Does ESG-motivated stakeholder pressure work? Evidence from environmental violations

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Abstract. We document a major shift in the effectiveness of stakeholder pressure in disciplining firms for poor environmental performance. Before 2007, stakeholder reactions to firms' environmental violations had little valuation impact. Since 2007, however, stakeholder reactions have imposed large and increasing costs on polluting firms. Compared to matched peers, violators experience an outflow of ESG-oriented investors, an increase in the cost of capital, and a decrease in sales and customers. In response, these firms work to rebuild their reputations by establishing new ESG-related board committees and reducing greenhouse gas emissions. Together, these results indicate that stakeholder pressure has become value-relevant only recently, but now imposes meaningful costs on polluting firms.

***Keywords*:** Stakeholders, ESG, environmental violations, reputation loss, reputation repair

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1. Introduction

Do stakeholder reactions force firms to internalize the costs of environmental harm? A large literature argues they can, particularly when investors, customers, and suppliers are motivated by environmental and climate concerns. Heinkel, Kraus, and Zechner (2001) and Dangl, Halling, Yu, and Zechner (2025) show how green investment strategies can increase polluting firms' cost of capital.[1] Starks (2023) notes that polluting firms can lose customers, consistent with evidence in Barrage, Chyn, and Hastings (2020) and Meier, Servaes, Wei, and Xiao (2023). Flammer (2013) concludes that such stakeholder pressure helps to punish firms for "eco-harmful behavior." Polluting firms also face unfavorable media coverage that is associated with decreases in firm value (e.g., see Hamilton, 1995; Zou et al., 2015; Chortareas et al., 2024). These results suggest that stakeholder pressure penalizes environmentally harmful behavior and thereby encourages better behavior.

A competing view is that stakeholder pressure is ineffectual and does not impose meaningful costs on polluting firms. In a detailed case study, Shapira and Zingales (2025) find that DuPont faced only much-delayed and watered-down consequences for its long-running contamination of the Ohio River Valley. In larger samples, Laplante and Lanoie (1994) and Jones and Rubin (2001) find no losses in share values upon news of an environmental violation. Karpoff, Lott, and Wehrly (2005) and Brady, Evans, and Wehrly (2019) find that firms do lose value when they are penalized for environmental violations, but the losses arise from regulatory and legal penalties rather than stakeholder reactions. Other evidence indicates that ESG-oriented investment strategies are ineffective (e.g., Davies and Van Wesep, 2018; Atta-Darkua, Glossner, Krueger, and Matos, 2023) or could increase rather than decrease carbon emissions (Hartzmark and Shue, 2026).

This paper tests whether stakeholder reactions impose economically meaningful costs on firms that violate environmental regulations. This is an important question because the case for ESG-based discipline rests largely on the premise that stakeholder pressure punishes poor environmental performance and

[1] See also Krüger (2015), Dai, Liang, and Ng (2024), and Bachmann, Ehrlich, Fan, and Ruzic (2023). For effects on the cost of capital, see also Pastor, Stambaugh, and Taylor (2021), DeAngelis, Tankov, and Zerbib (2023), Berk and van Binsbergen (2025), Landier and Lovo (2025), Inderst and Opp (2025), and Pedersen (2026).

rewards good performance. If stakeholder pressure is effective, firms will internalize a significant portion of their environmental costs and be incentivized to improve their environmental performance. If it is not, the disciplining role of ESG-motivated stakeholders is more limited than is often argued.

Our analysis is also motivated by the possibility that stakeholder pressure has become more important over time, as socially responsible investing (SRI) and environmental awareness among investors and other stakeholders have increased.[2] We therefore examine not only whether environmental violators face stakeholder-imposed costs, but whether such costs have increased and become more salient over time.

To investigate the efficacy of ESG-motivated stakeholder pressure, we use data from Violation Tracker and hand-collection for 596 environmental violations by publicly traded firms that triggered legal penalties of at least $1 million from 2000-2021. We begin by showing these violations are costly for firms, as news about the violations and related penalties is associated with declines in share values that average −1.97% to −2.73%. These losses in share value, however, could reflect merely the prospect of legal penalties. To isolate the effect of stakeholder discipline, we subtract the legal penalties from the share value loss and use the residual to measure the cost of stakeholder reactions, or what previous researchers call the reputation loss.[3] The reputation loss reflects investors' expectations of any losses arising from stakeholder reactions, including higher financing costs and lower cash flows.

Our first primary finding is that the reputation loss from environmental violations has changed significantly over time. Consistent with previous results from early samples (e.g., Karpoff, Lott, and Wehrly, 2005), the average reputation loss is negligible and insignificantly different from zero during the 2000-2006 period (–0.05% of share value with *t*-statistic = –0.05). From 2007-2016, however, the average reputation loss is –1.76% of share value (*t*-statistic = –2.29), and from 2017-2021 it is –4.01% (*t*-statistic = –3.07).

[2] E.g., see Starks (2023). Section 2 and Appendix A discuss the timeline of events that have contributed to ESG awareness and salience over the 2000-2021 period.

[3] For previous uses of this empirical approach, see Peltzman (1981), Jarrell and Peltzman (1985), Karpoff and Lott (1993), Karpoff, Lee, and Vendrzyk (1999), Alexander (1999), Armour, Mayer, and Polo (2017), Haslem, Hutton, and Smith (2017), Cline, Walkling, and Yore (2018), and Kamiya et al. (2020).

This pattern suggests that the impact of environmentally motivated stakeholders has increased over time. The year 2006 is a pivot point, corresponding to a cluster of events that legitimized the view that greenhouse gas emissions create financially material risks, and indications that SRI investment flows had achieved large scale. As discussed below, these events include the launch of the U.N. Principles for Responsible Investment (PRI) at the NYSE, the publication of an influential report (the Stern Review) that elevated climate change to material risk status, and the release of a 2007 SIF Foundation report indicating that SRI fund flows had reached record levels. Our findings indicate that ESG-oriented stakeholder pressure shifted from having negligible effects on polluting firms through roughly 2006, to having economically meaningful effects since 2007.

We investigate two main channels by which stakeholder reactions can impose costs on violating firms. The first channel is via sustainable investment strategies and the cost of capital. As Krueger, Sautner, and Starks (2020) and Starks (2023) show, ESG-oriented impact investing by institutional investors has increased substantially since 2000. Consistent with this growth, we find that the magnitude of violating firms' reputation loss is positively related to the ESG-orientation of their institutional investors – but only after 2006. Stacked difference-in-differences (DiD) tests show that violating firms' cost of equity capital increases after their environmental violations, particularly when ESG-oriented investors hold a large ownership stake. These increases are accompanied by decreases in shareholdings by ESG-oriented institutional investors. These results imply that violating firms incur losses via a cost-of-capital channel as ESG-motivated investors reallocate capital away from environmentally brown firms (e.g., Heinkel et al., 2001).

The second channel is via customers' and employees' reactions to environmental violations. Among cases that were settled after 2006, violating firms lose sales and have higher labor costs after their violations, compared to matched peer firms. In stacked DiD tests that control for customer-matching, violating firms are also significantly more likely to lose a corporate customer in the four years after their violations, and weak evidence suggests that corporate customers are more likely to terminate the business relationship when their own stakeholders have strong environmental preferences. This result is consistent with the

argument that customers' environmental concerns affect their willingness to do business with a violating firm (Bisetti, She, and Žaldokas, 2026).

If stakeholder reactions impose meaningful costs on polluting firms, violating firms have incentives to repair their reputations by boosting their ESG performance. Consistent with this repair, we find that violating firms are subsequently more likely than other firms to include environmental and social responsibilities in their board committees and to reduce their greenhouse gas emissions. These changes are most pronounced among firms with high concentrations of ESG-motivated institutional shareholders and stakeholders. Thus, violating firms tend to reinvest in their environmental reputations particularly when their stakeholders care about the environment.

Together, these results are consistent with the view that stakeholder pressure on firms' environmental discipline and performance has undergone a profound change over time. Advocacy for impact investing is not new, as reflected in calls for socially responsible business in the 1960s and stakeholder theory in the 1980s (e.g., Freeman 1984). But until about 2007, stakeholder pressure does not appear to have imposed substantial monetary incentives – over and above any legal consequences – for firms to consider the costs of their environmental harms. In more recent years, however, violating firms' reputation-based financial losses have been positive, significant, and growing over time. These findings indicate that institutional and social changes associated with the ESG movement have become more effective at forcing firms to internalize at least some of the costs of their environmental impacts.

These findings inform debates regarding business and public environmental policy in three ways. First, they reconcile an apparent discrepancy between theoretical arguments and previous empirical findings. Our results are consistent with early empirical evidence that stakeholder pressure had only negligible effects (e.g., Karpoff, Lott, and Wehrly, 2005), but our finding that stakeholder reactions have grown substantially over time is consistent with more recent arguments that ESG considerations matter to many investors and stakeholders, and that firms can create value by catering to ESG concerns (e.g., Edmans, 2024; Starks, 2023). Second, the evidence supports theoretical arguments that ESG-motivated investors who tilt their portfolios away from environmentally harmful firms can have a material effect on the cost of capital at

those firms (e.g., Heinkel et al., 2001; Dyck et al., 2019; Chen et al., 2020; Krueger et al., 2020), and more broadly that environmental and climate issues now impose meaningful financial risk at the firm level (e.g., Wetzer, Stuart-Smith, and Dibley, 2024). Third, the existence of large and growing reputation losses has direct implications for the assessment and design of environmental policy enforcement. By focusing only on legal penalties and ignoring reputational losses, the standard approach to evaluating enforcement leaves out a major economic deterrent to environmental harm. This omission is especially relevant for arguments that polluting tends to be profit-maximizing (e.g., Dodge 2000; McGuire 2000; Atkinson 2023; Anderson and Vaughan 2023). It also has direct implications for the optimal design of legal penalties. Under a Becker (1968) framework, for example, regulators should assess lower legal penalties when expected reputation losses are high and larger penalties when reputation losses are low. Our evidence, that legal penalties have shrunk as reputation losses have grown, is consistent with regulators already applying such a framework, perhaps implicitly.

This paper is organized as follows: Section 2 reviews the theoretical basis for our tests and historical developments that may contribute to changing effects over time. Section 3 details our data sources and sample. Section 4 reports on how market reactions and reputational losses for environmental violations have changed over time. Section 5 examines the stakeholder channels by which reputational losses occur. Section 6 investigates firms' reputation-rebuilding efforts and the associated economic outcomes post-violation. Section 7 reports additional tests consistent with the disciplining effect of reputational capital. Section 8 concludes the paper.

2. Conceptual background and historical developments

2.1. Reputation costs for environmental harms

Our investigation is motivated by the ongoing debate about corporate purpose and whether managers should act primarily in the interests of shareholders or stakeholders. The debate is largely beside the point when stakeholder and shareholder interests are aligned, as when a firm offers high-quality products or safe working conditions that also maximize firm value (e.g., see Edmans, 2024). Alignment is less likely,

however, around the firm's environmental performance. The parties harmed by a firm's water or air emissions often do not transact directly with the firm, while the parties that do transact with the firm have little direct pecuniary stake in these external harms. Karpoff (2012) argues that this disconnect – the separation between the firm's direct counterparties and the parties it harms – explains the historical lack of evidence on reputation costs for environmental violations. In contrast to consumer frauds and financial misreporting, where misconduct directly harms counterparties and provokes large stakeholder reactions, environmental violations often have little effect on the firm's contracting with investors, customers, employees, and suppliers. That is, environmental violations impose costs that are largely external to the firm and its direct stakeholders.

As Freeman (1984) and others argue, managers can attempt to decrease the firm's external costs by voluntarily considering stakeholder concerns. Such stakeholder-based management, however, is subject to information and incentive problems, as managers have insufficient information to weigh the shadow prices of many diverse stakeholders' demands and can use a stakeholder argument to justify poor or self-serving decisions (see e.g., Bebchuk and Tallarita 2020; Flugum and Souther, 2025; DeAngelo, 2025). As an alternative, managers can be forced to consider the firm's impact on the broader community if the firm's stakeholders are willing to incur costs to avoid doing business with an environmental violator (e.g., Hart and Zingales, 2022; Starks, 2023). If, for example, enough ESG investors tilt their holdings away from brown firms even though they earn a lower expected return on capital, brown firms' cost of capital will increase (e.g., Heinkel et al., 2001). Similarly, ESG-motivated consumers can eschew an environmentally insensitive firm's products by switching to otherwise less-preferred substitutes, thereby decreasing the firm's cash flow. A central tenet of the ESG movement is that such altruistic investment and consumption decisions by the firm's investors and other stakeholders impose costs that force firms to internalize their environmental costs.

Previous research demonstrates that many investors consider environmental factors (e.g., Hartzmark and Sussman, 2019; Bauer, Ruof, and Smeets, 2021), and that stakeholders' environmental concerns can affect firm disclosure and ESG policies (e.g., see Flammer, Toffel, and Viswanathan, 2021; Gantchev,

Giannetti, and Li, 2019). The question we seek to address is whether investors and stakeholders' environmental concerns translate into meaningful value-relevant consequences for firms.

2.2. Changes in stakeholder pressure over time

An important aspect of our investigation is the growth over time in sustainable investing and corporate attention to ESG concerns. Environmental concerns have been a prominent aspect of business risk management dating at least to the publication of Rachel Carson's *Silent Spring* in 1962, the first Earth Day in 1970, and the passage of the National Environmental Policy Act of 1969, Clean Air Act of 1970, Clean Water Act of 1972, and Endangered Species Act of 1973. Such legislative changes increased firms' legal liabilities for environmental harms, and subsequent developments such as the 1989 Exxon Valdez oil spill spawned grassroots efforts by consumer and investor groups to boycott firms regarded as imposing environmental harms on society. Still, research using data from this era indicates that, on average, stakeholder pressure imposed negligible costs on polluting firms over and above their legal liabilities (e.g., see Karpoff, Lott, and Wehrly, 2005).

Events over time, however, indicate that stakeholder pressure may have become more salient in recent years. Appendix A presents a timeline of important developments in this regard from 2000-2021, beginning with the launch of the United Nations' Global Compact in 2000, which articulated environmental sustainability principles and lent credibility and momentum to sustainable investment strategies. The timeline summarizes a secular increase in awareness, salience, and potential impact of stakeholder concerns throughout this period, but two clusters of events suggest particularly large changes.

The first is a cluster of events in 2006-2007, indicating that ESG and SRI investment flows had achieved large scale and legitimized the view of greenhouse gas emissions as creating financially material risks. These events include the launch of the U.N. Principles for Responsible Investment (PRI) at the NYSE, the publication of an influential report (the Stern Review) that elevated climate change to material risk status, and the release of a 2007 SIF Foundation report indicating that SRI fund flows had reached record levels.

The second cluster of events occurred in 2015-2016, including the Paris Agreement in which many countries committed to specific decarbonization goals, record-setting levels of shareholder votes at U.S. companies supporting climate disclosure and reductions, and continued growth of SRI funds. In tests below, we use these two clusters of events to break the sample period into subperiods for 2000-2006, 2007-2016, and 2017-2021. Our finding of a large and economically meaningful increase in the efficacy of stakeholder pressure over time, however, does not depend on these specific breakpoints in the subperiod analysis.

3. Data

3.1. Environmental violation data

Our data on environmental violations come from the "environment-related offences" listed by Violation Tracker, which compiles enforcement data regarding environmental, consumer protection, and workplace health and safety violations from more than 400 federal, state, and local regulatory agencies.[4] These cases are reported by the U.S. Environmental Protection Agency (EPA) (in particular, the EPA's Enforcement and Compliance History Online (ECHO) database), the Bureau of Safety and Environmental Enforcement, state regulatory agencies, and state attorneys general.

Table 1 reports on our sample. To focus on economically meaningful violations, we restrict the sample to cases that resulted in legal penalties of at least $1 million. Altogether, the Violation Tracker data identify 718 such environmental violations involving publicly traded firms that were settled between 2000 and 2021. Appendix B provides an example of an individual record in Violation Tracker.

The Violation Tracker dataset provides detailed information about the company involved, the type of violation, the total value of all legal penalties, and the date of the penalty announcement or settlement. Legal penalty amounts include adjustments for negotiated reductions in penalties, duplications in agencies' records, multiple settlement announcements for a given violation, cases in which penalties associated with

[4] See https://violationtracker.goodjobsfirst.org/, which contains detailed information on the dataset.

multiple locations are recorded individually for each facility, and cases in which regulators independently adjust the amounts.

To track the public release of news about these violations, we manually checked the Violations Tracker data and collected information on newswire articles related to the violations using the Factiva database, resulting in an initial sample of 2,189 unique announcement event days relating to the 718 environmental violations. However, 50 events pertain to duplicate Violation Tracker entries involving the same case, and 155 event days have significant confounding news events, including announcements of mergers, earnings, equity offerings, debt issues, and dividend payments. An additional 11 events relating to four cases involve large environmental disasters and penalties (i.e., in the top 1% by penalty amount in our sample) that we delete from the sample, and 403 event days have missing values in the CRSP and/or Compustat databases for variables used in some of the tests (described below).[5] After deleting these events, the resulting sample consists of 1,570 event-day observations referring to 596 unique environmental violations.

[Insert Table 1 about here]

On average, a violation case has 2.6 unique news event days throughout the enforcement process. The majority (314) of cases, however, have only a single observable announcement, the settlement date. Among cases with multiple announcements, the average time between the initial revelation and the settlement date is 26 months, with the longest case spanning 348 months. Appendix B illustrates the nature of a case with multiple news events involving *Cabot Oil & Gas Co*.

Table 2 summarizes the distribution of the 596 environmental violation cases and associated legal penalties by type of legal action, jurisdiction, environmental harm, and penalty type. Panel A shows that most cases (546) involve enforcement actions brought by regulatory authorities. However, the average penalty is substantially higher in the 50 cases resolved through actions involving litigation brought by individuals or private entities ($74.38 million versus $37.58 million). (For cases involving both government

[5] As detailed in Appendix K, including the four extreme cases does not alter our main results.

agencies and private parties, we classify the action based on the entity that announces the resolution.) The distribution of penalties is highly skewed, with median penalty amounts substantially smaller than the means.

[Insert Table 2 about here]

Panel B shows that 232 cases were brought by state or local governments, with an average legal penalty of $31.69 million, while 364 cases were brought by the federal government, with an average penalty of $46.39 million. As indicated in Table 1, 50 cases have duplicate Violation Tracker entries because they involve both federal and state agencies. These duplicates are combined and classified as federal cases.

Panel C classifies cases by the type of environmental harm. A total of 201 cases involves air pollution, with an average legal penalty of $54.45 million; 145 cases involve water contamination, with an average penalty of $44.82 million; and 37 cases involve hazardous waste discharge, with an average penalty of $35.44 million. An additional 213 cases are classified as "Multiple or miscellaneous" because they involve more than one type of harm or because the specific harm does not fall into the other three categories. Panel D further classifies cases by the form of penalty imposed. A total of 303 cases involves civil fines only, while 293 include additional or mixed monetary sanctions such as civil fines, settlement payments, cleanup and/or compliance costs.

3.2. Additional data

In tests below that explore whether and how stakeholder pressure affects firms' values, we use data from several additional sources, including Compustat North America Fundamentals (for financial data), CRSP (for stock returns), Refinitiv Institutional (13F) Holdings (for institutional investor shareholdings), and RavenPack (for media coverage data). Cumulative abnormal returns are calculated using the event study methodology provided by Wharton Research Data Services. Corporate ESG scores are compiled from four sources: MSCI, Sustainalytics, Trucost, and Refinitiv, and supply-chain data are constructed from FactSet Revere data. Additionally, we gather data on social capital from the Northeast Regional Center for Rural Development, and CEOs' political ideologies from the U.S. Federal Election Commission. Other

relevant data include disaster claims from Federal Emergency Management Agency (FEMA) datasets and Brian Bushee's Institutional Investor Classification datasets. Appendix C reports definitions and summary statistics on the variables we develop from these data sources and that are introduced below.

4. Market reactions and reputation effects of environmental violations

4.1. Changes in market values

We assess the impact of environmental violations on market value by analyzing the firm's stock price reactions to specific news events about the violation and its associated penalty. Information leakage is a concern for many of the event-day announcements in our sample, particularly for settlement announcements. We therefore measure abnormal stock returns over both a shorter (–3, +3) window and a longer (–10, +3) daily window. Abnormal stock returns are measured as the difference between the raw return and the return predicted from a one-factor market model:

$$AR_{i,t} = R_{i,t} - \alpha_i - \beta_i R_{m,t}\,, \tag{1}$$

where $R_{i,t}$ is the firm i's stock common stock on day t and $R_{m,t}$ is the value-weighted CRSP index return on day t. We estimate the coefficients α_i and β_i by regressing $R_{i,t}$ on $R_{m,t}$ over days –160 through –61 relative to the event date. The cumulative abnormal return over the [−10, +3] window for event date t is:

$$Event\ CAR\ [-10,\ +3] = \sum_{t=-10}^{3} AR_{i,t}\,, \tag{2}$$

To assess the overall market value impact of the environmental violation and penalty, we then cumulate the *Event CAR [–10, +3]* over all n unique event dates relating to that particular case:

$$Accumulated_CAR\ [-10,\ +3] = \prod_{n=1}^{N}[1 + Event\ CAR\ [-10,\ +3]_{i,n}] - 1 \tag{3}$$

Table 3, Panel A reports the results. The mean *Accumulated_CAR* is –2.73% (t= –4.84) measured over the [–10, +3] window, and is –1.97% (t= –5.10) measured over the [–3, +3] window. These estimates indicate that news of environmental violations and the associated penalties is associated with an economically meaningful loss in firm value.

[Insert Table 3 about here]

4.2. Losses due to stakeholder pressure

These market-value losses, however, likely reflect a combination of investors' expectations about prospective legal penalties and the impact of stakeholders' reactions. To isolate the effect of stakeholders, we follow the procedure first used by Peltzman (1981) and Jarrell and Peltzman (1985) by subtracting the portion of the loss that arises from legal penalties.[6] For each firm *i*:

$$\textit{Reputation loss}_i\,[-10, +3] = \textit{Accumulated CAR}_i\,[-10, +3] - (\textit{Penalty/market value})_i \qquad (4)$$

Again, information on each firm's legal penalties – which include regulatory fines, civil settlements, clean-up costs, and in some cases, criminal fines – is provided in the Violation Tracker database. We measure the firm's equity market value at the end of the month preceding the first announcement event date for firm *i*.

As reported in Panel A of Table 3, the mean value of $(\textit{Penalty/market value})_i$ is 1.07%, indicating that penalties average 1.07% of the firm's market capitalization. (To facilitate interpretation and ensure consistency in data analysis, we multiply the *Penalty-to-market value* by –1. This adjustment aligns the directional influence of financial penalties with market reactions.)

Subtracting the penalty amount from the overall loss in stock value yields our estimate of the reputation loss, which is the loss attributable to stakeholder pressure. The mean *Reputation loss* is –1.66% (t = –2.93) measured over the [–10, +3] window, and is –0.90% (t = –2.25) measured over the [–3, +3] window. These estimates indicate that violating firms' equity value losses are significantly larger than these firms' legal penalties, reflecting investors' expectations of meaningful losses from changes in the firms' cash flows or costs of capital, which can arise from stakeholder pressure.

[6] See also the references in footnote 3.

4.3. Variation in stakeholder-related losses over time

Panel B of Table 3 reports on measures of the reputation effect over three different time periods: 2000-2006, 2007-2016, and 2017-2021. As discussed in Section 2, these intervals reflect significant developments in the potential for stakeholder pressure regarding firms' emissions around 2006 and 2016.

During the early period of 2000-2006, the average reputation effect is –0.05% and is statistically insignificant. This result is consistent with previous findings that the reputation losses for environmental violation are negligible, which are based on pre-2007 data (e.g., see Karpoff, Lott, and Wehrly 2005) It implies that, through roughly 2006, firms did not experience significant losses from stakeholder reactions to their environmental harms, on average.

During the 2007-2016 period, however, the reputation effects became negative and statistically significant, as the mean *Reputation loss* is –1.76% (t= –2.29) measured over the [–10, +3] window, and is –1.44% (t= –2.66) measured over the [–3, +3] window. The average reputation loss becomes even larger in magnitude during the 2017-2021 period, equal to –4.01% (t = –3.07) measured over the [–10, +3] window, and –2.13% (t = –2.33) measured over the [–3, +3] window. As reported in Panel C of Table 3, the change in reputation loss from 2000-2006 to 2017-2021 is 3.96% using the [–10, +3] window (t = 2.38) and 2.71% using the [–3, +3] window (t = 2.28).

The results in Table 3 also indicate that violating firms' legal costs have declined as a percentage of market capitalization. Karpoff et al. (2005) report that legal penalties averaged 2.26% of firm market capitalization in their sample from 1980 – 2000. In our sample, legal penalties average 1.94% of firm market capitalization in the 2000-2006 period, decreasing in magnitude to 0.74% from 2007-2016, and to 0.39% from 2017-2021. The penalty-to-market-value ratio falls by 1.21% between 2000–2006 and 2007–2016 (t = –3.14), and by 1.55% between 2000–2006 and 2017–2021 (t = –3.07).

The Table 3 results are illustrated in Figure 1, which shows how the overall market reaction, legal penalties, and reputational effects have changed across the three subperiods. While legal penalties decline steadily over time, the reputational loss becomes increasingly dominant in explaining the overall market value loss associated with environmental violations. Thus, the cost of environmental violations has shifted

from heavy reliance on legal penalties and toward stakeholder-driven reputational penalties. This result indicates that, although the overall cost to violating firms has increased over time, legal penalties and reputation costs serve as substitutes in penalizing misconduct. Since 2007, legal penalties significantly understate a firm's total cost of environmental non-compliance.

4.4. Determinants of reputation effects

Reputation losses that arise from stakeholders' reactions can reflect an increase in the cost of capital and/or a decrease in cash flows. We begin our analysis of the specific channels by which stakeholder reactions operate by examining the cross-sectional determinants of firms' reputation losses using the following regression model:

$$\textit{Reputation Effect } [-10, +3]_{i,t} = \alpha_0 + \alpha_1 \textit{Ln (Penalty Amount)}_{i,t} + \alpha_2 X_{i,t-1} + \alpha_3 P_{i,t} + \alpha_4 K_{i,t-1} + \textit{Industry } FE_i + u_{i,t} \quad (5)$$

Here, i denotes the firm and t denotes the year-quarter of the firm's settlement date. *Ln* (*Penalty Amount*)$_{i,t}$ is the logarithm of the settlement amount for each environmental violation. $X_{i,t-1}$ includes two firm characteristics that reflect the ESG-orientation of the firm's investors and other stakeholders. To measure the ESG-orientation of a firm's investors, *SRI ownership* measures the share ownership by SRI investors. As described in Appendix C, an institutional investor is classified as an SRI investor if its portfolio's value-weighted ESG score is in the top decile among all institutional investors in Refinitiv's 13F filings for a given fiscal quarter. To measure the ESG-orientation of the firm's other stakeholders, we include a measure of the social capital of the county in which the firm's headquarters are located. The social capital measure follows that in Jha and Chen (2015) and uses data from the Northeast Regional Center for Rural Development. This variable is based on evidence that individuals' ESG concerns are positively related to their communities' social capital.[7]

[7] See Choy, Koci, and Wang (2023), Marbuah (2019), Hoi, Wu, and Zhang (2018), and Torgler and Garciá-Valiñas (2007). Many customers and employees do not live near the firm's headquarters, so *Social capital* is a noisy measure of all customers' and employees' social capital.

Appendix C presents definitions of the other right-hand side variables used to estimate equation (5). $P_{i,t}$ is a vector of violation characteristics denoting the type of harm, form of penalty, and action type, and $K_{i,t-1}$ represents firm-level control variables, including firm size, leverage, market-to-book ratio, return on assets, dividend payout ratio, institutional ownership, the CEO's political affiliation, the amount of firm-related media coverage, and a measure of the disaster-related vulnerability of peer firms located in the same region. All firm-level variables are measured as of the end of the quarter immediately preceding the first public news event about the violation. We also include industry fixed effects, and standard errors are clustered at the industry level.

Environmental violations are heavily represented in certain industries, most notably oil, electricity, and gas. So, the cross-sectional dispersion in abnormal returns may partly reflect industry-level variation in the frequency of violations, indicating a heteroskedasticity issue.[8] Accordingly, we estimate equation (5) using weighted least squares (WLS), assigning weights equal to the square root of each industry's violation frequency. The WLS results are reported in Table 4.

[Insert Table 4 about here]

Columns (1) and (3) of Table 4 report baseline regressions using the reputation loss measured over event days [–10, +3] and [–3, +3], respectively. Negative coefficients indicate that the characteristic is associated with a larger reputation loss. The results indicate that, in the cross-section, the reputation loss is positively related to the amount of the legal penalty, firm financial performance as measured by ROA, and the firm's dividend payout ratio. Reputation losses are relatively large when the environmental violation is associated with a disaster declaration and – in column (3) – when the firm receives a lot of media coverage.

Our key variables of interest, however, are those that plausibly reflect the firms' stakeholders' concern about environmental performance. The coefficients on *SRI ownership* are negative and significant (coefficient = –0.207 with *t*-statistic = –2.00 in column (1); coefficient = –0.204 with *t*-statistic = –3.18 in

[8] To test for heteroskedasticity, we regress the absolute residuals from the OLS estimation of equation (5) on the square root of the inverse of each NAICS industry's violation frequency. The results provide evidence of heteroscedasticity, as the *t*-statistic of the square root of the inverse of the frequency variable is 1.78.

column (3)), implying that, in the cross-section, reputation losses increase with the percentage of shares held by SRI investors. Similarly, the coefficients on *Social capital* are negative and significant, indicating that the reputational loss is larger for firms that are headquartered in high-social-capital counties.

Columns (2) and (4) of Table 4 report results when we interact *SRI ownership* and *Social capital* with the period indicators defined earlier. In both columns, neither *SRI ownership* nor *Social capital* is significantly related to the reputation loss. The effects of both, however, become significant and increase monotonically in the 2007-2016 and 2017-2021 periods. Furthermore, the subperiod dummy variables are statistically insignificant in both regressions. These results indicate that the secular increase in reputation losses for environmental violations reflects the direct influence of SRI institutional shareholders and the social capital of the firm's local community over time. These results present preliminary evidence that the reputation losses are associated with stakeholder pressure.

5. Direct tests of stakeholder reactions and pressure

5.1. Investor reactions to environmental violations

As Heinkel et al. (2001) show, environmentally motivated investors may tilt their holdings toward environmentally friendly firms, decreasing demand for brown firms' shares and increasing their costs of capital. Firms that are penalized for environmental violations are obvious candidates to be excluded from ESG-oriented investors' portfolios. In this section, we implement a stacked difference-in-differences (DiD) design (Baker, Larcker, and Wang, 2022) to test whether violating firms experience an increase in the cost of capital and a decrease in shareholdings by ESG-oriented institutional investors. The results from Section 4 indicate that reputation losses become economically important after 2006, so we restrict the sample to the subset of 404 cases that have 2007–2021 settlement dates. The DiD tests employ data from 20 quarters before treatment through 20 quarters after treatment. In Appendix N, we test the robustness of our results by excluding violations whose *[−20, +20]* quarter estimation window overlaps with that of another

violation by the same firm. In Appendix O, we further restrict the sample to each firm's first violation only. The results are robust to both restrictions.

For each violation settlement date in our sample, we denote by *t* the corresponding year-quarter and construct cohorts of treated and control firms over the interval [$t - 20, t + 20$] quarters. (Appendix M shows that the results are similar using shorter windows of [$t-16, t+16$], and [$t-12, t+12$] quarters.) Control firms are selected using a propensity score matching (PSM) procedure that is described in Appendix D and that identifies otherwise similar firms that do not have environmental violations. The cohort-specific panels are then stacked, and we include *Cohort*×*Firm* and *Cohort*×*Year* fixed effects and cluster standard errors at the *Cohort*×*Firm*×*Year* level.

In the stacked DiD tests, *Treat* equals one for violating firms and zero for matched control firms. *Post* equals one for quarters after the settlement announcement and zero otherwise. We measure each firm's cost of equity capital, k_E, for each quarter using Li and Mohanram's (2014) residual income model.

Column 1 of Table 5 reports the baseline results. The coefficient for the interaction term *Treat*×*Post* is positive and statistically significant (β_1 = 0.028, *t*-statistic = 3.30), indicating that, on average, violating firms' cost of capital increases in the quarters following their violation settlement dates.

[Insert Table 5 about here]

Previous research indicates that investor-motived effects on a violating firm's cost of capital are most likely when a substantial fraction of the firm's investors care about the environment (e.g., see Heinkel et al., 2001). To examine this prediction, columns (2) and (3) of Table 5 report on tests that examine the influence of the firm's shareholder base on its change in the cost of capital. *Low SRI ownership* refers to violation firms with ESG-institutional shareholdings below the median level, and *High SRI ownership* refers to violation firms with higher than median holdings by ESG-oriented institutional shareholders. For violating firms with relatively low *SRI ownership*, the coefficient for *Treat*×*Post* is 0.010 and statistically insignificant. Among firms with high *SRI ownership,* the coefficient for *Treat*×*Post* is positive and statistically significant (β_1 = 0.029, *t* = 2.87). This result indicates that the overall increase in the cost of

capital for violating firms is larger among firms with a high proportion of ESG investors, though the cross-group difference is not statistically significant.

Columns (4) and (5) of Table 5 further compare firms located in high versus low social capital regions. If investors reflect home bias in their portfolios, a firm's shareholder base will be tilted toward investors who are influenced by the social norms of the community in which the firm is located. Consistent with this conjecture, the coefficient on *Treat×Post* is positive and significant in both subsamples but is considerably larger among firms in high social capital areas (0.036, $t = 3.57$) than in low social capital areas (0.010, $t = 0.64$). This result is consistent with arguments that corporate responsibility and environmental stewardship are more salient norms in areas with high measures of social capital (e.g., see Barnett and Pollock, 2012; King and Whetten, 2008; Love and Kraatz, 2017).

Figure 2 reports event-time estimates from the stacked DiD specification. Panel A presents estimates for the full sample. The pre-treatment coefficients are small and statistically indistinguishable from zero, supporting the parallel trends assumption. Following the settlement date, the point estimates shift upward and remain consistently positive, with the largest effects at two to three years after settlement. Panels B-1 and B-2 split the sample by *SRI ownership* and *Social capital*, respectively. The post-treatment increase tends to be larger among firms with high SRI ownership and firms in high social capital areas, consistent with the baseline results in Table 5. The individual event-time coefficients in the subgroup panels are based on smaller samples and have lower *t*-statistics, but the directional pattern is consistent across both *SRI ownership* and *Social capital*.

The literature on impact investing also implies that the channel by which a polluting firm's cost of capital increases is that SRI-motivated investors sell their shares. We examine this prediction by measuring whether ESG-oriented institutional investors reduce their shareholdings in firms that violate environmental standards. We implement a stacked DiD design similar to the test of the cost of capital, again using each firm's settlement date as the shock. *SRI Investor* is an indicator variable equal to one if an institutional investor's portfolio-value-weighted ESG score is in the top decile of all institutions in a given fiscal quarter.

(As reported in Appendix C, ESG scores are the normalized "E," "S," and "G" ratings from MSCI, Refinitiv, Trucost, and Sustainalytics.)

We use two dependent variables. *Shares Allocation of Institutional Holdings* is the fraction of an institution's total shares across all equity holdings that is allocated to a given firm in each quarter. *Portfolio allocation of institutional holdings* is the fraction of a firm's equity value relative to the total equity value held by a given institution in each quarter. The final DiD sample consists of 3,998,020 institution-firm-quarter-cohort observations during the 2007–2021 period.

[Insert Table 6 about here]

Columns (1) and (2) in Table 6 show that the coefficient on the triple interaction *SRI Investor* × *Treat* × *Post* is negative and statistically significant for both measures (−0.030, $t = -3.41$ for shares allocation; −0.079, $t = -7.10$ for value allocation). This evidence indicates that SRI investors reduce both their share counts and the value of their holdings in violating firms after environmental violation settlements. The result based on shares allocation rules out the possibility that the decline in value allocation is driven mechanically by the post-violation stock price decline. These results provide further support for a disciplining effect via an investor channel, as suggested by theoretical models of impact investing (e.g., see Heinkel et al., 2001).

Appendix E reports additional evidence that supports this inference. In the cross-section, a firm's reputation loss is positively related to the subsequent increase in its cost of capital. Taken together, these results support the inference that violating firms experience significant decreases in firm value because their ESG investors divest their holdings, raising the cost of capital. This evidence of a reputation loss indicates that investors' reactions work to discipline environmental violators, thus internalizing the environmental costs over and above the effects of any legal penalties.

5.2. Customer and employee reactions to environmental violations

In addition to investors, customers and employees also can react in ways that impose costs on firms that harm the environment. As a prominent example, British Petroleum experienced customer boycotts and

a decrease in sales at its branded gasoline stations following its Deepwater Horizon oil spill in 2010 (see Barrage, Chyn, and Hastings, 2020). Volkswagen's sales decreased following its 2015 "dieselgate" scandal in which Volkswagen was discovered to have fraudulently programmed its diesel cars to pass emissions tests (Bachmann, Ehrlich, Fan, and Ruzic, 2023). Other examples include a 2010 boycott of Nestlé over its alleged connections to rainforest destruction in its palm-oil supply chain, a boycott of Coca-Cola in the early 2000s over its alleged contribution to groundwater depletion and contamination in India, and a consumer boycott of Exxon following its 1989 Exxon Valdez oil spill.

Similarly, at least some firms have been subject to employee backlash for their (alleged) environmental harms. In 2019, a large group of Amazon employees denounced the firm's ties to fossil fuel interests, demanded the company adopt a stronger climate action plan, and staged a walkout. As another example, more than 1,000 Google employees signed a letter urging a stronger company climate action plan and urging Google to drop contracts with intensive greenhouse gas-emitting firms. The effects of employee backlash are less direct than losing customers and sales, but employees' environmental concerns could increase employee turnover and decrease productivity in ways that increase the firm's labor costs.

If customer or employee backlash to firms' environmental violations is an important channel by which firms experience reputation losses, we should observe that violating firms experience a decrease in sales and/or an increase in labor costs. To test whether violating firms' reputation losses occur via customer and employee reactions, we measure changes in violating firms' sales and labor costs in a stacked DiD model comparing the violating firms to control firms that are selected using the PSM procedure that is described in Appendix D. Sales data are obtained from Compustat, and we measure labor costs using the approach of Donangelo et al. (2019), which extrapolates staff expenses as the product of the industry-year staff expense per employee and the firm-year total employment. [9] While sales data are available quarterly, labor-cost data are available only annually. Accordingly, the DiD tests for sales in Table 7 use quarterly

[9] We note that this labor cost measure is not directly observed but extrapolated using industry-level staff expense per employee and firm-level total employment. It captures changes in workforce size and industry-level wage dynamics but may not fully reflect firm-specific wage adjustments.

data, whereas those for labor costs use annual data. The stacked DiD specification includes *Cohort×Firm* and *Cohort×Year* fixed effects, which absorb most of the variation in the dependent variables and result in high R^2 values. The high R^2 value is common in stacked DiD estimation with high-dimensional fixed effects (e.g., Bonsall et al., 2025; Wing, Freedman, and Hollingsworth, 2024) and does not indicate model overfitting. This is particularly pronounced for the labor-cost model, which has fewer time periods per cohort.

[Insert Table 7 about here]

The results are reported in Panel A of Table 7. In column (1), the coefficient for *Treat×Post* is –0.031 with a *t*-statistic of –2.52, indicating that, on average, violating firms' sales decreased after their violation settlements by approximately 3.1 percentage points relative to the matched control firms. In column (2), the coefficient for *Treat×Post* is 0.239 with a *t*-statistic of 3.25. This indicates that violating firms' labor costs increased significantly after their violation settlements compared to the control firms.

These tests are not perfectly identified, as the decreases in sales and increases in labor costs could reflect a general decrease in these firms' financial health that is correlated with their environmental violations. Still, the results are consistent with the evidence that these firms' reputation losses are attributable, in part, to changes in their stakeholders' willingness to do business with violating firms.

Panel B examines heterogeneity by SRI ownership. The decline in sales following environmental violations is concentrated among firms with high SRI ownership. In column (2), the coefficient on *Treat* × *Post* is –0.104 (t = –4.49), while the corresponding estimate for firms with low SRI ownership is small and insignificant. In contrast, the effects on labor costs do not differ significantly across the two groups.

Panel C examines heterogeneity by local social capital. The decline in sales is concentrated among firms located in high social capital areas (−0.062, t = −2.84), while the coefficient for firms in low social capital areas is small and insignificant. The difference between the two subsamples is significant. The effects on labor costs do not differ significantly across the two social capital groups. The lack of significant heterogeneity in labor costs may reflect limited statistical power rather than the absence of a differential

effect, as the annual frequency of labor cost data substantially reduces the number of observations available for the stacked DiD design in subgroup regressions.

Appendix F reports the dynamic event-time estimates from the stacked DiD specification for sales and labor costs. The pre-treatment coefficients are close to zero in both panels, supporting the parallel trends assumption. The post-treatment estimates show a progressive decline in sales and a progressive increase in labor costs, consistent with the results in Table 7. These results indicate that stakeholder responses via the customer channel are stronger in environments with greater social norms around environmental responsibility.

5.3. Supply chain reactions to environmental violations

In this section we examine the reactions of a subset of stakeholders – corporate customers – using data that permits better identification. In particular, we examine terminations in violating firms' trading relationships with other firms using annual data in a stacked DiD regression framework. As before, we define treatment as occurring on the settlement date and use data from the 404 cases settled from 2007-2021.

For each supplier violation, we define t as the year a penalty settlement is announced. We use annual data in this test because supply chain data from FactSet Revere is available at an annual frequency. We then construct cohorts of treated and control trade relationships within the interval $[t - n, t + n]$ (where n ranges from 1 to 4 years) surrounding the violation. The treated sample in any given cohort consists of supplier-customer relationships where suppliers face penalties for environmental violations in year t. Conversely, the control sample comprises trade relationships between affected customers and their other suppliers who were not penalized during the sample period.

Our main stacked panel aggregates observations at the customer-supplier-cohort-year level. We estimate the model as follows:

$$Customer\ Decouple_{i,j,c,t} = \beta_0 + \beta_1 Treat\ Supp_{j,c} \times Post_{c,t} + \beta_2 Post_{c,t} + \beta_3 X_{i,t-1} + \gamma_{i,j,c} + \tau_{i,c} + \epsilon_{i,j,c,t} \quad (6)$$

where i, j, c, and t denote customers, suppliers, cohorts, and years, respectively. $Customer\ Decouple_{i,j,c,t}$ is a binary measure indicating the existence of a trade relationship between customer i and supplier j in year t, set to one if decoupled and zero otherwise; $Treat\ Supp_{j,c}$ indicates suppliers with a penalty announcement in cohort c; $Post_{c,t}$ denotes years following the event year t in cohort c; $X_{i,t-1}$ includes customer-specific lagged characteristics; $\gamma_{i,j,c}$ and $\tau_{i,c}$ are fixed effects for *Cohort*×*Relationship* and *Cohort*×*Customer*, respectively, allowing us to control for trade variation over time within relationships and across cohorts. Since the year fixed effect is absorbed by these fixed effects, we remove it from the model. We cluster standard errors at the relationship-year level to address concerns about serial correlation. The results are presented in Table 8.

[Insert Table 8 about here]

Panel A of Table 8 shows that the coefficient β_l is positive and significant within the time windows from [–1, +1] and [–4, +4], indicating an increased likelihood of customers severing ties with violating firms after their penalty announcements are made. These results indicate that firms that are revealed to have engaged in environmental violations are more likely to lose customers in the ensuing four years.

It is reasonable to expect that corporate customers' concerns about the violating firm's behavior will be related to the extent to which their own stakeholders have ESG concerns. Panel B of Table 8 reports on tests that examine the mediating effects of the customer firms' SRI investors. The point estimates indicate that customer firms with higher levels of SRI ownership are more likely to terminate relationships with violating supplier firms in most windows, while the corresponding coefficients for low-SRI customer firms are smaller and in some windows insignificant. However, the cross-group differences are not statistically significant in these windows. Panel C examines the moderating role of social capital. The decoupling effect is positive and significant for customer firms in both high and low social capital areas across most windows. The point estimates are slightly larger for high social capital firms, but the cross-group differences are again not statistically significant. Overall, these results indicate that environmental violators are more likely to lose customers, consistent with a customer channel that helps to internalize the costs of the violation. Unlike

the investor channel, where the response is concentrated among ESG-oriented institutions, the customer decoupling effect operates more broadly across the customer base.

6. Reputation rebuilding

To the extent that stakeholder pressure is salient for firms and their managers, firms that incur reputational losses from environmental violations will consider reinvesting in their environmental reputations. In this section, we investigate two ways in which firms can attempt to build their reputational capital with stakeholders: incorporating environmental and social responsibilities into corporate board committees and decreasing greenhouse gas emissions. For benchmarks, we use the same propensity-score matched firms and stacked DiD design described in Section 5 and examine changes in each of these metrics in the five years before and after the settlement of environmental violations. As in Section 5, the high-dimensional fixed effects structure results in high R^2 values, particularly for the annual-frequency GHG variables.

[Insert Table 9 about here]

Table 9 summarizes the results. Column (1) of Panel A reports that, in the post-violation period, violating firms are more likely to incorporate E&S responsibilities into their board committees (0.042, t = 3.27). Column (2) shows that greenhouse gas emissions are significantly lower among violating firms following their violation settlements (−0.236, t = −2.02). Taken together, these results indicate that violating firms tend to respond to environmental violations by strengthening board-level environmental oversight and reducing their emissions. Such changes are consistent with the prospect of both legal and reputation penalties for future environmental violations. The evidence that legal penalties are relatively small and decreasing, while reputation losses are relatively large and increasing (e.g., see Figure 1), suggests that violating firms invest in their environmental performance because the consequences of stakeholder pressure are significant and meaningful.

Panels B and C of Table 9 show that many of these changes are most pronounced among firms whose key stakeholders value environmental performance. In Panel B, violating firms with high ESG-oriented

institutional ownership are more likely to establish E&S board committees (0.043, $t = 2.23$) and exhibit larger reductions in GHG emissions (−0.320, $t = -2.69$). Panel C shows a similar pattern among firms headquartered in high-social-capital counties: the establishment of E&S committees is significant only among high-social-capital firms (0.082, $t = 3.54$), and GHG emission reductions are concentrated among high social capital firms (−0.307, $t = -2.18$). The cross-group differences are directionally consistent with the stakeholder pressure hypothesis ($p = 0.08$ and $p = 0.09$, respectively). The cross-group difference for E&S Committee is highly significant ($p < 0.01$), while the difference for GHG Emission is directionally consistent but not statistically significant ($p = 0.50$). The limited statistical power in the low-social-capital subgroup, due to the annual frequency of GHG data and limited residual degrees of freedom, may contribute to the imprecision of the GHG cross-group comparison.

In addition, we report in Appendix G the dynamic event-time estimates from the stacked DiD specification for ES Committee and GHG Emission. The pre-treatment coefficients are close to zero across all panels, supporting the parallel trends assumption. Overall, the results suggest that firms find it optimal to reinvest in environmental reputation when their investor base or local community places value on environmental responsibility. These results are consistent with our earlier evidence that reputational losses from stakeholder pressure have become substantial, motivating better environmental performance.

Finally, we test whether it is reputational losses rather than legal penalties that drive these internal adjustments. We classify violation cases separately by (i) total market value impact, (ii) inferred reputation effect, and (iii) severity of legal penalties (definitions follow Appendix I). We then interact these indicators with *Post* and compare the coefficient magnitudes across groups. Appendix H shows that reputation-building responses are significantly larger among firms experiencing greater reputational losses and larger stock price declines. Moreover, when legal penalties are smaller, reputation-building is stronger, which is consistent with reputational sanctions acting as a substitute for legal penalties. When regulators and courts impose weaker sanctions, market-based discipline becomes more important.

Collectively, these findings support the interpretation that firms actively rebuild environmental reputation when the market assigns a meaningful reputational cost to misconduct, particularly when that cost is amplified by ESG-conscious stakeholders.

7. Robustness tests

7.1. Reputational effects by penalty severity and event type

News about many violations in the sample is spread over multiple discrete announcements, raising questions about how best to measure the share value loss from the violation and its associated penalties. Our main tests aggregate the share price reactions from all discrete news events that we can identify from the Violation Tracker and Factiva databases. Other than selecting substantial violations that receive legal penalties of at least $1 million, we also do not distinguish between relatively large or small penalty violations. Appendices I and J report tests that examine whether the results are sensitive to this approach.

For example, Panel A of Appendix I presents the mean share value effect, legal penalty, and reputation loss for two subgroups partitioned by the ratio of the legal penalty to the firm's market value. For cases in which the legal penalties are smaller than 0.05% of the firm's market value, reputational losses dominate legal sanctions. For example, the mean reputation effect is –1.26% in the [–10, +3] window and –0.99% in the [–3, +3] window, almost fifty times larger than the average *penalty-to-market value* of –0.02%.

Panel B focuses on the 581 cases for which settlement dates are available. The average *penalty-to-market value* ratio at settlement is –0.99%. The mean cumulative abnormal return is –1.93% for [–10, +3] and –1.12% for the period [–3, +3]. These statistics also reveal that the overall reputational effect during the period [–10, +3] is –0.94% on average and is statistically significant. The reputation effect during the period [–3, +3] is –0.13%, which is insignificant, and may be attributed to potential information leakage before the official settlement date.

Panel C of Appendix I shows the market's reaction to the first public revelation of environmental violation cases, which represent 521 first-revealing dates. The average penalty-to-market value effect is –

0.94%, with a corresponding mean cumulative abnormal return of –1.79% during the [–10, +3] window. The mean reputational effect during the [–10, +3] period is –0.85%, and during the [–3, +3] period, it is –0.23%. Most of these reputational losses are economically smaller than those on settlement dates, suggesting that settlement dates contain meaningful information about the magnitude of the violation and penalties.

Since information leakage is normally less of a concern on the initial revelation dates, we supplement our analysis by examining market reactions over the [–1, +1] and [0, +1] windows around the first event date available for each case, as reported in Panel D of Appendix I. The results show an immediate and significant negative market response to the initial revelation of environmental violations.

Previous findings suggest that the reputational losses associated with environmental violations intensify at settlement dates; therefore, we next examine whether these findings on the determinants of reputational losses of environmental violations remain valid at the legal stage of settlement events. Appendix J repeats this analysis for 581 settlement-date events, where the reputation effect is calculated as the difference between the cumulative abnormal returns at the settlement date, *Event CAR* around the [–10, +3] and [3, +3] windows, and the ratio of *penalty-to-market value*. The results in Appendix J show that the pattern of reputational losses surrounding settlements closely mirrors our baseline findings in Table 4, which indicate that ESG-conscious stakeholders exert progressively greater market-based discipline on environmental violations over time. Results are also robust to including the four extreme cases (top 1% by penalty amount) that are excluded from the baseline sample. Appendix K reports that the pattern of reputation losses across subperiods is similar when these cases are included.

7.2. Placebo tests

To further validate our main findings, we conduct in-space placebo tests that randomly assign treatment status to non-violating firms while retaining the original treatment timing structure. We re-estimate the baseline DiD specification for each random assignment and repeat the procedure to generate an empirical distribution of placebo treatment effects.

Appendix L reports the results for six outcome variables: cost of capital, sales, labor costs, ES Committee, GHG Emission, and GHG Cost. In each panel, the solid vertical line indicates the estimated treatment effect from our true sample, and the dashed vertical line indicates the placebo distribution's mean. If our baseline results reflect the impact of environmental violations rather than chance or unobserved confounders, the actual treatment effect should fall in the tail of the placebo distribution.

Panel A shows that the actual cost-of-capital effect lies in the right tail of the placebo distribution, indicating that the observed increase in violating firms' cost of capital is unlikely to arise from random treatment assignment. Panel B shows that the actual sales effect lies in the left tail, consistent with a decline in sales following environmental violations. Panel C shows that the actual labor cost effect lies in the right tail, consistent with a real increase in labor costs for violating firms. Panels D through F show that the actual treatment effects for ES Committee, GHG Emission, and GHG Cost also lie in the tails of their respective placebo distributions, consistent with the reputation-rebuilding responses documented in Table 9.

7.3. Alternative event windows

Our baseline DiD tests use a [–20, +20] quarter window around each penalty announcement date. To ensure that our results are not sensitive to the choice of event window, we re-estimate the main specifications using narrower windows of [–12, +12] and [–16, +16] quarters. Appendix M reports the results. Across all four outcome variables, the results are robust to the alternative windows. The cost of capital increases for violating firms relative to controls, with the *Treat*×*Post* coefficient positive and significant in both windows. ESG-oriented institutional investors continue to reduce their portfolio allocations to violating firms, as the triple-interaction term *ESG Investor*×*Treat*×*Post* remains negative and highly significant across all specifications. Violating firms experience a significant decline in sales in both windows, with point estimates comparable in magnitude to those in the baseline specification. The increase in labor costs is positive in both windows, with the coefficient marginally significant in the [–4, +4] window.

7.4. Alternative sample restrictions

Our main DiD tests include all post-2006 violations in the sample. In Appendices N and O, we test the robustness of our results to two alternative sample restrictions designed to address potential concerns about overlapping treatment windows for firms with multiple violations.

Appendix N excludes any violation whose *[−20, +20]* quarter estimation window overlaps with that of another violation by the same firm. This restriction ensures that the pre- and post-treatment periods for each violation are not contaminated by the treatment effects of adjacent violations. Panel A reports that the cost-of-capital increase remains positive and highly significant (0.038, t = 3.92), with the effect concentrated among firms with high SRI ownership (0.038, t = 3.61) and high social capital (0.049, t = 3.79). Panel B confirms that SRI investors differentially reduce both their share counts (−0.035, t = −3.93) and the value of their holdings (−0.095, t = −8.30) in violating firms. Panel C shows a significant decline in sales (−0.047, t = −3.51), with the sales decline concentrated among firms with high SRI ownership (−0.091, t = −5.67, Chow $p < 0.01$ in Panel D). Labor cost results are positive but insignificant in this restricted sample.

Appendix O further restricts the sample to each firm's first violation only. The results are similar: the full-sample cost-of-capital increase is 0.042 (t = 3.81), SRI investors reduce their holdings (−0.042, t = −4.25 for shares; −0.094, t = −7.54 for value), and sales decline by 5.3% (t = −3.64). The SRI ownership Chow test for COC is marginally significant (p = 0.07) in this specification. Overall, the results are robust to both alternative sample restrictions.

8. Conclusion

A fundamental tenet of the ESG and sustainable investment movements is that stakeholders can influence firms' environmental performance via their private investment and purchase decisions. Previous findings undermine this tenet, as they show that firms that are penalized for environmental violations experience negligible stakeholder-related reputation losses. Such findings, however, are drawn from dated samples. More recent increases in ESG concerns and SRI fund flows suggest that stakeholder pressure could now be more salient and effective than in the past.

To explore this possibility, we investigate the consequences to publicly traded companies that faced legal and regulatory penalties of at least $1 million from 2000-2021. We find evidence of a significant shift in the effectiveness of stakeholder pressure. Consistent with previous results, violating firms before 2007 have only negligible reputation losses. Since 2007, in contrast, the reputation losses for environmental violations are statistically significant, economically large, and increasing over time. These losses come via investor, customer, and employee channels, as violating firms' costs of capital increase, sales decrease, and labor costs increase. Evidence of an investor channel is particularly strong, as violating firms in the post-2006 period experience a loss of ESG-oriented institutional investors and a corresponding increase in the cost of capital that is correlated with the firm's reputation losses. These effects are concentrated among firms whose investors and local communities place value on environmental performance, consistent with theoretical models of impact investing in which the cost-of-capital channel operates selectively through ESG-oriented stakeholders.

Our findings indicate that market-based stakeholder pressure reached critical mass during the 2000s to effectively impose costs on polluting firms, thereby forcing firms to internalize a greater portion of their environmental harms. This switching of costs – from externalized to internalized – represents a major shift in the economics of pollution control and abatement, as firms increasingly face market discipline for environmental harm.

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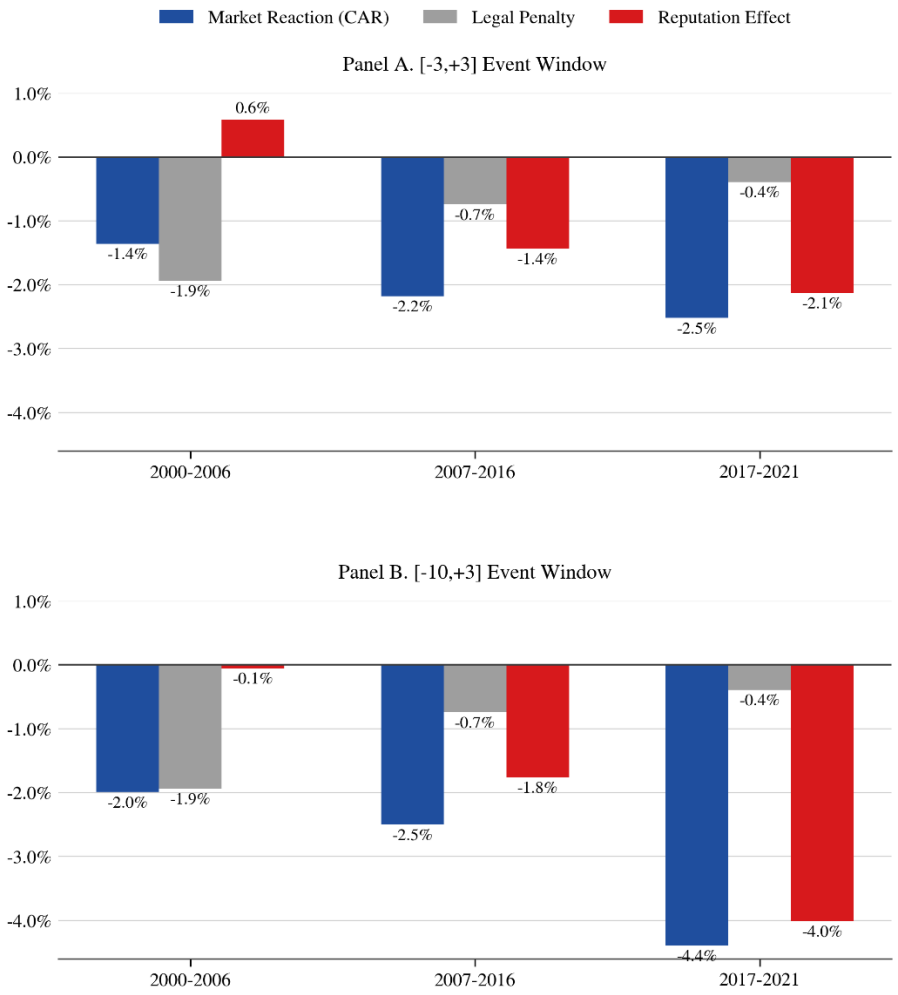
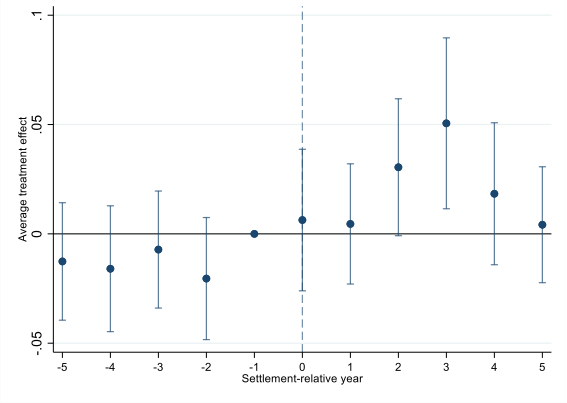
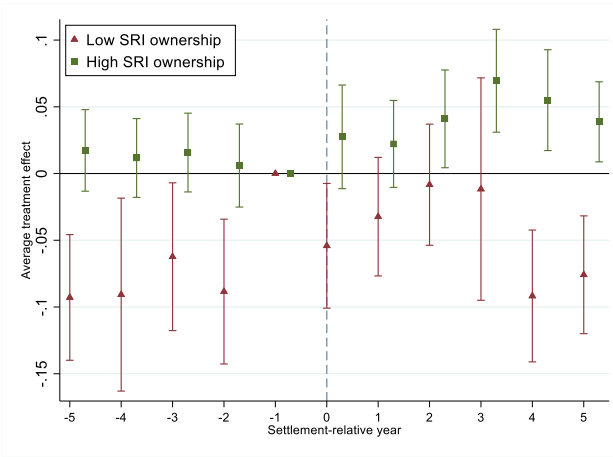


Figure 1. Reputational effects of environmental violations. This figure illustrates the decomposition of the market reaction to environmental violations for a sample of 596 cases. The total market reaction is measured as the cumulative abnormal return (CAR) around legal proceedings and is decomposed into a legal penalty component and a reputational effect. The reputational effect is defined as the accumulated abnormal return minus the Penalty-to-Market-Value ratio. Market value is measured as the firm's equity market capitalization at the end of the month preceding the first retained event date for each case after sample filtration. Panel A reports the decomposition using the [-10, +3] event window, and Panel B reports the decomposition using the [-3, +3] event window. The figure presents mean values for three subperiods: 2000–2006, 2007–2016, and 2017–2021. These periods correspond to major developments in global ESG investing, including the launch of the United Nations Principles for Responsible Investment (UNPRI) in 2006 and the entry into force of the Paris Agreement in 2016.

Panel A. Full sample



Panel B-1. By SRI ownership



Panel B-2. By social capital

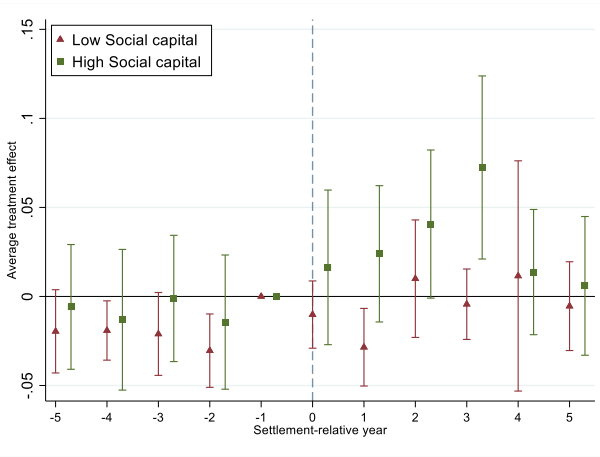


Figure 2. Dynamic effects of environmental violations on firms' cost of capital. This figure reports event-time estimates of the impact of environmental violation settlements on firms' cost of equity capital, estimated using the Li and Mohanram (2014) implied cost-of-capital model. The horizontal axis measures time in years relative to the settlement year ($t = 0$), and the vertical axis reports the estimated average treatment effect. Panel A presents estimates for the full sample. Panels B-1 and B-2 split the sample by SRI ownership and social capital, respectively. All estimates are from a stacked difference-in-differences specification with Cohort×Firm and Cohort×Year fixed effects. Control firms are drawn exclusively from never-treated firms. The dashed vertical line indicates the settlement year. Points represent estimated treatment effects in each event year, and vertical bars denote 95% confidence intervals based on standard errors clustered at the Cohort×Firm×Year level. The estimation uses quarterly data over a [−20, +20] quarter window; event-time coefficients are aggregated to annual bins for visual clarity.

Table 1: Sample selection

This table reports the sample construction process. The baseline sample consists of environmental violation cases from the Violation Tracker database between 2000 and 2021 involving publicly traded firms with legal penalties exceeding $1 million. News coverage of these violations is identified using the Factiva database. Many violation cases are associated with multiple news articles; however, for 314 cases the only identified news event corresponds to the announcement of the settlement and penalty.

	Number of cases	Number of unique news event days
Environmental violation cases from Violation Tracker from (2000 - 2021)	718	2,189
Less:		
Duplicate or multiple legal proceedings on the same date for the same firm	(37)	(50)
Event dates with significant confounding announcements (M&As, earnings announcements, equity offerings, debt issuance, and dividend payments)	(23)	(155)
Extreme event cases	(4)	(11)
Missing values in required variables	(58)	(403)
Final sample	596	1,570

Table 2: Sample distribution

This table reports the average penalty amounts (in millions of USD) for several characteristics of the 596 environmental violation cases from 2000-2021 that constitute our sample. Mean and median penalty amounts are presented for each category; the number of cases in each category appears in parentheses. "Miscellaneous Environmental Harm" refers to cases involving multiple or ambiguous types of environmental harm. "Civil Penalties Only" refers to cases in which the settlement consists solely of civil fines. "Miscellaneous Penalties" refer to cases involving other or mixed forms of financial sanctions, including settlement costs, compliance or remediation payments, mixed fines and other payments, or penalties that cannot be clearly classified. Variable definitions are provided in Appendix C.

Classifications	Penalty amount (millions USD)	
	Mean	Median
Panel A: Action type		
Agency action (546)	37.58	3.95
Private litigation (50)	74.38	14.75
Panel B: Level of government		
State and local government (232)	31.69	4.00
Federal government (364)	46.39	5.00
Panel C: Type of environmental harm		
Air pollution (201)	54.45	4.00
Water contamination (145)	44.82	5.30
Hazardous waste (37)	35.44	3.80
Miscellaneous environmental harm (213)	25.75	4.34
Panel D: Type of legal penalties		
Civil penalties only (303)	37.80	4.00
Miscellaneous penalties (293)	43.63	5.14

Table 3: Share value and reputational effects of environmental violations

This table summarizes the reputational effects associated with 596 environmental violation cases. Panel A reports the mean accumulated abnormal returns across all legal-proceeding event dates for each violation, as well as the resulting reputational effect, computed over the [-10, +3] and [-3, +3] windows. The reputational effect is defined as the accumulated abnormal return (row 1) minus the Penalty-to-Market-Value ratio (row 3). Market value is measured as the firm's equity market capitalization at the end of the month preceding the first event date retained after sample filtration for each case. Panel B presents the evolution of reputational effects over three periods: 2000-2006, 2007-2016, and 2017-2021. For each subperiod, mean accumulated abnormal returns and reputational effects are reported for the [-10, +3] and [-3, +3] windows, along with their associated *t*-statistics. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Full sample

Variables	[-10, +3] Window	[-3, +3] Window
Mean Accumulated_CAR	-2.73%***	-1.97%***
Accumulated_CAR *t*-statistic	t = -4.84	t = -5.10
Mean penalty-to-market value (-1)	-1.07%	-1.07%
Mean Reputation Effect (row 1-row 3)	-1.66%***	-0.90%**
Mean Reputation Effect *t*-statistic	t = -2.93	t = -2.25

Panel B: Subsample periods

Time period	Variables	[-10, +3] Window	[-3, +3] Window
2000-2006	Mean Accumulated_CAR	-1.99%*	-1.36%*
	Accumulated_CAR *t*-statistic	t = -1.95	t = -1.97
	Mean penalty-to-market value (-1)	-1.94%	-1.94%
	Mean Reputation Effect (row 1-row 3)	-0.05%	0.58%
	Mean Reputation Effect *t*-statistic	t = -0.05	t = 0.79
2007-2016	Mean Accumulated_CAR	-2.50%***	-2.18%***
	Accumulated_CAR *t*-statistic	t = -3.21	t = -4.03
	Mean penalty-to-market value (-1)	-0.74%	-0.74%
	Mean Reputation Effect (row 1-row 3)	-1.76%**	-1.44%***
	Mean Reputation Effect *t*-statistic	t = -2.29	t = -2.66
2017-2021	Mean Accumulated_CAR	-4.40%***	-2.52%***
	Accumulated_CAR *t*-statistic	t = -3.39	t = -2.77
	Mean penalty-to-market value (-1)	-0.39%	-0.39%
	Mean Reputation Effect (row 1-row 3)	-4.01%***	-2.13%**
	Mean Reputation Effect *t*-statistic	t = -3.07	t = -2.33

Panel C: Differences across periods

	Mean Accumulated_CAR		Mean Penalty-to-Market Value	Mean Reputation Effect	
	[-10, +3] Window	[-3, +3] Window		[-10, +3] Window	[-3, +3] Window
Difference between 2000-2006 and 2007-2016	0.50% t = 0.39	0.82% t = 0.94	-1.21%*** t = -3.14	1.71% t = 1.35	2.03%** t = 2.26
Difference between 2007-2016 and 2017-2021	1.90% t = 1.31	0.34% t = 0.33	-0.34% t = -1.41	2.25% t = 1.56	0.68% t = 0.68
Difference between 2000-2006 and 2017-2021	2.40% t = 1.45	1.16% t = 1.02	-1.55%*** t = -3.07	3.96%** t = 2.38	2.71%** t = 2.28

Table 4: Determinants of reputation effects

This table presents regression results examining the determinants of reputational effects for 596 environmental violation cases from 2000 to 2021. The reputational effect is defined as the accumulated abnormal returns minus the Penalty-to-Market-Value ratio, and thus negative values indicate reputation losses while positive values indicate reputation gains. Columns (1) and (3) report weighted least squares (WLS) estimates of the reputation effect measured over the [-10, +3] and [-3, +3] windows, respectively. Columns (2) and (4) include interaction terms between period indicators and *SRI ownership* as well as *Social capital*. The period indicators correspond to 2000-2006, 2007-2016, and 2017-2021. All regressions include firm-level control variables (defined in Appendix C), measured in the fiscal quarter preceding the first event date retained after sample filtration for each violation. Standard errors are clustered at the industry level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Variables	Reputation Effect [-10, +3]		Reputation Effect [-3, +3]	
SRI ownership	-0.207**		-0.204***	
	(-2.00)		(-3.18)	
Year 2000-2006×SRI ownership		0.033		0.175
		(0.10)		(0.57)
Year 2007-2016×SRI ownership		-0.089		-0.171**
		(-0.59)		(-2.14)
Year 2017-2021×SRI ownership		-0.319***		-0.403***
		(-2.70)		(-3.66)
Social capital	-0.023**		-0.019***	
	(-2.15)		(-3.67)	
Year 2000-2006×Social capital		-0.002		-0.003
		(-0.12)		(-0.25)
Year 2007-2016×Social capital		-0.019		-0.016*
		(-1.57)		(-1.88)
Year 2017-2021×Social capital		-0.029*		-0.039***
		(-1.96)		(-3.47)

Table 4 continued on next page

Table 4, continued

Control variables:				
Dedicated_IO	0.001	0.003	0.001	0.001
	(0.73)	(1.35)	(0.54)	(1.04)
Media Coverage	-0.002	-0.002	-0.004**	-0.003*
	(-0.89)	(-0.66)	(-2.02)	(-1.67)
CEO Liberalism	0.008	0.016	0.003	0.020
	(0.50)	(0.93)	(0.23)	(1.25)
Disaster Declaration	-0.002***	-0.003***	-0.002***	-0.002***
	(-3.31)	(-3.09)	(-4.15)	(-3.27)
Ln (Penalty Amount)	0.009***	0.008***	0.011***	0.010***
	(5.08)	(3.98)	(9.42)	(6.67)
Air Pollution	-0.009	-0.008	0.006	0.006
	(-0.83)	(-0.81)	(0.60)	(0.65)
Water Contamination	0.036**	0.029*	0.020**	0.017*
	(2.28)	(1.92)	(2.12)	(1.78)
Hazardous Waste	0.016	0.018	0.018**	0.017*
	(0.98)	(1.13)	(2.09)	(1.91)
Civil Penalty	0.005	0.013	0.006	0.007
	(0.45)	(1.33)	(0.65)	(0.96)
Private	-0.044	-0.042	-0.017	-0.017
	(-1.22)	(-1.24)	(-0.93)	(-0.90)
Federal	-0.001	0.000	-0.010	-0.010
	(-0.07)	(0.00)	(-0.85)	(-0.83)
Size	0.013**	0.014**	0.005	0.006
	(2.56)	(2.38)	(1.15)	(1.03)
LEV	0.051	0.065	-0.043	-0.045
	(0.61)	(1.00)	(-0.62)	(-0.68)
MTB	-0.012	-0.009	-0.002	-0.003
	(-0.70)	(-0.60)	(-0.22)	(-0.37)
ROA	1.521***	1.299***	0.644**	0.611**
	(3.89)	(4.78)	(2.21)	(2.49)
Dividend	0.012*	0.014*	0.015***	0.017***
	(1.77)	(1.89)	(4.99)	(4.48)
Year 2000-2006		0.049		0.003
		(1.33)		(0.08)
Year 2007-2016		0.021		-0.012
		(1.24)		(-0.71)
Constant	-0.206***	-0.242***	-0.084	-0.083
	(-3.32)	(-3.28)	(-1.30)	(-0.96)
Industry FE	YES	YES	YES	YES
N	596	596	596	596
R^2	0.205	0.221	0.194	0.210

Table 5: Changes in violating firms' cost of capital

This table reports the capital market consequences of environmental violations. Panel A examines changes in firms' quarterly cost of equity capital (*COC*), estimated using the Li and Mohanram (2014) implied cost of capital model. *Treat* equals one if the firm is penalized for an environmental violation, and zero otherwise. *Post* equals one for quarters following the penalty announcement, and zero otherwise. Column (1) reports result for the full sample. Columns (2) and (3) split firms into low and high SRI ownership (*SRI ownership*) groups, while columns (4) and (5) split firms into low and high social capital groups. Differences in coefficients across the subsamples are evaluated using a Chow test. All regressions include Cohort×Firm and Cohort×Year fixed effects. Standard errors are clustered at Cohort×Firm×Year levels. Variable definitions are provided in Appendix C. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent variables=COC	Full Sample	Low SRI ownership	High SRI ownership	Low Social capital	High Social capital
Treat×Post	0.028***	0.010	0.029***	0.010	0.036***
	(3.30)	(1.02)	(2.87)	(0.64)	(3.57)
Difference (Chow Test)		0.019 (p = 0.17)		0.026 (p = 0.14)	
Size	0.002	0.042**	-0.020	-0.004	-0.001
	(0.21)	(2.06)	(-1.57)	(-0.14)	(-0.05)
LEV	0.036	-0.092	0.098*	-0.023	0.079
	(0.72)	(-0.94)	(1.91)	(-0.23)	(1.41)
MTB	-0.026***	-0.015	-0.026***	-0.030***	-0.025***
	(-4.22)	(-1.51)	(-3.35)	(-2.71)	(-3.69)
ROA	-0.051	-0.139	-0.009	0.101	-0.175
	(-0.26)	(-0.28)	(-0.05)	(0.24)	(-1.04)
Dividend	0.005***	0.015***	0.003	0.007***	0.000
	(2.61)	(8.10)	(1.39)	(3.15)	(0.20)
Constant	0.030	-0.309*	0.235*	0.119	0.045
	(0.28)	(-1.69)	(1.77)	(0.45)	(0.41)
Cohort×Firm	YES	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES	YES
N	5,346	1,507	3,839	1,836	3,510
R^2	0.758	0.786	0.733	0.794	0.732

Table 6: Changes in violating firms' institutional ownership

This table examines how ESG-oriented institutional investors adjust their holdings in firms that commit environmental violations. The dependent variables, *Shares Allocation of Institutional Holdings*, is defined as the shares of institution *k*'s holdings in firm *i* divided by the total shares of all equity holdings of institution *k* in a given quarter. *Value Allocation of Institutional Holdings*, is defined as the value of institution *k*'s holdings in firm *i* divided by the total value of all equity holdings of institution *k* in a given quarter. *Treat* equals one if firm *i* is penalized for an environmental violation; *Post* equals one for quarters after the penalty announcement. *ESG Investor* equals one for institutions classified as ESG-oriented. Cohort×Institution×Firm and Cohort×Year fixed effects are included. Standard errors are clustered at the Cohort×Institution level. Variable definitions are provided in Appendix C. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
Variables	Shares Allocation of Institutional Holdings	Value Allocation of Institutional Holdings
SRI Investor×Treat×Post	-0.030***	-0.079***
	(-3.41)	(-7.10)
SRI Investor×Treat	0.074***	0.091***
	(15.03)	(17.05)
SRI Investor×Post	0.029***	0.053***
	(4.43)	(5.97)
Treat×Post	0.008	-0.034***
	(1.51)	(-6.37)
Size	0.063***	0.084***
	(14.78)	(18.95)
LEV	-0.389***	-0.292***
	(-21.74)	(-16.53)
MTB	-0.008***	0.051***
	(-6.20)	(29.54)
ROA	-0.097***	0.141***
	(-6.38)	(8.41)
Dividend	-0.000	-0.001***
	(-0.96)	(-6.11)
Constant	-0.115***	-0.306***
	(-2.64)	(-6.69)
Cohort×Year	YES	YES
Cohort×Institution×Firm	YES	YES
N	3,998,020	3,998,020
R^2	0.848	0.843

Table 7: Changes in violating firms' sales and labor costs

This table reports on changes in violating firms' sales and labor costs following their environmental violations. Panel A reports result for the full sample. Column (1) reports effects on firms' quarterly sales. Column (2) reports effects on firms' annual labor costs, measured by extrapolating staff expenses as the product of industry-year staff-expense-per-employee and firm-year total employees, following Donangelo et al. (2019). Sales data are available quarterly, so the DiD specification in column (1) is estimated at the quarterly level. Labor-cost data are available only annually, so the DiD specification in column (2) is estimated at the annual level. *Treat* equals one if the firm is involved in an environmental violation, and zero otherwise. *Post* equals one for periods after the penalty announcement. Panel B splits firms into low and high ESG institutional ownership (*SRI ownership*) groups, while Panel C splits firms into low and high social capital groups. Both Cohort×Firm and Cohort×Year fixed effects are included in all columns. Standard errors are clustered at the Cohort×Firm×Year levels. Variable definitions are provided in Appendix C. ***, **, and * indicate the statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Changes in violating firms' sales and labor costs on full sample

	(1)	(2)
Variables	Sales	Labor Cost
Treat×Post	-0.031**	0.239***
	(-2.52)	(3.25)
Size	0.503***	0.444***
	(28.88)	(3.44)
LEV	-0.091	-0.158
	(-1.27)	(-0.31)
MTB	0.101***	0.174
	(9.03)	(1.39)
ROA	0.490**	0.847
	(2.43)	(0.44)
Dividend	-0.001	-0.138*
	(-0.59)	(-1.69)
Constant	2.536***	2.303*
	(15.04)	(1.79)
Cohort×Firm	YES	YES
Cohort×Year	YES	YES
N	17,850	2,274
R^2	0.984	0.992

Table 7, continued

Panel B: Moderating role of SRI ownership

	(1)	(2)	(3)	(4)
Variables	Sales		Labor Cost	
SRI ownership classification	Low	High	Low	High
Treat×Post	0.011	-0.104***	0.194**	0.270**
	(0.75)	(-4.49)	(2.21)	(2.05)
Difference (Chow Test)	-0.115*** (p = 0.00)		0.076 (p = 0.64)	
Size	0.520***	0.449***	0.470***	0.350
	(25.00)	(15.85)	(2.93)	(1.56)
LEV	-0.030	-0.289***	-0.109	-0.577
	(-0.32)	(-3.08)	(-0.18)	(-0.65)
MTB	0.082***	0.150***	0.049	0.297
	(6.18)	(7.73)	(0.41)	(1.29)
ROA	0.645***	0.041	0.131	3.597
	(3.15)	(0.08)	(0.08)	(0.67)
Dividend	-0.003***	0.000	-0.003	-0.304
	(-2.58)	(0.05)	(-0.04)	(-1.62)
Constant	2.160***	3.503***	2.058	3.442
	(11.30)	(11.81)	(1.40)	(1.38)
Cohort×Firm	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES
N	11,441	6,409	1,485	789
R^2	0.984	0.976	0.995	0.985

Table 7, continued

Panel C: Moderating role of social capital

	(1)	(2)	(3)	(4)
Variables	Sales		Labor Cost	
Social capital classification	Low	High	Low	High
Treat×Post	-0.018	-0.062***	0.199**	0.226*
	(-1.19)	(-2.84)	(2.47)	(1.67)
Difference (Chow Test)	-0.044* (p = 0.09)		0.027 (p = 0.86)	
Size	0.530***	0.425***	0.385***	0.931**
	(25.79)	(13.71)	(2.95)	(2.12)
LEV	-0.042	-0.254**	-0.963*	2.214**
	(-0.47)	(-2.53)	(-1.67)	(2.43)
MTB	0.130***	0.036***	0.223	-0.138
	(8.79)	(2.61)	(1.54)	(-0.85)
ROA	0.375	0.687***	-1.143	3.686
	(1.40)	(3.18)	(-0.57)	(1.06)
Dividend	-0.001	-0.001	-0.024	-0.511*
	(-1.38)	(-0.49)	(-0.46)	(-1.80)
Constant	2.245***	3.359***	2.969**	-2.577
	(11.16)	(11.57)	(2.32)	(-0.59)
Cohort×Firm	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES
N	12,183	5,667	1,556	718
R^2	0.982	0.987	0.994	0.989

Table 8: Changes in violating firms' relationships with corporate customers

This table examines the impact of environmental violations on customer-supplier relationships. The dependent variable, *Customer Decouple*, equals one if no trade relationship exists between customer *i* and supplier *j* in year *t* within cohort *c*, and zero otherwise. *Treat Supp* equals one if the supplier is penalized for an environmental violation in cohort *c*; *Post* equals one for years following the penalty announcement in cohort *c*. Panel A reports the average effect of violations on supply-chain decoupling across different event windows, ranging from [-1, +1] to [-4, +4] years. Panel B evaluates how customers' ESG institutional ownership moderates this response. Panel C evaluates the moderating role of social capital in the customer-supplier relationship. All regressions include Cohort×Customer and Cohort×Relationship fixed effects. Year fixed effects are absorbed by these fixed effects and therefore omitted. Standard errors are clustered at the Relationship×Year level. Variable definitions appear in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Customer-supplier decoupling around environmental violation events (alternative windows)

	(1)	(2)	(3)	(4)
Dependent variable=Customer Decouple	[-1, +1]	[-2, +2]	[-3, +3]	[-4, +4]
Treat Supp×Post	0.012***	0.017***	0.017***	0.014***
	(2.79)	(4.47)	(4.95)	(4.33)
Post	0.005***	0.010***	0.014***	0.018***
	(6.71)	(12.62)	(19.25)	(23.78)
Size	-0.016***	-0.014***	-0.013***	-0.016***
	(-3.94)	(-4.77)	(-5.16)	(-7.55)
LEV	-0.024*	-0.015**	-0.019***	-0.025***
	(-1.80)	(-2.31)	(-3.57)	(-5.13)
MTB	-0.009***	-0.004*	0.002	0.003**
	(-2.89)	(-1.67)	(1.21)	(2.04)
ROA	-0.033*	-0.005	-0.004	-0.007
	(-1.80)	(-0.97)	(-0.78)	(-1.21)
Dividend	0.018***	0.002	0.000	0.000
	(4.75)	(1.25)	(1.03)	(0.87)
Constant	1.124***	1.095***	1.074***	1.112***
	(22.38)	(30.82)	(36.24)	(43.81)
Cohort×Customer	YES	YES	YES	YES
Cohort×Relationship	YES	YES	YES	YES
N	93,411	155,274	216,565	277,854
R^2	0.059	0.037	0.023	0.015

Table 8, continued

Panel B: Moderating role of SRI ownership

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable=Customer Decouple	[-1, +1]		[-2, +2]		[-3, +3]		[-4, +4]	
SRI ownership classification	Low	High	Low	High	Low	High	Low	High
Treat Supp×Post	0.009	0.014**	0.014**	0.019***	0.017***	0.018***	0.013***	0.015***
	(1.26)	(2.43)	(2.32)	(3.91)	(2.98)	(3.96)	(2.85)	(3.28)
Difference (Chow Test)	0.005 (p = 0.55)		0.005 (p = 0.50)		0.001 (p = 0.85)		0.002 (p = 0.85)	
Post	0.008***	0.004***	0.013***	0.008***	0.015***	0.013***	0.017***	0.016***
	(4.44)	(4.81)	(7.91)	(8.02)	(9.54)	(13.32)	(10.87)	(16.52)
Size	-0.027***	-0.022**	-0.023***	-0.007	-0.019***	-0.004	-0.021***	-0.010***
	(-4.43)	(-2.53)	(-5.74)	(-1.20)	(-5.94)	(-0.82)	(-7.66)	(-2.58)
LEV	-0.077***	0.075***	-0.072***	0.004	-0.045***	-0.007	-0.044***	-0.011*
	(-3.28)	(2.84)	(-5.29)	(0.60)	(-4.27)	(-1.14)	(-4.83)	(-1.88)
MTB	0.000	-0.015***	-0.006**	-0.003	-0.006***	0.011***	-0.006***	0.012***
	(0.01)	(-3.53)	(-2.08)	(-0.84)	(-2.65)	(3.70)	(-2.94)	(4.91)
ROA	-0.034*	-0.294***	-0.018***	0.029	-0.011**	0.109	-0.008	-0.046
	(-1.68)	(-2.61)	(-3.12)	(0.28)	(-2.01)	(1.50)	(-1.46)	(-0.71)
Dividend	0.023	0.013***	-0.002	0.008***	0.000	-0.000	0.000	0.007***
	(1.23)	(3.10)	(-1.60)	(3.04)	(1.12)	(-0.09)	(0.93)	(2.92)
Constant	1.240***	1.174***	1.200***	1.003***	1.150***	0.957***	1.168***	1.026***
	(17.27)	(11.98)	(25.32)	(15.13)	(30.52)	(18.01)	(37.31)	(23.09)
Cohort×Customer	YES	YES	YES	YES	YES	YES	YES	YES
Cohort×Relationship	YES	YES	YES	YES	YES	YES	YES	YES
N	24,054	69,357	39,669	115,605	55,211	161,354	70,997	206,857
R^2	0.070	0.055	0.043	0.035	0.027	0.022	0.017	0.014

Table 8, continued

Panel C: Moderating role of social capital

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable=Customer Decouple	[-1, +1]		[-2, +2]		[-3, +3]		[-4, +4]	
Social capital classification	Low	High	Low	High	Low	High	Low	High
Treat Supp×Post	0.012**	0.013*	0.016***	0.020***	0.017***	0.018***	0.012***	0.016***
	(2.10)	(1.76)	(3.29)	(3.01)	(3.81)	(3.14)	(3.10)	(2.92)
Difference (Chow Test)	0.001 (p = 0.91)		0.004 (p = 0.66)		0.001 (p = 0.85)		0.003 (p = 0.62)	
Post	0.003***	0.008***	0.007***	0.015***	0.012***	0.020***	0.015***	0.024***
	(3.79)	(4.43)	(8.53)	(8.82)	(14.33)	(12.05)	(17.85)	(13.82)
Size	0.001	-0.045***	-0.004	-0.053***	-0.003	-0.046***	-0.009***	-0.041***
	(0.22)	(-4.00)	(-1.13)	(-6.80)	(-1.16)	(-7.53)	(-3.48)	(-8.72)
LEV	0.026	-0.044	-0.000	-0.021	-0.012**	-0.009	-0.017***	-0.023*
	(1.63)	(-1.38)	(-0.03)	(-1.12)	(-2.09)	(-0.54)	(-3.15)	(-1.69)
MTB	-0.012***	-0.001	-0.003	-0.011**	0.006***	-0.011**	0.007***	-0.007
	(-3.66)	(-0.15)	(-1.12)	(-2.04)	(2.58)	(-2.34)	(3.71)	(-1.64)
ROA	-0.166*	-0.172	0.084	-0.019	0.114*	0.190	-0.001	0.276**
	(-1.68)	(-0.91)	(1.37)	(-0.12)	(1.86)	(1.17)	(-0.02)	(2.38)
Dividend	0.014***	0.012	0.005*	-0.006*	-0.001	-0.004	0.005**	-0.007**
	(3.73)	(0.55)	(1.93)	(-1.74)	(-0.50)	(-1.32)	(2.31)	(-2.23)
Constant	0.917***	1.450***	0.970***	1.537***	0.959***	1.452***	1.020***	1.395***
	(15.17)	(10.79)	(24.76)	(16.87)	(28.56)	(20.33)	(34.36)	(25.76)
Cohort×Customer	YES	YES	YES	YES	YES	YES	YES	YES
Cohort×Relationship	YES	YES	YES	YES	YES	YES	YES	YES
N	70,495	22,835	117,330	37,809	163,666	52,710	210,060	67,551
R^2	0.053	0.076	0.034	0.045	0.022	0.028	0.014	0.017

Table 9: Reputation rebuilding following environmental violations

This table analyzes firms' post-violation efforts to rebuild their environmental reputation. Panel A reports average changes in environmental governance and performance, including *ES Committee*, and *GHG Emission*, after the settlement of environmental violations. In Panels B and C, the sample is split by ESG institutional ownership (*SRI ownership*) and by social capital, respectively, to test heterogeneity in reputation rebuilding. *Treat* is an indicator variable that equals one if the firm is involved with environmental violations, and zero otherwise. *Post* is an indicator variable that equals one for the quarters following the penalty announcement date, and zero otherwise. The Chow test evaluates whether the coefficient on *Treat* × *Post* differs across subsamples; difference between the coefficients and *p-values* appear in the "Difference" row. All regressions include Cohort×Firm and Cohort×Year fixed effects. Standard errors are clustered at the Cohort×Firm×Year levels. Variable definitions are provided in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Reputation rebuilding after environmental violations

	(1)	(2)
Dependent variable=	ES Committee	GHG Emission
Treat×Post	0.042**	-0.236**
	(2.33)	(-2.02)
Size	-0.003	0.128
	(-0.11)	(1.17)
LEV	-0.022	0.059
	(-0.25)	(0.13)
MTB	0.007	0.322**
	(0.38)	(2.00)
ROA	0.257	-0.825
	(0.46)	(-0.32)
Dividend	-0.024	-0.084
	(-1.29)	(-0.70)
Constant	0.248	-1.509
	(0.93)	(-1.27)
Cohort×Firm	YES	YES
Cohort×Year	YES	YES
N	3,465	2,499
R^2	0.958	0.809

Table 9, continued

Panel B: Moderating role of SRI ownership

	(1)	(2)	(3)	(4)
Dependent variable=	ES Committee		GHG Emission	
SRI ownership classification	Low	High	Low	High
Treat×Post	0.032	0.043**	0.095	-0.320***
	(0.76)	(2.23)	(0.29)	(-2.69)
Difference (Chow Test)	0.011 (p = 0.81)		-0.415 (p = 0.21)	
Size	0.136**	-0.055**	0.077	0.132
	(2.29)	(-1.97)	(0.17)	(1.26)
LEV	0.200	-0.151*	-0.030	0.054
	(0.88)	(-1.85)	(-0.04)	(0.10)
MTB	0.031	0.006	0.204	0.339*
	(0.84)	(0.30)	(0.75)	(1.71)
ROA	1.003	0.036	1.364	-2.440
	(0.92)	(0.06)	(0.50)	(-0.60)
Dividend	-0.062	-0.002	-0.423	-0.030
	(-1.33)	(-0.10)	(-0.63)	(-0.33)
Constant	-1.136**	0.793***	-0.838	-1.566
	(-2.00)	(2.90)	(-0.19)	(-1.29)
Cohort×Firm	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES
N	1,039	2,426	665	1,834
R^2	0.949	0.964	0.763	0.830

Panel C: Moderating role of social capital

	(1)	(2)	(3)	(4)
Dependent variable=	ES Committee		GHG Emission	
Social capital classification	Low	High	Low	High
Treat×Post	-0.034	0.082***	-0.131	-0.307**
	(-1.23)	(3.54)	(-0.61)	(-2.18)
Difference (Chow Test)	0.115*** (p = 0.00)		-0.176 (p = 0.50)	
Size	0.086**	-0.054	-0.048	0.214*
	(2.41)	(-1.51)	(-0.18)	(1.70)
LEV	-0.082	-0.014	-0.339	0.382
	(-0.47)	(-0.14)	(-0.44)	(0.66)
MTB	0.053	-0.018	0.247	0.384*
	(1.55)	(-0.90)	(1.09)	(1.76)
ROA	-0.224	0.659	1.550	-2.640
	(-0.21)	(1.05)	(0.58)	(-0.65)
Dividend	-0.056	-0.005	-0.175	-0.033
	(-1.53)	(-0.23)	(-0.72)	(-0.27)
Constant	-0.598*	0.735**	0.412	-2.477*
	(-1.71)	(2.10)	(0.15)	(-1.77)
Cohort×Firm	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES
N	1,193	2,272	808	1,691
R^2	0.969	0.955	0.701	0.852

Appendix A: Important developments affecting the amount and salience of stakeholder pressure, 2000–2021

This timeline lists events from 2000-2021 that reflect and plausibly caused an increase in investor and stakeholder attention to firms' environmental impacts, particularly greenhouse gas emissions. These events (i) increased the availability and standardization of emissions and ESG information, (ii) made climate policy and enforcement risk more credible, and (iii) increased investor coordination and investment in sustainable investing strategies. Two events are highlighted as break points representing potentially large increases in stakeholder pressure in 2006 and 2016.

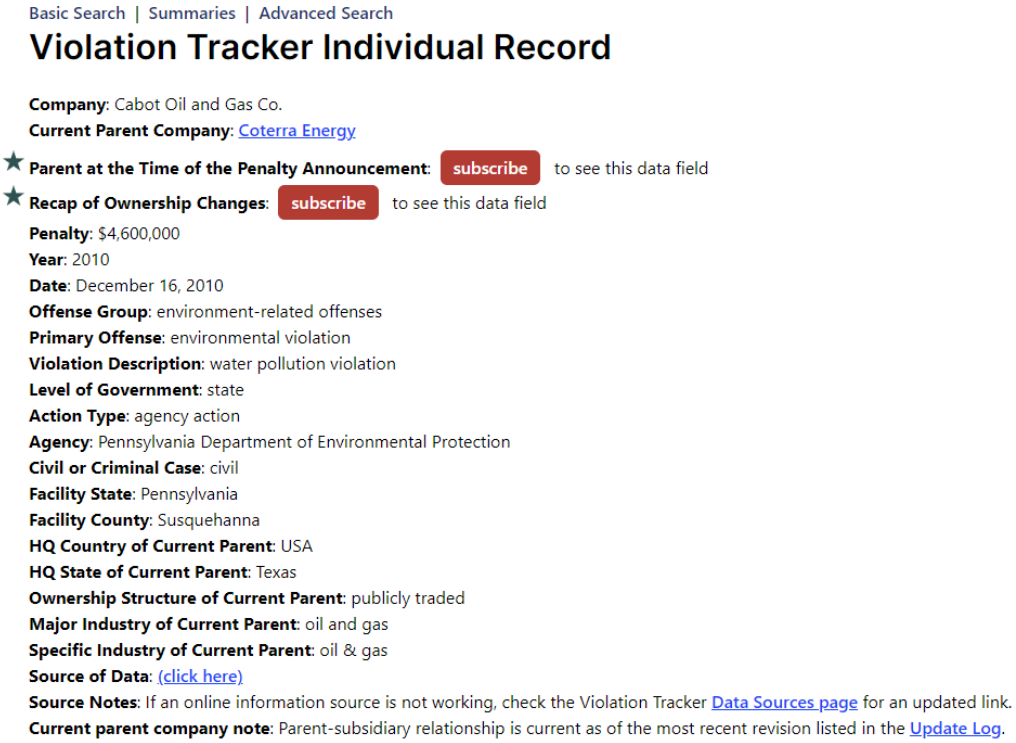
Date	Event	Description
Jul 26, 2000	UN Global Compact launched	Emphasized the concept of corporate responsibility and environmental performance.
2000	First Global Reporting Initiative (GRI) Sustainability Reporting Guidelines released.	Created an early, widely adopted framework for environmental reporting.
2000	Carbon Disclosure Project founded	Began large-scale, investor-facing climate disclosure requests from firms.
Nov 21, 2003	Institutional Investor Summit on Climate Risk at the United Nations	High-profile coordination among institutional investors to treat climate as an investment risk.
Apr 27, 2006	UN-supported Principles for Responsible Investment (PRI) launched at the New York Stock Exchange.	A global coordination and commitment platform for integrating ESG into investment analysis.
Sep 27, 2006	California Global Warming Solutions Act (AB 32) signed.	Carbon regulation in a major U.S. market, raising transition-risk salience for many firms.
Oct 2006	Stern Review published.	Emphasized climate change as a financial risk, increasing materiality concerns.
Apr 2, 2007	U.S. Supreme Court decision in Massachusetts v. EPA.	Affirmed EPA authority to regulate emissions under the Clean Air Act.
Sep 30, 2007	US SIF Foundation's 2007 Trends Report	Documented rapid growth in socially responsible investing (SRI) assets.
Dec 2009	EPA Endangerment Finding	Bolstered federal authority to regulate greenhouse gases, increasing risk for carbon-intensive firms.
Feb 2, 2010	SEC issues interpretive guidance on climate-change disclosure	Explicitly linked climate matters to existing disclosure obligations for public companies (Release 33-9106).
2011	SASB founded	Advocates for industry-specific, investor-oriented sustainability disclosure standards.
Sep 25, 2014	Montréal Carbon Pledge launched	Investors pledge to measure and disclose the carbon footprints of their portfolios.
Oct 22, 2015	U.S. Department of Labor issues Interpretive Bulletin 2015-01	Clarified when ERISA fiduciaries may consider ESG/ETI factors.
Oct 23, 2015	Clean Power Plan final rule published (Federal Register).	Strengthened expectations of U.S. power-sector (and supply chains) decarbonization policy
Dec 4, 2015	Financial Stability Board (FSB) establishes the Task Force on Climate-related Financial Disclosures (TCFD).	Frames climate as a financial-stability and disclosure issue and advocates for climate-risk reporting.
Dec 12, 2015	Paris Agreement adopted at COP21.	Created a global policy framework for decarbonization and justifies transition-risk considerations.
Nov 4, 2016	Paris Agreement enters into force.	Emphasized that decarbonization commitments and transition risk would motivate real investment.

May 25, 2016	ExxonMobil climate disclosure proposal receives 38.2% support.	Highly visible signal that large mainstream shareholders were willing to vote for climate disclosure and change.
2016	US SIF 2016 Trends Report	Estimates that $8.72T in U.S. assets use sustainable/ESG strategies.
Jun 1, 2017	U.S. administration announces intent to withdraw from the Paris Agreement.	Triggered counter-efforts among investors and firms focused on climate risk and disclosure.
Jun 29, 2017	TCFD publishes final recommendations	Provided a widely used disclosure blueprint.
Dec 2017	Climate Action 100+ launched at the One Planet Summit	Scaled coordinated investor engagement targeting the largest corporate emitters.
Oct 2018	IPCC Special Report on Global Warming of 1.5°C (SR1.5)	Often cited in investor engagement and transition-risk analysis.
Aug 19, 2019	Business Roundtable issues updated Statement on the Purpose of a Corporation	Supported stakeholder and ESG-focused management.
Nov 13, 2020	DOL final rule on Financial Factors in Selecting Plan Investments	Increased salience of ESG as an investment and governance issue.
Jan 2020	BlackRock CEO letter: “Climate Risk Is Investment Risk”	Frames climate as core investment risk.
Dec 11, 2020	Net Zero Asset Managers initiative launched	Expanded coordination among asset managers around net-zero portfolio alignment and engagement.
Feb 19, 2021	United States officially rejoins the Paris Agreement.	Renewed U.S. federal policy toward climate action.
Mar 4, 2021	SEC creates a Climate and ESG Task Force in Enforcement.	Increased perceived enforcement risk around ESG disclosures and greenwashing.
Jun 2, 2021	Engine No. 1 wins a third board seat at ExxonMobil	Climate-focused shareholder activism.
Nov 3, 2021	IFRS Foundation announces formation of the International Sustainability Standards Board (ISSB) at COP26.	Major step toward global sustainability disclosure standards.

Appendix B: An example of a violation record: Cabot Oil and Gas Co.

To illustrate a relatively complex case, this appendix reports on *Cabot Oil & Gas Co*. Violation Tracker reports that this case was initiated by the Pennsylvania Department of Environmental Protection (DEP) for a violation of the Clean Water Act, and settled on December 16, 2010, with a final penalty amount of $4,600,000. Using this information as a starting point, we manually trace news events backwards to when the violation was first publicly revealed on September 15, 2009, yielding the following sequence of information events:

News date	News description
15/09/2009	The Department of Environmental Protection has issued a notice of violation to Cabot Oil & Gas for two liquid gel spills last week at the company's Heitsman natural gas well pad in Dimock Township, Susquehanna County, which polluted a wetland and caused a fish kill in Stevens Creek
22/09/2009	Pennsylvania DEP issues violation notices to Cabot Oil & Gas
25/09/2009	DEP orders Cabot Oil & Gas to cease all gas well fracking in Susquehanna County
27/09/2009	Cabot Oil & Gas responds to PADEP protection order
16/10/2009	Cabot Oil & Gas Corporation; Cabot Oil & Gas responds to Pennsylvania Department of Environmental Protection Order
22/10/2009	DEP fines Cabot Oil & Gas Corp. $56,650 for Susquehanna County Spills
04/11/2009	Pennsylvania DEP reaches agreement with Cabot to prevent gas migration, restore water supplies in Dimock Township
20/11/2009	Cabot Oil & Gas enters agreement with the Pennsylvania Department of Environmental Protection
23/11/2009	Pennsylvania residents sue Cabot for hydrofrac contamination
02/01/2010	Environmental concerns rise in Northeastern Pennsylvania as Natural Gas Drilling Spreads
15/04/2010	Cabot Oil & Gas enters modified agreement with the Pennsylvania Department of Environmental Protection
01/05/2010	The Department of Environmental Protection today ordered Cabot Oil & Gas Corp. to close and remove an earthen pit in Susquehanna County that holds drilling fluids to determine whether it is contaminating nearby water resources.
14/05/2010	Cabot Oil & Gas announces progress in Susquehanna County
21/09/2010	Statement of Cabot Oil & Gas Corporation refuting reports of contamination of Carter Road Water by hydraulic fracturing fluid
28/09/2010	Cabot Oil & Gas responds to recent statements, actions by the Pennsylvania Department of Environmental Protection
15/10/2010	Cabot Oil & Gas responds to recent statements, actions by the Pennsylvania Department of Environmental Protection
16/11/2010	Federal Judge OKs Strict Liability Claim Against Gas Driller
06/12/2010	Cabot's Motion to Dismiss Marcellus Lawsuit Denied



Basic Search | Summaries | Advanced Search

Violation Tracker Individual Record

Company: Cabot Oil and Gas Co.
Current Parent Company: Coterra Energy
★ **Parent at the Time of the Penalty Announcement**: subscribe to see this data field
★ **Recap of Ownership Changes**: subscribe to see this data field
Penalty: $4,600,000
Year: 2010
Date: December 16, 2010
Offense Group: environment-related offenses
Primary Offense: environmental violation
Violation Description: water pollution violation
Level of Government: state
Action Type: agency action
Agency: Pennsylvania Department of Environmental Protection
Civil or Criminal Case: civil
Facility State: Pennsylvania
Facility County: Susquehanna
HQ Country of Current Parent: USA
HQ State of Current Parent: Texas
Ownership Structure of Current Parent: publicly traded
Major Industry of Current Parent: oil and gas
Specific Industry of Current Parent: oil & gas
Source of Data: (click here)
Source Notes: If an online information source is not working, check the Violation Tracker Data Sources page for an updated link.
Current parent company note: Parent-subsidiary relationship is current as of the most recent revision listed in the Update Log.

The link to the source data provides detailed information for the case (see the snapshot below) https://www.ahs.dep.pa.gov/NewsRoomPublic/SearchResults.aspx?id=15595&typeid=1:

DEP Newsroom

Print

COMMONWEALTH OF PENNSYLVANIA
Dept. of Environmental Protection
Commonwealth News Bureau
Room 308, Main Capitol Building
Harrisburg PA., 17120

FOR IMMEDIATE RELEASE
12/16/2010

CONTACT:
Michael Smith, Department of Environmental Protection
717-787-1323

Dimock Residents to Share $4.1 Million, Receive Gas Mitigation Systems Under DEP-Negotiated Settlement with Cabot Oil and Gas
Additional $500,000 to Reimburse DEP for Investigative Costs DEP to Drop Montrose Water Line Plan Given Uncertain Prospects

Harrisburg – Residents of Dimock Township, Susquehanna County, who have had their drinking water supplies contaminated by natural gas will each receive a share of $4.1 million that Cabot Oil and Gas Co. will pay under a settlement negotiated by the Department of Environmental Protection and the company.

The settlement, which will enable the affected families to address their individual circumstances as they see fit, also binds Cabot to offer and pay to install whole-house gas mitigation devices in each of the 19 affected homes.

Cabot also will pay DEP $500,000 to offset the state's expense of investigating the stray gas migration cases that have plagued Dimock residents for nearly two years.

"The 19 families in Dimock who have been living under very difficult conditions for far too long will receive a financial settlement that will allow them to address their own circumstances in their own way," said DEP Secretary John Hanger, who explained that the amount paid to each family will equal two-times the value of their home, with a minimum payment of $50,000.

"In addition to the significant monetary component of this settlement, there is a requirement that Cabot continue to work with us to ensure that none of their wells allow gas to migrate," Hanger noted.

DEP began investigating reports of stray gas in Dimock water wells in January 2009. A consent order and agreement signed in November 2009 required Cabot to install whole-house treatment systems in 14 homes, but residents found that action to be unsatisfactory.

The agreement was modified in April 2010 and DEP ordered Cabot to cap three wells believed to be the source of the migrating gas. DEP also suspended its review of Cabot's pending permit applications for new drilling activities statewide and prohibited the company from drilling any new wells in a nine-square-mile area around Dimock.

In September, DEP announced that Pennsylvania American Water Co. would construct a 5.5-mile water main from its Lake Montrose water treatment plant to supply the affected Dimock residents with a reliable source of quality drinking water. In November, the Pennsylvania Infrastructure Investment Authority, or PENNVEST, approved an $11.8 million grant and loan package for the project, with the commonwealth intending to recover the cost of the project from Cabot.

Given the opposition to the planned water line and the uncertain future the project faces, Hanger said the department would abandon its pursuit of the project.

"Our primary goal at the department has always been to ensure that the wells Cabot drilled in Dimock were safe and that they were not contaminating local private water supplies," said Hanger. "We've made great progress in doing that. Since we initiated our enforcement actions, gas levels in a majority of the contaminated water wells have gone down significantly. This agreement lays the foundation for families to finally put an end to this ordeal."

Appendix C: Variable definitions and construction

Appendix C.1 describes the variables used in empirical tests. Appendix C.2 provides the rationale for the variables included in tests examining the size and sources of reputation losses. Appendix C.3 presents summary statistics of the main variables in the empirical tests.

Appendix C.1. Variable definitions and data sources

Variables	Definition	Data source
Panel A: Dependent variables		
Event CAR [-10, +3]	Cumulative abnormal return from trading day -10 to +3 relative to the news event, estimated using the market model over days -160 to -60.	Event Study by WRDS
Event CAR [-3, +3]	Cumulative abnormal return from trading day -3 to +3 relative to the news event, estimated using the market model over days -160 to -60.	Event Study by WRDS
Accumulated_CAR [-10, +3]	Compounded cumulative abnormal returns in the window [-10, +3] for all news events of each violation case, as defined in Equation (3).	Event Study by WRDS
Accumulated_CAR [-3, +3]	Compounded cumulative abnormal returns in the window [-3, +3] for all news events of each violation case, as defined in Equation (3).	Event Study by WRDS
Reputation Effect [-10, +3]	*Accumulated_CAR* [-10, +3] minus the ratio of penalty amount to market value of equity at the end of the month preceding the first usable event date for each case.	Event Study by WRDS, CRSP, Violation Tracker
Reputation Effect [-3, +3]	*Accumulated_CAR* [-3, +3] minus the ratio of penalty amount to market value of equity at the end of the month preceding the first usable event date for each case.	Event Study by WRDS, CRSP, Violation Tracker
Customer Decouple	A binary variable indicating the existence of a trade relationship between a customer and a supplier.	FactSet Revere
Sales	Total quarterly net sales revenue.	Compustat
Labor Costs	Extrapolated staff expenses, calculated as the product of industry-year staff expense per employee and firm-year total employment, following Donangelo et al. (2019).	Compustat
ES Committee	Indicator variable equal to one if the board assigns responsibility for environmental and social issues to a board committee, and zero otherwise.	BoardEx
GHG Emission	The change in greenhouse gas (GHG) emissions over which the company has control, divided by the company's revenue.	Trucost
COC	Firm-quarter cost of equity capital estimated following Li and Mohanram (2014).	Compustat

Panel B: Independent variables		
Penalty-to-Market Value	Penalty amount divided by the market value of equity at the end of the month preceding the first usable news event.	CRSP, Violation Tracker
Treat	Indicator variable equal to one if the firm is identified as an environmental violator (appears in Violation Tracker), and zero otherwise.	Violation Tracker
Post	Indicator variable equal to one for quarters following the penalty settlement date, and zero otherwise. In the customer decoupling regression, *Post* is defined at the annual level due to the yearly frequency of the supply chain data.	Violation Tracker
SRI Investor	Indicator variable equal to one if an institutional investor's portfolio-value-weighted ESG score is in the top decile of all institutions in a given fiscal quarter. ESG scores are the normalized "E," "S," and "G" ratings from MSCI, Refinitiv, Trucost, and Sustainalytics.	Thomson Reuters Institutional (13F) Holdings
Panel C: ESG factors		
Social Capital	County-level social capital index following Jha and Chen (2015).	Northeast Regional Center for Rural Development (NRCRD)
CEO Liberalism	Degree to which the CEO supports the Democratic Party, constructed following Chin et al. (2013).	U.S. Federal Election Commission (FEC)
SRI ownership	The total ESG institutional ownership in each quarter. We normalize the "E" (Environmental), "S" (Social), and "G" (Governance) scores from MSCI, Refinitiv, Trucost, and Sustainalytics. Institutional investors are classified as ESG responsible if their portfolios' value-weighted ESG scores are in the top decile among all institutional investors in Refinitiv's 13F filings for a given fiscal quarter. Then, we calculate the total institutional holdings of the firm's ESG responsible investors for all shares of firms.	Thomson Reuters Institutional (13F) Holdings
Dedicated_IO	Indicator variable equals to one if the firm's dedicated institutional ownership is in the top decile per industry, and zero otherwise. Dedicated investors are defined using the Bushee's (1998; 2001) approach.	Thomson Reuters Institutional (13F) Holdings, Bushee's Institutional Investor Classification Data
Disaster Declaration	The natural logarithm of one plus the number of federally declared disasters in the firm's state each year.	Federal Emergency

		Management Agency
Media Coverage	Monthly standardized sum of winsorized, deseasonalized daily log changes in RavenPack article counts, following the news-flow shock construction logic in Da, Engelberg, and Gao (2015).	RavenPack
Harm Type	Categorical variable that equals to one if the environmental violation involves air emissions, two if the violation involves water pollution, three if the violation involves hazardous waste, and zero if the violation involves more than one category or cannot be identified from descriptions available.	Violation Tracker
Civil Penalty	Indicator variable equals to one if the legal penalty involves civil penalties, and zero if the legal penalty involves other forms or cannot be identified.	Violation Tracker
Private	Indicator variable equals to one if the lawsuit was initiated by private parties.	Violation Tracker
Federal	Indicator variable equals to one if the enforcement is brought by the federal government and zero if brought by the state or local government.	Violation Tracker
Panel D: Firm characteristics		
Size	The natural logarithm of the firm's total assets (ATQ) for each quarter.	Compustat
LEV	The sum of long-term (DLTQ) and short-term debt (DLCQ) divided by assets (ATQ) for each quarter.	Compustat
MTB	The market value of equity (PRCCQ × CSHOQ) divided by the book value of equity (CEQQ) for each quarter.	Compustat
ROA	Income Before Extraordinary Items (IBQ) divided by firm book assets (ATQ) for each quarter.	Compustat
Dividend	Dividends as a fraction of income before extraordinary items (IBQ).	Financial Ratios Firm Level by WRDS

Appendix C.2: Rationales for variables included in the cross-section tests

In this appendix, we supplement Appendix C.1 and provide more variable construction details for the determinants of reputation effects and summary statistics.

1. Determinants of Reputation Effects

Prior research suggests that the expected total cost of misconduct should encompass not only legal penalties but also reputational losses (Becker, 1968). In addition to statutory penalties, our study incorporates various factors identified in recent ESG literature that relate to firms' ESG activities (e.g., Acharya, Abebe, and Kroll, 2019; Cao,

Titman, Zhan, and Zhang, 2023; Gamache and McNamara, 2019; Lins, Servaes, and Tamayo, 2017). Among the variables examined in prior work, ESG-oriented institutional ownership and social capital have emerged as the two most frequently studied and influential external factors compelling firms to enhance their ESG engagement and respond to stakeholder concerns. Thus, we will mainly focus on these two factors, as they operate through distinct yet complementary channels of stakeholder governance and accountability. We also account for additional variables that may shape stakeholder expectations regarding environmental responsibility, including CEO political ideology, media coverage, dedicated institutional ownership, and whether the firm is headquartered in a state subject to a federal disaster declaration. All these potential determinants of reputation effects are detailed as follows.

1) ESG Institutional Ownership (*SRI ownership*): ESG-oriented institutional ownership acts as a centralized, top-down mechanism of stakeholder pressure. The threat is financial and explicit: align with ESG principles or face a higher cost of capital, divestment, and public opposition from influential shareholders (e.g., Dyck et al., 2019; Chen et al., 2020; Krueger et al., 2020; Starks, 2023). This creates a direct incentive for firms to retain this growing pool of capital and to internalize ESG risks and reputation costs.

In the literature on responsible investment, two primary methods are used to measure the ESG activism of institutional investors: the identification of UNPRI signatories (e.g., Dyck et al., 2019; Liang, Sun, and Teo, 2022; Kim and Yoon, 2023; Lel, 2025) and the evaluation of investor portfolios' ESG ratings (e.g., Hwang, Titman, and Wang, 2022; Cao, Titman, Zhan, and Zhang, 2023). Recent studies indicate that UNPRI signatories often do not fully adhere to their ESG commitments, rendering many of them symbolic (Gibson Brandon et al., 2022). Consequently, we focus on the ESG rating profiles of firms within institutional investor portfolios. To address the variability of ESG ratings among different rating agencies (Berg et al., 2022), we combine ratings from four major agencies. Specifically, we normalize ESG scores from MSCI, Sustainalytics, Trucost, and Refinitiv (formerly Thomson Reuters ASSET4). We classify institutional investors as ESG responsible if their portfolios' value-weighted ESG scores rank in the top decile among all institutional investors in Refinitiv's 13F filings for a given fiscal quarter. This approach is similar to mutual fund ESG ratings, such as the Morningstar Globe ratings (Raghunandan and Rajgopal, 2022). We then calculate the total institutional holdings of firms deemed ESG responsible relative to total shares outstanding in each quarter.

2) Social Capital (*Social Capital*): Social capital acts as a decentralized, bottom-up mechanism for stakeholder influence. It reflects the strength of secular norms and the density of social networks that encourage cooperation between firms and external stakeholders. Prior studies have shown that social capital can limit short-term incentives, reduce conflicts of interest, and deter opportunistic actions (e.g., Guiso, Sapienza and Zingales, 2008; Payne, Moore, and Griffis, 2011; Jha and Chen, 2015; Hasan, Hoi and Wu, 2017; Dai, Deng and Yan, 2024). Therefore, rooted in strong norms of cooperation, mutual trust, and civic duty, firms in high social capital areas would face implicit expectations from stakeholders for responsible behavior (e.g., King and Whetten, 2008; Barnett and Pollock, 2012; Hoi, Wu and Zhang, 2018). When a firm fails to uphold such expectations, for example, in the case of an environmental violation, it is perceived not just as a legal infraction but as a conspicuous breach of community values and stakeholder trust, thereby amplifying the reputational costs.

Following Jha and Chen (2015), we measure the social capital of the county in which the firm is headquartered as the first principal component of four standardized variables: the percentage of eligible voters participating in the most recent presidential election, the Census Bureau survey response rate, the number of tax-exempt nonprofit organizations per 10,000 people, and the number of social organizations per 100,000 people. The raw data are obtained from the NRCRD at Pennsylvania State University. The social capital index is available for 1997, 2005, 2009, and 2014; values for non-survey years are linearly interpolated. When county-level data are missing, we substitute state-level social capital, computed as the average across counties within a state.

3) CEO Liberalism (*CEO Liberalism*): This variable measures the extent to which the CEO favors the Democratic Party over the Republican Party (Chin, Hambrick, and Treviño, 2013). We utilize data from the U.S. Federal Election Commission (FEC) to analyze executives' campaign contribution records for the ten years prior to their appointment as CEOs. The political liberalism index score is calculated by averaging four indicators: (1) the number of donations made to Democrats divided by the total number of donations to recipients from both parties; (2) the total dollar amount of donations to Democrats divided by the total donations to both parties; (3) the number of years (out of the ten-year period) in which the executive made donations to Democrats divided by the total years in which donations were made to either party; and (4) the number of distinct Democratic recipients of donations divided

by the total number of distinct recipients from both parties. To address missing values, we set the CEO liberalism score at 0.5, where scores above 0.5 indicate CEO liberalism and scores below 0.5 indicate CEO conservatism.

4) Media Coverage (*Media Coverage*): We measure media attention using RavenPack news data. For each firm-month, we construct a news-flow metric that captures unexpected changes in media intensity rather than the level of coverage. In the spirit of Da, Engelberg, and Gao (2015), we quantify media attention as the sum of winsorized, deseasonalized, and standardized daily log changes in article counts over the month, where the daily log change is defined as the difference in the logarithm of the number of articles between adjacent days, with missing values set to zero. This approach follows Da et al.'s (2015)core logic of isolating innovations in news flow, i.e., unanticipated increases in information arrival that are most likely to shift investor attention and generate reputational pressure, rather than simply counting news volume.

5) Disaster Declaration (*Disaster Declaration*): We proxy each firm's climate vulnerability by the frequency of federally declared disasters in its home state. Specifically, we calculate the climate vulnerability measure for each state and year as the logarithm of one plus the total number of federally declared disasters for that state in that year. Data on disaster declarations are sourced from the Federal Emergency Management Agency (FEMA) datasets.

6) Dedicated Institutional Ownership (*Dedicated_IO*): We measure dedicated institutional ownership as the shares held by dedicated investors divided by the total number of shares outstanding each quarter. Dedicated investors are classified according to the approach by Bushee (1998; 2001).[10]

2. Legal and Regulatory Attributes of Environmental Violations

Our dataset captures environmental violations through various legal channels involving regulatory bodies and private litigants. To enhance our understanding of these legal actions, we construct variables to identify the type of litigant and the level of government jurisdiction involved: (1) Harms of Violations (Harm Type). We create three indicator variables to represent the types of environmental harms associated with violation cases: *Air Pollution* (1 if the environmental offense is related to air pollution and 0 otherwise), *Water Contamination* (1 if the environmental offense is related to water pollution and 0 otherwise), and *Hazardous Waste* (1 if the environmental offense is related to hazardous waste and 0 otherwise). These variables are set to zero if the harm from the violation cannot be determined from the available descriptions. (2) Forms of Legal Penalty (*Civil Penalty*). This binary variable is set to 1 if the legal penalty involves a civil penalty only, and 0 if the legal penalty involves other or mixed types of penalties and settlement costs or cannot be identified from the available descriptions. (3) Private Litigation (*Private*). This binary variable is coded as one if the action is a private litigation and zero if it is an agency action. (4) Governmental Jurisdiction (*Federal*). This variable equals 1 if the enforcement action is taken by a federal authority and 0 if brought by state or local governments.[11]

3. Other control variables

We include a set of firm-level control variables to reflect firm characteristics that prior research has shown to influence market reactions to penalty announcements (e.g., Armour, Mayer, and Polo, 2017; Karpoff, Lee, and Martin, 2008). These variables are: Firm size (*Size)*, measured as the log of firm assets (*ATQ*) in each quarter; firm leverage (*LEV*), measured as the sum of long-term (*DLTQ*) and short-term debt (*DLCQ*) divided by total assets (*ATQ*) in each quarter; market-to-book (*MTB*) ratio, measured as the market value of equity (*PRCCQ*×*CSHOQ*) divided by the book value of equity (*CEQQ*) in each quarter; and return on assets (*ROA*), defined as income before extraordinary items (*IBQ)* divided by book assets (*ATQ*) in each quarter; Dividend Payout Ratio *(Dividend*), defined as the fraction of dividends relative to income before extraordinary items (*IBQ)*. For missing firm-quarter control variables, we replace them with observations from the previous year-end. Detailed definitions are in Section C.1.

Appendix C.3 Summary statistics

[10] We obtain the investor classification data from the website: https://accounting-faculty.wharton.upenn.edu/bushee/wp-content/uploads/sites/4/2024/05/iiclass.txt.

[11] When duplicate federal and state announcements exist for the same case, we retain the federal record to prevent double counting.

Table C1 reports summary statistics for the 596 environmental violation cases in our sample. Because a single violation may generate multiple legal-proceeding announcements, we aggregate market reactions across all associated event dates to capture the total cumulative effect of each violation on firm value. To mitigate concerns about reverse causality, all explanatory variables are measured in the fiscal quarter immediately preceding the first news announcement retained after sample filtration for each environmental violation case in our sample.

Table C1: Summary statistics

This table reports descriptive statistics for the key variables used in the analysis of 596 environmental violation cases. All variables are defined in Section C.1.

Variables	N	Mean	Std	P25	P50	P75
Accumulated_CAR [-10, +3]	596	-0.027	0.129	-0.064	-0.011	0.032
Accumulated_CAR [-3, +3]	596	-0.020	0.088	-0.042	-0.009	0.021
Penalty-to-Market Value	596	-0.011	0.038	-0.003	-0.000	-0.000
Reputation Effect [-10, +3]	596	-0.017	0.129	-0.058	-0.005	0.040
Reputation Effect [-3, +3]	596	-0.009	0.091	-0.038	-0.006	0.028
SRI ownership	596	0.019	0.030	0.000	0.004	0.029
CEO Liberalism	596	0.346	0.265	0.053	0.500	0.500
Social Capital	596	-0.414	1.033	-1.289	-0.453	0.170
Media Coverage	596	0.719	1.932	-0.110	0.000	1.703
Disaster Declaration	596	6.869	5.785	0.000	9.975	11.723
Dedicated_IO	596	0.038	0.078	0.000	0.000	0.074
Air Pollution	596	0.337	0.473	0.000	0.000	1.000
Water Contamination	596	0.243	0.429	0.000	0.000	0.000
Hazardous Waste	596	0.062	0.242	0.000	0.000	0.000
Civil Penalty	596	0.508	0.500	0.000	1.000	1.000
Private	596	0.084	0.277	0.000	0.000	0.000
Federal	596	0.611	0.488	0.000	1.000	1.000
Size	596	9.741	1.728	8.664	9.859	10.801
LEV	596	0.295	0.159	0.175	0.298	0.400
MTB	596	0.948	0.723	0.475	0.744	1.188
ROA	596	0.012	0.018	0.004	0.012	0.022
Dividend	596	0.363	0.723	0.000	0.183	0.409

As reported in the paper, the mean of *Accumulated_CAR* [-10, +3] and *Accumulated_CAR* [-3, +3] is −2.60% and −1.90%, respectively, indicating negative market reactions surrounding environmental violation announcements. These findings suggest that environmental violations impose economically meaningful losses on shareholders.

We compute cumulative abnormal returns beginning ten (or three) trading days before the event date to allow for potential information leakage during the legal process. Over these same windows, average reputational losses are –1.60% for [–10, +3] and –0.8% for [–3, +3]. The mean ESG ownership *(SRI ownership*) is 1.90%, and the mean CEO liberalism score is 0.346, both of which are consistent with Chin et al. (2013). Social capital exhibits substantial cross-firm variations: its standard deviation is 1.033, with an interquartile range from –1.289 to 0.170. Sample statistics for the remaining firm-level control variables align with those reported in prior studies (e.g., Hasan et al., 2017; Karpoff et al., 2008).

Appendix D: Propensity score matching procedure

We construct treatment and control cohorts using a propensity score matching (PSM) procedure. For each treatment firm (*Treat* = 1), we select a control firm (*Treat* = 0) with the closest propensity score. Treatment firms are those listed in the Violation Tracker for environmental violations, and control firms are firms not listed in the database during our sample period but with similar observable characteristics.

Propensity scores are estimated using lagged firm characteristics measured in the quarter prior to the settlement date. The matching variables include firm size, leverage, market-to-book ratio, return on assets, and dividend payout ratio.

To preserve statistical independence, we implement nearest-neighbor matching without replacement. Matching is performed within the same fiscal year and quarter corresponding to the settlement date of the treatment firm. Once a control firm is matched, it is removed from the matching pool for that fiscal year-quarter. We retain only matched observations, resulting in a final sample of 404 unique treatment-control pairs.

Table D1 reports a series of diagnostic tests evaluating the quality of the matching procedure. Panel A presents univariate comparisons of pre-settlement characteristics between treatment and control firms before matching. Panel B reports the estimate from the logit model used to predict treatment assignment. The dependent variable equals one if the firm-quarter belongs to the treatment group and zero otherwise. Column (1) reports results from the full sample prior to matching, while column (2) reports results using the matched sample of 404 pairs of firm-event groups. After matching, most covariates lose statistical significance, and the pseudo-R^2 declines substantially to 1.4%, indicating improved balance between the treatment and control groups.

Panel C compares the propensity scores of treatment firms and their matched controls. The differences are economically small: for example, the maximum distance between matched firms' propensity scores is only 0.000. Panel D reports univariate comparisons of pre-settlement firm characteristics after matching. Relative to Panel A, differences across the two groups largely disappear. Overall, these diagnostics indicate that the PSM procedure substantially improves the comparability of treatment and control firms and mitigates observable selection concerns.

A remaining identification concern is that an omitted factor may simultaneously influence both the settlement of environmental violations and changes in firms' reputation capital. Although such confounding factors appear unlikely to drive our results, we acknowledge that the difference-in-differences design cannot fully rule out this possibility.

Table D1: Propensity score matching and covariate balance diagnostics

Panel A: Differences in firm characteristics before the settlement of environmental violations before PSM

Variables	Control		Treatment		Difference
	(1)	(2)	(3)	(4)	(2)-(4)
	No. of Obs.	Mean	No. of Obs.	Mean	
Size	410784	5.361	404	9.866	-4.505***
LEV	410784	0.398	404	0.296	0.103
MTB	410784	4.753	404	0.937	3.816***
ROA	410784	-0.129	404	0.009	-0.138***
Dividend	410784	0.092	404	0.340	-0.248***

Table D1, continued

Panel B: Pre-match propensity score regression and post-match diagnostic regression

Variables	(1)	(2)
	Dummy = 1 if in treatment group; 0 if in control group	
	Pre-match	Post-match
Size	0.733***	0.029
	(27.65)	(0.65)
LEV	0.583***	0.137
	(5.17)	(0.77)
MTB	0.012	0.353***
	(1.00)	(3.26)
ROA	5.064**	-1.959
	(2.46)	(-0.43)
Dividend	0.989***	-0.014
	(11.15)	(-0.91)
Constant	-13.169***	-0.589
	(-47.43)	(-1.24)
N	411188	808
pseudo R^2	0.195	0.014

Panel C: Estimated propensity score distributions

Propensity scores	No. of Obs.	P5	P25	P50	P75	P95
Treatment	404	0.001	0.002	0.004	0.008	0.024
Control	404	0.001	0.002	0.004	0.008	0.024
Difference		0.000	0.000	0.000	0.000	0.000

Panel D: Differences in firm characteristics before the settlement of environmental violations after PSM

Variables	Control		Treatment		Difference
	(1)	(2)	(3)	(4)	(2)-(4)
	No. of Obs.	Mean	No. of Obs.	Mean	
Size	404	9.915	404	9.936	-0.021
LEV	404	0.276	404	0.296	-0.020
MTB	404	0.752	404	0.937	-0.185***
ROA	404	0.035	404	0.009	0.026
Dividend	404	0.906	404	0.494	0.411

Appendix E: Market value loss, legal penalty, reputation loss, and post-violation outcomes

Table E1: Market value loss, legal penalty, reputation loss, and post-violation outcomes

This table presents the results estimating the effect of the firm's share value loss, legal penalty, and reputation loss on the cost of capital, sales, and labor costs following environmental violations. The share value loss is labeled as *Small* if the accumulated cumulative abnormal returns around the [-3, +3] window is less negative than the sample median, and *Large* otherwise. The reputation effect is labeled as *Small* if the reputation loss around the [-3, +3] window is less negative than the sample median, and *Large* otherwise. The severity of legal penalty is labeled as *More* if the penalty-to-market value is higher than the sample median, and *Less* otherwise. Both Cohort×Firm and Cohort×Year fixed effects are included in all columns. Standard errors are clustered at the Cohort×Firm×Year level. Variable definitions are provided in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Cost of capital

	(1)	(2)	(3)
Variables		COC	
Accumulated_CAR [-3, +3] (Small)_Treat×Post	-0.002		
	(-0.14)		
Accumulated_CAR [-3, +3] (Large)_Treat×Post	0.034***		
	(3.57)		
Reputation Effect [-3, +3] (Small)_Treat×Post		-0.005	
		(-0.31)	
Reputation Effect [-3, +3] (Large)_Treat×Post		0.033***	
		(3.59)	
Penalty-to-Market Value (More)_Treat×Post			-0.001
			(-0.04)
Penalty-to-Market Value (Less)_Treat×Post			0.031***
			(3.31)
Size	0.003	0.003	0.001
	(0.30)	(0.32)	(0.09)
LEV	0.035	0.034	0.033
	(0.70)	(0.67)	(0.64)
MTB	-0.026***	-0.026***	-0.027***
	(-4.23)	(-4.24)	(-4.22)
ROA	-0.049	-0.049	-0.055
	(-0.24)	(-0.24)	(-0.28)
Dividend	0.005***	0.005***	0.005***
	(2.61)	(2.62)	(2.59)
Constant	0.022	0.020	0.045
	(0.21)	(0.19)	(0.42)
F-test:			
Accumulated_CAR [-3, +3] (Small)_Treat×Post = Accumulated_CAR [-3, +3] (Large)_Treat×Post			
Difference	0.036**		
F-statistic	5.12		
Reputation Effect [-3, +3] (Small)_Treat×Post = Reputation Effect [-3, +3] (Large)_Treat×Post			
Difference		0.038**	
F-statistic		4.27	
Penalty-to-Market Value (More)_Treat×Post = Penalty-to-Market Value (Less)_Treat×Post			
Difference			0.032*
F-statistic			2.90
Cohort×Firm	YES	YES	YES
Cohort×Year	YES	YES	YES
N	5346	5346	5346
R^2	0.758	0.758	0.758

Table E1, continued

Panel B: Sales

	(1)	(2)	(3)
Dependent variables=		Sales	
Accumulated_CAR [-3, +3] (Small)_Treat×Post	0.025		
	(0.49)		
Accumulated_CAR [-3, +3] (Large)_Treat×Post	-0.029**		
	(-2.22)		
Reputation Effect [-3, +3] (Small)_Treat×Post		0.025	
		(0.49)	
Reputation Effect [-3, +3] (Large)_Treat×Post		-0.029**	
		(-2.22)	
Penalty-to-Market Value (More)_Treat×Post			0.052
			(1.02)
Penalty-to-Market Value (Less)_Treat×Post			-0.030**
			(-2.28)
Size	0.477***	0.477***	0.477***
	(25.37)	(25.37)	(25.40)
LEV	-0.056	-0.056	-0.061
	(-0.69)	(-0.69)	(-0.75)
MTB	0.095***	0.095***	0.095***
	(7.99)	(7.99)	(8.00)
ROA	0.505**	0.505**	0.510**
	(2.32)	(2.32)	(2.34)
Dividend	0.011	0.011	0.011
	(1.05)	(1.05)	(1.11)
Constant	2.779***	2.779***	2.774***
	(15.26)	(15.26)	(15.24)
F-test:			
Accumulated_CAR [-3, +3] (Small)_Treat×Post = Accumulated_CAR [-3, +3] (Large)_Treat×Post			
Difference	-0.054		
F-statistic	1.08		
Reputation Effect [-3, +3] (Small)_Treat×Post = Reputation Effect [-3, +3] (Large)_Treat×Post			
Difference		-0.054	
F-statistic		1.08	
Penalty-to-Market Value (More)_Treat×Post = Penalty-to-Market Value (Less)_Treat×Post			
Difference			-0.082
F-statistic			2.44
Cohort×Firm	YES	YES	YES
Cohort×Year	YES	YES	YES
N	16284	16284	16284
R^2	0.985	0.985	0.985

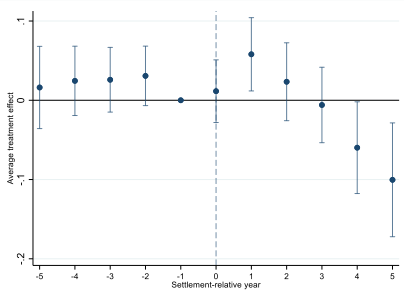
Table E1, continued

Panel C: Labor Costs

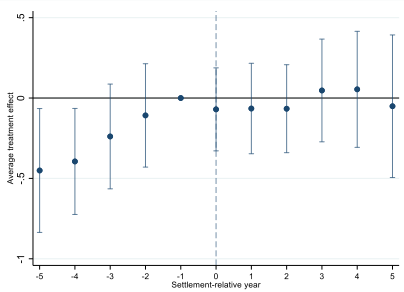
	(1)	(2)	(3)
Dependent variables=	Labor Costs		
Accumulated_CAR [-3, +3] (Small)_Treat×Post	0.000		
	(0.00)		
Accumulated_CAR [-3, +3] (Large)_Treat×Post	0.218**		
	(2.08)		
Reputation Effect [-3, +3] (Small)_Treat×Post		0.016	
		(0.13)	
Reputation Effect [-3, +3] (Large)_Treat×Post		0.209**	
		(2.05)	
Penalty-to-Market Value (More)_Treat×Post			-0.038
			(-0.16)
Penalty-to-Market Value (Less)_Treat×Post			0.220**
			(2.34)
Size	0.453***	0.452***	0.438***
	(3.13)	(3.12)	(3.13)
LEV	-0.158	-0.163	-0.177
	(-0.27)	(-0.28)	(-0.30)
MTB	0.058	0.054	0.029
	(0.47)	(0.45)	(0.24)
ROA	1.911	1.901	1.870
	(0.94)	(0.94)	(0.91)
Dividend	-0.040	-0.040	-0.040
	(-0.87)	(-0.88)	(-0.88)
Constant	2.285	2.296	2.460*
	(1.61)	(1.62)	(1.79)
F-test:			
Accumulated_CAR [-3, +3] (Small)_Treat×Post = Accumulated_CAR [-3, +3] (Large)_Treat×Post			
Difference	0.218		
F-statistic	1.85		
Reputation Effect [-3, +3] (Small)_Treat×Post = Reputation Effect [-3, +3] (Large)_Treat×Post			
Difference		0.193	
F-statistic		1.32	
Penalty-to-Market Value (More)_Treat×Post = Penalty-to-Market Value (Less)_Treat×Post			
Difference			0.258
F-statistic			1.05
Cohort×Firm	YES	YES	YES
Cohort×Year	YES	YES	YES
N	2155	2155	2155
R^2	0.993	0.993	0.993

Appendix F: Dynamic effects of environmental violations on sales and labor costs

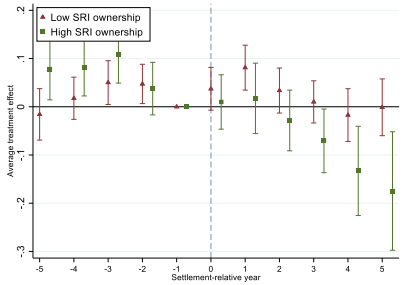
Panel A-1. Sales (full sample)



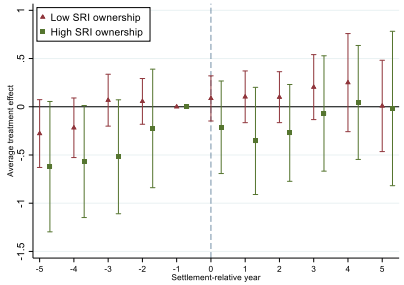
Panel A-2. Labor costs (full sample)



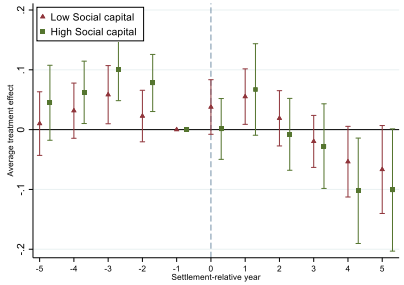
Panel B-1. Sales, by SRI ownership



Panel B-2. Labor costs, by SRI ownership



Panel C-1. Sales, by social capital



Panel C-2. Labor costs, by social capital

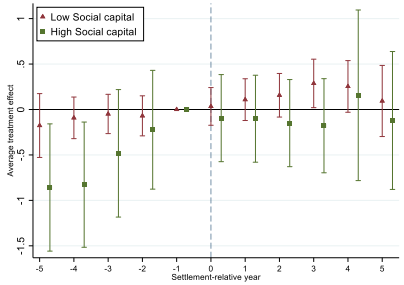


Figure F1. Dynamic effects of environmental violations on sales and labor costs. This figure reports event-time estimates from the stacked difference-in-differences specification for sales (left column) and labor costs (right column). Panels A-1 and A-2 present estimates for the full sample. Panels B-1 and B-2 split the sample by SRI ownership, and Panels C-1 and C-2 split the sample by social capital. The horizontal axis measures time in years relative to the settlement year ($t = 0$), and the vertical axis reports the estimated average treatment effect. All estimates include Cohort×Firm and Cohort×Year fixed effects. Control firms are drawn exclusively from never-treated firms. The dashed vertical line indicates the settlement year. Points represent estimated treatment effects in each event year, and vertical bars denote 95% confidence intervals. Sales data are estimated at the quarterly level; labor-cost data are estimated at the annual level. Event-time coefficients are aggregated to annual bins for visual clarity.

Appendix G: Dynamic effects of environmental violations on reputation rebuilding

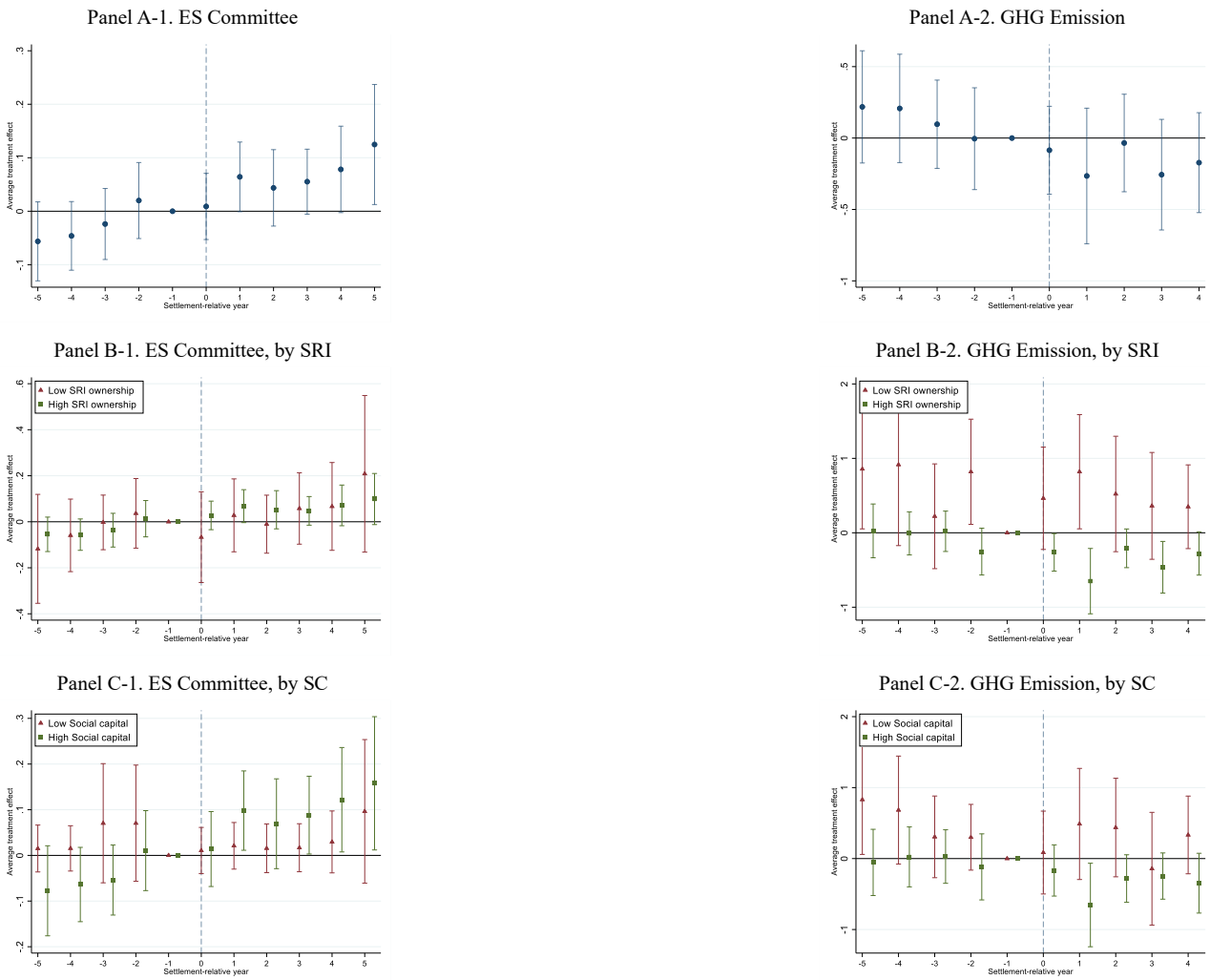


Figure G1. Dynamic effects of environmental violations on reputation rebuilding. This figure reports event-time estimates from the stacked difference-in-differences specification for ES Committee (left column), GHG Emission (center column), and GHG Cost (right column). Panels A-1 through A-2 present estimates for the full sample. Panels B-1 through B-2 split the sample by SRI ownership, and Panels C-1 through C-2 split the sample by social capital. The horizontal axis measures time in years relative to the settlement year (t = 0), and the vertical axis reports the estimated average treatment effect. All estimates include Cohort×Firm and Cohort×Year fixed effects. Control firms are drawn exclusively from never-treated firms. The dashed vertical line indicates the settlement year. Points represent estimated treatment effects in each event year, and vertical bars denote 95% confidence intervals. Event-time coefficients are aggregated to annual bins for visual clarity.

Appendix H: Market value loss, legal penalty, reputation loss, and reputation rebuilding

Table H1: Market value loss, legal penalty, reputation loss, and reputation rebuilding

This table presents the results estimating the effect of the firm's market value loss, legal penalty, and reputation loss on reputation rebuilding following environmental violations. The share value loss is labeled as *Small* if the accumulated cumulative abnormal returns around the [-3, +3] window is less negative than the sample median, and *Large* otherwise. The reputation effect is labeled as *Small* if the reputation loss around the [-3, +3] window is less negative than the sample median, and *Large* otherwise. The severity of legal penalty is labeled as *More* if the penalty-to-market value is higher than the sample median, and *Less* otherwise. Both Cohort×Firm and Cohort×Year fixed effects are included in all columns. Standard errors are clustered at the Cohort×Firm×Year level. Variable definitions are provided in Appendix C. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: ES Committee

	(1)	(2)	(3)
Dependent variables=	ES Committee		
Accumulated_CAR [-3, +3] (Small)_Treat×Post	0.015		
	(0.64)		
Accumulated_CAR [-3, +3] (Large)_Treat×Post	0.048**		
	(2.27)		
Reputation Effect [-3, +3] (Small)_Treat×Post		0.015	
		(0.64)	
Reputation Effect [-3, +3] (Large)_Treat×Post		0.048**	
		(2.27)	
Penalty-to-Market Value (More)_Treat×Post			0.008
			(0.31)
Penalty-to-Market Value (Less)_Treat×Post			0.049**
			(2.33)
Size	-0.002	-0.002	-0.002
	(-0.08)	(-0.08)	(-0.08)
LEV	-0.020	-0.021	-0.020
	(-0.23)	(-0.24)	(-0.23)
MTB	0.008	0.008	0.006
	(0.42)	(0.41)	(0.34)
ROA	0.263	0.258	0.268
	(0.45)	(0.44)	(0.46)
Dividend	-0.023	-0.023	-0.024
	(-1.25)	(-1.26)	(-1.31)
Constant	0.238	0.238	0.240
	(0.89)	(0.89)	(0.90)
F-test:			
Accumulated_CAR [-3, +3] (Small)_Treat×Post = Accumulated_CAR [-3, +3] (Large)_Treat×Post			
Difference	0.033		
F-statistic	1.17		

Reputation Effect [-3, +3] (Small)_Treat×Post = Reputation Effect [-3, +3] (Large)_Treat×Post			
Difference		0.033	
F-statistic		1.09	
Penalty-to-Market Value (More)_Treat×Post = Penalty-to-Market Value (Less)_Treat×Post			
Difference			0.041
F-statistic			1.44
Cohort×Firm	YES	YES	YES
Cohort×Year	YES	YES	YES
N	3465	3465	3465
R^2	0.959	0.959	0.959

Table H1, continued

Panel B: GHG Emission

	(1)	(2)	(3)
Dependent variables=	GHG Emission		
Accumulated_CAR [-3, +3] (Small)_Treat×Post	0.150		
	(0.73)		
Accumulated_CAR [-3, +3] (Large)_Treat×Post	-0.299**		
	(-2.25)		
Reputation Effect [-3, +3] (Small)_Treat×Post		0.150	
		(0.73)	
Reputation Effect [-3, +3] (Large)_Treat×Post		-0.299**	
		(-2.25)	
Penalty-to-Market Value (More)_Treat×Post			-0.051
			(-0.34)
Penalty-to-Market Value (Less)_Treat×Post			-0.234*
			(-1.87)
Size	0.156	0.156	0.156
	(1.42)	(1.42)	(1.42)
LEV	0.182	0.182	0.099
	(0.41)	(0.41)	(0.22)
MTB	0.312*	0.312*	0.326**
	(1.93)	(1.93)	(2.00)
ROA	-0.771	-0.771	-0.866
	(-0.29)	(-0.29)	(-0.32)
Dividend	-0.099	-0.099	-0.094
	(-0.82)	(-0.82)	(-0.77)
Constant	-1.814	-1.814	-1.808
	(-1.52)	(-1.52)	(-1.51)
F-test:			
Accumulated_CAR [-3, +3] (Small)_Treat×Post = Accumulated_CAR [-3, +3] (Large)_Treat×Post			

Difference	-0.449*		
F-statistic	3.47		
Reputation Effect [-3, +3] (Small)_Treat×Post = Reputation Effect [-3, +3] (Large)_Treat×Post			
Difference		-0.449*	
F-statistic		3.47	
Penalty-to-Market Value (More)_Treat×Post = Penalty-to-Market Value (Less)_Treat×Post			
Difference			-0.183
F-statistic			0.89
Cohort×Firm	YES	YES	YES
Cohort×Year	YES	YES	YES
N	2494	2494	2494
R^2	0.812	0.812	0.811

Appendix I: Market value impact and reputational effects of environmental violations: By event type and penalty severity

Table I1: Market value impact and reputational effects of environmental violations: By event type and penalty severity

This table presents market value impacts and reputational effects by types of event date and size of legal penalty. The numbers in brackets indicate the number of cases associated with each classification. Panel A report the accumulated market reactions and the corresponding reputation effects around the [-10, +3] and [-3, +3] window for subsets of 596 environmental violations, grouped by whether the ratio of legal penalty to market value is above or below the 0.05% threshold. The reputational effect is quantified as the difference between the Accumulated Abnormal Returns (row 1) and the Penalty-to-Market Value ratio (row 3). Panel B reports the cumulative market value effects and reputational effects around the [-10, +3] and [-3, +3] window for 581 settlement dates, Panel C reports the results for 521 first public revealing dates, and Panel D reports the results for 521 first public revealing dates around the shorter [-1, +1] and [0, +1] windows, as well as their subsample results grouped by whether the ratio of legal penalty to market value is above or below the 0.05% threshold. In Panels B to D, the reputational effect is quantified as the difference between the Cumulative Abnormal Returns (row 1) and the Penalty-to-Market Value ratio (row 3). The market value refers to the firm's equity market value at the end of the month preceding the type of news event indicated. Mean values on results are reported, along with their associated *t*-statistics. Statistical significance is indicated by asterisks: *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively.

Panel A: All 596 environmental violation cases

	Penalty-to-Market Value < 0.05% (306 cases)		Penalty-to-Market Value >= 0.05% (290 cases)	
	[-10, +3] Window	[-3, +3] Window	[-10, +3] Window	[-3, +3] Window
Mean Accumulated_CAR	-1.28%**	-1.00%**	-4.26%***	-3.00%***
Accumulated_CAR *t*-statistic	t = -2.45	t = -2.41	t = -4.20	t = -4.55
Mean Penalty-to-Market Value	-0.02%		-2.18%	
Mean Reputation Effect (row 1-row 3)	-1.26%**	-0.99%**	-2.07%**	-0.81%
Mean Reputation Effect *t*-statistic	t = -2.43	t = -2.37	t = -2.03	t = -1.16

Panel B: 581 Settlement dates

	Full Sample (581 cases)		Penalty-to-Market Value < 0.05% (310 cases)		Penalty-to-Market Value >= 0.05% (271 cases)	
	[-10,+3] Window	[-3,+3] Window	[-10,+3] Window	[-3,+3] Window	[-10,+3] Window	[-3,+3] Window
Mean CAR	-1.93%***	-1.12%***	-1.34%***	-0.77%***	-2.60%***	-1.52%***
CAR *t*-statistic	t = -4.63	t = -4.28	t = -4.06	t = -3.26	t = -3.21	t = -3.09
Mean Penalty-to-Market Value	-0.99%		-0.01%		-2.11%	
Mean Reputation Effect (row 1-row 3)	-0.94%**	-0.13%	-1.33%***	-0.76%***	-0.49%	0.59%
Mean Reputation Effect *t*-statistic	t = -2.14	t = -0.44	t = -4.02	t = -3.20	t = -0.57	t = 1.03

Table I1, continued

Panel C: 521 Initial public revelation dates

	Full Sample (521 cases)		Penalty-to-Market Value < 0.05% (284 cases)		Penalty-to-Market Value >= 0.05% (237 cases)	
	[-10,+3] Window	[-3,+3] Window	[-10,+3] Window	[-3,+3] Window	[-10,+3] Window	[-3,+3] Window
Mean CAR	-1.79%***	-1.17%***	-0.73%**	-0.62%**	-3.04%***	-1.84%***
CAR *t*-statistic	t = -3.99	t = -3.98	t = -2.06	t = -2.36	t = -3.46	t = -3.26
Mean Penalty-to-Market Value	-0.94%		-0.01%		-2.05%	
Mean Reputation Effect (row 1-row 3)	-0.85%*	-0.23%	-0.72%**	-0.60%**	-1.00%	0.21%
Mean Reputation Effect *t*-statistic	t = -1.81	t = -0.69	t = -2.02	t = -2.30	t = -1.07	t = 0.32

Panel D: 521 First public revealing dates (shorter window)

	Full Sample (521 cases)		Penalty-to-Market Value < 0.05% (284 cases)		Penalty-to-Market Value >= 0.05% (237 cases)	
	[-1,+1] Window	[0,+1] Window	[-1,+1] Window	[0,+1] Window	[-1,+1] Window	[0,+1] Window
Mean CAR	-0.50%***	-0.29%**	-0.29%*	-0.19%	-0.74%**	-0.40%*
CAR *t*-statistic	t = -3.05	t = -2.27	t = -1.82	t = -1.43	t = -2.46	t = -1.77
Mean Penalty-to-Market Value	-0.94%		-0.01%		-2.05%	
Mean Reputation Effect (row 1-row 3)	0.44%**	0.66%***	-0.28%*	-0.17%	1.31%***	1.65%***
Mean Reputation Effect *t*-statistic	t = 2.01	t = 3.35	t = -1.73	t = -1.32	t = 2.97	t = 4.20

Appendix J: Reputation effects: Determinants (581 settlement dates)

Table J1: Reputation effects: Determinants (581 settlement dates)

This table presents regression results analyzing the factors associated with firms' reputational effects due to environmental violations from 2000 to 2021, considering 581 settlement dates. In this table, columns (1) and (3) present the weighted least squares (WLS) regression results of *Reputation Effect* [-10, +3] and *Reputation Effect* [-3, +3] on potential factors of reputation losses, while columns (2) and (4) add interaction terms between time dummies and *SRI ownership* as well as *Social Capital*. Time dummies indicate the period between 2000 and 2006, 2007 and 2016, then 2017 to 2021. Both columns control for firm characteristics. Variable definitions are provided in Appendix C. All control variables are measured in the quarter preceding the first event date available after sample filtration for each environmental violation. Industry fixed effects are included. Standard errors are clustered by industry. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
Variables	Reputation Effect [-10, +3]		Reputation Effect [-3, +3]	
SRI ownership	-0.032		-0.099*	
	(-0.39)		(-1.95)	
Year 2000-2006×SRI ownership		0.161		0.218
		(0.99)		(0.99)
Year 2007-2016×SRI ownership		0.075		-0.105
		(0.40)		(-1.31)
Year 2017-2021×SRI ownership		-0.219**		-0.191***
		(-2.23)		(-3.49)
Social Capital	-0.015***		-0.013***	
	(-3.12)		(-4.25)	
Year 2000-2006×Social Capital		-0.012		-0.007
		(-1.23)		(-0.99)
Year 2007-2016×Social Capital		-0.008		-0.011*
		(-0.89)		(-1.72)
Year 2017-2021×Social Capital		-0.019***		-0.020***
		(-3.60)		(-3.98)
Dedicated_IO	-0.000	0.001	-0.000	0.000
	(-0.09)	(1.03)	(-0.03)	(1.08)
Media Coverage	-0.002	-0.002	-0.003***	-0.003***
	(-1.49)	(-1.32)	(-3.30)	(-2.94)
CEO Liberalism	-0.011	-0.008	-0.002	0.004
	(-0.64)	(-0.43)	(-0.32)	(0.42)
Disaster Declaration	-0.001**	-0.001***	-0.001***	-0.001***
	(-2.26)	(-2.63)	(-2.78)	(-2.72)
Ln (Penalty Amount)	0.010***	0.010***	0.008***	0.008***
	(7.71)	(6.45)	(6.07)	(5.61)
Air Pollution	-0.004	-0.003	0.006	0.006
	(-0.36)	(-0.27)	(1.24)	(1.29)
Water Contamination	0.006	0.005	0.009**	0.007**
	(0.91)	(0.88)	(2.41)	(2.10)
Hazardous Waste	0.003	0.003	0.008	0.007

	(0.27)	(0.28)	(0.84)	(0.75)
Civil Penalty	0.002	0.002	0.001	0.001
	(0.24)	(0.26)	(0.28)	(0.16)
Private	-0.018*	-0.018*	-0.008	-0.008
	(-1.83)	(-1.94)	(-1.05)	(-1.04)
Federal	-0.001	-0.001	-0.005	-0.005
	(-0.21)	(-0.16)	(-1.32)	(-1.39)
Size	0.003	0.003	0.001	0.001
	(0.81)	(0.71)	(0.35)	(0.39)
LEV	0.004	0.024	-0.038	-0.030
	(0.09)	(0.43)	(-1.40)	(-1.03)
MTB	-0.004	-0.003	0.004	0.003
	(-0.37)	(-0.33)	(0.64)	(0.56)
ROA	0.396*	0.389*	0.069	0.076
	(1.84)	(1.70)	(0.29)	(0.33)
Dividend	0.003	0.005*	0.006***	0.007***
	(1.05)	(1.71)	(2.83)	(2.76)
Year 2000-2006		0.005		0.002
		(0.20)		(0.13)
Year 2007-2016		0.010		0.003
		(0.69)		(0.30)
Constant	-0.055	-0.064	-0.019	-0.024
	(-1.57)	(-1.60)	(-1.08)	(-1.07)
Industry FE	YES	YES	YES	YES
N	581	581	581	581
R^2	0.206	0.213	0.230	0.238

Appendix K: Reputational effects, including extreme cases

Table K1: Reputational effects, including extreme cases

This table reports robustness results for the reputational effects associated with environmental violations when extreme cases are included in the sample. The sample contains 599 violation cases. In the baseline sample reported in Table 3, four extreme cases with the largest penalty amounts were excluded. When these cases are added back, the sample increases from 596 to 599 cases because one of the four cases has missing data required to calculate the market reaction. Panel A reports the mean accumulated abnormal returns across all legal-proceeding event dates for each violation, as well as the resulting reputational effect, computed over the [-10, +3] and [-3, +3] windows. The reputational effect is defined as the accumulated abnormal return (row 1) minus the Penalty-to-Market-Value ratio (row 3). Market value is measured as the firm's equity market capitalization at the end of the month preceding the first event date retained after sample filtration for each case. Panel B presents the evolution of reputational effects over three periods: 2000-2006, 2007-2016, and 2017-2021. These periods align with major global ESG milestones: the launch of the UNPRI in 2006 and the entry into force of the Paris Agreement in 2016. For each subperiod, mean accumulated abnormal returns and reputational effects are reported for the [-10, +3] and [-3, +3] windows, along with their associated *t*-statistics. Panel C reports the difference of market reactions, legal penalty, and reputation losses between these periods for the [-10, +3] and [-3, +3] windows. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Full sample: average effects

Variables	[-10, +3] Window	[-3, +3] Window
Mean Accumulated_CAR	-2.68%***	-1.96%***
Accumulated_CAR *t*-statistic	t = -4.76	t = -5.07
Mean Penalty-to-Market Value	-1.34%	
Mean Reputation Effect (row 1-row 3)	-1.34%**	-0.62%
Mean Reputation Effect *t*-statistic	t = -2.31	t = -1.45

Panel B: Subsamples: Time variation

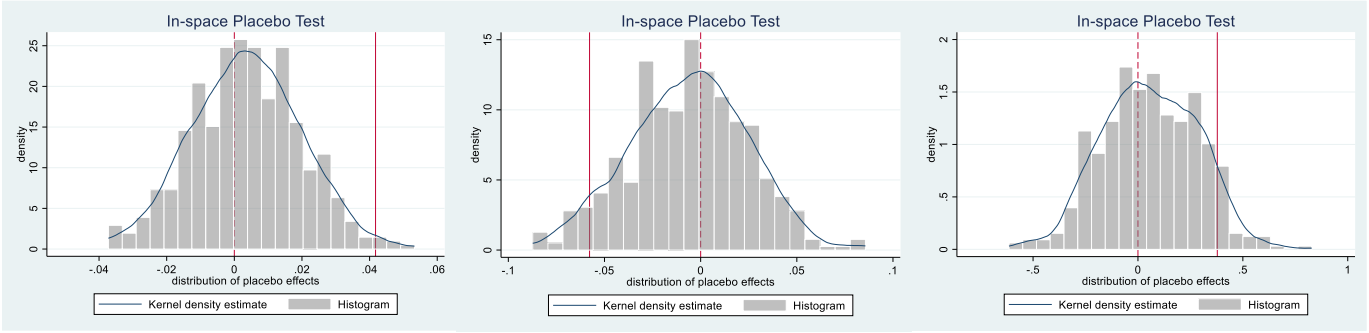
Time Period	Variables	[-10, +3] Window	[-3, +3] Window
2000-2006	Mean Accumulated_CAR	-1.99%*	-1.32%*
	Accumulated_CAR *t*-statistic	t = -1.96	t = -1.92
	Mean Penalty-to-Market Value	-2.68%	
	Mean Reputation Effect (row 1-row 3)	0.69%	1.37%
	Mean Reputation Effect *t*-statistic	t = 0.63	t = 1.62
2007-2016	Mean Accumulated_CAR	-2.40%***	-2.18%***
	Accumulated_CAR *t*-statistic	t = -3.08	t = -4.06
	Mean Penalty-to-Market Value	-0.77%	

	Mean Reputation Effect (row 1-row 3)	-1.63%**		-1.40%**
	Mean Reputation Effect *t*-statistic	t = -2.09		t = -2.59
2017-2021	Mean Accumulated_CAR	-4.40%***		-2.52%***
	Accumulated_CAR *t*-statistic	t = -3.38		t = -2.77
	Mean Penalty-to-Market Value		-0.39%	
	Mean Reputation Effect (row 1-row 3)	-4.01%***		-2.13%**
	Mean Reputation Effect *t*-statistic	t = -3.07		t = -2.32

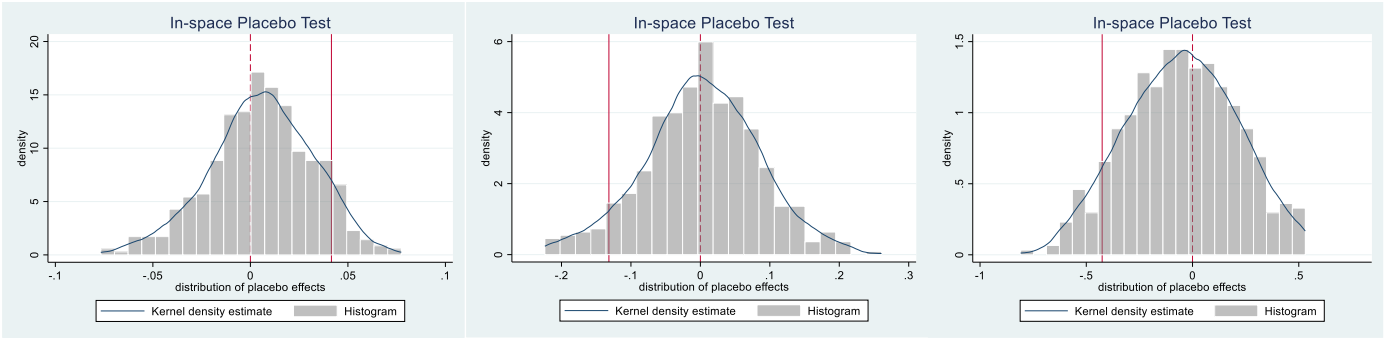
Panel C: Differences across periods

	Mean Accumulated_CAR		Mean Penalty-to-Market Value	Mean Reputation Effect	
	[-10, +3] Window	[-3, +3] Window		[-10, +3] Window	[-3, +3] Window
Difference between 2000-2006 and 2007-2016	0.41%	0.86%	-1.91%***	2.32%*	2.77%***
	t = 0.32	t = 1.00	t = -3.46	t = 1.78	t = 2.87
Difference between 2007-2016 and 2017-2021	2.00%	0.34%	-0.38%	2.38%	0.72%
	t = 1.38	t = 0.33	t = -1.53	t = 1.64	t = 0.71
Difference between 2000-2006 and 2017-2021	2.41%	1.20%	-2.29%***	4.69%***	3.49%***
	t = 1.45	t = 1.06	t = -2.98	t = 2.73	t = 2.70

Appendix L: Placebo tests using randomly assigned treatment



Panel A: Cost of Capital | Panel B: Sales | Panel C: Labor costs



Panel D: ES Committee | Panel E: GHG Emission | Panel F: GHG Cost

Figure L1. Distribution of placebo treatment effects. This figure presents the results of in-space placebo tests for the cost of capital (Panel A), sales (Panel B), labor costs (Panel C), ES Committee (Panel D), GHG Emission (Panel E), and GHG Cost (Panel F). In each panel, we randomly assign treatment status to non-violating firms from the control sample while retaining the original treatment timing structure. We then re-estimate the baseline stacked DiD specification and record the placebo *Treat*×*Post* coefficient. This procedure is repeated 500 times to generate an empirical distribution of placebo treatment effects, shown as the histogram and kernel density estimate. The solid vertical line indicates the actual treatment effect estimated from the true sample, and the dashed vertical line indicates the mean of the placebo distribution. If the actual treatment effect is driven by the environmental violation rather than by unobserved confounders or chance, it should fall in the tail of the placebo distribution. In each panel, the actual treatment effect lies in the expected tail of the placebo distribution, indicating that the observed effects are unlikely to arise by chance.

Appendix M: Robustness to alternative event windows

Table M1: Robustness to alternative event windows

This table examines the sensitivity of our main DiD results to alternative event windows. Panel A reports the effect of environmental violations on firms' cost of equity capital. Panel B reports the effect on portfolio allocation of institutional holdings, using a triple-interaction specification with ESG investor classification. Panel C reports the effect on sales, and Panel D reports the effect on labor costs. The baseline window is [-5, +5] years relative to the violation settlement date; here we report results using [-3, +3] and [-4, +4] year windows. All other specifications are identical to those in the corresponding main tests. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Cost of capital

Variables	(1)	(2)
	COC	
	[-3, +3]	[-4, +4]
Treat×Post	0.024**	0.030***
	(2.45)	(3.11)
Size	0.014	0.004
	(0.89)	(0.28)
LEV	0.068	0.031
	(0.75)	(0.51)
MTB	-0.019***	-0.026***
	(-2.66)	(-3.59)
ROA	-0.138	-0.045
	(-0.61)	(-0.20)
Dividend	0.002	0.005**
	(0.62)	(2.57)
Constant	-0.098	0.019
	(-0.63)	(0.16)
Cohort×Firm	YES	YES
Cohort×Year	YES	YES
N	3488	4441
R^2	0.753	0.748

Panel B: Institutional holdings

Variables	(1)	(2)	(3)	(4)
	Shares Allocation of Institutional Holdings		Value Allocation of Institutional Holdings	
	[-3, +3]	[-4, +4]	[-3, +3]	[-4, +4]
ESG Investor×Treat×Post	-0.013	-0.025***	-0.043***	-0.062***
	(-1.41)	(-2.71)	(-3.83)	(-5.54)
ESG Investor×Treat	0.053***	0.065***	0.070***	0.081***
	(10.63)	(12.97)	(12.91)	(14.87)
ESG Investor×Post	0.012*	0.020***	0.024**	0.039***
	(1.71)	(2.87)	(2.55)	(4.28)
Treat×Post	0.010**	0.011**	-0.022***	-0.029***
	(2.31)	(2.22)	(-4.37)	(-5.47)
Size	0.051***	0.061***	0.089***	0.090***
	(12.09)	(13.22)	(17.75)	(17.45)
LEV	-0.317***	-0.371***	-0.233***	-0.258***
	(-20.77)	(-21.17)	(-14.86)	(-15.04)
MTB	-0.008***	-0.009***	0.034***	0.038***
	(-6.83)	(-7.20)	(20.98)	(22.85)

ROA	-0.100***	-0.119***	0.215***	0.171***
	(-5.63)	(-7.33)	(10.67)	(9.34)
Dividend	-0.000	-0.000	-0.001***	-0.001***
	(-0.76)	(-0.62)	(-4.19)	(-7.25)
Constant	-0.020	-0.102**	-0.362***	-0.364***
	(-0.45)	(-2.16)	(-6.90)	(-6.82)
Cohort×Year	YES	YES	YES	YES
Cohort×Institution×Firm	YES	YES	YES	YES
N	2727993	3385559	2727993	3385559
R^2	0.874	0.860	0.870	0.855

Panel C: Sales and labor costs

Variables	(1)	(2)	(3)	(4)
	Sales		Labor Costs	
	[-3, +3]	[-4, +4]	[-3, +3]	[-4, +4]
Treat×Post	-0.025**	-0.036***	0.151**	0.217***
	(-2.05)	(-3.01)	(2.03)	(2.99)
Size	0.378***	0.448***	0.257	0.441***
	(18.11)	(23.55)	(1.64)	(2.83)
LEV	0.049	0.039	0.053	-0.027
	(0.74)	(0.64)	(0.09)	(-0.05)
MTB	0.095***	0.105***	0.225	0.246*
	(6.21)	(8.15)	(1.31)	(1.78)
ROA	0.423	0.681**	1.561	0.666
	(1.28)	(2.33)	(0.51)	(0.23)
Dividend	0.037*	0.016	0.026	-0.056
	(1.79)	(0.90)	(0.29)	(-0.61)
Constant	3.692***	3.033***	3.997**	2.234
	(18.17)	(16.61)	(2.50)	(1.45)
Cohort×Firm	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES
N	12071	15049	1550	1934
R^2	0.986	0.985	0.994	0.993

Appendix N: Excluding violations with overlapping estimation windows

Table N1: Excluding violations with overlapping estimation windows

This table reports robustness results after excluding violations whose *[−20, +20]* quarter estimation window overlaps with that of another violation by the same firm. This restriction addresses the concern that overlapping treatment windows may contaminate the Post indicator for firms with multiple violations. Panel A reports the effect on firms' cost of equity capital (*COC*). Panel B reports the effect on portfolio allocation of institutional holdings using a triple-interaction specification with ESG investor classification. Panel C reports the effect on sales and labor costs for the full sample. Panel D splits the sales and labor cost sample by *SRI ownership*, and Panel E splits by social capital. All regressions include Cohort×Firm and Cohort×Year fixed effects except Panel B, where column (1) includes Cohort×Institution, Cohort×Firm, and Cohort×Year fixed effects and column (2) includes Cohort×Institution×Firm and Cohort×Year fixed effects. Standard errors are clustered at the Cohort×Firm×Year level (Panels A, C, D, E) or Cohort×Institution level (Panel B). Variable definitions are provided in Appendix C. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Cost of capital

	(1)	(2)	(3)	(4)	(5)
Dependent variables=COC	Full Sample	Low SRI ownership	High SRI ownership	Low Social capital	High Social capital
Treat×Post	0.038***	0.019	0.038***	0.026*	0.049***
	(3.92)	(1.36)	(3.61)	(1.68)	(3.79)
Difference (Chow Test)		0.019 (p = 0.28)		0.024 (p = 0.24)	
Size	-0.004	0.042	-0.022	0.016	-0.023
	(-0.27)	(1.30)	(-1.47)	(0.64)	(-1.31)
LEV	0.034	-0.108	0.101*	-0.045	0.113
	(0.59)	(-0.85)	(1.95)	(-0.43)	(1.58)
MTB	-0.028***	-0.022*	-0.028***	-0.035***	-0.026***
	(-3.84)	(-1.83)	(-3.22)	(-2.74)	(-3.18)
ROA	-0.028	-0.124	0.007	0.038	-0.137
	(-0.13)	(-0.24)	(0.04)	(0.09)	(-0.74)
Dividend	0.006***	0.013***	0.004*	0.008***	0.003*
	(2.87)	(7.29)	(1.75)	(3.22)	(1.70)
Constant	0.090	-0.285	0.246	-0.080	0.248
	(0.65)	(-1.00)	(1.61)	(-0.32)	(1.50)
Cohort×Firm	YES	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES	YES
N	4477	1306	3171	1687	2790
R^2	0.754	0.799	0.699	0.764	0.750

Table N1, continued

Panel B: Institutional holdings

Variables	(1) Shares Allocation of Institutional Holdings	(2) Value Allocation of Institutional Holdings
ESG Investor×Treat×Post	-0.035***	-0.095***
	(-3.93)	(-8.30)
ESG Investor×Treat	0.072***	0.096***
	(14.01)	(16.46)
ESG Investor×Post	0.036***	0.064***
	(5.76)	(7.04)
Treat×Post	0.014***	-0.030***
	(2.62)	(-5.23)
Size	0.056***	0.079***
	(13.07)	(16.31)
LEV	-0.367***	-0.230***
	(-20.73)	(-13.14)
MTB	-0.010***	0.051***
	(-7.70)	(29.76)
ROA	-0.123***	0.135***
	(-8.26)	(7.92)
Dividend	-0.000	-0.001***
	(-0.34)	(-5.47)
Constant	-0.046	-0.264***
	(-1.06)	(-5.26)
Cohort×Year	YES	YES
Cohort×Institution×Firm	YES	YES
N	3966899	3966899
R^2	0.845	0.839

Panel C: Sales of labor costs

Variables	(1) Sales	(2) Labor Costs
Treat×Post	-0.047***	0.125
	(-3.51)	(1.03)
Size	0.463***	0.347**
	(27.14)	(2.12)
LEV	-0.121	-0.524
	(-1.58)	(-0.66)
MTB	0.106***	0.019
	(9.19)	(0.12)
ROA	0.353*	1.757
	(1.68)	(0.78)
Dividend	-0.001	-0.004
	(-0.76)	(-0.08)
Constant	2.894***	3.257**
	(17.74)	(2.05)
Cohort×Firm	YES	YES
Cohort×Year	YES	YES
N	15447	1687
R^2	0.984	0.996

Table N1, continued

Panel D: Moderating role of SRI ownership

	(1)	(2)	(3)	(4)
Variables	Sales		Labor Costs	
SRI ownership classification	Low	High	Low	High
Treat×Post	0.056**	-0.091***	0.087	0.169
	(2.36)	(-5.67)	(0.61)	(0.79)
Difference (Chow Test)	-0.146*** (p = 0.00)		0.082 (p = 0.75)	
Size	0.461***	0.456***	0.447*	0.169
	(15.32)	(23.14)	(1.75)	(0.62)
LEV	-0.207	-0.090	-0.381	-0.858
	(-1.27)	(-1.25)	(-0.36)	(-0.77)
MTB	0.046**	0.147***	-0.030	-0.025
	(2.47)	(10.25)	(-0.15)	(-0.09)
ROA	-0.040	0.559*	0.566	6.735
	(-0.13)	(1.93)	(0.25)	(1.20)
Dividend	-0.007***	-0.000	-0.011	0.010
	(-5.10)	(-0.11)	(-0.14)	(0.16)
Constant	2.689***	3.054***	2.236	5.359*
	(9.83)	(15.94)	(1.00)	(1.74)
Cohort×Firm	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES
N	5035	10412	1118	569
R^2	0.981	0.985	0.997	0.993

Panel E: Moderating role of social capital

	(1)	(2)	(3)	(4)
Variables	Sales		Labor Costs	
Social capital classification	Low	High	Low	High
Treat×Post	-0.040*	-0.055***	0.097	0.126
	(-1.73)	(-3.36)	(0.66)	(0.64)
Difference (Chow Test)	-0.015 (p = 0.60)		0.029 (p = 0.91)	
Size	0.405***	0.498***	0.209	0.577***
	(14.19)	(23.13)	(0.97)	(2.84)
LEV	-0.017	-0.210*	-1.293	2.064*
	(-0.19)	(-1.85)	(-1.42)	(1.82)
MTB	0.095***	0.112***	0.041	0.117
	(5.24)	(7.32)	(0.19)	(0.67)

ROA	-0.421	0.946***	0.856	1.483
	(-1.16)	(4.00)	(0.31)	(0.48)
Dividend	-0.000	-0.001	-0.009	-0.017
	(-0.07)	(-0.72)	(-0.12)	(-0.25)
Constant	3.449***	2.569***	4.719**	0.475
	(12.65)	(12.52)	(2.42)	(0.23)
Cohort×Firm	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES
N	5702	9745	1157	530
R^2	0.982	0.985	0.996	0.997

Appendix O: First-violation sample

Table O1: First-violation sample

This table reports the results of environmental violations using only the first violation for each firm. To address concerns about overlapping DiD windows from repeated violations, we retain only each firm's first penalty settlement and discard subsequent events. For firms with a single violation, that event is retained. Panel A reports the effect on firms' cost of equity capital (*COC*). Panel B reports the effect on portfolio allocation of institutional holdings using a triple-interaction specification with ESG investor classification. Panel C reports the effect on sales and labor costs for the full sample. Panel D splits the sales and labor cost sample by *SRI ownership*, and Panel E splits by social capital. All regressions include Cohort×Firm and Cohort×Year fixed effects except Panel B, where column (1) includes Cohort×Institution, Cohort×Firm, and Cohort×Year fixed effects and column (2) includes Cohort×Institution×Firm and Cohort×Year fixed effects. Standard errors are clustered at the Cohort×Firm×Year level (Panels A, C, D, E) or Cohort×Institution level (Panel B). Variable definitions are provided in Appendix C. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Cost of capital

	(1)	(2)	(3)	(4)	(5)
Dependent variables=COC	Full Sample	Low SRI ownership	High SRI ownership	Low Social capital	High Social capital
Treat×Post	0.042***	0.001	0.041***	0.030*	0.051***
	(3.81)	(0.04)	(3.52)	(1.75)	(3.53)
Difference (Chow Test)		0.040* (p = 0.07)		0.021 (p = 0.34)	
Size	0.000	0.043	-0.017	0.017	-0.022
	(0.00)	(1.10)	(-0.98)	(0.59)	(-1.00)
LEV	0.032	-0.164	0.111*	-0.057	0.118
	(0.48)	(-0.97)	(1.93)	(-0.43)	(1.47)
MTB	-0.029***	-0.026	-0.030***	-0.039**	-0.028***
	(-3.56)	(-1.59)	(-3.12)	(-2.46)	(-3.02)
ROA	0.003	-0.171	0.046	0.059	-0.103
	(0.01)	(-0.27)	(0.23)	(0.12)	(-0.50)
Dividend	0.006***	0.019	0.006**	0.008***	0.004
	(2.76)	(0.98)	(2.50)	(2.99)	(1.62)
Constant	0.052	-0.264	0.199	-0.080	0.238
	(0.31)	(-0.78)	(1.10)	(-0.27)	(1.16)
Cohort×Firm	YES	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES	YES
N	4113	1101	3012	1479	2634
R^2	0.754	0.801	0.700	0.757	0.755

Table O1, continued

Panel B: Institutional holdings

Variables	(1) Shares Allocation of Institutional Holdings	(2) Value Allocation of Institutional Holdings
ESG Investor×Treat×Post	-0.042***	-0.094***
	(-4.25)	(-7.54)
ESG Investor×Treat	0.077***	0.090***
	(12.70)	(13.87)
ESG Investor×Post	0.038***	0.073***
	(5.66)	(7.50)
Treat×Post	0.019***	-0.044***
	(3.17)	(-6.59)
Size	0.061***	0.081***
	(13.48)	(16.37)
LEV	-0.412***	-0.275***
	(-21.57)	(-14.65)
MTB	-0.011***	0.059***
	(-7.08)	(30.03)
ROA	-0.121***	0.212***
	(-7.75)	(12.07)
Dividend	-0.000	-0.001***
	(-0.88)	(-5.43)
Constant	-0.070	-0.264***
	(-1.52)	(-5.14)
Cohort×Year	YES	YES
Cohort×Institution×Firm	YES	YES
N	3519344	3519344
R^2	0.844	0.838

Panel C: Sales of labor costs

Variables	(1) Sales	(2) Labor Costs
Treat×Post	-0.053***	0.135
	(-3.64)	(1.01)
Size	0.467***	0.347*
	(24.46)	(1.97)
LEV	-0.034	-0.464
	(-0.44)	(-0.53)
MTB	0.098***	0.017
	(8.40)	(0.09)
ROA	0.417*	1.086
	(1.95)	(0.44)
Dividend	-0.002	-0.023
	(-1.25)	(-0.29)
Constant	2.811***	3.160*
	(15.65)	(1.87)
Cohort×Firm	YES	YES
Cohort×Year	YES	YES
N	14619	1552
R^2	0.984	0.996

Table O1, continued

Panel D: Moderating role of SRI ownership

	(1)	(2)	(3)	(4)
Variables	Sales		Labor Costs	
SRI ownership classification	Low	High	Low	High
Treat×Post	0.077**	-0.108***	0.101	0.163
	(2.51)	(-6.74)	(0.60)	(0.61)
Difference (Chow Test)	-0.184*** (p = 0.00)		0.061 (p = 0.85)	
Size	0.464***	0.454***	0.465*	0.154
	(12.35)	(22.68)	(1.69)	(0.61)
LEV	-0.042	-0.059	-0.472	-0.669
	(-0.25)	(-0.83)	(-0.39)	(-0.63)
MTB	0.025	0.149***	-0.051	-0.050
	(1.37)	(10.33)	(-0.17)	(-0.19)
ROA	0.119	0.543*	-0.359	6.005
	(0.39)	(1.84)	(-0.13)	(0.90)
Dividend	-0.007***	-0.001	-0.024	0.001
	(-5.31)	(-0.49)	(-0.26)	(0.01)
Constant	2.562***	3.038***	2.055	5.326*
	(7.68)	(15.73)	(0.87)	(1.88)
Cohort×Firm	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES
N	4478	10141	1037	515
R^2	0.980	0.985	0.997	0.993

Panel E: Moderating role of social capital

	(1)	(2)	(3)	(4)
Variables	Sales		Labor Costs	
Social capital classification	Low	High	Low	High
Treat×Post	-0.047*	-0.061***	0.099	0.118
	(-1.67)	(-3.72)	(0.60)	(0.59)
Difference (Chow Test)	-0.013 (p = 0.69)		0.019 (p = 0.94)	
Size	0.410***	0.502***	0.183	0.626***
	(11.19)	(22.60)	(0.76)	(3.02)
LEV	0.088	-0.132	-1.142	2.372*
	(0.66)	(-1.47)	(-1.13)	(1.80)
MTB	0.051**	0.124***	0.062	0.160
	(2.44)	(8.76)	(0.22)	(0.87)

ROA	-0.406	0.982***	0.500	-0.517
	(-1.02)	(4.42)	(0.16)	(-0.17)
Dividend	0.002	-0.002	-0.015	-0.211
	(0.34)	(-1.22)	(-0.17)	(-0.91)
Constant	3.342***	2.499***	4.793**	-0.071
	(9.71)	(11.99)	(2.24)	(-0.03)
Cohort×Firm	YES	YES	YES	YES
Cohort×Year	YES	YES	YES	YES
N	5131	9488	1088	464
R^2	0.981	0.986	0.996	0.997