# Bound by the Bottom Line: The Effect of Loan Covenant Stringency on Corporate Environmental Spending

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**Abstract**

Although it is well-established that a firm's sustainability efforts are shaped by various stakeholders, the influence of debtholders is often overlooked in the literature. This study investigates how the strictness of loan covenants affects U.S. firms' environmental spending to reduce corporate CO2 emissions. Employing a novel method to measure loan covenant stringency and controlling for potential liquidity risk, we find that financial covenants significantly reduce a borrowing firm's environmental expenditures in subsequent years. Further analysis reveals that the negative impact is primarily driven by covenants targeting a firm's short-term operational metrics (performance covenants), but not those related to its capital structure (capital covenants). Our findings suggest that a firm's long-term sustainability strategies can be constrained by short-term performance-based contractual obligations.

**Keywords**: Debt covenant, CSR, ESG, sustainability, corporate carbon footprint, environmental expenditures

**EFM Classification Codes:** 150, 180

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## 1. Introduction

This paper examines how the strictness of certain covenants included in loan contracts affects corporate environmental expenditures. Corporate social responsibility (CSR) is closely intertwined with a firm's relationships with its stakeholders, and maintaining and enhancing such connections is vital for CSR initiatives to be effective (Barnett, 2007; Barnett & Salomon, 2012). Recent studies on investor preferences for CSR suggest that investors often value environmental or social factors more than monetary motives (Riedl and Smeets, 2017; Hartzmark and Sussman, 2019). A more recent study by Azar et al. (2021) shows how shareholder activism and investment choices can drive firms to enhance their environmental efforts. Sustainability initiatives also serve as a signaling mechanism, allowing firms to communicate unobservable product quality to consumers (Servaes and Tamayo, 2013). Hiatt et al. (2015) further support this notion by showing that firms are more likely to respond to consumer activist demands when faced with public pressure. These studies collectively underscore that CSR initiatives not only serve as a strategic tool for firms to navigate external pressures but are also shaped by stakeholder dynamics. Nevertheless, despite an extensive body of literature on CSR and stakeholders, one type of stakeholder often under-researched is the debtholder.

Some studies discuss the intersection of CSR and debt financing through certain mechanisms. It is well known that firms with CSR concerns (Goss and Roberts, 2011; Tan et al., 2020) or weaker social capital (Hasan et al., 2017) tend to suffer from higher interest rates on public debt. There is also a close relationship between creditor monitoring and CSR. Benlemlih (2017) argues that firms use debt with shorter maturities to control overinvestment in CSR related to employee and community welfare while He et al. (2020) find that increased credit monitoring reduces firm activities in these areas. However, there is limited research on how debt financing

affects a firm's environmental efforts. In particular, the role of financial covenants as a tool for guiding environmental investments is largely unexplored. This study fills that gap by investigating how different types of financial covenants influence corporate environmental expenditures.

The primary objective of our research is to assess whether financial covenants influence sustainable investments and, more importantly, whether different types of financial covenants have varying impacts. Specifically, we examine two distinct types of financial covenants: *performance covenants* and *capital covenants*. This distinction provides unique insights into how debtholders can influence corporate behavior. Performance covenants, primarily concerned with operational performance and liquidity, serve as short-term risk indicators for lenders. Capital covenants, on the other hand, focus on long-term capital structure and leverage, acting as a measure of overall risk exposure (Christensen and Nikolaev, 2012; Devos et al., 2017).

We find that the strictness of performance covenants reduces a firm's environmental expenditures in subsequent years. In contrast, capital covenants show no significant effect on environmental investments. We obtain the environmental expenditure data reported by U.S. firms during the period from 2012 to 2022. Corporate loan information during the same period comes from Reuters DealScan. To measure the degree of restrictions imposed by loan contracts, we follow previous studies (Billett et al., 2007; Bradley and Roberts, 2015; Devos et al., 2017) and create a covenant stringency index based on the number of either performance or capital covenants for each firm-year. Our regression analysis demonstrates that the stringency index of performance covenants has negative and statistically significant lagged effects on a firm's environmental expenditures. The results are consistent for the full sample as well as a subset of energy-intensive industries. Our findings highlight the need for alignment across all contract terms to ensure effective debt-financed carbon-reduction activities and optimal risk management.

This paper contributes to the extant literature on debtholder influence on CSR in multiple ways. First, this is among the few studies distinguishing the effects of performance and capital covenants on a firm's environmental spending. One implication of our findings is that a firm's long-term sustainability efforts can be shaped by contractual requirements on short-term operational performance. This is consistent with previous findings on the role of financial frictions in the allocation of investment capital (e.g. Myers, 1977; Chava and Robert, 2008; Shen, 2017). Debt covenants, particularly performance covenants, reduce a firm's investment in carbon reduction activities. Carbon reduction is a long-term strategic action by the firm. When short-term performance metrics induce firms to lower environmental investments, firms are hindered from meeting policy and regulatory goals to quickly and efficiently reduce their carbon footprint.

Second, to the best of our knowledge, this is the first research to empirically examine the effect of loan covenants on a firm's environmental spending decisions. Existent literature examines the effect of a firm's research and development (R&D) expenditures to proxy CSR investment (e.g. McWilliams and Siegel, 2000; Prior et al., 2008; Padgett and Galan, 2010). However, few studies utilize corporate expenditure data specifically related to a firm's environmental activities. When we use the corporate expenditure data in conjunction with debt covenant information, we observe a negative relationship between additional debt covenants and corporate environmental investment.

Obviously, firm characteristics also play a role in both environmental expenditures and debt contract terms. Firm size impacts the publicity, scrutiny, and cash flow available for sustainable investments as well as debt repayment (e.g., Godfrey et al., 2008; Crain and Crain, 2010; Bradley and Roberts, 2015). Too little liquidity and too much leverage can diminish environmental investment and ability to repay creditors (e.g., Nini et al., 2009, Bradley and

Roberts, 2015). Profitability provides the operating capital to fund sustainability initiatives and enhance short-term liquidity (Ding et al., 2016). We control for firm size, liquidity, leverage and profitability in our analysis.[1] It is possible for these variables to directly impact sustainable expenditure decisions while the loan covenants may not. Figure 1 illustrates the relationships among these factors. Our results are robust to the additional control variables and across model specifications.

[Insert Figure 1 around here]

The structure of the remaining sections in this paper is as follows. Section 2 provides a comprehensive review of studies relevant to our research questions, accompanied by the development of hypotheses. Section 3 details the data utilized in this study and outlines the methodology employed to calculate debt covenant intensity. Section 4 presents the findings derived from our empirical analyses. Finally, Section 5 concludes this study by summarizing the key outcomes and presenting suggestions for future research.

## 2. Literature and Hypothesis Development

### *2.1 Environmental expenditures and corporate carbon footprint*

The positive and strong relationship between firms' investment expenditures and CSR has been widely recognized in literature. Many aspects of CSR lead to a product or process innovation. Likewise, intangible resources generated through R&D investments enhance a firm's technological adaptability and bolster its CSR efforts (McWilliams and Siegel, 2000; Prior et al., 2008).

[1] The control variables are described in Section 3.2.

Among the earliest studies on the relationship between a firm's investment expenditures and CSR are McWilliams and Siegel (2000). They argue that any regression analysis on a firm's CSR can be misspecified if the model does not control for R&D investment. Prior et al. (2008) examine the relationship between a firm's investment expenditures on CSR and financial performance, particularly in the context of earnings management. It is worthwhile to note that they distinguish between strategic CSR investments and discretionary CSR investments, which may be used as a tool for managerial entrenchment and do not directly affect the bottom line. Padgett and Galan (2010) specifically analyze the impact of R&D expenditures on CSR. They find that a firm's R&D significantly improves CSR scores in manufacturing industries while there is no significant impact in non-manufacturing industries.

Environmental expenditures include investments in cleaner, more efficient technologies that reduce carbon dioxide (CO2) and CO2-equivalent emissions. For example, the 2022 Form 10-K report of Exxon Mobil Corp. states that the firm's environmental expenditures are reported based on the definitions and guidelines by the American Petroleum Institute, and include all the expenditures "in refining infrastructure and technology to manufacture clean fuels, as well as projects to monitor and reduce air, water, and waste emissions, and expenditures for asset retirement obligations".[2] We expect that a firm's environmental expenditures have a more direct impact on the reduction of a firm's emission levels than R&D expenditures. Following the studies on R&D expenditures (McWilliams and Siegel, 2000; Prior et al., 2008; Padgett and Galan, 2010, among others), where the ratio of R&D expenditures to total revenues is used, we normalize a firm's environmental expenditures by dividing it by total revenues. We call the measure *environmental expenditure intensity*.

[2] See https://www.sec.gov/Archives/edgar/data/34088/000003408823000020/xom-20221231.htm

To our knowledge, there is limited empirical research examining the impact of a firm's environmental spending on corporate carbon emissions.[3] However, an increasing number of US firms have disclosed their environmental expenditure amounts in recent years. This trend is partly driven by managers' motivation to publicize environmental-related information to justify high expenditures and mitigate shareholder dissent (Wang and Wang, 2024). Disclosing numerical information, such as environmental expenditure amounts, can be more informative to the public than materials based on discussions (Beck et al., 2010).[4] Moreover, Fernando et al. (2017) show that a firm's environmental expenditures have a positive effect on the breadth of ownership, measured as the number of unique shareholders, indicating that firms' environmental effort attracts the attention of more investors.[5]

Climate risk exposure is nonfinancial information, and it is not required by law. Shareholder activism, particularly by institutional investors, can increase voluntary disclosures of climate risks faced by the firm (Flammer et al., 2021). This information has a positive impact on share price, reflecting the value of this additional information. Firms facing climate risks can benefit from transparency, particularly when they have active long-term institutional investors. As climate risk grows, firms face added pressure to voluntarily report exposure to these risks.

The three largest institutional investors focus on large firms with high CO2 emissions (Azar et al., 2021). Concerned with the impact of climate risk on the value of their holdings, they use their influence to push these firms to reduce emissions. As the three largest institutional investors increase their CSR commitment, their influence on emissions reduction has grown. These large

[3] At the country-level, Koçak and Ulucak (2019) and Petrović and Lobanov (2020) both show mixed results in their analyses on the effect of environmental R&D expenditures on CO2 emission reduction.
[4] On the other hand, based on interviews with Finnish energy companies, Laine et al. (2017) warn that quantitative environmental information published by firms need to be approached with caution.
[5] For their robustness test, Fernando et al. (2017) also classify environmental expenditures as voluntary, mandatory, or legal expenditures.

institutions often hold corporate debt as well as equity, providing additional influence over large firms.

*2.2 Impact of sustainable investment on debtholders.*

Sustainability initiatives are a consideration in setting debt contract terms and rates. Goss and Roberts (2011) find that firms with more CSR concerns have higher interest rates on their debt. For riskier borrowers, discretionary CSR spending results in higher spreads and shorter maturities. Firms with weaker social capital (Hasan et al., 2017) or CSR (Ge and Liu, 2015) also face stronger nonprice loan terms, such as collateral requirements and covenant use. On the other hand, lenders may opt for more lenient nonprice terms to offset higher spreads for firms with weak environmental records (Attig et al., 2024). The relationship between loan spreads and CSR strength is non-linear (Bae et al., 2018), with spreads increasing once the level of CSR investment is deemed excessive. This suggests an optimum level of CSR investment for firms with strong CSR positions.

Lenders include debt covenants to reduce agency costs and align incentives, particularly when there are concerns about the borrower's risk. They increase the number and rigor of covenants to alter the firm's behavior, particularly initiatives that could destroy value. Nandy and Lodh (2012) find that firms with high environmental scores have fewer general covenants but more financial ones, raising the number overall. In contrast, Shi and Sun (2015) find that firms with stronger CSR have fewer covenants, especially for environmentally sensitive industries. In addition, Jin et al. (2018) show that firms with higher CSR scores have lower borrowing costs as well as fewer and less restrictive financial covenants. Asimakopoulos et al. (2023) support this, finding lower covenant requirements for high ESG firms along with lower leverage ratios to avoid debt overhang and underinvestment.

Bae et al. (2016) find no impact on the number of covenants for firms with CSR strengths, but firms with CSR concerns face stricter loan covenants as lenders worry about value destroying CSR costs. Better credit ratings and higher CSR engagement can improve covenant terms (Bae et al., 2018). Lenders use additional debt covenants to reduce information asymmetry when they cannot gauge the level and quality of CSR investment. These covenants provide additional checkpoints and monitoring benchmarks to align incentives and prevent excess CSR investment.

*2.3. Effect of debt covenant stringency*

A corporate loan is a debt-based funding arrangement between a firm and financial institutions, such as commercial or investment banks. Along with public debt, such as bonds, corporate loans play significant roles in firms' financing activities. Roughly 80% of all public firms maintain private credit agreements, compared with only 15–20% that have public debt (Faulkender and Petersen, 2006). During our sample period (2012 – 2022), the aggregate amount of commercial and industrial loans for US firms was $2.093 trillion on average. This accounts for 21.4% of the total amount of public and private debt of non-financial US firms.[6] Nevertheless, managers acting to maximize equity value rather than overall firm value may have incentives to over- and underinvest in future growth opportunities (Jensen and Meckling, 1976; Myers, 1977; Smith and Warner, 1979). Loan covenants are intended to protect the creditors from the suboptimal incentive effects of debt financing. For this reason, debt covenants often limit management's ability to make certain decisions, such as asset distributions, additional debt issuance, and capital spending.

A large body of research examines the role of debt covenants in contracts written between lenders and borrowing firms. Nevertheless, the majority of the studies on the effect of debt

[6] The data can obtained at https://fred.stlouisfed.org/series/busloans and https://fred.stlouisfed.org/series/bcnsdodns.

covenants on corporate decisions focus on bank loans (e.g., Dichev and Skinner, 2002; Chava and Roberts, 2008; Nini et al., 2009; Christensen and Nikolaev, 2012; Bradley and Roberts, 2015; Devos et al., 2017, among others) instead of public debt. This is because debt covenants are included in private debt contracts far more frequently or tightly than in public debt (Dichev and Skinner, 2002; Bradley and Roberts, 2015), and therefore can be more effective in loan contracts than bond contracts.[7]

The literature shows that the inclusion of covenants in debt contracts is often associated with a firm's growth opportunities. Among the earliest studies that construct a measure of covenant protection intensity, Billett et al. (2007) utilize such an indicator to analyze the effect of restrictive covenants in corporate bonds. They show that the degree of covenant protection tends to increase as a firm presents more growth opportunities measured by sales growth or R&D intensity. This suggests that these restrictive covenants can be used to control suboptimal incentive effects of debt financing. Shifting focus to corporate loans, Bradley and Roberts (2015) show that firms with high growth opportunities, as measured by R&D intensity, are likely to include covenants in their debt contracts, restricting their investment decisions. This is consistent with the study on bond covenants by Billett et al. (2007). Bradley and Roberts (2015) also show that corporate debt yields are lower when firms include covenants in their loan agreements, indicating that the decision to include a specific covenant is made concurrently with the pricing of the loan contract.

Similarly, some studies analyze how covenant protection impacts a firm's capital expenditures in subsequent years. For example, Nini et al. (2009) specifically examine loan covenants designed to limit a firm's capital expenditures, which exist in 32% of loan agreements between banks and publicly-traded US corporations. They find that capital expenditure restrictions

[7] It is also worthwhile to note that loans made by investment banks and syndicated loans are more likely to include protective covenants than those made by commercial banks (Bradley and Roberts, 2015).

cause a reduction in a firm's investment and that a covenant breach is followed by a reduction in corporate spending. This is likely because of the inclusion of additional covenants designed to restrict investment. Likewise, Chava and Roberts (2008) focus on financial covenants (e.g., requiring the maintenance of a minimum current ratio) and examine the influence of covenant violations on corporate investment. They show that a firm's capital expenditures decline sharply following a covenant violation as a result of creditors intervening in management. Interestingly, Dichev and Skinner (2002) show that most covenant violations are not associated with borrowing firms' financial distress. They argue that lenders often do not impose serious consequences on borrowing firms after their violations.

Heavy reliance on loan covenants also affects other aspects of corporate decisions, such as earnings management and capital structure adjustment. Kim et al. (2010) examine how the level of a firm's proximity to loan covenant violation influences a firm's earnings management practices. They find that firms are more likely to use earnings management when they are closer to violations of net worth debt covenants. Devos et al. (2017) find that bank loan covenant is the major mechanism that reduces capital structure adjustment speed. Capital covenants, in particular, have a significant impact in hampering the speed of capital adjustment. In the subsequent section, capital (versus performance) covenants are discussed in more detail.

Some of these studies construct a *covenant index* based on the number of covenants included in the debt contract as a way to measure covenant protection (Billett et al., 2007) or intensity (Bradley and Roberts, 2015; Devos et al., 2017). This approach is similar to the *governance index* developed by Gompers et al. (2003). We also adopted a covenant index in our study.[8] This methodology is covered in more detail in Section 3.

[8] The governance index in Gompers et al. (2003) is constructed based on the number of corporate governance provisions, and is used as a measure of the balance of power between shareholders and managers.

Graham et. al. (2005) find that managers will sacrifice long-term economic value to smooth earnings and meet analyst expectations, even when GAAP accounting choices are available. More predictable earnings are believed to reduce market turmoil and lower risk premiums. Stock prices, reputation, credibility and conveying growth prospects are key reasons for smoothing earnings. Debt covenants are a factor when the constraint is binding, such as a potential covenant violation and for private firms. This result is supported by He et al. (2020), who find that higher credit monitoring from covenant violations leads to lower investment in CSR. The most significant reduction is to social factors. Emission reduction and other environmental scores also falls, but their results are not statistically significant.

*2.4. Hypothesis development*

CSR is considered a strategic initiative pursuing long-term benefits for a firm, rather than maximizing short-term profits. Today's shareholders increasingly prioritize environmental issues, such as CO2 emissions, understanding that these concerns are crucial for a firm's sustainable growth even though they may not have an immediate impact on financial performance (Christensen et al., 2021). Nevertheless, as Bénabou and Tirole (2010) point out, managerial short-termism often drives decisions that favor immediate financial results at the expense of long-term value. For instance, managers might reduce or hesitate to expand investments in sustainability initiatives, especially when faced with the pressures of strict loan covenants. If a firm's financial performance declines, the risk of breaching these covenants increases. Managers may neglect long-term environmental objectives, fearing that rising environmental costs could further weaken financial metrics.

Before analyzing the impact of loan covenant stringency on environmental expenditures, it is essential to establish that a firm's environmental expenditures are relevant to the reduction of

corporate carbon footprint. The positive relationship between corporate expenditures and CSR performance is well-documented in the literature. While previous studies (McWilliams and Siegel, 2000; Prior et al., 2008; Padgett and Galan, 2010, among others) primarily focus on a company's R&D spending, we argue that environmental expenditures can enhance a firm's CSR performance even more significantly. Specifically, we expect that, as a firm's environmental spending increases, its corporate carbon footprint decreases over time. We hypothesize the following.

**Hypothesis 1:** A firm's environmental expenditures negatively and significantly affects its CO2 and CO2-equivalent emissions in the following years.

The primary objective of this study is to examine whether stringency in financial covenants negatively impacts managerial decisions on environmental spending. Financial covenants are intended to ensure that a borrowing firm maintains a certain level of operating performance and financial health, and usually impose a maximum or minimum threshold in a financial ratio.[9] Nevertheless, the impact of covenant stringency on borrowing firms can vary significantly across different financial covenants. Building on the frameworks established in previous studies (Chava and Roberts, 2008; Christensen and Nikolaev, 2012; Devos et al., 2017), we classify financial covenants into two categories: performance covenants and capital covenants.

Performance covenants target the operational performance and short-term financial metrics of the borrowing firm, such as the debt-to-cash-flow ratio. Lenders use these covenants as early warning systems, enabling them to reassess loan terms if the firm's operational performance begins to decline (Dichev and Skinner, 2002; Christensen and Nikolaev, 2012). Moreover, Christensen and Nikolaev (2012) show that a strong emphasis on performance covenants is associated with

[9] Another type of covenants commonly examined is the restrictive (or negative). For example, Billett et al. (2007) classify negative covenants into four categories: asset distributions, financing activities, event-driven triggers, and investment policy.

more frequent contract renegotiations and can restrict certain managerial actions, such as pursuing high-risk projects.[10] Motivated by these studies, we expect that strictness of performance covenants negatively affects a firm's annual environmental expenditures. This leads us to the following hypothesis.

**Hypothesis 2:** Covenant stringency associated with *performance covenants* negatively and significantly affects a firm's environmental expenditures.

In contrast to performance covenants, capital covenants focus on the company's sources and uses of capital, such as leverage ratios. These covenants serve as long-term safeguards, aiming to align the interests of debt holders and shareholders by minimizing the borrower's overall risk profile. Existing literature shows that performance and capital covenants influence firms' decisions in distinct ways. For example, Devos et al. (2017) show that capital covenants, but not performance covenants, significantly slow a firm's ability to adjust its debt ratio towards the optimal level. Given the nature of capital covenants, we do not expect that stringency of these covenants significantly impacts a firm's environmental expenditures. Our final hypothesis is therefore as following.

**Hypothesis 3:** Covenant stringency associated with *capital covenants* does not significantly affect a firm's environmental expenditures.

## 3. Data and Methodology

### *3.1. Measure of corporate carbon footprint*

Corporate carbon footprint is a firm's greenhouse gas (GHG) emissions within a certain time period. GHG emissions can be classified into three categories. Scope 1 emissions are direct

[10] Christensen and Nikolaev (2012) also report that negative covenants are likely to be included in a loan contract if performance covenants are included.

emissions that are associated with the sources controlled or owned by a firm (e.g., emissions from a firm's own manufacturing facilities, company-owned vehicles). Scope 2 emissions are indirect emissions related to the purchases of electricity, steam, heat, or cooling consumed by a firm. Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly affects in its value chain.[11] Examples of Scope 3 emissions include, but are not limited to, emissions from product use by customers, contractor-owned vehicles, production of purchased materials, and electricity purchased for resale. Our data source for emission information is Refinitiv Eikon, and we collect corporate CO2 and CO2-equivalent emission amount data in tonnes for all the U.S. firms that publicly disclose the information for the period between 2012 and 2022.

[Insert Table 1 around here]

Table 1 presents the summary statistics. Scope 3 emissions account for a significant portion of the overall COS emissions by U.S. firms. The table shows that the average annual Scope 3 emission amount reported by the firms within our sample is 24,400,000 tons. This is roughly 4.3 times greater than the average of 5,665,914 tons associated with the direct operating emissions (i.e., Scope 1) and 26.2 times greater than the average of 930,283 tons associated with Scope 2 emissions. Of the total COS emissions by the firms examined in this study, 78.7% is classified as Scope 3.

Moreover, Scope 3 reporting is increasingly urged by investors, policy makers, and other key stakeholders because it focuses a firm's reduction efforts internally rather than shifting responsibility down the supply chain (Emborg et al., 2023). For these reasons, our regression analysis corresponding to Hypothesis 1 focuses on Scope 3 emissions of firms. We have a total of

[11] https://www.epa.gov/climateleadership/scopes-1-2-and-3-emissions-inventorying-and-guidance

1,006 firm-year observations with Scope 3 CO2 emissions data, environmental expenditures data, and financial information from Compustat for the period between 2012 and 2022.

In this study, we utilize the concept commonly known as *carbon intensity* instead of directly examining the actual amount of CO2 emissions in tonnes. An intensity metric using a common denominator provides an apples-to-apples comparison for firms with different sizes and across industries. Following previous studies (Stanny and Ely, 2008; Chatterji et al., 2009; Chapple et al., 2013, among others), we standardize a firm's annual total CO2 emission amount by dividing it by total revenue.[12]

*3.2. Environmental expenditures and firm characteristics*

One of the key variables examined in this study is environmental expenditures. A firm's environmental expenditures include all the amounts of environmental spending to control, prevent, or reduce environmental impacts and hazards. These expenses also include clean-up, disposal, sanitation, and treatment expenditures. Firms typically report environmental expenditures through their Form 10-K annual reports or annual sustainability reports. Like CO2 emission data, we obtain environmental expenditure data from Refinitiv Eikon. We rely on the data collected by Refinitiv as we believe that utilizing a third-party database will result in a more accurate and complete dataset than hand-collecting information directly from thousands of reports. R&D expenditures data also come from Refinitiv Eikon. The sample used for our empirical tests includes all the firms that have R&D expenditures data in the Refinitiv database. All financial statement data for firms in our sample are obtained from Compustat.

Based on the environmental expenditure data, we calculate the *environmental expenditure intensity* by dividing a firm's expenses in a given year by total revenue. This approach is consistent

[12] The earlier study by Konar and Cohen (2001) examine a firm's aggregate toxic chemicals emitted per revenue.

with previous studies on R&D expenditures (e.g., McWilliams and Siegel, 2000; Prior et al., 2008; Padgett and Galan, 2010). Table 2 shows the summary of corporate expenditures and firm characteristics during our sample period.[13]

[Insert Table 2 around here]

Our study incorporates several control variables to account for pre-existing differences among firms. Firm size is one of the most critical ones, and we use total assets as a proxy. Larger firms generally have stronger incentives to maintain CSR initiatives due to greater public scrutiny (Godfrey et al., 2008; Wickert et al., 2016). In contrast, smaller firms often struggle to sustain environmental activities, facing compliance costs with environmental regulations that are five times higher per employee than those for large firms (Crain and Crain, 2010). Firm size is also relevant to corporate loan covenants. For instance, Bradley and Roberts (2015) show that loan contracts are more likely to include protective covenants when a borrowing firm is small and has high growth opportunities.

The second control variable is a measure of a firm's liquidity risk. It is reasonable to assume that, if a borrowing firm is facing cash flow concerns on short-term debt, creditors attempt to limit its investment by including strict loan covenants in a loan contract. This expectation is consistent with the finding by Nini et al. (2009).[14] As a measure of liquidity risk, we use firm's quick ratio calculated as its total current assets without inventories divided by total current liabilities.[15]

The third control variable is the level of firm leverage, which is calculated as the firm's total liabilities divided by total assets. Protective covenants are more likely to be included in loans when a borrowing firm is highly levered (Bradley and Roberts, 2015). The other two control

[13] The table is based on the samples used in our regression analyses reported in Sections 4.2.
[14] On the other hand, Billett et al. (2007) argue that liquidity risk is only relevant for lower-quality or unrated firms.
[15] Although not reported, our result is unaffected when the cash ratio is included instead of the quick ratio.

variables are return on assets (ROA) as a measure of firm profitability and Tobin's q. ROA is calculated as a firm's net income divided by total assets. Tobin's q is a firm's market value divided by the replacement value of its assets, and is known to reflect the market adjustment to a firm's value with respect to the effect of its CSR efforts (Ding et al., 2016).

*3.3. Covenant stringency index*

Another key variable examined in this study is the measure of loan covenant stringency. Corporate loan information comes from Reuters DealScan, formerly known as Loan Pricing Corporation Deal Scan. The information in this database is collected from regulatory filings and proprietary sources, such as Refinitiv's league tables. DealScan has been widely used in previous studies (Chava and Roberts, 2008; Kim et al., 2010; Devos et al., 2017 among others) as the data sources of debt covenant information. The basic unit of observation in Dealscan is a loan, referred to as a tranche in the database. Tranches are often grouped together into deals. For example, in October of 2019, Boeing Co. entered into a $9.6 billion deal consisting of three tranches: a 364-day facility for $3.2 billion, a 3-year revolving line of credit for $3.2 billion, and a 5-year revolving line of credit for $3.2 billion.

Following Chava and Roberts (2008) and Devos et al., (2017), we include all the financial covenants imposing a maximum or minimum threshold. These covenants define the allowable range for underlying financial ratios, such as a leverage ratio of $\leq 0.70$, beyond which the covenant would be breached. As described in Section 3, following Christensen and Nikolaev (2012) and Devos et al. (2017), we further group these covenants into either performance or capital covenants. We collect information of all six performance covenants available in the DealScan database: 1) maximum debt to cash flow, 2) minimum interest coverage ratio, 3) minimum debt service coverage ratio, 4) maximum senior debt to cash flow, 5) minimum fixed charge coverage ratio,

and 6) minimum cash interest coverage ratio. The database also provides five capital covenants: 1) maximum leverage ratio, 2) minimum current ratio, 3) maximum debt to equity ratio, 4) maximum loan to value ratio, 5) maximum debt to tangible net worth, 6) minimum level of net worth, and 7) minimum level of tangible net worth.

Our initial dataset of loan contracts includes a total of 143,204 tranches, which are all the loan observations available in the DealScan database for the period between 2012 and 2022. These loans are then grouped together into 85,132 deals. Obviously, many deals are associated with more than one contract-year observation. For example, if a deal is entered into in 2015 and the loan with the longest maturity ends in 2018, the relevant covenant years are 2015, 2016, 2017, and 2018. Consequently, we duplicate the contract information to include all the contract-years for the duration of each contract. The dataset is then merged with the Compustat and environmental expenditures data, resulting in a total 1,729 contract-year observations for the period between 2012 and 2022. Table 3 presents the summary of loan covenants sorted by the covenant type. Note that, if a loan contract may have more than one covenant, the contract can be associated with more than one contract-year observation in a given year.

[Insert Table 3 around here]

Our primary measure of covenant restrictions is how many covenant provisions a firm has in a given year. We then create a Covenant Index (CI) based on the number of covenants. To measure the degree of restrictions imposed by loan contracts, we follow previous studies (Billett et al., 2007; Bradley and Roberts, 2015; Devos et al., 2017) and create covenant indicator variables, each of which is equal to one if a firm has at least one loan contract that includes a given covenant

in a given year and zero otherwise. The CI for each firm-year is then calculated as the sum of the covenant indicator variables divided by the number of covenant categories examined.[16]

$$\text{CovenantIndex}_{i,t-k} = \frac{\sum_{j=1}^{n} \text{D.Covenant}_{i,j,t-k}}{n} \quad (1)$$

$\text{D. Covenant}_{i,j,t-k}$ is equal to one if firm i has at least one loan contract that includes covenant j in year t – k, and zero otherwise. n represents the number of covenant categories, which is equal to 6 for the performance covenant group. For the capital covenant group, n equals 7. Each of the covenant index values ranges from zero (i.e., no covenant protection) to one (i.e., complete covenant protection). A higher index value indicates more restrictions imposed on a firm.

Our primary regression analysis examines the effect of loan covenant stringency on firms' environmental spending. All the firms included in this analysis must have the Compustat data, environmental expenditures data from Refinitiv Eikon, and DealScan's loan covenant data. If a firm has multiple loan contracts in a given year, all the covenant information from these contracts is combined into one firm-year observation. At the end, our sample comprises 775 firm-year observations for the period between 2012 and 2022. For a comparison, we also examine the effect on R&D intensity, for which firms must have the Compustat data, R&D expenditures data from Refinitiv Eikon, and DealScan's loan covenant data. For this analysis, our sample comprises 2,072 firm-year observations.

## 4. Empirical Results

*4.1. Effect of environmental spending on CO2 emissions*

[16] While this is a straightforward approach, one caveat is that it gives equal weight to all covenant categories.

Our baseline assumption is that a firm's environmental spending reduces its carbon footprint over time. To test this, we first examine the impact of environmental expenditures on the firm's annual CO2 emissions (Hypothesis 1). This preliminary analysis aims to confirm the relevance of environmental spending in reducing corporate carbon footprint. The following regression model is used for this test.

$$\text{CarbonIntensity}_{i,t} = \beta_0 + \beta_1 \text{EnvExpIntensity}_{i,t\text{-}k} + \delta \text{X}_{i,t\text{-k}} + \Lambda + \varepsilon_{i,t} \quad (2)$$

$\text{CarbonIntensity}_{i,t}$ is the corporate carbon intensity of firm i in year t. Carbon intensity is defined as a firm's total Scope 3 CO2 and CO2-equivalent emission amount, in tonnes, divided by total revenue in year t. $\text{EnvExpIntensity}_{i,t-k}$ is the environmental expenditure intensity, which is defined as the environmental expenditure of firm i divided by its total revenue in year t – k ($0 \leq k \leq 3$). $\text{X}_{i,t}$ is a set of control variables. The control variables include the following firm-specific attributes: total assets, liquidity, book leverage, return on assets (ROA), and Tobin's q. $\Lambda$ includes industry and year fixed effects. $\varepsilon_t$ is the error term. Standard errors are clustered at the industry level. Data for all the continuous variables are winsorized at the top and bottom 1%. Table 4 presents the result.

[Insert Table 4 around here]

As presented in Panel A, the effect a firm's environmental expenditures on its total Scope 3 CO2 and CO2-equivalent emission amount is rather straightforward. Particularly, the coefficient estimate of *Env. expenditure intensity* in the fourth column is -11.639 with a significance level of 1%. This coefficient can be interpreted that a 0.1 increase in a firm's environmental expenditure intensity reduces its carbon intensity on Scope 3 emissions later by 0.0011639 (= -11.639 ÷ 1,000 × 0.1) two years later.

For a comparison, we also test the impact of a firm's R&D expenditures on its CO2 emissions. We test the regression model presented as Equation (3).

$$\text{CarbonIntensity}_{i,t} = \beta_0 + \beta_1 \text{RDIntensity}_{i,t\text{-}k} + \delta \text{X}_{i,t\text{-k}} + \Lambda + \varepsilon_{i,t} \quad (3)$$

$\text{RDIntensity}_{\text{i,t}-\text{k}}$ is a firm's R&D intensity, defined as the ratio of its R&D expenditures to total revenue in year t – k ($0 \leq k \leq 3$). The rest of the variables are the same as those in Equation (2). As shown in Panel B of the table, the effect of the R&D intensity on a firm's total Scope 3 CO2 emission amount is statistically insignificant for all the years. This should not be surprising since a firm's R&D expenditures are not exclusively dedicated to its environmental activities. Overall, our pre-test supports our expectation that a firms' corporate carbon footprint declines over time as the firm increases its environmental spending. This also demonstrates that a firm's environmental expenditure intensity is relevant to our research questions while R&D intensity is not.

Although not reported in this article, we also examine the effect of a firm's environmental expenditure intensity on its Scope 1 and Scope 2 CO2 and CO2-equivalent emission amounts. However, the effect of the environmental expenditure intensity on a firm's total Scope 1 CO2 emission amount is statistically insignificant. As explained in Section 3, Scope 2 emissions account for a very small portion of the overall COS emissions by U.S. firms.[17]

*4.2. Effect of financial covenant stringency on environmental expenditures*

The primary objective of this study is to examine the effect of corporate loan covenants on a firm's environmental investment. As described in Section 2.4, the two types of financial covenants are quite different from each other in nature. For this reason, we examine their effects on corporate expenditures separately and calculate the Covenant Index based on performance covenants only (= performance covenant index) or capital covenants only (= capital covenant

[17] The result of the analysis is available upon request.

index). First, we investigate whether stricter performance covenants lead to reduced environmental expenditures (Hypothesis 2). We test the following regression model.

$$\text{EnvExpIntensity}_{i,t} = \beta_0 + \beta_1 \text{CovenantIndex}_{i,t-k} + \delta \text{X}_{i,t-\text{k}} + \Lambda + \varepsilon_{i,t} \quad (4)$$

$\text{CovenantIndex}_{i,t-k}$ is the Covenant Index (CI) of firm i in year t – k ($0 \leq k \leq 3$) as indicated in Equation (1), and its value ranges from 0 to 1. For the performance covenant index, the CI is based on 6 performance covenants: maximum debt to cash flow, minimum interest coverage ratio, minimum debt service coverage ratio, maximum senior debt to cash flow, minimum fixed charge coverage ratio, and minimum cash interest coverage ratio. The rest of the variables are the same as those in Equation (2). Standard errors are clustered at the industry level. The sample for this analysis only includes firm-year observations corresponding to the loan covenant information collected from Dealscan. Table 5 presents the results.

[Insert Table 5 around here]

Each of the models shows the effect or lagged effect of a firm's performance covenant index on its environmental expenditure intensity in a different period. For example, all the independent variables in Model (2) are lagged by one year. For legibility, the revenue in thousands of dollars is used to calculate a firm's environmental expenditure intensity as well as R&D intensity. That is, the value for the dependent variable is the actual value multiplied by 1,000.

As shown in Panel A, the coefficient estimates of *Covenant index* are negative and statistically significant for year t – 1 and year t – 2. To obtain a sense of the magnitude of the effect, the coefficient estimates of *Covenant index* in Model (2) can be interpreted that a firm's environmental expenditure intensity declines by 0.000606 (= -3.634 ÷ 1,000 × 1/6) one year later as the number of performance covenants in its loan contract increases by one. The lagged effect of covenant stringency in the following year (k = 2) is even more significant both economically and

statistically. For a comparison, we also examine the effect of the performance covenant index on a firm's R&D expenditures. The following regression model is used.

$$\text{RDIntensity}_{i,t} = \beta_0 + \beta_1 \text{CovenantIndex}_{i,t\text{-}k} + \delta \text{X}_{i,t\text{-k}} + \Lambda + \varepsilon_{i,t} \quad (5)$$

The result is shown in Panel B of the table. Note that this analysis includes all firms with available R&D expenditure data in the Refinitiv database, resulting in a larger sample size compared to the one used in the analysis shown in Panel A. As shown in the table, the coefficient estimates of *Covenant index* is not statistically significant in any of the periods. This means that in sharp contrast to a firm's environmental expenditures, R&D expenditures are not affected by performance covenants.

Overall, the result of this analysis is consistent with Hypothesis 2. The restrictiveness of performance covenants included in a firm's loan contract has an adverse impact on its environmental expenditures, but not R&D expenditures, over time. It is also worthwhile to note that a firm's liquidity measure, defined as its quick ratio, has a negative and statistically significant impact on its environmental expenditures in the current year (k = 0). Interestingly, the effect diminishes rather quickly after the current year while the lagged effect of the performance covenant strictness remains over the subsequent two years.

Next, we examine whether strictness of capital covenants reduces a firm's environmental expenditures (Hypothesis 3). For the capital covenant index, the CI is based on 7 capital covenants: maximum leverage ratio, minimum current ratio, maximum debt to equity ratio, maximum loan to value ratio, maximum debt to tangible net worth, net worth, and tangible net worth. The result is indicated in Table 6.

[Insert Table 6 around here]

We find that lagged effects of capital covenants are not statistically significant in any of the years examined. This is consistent with Hypothesis 3. That is, the negative impact on a firm's environmental spending is associated with performance covenants, but not capital covenants. Unlike capital covenants, performance covenants pertain to a firm's short-term financial performance. Our finding suggests that a firm's long-term sustainability effort can be shaped by its short-term operational results.

*4.3. Effect of individual covenants on environmental expenditures*

To gain deeper insights into the findings in the preceding section, we examine the impact of individual covenants on a firm's environmental expenditures. These include two performance covenants and one capital covenant, namely the maximum debt to cash flow, the minimum interest coverage ratio, and the maximum leverage ratio. As presented in Table 3, these three covenants are far more frequently included in corporate loan contracts than the rest of the financial covenants during our sample period. We test the following regression model.

$$\text{EnvExpIntensity}_{i,t} = \beta_0 + \beta_1 \text{D.Covenant}_{i,j,t\text{-}k} + \delta \text{X}_{i,t\text{-k}} + \Lambda + \varepsilon_{i,t} \quad (6)$$

$\text{D. Covenant}_{i,t-k}$ is equal to '1' if firm i has at least one loan contract that includes covenant j in year t – k ($0 \leq k \leq 3$), and '0' otherwise. Table 7 presents the result.

[Insert Table 7 around here]

Panel A presents the results associated with the effect of the maximum debt to cash flow covenant. The coefficient estimates of *D.Covenant* is negative and statistically significant across all of the years, except when k = 3. The coefficient estimates of *Covenant index* in Model (2) can be interpreted that a firm's environmental expenditure intensity declines by 0.00132 if a covenant imposing the restrictions on the level of debt-to-cash-flow ratio is included in its loan contract in

the previous year. The lagged effect of this particular covenant in the following year (k = 2) is even more significant both economically and statistically.

The effect of the minimum interest coverage ratio covenant, presented in Panel B, is also statistically significant across all years, except when k = 3. On the other hand, the effect of the maximum leverage ratio covenant presented in Panel C is statistically insignificant across the years examined. These results are consistent with Tables 5 and 6, reinforcing our finding that the negative effects of financial covenant stringency are related with performance covenants but not capital covenants.

*4.4. Environmentally-sensitive firms*

The results reported in the preceding sections use all U.S. firms. As an additional analysis, we limit our sample to industries closely related to environmental concerns. It is fair to assume that environmental expenditures are of particular importance to the industries contributing to the overall $CO_2$ emissions. Previous studies (Sharfman, 1996; Capelle-Blancard & Petit, 2017) support this notion, showing that firms tend to be scrutinized more intensely for the ESG dimension most relevant to their industry. According to the data shown by Climate Watch, the electricity and heat production sectors contribute to 42.22% of the total $CO_2$ emission amount in the U.S.[18] The manufacturing and construction sectors account for 9.21% of $CO_2$ emissions while transportation contributes to 35.38% of $CO_2$ emissions, a significant portion of which is associated with passenger travel, such as automobiles and motorcycles.

Following the research on environmental disclosure (Cho & Patten, 2007; Michelon et al., 2015), we adopt the notion of the environmentally-sensitive industries that include: mining, oil and gas extraction, utilities, paper, petroleum refining, chemical, and metals. These industries

[18] https://www.climatewatchdata.org/ghg-emissions

combined contribute to the vast majority of the total $CO_2$ emissions in the U.S. We pick applicable firms based on the two-digit North American Industry Classification System (NAICS) code.

[Insert Table 8 around here]

The results from Table 8 support our earlier analysis. Firms in environmentally-sensitive industries experience a negative impact on their environmental spending from performance covenants in year t – 1 and year t – 2, consistent with the results shown in Table 5. On the other hand, there was no significant impact from capital covenants. Once again, short-term performance covenants appear to slow a firm's ability to meet its carbon reduction goals.

*4.5. Robustness checks*

We use a variety of alternative specifications to ensure the robustness of our results reported in the preceding sections. First, our finding is robust to different sample periods. Each of the regression analyses examines the lagged effects of covenant stringency on environmental expenditures over a 11-year span from 2012 to 2022. Due to the limited availability of reported data, including earlier years may be challenging. Instead, we test a series of shorter periods – 5, 6, 7, 8, 9, and 10 years up to the year 2022 – to assess robustness. Although the results are not reported, our findings remain consistent across these different timeframes.[19]

Next, our result is robust to a different definition of carbon intensity. In our reported analyses, carbon intensity is calculated as a firm's annual total CO2 emissions divided by total revenue. This is a method consistent with previous studies (Stanny and Ely, 2008; Chatterji et al., 2009; Chapple et al., 2013, among others). To verify robustness, we also follow King and Lenox (2001) and calculate carbon intensity by dividing a firm's annual total CO2 emissions by the number of employees. We confirm that this alternative definition does not alter our findings.

[19] The result of the analysis is available upon request.

Moreover, we test each of the regression models with firm fixed effects, instead of industry fixed effects. Our reported regression models include industry fixed effects in order to control for unobserved heterogeneity in time-invariant industry-specific shocks, such as clean air regulations. We confirm that our results remain virtually unchanged with firm fixed effects. Likewise, we verify that using standard errors clustered at the firm level, instead of the industry level, yields virtually identical results.

Finally, we conduct analyses using raw, unadjusted data only. To mitigate the influence of outliers, all the continuous variables in the reported analyses are winsorized at the top and bottom 1%. We confirm that our findings are unchanged across all tests.

## 5. Conclusions and Directions for Future Research

Our analysis is among a limited number of studies to shed light on the influence of debtholders on a firm's sustainability efforts. Using information from bank loan contracts in conjunction with the firm's corporate expenditure data, our results support the importance of stakeholders in swaying environmental expenditures. As environmental expenditure intensity rises, Scope 3 emissions fall significantly. This is not the case for R&D expenditure intensity, suggesting that R&D is a weak proxy for environmental expenditures.

As lenders increase the number of financial performance covenants, borrowers reduce their environmental expenditure intensity. This occurs in a subset of environmentally sensitive industries as well as the full sample. Borrowers do not reduce their R&D expenditures when faced with additional performance covenants. R&D expenditure may be seen as more vital to mid and long-term competitiveness and performance, and it may be more difficult for executives to justify reduced R&D expenditure to their shareholders. Sustainability is viewed as a "public good," so

firms opt to reduce environmental expenditures instead. This is particularly the case for discretionary environmental expenditures.

Lenders use performance covenants to improve liquidity and reduce their risk, providing an opportunity to reassess loan terms more frequently (Dichev and Skinner, 2002; Christensen and Nikolaev, 2012, He et al., 2020). We find that this lowers environmental expenditures. Whether this moves firms to their optimum level of CSR investment, reducing inefficiencies and excess CSR, or introduces a financial friction that removes valuable carbon-reducing emissions investment is a question for future research.

Although they may impact long-term leverage goals (Devos et al., 2017), we find that more financial capital covenants do not significantly alter environmental or R&D expenditure intensity. The results are robust and apply to the full sample as well as energy-intensive industries. Capital covenants focus on long-term risks, and more environmental expenditures are long-term investments for a firm. On the other hand, performance covenants focus on short-term liquidity, so an additional research question is whether borrowers are sacrificing long-term sustainable investment to meet short-term liquidity goals. This myopia can harm long-term results if sustainable investments are necessary to keep the firm competitive long-term.

Another area for future research involves the perceived strength of the borrower. Prior studies focus on the impact of CSR concerns and strength (e.g., Goss and Roberts, 2011; Shi and Sun, 2015, Bae et al., 2018) on the number and intensity of loan covenants. Separating the borrowers into two groups, high and low CSR reputation, could reveal additional insights into the relationship between debt performance covenants and subsequent environmental expenditures. Further subdivision could introduce sample size problems. Not many firms have disclosed their

environmental expenditure information. As a result, our initial sample size is relatively small.[20] Subdividing by CSR reputation would exacerbate this issue.

Our data is limited to environmental expenditures, but these expenditures can be voluntary, mandatory (i.e., regulatory compliance or remediation), or legal (i.e., legal cases or penalties). The type of environmental expenditure is not typically disclosed with this level of detail. For example, Fernando et al. (2017) state that only 3.1% of their sample explicitly disclose their voluntary environmental expenditures. Moreover, there is no "reporting standard" for environmental expenditures. For example, Exxon Mobil reports its annual amount based on the guidelines by the American Petroleum Institute. Not every firm follows the same guidelines. This makes it difficult to identify the type of environmental expenditure that is reduced through performance covenants. We would expect firms to reduce voluntary expenditure, but there is insufficient data to test this.

While lenders can select from seven capital covenants, only the maximum leverage ratio is frequently used. This is also a problem for other studies of debt covenants. Other choices and combinations of capital covenants are possible. With a long-term focus, these covenants appear more aligned with CSR investment than the performance covenants.

This points to a key policy implication. Firms and lenders should carefully consider the structure of debt contracts when negotiating loan terms. Performance covenants focus on short-term operational performance. Even if a firm has adequate liquidity, their inclusion lowers the firm's carbon-reduction expenditures. Capital covenants do not have this impact.

Stakeholders want firms to reduce their carbon footprint, especially for firms in energy-intensive industries. It is important to design debt contracts that balance the lender's concerns with risk and the firm's goals with reducing carbon emissions. Adding capital or non-financial

[20] Other studies on R&D expenditures and advertising have similar limitations.

covenants would allow firms, particularly those in energy-intensive industries, to continue their carbon-reducing expenditures while allowing lenders to address concerns of risk and informational asymmetry. This would provide a range of environmental and financial risk reduction benefits to all stakeholders.

## References


Asimakopoulos, P., Asimakopoulos, S., & Li, X. (2023). The role of environmental, social, and governance rating on corporate debt structure. *Journal of Corporate Finance, 23,* 102488.

Attig, N., Rahaman, M., & Trabelsi, S. (2024). Creditors at the gate: Effects of selective environmental disclosure on the cost of debt. *Corporate Governance: An International Review,* 1-29.

Azar, J., Duro, M., Kadach, I., & Ormazabal, G. (2021). The Big Three and corporate carbon emissions around the world. *Journal of Financial Economics, 142,* 674-696.

Bae, S. C., Chang, K., & Yi, H. (2016). The impact of corporate social responsibility activities on corporate financing: a case of bank loan covenants. *Applied Economics Letters, 23 (17),* 1234-1237.

Bae, S. C., Chang, K., & Yi, H. (2018). Corporate social responsibility, credit rating, and private debt contracting: new evidence from syndicated loan market. *Review of Quantitative Finance and Accounting, 50,* 261-299.

Barnett, M. L. (2007). Stakeholder influence capacity and the variability of financial returns to corporate social responsibility. Academy of Management Review, 32(3), 794-816.

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

Beck, A. C., Campbell, D., & Shrives, P. J. (2010). Content analysis in environmental reporting research: Enrichment and rehearsal of the method in a British–German context. *The British Accounting Review, 42*(3), 207-222.

Bénabou, R., & Tirole, J. (2010). Individual and corporate social responsibility. *Economica,* 77(305), 1-19.

Benlemlih, M. (2017). Corporate Social Responsibility and Firm Debt Maturity. *Journal of Business Ethics, 144,* 491-517.

Billett, M. T., King, T. H. D., & Mauer, D. C. (2007). Growth opportunities and the choice of leverage, debt maturity, and covenants. *the Journal of Finance*, *62*(2), 697-730.

Bradley, M., & Roberts, M. R. (2015). The structure and pricing of corporate debt covenants. *The Quarterly Journal of Finance*, 5(02), 1550001.

Chapple, L., Clarkson, P. M., & Gold, D. L. (2013). The cost of carbon: Capital market effects of the proposed emission trading scheme (ETS). *Abacus*, *49*(1), 1-33.

Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. Accounting, Organizations and Society, 32(7-8), 639-647.

Capelle-Blancard, G., & Petit, A. (2017). The weighting of CSR dimensions: One size does not fit all. Business & Society, 56(6), 919-943.

Chatterji, A. K., Levine, D. I., & Toffel, M. W. (2009). How well do social ratings actually measure corporate social responsibility?. *Journal of Economics & Management Strategy*, *18*(1), 125-169.

Chava, S., & Roberts, M. R. (2008). How does financing impact investment? The role of debt covenants. *The journal of finance*, *63*(5), 2085-2121.

Christensen, H. B., Hail, L., & Leuz, C. (2021). Mandatory CSR and sustainability reporting: Economic analysis and literature review. *Review of accounting studies*, *26*(3), 1176-1248.

Christensen, H. B., & Nikolaev, V. V. (2012). Capital versus performance covenants in debt contracts. *Journal of Accounting Research*, *50*(1), 75-116.

Crain, W. M., & Crain, N. V. (2014). The cost of federal regulation to the US economy, manufacturing and small business. *Washington, DC: National Association of Manufacturers*, *1*.

Ding, D. K., Ferreira, C., & Wongchoti, U. (2016). Does it pay to be different? Relative CSR and its impact on firm value. International Review of Financial Analysis, 47, 86-98.

Devos, E., Rahman, S., & Tsang, D. (2017). Debt covenants and the speed of capital structure adjustment. *Journal of Corporate Finance*, *45*, 1-18.

Dichev, I. D., & Skinner, D. J. (2002). Large–sample evidence on the debt covenant hypothesis. *Journal of accounting research*, *40*(4), 1091-1123.

Emborg, M., Lloyd, S., & Olsen, S. (2023). Why process-level Scope 3 accounting is needed for delivering supply chain greenhouse gas emission reduction. *Integrated environmental assessment and management*, *19*(5), 1165-1167.

Faulkender, M., & Petersen, M. A. (2006). Does the source of capital affect capital structure?. *The Review of Financial Studies*, *19*(1), 45-79.

Fernando, C. S., Sharfman, M. P., & Uysal, V. B. (2017). Corporate environmental policy and shareholder value: Following the smart money. *Journal of Financial and Quantitative Analysis*, *52*(5), 2023-2051.

Flammer, C., Toffel, M., & Viswanathan, K. (2021). Shareholder activism and firms' voluntary disclosure of climate change risks. *Strategic Management Journal, 42* (10), 1850 – 1879.

Ge, W. & Liu, M. (2015). Corporate social responsibility and the cost of corporate bonds. *Journal of Accounting and Public Policy*, 34, 597-624.

Godfrey, P. C., Merrill, C. B., & Hansen, J. M. (2009). The relationship between corporate social responsibility and shareholder value: An empirical test of the risk management hypothesis. *Strategic Management Journal*, 30(4), 425-445.

Gompers, P., Ishii, J., & Metrick, A. (2003). Corporate governance and equity prices. *The quarterly journal of economics*, *118*(1), 107-156.

Goss, A. & Roberts, G. (2011). The impact of corporate social responsibility on the cost of bank loans. *Journal of Banking and Finance*, 35, 1794-18010.

Graham, J. R., Harvey, C. R., & Rajgopal, S. (2005). The economic implications of corporate financial reporting. *Journal of accounting and economics*, *40*(1-3), 3-73.

Hartzmark, S. M., & Sussman, A. B. (2019). Do investors value sustainability? A natural experiment examining ranking and fund flows. *The Journal of Finance*, *74*(6), 2789-2837.

Hasan, I., Hoi, C. K., Wu, Q., & Zhang, H. (2017). The direct and cross effects in a supply chain with consumers sensitive to both carbon emissions and delivery time. *Journal of Financial and Quantitative Analysis*, 52(3), 1017 – 1047.

He, L., Zhang, J., & Zhong, L. (2020). Creditor Monitoring and Corporate Social Responsibility: Evidence from Covenant Violations. (November 9, 2020). Available at SSRN: https://ssrn.com/abstract=3727652 or http://dx.doi.org/10.2139/ssrn.3727652

Hiatt, S., Grandy, J., & Lee, B. (2015). Organizational responses to public and private politics: An analysis of climate change activists and U.S. oil and gas firms. Organization Science, 26(6), 1553-1804.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, *3*(4), 305-360.

Jin, D., Liu, L., Ma, J., Wang, H. & Yin, D. (2018). How Have Green Companies Fared in Transactions with Banks? A Stakeholder-Management Perspective. *Journal of Applied Corporate Finance*, *30*(4), 89-107.

Kim, B. H., Lisic, L. L., & Pevzner, M. (2010). Debt covenant slack and real earnings management. *Available at SSRN*.

King, A. A., & Lenox, M. J. (2001). Does it really pay to be green? An empirical study of firm environmental and financial performance. *Journal of industrial ecology*, *5*(1), 105-116.

Koçak, E., & Ulucak, Z. Ş. (2019). The effect of energy R&D expenditures on CO 2 emission reduction: estimation of the STIRPAT model for OECD countries. *Environmental Science and Pollution Research*, *26*, 14328-14338.

Konar, S., & Cohen, M. A. (2001). Does the market value environmental performance?. *Review of economics and statistics*, *83*(2), 281-289.

Laine, M., Järvinen, J. T., Hyvönen, T., & Kantola, H. (2017). Ambiguity of financial environmental information: A case study of a Finnish energy company. *Accounting, Auditing & Accountability Journal*, *30*(3), 593-619.

McWilliams, A., & Siegel, D. (2000). Corporate social responsibility and financial performance: correlation or misspecification?. *Strategic management journal*, *21*(5), 603-609.

Michelon, G., Pilonato, S., & Ricceri, F. (2015). CSR reporting practices and the quality of disclosure: An empirical analysis. Critical Perspectives on Accounting, 33, 59-78.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of financial economics*, *5*(2), 147-175.

Nandy, M., & Lodh, S. (2012). Do banks value the eco-friendliness of firms in their corporate lending decision? Some empirical evidence. *International Review of Financial Analysis*, *25*, 83-93.

Nini, G., Smith, D. C., & Sufi, A. (2009). Creditor control rights and firm investment policy. *Journal of Financial Economics*, *92*(3), 400-420.

Noack, S., Bordiyanu, H., Zirkler, B., & Brauweiler, C. (2023). Sustainability Covenants as a Financial Measure to Enhance the Efficiency of Companies. *Eurasian Journal of Economic and Business Studies*, *67*(3), 104-121.

Padgett, R. C., & Galan, J. I. (2010). The effect of R&D intensity on corporate social responsibility. *Journal of Business Ethics*, *93*, 407-418.

Petrović, P., & Lobanov, M. M. (2020). The impact of R&D expenditures on CO2 emissions: evidence from sixteen OECD countries. *Journal of Cleaner Production*, *248*, 119187.

Prior, D., Surroca, J., & Tribó, J. A. (2008). Are socially responsible managers really ethical? Exploring the relationship between earnings management and corporate social responsibility. *Corporate governance: An international review*, *16*(3), 160-177.

Riedl, A., & Smeets, P. (2017). Why do investors hold socially responsible mutual funds?. *The Journal of Finance*, *72*(6), 2505-2550.

Servaes, H., & Tamayo, A. (2013). The impact of corporate social responsibility on firm value: The role of customer awareness. Management Science, 59(5), 1045-1061.

Sharfman, M. (1996). The construct validity of the Kinder, Lydenberg & Domini social performance ratings data. *Journal of Business Ethics*, 15(3), 287-296.

Shen, T. (2017). Credit spreads and investment opportunities. *Review of quantitative finance and accounting*, 48(1), 117-152.

Shi, G. & Sun, J. (2015). Corporate bond covenants and social responsibility index. *Journal of business ethics*, *131*, 285-303.

Smith Jr, C. W., & Warner, J. B. (1979). On financial contracting: An analysis of bond covenants. *Journal of financial economics*, *7*(2), 117-161.

Stanny, E., & Ely, K. (2008). Corporate environmental disclosures about the effects of climate change. *Corporate social responsibility and environmental management*, *15*(6), 338-348.

Tan, W. Tsang, A., Wang, W. & Zhang, W. (2020). Corporate Social Responsibility (CSR) Disclosure and the Choice between Bank Debt and Public Debt. *Accounting Horizons*, *34*(1), 151-173.

Wang, J., & Wang, H. (2024). Environmental regulation and corporate financial risk: The role of credit guarantees. *Finance Research Letters*, *63*, 105357.

Wickert, C., Scherer, A. G., & Spence, L. J. (2016). Walking and talking corporate social responsibility: Implications of firm size and organizational cost. Journal of Management Studies, 53(7), 1169-1196.

## TABLE 1. Direct and Indirect Corporate CO2 Emissions

The table presents the summary of the measures of corporate carbon footprint for the period between 2012 and 2022. The sample includes 1,870 (Scope 1), 1,818 (Scope 2), and 1,006 (Scope 3) firm-year observations. *CO2 emissions* indicates a firm's total Scope 1, Scope 2, or Scope 3 CO2 and CO2-equivalent emission amount in terms of tonnes. *Carbon intensity* is a firm's emission amount divided by its total revenue.

| Variables | Obs. | Mean | St. deviation | Min | Max |
|---|---|---|---|---|---|
| Scope 1 CO2 emissions: | | | | | |
| Emission amount (in tons) | 1,870 | 5,665,914 | 15,400,000 | 0 | 144,000,000 |
| Carbon Intensity (×1,000) | 1,870 | 0.455 | 1.210 | 0.000 | 26.519 |
| Scope 2 CO2 emissions: | | | | | |
| Emission amount (in tons) | 1,818 | 930,283 | 1,839,489 | 0 | 15,700,000 |
| Carbon Intensity (×1,000) | 1,818 | 0.084 | 0.227 | 0.000 | 4.240 |
| Scope 3 CO2 emissions: | | | | | |
| Emission amount (in tons) | 1,006 | 24,400,000 | 85,700,000 | 0 | 1,120,000,000 |
| Carbon Intensity (×1,000) | 1,006 | 1.734 | 6.964 | 0.000 | 133.267 |

## TABLE 2. Summary of Corporate Expenditures and Firm Characteristics

The shows the summary of corporate expenditures and firm characteristics for the period between 2012 and 2022. *Environmental expenditures* represent a firm's total amount of investment for environmental protection. *Env. Expenditure Intensity* is the environmental expenditures of a firm divided by total revenue. *R&D expenditures* is a firm's research and development expenditures. *R&D intensity* is the ratio of a firm's R&D expenditures to total revenue. *Total assets* is a firm's total assets in millions of dollars. *Quick ratio* is a firm's total current assets without inventories divided by total current liabilities. *Cash ratio* is a firm's cash and cash equivalents divided by total current liabilities. *Leverage* equals a firm's total debt divided by total assets. *Profitability (ROA)* is a firm's net income divided by total assets. *Tobin's q* is the ratio of a firm's total debt plus market capitalization to the book value of assets.

| Variables | Obs. | Mean | St. deviation | Min | Max |
|---|---|---|---|---|---|
| Env. expenditures ($ in millions) | 775 | 114 | 384 | 0 | 5,200 |
| Env. expenditures intensity | 775 | 0.008 | 0.014 | 0.000 | 0.102 |
| R&D expenditures ($ in millions) | 2,072 | 943 | 3,220 | 0 | 62,600 |
| R&D intensity | 2,072 | 0.086 | 0.080 | 0.000 | 0.434 |
| Total assets ($ in millions) | 775 | 35,201 | 66,228 | 344 | 685,328 |
| Quick ratio | 775 | 1.114 | 0.775 | 0.000 | 4.403 |
| Cash ratio | 775 | 0.465 | 0.616 | 0.000 | 3.830 |
| Leverage | 775 | 0.639 | 0.169 | 0.231 | 1.230 |
| Profitability (ROA) | 775 | 0.053 | 0.068 | -0.185 | 0.294 |
| Tobin's q | 775 | 1.733 | 0.747 | 0.847 | 4.871 |

## TABLE 3. Summary of Corporate Loan Covenants

This table presents a list of covenant restrictions found in corporate loans during the 2012–2022 period. Out sample includes a total of 1,729 contract-year observations in the intersection of the Compustat, Dealscan, and Refinitiv (i.e., firms disclosing environmental expenditures) databases. Panel A presents the frequencies of contract-year observations based on whether each type of covenant exists in at least one loan contract. Covenants are classified into either performance covenants or capital covenants. Panel B reports the frequencies of contract-year observations by the number of covenants included.

*Panel A: Covenant types*

| Types of covenant | Contract-year observations | Percentage of total |
|---|---|---|
| *1. Performance covenants:* | | |
| Maximum debt to cash flow | 513 | 29.67% |
| Minimum interest coverage ratio | 357 | 20.65% |
| Minimum debt service coverage ratio | 66 | 3.82% |
| Maximum senior debt to cash flow | 66 | 3.82% |
| Minimum fixed charge coverage ratio | 44 | 2.54% |
| Minimum cash interest coverage ratio | 17 | 0.98% |
| *2. Capital covenants:* | | |
| Maximum leverage ratio | 425 | 24.58% |
| Tangible Net worth | 42 | 2.43% |
| Net worth | 39 | 2.26% |
| Minimum current ratio | 11 | 0.64% |
| Maximum debt to equity ratio | 0 | 0% |
| Maximum loan to value ratio | 0 | 0% |
| Maximum debt to tangible net worth | 0 | 0% |

1,729 contract-year observations

*Panel B: Covenant frequencies*

| Number of covenants | Contract-year observations | Percentage of total |
|---|---|---|
| No covenant | 727 | 42.05% |
| Only one covenant | 563 | 32.56% |
| Two covenants | 317 | 18.33% |
| Three covenants | 105 | 6.07% |
| More than three covenants | 17 | 0.98% |

1,729 contract-year observations

## TABLE 4. Effect of Corporate Expenditures on Scope 3 CO2 Emissions

The table reports the coefficient estimates with the corresponding test statistics in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). Our sample includes all U.S. firms that have reported relevant information for the period between 2012 and 2022. The dependent variable is the carbon intensity of firm i, defined as a firm's total Scope 3 CO2 and CO2-equivalent emission amount in tonnes in year t divided by total revenue. For legibility, carbon intensity is multiplied by 1,000 in this analysis. *Env. expenditure intensity* (Panel A) is the environmental expenditures of firm i in year t – k divided by its total revenue. *R&D intensity* (Panel B) is the research and development (R&D) expenditures of firm i in year t – k divided by its total revenue. *ln(Size)* is the natural logarithm of firm i's total assets in year t-k. *Liquidity* is firm i's quick ratio. *Leverage* equals firm i's total debt divided by total assets in year t-k. *Profitability* is firm i's net income divided by total assets in year t-k. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year t-k. Standard errors are clustered at the industry level.

*Panel A: Effect of Environmental Expenditures*

| Model: | (1)<br>k = 0 | (2)<br>k = 1 | (3)<br>k = 2 | (4)<br>k = 3 |
|---|---|---|---|---|
| Env. expenditure intensity | -5.876 (-2.22)** | -6.757 (-1.71) | -11.639 (-3.62)*** | -4.283 (-0.51) |
| ln (Size) | -0.061 (-0.40) | -0.256 (-1.54) | -0.227 (-0.82) | -0.604 (-1.28) |
| Liquidity | 0.000 (0.00) | -0.087 (-1.51) | -0.104 (-1.81)* | -0.115 (-1.01) |
| Leverage | -0.805 (-1.56) | -0.727 (-1.42) | -1.208 (-1.68) | -1.167 (-1.52) |
| Profitability | -1.022 (-2.84)** | -1.107 (-3.75)*** | -0.828 (-1.81)* | 0.358 (0.72) |
| Tobin's q | 0.036 (1.04) | 0.022 (0.31) | -0.061 (-1.05) | -0.207 (-2.14)* |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.101 | 0.099 | 0.115 | 0.176 |
| Number of firm-years | 1,006 | 640 | 434 | 299 |

*Panel B: Effect of R&D Expenditures*

| Model: | (1)<br>k = 0 | (2)<br>k = 1 | (3)<br>k = 2 | (4)<br>k = 3 |
|---|---|---|---|---|
| R&D intensity | -0.000 (-0.21) | -0.000 (-1.49) | -0.000 (-1.41) | -.000 (-1.49) |
| ln (Size) | -0.053 (-2.48)** | -0.008 (-0.25) | 0.016 (0.36) | 0.015 (0.26) |
| Liquidity | -0.004 (-0.28) | 0.010 (0.92) | 0.003 (0.58) | -0.011 (-1.99)* |
| Leverage | -0.327 (-5.58)*** | -0.238 (-4.34)*** | -0.170 (-2.50)** | -0.249 (-2.24)** |
| Profitability | -0.105 (-1.53) | -0.004 (-0.06) | 0.000 (0.00) | 0.024 (0.53) |
| Tobin's q | 0.000 (0.09) | -0.006 (-1.22) | -0.004 (-0.63) | -0.016 (-1.90)* |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.133 | 0.136 | 0.123 | 0.140 |
| Number of firm-years | 1,040 | 822 | 646 | 501 |

## TABLE 5. Effect on Performance Covenant Stringency on Corporate Expenditures

The table reports the coefficient estimates with the corresponding test statistics in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). Our sample includes all the U.S. firms that have reported relevant information for the period between 2012 and 2022. The dependent variable is firm i's environmental expenditure intensity defined as its environmental expenditure in year t divided by total revenue (Panel A) or R&D intensity defined as its research and development expenditures in year t divided by its total revenue (Panel B). For legibility, environmental expenditure intensity and R&D intensity are both multiplied by 1,000. *Covenant index* is the Covenant Index (CI) of firm i in year t – k calculated based on performance covenants only. *ln(Size)* is the natural logarithm of firm i's total assets in year t-k. *Liquidity* is firm i's quick ratio. *Leverage* equals firm i's total debt divided by total assets in year t-k. *Profitability* is firm i's net income divided by total assets in year t-k. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year t-k. Standard errors are clustered at the industry level.

*Panel A: Effect on Environmental Expenditures*

| Model: | (1) k = 0 | (2) k = 1 | (3) k = 2 | (4) k = 3 |
|---|---|---|---|---|
| Covenant index | -3.751 (-1.69) | -3.634 (-3.12)*** | -6.561 (-3.29)*** | -4.718 (-1.29) |
| ln (Size) | -0.697 (-0.69) | -0.485 (-1.28) | 0.303 (0.47) | 1.090 (0.74) |
| Liquidity | -0.490 (-5.71)*** | 0.156 (1.22) | 0.023 (0.09) | -0.323 (-2.58)** |
| Leverage | -1.348 (-0.71) | -1.629 (-1.92)* | 1.667 (1.47) | 3.892 (2.13)* |
| Profitability | -5.246 (-2.01)* | -3.419 (-1.29) | 1.882 (0.84) | 5.835 (1.17) |
| Tobin's q | -0.786 (-2.26)** | -0.331 (-1.32) | -0.111 (-0.25) | 0.340 (0.73) |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.057 | 0.059 | 0.076 | 0.085 |
| Number of firm-years | 775 | 669 | 568 | 476 |

*Panel B: Effect of R&D Expenditures*

| Model: | (1) k = 0 | (2) k = 1 | (3) k = 2 | (4) k = 3 |
|---|---|---|---|---|
| Covenant index | -11.032 (-1.67) | -3.885 (-0.60) | -3.255 (-0.32) | -4.721 (-1.11) |
| ln (Size) | -11.161 (-2.67)** | -2.438 (-0.69) | 9.012 (2.44)** | 8.882 (3.51)*** |
| Liquidity | -0.147 (-0.19) | -0.773 (-0.47) | 2.056 (1.11) | 2.245 (2.42) |
| Leverage | -13.201 (-1.97)* | -29.108 (-2.45)** | -0.711 (-0.10) | 31.906 (1.61) |
| Profitability | -127.953 (-3.33)*** | -67.376 (-3.60)*** | -31.175 (-1.59) | 12.027 (0.44) |
| Tobin's q | -0.285 (-0.16) | -1.426 (-0.66) | 0.185 (0.11) | 0.099 (0.05) |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.143 | 0.055 | 0.035 | 0.046 |
| Number of firm-years | 2,072 | 1,740 | 1,427 | 1,148 |

## TABLE 6. Effect on Capital Covenant Stringency on Corporate Expenditures

The table reports the coefficient estimates with the corresponding test statistics in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). Our sample includes all the U.S. firms that have reported relevant information for the period between 2012 and 2022. The dependent variable is firm i's environmental expenditure intensity defined as its environmental expenditure in year t divided by total revenue (Panel A) or R&D intensity defined as its research and development expenditures in year t divided by its total revenue (Panel B). For legibility, environmental expenditure intensity and R&D intensity are both multiplied by 1,000. *Covenant index* is the Covenant Index (CI) of firm i in year t – k calculated based on capital covenants only. *ln(Size)* is the natural logarithm of firm i's total assets in year t-k. *Liquidity* is firm i's quick ratio. *Leverage* equals firm i's total debt divided by total assets in year t-k. *Profitability* is firm i's net income divided by total assets in year t-k. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year t-k. Standard errors are clustered at the industry level.

*Panel A: Effect on Environmental Expenditures*

| Model: | (1) k = 0 | (2) k = 1 | (3) k = 2 | (4) k = 3 |
|---|---|---|---|---|
| Covenant index | 1.841 (0.23) | 5.801 (0.43) | 2.848 (0.31) | -1.236 (-0.38) |
| ln (Size) | -0.697 (-0.71) | -0.491 (-1.47) | 0.182 (0.27) | 0.886 (0.64) |
| Liquidity | -0.496 (-5.50)*** | 0.191 (1.53) | 0.039 (0.14) | -0.314 (-2.43)** |
| Leverage | -1.286 (-0.67) | -1.601 (-2.07)* | 1.703 (1.76) | 3.982 (2.33)** |
| Profitability | -5.525 (-2.10)* | -3.763 (-1.34) | 1.313 (0.59) | 5.852 (1.11) |
| Tobin's q | -0.704 (-2.23)** | -0.228 (-0.75) | 0.076 (0.15) | 0.443 (0.82) |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.053 | 0.057 | 0.057 | 0.074 |
| Number of firm-years | 775 | 669 | 568 | 476 |

*Panel B: Effect of R&D Expenditures*

| Model: | (1) k = 0 | (2) k = 1 | (3) k = 2 | (4) k = 3 |
|---|---|---|---|---|
| Covenant index | -3.336 (-0.47) | 17.808 (1.15) | 36.612 (1.32) | 29.068 (0.82) |
| ln (Size) | -11.436 (-2.81)** | -2.550 (-0.71) | 8.812 (2.33)** | 8.572 (3.55)*** |
| Liquidity | -0.147 (-0.19) | -0.777 (-0.47) | 2.027 (1.08) | 2.223 (2.39) |
| Leverage | -12.296 (-1.71) | -29.094 (-2.43)** | -1.198 (-0.16) | 31.485 (1.59) |
| Profitability | -127.916 (-3.32)*** | -67.314 (-3.59)*** | -30.867 (-1.59) | 12.057 (0.45) |
| Tobin's q | -0.310 (-0.17) | -1.430 (-0.66) | 0.187 (0.12) | 0.122 (0.07) |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.142 | 0.055 | 0.037 | 0.047 |
| Number of firm-years | 2,072 | 1,740 | 1,427 | 1,148 |

## TABLE 7. Effect of Individual Financial Covenants on Environmental Expenditures

The table reports the coefficient estimates with the corresponding test statistics in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). Our sample includes all the U.S. firms that have reported relevant information for the period between 2012 and 2022. The dependent variable is the environmental expenditure intensity of firm i defined as its environmental expenditure in year t divided by total revenue. For legibility, environmental expenditure intensity is multiplied by 1,000. *D.Covenant* is equal to 1 if firm i has at least one loan contract that includes a given covenant in year t – k, and 0 otherwise. The loan covenants examined include: *Max. Debt to Cash Flow* (Panel A), *Min. Interest Coverage Ratio* (Panel B), and *Max. Leverage Ratio* (Panel C). *ln(Size)* is the natural logarithm of firm i's total assets in year t-k. *Liquidity* is firm i's quick ratio. *Leverage* equals firm i's total debt divided by total assets in year t-k. *Profitability* is firm i's net income divided by total assets in year t-k. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year t-k. Standard errors are clustered at the industry level.

*Panel A: Max. Debt to Cash Flow*

| Model: | (1) k = 0 | (2) k = 1 | (3) k = 2 | (4) k = 3 |
|---|---|---|---|---|
| D.Covenant | -1.448 (-1.81)* | -1.320 (-2.75)** | -1.695 (-3.26)*** | -1.361 (-1.18) |
| ln (Size) | -0.776 (-0.72) | -0.549 (-1.34) | 0.215 (0.34) | 1.052 (0.72) |
| Liquidity | -0.490 (-5.37)*** | 0.151 (0.15) | -0.001 (-0.00) | -0.341 (-2.48)** |
| Leverage | -1.474 (0.75) | -1.755 (-1.85)* | 1.538 (1.31) | 3.853 (2.11)* |
| Profitability | -5.173 (-2.03)* | -3.414 (-1.32) | 1.797 (0.85) | 5.781 (1.14) |
| Tobin's q | -0.792 (-2.27) | -0.330 (-1.31) | -0.057 (-0.13) | 0.358 (0.76) |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.061 | 0.061 | 0.070 | 0.083 |
| Number of firm-years | 775 | 669 | 568 | 476 |

*Panel B: Min. Interest Coverage Ratio*

| Model: | (1) k = 0 | (2) k = 1 | (3) k = 2 | (4) k = 3 |
|---|---|---|---|---|
| D.Covenant | -1.004 (-3.36)*** | -1.300 (-2.87)** | -2.317 (-2.71)** | -1.406 (-1.11) |
| ln (Size) | -0.648 (-0.65) | -0.428 (-1.10) | 0.369 (0.56) | 1.057 (0.72) |
| Liquidity | -0.465 (-5.18)*** | 0.188 (1.44) | 0.051 (0.20) | -0.307 (-2.53)** |
| Leverage | -1.206 (-0.66) | -1.458 (-1.81)* | 1.918 (1.78)* | 3.990 (2.25)** |
| Profitability | -5.332 (-2.01)* | -3.463 (-1.27) | 1.766 (0.77) | 5.805 (1.15) |
| Tobin's q | -0.777 (-2.38)** | -0.346 (-1.37) | -0.129 (-0.30) | 0.348 (0.76) |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.056 | 0.060 | 0.079 | 0.083 |
| Number of firm-years | 775 | 669 | 568 | 476 |

*Panel C: Max. Leverage Ratio*

| Model: | (1)<br>k = 0 | (2)<br>k = 1 | (3)<br>k = 2 | (4)<br>k = 3 |
|---|---|---|---|---|
| D.Covenant | 0.606 (0.39) | 1.369 (0.56) | 0.511 (0.31) | -0.357 (-0.54) |
| ln (Size) | -0.707 (-0.70) | -0.524 (-1.52) | 0.166 (0.26) | 0.893 (0.65) |
| Liquidity | -0.489 (-5.23)*** | -0.193 (1.67) | 0.388 (0.14) | -0.319 (-2.54)** |
| Leverage | -1.387 (-0.68) | -1.800 (-1.98) | 1.654 (1.65) | 4.005 (2.33)** |
| Profitability | -5.494 (-2.09)* | -3.672 (-1.40) | 1.380 (0.69) | 5.867 (1.12) |
| Tobin's q | -0.700 (-2.22)* | -0.223 (-0.73) | 0.071 (0.15) | 0.445 (0.82) |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.054 | 0.060 | 0.057 | 0.074 |
| Number of firm-years | 775 | 669 | 568 | 476 |

## TABLE 8. Effect of Financial Covenants - Environmentally-Sensitive Industries

The table reports the coefficient estimates with the corresponding test statistics in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). Our sample includes all the U.S. firms that are in the environmentally-sensitive industries and have reported relevant information for the period between 2012 and 2022. The dependent variable is the environmental expenditure intensity of firm i, defined as its environmental expenditure in year t divided by its total revenue. For legibility, environmental expenditure intensity is multiplied by 1,000. *Covenant index* is the Covenant Index (CI) of firm i in year t – k. The CI is calculated based on performance covenants only (Panel A) or capital covenants only (Panel B). *ln(Size)* is the natural logarithm of firm i's total assets in year t-k. *Liquidity* is firm i's quick ratio. *Leverage* equals firm i's total debt divided by total assets in year t-k. *Profitability* is firm i's net income divided by total assets in year t-k. *Tobin's q* is the ratio of firm i's total debt plus market capitalization to the book value of assets in year t-k. Standard errors are clustered at the industry level.

*Panel A: Performance covenant index*

| Model: | (1) k = 0 | (2) k = 1 | (3) k = 2 | (4) k = 3 |
|---|---|---|---|---|
| Covenant index | -4.139 (-1.58) | -4.007 (-3.02)** | -7.224 (-3.56)** | -5.295 (-1.37) |
| ln (Size) | -0.350 (-0.26) | -0.341 (-0.57) | 0.781 (0.87) | 2.069 (1.03) |
| Liquidity | -0.534 (-4.54)*** | 0.075 (0.59) | -0.038 (-0.15) | -0.230 (-6.57)*** |
| Leverage | -0.934 (-0.39) | -1.975 (-2.55)* | 0.914 (1.14) | 3.834 (2.26)* |
| Profitability | -5.050 (-1.58) | -4.579 (-1.46) | 1.153 (0.40) | 5.328 (1.02) |
| Tobin's q | -0.566 (-1.29) | -0.020 (-0.07) | 0.384 (0.70) | 0.829 (1.40) |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.059 | 0.069 | 0.096 | 0.111 |
| Number of firm-years | 670 | 584 | 499 | 419 |

*Panel B: Capital covenant index*

| Model: | (1) k = 0 | (2) k = 1 | (3) k = 2 | (4) k = 3 |
|---|---|---|---|---|
| Covenant index | 2.516 (0.26) | 5.653 (0.37) | 2.582 (0.25) | -0.504 (-0.13) |
| ln (Size) | -0.365 (-0.28) | -0.367 (-0.66) | 0.614 (0.60) | 1.786 (0.93) |
| Liquidity | -0.526 (-4.50)*** | 0.125 (1.07) | -0.001 (-0.00) | -0.217 (-4.17)*** |
| Leverage | -0.848 (-0.35) | -1.928 (-3.35)** | 0.992 (2.49)* | 3.893 (2.55)* |
| Profitability | -5.459 (-1.71) | -4.983 (-1.48) | 0.566 (0.19) | 5.363 (0.97) |
| Tobin's q | -0.452 (-1.08) | 0.096 (0.23) | 0.592 (0.89) | 0.946 (1.33) |
| Industry fixed effects | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes |
| R-squared | 0.054 | 0.066 | 0.074 | 0.097 |
| Number of firm-years | 670 | 584 | 499 | 419 |

## FIGURE 1. Firm Characteristics, Loan Covenants, and Environmental Expenditures

We classify financial covenants into two categories: performance covenants that target short-term operational performance; and capital covenants that focus on overall capital structure. Whether or not each of these covenants is included may depend on certain firm characteristics (e.g., size, liquidity, leverage), which can also directly affect a firm's environmental spending decisions.