Monitoring the Green Line: Environmental Covenants in Supply Chain Contracts

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July 13, 2025

Abstract

This paper investigates the determinants and real economic effects of environmental covenants in supply chain contracts, as well as their interaction with public regulatory enforcement. We show that the likelihood of including environmental covenants is positively associated with the expected benefits of managing suppliers' pollution risks and aligning with shareholder preferences for sustainability, and negatively associated with the anticipated costs of monitoring and enforcing compliance. In settings such as high-polluting industries, where both benefits and costs are elevated, whether covenants are adopted ultimately depends on which effect dominates. Using identification strategies based on the close victory of the Democratic Party in elections, we find that stronger public regulatory enforcement reduces the likelihood of covenant adoption, indicating that contractual monitoring and public oversight function as substitutes. Finally, we provide evidence that environmental covenants causally generate tangible improvements in supply chain sustainability, as disciplined suppliers significantly reduce toxic emissions and increase their hiring of environmental specialists.

Keywords: Supply Chain Contracting, Environmental Covenants, Customer Monitoring
*JEL Classification Codes:*D23, L14, M14

∗ Ling Cen acknowledges the funding support from The National Natural Science Foundation of China [Grant number 72495151].

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1. Introduction

Sustainable supply chains have become essential for firms seeking to meet ESG objectives and respond to intensifying scrutiny from shareholders, regulators, employees, and consumers. However, agency theory (Jensen and Meckling, 1976) highlights a fundamental challenge: under information asymmetry, suppliers have incentives to opportunistically underinvest in environmental compliance or risk management to reduce costs and compete more aggressively on price to attract customers. Such moral hazard not only shifts environmental risks downstream, but also exposes customer firms to substantial reputational and regulatory liabilities. To address these agency problems, customer firms increasingly incorporate environmental covenants into supply chain contracts supplementing public regulatory enforcement with contractual safeguards to monitor and incentivize suppliers' environmental accountability (Aghion and Bolton, 1992).

While environmental covenants are increasingly viewed as an important tool for fostering sustainable supply chains, little is known about their determinants, their real economic effects, or how they interact with public regulatory enforcement. This gap largely reflects the lack of systematic data on the prevalence and content of environmental provisions in supply chain contracts. To address this challenge, we compile a novel dataset of 6,031 supply chain agreements disclosed in SEC filings between 1996 and 2022, using a large language model (LLM) approach to identify and classify environmental covenants. Consistent with emerging evidence on private environmental monitoring (e.g. Choy et al., 2024), we find that approximately 21% of these contracts include at least one environmental covenant.

Using this dataset, we examine three central research questions about the role of en-

vironmental covenants in supply chain agreements. First, we analyze the key cost-benefit trade-offs that influence whether such covenants are included. Second, we investigate how contractual provisions interact with alternative pollution control mechanisms, and whether they operate as substitutes or complements to public regulatory enforcement. Finally, we assess whether environmental covenants lead to tangible improvements in suppliers' environmental performance.

We consider two primary benefits that can motivate the inclusion of environmental covenants in supply chain contracts. First, firms increasingly face external pressure to demonstrate environmental responsibility across their entire supply chains, driven by expectations from shareholders, customers, and regulators that accountability extends beyond their own operations. Second, even when customer firms do not have strong green preferences, environmental covenants can help mitigate the risk of supply disruptions, liability, or reputational damage if suppliers are targeted by regulatory enforcement actions such as EPA sanctions. The primary cost of environmental covenants is that requiring greener practices imposes real economic burdens on the supplier-customer pair, including higher production costs, compliance expenses, or investments in new processes. Who ultimately bears these costs and their effect on covenant adoption depends on the parties' relative bargaining power and the terms negotiated in the contract.[1]

Consistent with our hypotheses, we find that the likelihood of including environmental covenants in supply chain contracts is positively associated with the benefits of curbing

1 Suppliers may also perceive that stricter standards make them less competitive in serving other customers, potentially prompting demands for additional compensation or leading them to reject the covenants altogether. Environmental covenants could also create proprietary costs by revealing sensitive operational information to competitors, but we are not able to isolate these considerations empirically.

suppliers' opportunistic pollution incentives and aligning with shareholder green preferences. In contrast, adoption is negatively associated with the expected costs of monitoring and enforcing compliance. Not surprisingly, the strongest predictors relate to the need to restrict opportunistic pollution, such as whether a supplier operates in a high-polluting industry. Placebo tests using product quality and financial covenants as dependent variables confirm that these patterns are specific to environmental covenants rather than reflecting general contracting tendencies.

Next, we examine how environmental covenants interact with public regulatory enforcement in shaping suppliers' incentives to limit pollution. Theoretically, this relationship is ambiguous. On one hand, stronger regulatory oversight can increase the risk of ex post liability or reputational damage for customers, which may encourage them to adopt stricter contractual safeguards. On the other hand, when regulators already monitor suppliers intensively, firms may view private contractual enforcement as redundant and rely instead on public oversight, consistent with evidence in Demerjian et al. (2025).

Empirically, we find that environmental covenants and public regulatory enforcement function as substitutes. Specifically, higher EPA monitoring intensity at the state level weakens the association between suppliers' pollution risk and the likelihood of covenant inclusion. To address potential endogeneity, we follow Choy et al. (2024) and use close victories by Democratic candidates in congressional elections as an instrumental variable for regulatory enforcement intensity. This approach indicates that the substitution effect is causal.

Finally, we investigate whether environmental covenants in supply chain contracts are primarily symbolic—signaling the type of suppliers—or whether they lead to tangible im-

provements in suppliers' environmental practices. Using an event study framework around contract signing, we examine whether suppliers reduce toxic emissions or increase the hiring of environmental specialists when customers adopt environmental covenants compared to contracts without such provisions. Our findings indicate that covenants are associated with meaningful improvements in both outcomes.

To address potential endogeneity, particularly the concern that more environmentally conscious suppliers may self-select into accepting these covenants, we leverage mergers and acquisitions as an identification strategy. In these transactions, environmental considerations are typically not the primary motivation. However, after the deal closes, the acquired target firms automatically become subject to any pre-existing environmental covenants between the acquiring supplier and its customers. Using this approach, we find that these covenants causally enhance the environmental practices of the acquired firms.

Our study contributes to several strands of literature. First, we extend research on the determinants of corporate environmental behavior by showing how customer firms use contractual mechanisms to influence suppliers' practices. Prior work has documented how firm-level characteristics such as financial constraints Xu and Kim (2022), ownership structure Shive and Forster (2020), environmental liabilities Akey and Appel (2021), and the presence of external monitors such as auditors Duflo et al. (2013) or insurers Boomhower (2019) affect environmental outcomes. Recent studies also highlight the role of stakeholders—including shareholders (Dimson et al., 2015; Dyck et al., 2019), creditors Choy et al. (2024), and customers (Schiller, 2018; Dai et al., 2021)—in shaping firms' ESG practices. Our findings contribute new evidence on how supply chain contracts serve as a private governance tool to manage environmental risks beyond a firm's own operations.

Second, we build on the literature examining how supply chain contracts mitigate incentive conflicts and allocate control rights (Costello, 2013), by showing that contractual provisions can be adapted to address reputational, regulatory, and sustainability objectives. In this way, our study expands the scope of supply chain contracting research to incorporate environmental performance alongside traditional economic and operational concerns.

Third, our evidence contributes to the debate over whether private governance mechanisms are merely symbolic or produce real improvements in environmental outcomes. Using an event study and an identification strategy based on mergers and acquisitions, we document that environmental covenants causally reduce suppliers' toxic emissions and increase their investment in environmental human capital. Finally, by showing that stronger public enforcement substitutes for contractual monitoring, our study highlights the interplay between private contracting and public regulation in shaping supply chain sustainability.

The remainder of the paper proceeds as follows. Section 2 provides literature reviews with hypothesis development. Section 3 discusses the sample selection and the data. Section 4 presents the cost-benefit analysis for the determinants of environmental covenant inclusion in supply chain contracts. Section 5 discusses the interaction between environmental covenants and public regulatory enforcement in disciplining the polluting incentives of suppliers. Section 6 presents the real economic outcomes of environmental covenants. Section 7 concludes.

2. Literature Review and Hypothesis Development

2.1. Literature Review

2.1.1. Private Governance and Contract Design

Contracts play a central role in mitigating agency conflicts between firms. In the context of financial contracting, Smith and Warner (1979) argue that covenants are adopted when the benefits of controlling opportunistic behavior outweigh the costs associated with reduced flexibility, monitoring, and enforcement. Their foundational framework, while developed for debt contracts, applies broadly to contractual design across firm relationships. Extending this logic to supply chain settings, Costello (2013) demonstrates that long-term supply chain contracts serve to align incentives and mitigate supplier opportunism, particularly when suppliers must make relationship-specific investments and when formal legal enforcement is costly or incomplete. Moreover, when external enforcement mechanisms are weak, relational contracting becomes increasingly important to sustain cooperation and manage risk (Baker et al., 2002). These insights suggest that firms design private governance mechanisms, including specific contractual provisions, to address incentive problems that cannot be easily resolved through external legal means.

In the context of supply chains, environmental performance represents a growing source of counterparty risk. Suppliers that minimize environmental compliance efforts to reduce costs may expose downstream customer firms to reputational damage, regulatory sanctions, and operational disruptions. Building on prior contracting theory, we view the inclusion of environmental covenants in supply chain contracts as a targeted private governance tool designed to restrict supplier opportunism related to environmental behavior.

2.1.2. Proprietary Costs and the Limits of Contractual Governance

While contractual provisions can help mitigate agency problems, their adoption reflects a trade-off between expected benefits and expected costs. In the context of environmental covenants, one primary benefit is reducing suppliers' incentives to engage in opportunistic pollution or underinvestment in compliance. By imposing clear standards and monitoring requirements, customers can limit the risk of regulatory sanctions, supply disruptions, or reputational damage resulting from suppliers' environmental practices. In addition, environmental covenants can help align firms with growing stakeholder expectations for sustainability, including the demands of institutional investors and environmentally conscious consumers.

However, these benefits must be weighed against several types of costs. Implementing stricter environmental standards often entails higher production and compliance expenses, which suppliers may attempt to pass on to customers through higher prices or other contractual terms. Enforcing compliance can also require investments in monitoring systems and specialized personnel. In some cases, contractual provisions may create proprietary risks by requiring disclosure of operational practices or sustainability initiatives that competitors could exploit, although such effects are difficult to measure directly. Finally, the distribution of these costs and the feasibility of enforcing covenants often depend on the relative bargaining power of the contracting parties.

Taken together, this trade-off between governance benefits and implementation costs shapes whether firms choose to include environmental covenants in their supply chain contracts and how these provisions are structured.

2.1.3. Private Governance as a Substitute for Public Enforcement

The balance between contractual governance benefits and costs is further shaped by the external regulatory environment. Hadfield and Weingast (2012) argue that when formal public legal systems are underdeveloped or weakly enforced, private ordering mechanisms — including contracts, norms, and reputation — emerge to fill the governance gap. In supply chains, environmental covenants may similarly function as substitutes for public regulatory enforcement when environmental oversight is weak or inconsistent across jurisdictions. Firms may be more willing to invest in private monitoring and contractual restrictions when they cannot rely on external regulators to deter supplier misconduct. Consequently, variation in the strength of public environmental enforcement should influence the propensity of firms to embed environmental governance mechanisms within their private supply chain contracts.

2.1.4. Covenants and Real Economic Outcomes

While most contracting theory has focused on the adoption and design of contractual terms, a growing body of empirical research examines whether contracts produce real economic effects. Chava et al. (2009) show that covenant structures in loan agreements can influence borrower investment policies and risk-taking behavior, demonstrating that contractual governance provisions have tangible impacts beyond contractual compliance itself. More recently, Choy et al. (2024) find that environmental covenants in bank loans lead to reductions in borrower pollution levels, suggesting that private contractual terms can meaningfully influence firms' environmental practices.

In the supply chain setting, however, little is known about whether customer-imposed environmental covenants lead to measurable improvements in supplier environmental out-

comes. Addressing this gap, we examine whether the inclusion of environmental covenants in supply chain contracts is associated with reductions in supplier toxic emissions. Establishing such a link would provide important validation that private contractual governance can extend beyond risk management to influence broader environmental performance.

2.2. Hypothesis Development

Building on these insights, we develop predictions regarding both the determinants of environmental covenant adoption and their consequences for supplier behavior.

2.2.1. Determinants of Covenant Adoption

We hypothesize that firms are more likely to include environmental covenants when the benefits of managing supplier environmental risks are higher. For example, suppliers operating in high-polluting industries create greater potential exposure to regulatory penalties, reputational damage, and supply disruptions, which increases the value of contractual safeguards. At the same time, these suppliers often face higher compliance costs if stricter standards are imposed, so whether covenants are adopted ultimately depends on whether the perceived benefits outweigh the costs in each case. This trade-off underscores the importance of empirical analysis to determine the net effect.

In contrast, other factors may more clearly indicate benefits without substantial offsetting costs. For instance, customers with greater reputational stakes—including those with prior environmental violations or extensive sustainability disclosures—are likely to face stronger incentives to adopt environmental standards. Similarly, firms under scrutiny from environmentally conscious investors may embed environmental commitments in contracts to address stakeholder expectations.

Conversely, we expect covenant adoption to be less likely when the costs of requiring greener practices are relatively high and unaccompanied by proportionate benefits. Implementing more stringent standards can impose substantial production and compliance expenses. Who ultimately bears these costs—and whether they discourage adoption—depends on the relative bargaining power between customers and suppliers and the terms negotiated in the contract. In some cases, suppliers may also perceive that adopting higher standards limits their competitiveness with other customers or requires disclosure of sensitive information, though we do not separately test these considerations empirically.

2.2.2. Consequences for Supplier Behavior

We also hypothesize that environmental covenants produce real improvements in suppliers' environmental performance rather than serving only as symbolic commitments. Specifically, suppliers subject to such provisions should exhibit greater reductions in toxic emissions and increased investment in environmental expertise relative to suppliers not governed by similar standards. This prediction complements our analysis of adoption determinants by assessing whether contractual ESG commitments translate into measurable outcomes.

2.2.3. Summary of Predictions and Empirical Approach

Building on the cost–benefit framework described above, our empirical analysis proceeds in two parts. First, we test predictions about the determinants of covenant adoption. We examine how supplier characteristics (pollution intensity, financial constraints), customer characteristics (reputational exposure, green investor pressure, monitoring capabilities), and regulatory enforcement influence the likelihood that environmental covenants are included in supply contracts.

Second, we test whether environmental covenants lead to improvements in suppliers' environmental practices. Specifically, we examine whether covenant adoption is associated with reductions in toxic emissions and increased hiring of environmental specialists. By analyzing both the determinants and the consequences of covenant inclusion, we aim to provide a comprehensive assessment of how private supply chain governance mechanisms operate to manage environmental risks.

3. Sample and Data

3.1. Data Sources

3.1.1. Supply Chain Contracts

Building on the data collection methodologies outlined in previous studies (Costello, 2013; Bushee et al., 2020; Hui et al., 2024; Dai et al., 2024), we identify environmental covenants in supply chain contracts using exhibits disclosed in Securities and Exchange Commission (SEC) filings. According to Section 10(ii)(b) of Regulation S-K, firms are required to disclose material business contracts as exhibits in SEC filings, with each exhibit corresponding to a distinct material contract.[2]

To identify these contracts, we first utilize the EDGAR index file (U.S. Securities and Exchange Commission, 2025), which encompasses all filings and exhibits, amounting to approximately 6.5 million URLs. We focus on exhibits potentially related to supply chain contracts, specifically from Forms 10-K, 8-K, and S (Initial Public Offering) filings. Our

2 Pursuant to SEC rules, material contracts must be filed if they (i) are not within the ordinary course of business, or (ii) are within the ordinary course of business but the filer's operations are substantially dependent on the contract during the filing period. The SEC suggests a materiality threshold of approximately 10% of sales (SEC, 2004; Hui et al., 2024).

selection criteria include documents where the filing titles or the first 1,000 characters of their descriptions contain the terms "agreement" or "contract," along with at least one of the following keywords: "leas (covering "lease" and "leasing")," "rental," "service," "consult," "market," "advert," "license," "construction," "engineer," "program," "manufactur (covering "manufacture", "manufacturing", and "manufacturer")," "purchase," "buy," "procur (covering "procure" and "procuring")," "acquisition," "sale," or "suppl (covering "supplier" and "supply")". Detailed selection criteria are provided in Appendix B.1.

To ensure the integrity of the dataset, we implement a rigorous filtering process to exclude other types of contracts. This involves removing duplicates and excluding contracts that contain keywords such as "memorandum," "letter," "warranty," "terminate," "dismiss," "settle," "discontinue," "suspend," "cessation," "stock," "equity," "security," "loan," "credit," "employ," "mortgage," "escrow," "incentive," or "asset transfer." A comprehensive list of excluded terms is provided in our *Invalid Word List* in Appendix B.2. After applying these filters, we can identify a total of 82,156 supply chain contracts.

Next, we utilize a Large Language Model (LLM) to extract critical contract details, including contract dates (for S forms) and other essential terms. For Forms 10-K and 8-K, we use the filing dates as proxies for contract dates, given the requirement for the timely disclosure of material events in these forms. For S forms, which may include historical contracts for IPO filing, the LLM is employed to identify exact contract dates accurately. In addition, we extract supplier and customer names from contract filings.

To enhance data accuracy, we apply fuzzy matching techniques to align supplier and customer names with firms and their subsidiaries in the Compustat universe, mapping them

to GVKEY identifiers. Contracts with a mapping score of 85 or higher are retained.[3] We limit our analysis to publicly listed firms in the Compustat universe, ensuring sufficient data availability for empirical analysis. Contracts with fewer than 4,000 characters, which may indicate incomplete agreements, are excluded. In addition, we combine multi-contract filings involving the same supplier and customer pair on a given day to avoid duplication. Contracts involving firms in the financial services industry (SIC codes 6000–6999) are excluded.

Our final sample comprises 6,031 unique contracts spanning the period from 1996 to 2022, which forms the basis for our primary empirical analyses. These contracts involve 2,492 unique customers and 2,222 unique suppliers with 4,717 unique supply chain pairs. A detailed description of the sample selection process with observation counts of each step is presented in Table D1.

3.1.2. Environmental Covenants in Supply Chain Contracts

To identify environmental covenants in our sample of supply chain contracts, we follow the methodologies of Choy et al. (2024) and Lui (2021), which examine environmental covenants in loan agreements. Specifically, we refer to the covenant patterns modeled in Vandenbergh et al. (2022) and those identified in the loan contracts to determine whether there are similar environmental covenants in the supply chain contracts. We consider four types of environmental covenants: environmental law compliance covenants, environmental disclosure covenants, environmental action covenants, and environmental audit covenants.[4] A supply chain contract is considered to include an environmental covenant if it falls into any of these categories. Among all environmental covenant types, compliance covenants are

3 We use the Python package Rapidfuzz and rely on the WRatio as the selection criteria.
4 See Appendix B.3 for the search patterns. Please refer to Appendix C for examples of these covenants.

the most common ones. In our sample, 20.6% of the contracts contain some types of environmental covenant. Specifically, 12.4% contain environmental disclosure covenants, 2.7% contain environmental action covenants, 1.6% contain environmental audit covenants, and 17.8% contain environmental law compliance covenants.

3.1.3. Measurement of Supplier Emissions

The EPA's Toxics Release Inventory (TRI) provides detailed data on emissions reported by suppliers. Land emissions include the storage and discharge of toxic chemicals into surface impoundments (uncovered holding areas used to volatilize and/or settle waste), underground injection wells, landfills, waste piles, and releases due to spills and leaks (EPA, 2024). Groundwater emissions arise from runoff, leaks, spills, and discharges into bodies of water such as streams, lakes, rivers, and oceans (EPA, 2024). Air emissions are categorized into point source emissions—those released through confined air streams like stacks, ducts, or pipes—and fugitive emissions, which occur through leaks or evaporation from spills and storage tanks (EPA, 2024). Following prior studies using this dataset (e.g., Heath et al., 2023; Dai et al., 2024), we calculate a supplier's total emissions by aggregating their reported releases to land, groundwater, and air.

3.1.4. State Regulatory Enforcement Intensity

State regulators conduct inspections to evaluate an entity's compliance with regulations and take enforcement actions upon discovering violations. Similar to Choy et al. (2024), we obtain enforcement and inspection data from the Integrated Compliance Information System for Federal Civil Enforcement Case Data (ICIS FE&C) in the EPA's Enforcement and Compliance History Online (ECHO) database. We use data on inspections and formal

administrative and judicial enforcement actions taken by the EPA under all environmental statutes. To measure the intensity of state-level regulatory enforcement, we normalize the total number of inspections and enforcement actions in a state by the total number of TRI reporting facilities.

3.2. Summary Statistics

Table 1 presents the descriptive statistics for environmental covenants and other key variables used in our analysis. In our sample, 20.6% of supply chain contracts include at least one environmental covenant, indicating a moderate prevalence of private governance mechanisms in supply chain relationships. 7.5% of the sample comprises suppliers from high-polluting industries, as defined by the EPA. 31% of the contracts involving suppliers from high-polluting industries contain environmental covenants. Furthermore, around 60% of customer firms disclose environmental information in their annual reports, as indicated by the *Customer Has EDisclosure* variable. The logarithmic value of the frequency of environmental keywords in these reports (*Customer EDisclosure*) averages 1.6, suggesting that customers place varying levels of emphasis on environmental disclosure.

[Insert Table 1 Here]

Figure 1 illustrates the trends of three time series from 1996 to 2022, including the percentage of supply-chain contracts that include environmental contracts, the percentage of customers' 10-K filings that include environmental disclosures, and the percentage of suppliers' 10-K filings that include environmental disclosures. Both customer and supplier firms are increasingly emphasizing environmental concerns in their annual filings, most likely to address

the growing environmental concerns from shareholders (particularly "green" institutional investors). However, the likelihood for supply chain partner firms to include environmental covenants in supply chain contracts does not exhibit an increasing pattern over time, suggesting a stable trade-off between the costs and benefits of including environmental covenants.

[Insert Figure 1 Here]

When restricting the sample to high-polluting industry suppliers, as shown in Figure 2, we observe that, on average, over 30% of supply chain contracts include at least one environmental covenant. The higher inclusion rate, relative to that for the full sample, indicates that customers are more inclined to impose environmental governance measures on suppliers operating in industries with elevated environmental risks and opportunistic incentives. This pattern suggests that, while environmental covenants are more prevalent in high-polluting industries, their adoption is not uniform and may be shaped by external factors such as regulatory intensity or economic cycles. In general, descriptive statistics and trends highlight the increasing role of environmental covenants and disclosures in supply chain governance, particularly in high-pollution industries. These patterns underscore the importance of examining the interaction between public enforcement, private governance, and industry characteristics to better understand the adoption and effectiveness of environmental measures in supply chains.

[Insert Figure 2 Here]

4. Determinants of Supply Environmental Covenant Adoption

4.1. Baseline Specification

To identify the main determinants that affect the likelihood of including environmental covenants in supply-chain contracts, we estimate the following linear probability model.[5]

$$\begin{aligned}\Pr(\textit{Environmental Covenant}_l = 1) = {} & \beta_1 \times \textit{Benefits of Environmental Covenant}_{s/c,t-1} \\ & + \beta_2 \times \textit{Costs of Environmental Covenant}_{s/c,t-1} \\ & + \text{Supplier Controls}_{s,t-1} + \text{Customer Controls}_{c,t-1} \\ & + \text{Contract Controls}_{l,t} + \text{Fixed Effects} + \varepsilon_{l,t}\end{aligned} \tag{1}$$

where l s, c, t denote contract, supplier, customer, and time (year), respectively. The dependent variable, *Environmental Covenant*, is a binary indicator that equals one if supply-chain contract l in year t includes any environmental covenant and zero otherwise. Based on the discussion in our literature review and hypothesis development section, we include variables capturing both costs and benefits of including environmental covenants in supply chain contracts in this test specification. We discuss these variables in the following subsection. In addition to the main determinants capturing the cost-benefit trade-off, our test specifications also include vectors of time-varying controls for supplier firm characteristics (*Supplier Controls*) and customer firm characteristics (*Customer Controls*). *Supplier Controls* include time-varying supplier characteristics such as supplier size (*Ln(Supplier AT)*), profitability (*Supplier ROA*), leverage ratio (*Supplier Leverage*), sales scaled by assets (*Supplier Sales*), and market competition faced by the supplier based on FFI-48 industry classification(*Supplier HHI*). *Customer Controls* include customer assets (*Customer Ln(AT)*),

5 We primarily rely on the linear probability model because it allows us to include a large number of fixed effects without worrying about biased estimators (Greene, 2004). Results based on Probit models are presented in Appendix D2.

leverage (*Customer Leverage*), sales scaled by total assets (*Customer Sales*), return on total assets (*Customer ROA*), and the customer's market competition based on FFI-48 industry classification(*Customer HHI*). Customer and supplier firm-level variables reflect information in year $t-1$, the year before the contract is signed between supply-chain partners. Contract-level variables reflect information within each contract. *Contract Controls* include the log-transformed size of the supply chain contract document (*Document Size*), and whether the contract is amended (*Amendment*). In addition to these controls, we also include year (industry and year) fixed effects to control for unobservable market-wide (industry-specific) shocks that affect all firms in the market (within the industry). Standard errors are clustered at the supplier industry level to address potential within-industry correlations.

4.1.1. Variables Capturing the Costs and Benefits of Environmental Covenant Inclusion

As discussed in Section 2.2, we analyze the trade-offs firms face when incorporating environmental covenants into supply chain contracts, focusing on two key dimensions of benefits and two key dimensions of costs. The first dimension of benefits is related to the intention of using environmental contracts to mitigate suppliers' short-term opportunism in pollution. Specifically, from a customer firm's perspective, including environmental covenants is more necessary when its supplier firms are more likely to engage in any polluting activities or reluctant to adopt pollution-reduction technologies (to avoid additional operating costs). We construct two variables to capture this dimension: whether a supplier's business involves polluting activities and whether a supplier is financially constrained (so it cannot afford pollution-reduction technologies). Specifically, *High Polluting Supplier* is an indicator variable equal to one if a supplier operates in a top-5 polluting industry as defined by the

EPA.[6] *Supplier O Score* is the Ohlson score (O-Score) (Ohlson, 1980b) of the supplier firm, capturing the level of its financial constraints. Both variables reflect information in year *t-1*, i.e., the year before the contract is signed. Our conjecture is that the benefits of including environmental covenants are greater (therefore, the inclusion is more likely) when the supplier firm engages in business of higher pollution or the supplier firm is more financially constrained.

The second set of benefits associated with environmental covenants stems from addressing the "green preferences" of environmentally conscious stakeholders, particularly shareholders. *Customer EDisclosure* is a logarithmic value of the frequency of environmental keywords mentioned in Items 1 (Business) and Item 7 (Management's Discussion and Analysis (MD&A)) in the annual reports. *Customer Green Investor (%)* is customers' aggregated institutional ownerships held by "green investors" in year *t-1*.[7] Our conjecture is that environmental covenants are more likely to be included in supply-chain contracts when customers face greater pressure from their "green stakeholders".

From the cost side, we first focus on the proprietary costs of including environmental covenants in supply chain contracts. In our setting, proprietary costs refer to the potential competitive harm a firm may incur when the inclusion of environmental covenants reveals strategically sensitive information to rivals. For example, after observing environmental covenants in disclosed supply chain contracts, rival firms may identify environmental weak-

6 According to the FF48 industry classification, high-polluting industries include Utilities, Chemicals, Precious Metals, Non-Metallic and Industrial Metal Mining, Steel Works, and Business Supplies. Also, since it is an industry-level variable, we will not include the supplier industry fixed effects when we use *High-Polluting Supplier* to capture suppliers' short-term opportunism to pollute in our test specification.

7 "Green investors" are financial institutions committed to the Principles for Responsible Investment (PRI) based on the PRI record from https://www.unpri.org/signatories before or at year $t-1$.

nesses and replicate the sustainability innovations of the customer or supplier firms. We mainly focus on the proprietary costs for the supplier firm in our setting since they are usually smaller in size, less transparent, and in more competitive industries. Specifically, we capture the proprietary costs of suppliers by two variables: *Supplier Ln(Green Patent)* is logarithmic value of the number of green patents filled by the supplier firm in year $t-1$, capturing the supplier's sensitivity to sustainability innovation; *Supplier Product Fluidity* is the product fluidity of the supplier firm, following the definition in Hoberg et al. (2014). The product fluidity measure captures the competitive threat that the supplier faces from its competitors in the product market. Our conjecture is that the proprietary costs of including environmental covenants are higher when a supplier engages more in sustainability-related innovation and/or faces a greater competitive threat in the product market.

The last set of determinants captures customer firms' costs to monitor suppliers and enforce environmental covenants. Clearly, if customers are unable to monitor suppliers and enforce environmental covenants, including these covenants in the contract would be meaningless. *Customer Has Green Specialist* is a binary variable equal to one if the customer firm employs at least one environmental specialist in year $t-1$, and zero otherwise. *Distance* is the geographic distance between customers and suppliers. We conjecture that customers' monitoring and enforcement costs are lower when they employ green specialists or when they are located geographically closer to their suppliers.

4.1.2. Estimation Results

Table 2 presents the results of our baseline estimation. In columns (1)–(8), we introduce each variable capturing a distinct dimension of the costs or benefits associated with includ-

ing environmental covenants in supply-chain contracts into our baseline specification. The results largely align with our conjectures regarding the trade-offs between costs and benefits above. Unsurprisingly, the most economically significant determinant is whether a supplier operates in a high-pollution industry. Supply chain contracts involving such suppliers are 8.9 percentage points more likely to include any environmental covenant than those involving suppliers from other industries, representing a 12% increase relative to the sample mean. In terms of statistical significance, the strongest determinant is the supplier's O-Score (t-stat = 11.44).

[Insert Table 2 Here]

Both proprietary and enforcement costs exert a significant influence on the likelihood of covenant inclusion in equilibrium. For instance, a one percentage point increase in suppliers' green patent filings reduces the probability of environmental covenant inclusion by 2 percentage points. If a customer firm employs at least one green specialist, the likelihood of covenant inclusion increases by 2.4 percentage points compared to firms without such specialists.

Several control variables at the supplier, customer, and contract levels also demonstrate strong economic and statistical significance. Specifically, the likelihood of supply-chain contracts including environmental covenants increases when: (1) suppliers exhibit higher leverage or profitability; (2) customers report greater total sales; or (3) contracts feature larger document sizes (indicating more complete and comprehensive contracts).

4.2. Placebo Tests

One might argue that the cost-benefit analysis presented above applies broadly to opportunistic incentives among trade partners rather than being specific to environmental concerns. To address this potential concern, we conduct a placebo test in which the dependent variable is replaced with a binary indicator set to one if a supply chain contract includes non-environmental covenants and zero otherwise. Specifically, we consider two popular types of non-environmental covenants in this placebo test, i.e., product quality covenants (Panel A of Table 3) and financial covenants (Panel B of Table 3). All independent variables and other test specifications (e.g., other controls and fixed effects) are identical to those in Table 2.

[Insert Table 3 Here]

The results in Table 3 indicate that most determinants of environmental covenant inclusion do not influence the adoption of other covenant types. The sole exception is suppliers' O-Score, a proxy for their financial constraints, for product quality covenants. This finding is perhaps not surprising, as financial constraints—particularly those stemming from excessive leverage—create risk-shifting incentives that may encourage short-term opportunistic behavior, adversely affecting product quality and after-sales service (Maksimovic and Titman, 1991). Consequently, financially constrained suppliers are more likely to face covenants covering product quality and after-sales services. When we run the same placebo test on financial covenants, none of the determinants of environmental covenant inclusion exhibit explanatory power in the placebo tests. This supports our earlier cost-benefit analysis, underscoring its specificity to environmental considerations within supply chains.

5. Substitution of Contractual and Regulatory Governance Mechanisms

In addition to contractual agreements with supply-chain partners, alternative disciplinary mechanisms exist to mitigate firms' opportunistic incentives to pollute. External regulatory enforcement, such as monitoring by the U.S. Environmental Protection Agency (EPA), constitutes one of the most significant mechanisms. Pressures from other stakeholders, including those from financial institutions through loan covenants, also serve as important alternatives to environmental monitoring by supply-chain partners (Choy et al., 2024; Lee and Zakota, 2024). In this section, we focus on the economic dynamics between environmental covenants in supply chain contracts and public regulatory enforcement in deterring opportunistic incentives in pollution.

The theoretical relationship between public (external) and private (internal) governance mechanisms remains ambiguous ex ante, as they may function as either substitutes or complements. For instance, Choy et al. (2024) argue that public environmental enforcement and private lender monitoring operate as complements: stronger regulatory enforcement increases corporate environmental liabilities and credit risks, thereby incentivizing lenders (e.g., banks) to impose stricter environmental covenants. Conversely, one might argue that highly effective public regulatory enforcement could ex ante reduce firms' opportunistic incentives, diminishing the need for private monitoring mechanisms. For example, Giroud and Mueller (2011) find that firms with weaker internal governance (as proxied by a higher G-index) exhibit lower labor productivity, higher input costs, and a greater propensity for value-destroying acquisitions, but this holds only in non-competitive industries. Demerjian et al. (2025) find that the adoption of these high-level climate policy frameworks reduces

lenders' reliance on environmental covenants in loan agreements. Their results imply that external competitive pressure or regulatory enforcement may serve as a substitute for internal governance mechanisms. In our context, if public regulatory enforcement (e.g., by the U.S. EPA) is sufficiently stringent, customer firms may free-ride on enforcement efforts rather than incur additional costs through contractual provisions. This perspective suggests that regulatory enforcement and supply-chain contractual monitoring act as substitutes.

5.1. Substitutes or Complements?

We examine whether public regulatory enforcement is a substitute or complement to environmental covenants in supply chain contracts using the following empirical strategy. First, we augment the baseline test in column (1) of Table 2 by including measures of public regulatory enforcement into the independent variables. The measure for the intensity of public regulatory enforcement for each supplier firm, *Supplier Avg EPA Enforcement*, is the proportion of each supplier's plants located in states with high regulatory enforcement intensity. A state is considered high-enforcement if its ratio of total environmental inspections and enforcement actions to the number of TRI-reporting facilities exceeds the national median in a given year.

Second, we add the interaction terms between the public regulatory enforcement measure and *High Polluting Supplier*, the strongest predictor of environmental covenant inclusion (i.e., as a proxy for the opportunistic incentive to pollute). Results are provided in Table 4.

[Insert Table 4 Here]

Column (1) shows that, on average, public enforcement is negative but not significantly

related to the adoption of environmental covenants. To better understand this heterogeneity, Column (2) adds an interaction term between *Supplier Avg EPA Enforcement* and *High Polluting Supplier*. The coefficient on the interaction is negative and statistically significant, indicating that for suppliers with stronger pollution incentives, higher public enforcement reduces the likelihood of covenant adoption. In other words, when the supplier poses greater environmental risk, customers appear to rely less on private contract enforcement if the public regulator is already actively monitoring the firm. This strategy also helps to reduce the monitoring cost for the customers.

The insignificant average effect may reflect that for low-polluting suppliers, covenant adoption remains cost-effective, even in the presence of public enforcement. In contrast, for high-polluting suppliers, the monitoring burden is heavier, and customers are more likely to substitute toward public enforcement. This finding supports the interpretation that public and private monitoring function as substitutes in this context. Our results are consistent with Demerjian et al. (2025), who document that strong public enforcement can crowd out private monitoring efforts.

In Appendix D3, we examine the relationship between lender and customer monitoring. Unlike the patterns observed in Appendix D3, the presence of a "green loan" monitor, such as a bank that imposes environmental covenants in its loan agreements, is positively associated with the inclusion of environmental covenants in supply chain contracts. Although the interaction term is statistically insignificant, its positive coefficient implies that the sensitivity between suppliers' pollution incentives and covenant inclusion does not weaken when "green loan" monitors are involved. These findings suggest that lender and customer disciplinary efforts operate as complementary mechanisms in mitigating suppliers' polluting behaviors.

Moreover, the results indicate that the economic interplay between environmental covenants in supply chain contracts and alternative monitoring mechanisms is context-dependent.

5.2. Identification Strategy: Close Win of the Democratic Party in Elections

Results in Table 4 are based on correlations between alternative monitoring mechanisms and suffer from endogeneity concerns. The presence of green supply chain monitors might be driven by common omitted variables. While individual firms may not affect the state-level EPA enforcement, they do have the choice of states in which to operate. Further, the state-level EPA enforcement may confound other state-level factors that may affect the environmental covenant inclusions in supply chain contracts.

To partially address these endogeneity concerns, we adopt the instrumental variables based on the close wins of the Democratic Party candidates in House elections following Choy et al. (2024). Close elections are defined as those where the winning candidates' margin of victory is less than 5% (Akey, 2015; Heitz et al., 2023). Identical to the definitions in Choy et al. (2024), *Democratic Win* is a dummy variable that equals one if Democratic candidates win at least one close election in a state and *Democratic Majority Win* is a dummy variable that equals one if Democratic candidates win more than half of the close elections in a state. The advantage of this identification is that, close wins, by the competitive nature of these elections, are highly unpredictable and, therefore, are unlikely to be correlated with other state-level economic factors. To the extent that Democrats tend to impose stronger environmental enforcement than Republicans, and close elections are affected by random factors such as weather, close elections won by Democrats create an exogenous increase in environmental enforcement (Akey, 2015; Choy et al., 2024). In this identification strategy,

our primary conjecture is that the consequence of close wins of Democratic candidates generates a significant and positive impact on public environmental enforcement in the subsequent year, based on their political ideology and agenda.

[Insert Table 5 Here]

In the regressions reported in Panel A of Table 5, we first validate the effectiveness of our instruments within our sample period. We run a predictive regression for a sample organized at the state-year level, using close wins of Democratic candidates in each state to predict the intensity of state-level regulatory enforcement in the following years of the elections. Consistent with Choy et al. (2024), we show that both instrumental variables positively and significantly predict the intensity of state-level environmental regulatory enforcement in subsequent year, measured by the log of one plus the aggregate number of environmental inspections and enforcement actions per facility in the state in the year $t+1$ after close election year t.

In Panel B of Table 5, we instrument *Supplier Avg EPA Enforcement*$_t$ using close election outcomes at year $t-1$, following the premise that political shifts predict future enforcement intensity, as validated in Panel A. We restrict our sample to suppliers' plants in the close election states. Since *Supplier Avg EPA Enforcement* is defined as the proportion of a supplier's plants located in such states, the instruments—*Supplier Avg Democrat Win* and *Supplier Avg Democrat Majority*—are defined as the proportion of the supplier's plants located in states where Democrats have *Democrat Win* or *Democrat Majority Win* in close elections.

Columns (1) of Panels B.1 and B.2 report the first-stage regressions. The instruments are strongly predictive of *Supplier Avg EPA Enforcement*$_t$, with highly significant coefficients (at the 1% level). The Cragg–Donald Wald F-statistics exceed the conventional threshold of 10, indicating that the instruments are strong and help to reject the null of weak identification. Columns (2) report the second-stage results, consistent with the specification in Table 4. While the main effect of *Supplier Avg EPA Enforcement* is statistically insignificant, the interaction term with *High Polluting Supplier* remains negative and significant. This supports the main result that public enforcement substitutes for private contract enforcement, specifically when suppliers have stronger pollution incentives.

6. Real Economic Outcomes of Supply Environmental Covenants

6.1. Reduction of Total Emission Release and Recruitment of Green Specialists

One remaining question, after showing the economic dynamics between contractual and regulatory governance mechanisms, is whether the contractual agreement is effective in changing corporate behaviors ex post. This question is important since the answer to this question determines whether contractual covenants are symbolic or transformational. In our setting, we investigate whether environmental covenants indeed make suppliers "greener".

We test this prediction using the event-study approach proposed by Chen et al. (2021) and Demerjian et al. (2025). The sample is constructed as follows: for each supplier, we identify each year m (cohort m) in which it establishes any new supply chain contract. For each cohort, we include the supplier's observations from years $[m-3, m+3]$, excluding year m. We then examine how supplier's green performance changes from the pre-period $[m-3, m-1]$ to the post-period $[m+1, m+3]$, and how these changes are correlated with

the inclusion of environmental covenants in supply chain contracts.

The core idea underlying the stacked event-study design is to create distinct cohorts for each treatment year, thereby maintaining a symmetric time window around the treatment. These cohorts are then stacked into a single panel, aligning observations by event time rather than calendar time (Jeffers, 2024). The control group consists of suppliers who also establish new supply chain contracts without environmental covenants during the same sample period. The test specification is presented in Equation (2) below:

$$\begin{aligned} \textit{Supplier Outcome}_{s,t} = {} & \beta_1 \textit{Environmental Covenant}_{s,m} \times \textit{Post}_{s,m,t} \\ & + \beta_2 \textit{Environmental Covenant}_{s,m,t} + \beta_3 \textit{Post}_{s,m,t} \\ & + \text{Supplier Controls}_{s,t} + \text{FEs} + \varepsilon_{s,t} \end{aligned} \tag{2}$$

In Equation (2), m, s, p, and t denote the supply chain contract cohort year, supplier, plant, and time (year), respectively. The first dependent variable, *Supplier Ln(1+Total Emissions)*$_{s,p,t}$, represents the natural logarithm of one plus total emissions (scaled by sales) for plant p of supplier s in year t. Since emissions data are reported at the plant level, this specification is estimated using a plant-year panel. To control for location-specific time-varying factors, we include state × year fixed effects at the plant level. The second dependent variable, *Supplier Green Positions Num.*$_{s,t}$, is defined as the number of employees with green-related job titles at the firm-year level, capturing the firm's investment in environmental human capital. The specification is estimated at the firm-year level and includes supplier headquarter state × year fixed effects.

Among the key independent variables, *Environmental Covenant*$_{s,m}$ is a binary indicator equal to one if supplier s has at least one new supply chain contract in cohort contract year m that includes environmental covenants, and zero otherwise. *Post*$_{s,m,t}$ is a binary variable

equal to one in the three years following the supply chain contract initiation year m, and zero otherwise. We restrict the sample to suppliers with at least one year of both pre- and post-treatment observations.

We control for the same set of supplier-level covariates as in Table 2 for both tests. To account for time-invariant unobserved heterogeneity and contract-specific trends, we include a rich set of additional fixed effects: contract-event-cohort $\times$ year fixed effects and contract-event-cohort $\times$ supplier (firm or plant) fixed effects. These absorb both the main effects of the environmental covenants and the post-treatment indicator. Thus, identification relies on within-supplier variation relative to the timing of contract initiation, conditional on contract-specific trends. Standard errors are clustered at the supplier industry level. The results are presented in Panel A of Table 6.

[Insert Table 6 Here]

The negative and statistically significant coefficient on the interaction term between *Environmental Covenant* and *Post* indicates that, following the adoption of environmental covenants, suppliers' total emissions decline by 5% relative to the sample mean. Similarly, the results in Column (2) show that the inclusion of environmental covenants is associated with a 0.026 increase in the number of green positions. Given that the sample mean of green hires is only 0.06, this effect corresponds to an economically meaningful increase of approximately 42%.

Taken together, these findings support the view that the adoption of environmental covenants is associated with positive real effects—namely, reductions in total emissions and increased investment in environmental human capital through the hiring of green specialists.

In Panels B and C, we conduct a placebo test using the inclusion of financial covenants and product quality covenants as the main independent variables. The results indicate that both non-environmental covenants have no significant impact on suppliers' total emissions or their ex-post green positions. This placebo analysis suggests that the effects documented in Panel A are not mechanical and are unlikely to be driven by a general correlation between environmental covenants and other common contractual provisions in supply chain contracts.

We further examine the dynamic effects of *Environmental Covenant* around supply chain contract initiation in Figure 3. We estimate an event-study specification, replacing the *Post* indicator with year-specific indicators relative to the contract start year. The analysis is conducted at the plant level for the emissions outcome and at the firm level for green hiring. The coefficients on the interaction terms are statistically insignificant in the pre-contract years, supporting the parallel trends assumption. In the years following contract initiation, the coefficients become significantly negative for emissions and significantly positive for green positions, indicating that the effects are unlikely to be driven by suppliers' pre-existing environmental strategies.

6.2. Endogeneity Concerns and Our Identification Strategy based on M&As

One natural endogeneity concern is that only suppliers willing to make their business practices "greener" would accept environmental covenants in supply chain covenants. Under this argument, the improvement of suppliers' green practices is not necessarily driven by the enforcement of environmental covenants. Instead, it mainly reflects the type of suppliers signaled by their acceptance of environmental covenants in supply chain contracts. One may argue that, for suppliers that are willing to accept environmental covenants in contract

negotiation, they would improve their green practices irrespective of whether environmental covenants are enforced or not.

We address this endogeneity concern using the following identification strategy. We identify instances in which a supplier (the acquirer) acquires a target firm in the same industry, i.e., in a horizontal merger. For each firm, we identify each year m (cohort m) in which it was acquired by the supplier. The variable *Acquire Environmental Covenant* equals one if the acquiring firm (supplier) has an active supply chain contract containing environmental covenants within two years prior to the M&A event m, and zero otherwise. $Post_{m,t}$ is an indicator variable equal to one for the year t following three years after the M&A effective dates m (i.e., $t > m$), and zero otherwise.

We restrict the sample to target firms with at least one year of observations both before and after the M&A event, to ensure consistency in the difference-in-differences framework and to mitigate selection concerns. In this identification strategy, it is very unlikely that the entire M&A deal is motivated (or discouraged) by the environmental covenants with the existing customers of the acquirer (i.e., the supplier firm).[8] However, once the acquisition is complete, these pre-existing environmental covenants can impose real disciplinary pressure on the newly acquired business units. As such, we interpret the acquirer's environmental covenants as plausibly exogenous shocks to the target firm's environmental practices.

[Insert Table 7 Here]

Panel A of Table 7 reports the effects of acquire (supplier)-level environmental covenants

8 Here, we only require that this is not the first-order motivation of the deal.

on acquired target firms' environmental outcomes. We find that, after being acquired by a supplier that has environmental covenants with its customers, the target firm significantly reduces total emissions and increases the positions of green specialists. Both effects are economically and statistically meaningful. Specifically, the target firm reduces emissions by approximately 8% relative to the sample mean of 2.37, with the coefficient significant at the 10% level. Similarly, the number of green positions increases by roughly 31% relative to the sample mean of 0.258, significant at the 5% level.

Further, the magnitude of the emissions reduction coefficient (–0.21) is substantially larger than the baseline supplier-level effect (–0.04) documented in Table 6. This amplified effect likely reflects two reinforcing mechanisms: (1) target firms often have greater room for environmental improvement prior to acquisition; and (2) acquisitions facilitate stronger post-merger operational control and more concentrated exposure to environmental discipline through organizational restructuring.

To further validate this identification strategy, we conduct a placebo test using withdrawn deals—i.e., cases where the acquisition was announced but ultimately canceled. In this test, $Post_{w,t}$ is defined relative to the deal withdrawal date w. This placebo helps rule out the alternative explanation that improvements in environmental practices are driven by increased public scrutiny during the M&A process. In withdrawn deals, the target firm may still receive substantial attention (often comparable to or even exceeding that of completed deals), yet it is not subject to any of the acquirer (supplier)'s contractual covenants. Panel B of Table 7 presents the results of this test. We find no significant changes in the environmental practices of the target firm following deal withdrawal, reinforcing the interpretation that the effects observed in Panel A are driven by the environmental covenants embedded in the

acquirer(supplier)'s existing supply chain relationships.

To address potential selection bias–namely, the concern that suppliers with environmental covenants may be more likely to acquire environmentally proactive target firms–we conduct a selection test reported in the Appendix D4. This analysis examines whether the acquirers' pre-existing environmental contracting practices influence their choice of M&A targets based on environmental characteristics. The sample comprises all completed M&A transactions obtained from the SDC platform. Following Chen et al. (2021), we construct a choice set for each selected target firm by identifying up to five nearest-neighbor candidate firms within the same Fama–French 48 industry that are similar in size, book-to-market ratio, and sales. The unit of observation is the acquirer–candidate pair. We consider two proxies for the environmental profile of candidate firms: (i) an indicator for whether the candidate has green specialists in the year prior to the M&A (*Candidate Has Green Position*); and (ii) the log of one plus firm's total emissions scaled by sales (*Candidate Emissions*). We then interact these proxies with an indicator for whether the acquiring supplier has active supply chain contracts containing environmental covenants. The regression results indicate that neither proxy for the candidate's environmental characteristics significantly predicts selection by acquirers with environmental covenants. In particular, the interaction terms between the environmental covenant indicator and each green proxy are negative but statistically insignificant. This suggests that suppliers bound by environmental covenants are not systematically selecting environmentally proactive targets.

These findings mitigate concerns of strategic selection and help rule out a key source of endogeneity in our main results. That is, the observed improvements in target firms' environmental performance post-acquisition are unlikely to be driven by acquirers preferen-

tially selecting greener targets ex ante. Instead, the results reinforce the interpretation that the environmental improvements are attributable to the influence of the acquiring suppliers' contractual environmental obligations.

6.3. Real Outcomes: Substitution between Contractual and Regulatory Disciplines

In Section 5.1, we find that disciplinary effects of contractual covenants and regulatory enforcement substitute for each other. Following this intuition, we examine whether the real economic outcomes of environment covenants in supply chain contracts are muted when there exists a strong state-level regulatory environmental enforcement externally. Specifically, we partition the full sample into two subgroups based on the level of each firm's average regulatory enforcement intensity. We repeat the test in Panel A of Table 6 in these two subsamples separately. Results are reported in Table 8.

[Insert Table 8 Here]

We find that environmental covenants in supply chain contracts have significantly stronger effects on suppliers' environmental outcomes when regulatory enforcement by the EPA is weaker. As shown in Panel A of Table 8, covenants are associated with a statistically significant reduction in total emissions among suppliers located in low-enforcement regions, while the effect is smaller and not statistically significant in high-enforcement regions. The difference in coefficients across the two groups is statistically significant at the 10% level.

Similarly, Panel B shows that the positive effect of covenants on green positions has a larger coefficient magnitude and a marginally significant estimate in the low-enforcement

subgroup. The coefficient for the high-enforcement group is much smaller, and the difference in effects across groups is also statistically meaningful.

Taken together, these findings reinforce our earlier results in Section 5.1, suggesting that contractual covenants and formal regulatory enforcement act as substitutes in shaping firms' green practices. Environmental covenants appear to fill an institutional void when external environmental regulation is relatively weak, enabling customers to discipline their suppliers more effectively through private contracting mechanisms.

7. Conclusion

In this paper, we investigate the determinants of including environmental covenants in supply chain contracts, how these provisions interact with public regulatory enforcement, and whether they produce measurable improvements in suppliers' environmental practices.

Our analysis shows that covenant adoption is positively associated with the expected benefits of managing suppliers' pollution risks and aligning with shareholder preferences for sustainability. At the same time, the likelihood of inclusion decreases with the anticipated costs of compliance and monitoring. In high-polluting industries, where both benefits and costs are elevated, whether firms adopt covenants ultimately depends on which effects dominate. Using identification strategies based on close electoral victories of the Democratic Party, we find that stricter public regulatory enforcement reduces reliance on contractual safeguards, suggesting that public oversight and private contracting function as substitutes. Finally, our evidence indicates that environmental covenants causally generate tangible improvements in supply chain sustainability, as suppliers reduce toxic emissions and expand their recruitment of environmental specialists. These findings add to the growing evidence that private

governance mechanisms—like those documented in bank lending relationships—can reduce pollution beyond what is obtainable through public regulatory enforcement alone.

Future research could examine whether the impact of environmental covenants persists beyond the contract period and how technological innovations—such as real-time emissions monitoring and advanced data analytics—affect their effectiveness. In addition, studying the extent to which these provisions are enforced in practice could offer further insights into their role in shaping long-term environmental compliance.

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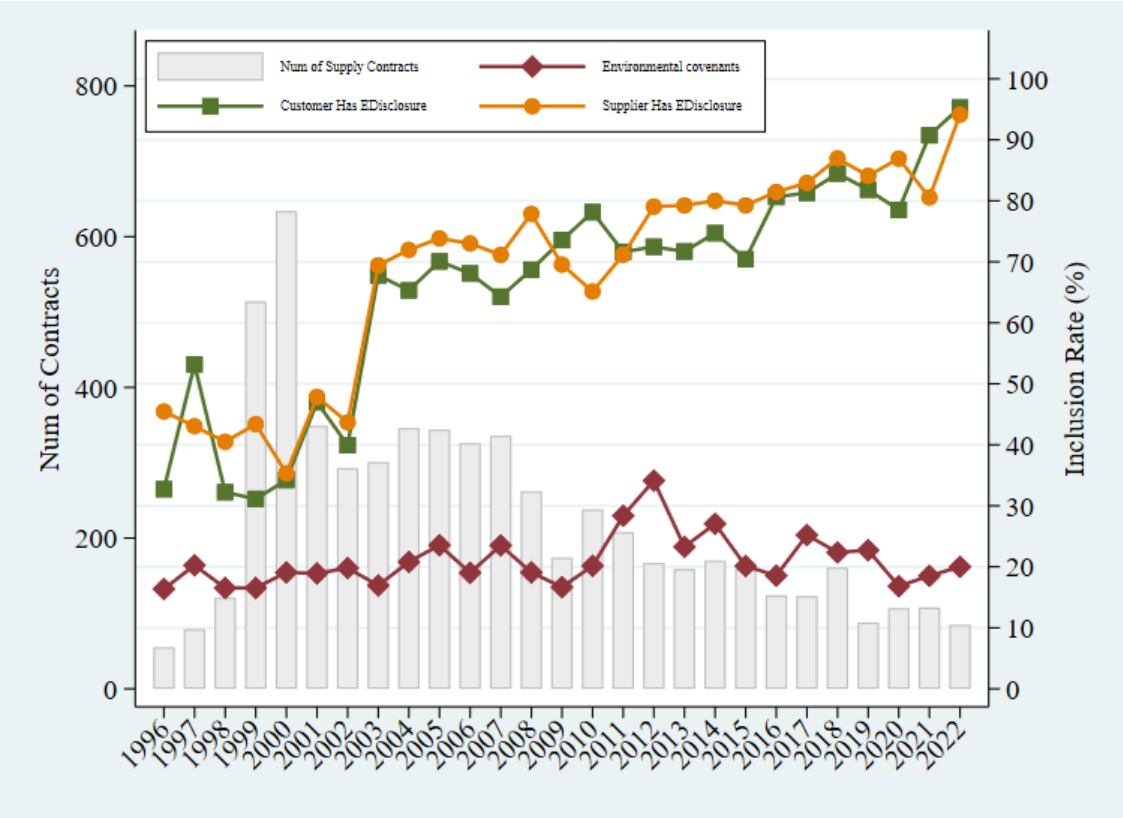
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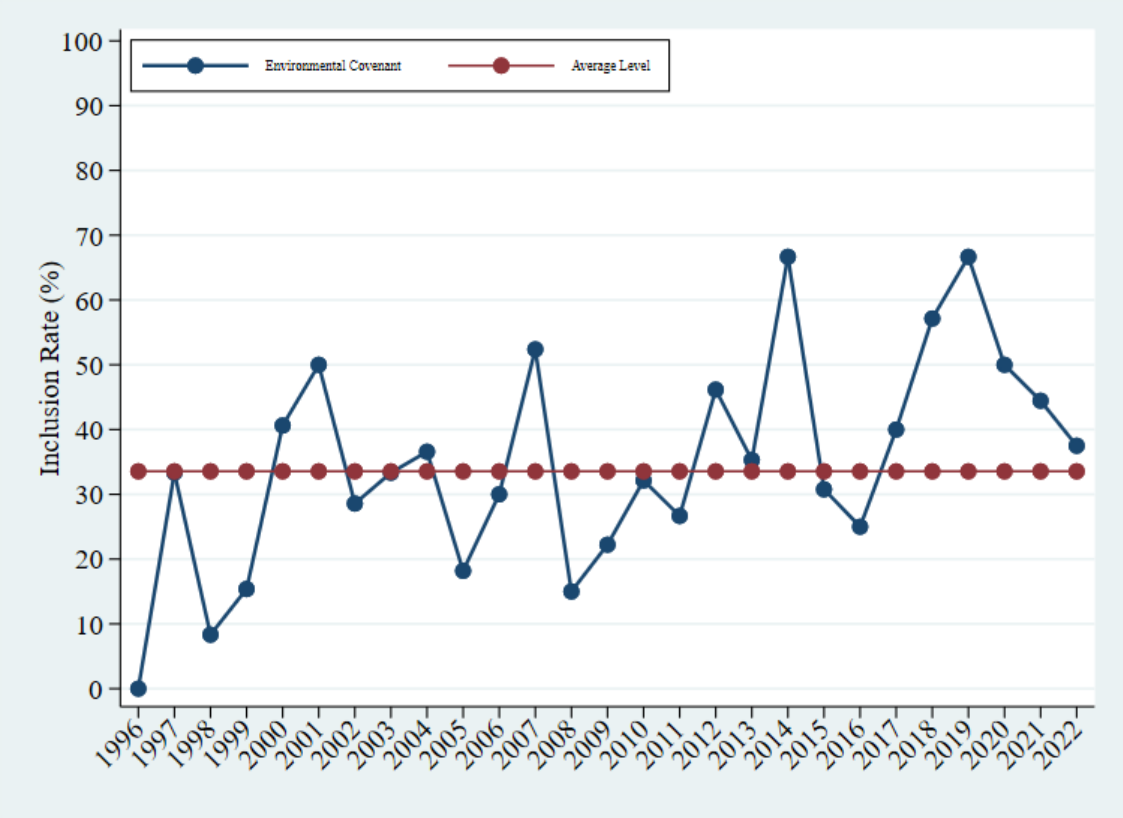
Tables and Figures

Figure 1. Yearly Inclusion Rate of Environmental Covenants in Supply Contract



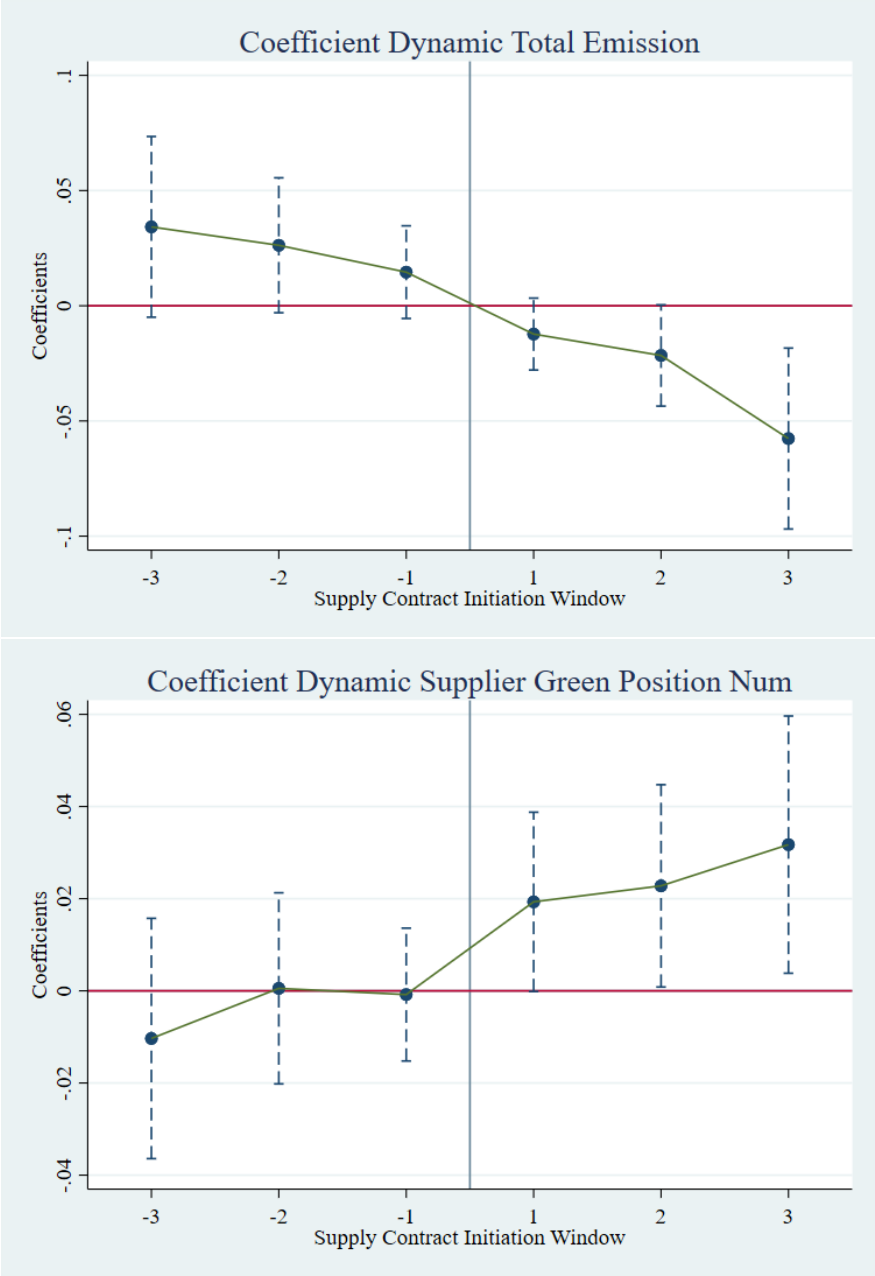
The graph depicts the temporal trends within the analysis sample from 1996 to 2022, encompassing a total of 6,031 identified contracts. The unit of analysis is the contract-supplier-customer level. The red line, marked with diamond symbols, represents the inclusion rate of the *Environmental Covenant* in supply contracts for each year. The *Environmental Covenant* dummy variable is assigned a value of one if the contracts contain Environmental Disclosure, Audit, and Action, or Environmental Law Compliance Covenants, as defined by Choy et al. (2024) and Vandenbergh et al. (2022). The green line, marked with squares, and the orange line, marked with circles, illustrate the percentage of customers and suppliers in the sample whose 10-K reports contained any environment-related disclosures for each year, following the methodology outlined in Rouen et al. (2024). The box of *Num of Supply Contracts* shows the contract sample distributions by each year.

Figure 2. Yearly Inclusion Rate of Environmental Covenants in High-Polluting Suppliers



This graph illustrates the inclusion rate of environmental covenants in the restricted sample (suppliers in high-polluting industries) for 453 observations. Within this restricted sample, 31% of contracts include at least one environmental covenant.

Figure 3. Coefficient Dynamics for Supplier's Total Emissions and Green Position Number



Figures 3 show the coefficient dynamics for total releases and green positions dynamics around the origination of loans having *Environmental Covenant*. We use the event study specification but replace *Post* with indicators for each year around the supply contract origination. The analysis is conducted at the plant level for the emissions outcome and at the firm level for green hiring. Supply Contract initiation window k on the x-axis is year k around supply contract initiation, where the negative (positive) integer k indicates years prior (post) to the supply contract initiation. Solid (dashed) lines indicate estimated coefficients (90% confidence intervals).

Table 1. Descriptive Statistics

	(1) N	(2) Mean	(3) Std	(4) Median
Panel A: Supply Contract Level Sample				
Environmental Covenant	6,031	0.206	0.405	0.000
Financial Covenant	6,031	0.340	0.474	0.000
Product Quality Covenant	6,031	0.399	0.490	0.000
Determinants				
High Polluting Supplier	6,031	0.075	0.264	0.000
Supplier O Score	4,980	-2.494	6.787	-3.420
Customer Has EDisclosure	6,031	0.606	0.489	1.000
Customer EDisclosure	6,031	1.632	1.670	1.386
Customer Green Investor (%)	6,031	0.031	0.066	0.000
Supplier Ln(Green Patent)	6,031	0.412	1.006	0.000
Supplier Product Fluidity	5,022	8.351	3.897	7.925
Customer Has Green Specialist	6,031	0.128	0.334	0.000
Distance	6,031	6.185	1.948	6.819
EPA Enforcement				
Supplier Avg EPA Enforcement	6,031	0.413	0.342	0.364
Supplier Controls				
Supplier Ln(AT)	6,031	6.912	2.740	7.046
Supplier Leverage	6,031	0.590	0.529	0.562
Supplier ROA	6,031	-0.137	0.484	0.022
Supplier Sale	6,031	0.855	0.859	0.648
Supplier HHI	6,031	0.054	0.033	0.050
Customer Controls				
Customer Ln(AT)	6,031	6.657	2.880	6.636
Customer Leverage	6,031	0.636	0.822	0.551
Customer ROA	6,031	-0.214	0.711	0.015
Customer Sale	6,031	0.827	0.918	0.614
Customer HHI	6,031	0.056	0.036	0.050
Contract Controls				
Amendment	6,031	0.276	0.447	0.000
Document Size	6,031	10.784	1.131	10.911
Panel B: Event Study Firm-Year Level Sample				
Outcomes: TRI Emissions				
Supplier Ln(1+Total Emissions)	64,328	0.917	1.621	0.071
Environmental covenant	64,328	0.299	0.458	0.000
Post	64,328	0.499	0.500	1.000
Outcomes: Green Positions				
Supplier Green Position Num.	14,100	0.063	0.390	0.000
Environmental Covenant	14,100	0.295	0.456	0.000
Post	14,100	0.529	0.500	1.000

This table presents summary statistics for the variables used in the analysis. Column (1)-(4) reports the number of observations, the mean, standard deviation, and the median.

Table 2. Environmental Covenant and Determinants

Determinants:	Benefits				Costs			
Dep. Var.=Environmental Covenant	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
High Polluting Supplier	0.089***							
	(5.15)							
Supplier O Score		0.002***						
		(4.12)						
Customer EDisclosure			0.014***					
			(5.39)					
Customer Green Investor (%)				0.157*				
				(1.78)				
Supplier Ln(Green Patent)					-0.021***			
					(-3.01)			
Supplier Product Fluidity						-0.005*		
						(-1.76)		
Customer Has Green Specialist							0.024**	
							(2.05)	
Distance								-0.008**
								(-2.35)
Supplier Controls								
Supplier Ln(AT)	0.002	-0.002	-0.002	-0.002	0.002	-0.006*	-0.002	-0.002
	(0.67)	(-0.85)	(-0.76)	(-0.81)	(0.87)	(-1.97)	(-0.73)	(-0.81)
Supplier Leverage	0.028**	0.010	0.018**	0.018**	0.018**	0.014	0.018**	0.019**
	(2.67)	(0.68)	(2.05)	(2.09)	(2.09)	(0.80)	(2.04)	(2.19)
Supplier ROA	0.028**	0.045***	0.022*	0.022*	0.016	0.051***	0.021*	0.021*
	(2.21)	(3.01)	(1.96)	(1.97)	(1.54)	(3.57)	(1.82)	(1.96)
Supplier Sale	0.012**	0.002	-0.002	-0.002	-0.001	-0.012*	-0.002	-0.002
	(2.35)	(0.23)	(-0.42)	(-0.46)	(-0.21)	(-1.76)	(-0.45)	(-0.38)
Supplier HHI	0.133	0.360	0.275	0.301	0.258	0.206	0.279	0.302
	(0.61)	(1.03)	(0.65)	(0.73)	(0.62)	(0.63)	(0.67)	(0.75)
Customer Controls								
Customer Ln(AT)	0.003*	0.000	-0.001	0.001	0.002	0.001	0.000	0.002
	(1.94)	(0.02)	(-0.49)	(0.70)	(1.20)	(0.37)	(0.18)	(1.07)

Customer Leverage	0.009	0.006	0.004	0.005	0.005	0.008	0.006	0.006
	(1.24)	(0.79)	(0.44)	(0.66)	(0.67)	(0.97)	(0.68)	(0.71)
Customer ROA	0.010	0.012	0.007	0.006	0.007	0.012	0.009	0.007
	(1.16)	(1.43)	(0.89)	(0.75)	(0.86)	(1.47)	(1.10)	(0.86)
Customer Sale	0.027***	0.017**	0.024**	0.024**	0.024**	0.025**	0.023**	0.023**
	(3.00)	(2.33)	(2.51)	(2.48)	(2.63)	(2.42)	(2.49)	(2.50)
Customer HHI	-0.171	-0.081	-0.143	-0.121	-0.129	-0.079	-0.123	-0.103
	(-0.97)	(-0.42)	(-0.92)	(-0.75)	(-0.80)	(-0.46)	(-0.76)	(-0.65)
Contract Controls								
Amendment	-0.002	0.004	0.006	0.006	0.006	0.005	0.006	0.006
	(-0.16)	(0.23)	(0.43)	(0.38)	(0.44)	(0.29)	(0.39)	(0.39)
Document Size	0.131***	0.133***	0.135***	0.135***	0.134***	0.136***	0.135***	0.135***
	(7.36)	(7.60)	(7.60)	(7.61)	(7.71)	(7.60)	(7.60)	(7.58)
Contract Type Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sup Ind FEs	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6,031	4,980	6,031	6,031	6,031	5,022	6,031	6,031
Adj. R^2	0.31	0.33	0.33	0.32	0.32	0.34	0.32	0.32

This table reports estimates from linear probability models examining the determinants of including an environmental covenant in supply contracts. The models are estimated using the following specification:

$$\Pr(\textit{Environmental Covenant}_l = 1) = \beta \textit{Determinant}_{s \text{ or } c,t-1} + \text{Supplier Controls}_{s,t-1} + \text{Customer Controls}_{c,t-1} + \text{Contract Controls}_{l,t} + \text{FEs} + \varepsilon_l$$

where indices l, s, c, and t denote contract, supplier, customer, and year. The dependent variable, *Environmental Covenant*$_l$, is a binary indicator equal to one if contract l in year t includes any environmental covenant, and zero otherwise. The key independent variables (*Determinant*$_{s \text{ or } c,t-1}$) vary by column: Column (1) uses *High Polluting Supplier*, which equals one if the supplier belongs to a high-polluting industry as defined in Choy et al. (2024). Column (2) uses *Supplier O Score*, the Ohlson O-score measuring the likelihood of financial distress. Column (3) uses *Customer EDisclosure*, the logarithm value of the frequency of environmental-related keywords in the customer's 10-K filing. Column (4) uses *Customer Green Investor (%)*, the percentage of green investors' shareholdings in the customer. Column (5) uses *Supplier Ln(Green Patent)*, the logarithm value of green patent filled by the supplier. Column (6) uses *Supplier Product Fluidity*, capturing the degree of product market dynamism and competitive threat based on Hoberg et al. (2014). Column (7) uses *Customer Has Green Specialist*, a binary variable equal to one if the customer employs a green job specialist. Column (8) includes *Distance*, the natural logarithm of the geographic distance between the supplier and customer headquarters. All regressions control for supplier characteristics (*Supplier Controls*$_{s,t-1}$), customer characteristics (*Customer Controls*$_{c,t-1}$), and contract characteristics (*Contract Controls*$_{l,t}$). Variable definitions are provided in Appendix A. Year and contract type effects are included in all models. Columns (2)–(8) additionally include supplier industry fixed effects. Standard errors are clustered at the supplier industry level, with t-statistics reported in parentheses. Statistical significance is denoted as follows: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3. Placebo Test: Non-Environmental Covenant and Determinants

Determinants:	Benefits				Costs			
	HighPollutSup	SupOscore	CusEDis	CusGreenInv(%)	SupLn(GreenPat)	SupFluid	CusHasGreenpSpe.	Distance
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Dep. Var.=Product Quality Covenant								
Determinant	-0.005	0.002***	-0.004	0.056	0.004	0.000	0.012	0.004
	(-0.15)	(6.17)	(-0.92)	(0.65)	(0.28)	(0.09)	(0.70)	(1.40)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contract Type Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sup Ind FEs	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6,031	4,980	6,031	6,031	6,031	5,022	6,031	6,031
Adj. R^2	0.29	0.32	0.31	0.31	0.31	0.32	0.31	0.31
Panel B: Dep. Var=Financial Covenant								
Determinant	-0.011	0.002	-0.004	-0.100	-0.010	0.002	-0.016	0.001
	(-0.43)	(1.68)	(-0.99)	(-1.05)	(-0.99)	(1.11)	(-0.98)	(0.27)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contract Type Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sup Ind FEs	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6,031	4,980	6,031	6,031	6,031	5,022	6,031	6,031
Adj. R^2	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.28

This table presents results from a placebo test examining whether the determinants identified in Table 2 for the inclusion of environmental covenants are also associated with the presence of non-environmental covenants, specifically *Product Quality Covenant* in Panel A and *Financial Covenant* in Panel B. All model identifications are the same as Table 2. Standard errors are clustered at the supplier industry level, with t-statistics reported in parentheses. Statistical significance is denoted as follows: $* \ p < 0.1$, $** \ p < 0.05$, $*** \ p < 0.01$.

Table 4. EPA Monitor and Environmental Covenant

Dep. Var.=	**Environmental Covenant**	
	(1)	(2)
Supplier Avg EPA Enforcement	-0.010	-0.003
	(-0.48)	(-0.11)
Supplier Avg EPA Enforcement × High Polluting Supplier		-0.131**
		(-3.38)
Controls	Yes	Yes
Contract Type Effects	Yes	Yes
Sup Ind × Year FEs	Yes	Yes
N	6,031	6,031
Adj. R^2	0.34	0.34

This table examines the impact of EPA enforcement on the inclusion of environmental covenants in supply contracts. The results are based on linear probability regressions estimating the following linear probability model:

$$\begin{aligned}\Pr(\textit{Environmental Covenant}_l = 1) = {} & \beta_1 \textit{High Polluting Supplier}_s \times \textit{Supplier Avg EPA Enforcement}_{t-1} \\ & + \beta_2 \textit{Supplier Avg EPA Enforcement}_{t-1} + \text{Supplier Controls}_{s,t-1} \\ & + \text{Customer Controls}_{c,t-1} + \text{Contract Controls}_{l,t} + \text{FEs} + \varepsilon_l\end{aligned}$$

The dependent variable, $\textit{Environmental Covenant}_l$, is a binary indicator that equals one if a supply contract l in year t includes environmental covenants, and zero otherwise. *High Polluting Supplier*, which equals one if the supplier belongs to a high-polluting industry as defined inChoy et al. (2024). *Supplier Avg EPA Enforcement* is the proportion of a supplier's plants located in states with high environmental regulation intensity at year $t-1$. A state is classified as high enforcement if the ratio of total inspections/enforcements to TRI-reporting facilities is above the yearly median. Each regression includes vectors of time-varying controls for supplier characteristics ($\textit{Supplier Controls}_{s,t-1}$), customer characteristics ($\textit{Customer Controls}_{c,t-1}$), and contract characteristics ($\textit{Contract Controls}_{l,t}$). All variable definitions are provided in Appendix A. We control for contract type effects and year × supplier industry fixed effects. Standard errors are clustered at the supplier industry level, with t-statistics reported in parentheses. Statistical significance is denoted as follows: $* \; p < 0.1$, $** \; p < 0.05$, $*** \; p < 0.01$.

Table 5. Close Elections and Environmental Covenant

Panel A: Close Election Validation Tests		
Dep. Var.=	**State Enforcement$_{t+1}$**	
	(1)	(2)
Democrat Win$_t$	0.029*	
	(1.70)	
Democrat Majority Win$_t$		0.031*
		(1.81)
Year FEs	Yes	Yes
State FEs	Yes	Yes
N	313	313
Adj. R^2	0.76	0.75
Panel B: 2SLS - Supplier Avg EPA Enforcement and Environmental Covenant		
B.1: Supplier Avg Democrat Win as IV	First Stage	Second Stage
Dep. Var.=	Sup Avg Enforcement$_t$	Environmental Covenant$_{t+1}$
Supplier Avg Democrat Win$_{t-1}$	0.169***	
	(7.81)	
Supplier Avg EPA Enforcement$_t$		0.264
		(1.33)
Supplier Avg EPA Enforcement$_t$ × High Polluting Supplier		-2.894**
		(-1.99)
Controls	Yes	Yes
Contract Type Effects	Yes	Yes
Sup Ind × Year FEs	No	Yes
N	1,739	1,739
Adj. R^2		0.078
CD Wald F	30.96	
SW χ^2	64.75	
B.2: Sup Avg Democrat Majority Win as IV	First Stage	Second Stage
Dep. Var.=	Sup Avg Enforcement$_t$	Environmental Covenant$_{t+1}$
Supplier Avg Democrat Majority Win$_{t-1}$	0.165***	
	(7.72)	
Supplier Avg EPA Enforcement$_t$		0.293
		(1.54)
Supplier Avg EPA Enforcement$_t$ × High Polluting Supplier		-1.944**
		(-2.47)
Controls	Yes	Yes
Contract Type Effects	Yes	Yes
Sup Ind × Year FEs	No	Yes
N	1,739	1,739
Adj. R^2		0.174
CD Wald F	31.31	
SW χ^2	62.76	

This table presents the identification strategy for the *Supplier Avg EPA Enforcement* variable used in

Table 4. Following Choy et al. (2024), Panel A presents a validation test by regressing *State Enforcement*$_{t+1}$ on political outcomes from close congressional elections in year t. The dependent variable is defined as the log of one plus the aggregate number of environmental inspections and enforcement actions per facility in a state in year $t+1$. Column (1) uses *Democrat Win*$_t$, an indicator equal to one if Democrats win at least one closely contested seat in a state in year t. Column (2) uses *Democrat Majority Win*$_t$, equal to one if Democrats win more than half of those seats. Regressions control for state and year fixed effects. The unit of observation is the state-year. Standard errors are clustered at the state level. In Panel B, the instruments—*Supplier Avg Democrat Win* and *Supplier Avg Democrat Majority*—are defined as the proportion of the supplier's plants located in states where Democrats have *Democrat Win* or *Democrat Majority Win* close elections. Columns (1) of Panels B.1 and B.2 report the first-stage regressions of *Supplier Avg EPA Enforcement*$_t$ on the instruments. Columns (2) report the second-stage regressions, following the specification in Table 4. Variable definitions are provided in Appendix A. Standard errors are clustered at the supplier industry level. t-statistics are reported in parentheses. Statistical significance is denoted as follows: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 6. Effects of Covenant on Supplier Emissions and Green Positions

Dep. Var.=	Supplier Ln(1+Total Emissions)	Supplier Green Positions Num.
	(1)	(2)
Panel A: Environmental Covenant		
Environmental Covenant × Post	-0.044***	0.026*
	(-2.33)	(1.70)
Supplier Controls	Yes	Yes
Contract Event Cohort × Year FEs	Yes	Yes
Contract Event Cohort × Supplier Plant FEs	Yes	No
Contract Event Cohort × Supplier Firm FEs	No	Yes
Year × Supplier Plant State FEs	Yes	No
Year × Supplier HQ State FEs	No	Yes
N	64,328	14,100
Adj. R^2	0.94	0.72
Panel B: Placebo test– Financial Covenant		
Financial Covenant × Post	-0.009	0.015
	(-0.51)	(1.20)
Supplier Controls	Yes	Yes
Contract Event Cohort × Year FEs	Yes	Yes
Contract Event Cohort × Supplier Plant FEs	Yes	No
Contract Event Cohort × Supplier Firm FEs	No	Yes
Year × Supplier Plant State FEs	Yes	No
Year × Supplier HQ State FEs	No	Yes
N	64,328	14,100
Adj. R^2	0.93	0.72
Panel C: Placebo test–Product Quality Covenant		
Product Quality Covenant × Post	-0.020	0.009
	(-0.91)	(0.52)
Supplier Controls	Yes	Yes
Contract Event Cohort × Year FEs	Yes	Yes
Contract Event Cohort × Supplier Plant FEs	Yes	No
Contract Event Cohort × Supplier Firm FEs	No	Yes
Year × Supplier Plant State FEs	Yes	No
Year × Supplier HQ State FEs	No	Yes
N	64,328	14,100
Adj. R^2	0.93	0.72

This table reports the effects of environmental/financial/product quality covenant on supplier outcomes. Specifically, we examine whether the adoption of each covenant in supply chain contracts is associated with (i) changes in suppliers' total emissions, and (ii) increased likelihood of green human capital investment. We estimate the following difference-in-differences specification using linear probability models. Column (1) reports results at the plant-year level; Column (2) reports results at the firm-year level:

$$\begin{aligned} \textit{Supplier Outcome}_{s,(p),t} = \beta_1 \textit{Covenant}_{s,m} \times \text{Post}_{s,m,t} + \beta_2 \textit{Environmental Covenant}_{s,m} \\ + \beta_3 \textit{Post}_{s,m,t} + \text{Supplier Controls}_{s,t} + \text{FEs} + \varepsilon_l \end{aligned}$$

where m, s, p, and t denote the supply chain contract event cohort year, supplier, plant, and time (year), respectively. The first dependent variable, The *Supplier Outcome* variables include: *Supplier Ln(1+Total Emissions)*$_{s,p,t}$, the natural logarithm of one plus total emissions scaled by sales for plant p of supplier s at year t; and *Supplier Green Positions Num.*$_t$, the number of green positions held by the supplier at year t. *Covenant*$_t$ is a binary indicator equal to one if a supply chain contract l signed in year t contains the corresponding covenant type, and zero otherwise. Specifically, *Covenant*$_{s,t}$ refers to *Environmental Covenant* in Panel A, *Financial Covenant* in Panel B, and *Product Quality Covenant* in Panel C. *Post*$_{m,t}$ is a binary indicator equal to one for the three years following the contract initiation year and zero otherwise. We require that each contract have at least one observation before and after the contract year. The vector of Supplier Controls$_{s,t}$ includes supplier-level controls consistent with Table 2. We include fixed effects for contract-event-cohort $\times$ year fixed effects, contract-event-cohort $\times$ supplier (firm or plant) fixed effects, and (plant) state $\times$ year fixed effects. Standard errors are clustered at the supplier industry level. Variable definitions are provided in Appendix A. t-statistics are reported in parentheses. Statistical significance is denoted as follows: $* \; p < 0.1$, $** \; p < 0.05$, $*** \; p < 0.01$.

Table 7. Effects of Acquire (Supplier) Environmental Covenant on Target Firms' Emissions and Green Positions Around M&A Events

Dependent Var=	Target Ln(1+Total Emissions)	Target Green Position Num.
	(1)	(2)
Panel A: Success M&A Case		
Acquire Environmental Covenants × Post	-0.214*	0.082**
	(-1.84)	(2.22)
Target Controls	Yes	Yes
MA Event Cohort × Year FEs	Yes	Yes
MA Event Cohort × Target Plant FEs	Yes	No
MA Event Cohort × Target Firm FEs	No	Yes
N	584	100
Adj. R^2	0.96	0.92
Panel B: Canceled M&A Cases		
Acquire Environmental Covenants × Post	0.104	-0.591
	(1.60)	(-1.50)
Target Controls	Yes	Yes
Canceled Event Cohort × Year FEs	Yes	Yes
Canceled Event Cohort × Target Plant FEs	Yes	No
Canceled Event Cohort × Target Firm FEs	No	Yes
N	3,024	293
Adj. R^2	0.93	0.63

This table replicates Table 6 by examining the effects of acquirer (which is also the supplier in our study) environmental covenants on target firm outcomes following merger and acquisition (M&A) events. Panel A presents results for completed M&A transactions, while Panel B reports results for canceled M&A announcements. We identify M&A events in which a supplier (the acquirer) merges with or acquires a target firm using SDC data. The variable *Acquire Environmental Covenant* equals one if the acquiring firm has an active supply contract containing environmental covenants within one year prior to the M&A announcement, and zero otherwise. *Post* is a binary indicator equal to one for the three years following the M&A event and zero otherwise. We require that each event have at least one observation before and after the event year. Target Controls$_{s,t}$ are defined analogously to the supplier-level controls in Table 2, but measured for the target firms. Variable definitions are provided in Appendix A. Standard errors are clustered at the target firm industry level, t-statistics are reported in parentheses. Statistical significance is denoted as follows: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 8. Environmental Covenant Effects on Total Emissions by Supplier Avg EPA Enforcement Level

Dep. Var.=	Supplier Ln(1+Total Emissions)	
	Low Enforcement	High Enforcement
	(1)	(2)
Environmental Covenant × Post	-0.065***	-0.023
	(-2.98)	(-0.90)
Supplier Controls	Yes	Yes
Contract Event Cohort × Year FEs	Yes	Yes
Contract Event Cohort × Supplier Plant FEs	Yes	Yes
Year × Supplier Plant State FEs	Yes	Yes
N	31,501	32,721
Adj. R^2	0.92	0.93
Test of diff in β_1***,*** ***Low−High Enforcement***	*p=0.054*	
Dep. Var.=	Supplier Green Position Num.	
	Low Enforcement	High Enforcement
	(1)	(2)
Environmental Covenant × Post	0.041	0.003
	(1.61)	(0.23)
Supplier Controls	Yes	Yes
Contract Event Cohort × Year FEs	Yes	Yes
Contract Event Cohort × Supplier Plant FEs	Yes	Yes
Year × Supplier Plant State FEs	Yes	Yes
N	7,606	5,778
Adj. R^2	0.78	0.88
Test of diff in β_1***,*** ***Low−High Enforcement***	*p=0.084*	

This table reports results from estimating the models presented in Panel A of Table 6, with the sample split based on the median value of *Supplier Average EPA Enforcement*. All estimation procedures follow those described in the footnote of Table 6, and variable definitions are provided in Appendix A. Differences in coefficients across subsamples are tested using 1,000 bootstrap replications. Standard errors are clustered at the borrower level, and t-statistics are reported in parentheses. Statistical significance is indicated as follows: $* \ p < .1$, $** \ p < .05$, $*** \ p < .01$.

A. Definitions of Variables

Variable	Definition	Sources
Covenants in Supply Contract		
Environmental Covenant	A binary variable equal to one if the supply contract includes environmental disclosure, audit, action, or law compliance covenants, following Choy et al. (2024), Lui (2021), and Vandenbergh et al. (2022); zero otherwise.	EDGAR
Financial Covenant	A binary variable equal to one if the supply contract includes any financial covenants, following Costello (2013); zero otherwise.	EDGAR
Product Quality Covenant	A binary variable equal to one if the supply contract specifies product certification requirements (e.g., ISO certifications or CGMP), following Costello (2013).	EDGAR
Determinants		
High-Polluting Supplier	A binary variable equal to one if the supplier operates in Utilities, Business Supplies, Precious Metals, Non-Metallic and Industrial Metal Mining, Steel Works, or Chemicals, following Choy et al. (2024).	EDGAR
Supplier O Score	Supplier's Ohlson Score based on Ohlson (1980a) and Griffin and Lemmon (2002), measuring the probability of financial distress. Firms with high scores are more likely to be distressed.	WRDS
Customer Has EDisclosure	A binary variable equal to one if the customer's 10-K contains any environmental-related keywords.	EDGAR
Customer EDisclosure	The natural logarithm of the frequency of environmental-related keywords in the customer's 10-K filing.	EDGAR
Customer Green Investor (%)	The percentage of green investors' shareholdings in the customer at year t. Green investors are defined as PRI signatories according to the UN PRI.	COMP, UN
Supplier Ln(Green Patent)	The logarithm of the number of green innovation patent filings by the supplier, based on OECD green technologies (Hascic and Migotto, 2015).	Kogan et al. (2017), OECD
Supplier Product Fluidity	Measures the extent to which other firms in related markets change product offerings from the previous year. Higher fluidity indicates more agile and innovative rivals, increasing competitive threat.	Hoberg et al. (2014)
Customer Has Green Specialist	A binary variable equal to one if the customer employs a green job specialist in year t.	Relievo
Distance	The natural logarithm of the geographic distance between supplier and customer headquarters, based on ZIP codes.	COMP
EPA Enforcements		
Sup Avg EPA Enforcement	The proportion of a supplier's facilities located in states with high regulatory enforcement, following Choy et al. (2024). A state is classified as high enforcement if the ratio of total inspections/enforcements to TRI-reporting facilities is above the yearly median.	EPA, NETS

Supplier Controls		
Supplier Ln(AT)	The natural logarithm of the supplier's total assets (in millions).	COMP
Supplier Leverage	Supplier's total liabilities divided by total assets.	COMP
Supplier ROA	Supplier's net income over average total assets.	COMP
Supplier BTM	Supplier's book value of equity over market value of equity.	COMP
Supplier HHI	Herfindahl-Hirschman Index (HHI) measuring the supplier's market concentration, based on FFI48 industry classification.	COMP
Customer Controls		
Customer Ln(AT)	The natural logarithm of the customer's total assets (in millions).	COMP
Customer Leverage	Customer's total liabilities divided by total assets.	COMP
Customer ROA	Customer's net income over average total assets.	COMP
Customer BTM	Customer's book value of equity over market value of equity.	COMP
Customer HHI	Herfindahl-Hirschman Index (HHI) measuring the customer's market concentration, based on FFI48 industry classification.	COMP
Contract Controls		
Amendment	A binary variable equal to one if the supply contract is an amendment.	EDGAR
Document Size	The natural logarithm of the contract file size.	EDGAR
Outcomes		
Ln(1+Total Emission)	The natural logarithm of one plus total annual TRI emissions scaled by sales (non-reporting firms coded as 0).	EPA TRI
Green Positions Num	The number of green positions the firm holds in year t (non-reporting firms coded as 0).	Relievo
Post	A binary variable equal to one for observations within three years after supply contract initiation, and 0 for the three years before.	EDGAR, Dealscan

B. Contract Types

B.1. Agreement Categories

- **Lease/Rental:** Lease agreement, Lease contract, Rental agreement, Rental contract
- **Service:** Service agreement, Service contract, Services agreement, Services contract, Supply & advertising agreement, Supply & advertising contract, Consulting agreement ,Consulting contract , Sale and marketing agreement , Sale and marketing contract
- **License:** Acquisition and license agreement, Procurement and license agreement, Acquisition and license contract

  Construction/Engineering/Program/Manufacturing: Agreement for engineering, procurement, Contract for engineering, procurement, Procurement and construction agreement, Construction agreement, Engineering agreement, Manufacturing agreement, Program agreement
- **Sale/Purchase** Agreement for sale, Sale agreement, Sale contract, Purchase-sale agreement, Purchase-sale contract, Agreement for purchase, Contract for purchase, Purchase agreement, Purchase contract, Acquisition agreement, Acquisition contract, Agreement to procure, Contract to procure
- **Supply/Supplier:** Agreement for supply, Agreement on the development and supply of, Agreement re: supply of, Contract of supply, Supplier agreement, Supplier contract, Procurement agreement, Procurement contract, Procurement framework agreement, Procurement framework contract, Purchase, supply and distribution agreement, Purchase, supply and distribution contract

B.2. Keywords List for Supply Contract Searching

1. **Keyword_List:** 'supply', 'supplier', 'purchas*', 'buy', 'procur*', 'acquisition', 'service', 'lease', 'rental', 'sale', 'consult', 'market', 'advertis*', 'construct', 'engineer', 'program', 'manufactur*'
2. **Invalid_Word_List:** 'stock purchase', 'asset purchase', 'deed of trust', 'stock', 'asset', 'deed', 'trust', 'merger', 'security', 'financing', 'credit', 'loan', 'warrant', 'share', 'securities', 'receivable', 'option', 'assets', 'bond', 'certificate', 'collateral', 'debenture', 'equity', 'note', 'interest', 'director', 'ceo', 'cfo', 'merge', 'termination', 'release', 'repurchase', 'forward purchase', 'purchase and assumption', 'private purchase', 'memorandum', 'letter', 'warranty', 'terminate', 'dismiss', 'settle', 'discontinue', 'suspend', 'cessation', 'employ', 'mortgage', 'escrow', 'incentive', 'news press', 'press release', 'immediate release', 'announce'

Note: All keywords and invalid words are case-insensitive, meaning they are matched regardless of capitalization.

Note: Words with asterisks (*) indicate that variations of these words will also be detected.

B.3. Pattern for Environmental Covenants

- Environmental Action Covenants: conduct, take, complete, implement, + 250 words spaces + remed, clean, remov, abate, dispos, eliminat, corrective + w/250 + environmental, hazard
- Environmental Disclosure Covenants: advise, notify, report, disclose, deliver, notice + 500 words spaces + environmental,hazard.
- Environmental Audit Covenants: conduct, provide, retain, hire, furnish + 250 words spaces + environmental + 250 words spaces + consultant, audit, engineering, consulting
- Environmental Law Compliance Covenant: Compliance with environmental laws is assessed based on references to environmental legislation, including but not limited to the general environmental law compliance, and specific acts such as the Atomic Energy Act, Clean Air Act, Comprehensive Environmental Response, Compensation and Liability Act, etc

C. Examples of Covenants

This section presents examples of the four types of environmental covenants considered in this study: compliance covenants (general and specific), disclosure covenants, audit covenants, and action covenants.

C.1. Compliance Covenant

C.1.1. General Compliance Covenants

This is the MANUFACTURING SERVICES AGREEMENT between NCR Voyix Corporation and Terafina Software Solutions Private Limited (collectively "NCR Voyix") and NCR Corporation India Private Limited ("Supplier") in 2023.

Section 17: Legal Requirements. Supplier will apply for and obtain all necessary licenses, permits, approvals, certifications, safety certifications, and other authorizations from, and will make all filings, notifications, and registrations with, all governmental and industry authorities and agencies as are necessary or appropriate in relation to the performance of the Services and Supplier's manufacturing operations. Supplier further represents, warrants, and covenants that it will strictly comply with all laws, rules, regulations, policies, procedures, standards, and orders of all applicable governmental and industry bodies, now or hereafter in effect, applicable to Supplier and any of its subcontractors in its and their capacity as a subcontractor to Supplier, **in providing the Services provided hereunder or applicable to corporations generally (e.g., environmental laws) (collectively, the "Legal Requirements")**, and that it will pay all fees and other charges required to comply with such laws, rules, regulations, policies, procedures, standards, and orders. Supplier acknowledges receipt of and agrees to strictly adhere to the NCR Voyix Supplier Quality Manual, as amended from time to time, which is incorporated herein in its entirety by this reference.

C.1.2. Specific Compliance Covenants

This is the RESOURCE RECOVERY SUPPLY AGREEMENT between Waste Connections of California, Inc. and Fulcrum Sierra BioFuels, LLC in 2008.

Article VI: Indemnity. Notwithstanding the foregoing, Fulcrum, in performing any of its obligations relating to the hauling or arranging of Feedstock to either the Facility or to a **solid waste disposal facility**, as the case may be (as contemplated by Sections 2.7(a) and (b)), shall under no circumstances be deemed an "agent" or "subcontractor" of WCC for purposes of this indemnity. Further, it is understood and agreed that any and all Losses incurred by WCC arising out of or in any way related to Fulcrum's aforesaid hauling of Feedstock shall be indemnifiable hereunder.

"Hazardous Material" means any and all hazardous, toxic, or harmful (or potentially harmful) substances, materials, or wastes, including: (i) those substances, materials, and wastes listed or identified now or in the future by the United States Department of Transportation in Table at 49 C.F.R. Section 172.101, any amendments thereto, or listed or identified by the United States Environmental Protection Agency as a hazardous substance at 40 C.F.R. Part 302, and any amendments thereto, and (ii) any substances, materials, or wastes that are or become regulated under applicable environmental laws, including any substances, materials, or waste which has or are: (a) petroleum and derivatives thereof; (b) radioactive; (c) asbestos; (d) polychlorinated biphenyls; (e) defined, designated, or listed as a "hazardous waste" under the **Solid Waste Disposal Act**, 42 U.S.C. Section 6901, et seq., or under any implementing regulations thereto and any equivalent state or local laws or regulations; (f) defined, designated, or listed as a "hazardous substance" under the **Comprehensive Environmental Response, Compensation and Liability Act**, 42 U.S.C. Section 9601, et seq., or under any implementing regulations thereto and any equivalent state or local laws or regulations; and (g) defined, designated, or listed as a "hazardous substance" under the **Clean Water Act**, 33 U.S.C. Section 1251, et seq., or under any implementing regulations thereto and any equivalent state or local laws or regulations.

C.2. Disclosure Covenant

This is the SUPPLY AGREEMENT between Carlisle Interconnect Technologies and Outset Medical, Inc. in 2021.

Section 7: Quality. Supplier shall **advise OUTSET immediately of any proposed or unannounced visit or inspection by any Government Authority, including any Regulatory Authority or any environmental regulatory authority**, and shall permit one or more qualified representatives of OUTSET to be present if requested by OUTSET. If OUTSET is not present during such a visit or inspection, Supplier shall promptly provide a summary report of the results of the inspection to OUTSET in English. Supplier shall promptly (and in no event later than [***] days) furnish OUTSET English summaries of all reports, documents, or correspondence with respect to any Regulatory Authority requests or inspections of any Facility, as well as a copy of each such report, document, or correspondence in English.

C.3. Audit Covenant

This is the LEAD DMD PRODUCT MANUFACTURING & SUPPLY AGREEMENT between Sarepta THERAPEUTICS, INC and CATALENT MARYLAND, INC in 2022.

Section 11.9: Environmental Audit of Catalent. Catalent agrees that Sarepta (the "Auditing Party") shall have the right upon reasonable notice and during normal business hours, at the Auditing Party's expense, once every year during the Term of this Agreement to conduct, or to nominate a Third Party (subject to execution of confidentiality and indemnity agreements reasonably acceptable to Catalent and the Auditing Party) to conduct, jointly or on the Auditing Party's behalf, **an environmental audit of Catalent's operations at the Catalent Facility under this Agreement to monitor Catalent's compliance with applicable environmental Laws and Regulatory Acts**, and with applicable environmental, health, or safety guidelines.

C.4. Action Covenant

This is the AMENDED AND RESTATED SUPPLY AGREEMENT between GENERAL ELECTRIC INTERNATIONAL and TPI Iowa, in 2016.

Section 15.2: Environment, Health, and Safety. **Seller covenants that it will take appropriate actions necessary to protect health, safety, and the environment**, including, without limitation, in the workplace and during transport, and has established an effective program to ensure any suppliers it uses to perform the work called for under this Order will be in compliance with Section 15 of this Order.

D. Appendix Tables

Table D1. Sample Selection

Steps	Drop	Keep	Unit
1. Collect all unique exhibit URLs from the SEC EDGAR Full-Index list from 1993-2024		6,491,764	Exhibits (EDGAR)
2. Filter EDGAR filings from 1993 to 2024 that must contain either 'Agreement' or 'Contract', and any of the words in ***Keyword_List*** in Appendix B.2 within the first 1000 characters of the content	5,981,392	510,372	Exhibits (EDGAR)
3. Use LLM to extract titles, supplier, and customer names from the top 1000 words of the exhibits, and exclude filings with any word in ***InvalidWord_List*** in Appendix B.2 in titles or the top 15 lines of the content	428,216	82,156	Contract (EDGAR)
4. Perform fuzzy matching of supplier and customer names with COMPUSTAT company and subsidiary names from WRDS to obtain corresponding GVKEY identifiers, retaining only pairs with a mapping score of 85 or higher	56,997	26,159	Contract-Sup-Cus
5. Remove observations lacking Compustat data for either the supplier or customer	10,144	16,015	Contract-Sup-Cus
6. Exclude entries where either the supplier or customer is in the financial industry (SIC 6000-6999) or has a name containing "finan*"	5,886	10,129	Contract-Sup-Cus
7. Discard short contract filings (contract size less than 4000 characters)	1,605	8,524	Contract-Sup-Cus
8. Retain samples with all necessary market competition data from financial and geographic data from Compustat and 10k/8K, and for years between 1996-2022, and non-singleton observations	2,493	6,031	Contract-Sup-Cus

This table presents the sample selection process. The sample is restricted to the period 1996–2022 for two reasons: (1) filings from earlier years are incomplete in EDGAR, and (2) S forms, which contain historical contracts that supplement information for certain years, are included. The years 2023 and 2024 are excluded due to the unavailability of future S forms, rendering the sample incomplete.

Table D2. Probit: Environmental Covenant and Determinants

Determinants:	Benefits				Costs			
Dep. Var.=Environmental Covenant	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
High Polluting Supplier	0.205***							
	(2.67)							
Supplier O Score		0.009***						
		(2.60)						
Customer Has EDisclosure			0.069***					
			(4.43)					
Customer Green Investor (%)				0.769*				
				(1.78)				
Supplier Ln(Green Patent)					-0.074**			
					(-2.56)			
Supplier Prod Fluidity						-0.031***		
						(-3.43)		
Customer Has Green Specialist							0.194**	
							(2.49)	
Distance								-0.046***
								(-4.21)
Contract Type Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dum	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sup Ind Dum	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6,031	4,969	6,027	6,027	6,027	5,011	6,027	6,027
P-value for model	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

This table reports estimates from probit models replicating the results from Table 2. Year and Supplier Industry dummy variables are included as controls to account for fixed effects. Variable definitions are provided in Appendix A. Standard errors are clustered at the supplier industry level, and z-statistics are reported in parentheses. The reported p-value corresponds to the overall model significance test. Statistical significance is denoted as follows: $* \ p < 0.1$, $** \ p < 0.05$, $*** \ p < 0.01$.

Table D3. Bank Loan Monitor and Environmental Covenant

Dep. Var.=	Env Covenant	
	(1)	(2)
Sup Green Loan Monitor	0.032**	0.031**
	(2.41)	(2.15)
Sup Green Loan Monitor × High Polluting Supplier		0.008
		(0.22)
Controls	Yes	Yes
Contract Type Effects	Yes	Yes
Year FEs	Yes	Yes
Sup Ind FEs	Yes	Yes
Sup State FEs	Yes	Yes
N	4,796	4,796
Adj. R^2	0.35	0.35

This table examines the impact of the presence of bank loan monitoring on the inclusion of environmental covenants in supply contracts. We replicate the model from Table 4, replacing *Supplier Avg EPA Enforcement* with *Sup Green Loan Monitor*. *Supplier Green Loan Monitor* equals one if the supplier has any outstanding bank loans that include environmental covenants, and zero otherwise. Firms without any bank loans are also coded as zero. The regressions control for contract type fixed effects, year fixed effects, and supplier industry fixed effects. Other model specifications follow those in Table 4. Variable definitions are provided in Appendix A. Standard errors are clustered at the supplier industry level, with t-statistics reported in parentheses. Statistical significance is denoted as follows: $* \ p < 0.1$, $** \ p < 0.05$, $*** \ p < 0.01$.

Table D4. M&A Target Selection When Acquire (Supplier) with Environmental Covenant Contract

Dep. Var.=Candidate Selected	(1)	(2)
Candidate Has Green Position$_{t-1}$ × Acquire Environmental Covenant	-0.188	
	(-1.33)	
Candidate Has Green Position$_{t-1}$	-0.128	
	(-1.10)	
Candidate Emissions$_{t-1}$		-0.010
		(-0.31)
Candidate Emissions$_{t-1}$ × Acquire Environmental Covenant		-0.045
		(-1.21)
Candidate AT	-0.070	-0.088**
	(-1.51)	(-1.97)
Candidate Sale	0.053	0.004
	(0.53)	(0.04)
Candidate Leverage	0.006	0.072
	(1.24)	(1.05)
Candidate BTM	0.000	-0.003
	(0.39)	(-0.80)
Distance	-0.014*	-0.015*
	(-1.84)	(-1.80)
Year Effect	Yes	Yes
Acquire FEs	Yes	Yes
Deal FEs	Yes	Yes
Candidate FEs	Yes	Yes
N	1,560	1,440
Adj. R^2	0.62	0.65

In Table D4, we report results from linear regressions that examine whether suppliers with environmental covenants are more likely to acquire environmentally proactive target firms. The analysis tests for strategic selection in M&A decisions based on the environmental profile of potential targets. The sample includes all completed M&A transactions from the SDC platform. For each target firm c, we construct a choice set of potential candidates using nearest-neighbor matching, selecting up to five firms from the same Fama–French 48 industry that are similar in size, book-to-market ratio, and sales, following Chen et al. (2021). The unit of observation is the acquirer (supplier)-candidate pair.
The regression model is specified as follows:

$$\begin{aligned}\Pr(\textit{Candidate Selected}_t = 1) = \beta_1 \textit{Candidate Green Characteristic}_{c,t-1} \times \textit{Acquire Environmental Covenant}_{s,t} \\ + \beta_2 \textit{Candidate Green Characters}_{c,t-1} + \text{Candidate Controls}_{c,t-1} + \text{FEs} + \varepsilon_l\end{aligned}$$

Candidate Green Characteristic$_{c,t-1}$ refers to two alternative indicators: (i) *Candidate Has Green Position*$_{t-1}$, equal to one if the candidate firm had green specialists in the year prior to the M&A event; and (ii) *Candidate Emissions*$_{t-1}$, is the the natural logarithm of one plus total emissions scaled by sales for candidate firm c at year $t-1$. *Acquire Environmental Covenant*$_{s,t}$ equals one if the acquirer (supplier) has an active supply contract with environmental covenants at the time of the M&A. Control variables include candidate firm asset size, sales, leverage, and book-to-market ratio. All regressions include fixed effects for the candidate firm, acquiring firm, M&A deal, and year. Variable definitions are provided in Appendix A. Standard errors are clustered at the candidate firm level, and t-statistics are reported in parentheses. Statistical significance is indicated as follows: $*$ $p < 0.1$, $**$ $p < 0.05$, $***$ $p < 0.01$.