms' financial data from Compustat, and obtain institutional ownership data from the Thomson Reuters Institutional Holdings (13F) data set. We extract firms' (historical) headquarters states and the Standard Industry Classification (SIC) codes using the Augmented 10-X Header Data downloaded from Bill McDonald's website.¹¹

To better measure firms' real environmental performance at the facility level, we also employ facility-level data on *#Source reduction practices* and *Production waste*, which is the total quantity of all TRI-listed toxic chemicals produced by a facility.¹² To control for a

the sample period for some new analyses, we downloaded the Refinitiv data again on November 11, 2024, and note that the correlation of the environmental scores between the two downloads is 0.99.

⁹ This data has been used in prior studies including Gantchev, Giannetti, and Li (2022) and Houston and Shan (2022).

¹⁰ We manually code a director's academic degree, field, and skill, following Kim and Starks (2016), Adams, Akyol, and Verwijmeren (2018), and Iliev and Roth (2023).

¹¹ <https://sraf.nd.edu/data/augmented-10-x-header-data/>

¹² This measure has been used in Li and Zhou (2017) and Hsu, Li, and Tsou (2023).

facility's scale and operating/financial condition, we use the National Establishment Time-Series (NETS) database (2020 version).¹³ Table IA2 in the Internet Appendix lists steps taken and filters applied to form firm- and facility-level samples.

Table IA3 Panel A in the Internet Appendix presents the summary statistics for the firm sample. In terms of corporate environmental performance, the average *E score* is 0.21. Over our sample period, the average share of female directors is 15%. Figure IA1 in the Internet Appendix plots the temporal trend in the share of female directors over the period 2001–2020. Consistent with the increasing attention and scrutiny from policymakers, regulators, and institutional shareholders regarding gender diversity in boardrooms, we see a clear upward trend in the share of female directors over the sample period, from about 10% in the early 2000s to over 20% by the end of the sample period.¹⁴ Table IA3 Panel B presents the summary statistics for the facility sample.¹⁵

4. Female Directors and Corporate Environmental Performance

4.1. Firm-level baseline results

To examine the relation between the share of female directors on a board and corporate environmental performance, we start with the following lead-lag panel data regression specification:

$$E\ measure_{it} = \alpha_0 + \alpha_1 Female\ director\ ratio_{it-1} + \alpha_2 Governance\ characteristics_{it-1} + \alpha_3 Firm\ characteristics_{it-1} + Industry \times Year\ FE + Firm\ FE + \varepsilon_{it}, \quad (1)$$

¹³ The TRI database offers the crosswalk between TRIFD and dunsnumber, which allows us to merge the two data sets. For more details about the NETS database, please refer to <https://maryannfeldman.web.unc.edu/data-sources/longitudinal-databases/national-establishment-time-series-nets/>.

¹⁴ The rise in the female director share is steeper since 2017 when the Big Three asset managers—BlackRock, Vanguard, and State Street—adopted a policy requiring at least one female director on every board of their portfolio firms (Gormley et al. 2023). We control for the shareholding of these asset managers in our regression analyses, and explore the change in 2017 in Section 5.3.

¹⁵ Table IA4 in the Internet Appendix presents the correlation matrix for the firm and facility sample. Examination of the correlation matrix generally suggests that multicollinearity is unlikely an issue.

where the dependent variables are *E score*, *#Source reduction practices*, and *Environmental news*. The control variables include an indicator variable for female CEO, a composite governance index *Board governance*, ownership by the Big Three asset managers, and firm characteristics (e.g., M/B, firm size, leverage, ROA, and cash holdings). Our variable of interest is *Female director ratio*. The choice of our control variables largely follows prior work (e.g., Dyck et al. 2019, 2023; Starks, Venkat, and Zhu 2024). We include (three-digit SIC) industry times year fixed effects to control for time-varying industry-specific shocks to both the share of female directors and corporate environmental performance. We also include firm fixed effects, which could absorb the persistent component of a firm's strategic position on ESG. Standard errors are clustered at the firm level.

Table 2 Panel A reports the regression results. We find a positive and significant association between *Female director ratio* and *E Score* in column (1). In terms of economic significance, a one-standard-deviation increase in *Female director ratio* is associated with an increase of 0.008 ($= 0.072 \times 0.107$) in *E score*, about 3% of its standard deviation (4% of its mean). In column (2), following Dyck et al. (2019), we replace *Big3 institutions* with two alternative institutional ownership measures: *UN PRI institutions*, the fractional ownership of PRI signatories (out of the total number of shares outstanding), and *Non UN PRI institutions*, the non-PRI institutional ownership. We find a positive and significant association between *UN PRI institutions* and *E score*, consistent with Dyck et al. (2019), whereas a negative and significant association between *Non UN PRI institutions* and *E score*. Importantly, these alternative institutional ownership measures do not affect the coefficient estimate on *Female director ratio* much.¹⁶

¹⁶ Due to the limited sample period coverage (PRI signatories began in 2006) and the limited information available for matching PRI signatories to the institutional ownership data (by name and country), in the remainder of the paper, we continue to control for *Big3 institutions* (all of which are PRI signatories).

We then estimate Equation (1) using Poisson regressions when the dependent variables are *#Source reduction practices* and *Environmental news*.¹⁷ Panel B column (1) shows a positive and significant association between *Female director ratio* and the number of source reduction practices. Column (2), on the other hand, shows a negative and significant association between *Female director ratio* and the number of negative environmental news items. In terms of economic significance, a one-standard-deviation increase in *Female director ratio* is associated with an increase in *#Source reduction practices* by 9.6% ($= \exp(0.094 \times 0.975) - 1$), and a drop in *Environmental news* by 6.8% ($= \exp(0.106 \times (-0.668)) - 1$). These results indicate that more female directors are associated with better environmental performance.¹⁸

4.2. Female directors and facility-level environmental performance

In this section, we provide micro-level evidence on investments and actions taken to improve environmental performance by firms with more female directors. We employ facility-level data from the EPA based on regulatory reporting, and run the following lead-lag panel data regressions:

$$\begin{aligned} \text{Facility} - \text{level outcome}_{jit} &= \alpha_0 + \alpha_1 \text{Female director ratio}_{it-1} + \alpha_2 \text{Facility characteristics}_{jt-1} \\ &+ \alpha_3 \text{Governance characteristics}_{it-1} + \alpha_4 \text{Firm characteristics}_{it-1} \\ &+ \theta \text{Facility FE}_j + \gamma_1 \text{Firm industry} \times \text{Year FE} \\ &+ \gamma_2 \text{Facility industry} \times \text{Year FE} + \gamma_3 \text{Firm HQ state} \times \text{Year FE} \\ &+ \gamma_4 \text{Facility state} \times \text{Year FE} + \varepsilon_{jit}, \end{aligned} \quad (2)$$

where *Facility – level outcome_{jit}* are the following two measures of facility *j* of firm *i* in industry *s* in year *t*: *#Source reduction practices* and *Production waste*.

Facility characteristics_{jt-1} include facility *j*'s sales, number of employees, and credit

¹⁷ It is worth noting that, given that we use Poisson estimations, the number of observations in these two columns is much smaller than that in column (1): Out of the 21,695 observations employed in column (1), only 9.0% and 13.2% have positive values for *#Source reduction practices* and *Environmental news*, respectively.

¹⁸ Table IA5 in the Internet Appendix presents the results with additional or different fixed effects.

ratings in year $t-1$. Other control variables are similar to those included in Equation (1) for our firm-year-level analysis. We control for facility fixed effects, firm industry times year and facility industry times year fixed effects, firm headquarters state times year fixed effects and facility state times year fixed effects. Including facility fixed effects helps mitigate the concern that firms may opportunistically relocate some of their most polluting production across facilities to help improve their environmental ratings. Moreover, our facility-level regression controls for the scale of a facility in terms of production output and employee headcount and thus helps rule out the possibility that a facility's drop in production waste results from an opportunistic cut of production scale.

Table 2 Panel C columns (1)-(2) show a positive and significant association between the share of female directors and the number of source reduction practices. In terms of economic significance, using column (2) as an example, a one-standard-deviation increase in *Female director ratio* is associated with a 19.6% increase in facilities' source reduction practices.¹⁹ Columns (3)-(4) reveal that the share of female directors is negatively and significantly associated with the facility-level quantity of production waste. In terms of economic significance, using column (4) as an example, a one-standard-deviation increase in *Female director ratio* is associated with a 2.7% decrease in facilities' total quantity of production waste.²⁰

In summary, our facility-level results provide micro-level evidence for some real effects of female directors on corporate environmental performance, echoing the survey evidence from the GPSS that women (men) put more emphasis on environmental protection (economic growth), and from PwC's Annual Corporate Directors Survey (2022) that female

¹⁹ When a firm increases its female director ratio from 0 to 0.084, its facility is associated with a 19.6% ($= (\exp(0.084 \times 2.134) - 1)$) increase in its number of pollution prevention activities.

²⁰ When a firm increases its female director ratio from 0 to 0.086, its facility is associated with a drop of -0.027 ($= ((1 + 1.270)/1.270) \times (\exp(0.086 \times (-0.174)) - 1)$) in total quantity of production waste produced relative to sample mean.

directors are more likely to prioritize reducing the impact of climate change than male directors. Our evidence also complements Bolton and Kacperczyk (2023) who uncover a positive association between a firm's share of female directors and its commitment to a carbon emissions reduction pathway.

5. Identification

5.1. SB 826 in California

To establish the causal effect of female directors, we explore California's SB 826 as a plausibly exogenous shock to *Female director ratio*. Signed into law on September 30, 2018, this was the first female-director-quota law in U.S. history. It required public companies headquartered in California to have at least one female director by the end of 2019 (i.e., the first phase), and, depending on board size, some firms were required to have multiple female directors by the end of 2021 (i.e., the second phase).²¹ To mitigate the concerns that firms with TRI-reporting facilities in California might be subject to different and potentially tighter environmental regulations than firms without, we remove those firms.

We employ a difference-in-differences (DID) specification to examine the difference of changes in both the share of female directors and corporate environmental performance before versus after the passage of SB 826 in 2018 between treated and control firms. We focus on *E Score* in this analysis, as data availability does not allow us to study the other environmental variables.²² The variable of interest is $Treated \times Post$, an interaction term between the indicator variable, *Treated*, for treated firms and the indicator variable, *Post*, for

²¹ In terms of enforcement, each director seat required to be filled by a female director, which is not filled by a female director, counts as a single violation. A first violation results in a \$100,000 fine and subsequent violations result in \$300,000 fine. Starting in March 2020, the California Secretary of State's website published an annual report on the status of compliance with the requirements of SB 826, including company name, disclosure date, and the number of female directors. The disclosure of non-compliance may create public pressure and affect a firm's image with its stakeholders.

²² Almost all firm-year observations in our matched treatment and control sample do not have any *#Source reduction practices* or *Environmental news*. Therefore, these two environmental performance variables cannot be used as dependent variables in Poisson regressions (as in Table 2 Panel B).

the post-event window (2019 to 2021; the pre-event window is 2015 to 2017). As before, we control for firm characteristics, as well as industry times year and firm fixed effects. The treated firms are public firms without a female director in 2018 and headquartered in California. To find control firms, we first search for public firms headquartered outside California without a female director in 2018. For each treated firm, we then find a control firm in the same (three-digit SIC) industry, with the smallest total (normalized) absolute difference in total assets and *E score* in 2018 to the treated firm.²³ After the above steps, we end up with 57 treated firms and their matched control, spanning a number of industries (e.g., pharmaceutical, electronic components, real estate, and business services).

Table 3 Panel A presents the univariate DID analysis of *Female director ratio* and *E score*. We show that the treated and control firms had similar shares of female directors as well as similar environmental performance in the period before the bill's passage. However, these values diverged between the treated and control firms after the bill's passage.

In Panel B column (1), we show that the coefficient on the interaction term *Treated* $\times$ *Post* is positive and significant, suggesting that the treated firms significantly increased their shares of female directors relative to the control firms, once the bill came into effect. Figure 1 Panel A plots the results from a dynamic DID specification. We show that, before the bill, both the treated and control firms had very few female directors; after the bill's passage, the gap between the two groups in *Female director ratio* grew wider over time.

Column (2) presents the DID analysis using *E score* as the dependent variable. We show that, once the bill took effect, the increase in the number of female directors stipulated by SB 826 is associated with better environmental performance of the treated firms in

²³ To pick control firms, we proceed as follows. First, for each treated firm, we identify all potential control firms in the same size quartile and *E score* quartile with the same three-digit SIC code as the treated firm in 2018. Second, for each possible control firm, we compute the absolute size (*E score*) difference between the control and treated firms, and we normalize the difference by the standard deviation of the difference across all possible treated-control pairs. Third, we add up the two normalized differences and pick a control firm with the smallest total (normalized) absolute difference in both size and *E score* to the treated firm.

California compared to the control firms outside California. The dynamic DID specification in Figure 1 Panel B confirms similar levels of *E score* before the bill, whereas the treated firms exhibited significantly better environmental performance, relative to the control firms, in the post-SB 826 period of 2019 to 2021.

Heath, Ringgenberg, Samadi, and Werner (2023) and Cronqvist, Ladika, Pazaj, and Sautner (2024) discuss the multiple hypothesis testing problem associated with “reused” quasi-natural experiments. Prior studies on how a regulatory shock affects firm policies other than what a focal paper studies, need to be considered “compound” the overall exclusion restriction required. More prior studies on the same quasi-natural experiment, with different economic channels, make the overall compound exclusion restriction assumption harder to satisfy (from the perspective of required statistical significance). Section IA3 in the Internet Appendix conducts a literature review of SB 826. We note that prior literature mainly focused on stock market reactions to SB 826, with some attention to director labor market frictions and regulatory uncertainty as potential explanations for the observed market reactions to SB 826.²⁴ Given the strong statistical significance of our results in Table 3, and that there are few prior studies on corporate policy changes due to SB 826, we believe that the compound exclusion restriction assumption is likely satisfied in our context.

5.2. *Additional analysis using SB 826*

Around the time SB 826 was passed in 2018, there were other legislative efforts in California focused on environmental accountability (e.g., SB 100 targeting utility firms and

²⁴ Greene, Intintoli, and Kahle (2020) and Hwang, Shivdasani, and Simintzi (2021) attribute stock market declines after the announcement of SB 826 to the limited supply of qualified female directors. von Meyerinck et al. (2021) show that part of the valuation declines resulted from investors’ concerns about potential further stakeholders-friendly legislation that could hurt shareholder value. Gertsberg, Mollerstrom, and Pagel (2022) find that the stock price declines were driven by sub-optimal turnovers of male directors rather than the supply of qualified female directors. Bian, Li, and Li (2025) demonstrate negative labor demand-side consequences underlying the negative valuation effect. The findings in our paper add another possible interpretation for the negative price reaction to the enactment of SB 826: The fear of adding female directors leading to more investments in firms’ environmental performance will dampen earnings—a potential outcome that investors with short investment horizons dislike.

AB 1884 targeting the hospitality industry). To address the concern that our DID results in Table 3 Panel B might be due to other state-level regulations or any specific factors that only affect California firms, we repeat the DID analysis, keeping the same treated firms but choosing the control firms from those headquartered in California with at least two female directors in 2018. As a result, those control firms are not required to add additional female directors.²⁵ We find the closest control firm for each treated firm by matching on firm size and *E score* and in the same (three-digit SIC) industry in 2018. This procedure reduces the treated firms to 43 (from 57 in Table 3). Table IA6 Panel A in the Internet Appendix presents the results. We note that our main findings remain: Compared to peer California firms without the pressure to add female directors, the treated firms experienced significant increases in *Female director ratio* and *E score* after the passage of SB 826. We interpret this finding as additional supporting evidence that the treatment effect is likely driven by an increase in the number of female directors mandated by SB 826, rather than by other state-level regulations or by any specific factors that only affect California firms.

We conduct several additional analyses. Table IA6 Panel B repeats the DID analysis using a sample of the 51 compliant firms (i.e., California firms that did not have a female director before September 30th, 2018, but had at least one female director the year after) and their matching controls. Our main findings remain. Panel C repeats the DID analysis using 2016 as the pseudo-event year. As expected, we do not see any significant treatment effect, suggesting that the estimated treatment effects in Table 3 Panel B are attributable to SB 826.

To cross-validate our main DID analysis, we expand the sample until 2023 to study the second phase of SB 826. The bill further required that by the end of 2021, all public firms

²⁵ We choose firms headquartered in California with at least two female directors in 2018 as the control group because some firms were required to have multiple female directors by the end of 2021 as discussed earlier. It is worth noting that our DID findings remain if we use control firms headquartered in California with at least one female director in 2018.

in California have at least two female directors if a board has five members, and three female directors if a board has six members or more. We identify treated firms as those with “shortfalls” according to the 2021 follow-up rule following Hwang, Shivdasani, and Simintzi (2021) and Gertsberg, Mollerstrom, and Pagel (2022). The rest of California firms are control firms. We conduct a DID analysis around 2021. Due to the recency of this more stringent requirement, we employ a shorter event window $[-2, +2]$ from 2019 to 2023 (or $[-1, +2]$ from 2020 to 2023). Table IA7 in the Internet Appendix presents the results. We find that firms with shortfalls of female directors based on the 2021 follow-up rule indeed experienced increases in *Female director ratio* to comply with the bill’s second phase, as well as improved *E score*. The magnitude is not as big as that in the first phase, possibly due to the uncertainty about the bill in the court battle, or talent shortage (Hwang, Shivdasani, and Simintzi 2021).

In summary, by exploiting a plausibly exogenous shock to female representation on boards, we identify a potential causal effect of female directors (as opposed to, for example, other director characteristics) on corporate environmental performance.

5.3. The Big Three’s campaigns

To provide supplemental evidence that board gender diversity helps improve corporate environmental performance, we study the effects of the Big Three’s campaigns in 2017 to increase board gender diversity in their portfolio firms, with potential implications for these firms’ environmental performance. Table IA8 in the Internet Appendix presents the results. Column (1) examines the effect of a firm’s Big Three ownership (*Big3 institutions*) on its *Female director ratio* using the same DID specification as in Gormley et al. (2023). Consistent with Gormley et al. (2023), we find that the Big Three’s campaigns indeed led to more female directors. Column (2) examines the effect of the Big Three’s campaigns on their portfolio firms’ environmental performance. We find that firms with a higher fraction of Big

Three ownership in 2016 experienced a significantly larger improvement in their environmental performance after 2016 compared to their peers with a lower fraction of Big Three ownership. One caveat to this analysis is that some asset managers may also have advocated pro-environment policies over the same period, therefore the effect we uncover may not just come from the increased board gender diversity.

6. Director Qualifications, Board Diversity, and Governance

To address the question of “*what women bring to the boardroom table*” (Adams 2016, p. 384), we provide some suggestive evidence for the economic tradeoffs female directors make to improve corporate environmental performance, and explore a number of non-mutually-exclusive channels: female directors’ backgrounds, expertise, contribution to board diversity, and governance roles.

6.1. Female directors and costs associated with corporate environmental performance

We first look at the other side of the environment-economy tradeoff, by examining potential costs associated with corporate environmental actions. Following Di Giuli and Kostovetsky (2014) and Chen, Dong, and Lin (2020), we use selling, general, and administrative expenses (SG&A) as a proxy for the potential costs associated with corporate environmental actions, such as training employees on sustainable practices and compliance with environmental regulations, participating in or sponsoring environmental initiatives and awareness campaigns, and implementing frameworks to monitor and reduce environmental impact. Table 4 Panel A presents the results. In column (1), we find a positive and significant association between the share of female directors and SG&A: A one-standard-deviation increase in *Female director ratio* can be translated into \$12 million SG&A,²⁶ after all the

²⁶ When a firm increases its female director ratio from 0 to 0.107, its SG&A increases by 1.06% ($= (\exp(0.099 \times 0.107) - 1)$). Given that the sample mean of SG&A is \$1,130 million, such an increase approximates \$12 million more in SG&A.

controls and fixed effects. Of course, not all of it can be directly attributed to the effect of female directors on corporate environmental investments due to the comprehensive nature of SG&A.²⁷ In column (2), we subtract advertising expenses from SG&A (only when the latter exceeds the former), and find that it does not affect the results. In addition, if a firm has non-material R&D expenses, it might lump them with other operating expenses or SG&A, although these R&D expenses arguably are not as important as those included in the income statement as a separate line item. In column (3), we subtract R&D expenses from SG&A (only when the latter exceeds the former) and show that our findings for SG&A are not driven only by increased R&D expenses. These results suggest that SG&A are a separate channel from R&D expenses.

In Panel B, we regress firms' environmental performance on SG&A (with and without advertising or R&D expenses) and find a positive relation. These results support the role of board gender diversity in enhancing corporate environmental performance via increasing SG&A.

While not the focus of our paper, Table IA9 in the Internet Appendix shows that higher SG&A are associated with a bigger drop in firms' market valuation in the same year, suggesting the short-term costs of environmental investment. However, higher SG&A predict a significant increase in market valuation in the next year, suggesting the potential long-term value benefits. We conjecture that one way to achieve such long-term benefits could be through more extensive risk oversight by boards, such as instituting E&S-focused compensation schemes, adopting policies addressing environmental risks and opportunities,

²⁷ For example, using U.K. firms, Brammer, Millington, and Pavelin (2009) suggest that gender-diverse boards are positively associated with enhanced corporate reputation in consumer-facing sectors. Servaes and Tamayo (2013) establish that CSR initiatives enhance firm value primarily when customer awareness is high, as indicated by significant advertising expenditures, a component of SG&A. We acknowledge that part of SG&A is dedicated to advertising or R&D expenses, which might not be related to environmental investment.

and issuing E&S reports (e.g., Amiraslani, Deller, Ittner, and Keusch 2024). We will later study directors' risk management skill and several of those governance channels.

In summary, consistent with the survey evidence from the GPSS and PwC showing a significant gender gap in viewing the tradeoff between environmental and economic benefits, we find that female directors influence corporate environmental performance, potentially through environmental investments.

6.2. Director and board qualifications

We next examine whether and how female directors differ significantly from their male counterparts in terms of biographic characteristics and professional qualifications. For this analysis, we employ a sample of firm-director-year observations derived from the firm sample in Table 2. Table IA10 in the Internet Appendix presents the summary statistics. We show that, at the firm-director-year level, the average probability that a director is a female is 17.9%. The average director is 62 years old, and the average director tenure is 8 years. On average, sample directors possess 3.4 skills based on our classification. It is worth noting that this statistic is similar to that reported in Adams, Akyol, and Verwijmeren (2018).

Table 5 presents the regression results, in which we control for firm times year fixed effects. Panel A presents the results comparing female and male directors in age, board tenure, educational and work experience, within a firm-year. Female directors are significantly younger, have less industry experience, but are more likely to have studied in more fields and have gained more exposure to environmental regulations (Iliev and Roth 2023). Panel B presents the regression results comparing female and male directors in skill sets, within a firm-year. We note that female directors are more likely than male ones to possess environment-related expertise (e.g., sustainability, community, and risk management), as well as significantly broader expertise.

We next explore the extent to which director/board qualifications account for the effect of female directors on firms' commitment to environmental performance in Panel C. We estimate the regression using the firm-year panel, similar to Table 2 Panels A and B, and take the averages of director-specific fields or skills across all directors in a firm-year. The coefficients on *Female director ratio* reduce by about 6%-20% when explaining *E Score* or *#Source reduction practices*. In contrast, most female director-specific fields or expertise do not exhibit a consistent, significant association with corporate environmental performance. When explaining *#Source reduction practices* and negative environmental news, the inclusion of director skills reduces the coefficient and significance of *Female director ratio*. While this may suggest director skills are a potential channel for the effect of female directors on some corporate environmental performance measures, over-saturation in the all-inclusive specification is also a concern, given the high-dimensional fixed effects and the smaller sample size due to our use of Poisson regressions for *#Source reduction practices* and *Environmental news* as the outcome variables.

6.3. Board diversity

To further explore how female directors help enhance corporate environmental performance, we examine whether and how firms consider board diversity when adding female directors and whether standard board diversity measures supersede *Female director ratio* in explaining firms' environmental performance.

Table 6 Panel A explores the relations between the share of female directors and board diversity in measurable dimensions, as suggested by the opening quotations. Following Bernile, Bhagwat, and Yonker (2018), we construct various Herfindahl-Hirschman indices (HHIs) spanning age, tenure, educational background, skill, sector experience, undergraduate college, and ethnicity. We then regress those HHIs on (contemporaneous) *Female director ratio*, controlling for industry times year and firm fixed effects. We show that there are

negative and significant associations between *Female director ratio* and most of the HHIs (with the exceptions of *HHI sector* and *HHI ethnicity*). This finding is consistent with PwC's Annual Corporate Directors Survey (2019), in which 88% of directors say that gender diversity is important for diversity of thought in boardrooms. Overall, our results suggest that companies indeed try to improve board diversity by adding female directors, potentially due to these directors' different backgrounds and expertise (from those of male directors).

We next examine the extent to which board diversity measures account for the influence of female directors on environmental performance in Panel B. We find that *Female director ratio* has a distinct and significant role rather than those HHIs in explaining all three corporate environmental performance measures. In general, there is no significant association between board diversity measure (except for ethnicity diversity, which largely reduces the sample size due to data availability) and corporate environmental performance measures.

6.4. Governance

In this section, we directly examine the governance role of female directors. Flammer, Hong, and Minor (2019) show that executive compensation design is vital to improving corporate environmental performance. Adams and Ferreira (2009) and Field, Souther, and Yore (2020) point to gender differences in director monitoring. We conjecture that one way that female directors help improve corporate environmental performance is via monitoring and/or linking executive compensation to corporate environmental performance or providing ESG reports. We obtain from the Refinitiv ESG data set, at the firm-year level, two E&S-related governance variables for whether there is compensation policy linking ESG metrics to executive pay and whether there is E&S reporting.²⁸ Table 7 presents the results.

²⁸ We focus on these two mechanisms due to data availability; nevertheless, we acknowledge that there may be other mechanisms through which female directors help improve corporate environmental performance. In Table IA10 Panel B in the Internet Appendix, we show that about a quarter of the firm-year observations have a compensation policy linking ESG metrics to executive pay, and 28% of the firm-year observations have E&S reporting.

Panel A presents the regression results comparing female and male directors in board leadership and committee roles, controlling for director characteristics such as education backgrounds and skills. Female directors are significantly less likely than their male counterparts to serve leadership roles on boards (as Chairman of the Board or lead director), consistent with the findings in Field, Souther, and Yore (2020). They are significantly more likely than their male counterparts to serve on key board committees (audit, compensation, and nomination), consistent with the findings in Adams and Ferreira (2009). Importantly, we identify a positive and significant association between a director being a female and her likelihood of serving on the CSR committee. But the probability of having a female chair of audit, compensation, and nomination committees is much lower (11%-14%), compared to the that of having a female chair of a CSR committee (25%). In addition, we compute the time (in years) elapsed between the first time a woman is appointed to a board and a CSR committee is formed for the first time. It takes 8 (5.9) years on average (median), and 0.7 years is the mode (which is also the 25th percentile). Overall, these findings suggest that most firms form a CSR committee only after new female directors are added to their boards, and that one of those females (eventually) becomes the chair of the CSR committee.

In Panel B, we show a positive and significant (and contemporaneous) association between a firm's *Female director ratio* and it having ESG-linked compensation policy for executives or E&S reporting, controlling for board-level academic fields and skills (averaged across of directors in a firm-year), as well as the firm-level controls and fixed effects.

In Panel C, we add the E&S-related governance variables to our baseline Equation (1). While the availability of those variables reduces the sample size quite a bit, we find that their inclusions does not eliminate the explanatory power of *Female director ratio* for *E score*: The two E&S-related governance variables are positively and significantly related to *E Score*, and reduce the coefficient on *Female director ratio* by about 20%. These results

suggest that governance mechanisms such as linking executive compensation to ESG metrics or E&S reporting could be a channel through which female directors exert their influence to improve corporate environmental performance. They also suggest that female directors could help improve corporate environmental performance through their advising and monitoring roles beyond these two specific channels.

In Table 8, we examine the effect of SB 826 on the two E&S-related governance measures. We find that treated California firms experienced a small increase in the frequency of *ESG-linked compensation (E&S reporting)*, compared to matched non-CA firms, after SB 826. However, the changes in those governance measures only mildly explain some of the effects of increased female director ratios in treated firms (when we control for them), as shown in Panel B. This is consistent with our panel data regression results for the full sample in Table 7 Panel C, suggesting that governance is one, but not the only channel for the board gender diversity effect.²⁹

Using an international sample, Schmid and Urban (2023) document significantly negative price reactions to female director deaths that cannot be explained by observable director characteristics, such as age, board tenure, and education. The authors conclude that unobservable differences across genders are the more likely explanation for what makes female directors different. Our results support the importance of unobservable or unmeasurable differences across genders. Our paper extends their findings by showing that gender differences in viewing the tradeoff between environmental and economic benefits could contribute to corporate environmental performance, for example, via female directors' governance role.

²⁹ In Table IA11 in the Internet Appendix, we show that the effect of SB 826 on *E score* is not driven by differences in director demographics, board qualifications, or other board diversity measures. This finding is consistent with those in Table 6 Panel B and Table 7 Panel C for the full sample. In Table IA12 in the Internet Appendix, we replicate the DID analysis in Table 8 using California firms with at least two female directors in 2018 as control firms, and find similar results.

7. Conclusions

Using surveys from the Gallup Poll Social Series and PwC, we first establish that both female respondents and female directors value environmental protection more, whereas male respondents and male directors value economic growth more. Using firm- and facility-level measures of corporate environmental performance, we show a robust and positive association between a firm's share of female directors and its environmental performance, confirming that such a gender divide in prioritizing environmental protection over economy and energy supplies plays a role in corporate decision-making. Based on an identification scheme using California's SB 826 in 2018, we find that the distinct effect of female directors on corporate environmental performances is likely to be causal.

Next, we show that female directors bring non-business backgrounds and expertise into the boardroom, contribute to greater boardroom diversity in educational background and skills. We further show that there are positive associations between a firm's share of female directors and it linking executive compensation to ESG metrics and providing ESG reports. However, when running horse races between the share of female directors and these director or board characteristics in explaining corporate environmental performance, we show that the latter only have a moderate power in explaining the role of female directors in some environmental outcomes. We conclude that director gender is likely a holistic measure of potentially unquantifiable values and perspectives that female directors bring to the table, for example their different views on environmental versus economic tradeoffs mentioned above, which help improve corporate environmental performance.

In the context of evolving ESG regulations, particularly in the U.S. amid political polarization and heightened policy uncertainty, our findings offer valuable insights for policymaking. Our paper highlights the positive externalities across corporate ESG dimensions, which could be crucial given the substantial resistance to direct environmental

regulations and the potential unintended negative effects of quantity-based regulations.

Increasing female representation on corporate boards could make a significant difference in corporate environmental performance, due to the distinct perspectives that women bring to decision-making, particularly regarding balancing environmental and economic considerations.

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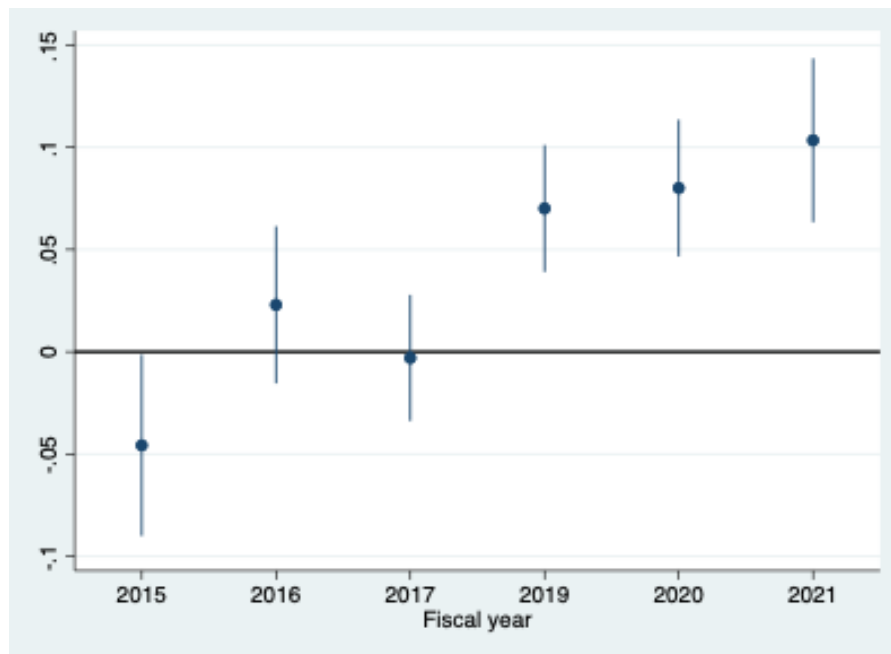
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Figure 1. The treatment effect of California's SB 826 on female director ratio and E score

This figure plots the dynamic effect of California's SB 826 on *Female director ratio* and *E score*. The treated firms are public firms without a female director in 2018, headquartered (and stayed) in California, and without TRI-reporting facilities in California. We find the closest control firm for each treated firm by matching on (three-digit SIC) industry, firm size, and *E score*. Panel A shows the estimated treatment effect on *Female director ratio*. Panel B shows the estimated treatment effect on *E score*. In both panels, the red line is the benchmark (omitted) event year 2018. The horizontal axis indicates the fiscal year and the vertical axis is the estimated coefficients on interaction terms of each event year with the treatment indicator (with 95% confidence intervals).

Panel A: The dynamic effect of SB 826 on *Female director ratio*



Panel B: The dynamic effect of SB 826 on *E score*

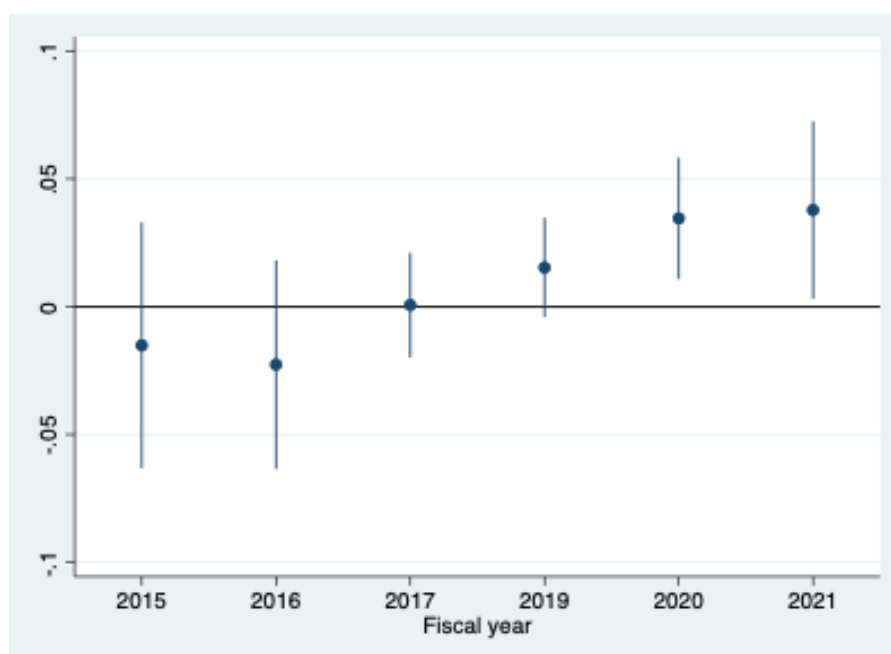


Table 1. Gender differences in viewing the tradeoff between environmental and economic benefits

This table reports gender differences in viewing the tradeoff between environmental and economic benefits using data from the Gallup Poll Social Series (GPSS). Introduced in 2001, the core questions in the March survey each year center around the environment. We use the two questions under the “trade-offs” category. The first question asks: “With which one of these statements about the environment and the economy do you most agree—protection of the environment should be given priority, even at the risk of curbing economic growth (or) economic growth should be given priority, even if the environment suffers to some extent?” The response “protect environment” is coded as 3, “equal priority” as 2, and “economic growth priority” as 1. The second question asks: “With which one of these statements about the environment and energy production do you most agree—protection of the environment should be given priority, even at the risk of limiting the amount of energy supplies—such as oil, gas and coal—which the United States produces (or) development of U.S. energy supplies—such as oil, gas and coal—should be given priority, even if the environment suffers to some extent?” The responses are similarly coded with higher values for protecting the environment over energy supplies. Panel A reports the raw survey responses grouped by a respondent’s gender. Panel B reports the survey responses grouped by a respondent’s gender, controlling for a respondent’s age, education, political party, year, and zip code fixed effects. Columns (1) and (2) present the gender gap in agreeing that environmental protection should be given priority over economic growth. Columns (3) and (4) present the gender gap in agreeing that environmental protection should be given priority over energy supplies. Columns (1) and (3) use the full sample in the analysis, and columns (2) and (4) use only the top income tercile of the sample. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Raw survey responses

	Environmental protection over economic growth		Environmental protection over energy supplies	
	Full sample (1)	Top income tercile (2)	Full sample (3)	Top income tercile (4)
Female	2.149	2.152	2.130	2.149
Male	2.012	1.953	1.995	1.937
Female – Male	0.136***	0.199***	0.135***	0.211***

Panel B: Survey responses controlling for a respondent’s age, education, political party, and various fixed effects

	Environmental protection over economic growth		Environmental protection over energy supplies	
	Full sample (1)	Top income tercile (2)	Full sample (3)	Top income tercile (4)
Female	0.039	0.044	0.030	0.026
Male	-0.039	-0.077	-0.030	-0.077
Female – Male	0.078***	0.120***	0.060***	0.103***

Table 2. Female directors and corporate environmental performance

This table examines the relation between the share of female directors on a board and corporate environmental performance. Panel A presents the firm-level evidence using *E score* as the dependent variable. Panel B presents the firm-level evidence using two other environmental performance measures as the dependent variables: *#Source reduction practices*, and *Environmental news*. Our variable of interest is *Female director ratio*, the number of female directors scaled by board size. The OLS sample for Panel A comprises 21,695 firm-year observations over the period 2002–2021. The Poisson samples for Panel B columns (1) and (2) comprise 6,006 and 7,639 firm-year observations over the period 2002–2020 and 2007–2020, respectively. We include (three-digit SIC) industry times year and firm fixed effects. Panel C presents the facility-level evidence using two different environmental performance measures as the dependent variables: *#Source reduction practices* and *Production waste*. The Poisson sample for columns (1)–(2) comprises 15,103 facility-year observations over the period 2002–2020. The OLS sample for columns (3)–(4) comprises 48,373 facility-year observations over the period 2002–2020. We include a rich set of fixed effects. Definitions of the variables are provided in Internet Appendix Table IA1. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Firm-level evidence using *E score*

	E score	
	(1)	(2)
Female director ratio	0.072*** (0.022)	0.068*** (0.022)
Board governance	0.004 (0.003)	0.004 (0.003)
Female CEO	-0.002 (0.015)	-0.001 (0.015)
Big3 institutions	-0.041 (0.036)	
UN PRI institutions		0.042** (0.018)
Non UN PRI institutions		-0.080*** (0.013)
M/B	-0.000 (0.000)	-0.000 (0.000)
Firm size	0.027*** (0.005)	0.027*** (0.005)
ROA	-0.019** (0.009)	-0.018** (0.008)
Leverage	-0.021 (0.013)	-0.020 (0.013)
Cash holdings	0.030* (0.018)	0.030* (0.017)
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	21,695	21,685
Adj-R2	0.844	0.845

Panel B: Firm-level evidence using *#Source reduction practices* and *Environmental news*

	#Source reduction practices	Environmental news
	(1)	(2)
Female director ratio	0.975** (0.473)	-0.668* (0.342)
Board governance	0.026 (0.036)	-0.061 (0.041)
Female CEO	-0.079 (0.279)	0.154 (0.106)
Big3 institutions	-0.599 (0.794)	-0.528 (0.574)
M/B	-0.001 (0.005)	-0.013** (0.005)

Firm size	0.153*	0.400***
	(0.085)	(0.063)
ROA	-0.126	0.040
	(0.251)	(0.268)
Leverage	0.097	-0.226
	(0.256)	(0.267)
Cash holdings	0.322	0.796**
	(0.391)	(0.390)
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	6,006	7,639
Pseudo-R2	0.509	0.823

Panel C: Facility-level evidence using #Source reduction practices and Production waste

	#Source reduction practices		ln(Production waste + 1)	
	(1)	(2)	(3)	(4)
Female director ratio	2.164***	2.134***	-0.175***	-0.174***
	(0.820)	(0.820)	(0.063)	(0.062)
Board governance	-0.023	-0.022	-0.000	-0.000
	(0.066)	(0.066)	(0.004)	(0.004)
Female CEO	0.111	0.117	-0.021	-0.019
	(0.428)	(0.429)	(0.025)	(0.025)
Big3 institutions	2.105	2.071	-0.090	-0.091
	(1.308)	(1.310)	(0.104)	(0.104)
M/B	0.015*	0.015*	-0.000	-0.000
	(0.009)	(0.009)	(0.000)	(0.000)
Firm size	-0.007	-0.005	0.030***	0.030***
	(0.140)	(0.137)	(0.012)	(0.012)
ROA	0.438	0.437	0.066*	0.066*
	(0.489)	(0.491)	(0.036)	(0.035)
Leverage	0.832	0.847	-0.091**	-0.090**
	(0.536)	(0.532)	(0.039)	(0.039)
Cash holdings	1.145**	1.129*	-0.046	-0.046
	(0.575)	(0.576)	(0.060)	(0.060)
ln(Sales +1)		0.008		0.006
		(0.173)		(0.013)
ln(#Employees +1)		-0.009		0.004
		(0.200)		(0.014)
Credit score		0.007		0.000
		(0.005)		(0.000)
Firm Industry × Year Fixed Effects	Yes	Yes	Yes	Yes
Facility Industry × Year Fixed Effects	Yes	Yes	Yes	Yes
Headquarters State × Year Fixed Effects	Yes	Yes	Yes	Yes
Facility State × Year Fixed Effects	Yes	Yes	Yes	Yes
Facility Fixed Effects	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes
Obs.	15,103	15,103	48,373	48,373
Pseudo-R ² / Adj-R2	0.541	0.541	0.928	0.928

Table 3. Female directors and corporate environmental performance: California's SB 826

This table examines changes in both the share of female directors on a board and corporate environmental performance between the treated and control firms around the passage of California's SB 826, which since 2018 has imposed a female director quota on firms headquartered in California. The treated firms are public firms without a female director in 2018, headquartered (and stayed) in California, and without TRI-reporting facilities in California. We find the closest control firm for each treated firm by matching on (three-digit SIC) industry, firm size, and *E score*. Panel A compares the share of female directors on a board and corporate environmental performance between the treated and control firms before and after SB 826. Panel B presents the DID results where the dependent variables are *Female director ratio* and *E score* using non-California firms as the control group. *Post* is an indicator variable that takes the value of one for the post-event window (2019 to 2021), and zero for the pre-event window (2015 to 2017). We include the same set of firm-level controls as in Table 2 Panel A. Definitions of the variables are provided in Internet Appendix Table IA1. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Comparing treated and control firms in female director share and E score

	Female director ratio			E score		
	Treated (1)	Control (2)	Treated – Control (3)	Treated (4)	Control (5)	Treated – Control (6)
Pre-event	0.022	0.026	-0.004	0.017	0.014	0.003
Post-event	0.210	0.126	0.084***	0.053	0.029	0.024**
Post – Pre			0.088***			0.021*

Panel B: DID analysis using non-California firms as the control group

	Female director ratio (1)	E score (2)
Treated × Post	0.080*** (0.012)	0.030*** (0.008)
Firm-level Controls	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	529	530
Adj-R ²	0.752	0.690

Table 4. Female directors and investment in corporate environmental performance

This table examines the relations between the share of female directors on a board and SG&A and between SG&A and corporate environmental performance. Panel A presents the regression results examining the relation between a firm's *Female director ratio* and its SG&A (with or without advertising or R&D expenses). Panel B presents the regression results examining the relation between a firm's SG&A (with or without advertising or R&D expenses) and its *E score*. We include firm-level controls and firm fixed effects as in Table 2 Panel B and do not report their coefficients to save space. Definitions of the variables are provided in Internet Appendix Table IA1. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Female directors and SG&A

	ln(SG&A) (1)	ln(SG&A – ADV) (2)	ln(SG&A – RD) (3)
Female director ratio	0.112** (0.046)	0.124** (0.048)	0.132** (0.066)
Firm-level Controls, Fixed Effects	Yes	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes	Yes
Intercept	Yes	Yes	Yes
Obs.	17,363	17,363	9,209
Adj-R2	0.987	0.986	0.981

Panel B: SG&A and corporate environmental performance

	(1)	E score (2)	(3)
ln(SG&A)	0.033*** (0.007)		
ln(SG&A – ADV)		0.032*** (0.007)	
ln(SG&A – RD)			0.027*** (0.009)
Firm-level Controls, Fixed Effects	Yes	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes	Yes
Intercept	Yes	Yes	Yes
Obs.	17,188	17,188	9,133
Adj-R2	0.853	0.853	0.851

Table 5. Director and board qualifications and corporate environmental performance

This table examines gender differences in director age, board tenure, board qualifications, and corporate environmental performance. Panel A presents the regression results comparing female and male directors in age, board tenure, educational and work experience. Panel B presents the regression results comparing female and male directors in skill. Panel C presents the regression results examining the relation between the share of female directors on a board, director average age, director average board tenure, board qualifications in terms of educational background and skill, and corporate environmental performance using *E score*, *#Source reduction practices*, and *Environmental news*. Definitions of the variables are provided in Internet Appendix Table IA1. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Gender differences in director age, tenure, educational and work experience

	Age	Tenure	Field_ arts	Field_ business	Field_ STEM	Field_ law	Field_ medicine	# Fields	Highest degree	Exposure to env reg	Industry experience
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Female	-3.358*** (0.115)	-2.315*** (0.102)	0.117*** (0.009)	-0.038*** (0.009)	-0.055*** (0.009)	0.008 (0.006)	0.009*** (0.003)	0.041*** (0.012)	0.085*** (0.011)	0.011** (0.004)	-0.128*** (0.007)
Firm × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	203,439	207,045	193,912	193,912	193,912	193,912	193,912	193,912	193,918	205,693	205,693
Adj-R ²	0.137	0.229	0.049	0.028	0.047	0.026	0.123	0.031	0.074	0.081	0.200

Panel B: Gender differences in director skills

	Skill_ academic	Skill_government & policy	Skill_risk management	Skill_ scientific	Skill_ technology	Skill_ sustainability	Skill_ community	Skill_ finance accounting & econ	Skill_ management
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	0.049*** (0.007)	0.073*** (0.007)	0.013*** (0.002)	0.012*** (0.003)	0.025*** (0.005)	0.019*** (0.003)	0.071*** (0.006)	0.002 (0.008)	-0.055*** (0.006)
Firm × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	207,045	207,045	207,045	207,045	207,045	207,045	207,045	207,045	207,045
Adj-R ²	0.034	0.064	0.015	0.134	0.051	0.015	0.016	0.030	0.028

	Skill_ entrepreneurship	Skill_ international	Skill_ legal	Skill_ manufacturing	Skill_ marketing	Skill_ strategic planning	Skill_ HR	Skill_ operations	Skill_ M&As	# Skills
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Female	-0.017** (0.008)	0.060*** (0.008)	0.032*** (0.005)	-0.006 (0.004)	0.089*** (0.008)	0.058*** (0.007)	0.058*** (0.005)	0.006 (0.007)	-0.010*** (0.003)	0.477*** (0.030)
Firm × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	207,045	207,045	207,045	207,045	207,045	207,045	207,045	207,045	207,045	207,045
Adj-R ²	0.068	0.091	0.010	0.046	0.064	0.057	0.015	0.032	0.022	0.106

Panel C: Female directors, board qualifications, and corporate environmental performance

	E score		#Source reduction practices		Environmental news	
	(1)	(2)	(3)	(4)	(5)	(6)
Female director ratio	0.069*** (0.023)	0.063*** (0.023)	0.940* (0.499)	0.773 (0.531)	-0.550 (0.338)	-0.277 (0.285)
Average age	-0.004*** (0.001)	-0.004*** (0.001)	-0.002 (0.015)	-0.007 (0.015)	-0.010 (0.014)	-0.013 (0.014)
Average tenure	0.003 (0.002)	0.003 (0.002)	-0.024 (0.034)	-0.011 (0.034)	0.051** (0.023)	0.052** (0.023)
Field_arts	-0.009 (0.022)	-0.015 (0.022)	0.164 (0.325)	0.135 (0.324)	-0.168 (0.222)	-0.218 (0.234)
Field_business	-0.037** (0.018)	-0.042** (0.019)	-0.329 (0.291)	-0.457 (0.308)	-0.033 (0.170)	-0.087 (0.197)
Field_STEM	0.007 (0.021)	-0.003 (0.022)	0.047 (0.288)	0.132 (0.292)	0.217 (0.213)	0.140 (0.218)
Field_law	0.020 (0.026)	0.023 (0.038)	0.494 (0.486)	-0.931 (0.659)	-0.217 (0.317)	-0.414 (0.448)
Field_medicine	0.059 (0.052)	0.069 (0.054)	-0.925 (0.940)	-0.833 (1.037)	-1.040 (1.017)	-0.871 (0.961)
Frac exposure to env reg	0.012 (0.023)	0.010 (0.023)	-0.021 (0.367)	-0.084 (0.348)	0.226 (0.231)	0.029 (0.216)
Frac industry experience	-0.020 (0.019)	-0.023 (0.019)	-0.108 (0.287)	-0.058 (0.265)	0.431** (0.179)	0.526*** (0.184)
Skill_academic		-0.000 (0.030)		-0.500 (0.447)		0.473* (0.264)
Skill_government & policy		0.020 (0.024)		0.174 (0.387)		0.232 (0.229)
Skill_risk management		0.064 (0.048)		-1.100 (0.988)		0.409 (0.498)
Skill_scientific		-0.005 (0.033)		-0.563 (0.455)		-0.704** (0.296)
Skill_technology		-0.004 (0.043)		0.104 (0.528)		0.230 (0.355)
Skill_sustainability		-0.008 (0.069)		0.142 (0.857)		-0.756 (0.653)
Skill_community		-0.049 (0.041)		-0.428 (0.590)		-0.234 (0.374)
Skill_finance accounting & economics		-0.000 (0.018)		0.329 (0.284)		-0.045 (0.200)
Skill_management		0.070*** (0.026)		0.284 (0.418)		0.068 (0.360)
Skill_entrepreneurship		0.013 (0.020)		-0.471 (0.352)		0.401* (0.216)
Skill_international		0.005 (0.022)		0.135 (0.327)		0.507** (0.204)
Skill_legal		-0.022 (0.051)		2.642*** (0.675)		-0.068 (0.477)
Skill_manufacturing		-0.013 (0.036)		-0.012 (0.439)		1.068*** (0.306)
Skill_marketing		-0.000 (0.023)		-0.488 (0.326)		-0.709*** (0.227)
Skill_strategic planning		0.008 (0.024)		0.251 (0.376)		0.256 (0.250)
Skill_HR		0.093** (0.045)		1.331** (0.671)		0.327 (0.406)
Skill_operations		0.020		0.025		0.490**

		(0.023)		(0.332)		(0.199)
Skill_M&As		-0.047		-0.711		-0.330
		(0.046)		(0.892)		(0.472)
Firm-level Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry $\times$ Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	21,534	21,534	5,970	5,970	7,602	7,602
<i>Adj-R² / Pseudo-R²</i>	0.846	0.846	0.508	0.512	0.824	0.826

Table 6. Board diversity and corporate environmental performance

This table examines the relation between board diversity and corporate environmental performance. Panel A presents the regression results examining the relation between the share of female directors on a board and different board diversity measures in terms of Herfindahl–Hirschman indices (HHIs) in director age, board tenure, educational background, skill, sector experience, undergraduate college, and ethnicity. Panel B presents the regression results examining the relation between the share of female directors on a board, board diversity, and corporate environmental performance using *E score*, *#Source reduction practices*, and *Environmental news*. We include firm-level controls and firm fixed effects as in Table 2 Panel B and do not report their coefficients to save space. Definitions of the variables are provided in Internet Appendix Table IA1. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Female directors and board diversity

	HHI age (1)	HHI tenure (2)	HHI field (3)	HHI skill (4)	HHI sector (5)	HHI college (6)	HHI ethnicity (7)
Female director ratio	-0.021*** (0.004)	-0.015*** (0.004)	-0.028*** (0.008)	-0.044*** (0.005)	-0.004 (0.006)	-0.033*** (0.008)	-0.014 (0.038)
Firm-level Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	21,636	21,636	21,636	21,636	21,636	21,636	8,246
Adj-R ²	0.803	0.798	0.779	0.830	0.905	0.827	0.741

Panel B: Female directors, board diversity, and corporate environmental performance

	E score		#Source reduction practices		Environmental news	
	(1)	(2)	(3)	(4)	(5)	(6)
Female director ratio	0.076*** (0.022)	0.088* (0.051)	0.880* (0.483)	1.235** (0.608)	-0.740** (0.335)	-1.039** (0.436)
HHI age	-0.045 (0.106)	0.021 (0.231)	3.638* (1.872)	3.020 (2.979)	2.292 (1.736)	2.912 (2.693)
HHI tenure	0.017 (0.111)	-0.077 (0.214)	-1.313 (1.898)	0.702 (2.814)	-2.486 (1.641)	-3.966 (2.675)
HHI field	-0.062 (0.041)	-0.034 (0.083)	-1.054** (0.492)	-1.150 (0.745)	-0.760 (0.463)	0.280 (0.812)
HHI skill	0.136 (0.084)	0.211 (0.178)	-1.212 (1.024)	1.638 (1.395)	-0.738 (0.965)	-1.355 (1.930)
HHI sector	0.041 (0.049)	0.094 (0.103)	0.626 (0.887)	-0.131 (1.843)	-0.760 (0.834)	0.278 (0.963)
HHI college	-0.010 (0.044)	0.136 (0.128)	0.478 (0.464)	-0.380 (0.909)	-0.047 (0.763)	-1.968 (1.933)
HHI ethnicity		0.043 (0.034)		0.199 (0.287)		-0.581** (0.250)
Firm-level Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	21,695	7,377	6,006	2,642	7,639	2,905
Adj-R ² / Pseudo-R ²	0.845	0.837	0.510	0.501	0.823	0.837

Table 7. Governance and corporate environmental performance

This table examines the relation between governance and corporate environmental performance. Panel A presents the regression results comparing female and male directors in board leadership and committee roles, controlling for a director's age, board tenure, educational background, and skills. Panel B presents the regression analysis examining the relation between a firm's share of female directors on a board and it having ESG-linked compensation or E&S reporting, controlling for board average age, average tenure, and qualifications in terms of educational backgrounds and skills. Panel C presents the regression results examining the relation between the share of female directors on a board, a firm having ESG-linked compensation or E&S reporting, and corporate environmental performance using *E score*, *#Source reduction practices*, and *Environmental news*. Definitions of the variables are provided in Internet Appendix Table IA1. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Female directors and board leadership and committee roles

	Chairman of the Board (1)	Lead director (2)	Audit committee (3)	Compensation committee (4)	CSR committee (5)	Nomination committee (6)
Female	-0.082*** (0.003)	-0.019*** (0.002)	0.096*** (0.007)	0.030*** (0.007)	0.014*** (0.002)	0.059*** (0.006)
Age	-0.003*** (0.000)	0.002*** (0.000)	0.011*** (0.000)	0.008*** (0.000)	0.000*** (0.000)	0.006*** (0.000)
Tenure	0.012*** (0.000)	0.003*** (0.000)	-0.010*** (0.000)	-0.002*** (0.000)	-0.000** (0.000)	-0.001** (0.000)
Field_arts	-0.002 (0.005)	0.006** (0.003)	0.003 (0.007)	0.038*** (0.007)	-0.001 (0.002)	0.029*** (0.006)
Field_business	-0.011*** (0.004)	0.009*** (0.003)	0.104*** (0.007)	0.007 (0.006)	-0.005*** (0.002)	-0.003 (0.005)
Field_STEM	0.011** (0.005)	0.005* (0.003)	0.007 (0.007)	0.012* (0.006)	-0.002 (0.002)	0.009* (0.006)
Field_law	0.008 (0.009)	0.020*** (0.006)	-0.022* (0.013)	-0.018 (0.012)	0.003 (0.004)	0.053*** (0.011)
Field_medicine	-0.025*** (0.008)	-0.019*** (0.006)	-0.101*** (0.016)	-0.032* (0.017)	-0.002 (0.004)	0.028* (0.014)
Highest degree	-0.003 (0.003)	0.002 (0.002)	-0.028*** (0.005)	0.008* (0.005)	0.003** (0.002)	0.005 (0.004)
Fraction exposure to env reg	-0.006 (0.012)	0.016* (0.008)	0.029 (0.020)	0.036** (0.018)	0.000 (0.005)	0.033** (0.016)
Fraction industry experience	0.002 (0.009)	-0.006 (0.006)	-0.017 (0.016)	0.010 (0.015)	0.003 (0.004)	0.003 (0.013)
Skill_academic	-0.036*** (0.005)	0.003 (0.004)	0.039*** (0.009)	0.001 (0.008)	0.003 (0.002)	0.038*** (0.007)
Skill_government & policy	0.004 (0.005)	0.004 (0.003)	-0.043*** (0.008)	-0.004 (0.007)	0.006*** (0.002)	0.031*** (0.006)
Skill_risk management	-0.008 (0.012)	-0.020*** (0.006)	0.070*** (0.021)	-0.082*** (0.017)	0.001 (0.005)	-0.052*** (0.015)
Skill_scientific	-0.000 (0.009)	-0.020*** (0.005)	-0.070*** (0.015)	-0.074*** (0.014)	0.006 (0.006)	-0.031** (0.012)
Skill_technology	-0.012* (0.006)	-0.001 (0.004)	0.015 (0.010)	-0.008 (0.009)	0.007** (0.003)	0.001 (0.008)
Skill_sustainability	0.006 (0.012)	-0.015** (0.007)	0.009 (0.021)	-0.014 (0.017)	0.019*** (0.007)	0.018 (0.015)
Skill_community	-0.023*** (0.006)	0.002 (0.005)	-0.013 (0.012)	0.010 (0.010)	0.007** (0.003)	0.021** (0.009)
Skill_finance accounting & econ	-0.011*** (0.004)	0.003 (0.003)	0.176*** (0.006)	-0.053*** (0.006)	-0.007*** (0.002)	-0.031*** (0.005)
Skill_management	0.069*** (0.004)	0.002 (0.004)	-0.081*** (0.009)	-0.012 (0.008)	-0.001 (0.002)	-0.043*** (0.007)
Skill_entrepreneurship	0.016*** (0.004)	0.003 (0.003)	-0.021*** (0.006)	0.020*** (0.006)	0.000 (0.001)	0.015*** (0.005)

Skill_international	-0.003 (0.004)	-0.000 (0.003)	-0.002 (0.007)	0.012* (0.007)	0.001 (0.002)	0.015*** (0.005)
Skill_legal	-0.015* (0.009)	-0.014** (0.006)	-0.004 (0.014)	0.014 (0.013)	-0.003 (0.003)	0.002 (0.011)
Skill_manufacturing	0.014* (0.007)	-0.000 (0.005)	-0.023** (0.011)	0.007 (0.010)	-0.001 (0.003)	0.004 (0.008)
Skill_marketing	0.009** (0.004)	0.000 (0.003)	-0.046*** (0.007)	0.033*** (0.006)	0.001 (0.002)	0.000 (0.005)
Skill_strategic planning	-0.008* (0.005)	0.002 (0.003)	0.015** (0.007)	-0.005 (0.006)	0.000 (0.002)	-0.000 (0.006)
Skill_HR	-0.010 (0.008)	0.006 (0.006)	-0.076*** (0.013)	0.101*** (0.013)	0.005 (0.004)	0.003 (0.010)
Skill_operations	0.009** (0.005)	-0.001 (0.003)	-0.025*** (0.007)	-0.012* (0.007)	0.001 (0.002)	-0.021*** (0.005)
Skill_M&As	-0.027*** (0.010)	-0.001 (0.006)	-0.021 (0.015)	0.004 (0.013)	-0.005 (0.005)	-0.002 (0.012)
Firm × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	193,722	193,722	193,722	193,722	193,722	193,722
Adj-R ²	-0.011	-0.019	0.050	0.098	0.426	0.237

Panel B: Female directors, ESG-linked executive compensation policy, and E&S reporting

	ESG-linked compensation		E&S reporting	
	(1)	(2)	(3)	(4)
Female director ratio	0.106** (0.050)	0.112** (0.052)	0.100* (0.053)	0.097* (0.055)
Average age		-0.000 (0.002)		-0.006*** (0.002)
Average tenure		0.005 (0.003)		0.004 (0.004)
Field_arts		-0.155*** (0.053)		-0.079 (0.052)
Field_business		0.010 (0.049)		-0.024 (0.048)
Field_STEM		-0.106** (0.052)		0.010 (0.050)
Field_law		-0.009 (0.105)		0.021 (0.096)
Field_medicine		0.019 (0.127)		0.180 (0.117)
Highest degree		0.076** (0.036)		-0.034 (0.034)
Frac exposure to env reg		0.019 (0.042)		-0.086* (0.045)
Frac industry experience		0.080* (0.045)		-0.025 (0.040)
Skill_academic		-0.027 (0.073)		0.049 (0.065)
Skill_government & policy		0.017 (0.060)		0.013 (0.053)
Skill_risk management		0.008 (0.122)		0.017 (0.102)
Skill_scientific		-0.100 (0.076)		0.136** (0.067)
Skill_technology		0.075 (0.088)		-0.135* (0.082)
Skill_sustainability		0.164 (0.189)		0.053 (0.153)
Skill_community		0.021 (0.102)		-0.159** (0.081)

Skill_finance accounting & economics		-0.020 (0.045)		-0.047 (0.041)
Skill_management		-0.071 (0.056)		0.008 (0.052)
Skill_entrepreneurship		-0.018 (0.044)		0.093** (0.041)
Skill_international		0.108** (0.048)		0.107** (0.044)
Skill_legal		0.053 (0.109)		0.026 (0.100)
Skill_manufacturing		0.132 (0.093)		0.011 (0.074)
Skill_marketing		-0.063 (0.048)		0.018 (0.046)
Skill_strategic planning		0.019 (0.050)		-0.031 (0.052)
Skill_HR		0.099 (0.110)		0.205** (0.092)
Skill_operations		0.045 (0.052)		-0.078* (0.046)
Skill_M&As		0.074 (0.105)		-0.030 (0.102)
Firm-level Controls, Fixed Effects	Yes	Yes	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes
Obs.	21,085	21,085	21,085	21,085
Adj-R ²	0.706	0.708	0.639	0.641

Panel C: Female directors, E&S-related governance, and corporate environmental performance

	E score		#Source reduction practices		Environmental news	
	(1)	(2)	(3)	(4)	(5)	(6)
Female director ratio	0.078*** (0.026)	0.062*** (0.023)	0.199 (0.684)	0.196 (0.685)	-0.757** (0.358)	-0.733** (0.343)
ESG-linked compensation		0.016*** (0.006)		-0.001 (0.086)		-0.069 (0.070)
E&S reporting		0.127*** (0.006)		-0.015 (0.075)		0.081 (0.071)
Firm-level Controls, Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	17,033	17,033	2,429	2,429	4,737	4,737
Adj-R ² / Pseudo-R ²	0.845	0.861	0.515	0.515	0.834	0.834

Table 8. California's SB 826 and E&S-related governance measures

This table examines changes in the two E&S-related governance measures and corporate environmental performance between the treated and control firms around the passage of California's SB 826, which since 2018 has imposed a female director quota on firms headquartered in California. The treated firms are public firms without a female director in 2018, headquartered (and stayed) in California, and without TRI-reporting facilities in California. We find the closest control firm for each treated firm by matching on (three-digit SIC) industry, firm size, and *E score*. Panel A presents the DID results where the dependent variables are the two E&S-related governance measures: *ESG-linked compensation* and *E&S reporting*. Panel B presents the DID results where the dependent variable is *E score*, and we additionally control for the two E&S-related governance variables *ESG-linked compensation* and *E&S reporting*. Definitions of the variables are provided in Internet Appendix Table IA1. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: The effect of SB 826 on E&S-related governance measures

	ESG-linked compensation (1)	E&S reporting (2)
Treated × Post	0.042* (0.022)	0.021** (0.008)
Firm-level Controls	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	477	477
Adj-R ²	0.728	0.209

Panel B: The effect of SB 826 on *E score* controlling for E&S-related governance measures

	E score (1)	E score (2)
Treated × Post	0.025*** (0.009)	0.019** (0.007)
ESG-linked compensation		0.038 (0.026)
E&S reporting		0.197*** (0.060)
Firm-level Controls	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	477	477
Adj-R ²	0.661	0.751

Internet Appendix for “The Eco-Gender Gap in Boardrooms” by Po-Hsuan Hsu, Kai Li, and Yihui Pan

Figure IA1. The share of female directors over time

This figure plots the temporal trend in the share of female directors over time. The horizontal axis indicates the fiscal year. The vertical axis is the average *Female director ratio* across sample firms in a fiscal year. Our sample comprises 21,695 firm-year observations representing 3,040 firms over the period 2001–2020.

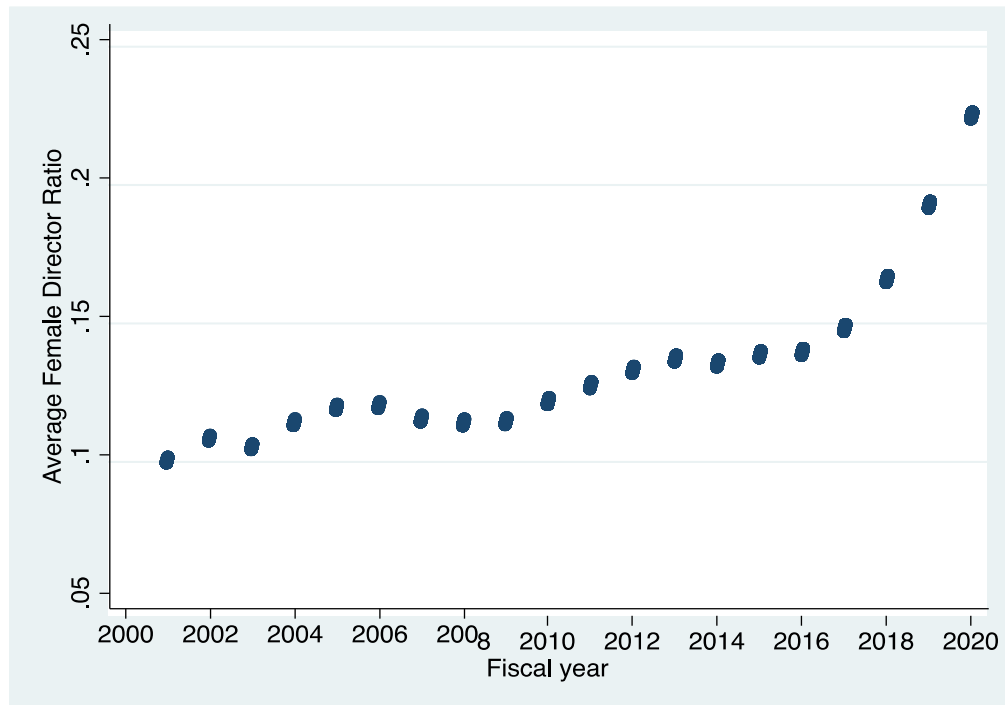


Table IA1. Variable definitions

All continuous variables are winsorized at the 1st and 99th percentiles.

Variable	Definition
Environmental performance measures	
E score	Average of emissions reduction score, resource use score, and innovation score. The emissions reduction score measures a company's commitment and effectiveness towards reducing environmental emissions in its production and operational processes. The resource use score measures a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management. The innovation score measures a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes, or through eco-designed products. (Source: Refinitiv ESG)
#Source reduction practices (facility-level)	The total number of a facility's source reduction activities (i.e., activities a facility implements to prevent pollution) applied to each different toxic chemical in a year. For example, if a facility implements two source reduction practices W1 and W2 in a year (both W1 and W2 are applied to toxic chemicals A and B, and W2 is applied to toxic chemical Z), then its <i>#Source reduction practices</i> is 5. The value is winsorized at the 1st and 99th percentiles. The value is collected from TRI File Type 2A Form (more details are provided in the Internet Appendix Section IA.2). (Source: EPA Pollution Prevention (P2))
#Source reduction practices (firm-level)	The sum of #source reduction practices across all facilities of a firm in a year. The value is winsorized at the 1st and 99th percentiles. (Source: EPA Pollution Prevention (P2))
Environmental news	A firm's number of negative environmental news items violating United Nations Global Compact's (UNGC) "Principle 7: Businesses should support a precautionary approach to environmental challenges," Principle 8: undertake initiatives to promote greater environmental responsibility," or "Principle 9: encourage the development and diffusion of environmentally friendly technologies" tagged by RepRisk. This number is weighted by the severity score (that takes the value of 1, 2, or 3) and the reach score (that takes the value of 1, 2, or 3). (Source: RepRisk)
Production waste (in million pounds)	A facility's total quantity of production-related waste (i.e., toxic chemicals) (in millions of pounds) in a year. (Source: EPA TRI)
SG&A	Selling, general, and administrative expenses (in million dollars) reported by a firm in a year. (Source: Compustat)
ADV	Advertising expenses (in million dollars) reported by a firm in a year. Missing values are set as zero. (Source: Compustat)
RD	R&D expenses (in million dollars) reported by a firm in a year. (Source: Compustat)
Firm characteristics	
Female director ratio	Number of female directors scaled by board size. (Source: BoardEx)
Board governance	Sum of three indicator variables: 1) Board size indicator takes the value of one if a firm's board size is not in the top quartile of BoardEx firms in a fiscal year, and zero otherwise; 2) Board independence indicator takes the value of one if a firm's board

independence ratio is in the top quartile of BoardEx firms in a fiscal year, and zero otherwise; and 3) Board busyness indicator takes the value of one if a firm's board busyness measure is not in the top quartile of BoardEx firms in a fiscal year, and zero otherwise. (Source: BoardEx)

Female CEO	Indicator variable that takes the value of one if a firm has a female CEO, and zero otherwise. (Source: BoardEx)
Big3 institutions	Fraction of shares outstanding held by BlackRock, Vanguard, and State Street. (Source: WRDS Thomson 13F)
UN PRI institutions	Fraction of shares outstanding held by UN PRI signatories (Source: WRDS Thomson 13F, PRI)
Non UN PRI institutions	Fraction of shares outstanding held by non-PRI institutional investors (Source: WRDS Thomson 13F, PRI)
M/B	Market value of equity scaled by book value of equity. (Source: Compustat)
Firm size	Natural logarithm of total assets. (Source: Compustat)
ROA	Net income after subtracting expenses or losses, including extraordinary items scaled by total assets. (Source: Compustat)
Leverage	Sum of long-term debt and debt in current liabilities scaled by total assets. (Source: Compustat)
Cash holdings	Cash and short-term investments scaled by total assets. (Source: Compustat)

Facility characteristics

Sales (in millions of dollars)	Estimated sales (in millions of dollars) of a facility in a year. (Source: NETS)
#Employees	Reported number of employees working in a facility in a year. (Source: NETS)
Credit score	The maximum Dun & Bradstreet PayDex Score, a 100-point indexing system that captures trade experience reported to NETS, compares payment to terms of sale, and scores the overall manner of payment. The index is dollar-weighted by the amount of credit involved. A PayDex Score of 80 indicates that, on average, a business pays its bills in a "Prompt" manner. (Source: NETS)

Director and board characteristics

Director-level

Female	Indicator variable that takes the value of one if a director is a female, and zero otherwise. (Source: BoardEx)
Age	Director age. (Source: BoardEx)
Tenure	Director tenure. (Source: BoardEx)
Field_arts	Indicator variable that takes the value of one if a director has earned a degree in arts (e.g., BA, AB, MA, MPhil), and zero otherwise. (Source: BoardEx)
Field_business	Indicator variable that takes the value of one if a director has earned a degree in economics or business (e.g., MBA, BBA, BCOM, DBA) or has professional designation as chartered accountant, or chartered financial analyst, and zero otherwise. (Source: BoardEx)
Field_STEM	Indicator variable that takes the value of one if a director has earned a degree in science (e.g., BS, BSc, Bachelor of Engineering, MSc), and zero otherwise. (Source: BoardEx)

Field_law	Indicator variable that takes the value of one if a director has earned a degree in law (e.g., JD, LLB, LLM), and zero otherwise. (Source: BoardEx)
Field_medicine	Indicator variable that takes the value of one if a director has earned a degree in medicine (e.g., MD), and zero otherwise. (Source: BoardEx)
#Fields	Sum of a director's fields of study. (Source: BoardEx)
Highest degree	Highest degree received by a director. It takes the value of 3 for PhD, 2 for MBA, JD, MD, or other master's degree, or 1 for bachelor's degree, and zero otherwise. (Source: BoardEx)
Frac exposure to env reg	Fraction of directors with exposure to environmental regulations in a firm-year (Source: BoardEx)
Frac industry experience	Fraction of directors on a board with experience in the focal firm's industry (Source: BoardEx)
Skill_academic	Indicator variable that takes the value of one if a director has worked at universities and her prior job roles contain any of the following key words—professor, lecturer, faculty, instructor, dean, director, chair, provost, chancellor, principal, or president, and zero otherwise. (Source: BoardEx)
Skill_government & policy	Indicator variable that takes the value of one if a director has worked at government agencies, or her prior job roles or descriptions contain any of the following key words—commissioner, council member, senior advisor, director, regulatory, policy, policies, government, public policy, ambassador, public sector, enforcement, or lobby, and zero otherwise. (Source: BoardEx)
Skill_risk management	Indicator variable that takes the value of one if a director has experience in risk management, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: risk, cyber, or information security. (Source: BoardEx)
Skill_scientific	Indicator variable that takes the value of one if a director has experience in scientific research or research and development, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: researcher, scientist, scientific, research & development, R&D, clinical research, research fellow, or research investigator. (Source: BoardEx)
Skill_technology	Indicator variable that takes the value of one if a director has experience in technology, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: technology, technologist, technologies, CIO, chief information officer, CTO, chief technology officer, innovation, IT, or information technology. (Source: BoardEx)
Skill_sustainability	Indicator variable that takes the value of one if a director has experience in environmental and/or sustainability issues, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: environment, safety, sustainability, sustainable, or ESG. (Source: BoardEx)
Skill_community	Indicator variable that takes the value of one if a director has worked at charities, or her prior job roles or job descriptions contain any of the following key words—community, non-profit, nonprofit, philanthropic, philanthropy, social, CSR, feminine care, family care, PR, public relation, public affair, charity, or charities, and zero otherwise. (Source: BoardEx)
Skill_finance accounting & econ	Indicator variable that takes the value of one if a director has experience in finance, accounting, or economics, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: 4srael4, CFO, accountant, accounting, auditing, auditor, bank, investment, securities, economist, economic, banker, private bank, equity research, private equity,

equity analyst, fixed income, bond, debt, loan, capital market, account manager, account management, accounts, trader, credit analyst, security analyst, credit officer, tax, underwriter, portfolio manager, treasury, treasurer, capital market, comptroller, controller, trading, trader, real estate, wealth, corporate accounts, enterprise account, asset management, holdings, lending, mortgage, high growth markets, quantitative analyst, CFA, or CPA. (Source: BoardEx)

Skill_management	Indicator variable that takes the value of one if a director has management experience, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: executive officer, president, CEO, CFO, COO, CIO, CTO, CPO, CCO, managing, or management. (Source: BoardEx)
Skill_entrepreneurship	Indicator variable that takes the value of one if a director has experience in entrepreneurship, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: entrepreneur, evaluating business, innovative idea, start-up, startup, venture, founder, co founder, co-founder, founding, owner, or small business. (Source: BoardEx)
Skill_international	Indicator variable that takes the value of one if a director has international experience, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: global, international, multinational, worldwide, north america, latin america, europe, asia, asia pacific, americas, middle east, africa, australia, china, japan, india, canada, united kingdom, UK, great britain, france, germany, new zealand, foreign, korea, emerging markets, brazil, ireland, mexico, turkey, colombia, americas region, poland, malaysia, taiwan, italy, hong kong, or israel. (Source: BoardEx)
Skill_legal	Indicator variable that takes the value of one if a director has legal experience, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: attorney, lawyer, legal, litigation, law, intellectual property, general counsel, patent counsel, law clerk, senior counsel, or corporate counsel. (Source: BoardEx)
Skill_manufacturing	Indicator variable that takes the value of one if a director has experience in manufacturing, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: industrial, manufactured, manufacturing, production, process, or quality. (Source: BoardEx)
Skill_marketing	Indicator variable that takes the value of one if a director has marketing experience, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: marketing, mktg, market, CMO, advertising, brand, sales, salesman, merchandising, merchandise, retail, product strategy, consumer, customer, channel, communication, user experience, client, media, investor relation, investor service, or analyst relation. (Source: BoardEx)
Skill_strategic planning	Indicator variable that takes the value of one if a director has experience in strategic planning, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: business planning, business planner, business-planning, business solutions, decision making, decision-making, problem solving, problem-solving, strategic, strategies, strategy, strategist, business intelligence, business development, business affairs, business analyst, corporate development, planner, corporate affairs, organization development, organizational development, alliance, or change management. (Source: BoardEx)
Skill_HR	Indicator variable that takes the value of one if a director has HR experience, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: human resource, HR, recruitment, recruiter, recruiting, talent, staffing, compensation, employee relation, labor, people operations, diversity, or DEI. (Source: BoardEx)
Skill_operations	Indicator variable that takes the value of one if a director has experience in operations, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: operations, COO, logistics, supply chain,

	supply-chain, business operations, supply, procurement, sourcing, buyer, commodity manager, distribution, project, quality assurance, global sourcing, product line manage, or OPS. (Source: BoardEx)
Skill_M&As	Indicator variable that takes the value of one if a director has experience in M&As, and zero otherwise. A director has such experience if her prior job roles or job descriptions contain any of the following key words: M&A, M & A, merger and acquisition, merger & acquisition, mergers and acquisitions, mergers & acquisitions, merger, or acquisition. (Source: BoardEx)
#Skills	Sum of a director's skills. (Source: BoardEx)
Chairman of the Board	Indicator variable that takes the value of one if a director is Chairman of the Board, and zero otherwise. (Source: BoardEx)
Lead director	Indicator variable that takes the value of one if a director's role contains any of the following key words—lead independent director, lead independent chairman, presiding lead independent director, lead independent corporate director, lead independent vice chairman, lead director, vice chairman (lead independent director), or lead independent outside director, and zero otherwise. (Source: BoardEx)
Audit committee	Indicator variable that takes the value of one if a director sits on audit committee in a year, and zero otherwise. (Source: BoardEx)
Compensation committee	Indicator variable that takes the value of one if a director sits on compensation committee in a year, and zero otherwise. (Source: BoardEx)
CSR committee	Indicator variable that takes the value of one if a director sits on CSR committee in a year, and zero otherwise. A board committee is responsible for ESG if its committee name contains any of the following key words: CSR, ESG, environ*, social, or sustain*. (Source: BoardEx)
Nomination committee	Indicator variable that takes the value of one if a director sits on nomination committee in a year, and zero otherwise. (Source: BoardEx)
<i>Firm-level</i>	
HHI age	Herfindahl-Hirschman index (HHI) of the share of directors in each age quartile of directors in BoardEx. (Source: BoardEx)
HHI tenure	HHI of the share of directors in each board tenure quartile of directors in BoardEx. (Source: BoardEx)
HHI field	HHI of the share of directors with different academic fields. The filed categories include arts, business, STEM, law, and medicine. (Source: BoardEx)
HHI skill	HHI of the share of directors with different skills due to work experience and job roles. The skill categories include academic, government, risk management, scientific, technology, sustainability, community, finance, accounting & economics, management, entrepreneurship, international, legal, manufacturing, marketing, strategic planning, HR, operations, and M&As. (Source: BoardEx)
HHI sector	HHI of the share of directors with different sector-specific experience, as defined by BoardEx. (Source: BoardEx)
HHI college	HHI of the share of directors attending different undergraduate colleges. (Source: BoardEx)
HHI ethnicity	HHI of the share of directors with different ethnicities, as defined by ISS. The ethnicity categories include Caucasian/white, Black/African American, Asian, Hispanic/Latin American, Middle-eastern/North African, Native American/Alaskan Native, Native Hawaiian/other Pacific Islander, and Other. (Source: ISS)

ESG-linked compensation	Indicator variable that takes the value of one if a firm has an executive compensation policy that takes into account its ESG performance, and zero otherwise. The data item from Refinitiv is as follows: “Does the company have an extra-financial performance oriented compensation policy that includes remuneration for the CEO, executive directors, non-board executives, and other management bodies based on ESG or sustainability factors?” (Source: Refinitiv)
E&S reporting	Indicator variable that takes the value of one if a firm publishes a separate CSR/Health and Safety/Sustainability report or publishes a section in its annual report on CSR/Health and Safety/Sustainability, and zero otherwise. (Source: Refinitiv)

Table IA2. Sample formation

This table lists the steps taken and filters applied to form the samples used in our analyses. Panel A reports the steps and filters applied to form our firm-level OLS sample for *E score* over the period 2002–2021, Poisson sample for *#Source reduction practices* over the period 2002–2020, and Poisson sample for *Environmental news* over the period 2007–2020. Panel B reports the steps and filters applied to form our facility-level Poisson sample for *#Source reduction practices* and OLS sample for *Production waste* over the period 2002–2020.

Panel A1: Firm-level OLS sample for *E score*

	#firm-year obs.	#firm-year obs. removed	#unique firms
WRDS Refinitiv ESG, 2002–2021	24,525		3,588
Remove observations with missing data from BoardEx	23,535	990	3,477
Remove observations with missing data form Compustat	23,343	192	3,450
Remove observations with missing data form WRDS Thomson 13F	23,279	64	3,445
Remove observations without Augmented 10-X Header Data	23,036	243	3,320
Remove observations due to fixed effects in OLS regressions	21,695	1,341	3,040
Final sample	21,695		3,040

Panel A2: Firm-level Poisson sample for *#Source reduction practices*

	#firm-year obs.	#firm-year obs. removed	#unique firms
WRDS Refinitiv ESG, 2002–2021	24,525		3,588
Remove observations with missing data from BoardEx	23,535	990	3,477
Remove observations with missing data form Compustat	23,343	192	3,450
Remove observations with missing data form WRDS Thomson 13F	23,279	64	3,445
Remove observations without Augmented 10-X Header Data	23,036	243	3,320
Remove observations due to fixed effects in Poisson regression	6,006	17,030	441
Final sample	6,006		441

Panel A3: Firm-level Poisson sample for *Environmental news*

	#firm-year obs.	#firm-year obs. removed	#unique firms
WRDS Refinitiv ESG, 2002–2021	24,525		3,588
Remove observations with missing data from BoardEx	23,535	990	3,477
Remove observations with missing data form Compustat	23,343	192	3,450
Remove observations with missing data form WRDS Thomson 13F	23,279	64	3,445
Remove observations without Augmented 10-X Header Data	23,036	243	3,320
Remove observations due to fixed effects in Poisson regression	7,639	15,397	796
Final sample	7,639		796

Panel B1: Facility-level Poisson sample for *#Source reduction practices*

	#firm-year obs.	#firm-year obs. removed	#unique firms
TRI facility-year observations matched to GVKEY (1991–2020)	166,453		14,008
Remove observations with missing information used in our firm-year obs. (BoardEx, Compustat, etc.)	90,193	76,260	8,551
Remove observations without NETS information	52,406	37,787	5,403
Remove observations due to fixed effects in Poisson regression	15,103	37,303	1,406
Final sample	15,103		1,406

Panel B2: Facility-level OLS sample for *Production waste*

	#firm-year obs.	#firm-year obs. removed	#unique firms
TRI facility-year observations matched to GVKEY (1991–2020)	166,453		14,008
Remove observations with missing information used in our firm-year obs. (BoardEx, Compustat, etc.)	90,193	76,260	8,551
Remove observations without NETS information	52,406	37,787	5,403
Remove observations due to fixed effects in OLS regressions	48,373	4,033	4,662
Final sample	48,373		4,662

Table IA3. Summary statistics

This table provides the summary statistics for our firm and facility samples. Panel A presents the summary statistics for the firm sample. The OLS sample for *E score* comprises 21,695 firm-year observations associated with 3,040 firms over the period 2002–2021. The Poisson sample for *#Source reduction practices* comprises 6,006 firm-year observations associated with 441 firms over the period 2002–2020. The Poisson sample for *Environmental news* comprises 7,639 firm-year observations associated with 796 firms over the period 2007–2020 (the sample reduction is due to the drop of firms with all-zero dependent variables in Poisson regressions). Panel B presents the summary statistics for the facility sample. The Poisson sample for *#Source reduction practices* comprises 15,103 facility-year observations associated with 1,406 facilities of 358 firms over the period 2002–2020. The OLS sample for *Production waste* comprises 48,373 facility-year observations associated with 4,662 facilities of 618 firms over the period 2002–2020. Panel B contains two subpanels that correspond to the analysis for *#Source reduction practices* and *Production waste*. Definitions of the variables are provided in Internet Appendix Table IA1.

Panel A: Summary statistics for the firm-level sample

	Mean	SD	P5	Median	P95
	(1)	(2)	(3)	(4)	(5)
OLS sample for <i>E score</i>					
E score	0.210	0.253	0.000	0.093	0.738
Female director ratio	0.150	0.107	0.000	0.143	0.333
Board governance	1.869	0.569	1.000	2.000	3.000
Female CEO	0.038	0.191	0.000	0.000	0.000
Big3 institutions	0.145	0.081	0.021	0.145	0.284
UN PRI institutions	0.268	0.194	0.000	0.266	0.584
Non UN PRI institutions	0.460	0.220	0.102	0.442	0.846
M/B	3.453	5.700	0.506	2.229	11.952
Firm size	8.136	1.932	4.866	8.147	11.286
ROA	-0.005	0.189	-0.347	0.027	0.155
Leverage	0.269	0.221	0.000	0.239	0.689
Cash holdings	0.171	0.219	0.005	0.080	0.712
Ln(SG&A)	5.694	1.606	3.147	5.682	8.676
Poisson sample for <i>#Source reduction practices</i>					
#Source reduction practices	2.382	3.351	0.000	1.000	10.000
Female director ratio	0.114	0.094	0.000	0.111	0.286
Board governance	1.841	0.610	1.000	2.000	3.000
Female CEO	0.025	0.157	0.000	0.000	0.000
Big3 institutions	0.114	0.077	0.008	0.106	0.246
M/B	2.986	4.452	0.642	2.237	7.906
Firm size	7.849	1.783	4.977	7.804	10.822
ROA	0.042	0.094	-0.092	0.051	0.145
Leverage	0.256	0.166	0.000	0.249	0.543
Cash holdings	0.116	0.118	0.007	0.080	0.356
Poisson sample for <i>Environmental news</i>					
Environmental news	4.886	16.435	0.000	0.000	24.000
Female director ratio	0.141	0.106	0.000	0.133	0.333
Board governance	1.840	0.553	1.000	2.000	3.000
Female CEO	0.037	0.189	0.000	0.000	0.000
Big3 institutions	0.137	0.079	0.002	0.146	0.263
M/B	3.014	5.052	0.414	2.061	9.805
Firm size	8.761	1.910	5.798	8.660	11.917

ROA	0.032	0.110	-0.098	0.036	0.152
Leverage	0.290	0.192	0.004	0.281	0.621
Cash holdings	0.104	0.128	0.002	0.060	0.354

Panel B: Summary statistics for the facility-level sample

	Mean	SD	P5	Median	P95
	(1)	(2)	(3)	(4)	(5)
Poisson sample for <i>#Source reduction practices</i>					
#Source reduction practices	1.052	2.054	0.000	0.000	6.000
Female director ratio	0.127	0.084	0.000	0.125	0.273
Board governance	1.607	0.750	0.000	2.000	3.000
Female CEO	0.020	0.139	0.000	0.000	0.000
Big3 institutions	0.118	0.074	0.009	0.115	0.239
M/B	3.261	4.075	0.947	2.585	8.028
Firm size	9.041	1.957	5.928	8.970	12.602
ROA	0.056	0.066	-0.031	0.056	0.148
Leverage	0.265	0.147	0.042	0.241	0.539
Cash holdings	0.096	0.082	0.009	0.075	0.250
ln(Sales +1)	17.774	1.600	14.915	17.889	20.192
ln(#Employees +1)	5.324	1.459	2.398	5.525	7.601
Credit score	73.558	5.212	64.000	74.000	80.000
OLS sample for <i>Production waste</i>					
ln(Production waste + 1)	0.371	0.711	0.000	0.044	2.202
Production waste (in million pounds)	1.270	3.882	0.000	0.045	8.045
Female director ratio	0.136	0.086	0.000	0.133	0.286
Board governance	1.661	0.743	0.000	2.000	3.000
Female CEO	0.029	0.168	0.000	0.000	0.000
Big3 institutions	0.124	0.077	0.009	0.129	0.247
M/B	2.996	4.299	0.874	2.272	7.840
Firm size	9.132	1.925	6.200	9.009	12.801
ROA	0.047	0.066	-0.043	0.047	0.136
Leverage	0.283	0.145	0.060	0.270	0.550
Cash holdings	0.087	0.079	0.006	0.067	0.234
ln(Sales +1)	17.640	1.664	14.627	17.792	20.291
ln(#Employees +1)	5.114	1.529	2.303	5.303	7.390
Credit score	73.741	5.526	64.000	75.000	80.000

Table IA4. Correlation matrices for different firm and facility samples

This table provides the correlation matrices for key variables in our firm and facility samples. Panel A1 presents the correlation matrices for key variables in the firm-level OLS sample for *E score* over the period 2002–2021. Panel A2 presents the correlation matrices for key variables in the firm-level Poisson sample for *#Source reduction practices* over the period 2002–2020. Panel A3 presents the correlation matrices for key variables in the firm-level Poisson sample for *Environmental news* over the period 2007–2020. Panel B1 presents the correlation matrices for key variables in the facility-level Poisson sample for *#Source reduction practices* over the period 2002–2020. Panel B2 presents the correlation matrices for key variables in the facility-level Poisson sample for *Production waste* over the period 2002–2020. Definitions of the variables are provided in Internet Appendix Table IA1. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A1: Correlation matrix of the firm-level OLS sample for *E score*

	1	2	3	4	5	6	7	8	9	10
1 E score	1.000									
2 Female director ratio	0.252***	1.000								
3 Board governance	-0.093***	0.030***	1.000							
4 Female CEO	0.033***	0.248***	0.025***	1.000						
5 Big3 institutions	0.286***	0.288***	0.142***	0.029***	1.000					
6 M/B	0.007	0.029***	0.007	0.016**	-0.009	1.000				
7 Firm size	0.506***	0.151***	-0.257***	-0.026***	0.171***	-0.127***	1.000			
8 ROA	0.201***	0.056***	-0.082***	-0.031***	0.168***	-0.044***	0.402***	1.000		
9 Leverage	0.114***	0.057***	0.056***	0.006	0.116***	-0.064***	0.124***	-0.009	1.000	
10 Cash holdings	-0.202***	-0.046***	0.081***	0.035***	-0.154***	0.217***	-0.491***	-0.468***	-0.266***	1.000

Panel A2: Correlation matrix of the firm-level Poisson sample for *#Source reduction practices*

	1	2	3	4	5	6	7	8	9	10
1 #Source reduction practices	1.000									
2 Female director ratio	0.058***	1.000								
3 Board governance	-0.155***	-0.033**	1.000							
4 Female CEO	-0.020	0.211***	-0.019	1.000						
5 Big3 institutions	-0.027**	0.373***	0.097***	0.052***	1.000					
6 M/B	0.020	0.114***	-0.040***	0.022*	0.077***	1.000				
7 Firm size	0.258***	0.371***	-0.268***	0.055***	0.377***	0.100***	1.000			
8 ROA	0.052***	0.081***	-0.047***	0.021	0.119***	0.155***	0.152***	1.000		
9 Leverage	0.042***	0.128***	0.009	-0.041***	0.083***	0.092***	0.263***	-0.162***	1.000	
10 Cash holdings	-0.094***	-0.118***	0.024*	0.025*	-0.022*	0.084***	-0.149***	0.005	-0.324***	1.000

Panel A3: Correlation matrix of the firm-level Poisson sample for *Environmental news*

	1	2	3	4	5	6	7	8	9	10
1 Environmental news	1.000									
2 Female director ratio	0.088***	1.000								
3 Board governance	-0.078***	0.001	1.000							
4 Female CEO	0.047***	0.262***	-0.003	1.000						

5	Big3 institutions	0.081***	0.370***	0.100***	0.042***	1.000								
6	M/B	-0.008	0.057***	-0.031***	0.040***	0.012	1.000							
7	Firm size	0.324***	0.314***	-0.226***	0.041***	0.306***	-0.008	1.000						
8	ROA	0.044***	0.109***	-0.067***	0.003	0.085***	0.093***	0.187***	1.000					
9	Leverage	-0.019*	0.013	0.062***	-0.012	0.019*	0.027**	-0.022*	-0.124***	1.000				
10	Cash holdings	-0.039***	0.002	-0.024**	-0.007	-0.057***	0.116***	-0.144***	-0.043***	-0.234***	1.000			

Panel B1: Correlation matrix of facility-level Poisson sample for *#Source reduction practices*

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 #Source reduction practices	1.000												
2 Female director ratio	-0.044***	1.000											
3 Board governance	-0.009	-0.051***	1.000										
4 Female CEO	-0.023***	0.163***	-0.012	1.000									
5 Big3 institutions	-0.078***	0.364***	0.215***	0.047***	1.000								
6 M/B	0.001	0.131***	-0.013	0.061***	0.083***	1.000							
7 Firm size	-0.012	0.400***	-0.421***	0.068***	0.194***	0.049***	1.000						
8 ROA	0.006	0.117***	-0.037***	0.047***	0.099***	0.231***	0.121***	1.000					
9 Leverage	0.037***	0.067***	0.061***	-0.011	0.059***	0.141***	0.044***	-0.227***	1.000				
10 Cash holdings	-0.031***	-0.017**	0.000	0.049***	0.079***	0.017**	-0.002	0.131***	-0.276***	1.000			
11 ln(Sales +1)	-0.017**	0.144***	-0.110***	0.031***	0.077***	0.047***	0.277***	0.077***	-0.020**	0.062***	1.000		
12 ln(#Employees +1)	-0.045***	0.076***	-0.083***	0.014*	0.011	0.046***	0.119***	0.029***	-0.011	0.051***	0.907***	1.000	
13 Credit score	0.013	-0.043***	0.093***	-0.005	0.020**	-0.018**	-0.125***	0.008	0.025***	0.031***	-0.095***	-0.101***	1.000

Panel B2: Correlation matrix of facility-level OLS sample for *Production waste*

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 ln(Production waste + 1)	1.000												
2 Female director ratio	0.028***	1.000											
3 Board governance	0.015***	0.006	1.000										
4 Female CEO	-0.022***	0.181***	-0.002	1.000									
5 Big3 institutions	0.030***	0.402***	0.217***	0.055***	1.000								
6 M/B	-0.020***	0.087***	0.007	0.041***	0.066***	1.000							
7 Firm size	0.113***	0.375***	-0.395***	0.086***	0.163***	-0.012***	1.000						
8 ROA	-0.007	0.048***	-0.030***	0.035***	0.067***	0.177***	0.059***	1.000					
9 Leverage	0.058***	0.126***	0.051***	-0.020***	0.110***	0.109***	0.081***	-0.237***	1.000				
10 Cash holdings	-0.057***	-0.062***	-0.055***	0.016***	-0.009*	0.030***	-0.026***	0.105***	-0.279***	1.000			
11 ln(Sales +1)	0.128***	0.112***	-0.091***	0.029***	0.030***	0.033***	0.241***	0.027***	0.058**	0.022***	1.000		
12 ln(#Employees +1)	0.056***	0.025***	0.016**	-0.022***	-0.051***	0.049***	0.078***	0.002	0.044***	0.037***	0.907***	1.000	
13 Credit score	0.028***	0.008*	0.070***	0.026***	0.029***	-0.039***	-0.038***	0.032***	-0.021***	-0.007	-0.024***	-0.057***	1.000

Table IA5. Female directors and corporate environmental performance: Various fixed effects

This table conducts robustness checks on the regression analysis in Table 2 Panels A and B. It examines the relation between the share of female directors on a board and corporate environmental performance by including firm fixed effects, industry times year fixed effects, headquarters state times year fixed effects, and incorporation state $\times$ year fixed effects. Definitions of the variables are provided in Internet Appendix Table IA1. Standard errors (in parentheses) are clustered at the firm level. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	E score (1)	#Source reduction practices (2)	Environmental news (3)
Female director ratio	0.053** (0.025)	1.728*** (0.620)	-0.610* (0.372)
Board governance	0.002 (0.003)	-0.004 (0.040)	-0.027 (0.053)
Female CEO	-0.007 (0.017)	0.496* (0.294)	0.156 (0.160)
Big3 institutions	-0.040 (0.040)	0.885 (0.944)	-0.569 (0.729)
M/B	-0.000 (0.000)	0.001 (0.007)	-0.016** (0.007)
Firm size	0.025*** (0.005)	0.091 (0.116)	0.474*** (0.080)
ROA	-0.010 (0.009)	-0.648** (0.330)	-0.191 (0.276)
Leverage	-0.019 (0.014)	-0.277 (0.290)	-0.430 (0.338)
Cash holdings	0.024 (0.019)	1.023** (0.484)	0.763 (0.488)
Industry $\times$ Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Headquarters state $\times$ Year Fixed Effects	Yes	Yes	Yes
Incorporation state $\times$ Year Fixed Effects	Yes	Yes	Yes
Intercept	Yes	Yes	Yes
Obs.	19,108	5,282	7,024
Adj- R^2	0.854	0.623	0.848

Table IA6. Additional analyses related to California's SB 826

This table conducts additional analyses related to California's SB 826. Panel A repeats the DID analysis in Table 3 Panel B using California firms with at least two female directors in 2018 as the control group. Panel B repeats the DID analysis using the compliant firms as treated firms. The compliant firms are public firms that did not have a female director before September 30th, 2018 but had at least one female director the year after, headquartered (and stayed) in California, and without TRI-reporting facilities in California. We find the closest control firm for each treated firm by matching on (three-digit SIC) industry, firm size, and *E score*. Panel C repeats the DID analysis using 2016 as the pseudo-event year. *Post* is an indicator variable that takes the value of one for the post-event window (2019 to 2021), and zero for the pre-event window (2015 to 2017). Definitions of the variables are provided in Internet Appendix Table IA1. Standard errors (in parentheses) are clustered at the state level. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: DID analysis using California firms with at least two female directors in 2018 as the control group

	Female director ratio (1)	E score (2)
Treated × Post	0.122*** (0.032)	0.025*** (0.004)
Firm-level controls	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	430	430
<i>Adj-R</i> ²	0.830	0.526

Panel B: DID analysis using the compliant firms (51 treated firms)

	Female director ratio (1)	E score (2)
Treated × Post	0.086*** (0.011)	0.033*** (0.006)
Firm-level controls	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	455	456
<i>Adj-R</i> ²	0.762	0.645

Panel C: DID analysis using 2016 as the pseudo-event year

	Female director ratio (1)	E score (2)
Treated × Post	0.011 (0.010)	0.008 (0.012)
Firm-level controls	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	367	367
<i>Adj-R</i> ²	0.559	0.712

Table IA7. The second phase of SB 826

This table examines changes in both the share of female directors on a board and corporate environmental performance between the treated and control firms around the second phase of SB 826. The bill further required that by the end of 2021, all public firms in California have at least two female directors if a board has five members, and three female directors if a board has six members or more. We identify treated firms as those with “shortfalls” according to the 2021 follow-up rule following Hwang et al. (2021) and Gertsberg et al. (2023). The rest of California firms are control firms. We conduct a DID analysis around 2021. Due to the recency of this more stringent requirement, we examine a shorter event window [-2, +2] from 2019 to 2023 (or [-1, +2] from 2020 to 2023). *2021 shortfall* is an indicator variable that takes the value of one for a California firm whose number of female directors did not meet the requirement of the second phase of the bill, and zero otherwise. *Post* is an indicator variable that takes the value of one for the post-event window (2021 to 2023), and zero for the pre-event window (2019 to 2020, or 2020). Definitions of the variables are provided in Internet Appendix Table IA1. Standard errors (in parentheses) are clustered at the state level. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	Female director ratio (1)	Female director ratio (2)	E Score (3)	E Score (4)
	[2019, 2023]	[2020, 2023]	[2019, 2023]	[2020, 2023]
2021 shortfall × Post	0.025*** (0.009)	0.021** (0.010)	0.021* (0.011)	0.019* (0.010)
Industry × Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm-level controls	Yes	Yes	Yes	Yes
Intercept	Yes	Yes	Yes	Yes
Obs.	2,065	1,595	1,681	1,335
Adj-R ²	0.772	0.770	0.953	0.969

Table IA8. The Big Three's campaigns

This table examines changes in both the share of female directors on a board and corporate environmental performance between the treated and control firms around the Big Three's campaigns in 2017. Following Gormley et al. (2023), we use a firm's ownership by the Big Three asset managers as of 2016 as a measure of its treatment intensity. *Post* is an indicator variable that takes the value of one for the post-event window (2017 to 2019), and zero for the pre-event window (2014 to 2016). Definitions of the variables are provided in Internet Appendix Table IA1. Standard errors (in parentheses) are clustered at the firm level. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	Female director ratio (1)	E score (2)
Big3 institutions (2016) × Post	0.024** (0.009)	0.194** (0.052)
Firm-level controls	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	9,238	9,238
Adj-R ²	0.779	0.909

Table IA9. SG&A and M/B

This table examines the relation between SG&A and firm value change measured by a firm's annual change in market-to-book ratio. Definitions of the variables are provided in Internet Appendix Table IA1. Standard errors (in parentheses) are clustered at the firm level. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	$\Delta(M/B)_t$ (1)	$\Delta(M/B)_{t+1}$ (2)
ln(SG&A)	-0.264* (0.142)	0.378*** (0.136)
Board governance	0.025 (0.058)	0.013 (0.060)
Female CEO	-0.227 (0.269)	0.134 (0.273)
Big3 institutions	-1.324* (0.775)	0.906 (0.793)
M/B	0.833*** (0.019)	-0.833*** (0.020)
Firm size	0.214* (0.129)	-0.693*** (0.126)
ROA	-1.615*** (0.343)	0.217 (0.366)
Leverage	-0.061 (0.426)	-0.222 (0.475)
Cash holdings	-0.041 (0.364)	0.544 (0.411)
Industry $\times$ Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	40,695	40,695
Adj- R^2	0.381	0.379

Table IA10. Summary statistics of director and board characteristics

This table provides the summary statistics of director and board characteristics for our director and firm samples. Panel A presents the summary statistics of director characteristics. The sample comprises 207,045 director-year observations associated with 3,040 firms over the period 2001–2020. Panel B presents the summary statistics of board characteristics. The sample comprises 21,695 firm-year observations associated with 3,040 firms over the period 2001–2020. Definitions of the variables are provided in Internet Appendix Table IA1.

Panel A: Summary statistics for the director sample

	Mean (1)	SD (2)	P5 (3)	Median (4)	P95 (5)
Female	0.179	0.383	0.000	0.000	1.000
Age	62.249	8.744	47.000	63.000	76.000
Tenure	7.917	7.366	0.600	5.700	22.600
Field_arts	0.389	0.487	0.000	0.000	1.000
Field_business	0.533	0.499	0.000	1.000	1.000
Field_STEM	0.451	0.498	0.000	0.000	1.000
Field_law	0.136	0.343	0.000	0.000	1.000
Field_medicine	0.033	0.179	0.000	0.000	0.000
#Fields	1.542	0.686	0.000	2.000	2.000
Highest degree	1.757	0.642	1.000	2.000	3.000
Exposure to env reg	0.100	0.300	0.000	0.000	1.000
Industry experience	0.470	0.500	0.000	0.000	1.000
Skill_academic	0.130	0.336	0.000	0.000	1.000
Skill_government & policy	0.188	0.390	0.000	0.000	1.000
Skill_risk management	0.016	0.124	0.000	0.000	0.000
Skill_scientific	0.043	0.204	0.000	0.000	0.000
Skill_technology	0.084	0.277	0.000	0.000	1.000
Skill_sustainability	0.018	0.135	0.000	0.000	0.000
Skill_community	0.069	0.254	0.000	0.000	1.000
Skill_finance accounting & economics	0.463	0.499	0.000	0.000	1.000
Skill_management	0.861	0.346	0.000	1.000	1.000
Skill_entrepreneurship	0.300	0.458	0.000	0.000	1.000
Skill_international	0.262	0.440	0.000	0.000	1.000
Skill_legal	0.095	0.293	0.000	0.000	1.000
Skill_manufacturing	0.072	0.258	0.000	0.000	1.000
Skill_marketing	0.267	0.442	0.000	0.000	1.000
Skill_strategic planning	0.179	0.383	0.000	0.000	1.000
Skill_HR	0.044	0.205	0.000	0.000	0.000
Skill_operations	0.228	0.420	0.000	0.000	1.000
Skill_M&As	0.033	0.179	0.000	0.000	0.000
#Skills	3.352	1.736	1.000	3.000	6.000
Chairman of the Board	0.101	0.302	0.000	0.000	1.000
Lead director	0.046	0.209	0.000	0.000	0.000
Audit committee	0.438	0.496	0.000	0.000	1.000
Compensation committee	0.358	0.479	0.000	0.000	1.000
CSR committee	0.033	0.180	0.000	0.000	0.000
Nomination committee	0.277	0.447	0.000	0.000	1.000

Panel B: Summary statistics for the board sample

	Mean (1)	SD (2)	P5 (3)	Median (4)	P95 (5)
HHI age	0.127	0.036	0.080	0.119	0.204
HHI tenure	0.125	0.035	0.080	0.119	0.186
HHI field	0.335	0.076	0.254	0.319	0.469
HHI skill	0.155	0.044	0.105	0.145	0.236
HHI sector	0.130	0.079	0.060	0.107	0.284
HHI college	0.150	0.077	0.083	0.136	0.265
HHI ethnicity	0.812	0.167	0.520	0.802	1.000
ESG-linked compensation	0.248	0.432	0.000	0.000	1.000
E&S reporting	0.275	0.446	0.000	0.000	1.000

Table IA11: California's SB 826 with more controls

This table conducts robustness checks on the analysis in Table 3 Panel B column (2) by including director demographic, skill, and board diversity measures. Definitions of the variables are provided in Internet Appendix Table IA1. Standard errors (in parentheses) are clustered at the state level. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

	E score	
	(1)	(2)
Treated × Post	0.027*** (0.009)	0.030*** (0.007)
Age	-0.002 (0.002)	
Tenure	0.002 (0.002)	
Field_arts	0.121** (0.053)	
Field_business	-0.012 (0.033)	
Field_law	0.004 (0.087)	
Field_STEM	0.079* (0.046)	
Field_medicine	-0.031 (0.050)	
Frac exposure to env reg	-0.011 (0.021)	
Frac industry experience	-0.095*** (0.021)	
Skill_academic	-0.088** (0.033)	
Skill_government & policy	-0.059* (0.034)	
Skill_risk management	-0.167** (0.080)	
Skill_scientific	0.012 (0.058)	
Skill_technology	-0.000 (0.076)	
Skill_sustainability	0.140** (0.059)	
Skill_community	-0.108** (0.049)	
Skill_finance accounting & econ	-0.004 (0.021)	
Skill_management	0.017 (0.043)	
Skill_entrepreneurship	0.011 (0.014)	
Skill_international	0.098** (0.043)	
Skill_legal	0.109 (0.109)	
Skill_manufacturing	-0.089** (0.034)	
Skill_marketing	-0.030 (0.049)	
Skill_strategic planning	0.005 (0.022)	
Skill_HR	-0.050 (0.085)	

Skill_operations	0.010 (0.018)	
Skill_M&As	-0.057 (0.074)	
HHI field		-0.147*** (0.029)
HHI skill		0.152 (0.094)
HHI age		-0.219* (0.111)
HHI tenure		0.308** (0.142)
HHI sector		0.013 (0.060)
HHI college		0.008 (0.023)
Firm-level controls	Yes	Yes
Industry $\times$ Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	530	530
<i>Adj-R²</i>	0.714	0.698

Table IA12: California's SB 826 and E&S-related governance measures: Robustness check

This table repeats the DID analysis in Table 8 using California firms with at least two female directors in 2018 as the control group, which are not required to add additional female directors. Definitions of the variables are provided in Internet Appendix Table IA1. Standard errors (in parentheses) are clustered at the state level. ***, **, * correspond to statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: The effect of SB 826 on E&S-related governance measures

	ESG-linked compensation (1)	E&S reporting (2)
Treated × Post	0.097*** (0.012)	0.011 (0.008)
Firm-level controls	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	389	389
Adj-R ²	0.865	0.246

Panel B: The effect of SB 826 on *E score* controlling for E&S-related governance measures

	E score (1)	E score (2)
Treated × Post	0.026*** (0.005)	0.016** (0.004)
ESG-linked compensation		0.075*** (0.016)
E&S reporting		0.309*** (0.013)
Firm-level controls	Yes	Yes
Industry × Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
Intercept	Yes	Yes
Obs.	389	389
Adj-R ²	0.390	0.644

Section IA1. Introduction to the GPSS survey and relevant survey questions

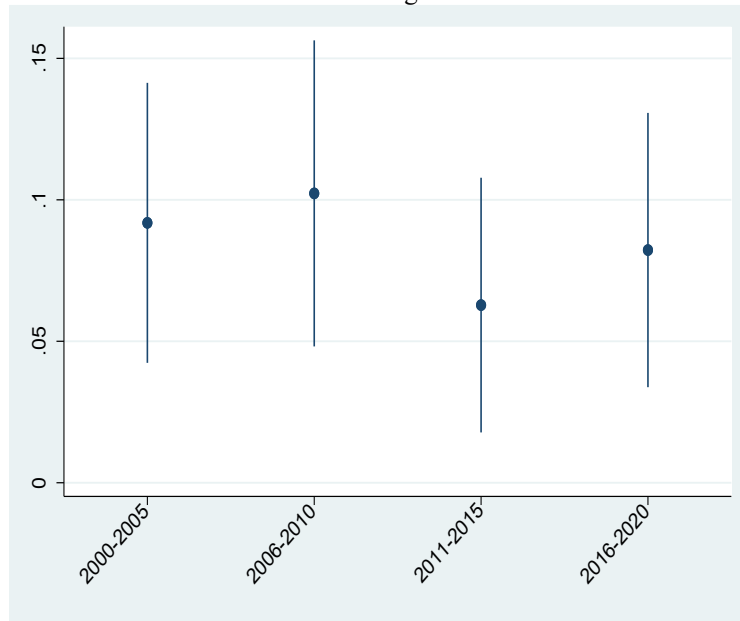
Gallup samples landline and cellphone numbers using random-digit-dial methods, then weights its final sample to match the U.S. population according to gender, age, race, ethnicity, education, region, population density, and phone status. The core questions in the March survey center around the environment, with about 1,000 respondents each year. We use the two questions under the “trade-offs” category. The first question asks: “With which one of these statements about the environment and the economy do you most agree—protection of the environment should be given priority, even at the risk of curbing economic growth (or) economic growth should be given priority, even if the environment suffers to some extent?” The response “protect environment” is coded as 3, “equal priority” as 2, and “economic growth priority” as 1. The second question asks: “With which one of these statements about the environment and energy production do you most agree—protection of the environment should be given priority, even at the risk of limiting the amount of energy supplies—such as oil, gas and coal—which the United States produces—(or) development of U.S. energy supplies—such as oil, gas and coal—should be given priority, even if the environment suffers to some extent?” The responses are similarly coded with higher values for protecting the environment over energy supplies.

Figure IA2 plots the temporal trend in gender differences in viewing the tradeoff between environmental and economic benefits, again controlling for respondents’ age, education, and political party. We group the survey results from 2011 to 2020 into four equal time periods: 2001–2005, 2006–2010, 2011–2015, and 2016–2020, and then we plot the estimated coefficient on gender for each period, in regressions with the controls mentioned above. We note that gender differences in viewing the tradeoff appear to be stable over the 20-year survey period.

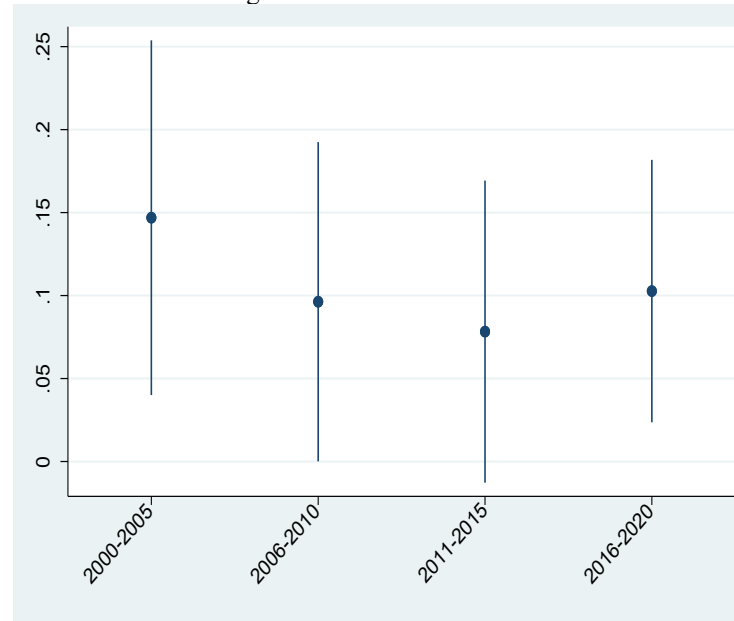
Figure IA2. Gender differences in viewing the tradeoff between environmental and economic benefits

This figure plots the temporal trend in gender differences in viewing the tradeoff between environmental and economic benefits using data from the Gallup Poll Social Series (GPSS). Introduced in 2001, the core questions in the March survey each year center around the environment. We use the two questions under the “trade-offs” category. The first question asks: “With which one of these statements about the environment and the economy do you most agree—protection of the environment should be given priority, even at the risk of curbing economic growth (or) economic growth should be given priority, even if the environment suffers to some extent?” The response “protect environment” is coded as 3, “equal priority” as 2, and “economic growth priority” as 1. The second question asks: “With which one of these statements about the environment and energy production do you most agree—protection of the environment should be given priority, even at the risk of limiting the amount of energy supplies—such as oil, gas and coal—which the United States produces (or) development of U.S. energy supplies—such as oil, gas and coal—should be given priority, even if the environment suffers to some extent?” The responses are similarly coded with higher values for protecting the environment over energy supplies. Panel A plots the temporal trend in gender differences (with 95% confidence intervals) in viewing the tradeoff between environmental protection and economic growth over four five-year periods (2001–2005, 2006–2010, 2011–2015, and 2016–2020) controlling for a respondent’s age, education, and political party. Panel B plots the temporal trend in gender differences (with 95% confidence intervals) in viewing the tradeoff between environmental protection and energy supplies over four five-year periods (2001–2005, 2006–2010, 2011–2015, and 2016–2020) controlling for a respondent’s age, education, and political party. The left-hand-side plot uses the full sample, and the right-hand-side plot uses only the top income tercile.

Panel A: Gender differences in viewing the tradeoff between environmental protection and economic growth over time

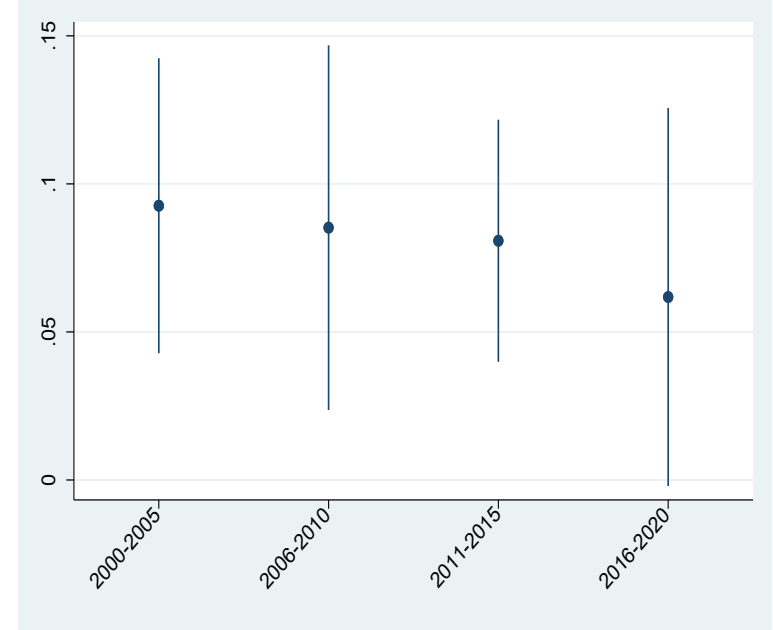


The full sample

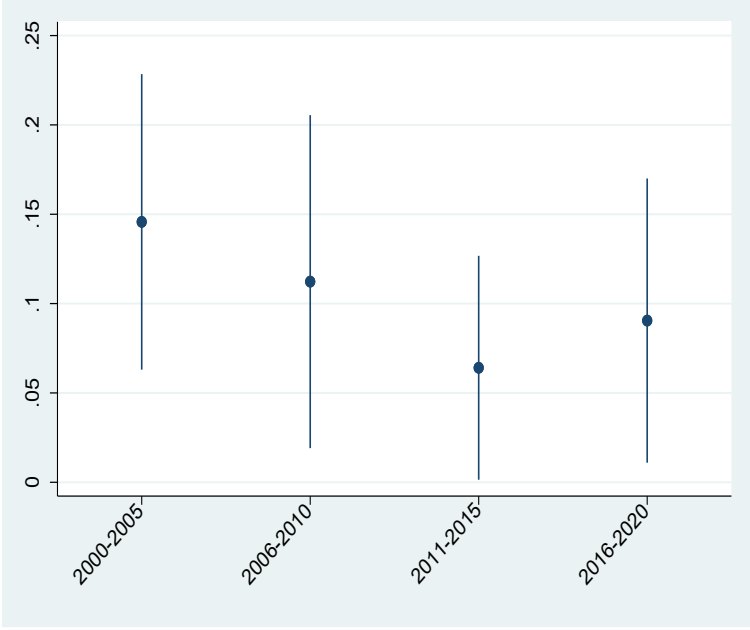


The top income tercile

Panel B: Gender differences in viewing the tradeoff between environmental protection and energy supplies over time



The full sample



The top income tercile

Section IA2. Databases for measuring corporate environmental performance

Refinitiv

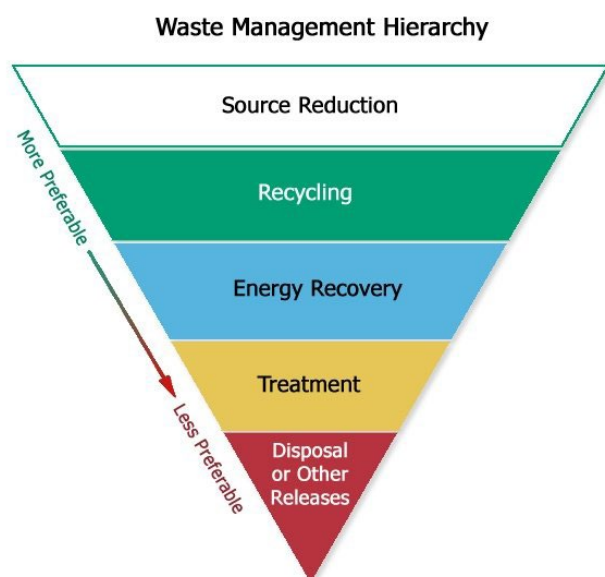
To measure corporate environmental performance, Refinitiv develops emissions reduction, innovation, and resource use scores. The emissions reduction score measures a company's commitment and effectiveness towards reducing environmental emissions in its production and operational processes. The resource use score measures a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management. The innovation score measures a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes, or through eco-designed products.

EPA's TRI database

A. The Pollution Prevention (P2) database

The Pollution Prevention Act (P2 Act), approved by Congress in 1990, authorized the EPA to gather and disseminate information on pollution prevention activities (also known as source reduction activities). Such actions are compiled under the TRI database (in File Type 2A: <https://www.epa.gov/toxics-release-inventory-tri-program/tri-basic-plus-data-files-calendar-years-1987-present>). Facilities satisfying the following criteria are required to report to the TRI database: (1) in the mining, utility, manufacturing, publishing, hazardous waste, or federal industry; (2) manufacturing, processing, or otherwise using a TRI-listed chemical in quantities above certain threshold levels set by the EPA in a given year; and (3) having ten or more full-time equivalent employees.

Facilities are required to disclose any source reduction practices implemented at their facilities to reduce production waste in the reporting year. Source reduction practices denote the first layer of the waste management hierarchy (see the figure below): Once potential production waste is reduced, firms do not need to recycle, recover, treat, and release it.

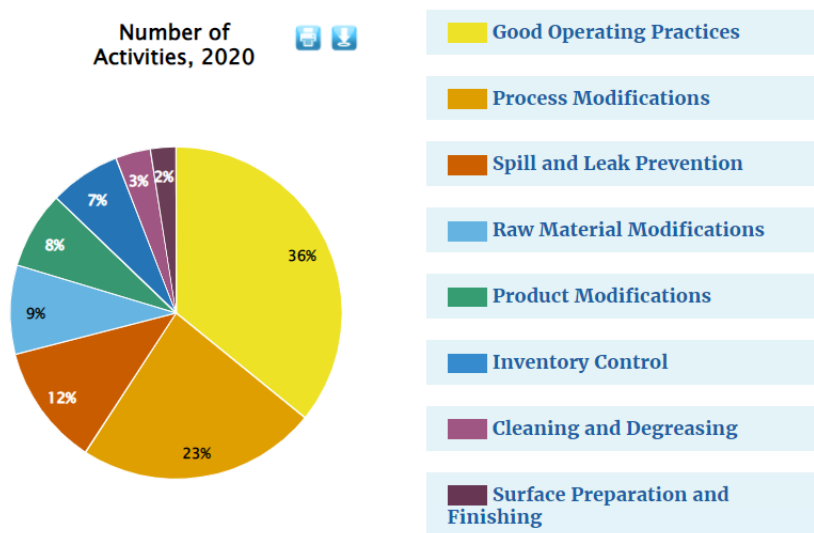


Source: <https://www.epa.gov/trinationalanalysis/pollution-prevention-and-waste-management>

Facilities report these newly implemented source reduction practices by selecting one or more predefined codes (W-codes) that describe specific practices within the eight categories: raw material modifications, product modifications, cleaning and degreasing, surface preparation and finishing, process modifications, spill and leak prevention, inventory control, and good operating practices (detailed definitions are provided at <https://www.epa.gov/toxics-release-inventory-tri-program/pollution-prevention-p2-and-tri>). Note that, since 2021, the classification of reduction practices has been changed to a system of S-codes, as seen in Appendix D of the following document: https://www.epa.gov/system/files/documents/2021-08/file_type_2a_0.pdf

The following pie chart illustrates the frequencies of eight categories of source reduction practices:

For 2020, a total of 1,188 facilities (6% of all TRI facilities) reported initiating 2,779 new source reduction activities. Good operating practices, process modifications, and spill and leak prevention were the activities reported most frequently. Click on the legend or graph to see examples of source reduction activities; reported codes are included in parentheses.



Source: <https://www.epa.gov/toxics-release-inventory-tri-program/pollution-prevention-p2-and-tri>

B. The Toxics Release Inventory (TRI) database

The TRI program was established by the EPA due to the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986. The TRI reporting started with the 1987 reporting year (first TRI reports due July 1st, 1988) and has continued to the present. In terms of coverage, we find more comprehensive coverage since 1991. By August 2022, the TRI toxic chemical list contains 775 individually listed chemicals and 33 chemical categories.

Each TRI-reporting facility reports the production and ultimate outlets of each chemical (see: <https://www.epa.gov/toxics-release-inventory-tri-program/common-tri-terms>). “Production waste” denotes the amount of all chemicals produced along with the production process. The outlets of those wastes include recycling, energy recovery, treatment, and releases (definitions are provided in the above link). The releases include air releases, water release, and land release (also defined in the above link).

After collecting all facility-level release data from the EPA website (<https://www.epa.gov/toxics-release-inventory-tri-program>), we use the link between facility id (TRIFD) and Compustat GVKEY, established by Chen, Hsieh, Hsu, and Ross (2022) based on matching facility names and parent company names.

In the TRI database, production waste captures the amount of TRI chemicals produced in the production procedure. Production waste will be treated, recycled, or released to the environment (air, water, or land). We focus on production waste because it better captures how many pollutants are produced, despite some may be treated or recycled later. See <https://www.epa.gov/toxics-release-inventory-tri-program/common-tri-terms>.

RepRisk

RepRisk data collection involves systematic screening of over 100,000 sources, including traditional and online media, NGOs, government bodies, regulators, and social media. We capture negative environmental news by focusing on news about a firm’s violation of UNGC Principle 7 (supporting a precautionary approach to environmental challenges), Principle 8 (undertaking initiatives to promote greater environmental responsibility), or Principle 9 (encouraging the development and diffusion of environmentally friendly technologies).

Environmental news is the number of negative environmental news items, classified by the United Nations Global Compact (UNGC) and weighted by severity and reach scores. For example, if a firm has two events (A and B) related to the RepRisk classification in a year, and if Event A (B) is assigned of a severity score of 2 and a reach score of 2 (a severity score of 3 and a reach score of 1), then its Environmental news (RepRisk) is $2 \times 2 + 3 \times 1 = 7$ in the year.

Section IA3. Literature review of papers focusing on California’s SB 826

This Appendix describes our process of conducting a literature review on SB 826, and synthesizes our findings.

In December 2024, We searched SSRN for papers with “SB 826” or “California Board Gender” in their title, abstract, or keywords. We identified 15 relevant papers, including 7 finance/business papers, and 8 law papers, that were posted before or around the time we posted our paper (November 2022). The table below lists their titles (with SSRN links), authors, main topics, and the number of citations. We also found 13 new finance or law papers (posted after November 2022, not listed in the table). The finance papers mainly focused on understanding the stock market responses to SB 826, as well as labor market conditions and director outcomes.

Heath, Ringgenberg, Samadi, and Werner (2023) and Cronqvist, Ladika, Pazaj, and Sautner (2024) discuss the compound exclusion restriction assumption for “re-used” quasi-natural experiments. Prior studies on, for example, how a regulatory shock affects firm policies other than what the focal paper studies, need to be considered and “compound” the overall exclusion restriction required. More prior studies on the same quasi-natural experiment, with different economic channels, make the overall compound exclusion restriction assumption harder to satisfy (from the perspective of required statistical significance).

Heath et al. (2023, p. 2343) suggest that “a good heuristic is that a new hypothesis should have a t-statistic of at least 2.5 if there are five prior findings and 3.0 if there are 20 prior findings using the same setting.” Our DID results, reported in Table 3 Panel A, have t-stats > 3 (between 3.7 and 6.9). Given the strong statistical significance of our results, and few prior studies on corporate policy changes due to SB 826, we believe that the compound exclusion restriction assumption is likely satisfied in our context.

Finance papers				
	Title	Topic/Finding	Authors	SSRN Citations
1	Do Board Gender Quotas Affect Firm Value? Evidence from California Senate Bill No. 826	Stock market reactions and board changes following SB 826	Greene, Intintoli, and Kahle	49
2	How Deep is the Labor Market for Female Directors? Evidence from Mandated Director Appointments	Director qualification post SB 826	Greene, Intintoli, and Kahle	3
3	As California Goes, So Goes the Nation? Board Gender Quotas and Shareholders' Distaste of Government Interventions	Understanding stock market responses to SB 826 and its repeal	von Meyerinck, Niessen-Ruenzi, Schmid, and Solomon	9
4	Mandating Women on Boards: Evidence from the United States	SB 826 lowered shareholder value, increased credit risk, and reduced earnings forecasts, driven by supply constraints.	Hwang, Shivdasani and Simintzi	15
5	Gender Quotas and Support for Women in Board Elections	Shareholder support for board nominees under SB 826, and how it relates to market reactions	Gertsberg, Mollerstrom, and Pagel	0
6	Women on Boards of Public Companies Headquartered in California - 2018	Descriptive paper without hypothesis testing	Barret	0
7	Gender Quota and CEO PAY Performance Sensitivity: Evidence from the California Gender Quota Law	Effect of SB 826 on CEO-board dynamics	Qiu and Zhen	0

Law papers				
1	Mandating Gender Diversity in the Corporate Boardroom: The Inevitable Failure of California's SB 826	Legal assessment of SB 826	Grundfest	6
2	Board Gender Diversity: A Path to Achieving Substantive Equality in the U.S.	U.S. vs. EU board gender diversity efforts, advocating for constitutional reforms to achieve true equality in the U.S.	Houser and Williams	0
3	Centros, California's 'Women on Boards' Statute and the Scope of Regulatory Competition	EU's Centros decision vs. California's SB 826	Fisch and Solomon	0
4	Mandating Board Diversity	Legal assessment of California's board diversity laws	Kim	0
5	Board Diversity by Term Limits?	Term limits may improve board gender diversity by increasing turnover	Nili and Rosenblum	0
6	Gender and Corporate Crime : Do Women on the Board of Directors Reduce Corporate Bad Behavior?	Gender diversity on boards improves corporate compliance	Lazar, Baum, and Gafni	0
7	The Contested Edges of Internal Affairs	California's gender diversity law challenge Delaware's dominant role in corporate governance	Manesh	1
8	California Dreaming?	Legal assessment of SB 826	Rosenblum	1

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