Low-Carbon Transition Capacity: Green Revenues and Financial Constraints

Abstract

Transitioning to a low-carbon economy requires mobilizing private capital not only for green firms, but also for high-emission firms with demonstrated prospect of decarbonization. This paper posits that green revenue—the proportion of revenue from environmentally beneficial activities—serves as a credible signal of a firm's capacity for low-carbon transition. Utilizing a global panel of 13,168 firms from 2014 to 2024, we present evidence that green revenue significantly eases financial constraints, measured via investment–cash flow sensitivity. The effects are strongest for high-emission firms, indicating that capital markets especially rely on credible signals of transition capacity for the firms most exposed to transition risks. Our findings hold when considering alternative financial constraint metrics and various robustness tests, suggesting a virtuous cycle: green revenue relaxes financial frictions, which in turn enables further decarbonization investment and counters the "brown penalty." Overall, our findings indicate that demonstrating transition capacity—particularly in high-emission sectors—can effectively help firms to mobilize private capital for the climate transition.

Keywords : Green revenue; Financial constraints; Investment-cash flow sensitivity; Transition risk; Low-carbon transition

1. Introduction

The transition to a low-carbon economy requires reallocating global capital not just to inherently green sectors, but critically to high-carbon firms with demonstrated prospect of decarbonization. The Glasgow Financial Alliance for Net Zero (GFANZ, 2022) stresses financing "entities committed to transition," prioritizing firms realigning business models over those already low-carbon. The International Monetary Fund (2022) similarly calls for "transition taxonomies" to classify financial assets by emission-reduction potential over time. Such frameworks highlight that carbon-intensive industries—such as cement, steel, and heavy transport—provide essential inputs to the global economy but face high technological and cost barriers to decarbonization.

Our paper examines whether investors and lenders allocate more capital to firms with demonstrated capacity to transition to a low-carbon business model (thereafter referred to as transition capacity). Financial market participants face the core challenge of assessing transition risk—the uncertainty over carbon-intensive firms' adaptation to a low-carbon economy. When a firm's financial prospects are uncertain, capital providers demand higher risk premia or restrict access to capital. In the latter case, firms face tighter financial constraints and must rely more heavily on internal cash flow to fund investment. A standard empirical measure of this friction is investment–cash flow sensitivity (ICFS), introduced by Fazzari, Hubbard, and Petersen (1988). Greater ICFS signals reliance on internal funds due to restricted external access.

Corporate finance traditionally frames financial constraints as arising from imperfect information and agency conflicts (Stein, 2003; Almeida and Campello, 2007). The *transition capacity* of a firm critically determines its transition success but remains unobservable and elusive to investors. We posit *green revenue*—the share of total revenue from environmentally beneficial activities (Klausmann, Krueger, and Matos, 2024)—as a tangible, verifiable signal of this capacity.[1][2] In line with this view, the Carbon Disclosure Project (CDP, 2021) identifies *internal consistency*—the integration of climate transition into a firm's financial planning and business strategy—as a key marker of credible transition plans. Green revenue directly contributes to this

[1] Green revenues include, for example, activities in renewable energy, energy efficiency, pollution prevention, and sustainable water management. While this definition captures a broad range of environmental initiatives, it reflects a firm's capacity to manage environmental risks—among which climate transition is one of the most financially material.

[2] Throughout this paper, we use the term "signal" solely as a synonym for "cue" or "indication." In particular, when we state that green revenue signals a firm's transition capacity, we mean that green revenue serves as an observable cue or indication of that capacity to investors. This usage contrasts with the concept of signaling in microeconomic theory (e.g., Spence, 1973), where signals are strategically conveyed by senders to influence the beliefs or perceptions of receivers.

internal consistency by demonstrating that decarbonization is embedded in the firm's profit model. Absent perfect information, green revenue thus may serve as a signal used by financial market participants to gauge a firm's ability to transition to a low-carbon business model. Leippold and Yu (2025) show that firms engaging in green innovation are perceived by investors as better hedged against transition risk, suggesting that financial market participants indeed rely on such transition capacity cues.

To formally evaluate this signaling mechanism, we develop two central hypotheses. First, we posit that firms generating green revenue face lower financial constraints (H1), thereby testing the core proposition that a forward-looking green business model mitigates financing frictions. Second, we hypothesize that this effect is strongest among firms in high-pollution industries (H2). Green revenue is not merely an additional income source but rather a signal that the firm actively manages its transition risk. The impact of such a signal on capital providers' decisions should be particularly significant when transition risk is high.

We test these hypotheses using a global sample of 13,168 firms over the period 2014–2024. The baseline results strongly support both hypotheses. Firms reporting green revenue exhibit a statistically and economically significant reduction in investment–cash flow sensitivity (H1), indicating eased reliance on internal funds. This effect is substantially more pronounced for firms with high CO_2 emissions (H2): for these high-pollution firms, green revenue is associated with a markedly lower dependence on internal cash flows, suggesting that capital markets especially value credible transition signals from the most exposed entities. By showing that the firms facing the greatest transition risk can unlock external financing through green activities, our evidence points to a virtuous cycle: green revenue relaxes financial constraints, which in turn facilitates further investment in decarbonization. This stands in contrast to the "vicious cycle" documented in prior work, in which tighter financial constraints reinforce higher emissions (e.g., Bartram, Hou, and Kim, 2022; Xu and Kim, 2022).

Our main findings are robust to extensive robustness tests that address measurement and distributional concerns, as well as alternative mechanisms. First, our findings are robust to replacing the baseline ICFS measure with three alternative proxies for financial constraints—the SA index (Hadlock and Pierce, 2010), dividend-paying status, and the WW index (Whited and Wu, 2006)—alleviating concerns that the results reflect specification-specific artifacts. Second, quantile regression analyses reveal that the reduction in ICFS associated with green revenue is monotonically increasing and is most potent at the 90th percentile of capital expenditure. This indicates that the financing advantage is most critical for the firms investing the most, i.e., precisely firms with greatest capital needs. This pattern is even more pronounced for high-pollution firms. Third, we examine the lending channel using a two-part model of syndicated loan issuance based on DealScan data. Green revenue is positively associated with the likelihood of obtaining a loan, indicating that green firms face fewer barriers to initial credit access. However, conditional on borrowing, green firms secure smaller loan amounts. Complementary Poisson regressions show that green revenue is positively related to both the number of loan deals and the number of tranches. Taken together, these findings suggest that green firms participate more frequently in syndicated loan markets, although individual loan sizes tend to be smaller. This pattern of more active but incremental engagement in credit markets for green firms is consistent with the idea of lower capital structure adjustment costs for firms facing fewer financial constraints (Faulkender et al., 2012). Overall, the loan-level evidence corroborates our ICFS results by showing that green firms enjoy broader access to external finance.

The causal interpretation of our baseline findings may be confounded by endogeneity. Two particular threats to identification warrant consideration. First, reverse causality presents a potential challenge: the observed relationship may be driven by the possibility that firms with ex-ante weaker financial constraints self-select into green activities, rather than green activities causing a relaxation of financing frictions (Hong, Kubik, and Scheinkman, 2012). Second, omitted variable bias is a concern. Unobserved firm-level heterogeneity, such as superior managerial quality or governance standards, could jointly determine a firm's strategic decision to pursue green revenue and its capacity to secure external financing, thereby inducing a spurious correlation.

To address potential endogeneity concerns and strengthen the causal interpretation of our findings, we implement a comprehensive set of identification strategies. We begin by extending our baseline specification to include additional governance and ESG controls, thereby mitigating potential omitted variable bias arising from unobserved firm-level heterogeneity in managerial capacity, governance, or "general ESG orientation." Next, we employ an Instrumental Variables (2SLS) approach to address reverse causality and simultaneity bias. As having green revenue is an endogenous firm choice, we instrument for it using plausibly exogenous shifts in country-level environmental sentiment. We leverage answers to the Yale Program on Climate Change Communication as sources of exogenous variation to construct instrumental variables (IV). We also estimate a System Generalized Method of Moments (GMM) dynamic panel model (Blundell and Bond, 1998) to account for unobserved firm heterogeneity and dynamic endogeneity. Finally, we employ matching techniques to ensure our treated (green) and control (non-green) firms are comparable on observable characteristics. We use both Propensity Score Matching (PSM) (Rosenbaum and Rubin, 1983) and the Entropy Balancing method (Hainmueller, 2012). These methods directly address confounding factors and selection bias by creating a sample where treated and control firms exhibit no significant differences in observable characteristics. Across all these strategies—IV, System GMM, and matching—our result remains statistically and economically significant, suggesting a causal link between green revenue and reduced financial constraints.

We further investigate heterogeneity in our results across key firm characteristics—ESG performance, size, and asset tangibility—to sharpen the signaling interpretation. If green revenue credibly signals transition capacity, its effect on easing financial constraints should be strongest for firms where such a signal is most needed to overcome baseline skepticism (i.e., low ESG scores, smaller size, lower tangibility). Contrary to initial expectations, the reduction in investment–cash flow sensitivity (ICFS) is significantly stronger for firms with high ESG scores. This suggests that robust sustainability governance amplifies the credibility of green revenue, as investors view it within a coherent strategic framework—aligning with evidence that strong ESG performance lowers capital costs (e.g., El Ghoul et al., 2011). However, the pollution-moderating effect (extra benefit for high emitters going green) is most pronounced among firms with low ESG scores: for these skeptically viewed entities, green revenue serves as a pivotal signal to offset a poor sustainability reputation. The effects are also substantially stronger for larger firms, consistent with their greater investor scrutiny and capacity to scale green product development, rendering the signal both credible and effective in relaxing constraints. Finally, benefits are more pronounced for firms with high asset tangibility, echoing tangibility's general role in mitigating frictions (Almeida and Campello, 2007): in carbon-intensive heavy industries (with factories, machinery, and elevated CO_2), green revenue powerfully reassures providers about transition viability.

This study advances the literature in three ways. First, it bridges a critical gap at the intersection of environmental activities and financial constraints. While "brown" operations raise financing costs (Bolton and Kacperczyk, 2021; Chava, 2014), far less is known about whether "green" activities mitigate them—particularly through a reverse mechanism where demonstrated transition capacity eases the very frictions that constrain sustainable investment. We fill this void by showing that green revenue acts as a credible signal of transition capacity and reduces investment–cash flow sensitivity, in line with positive market reactions to credible green finance instruments (Flammer, 2021). Our global analysis embeds climate-related signals within the canonical ICFS framework (Fazzari, Hubbard, and Petersen, 1988; Almeida and Campello, 2007) and shows that such signals act as important determinants of financial constraints.

Second, our findings shift the analysis on low-carbon financing from constraint to opportunity. High emitters face a "brown penalty" via elevated capital costs due to investors' exposure to regulatory risk (e.g., Hsu, Li, and Tsou, 2023), lender credit rationing (Ivanov, Kruttli, and Watugala, 2024), and policy shocks like emission trading systems that distort investment (Aghion et al., 2024). This creates a vicious cycle, despite regulation's potential to spur innovation (Brown, Martinsson, and Thomann, 2022). We document a countervailing virtuous cycle: green revenue relaxes constraints, enabling further decarbonization investments—especially for high-pollution firms—thus transforming transition finance into a market-rewarded opportunity.

Third, we highlight the heterogeneous financial benefits of the green transition across firm characteristics. The impact of green revenue is strongest for larger firms with high asset tangibility and strong ESG scores, where governance and scale enhance signal credibility and absorb transition costs. Conversely, low-ESG or smaller firms gain disproportionately from pollution moderation, offsetting reputational skepticism; yet they remain vulnerable to policy shocks, often downsizing (Boeckx, Struyfs, and Torsin, 2025). This identifies large, tangible, well-governed high emitters as prime candidates for scalable green transitions.

The remainder of the paper is structured as follows: Section 2 covers the literature review, and development of hypotheses. Section 3 outlines the research design, including the measurement of key variables, and provides descriptive statistics. Section 4 presents the main empirical results. Section 5 includes the robustness checks. Section 6 discusses the heterogeneity analyses while Section 7 concludes the paper. Additionally, the Appendix describes the definitions of variables and provides an additional robustness check of the study.

2. Literature Review and Hypotheses Development

Under perfect capital markets, investment decisions are independent of financing choices (Modigliani and Miller, 1958). Real-world frictions— notably, information asymmetry and agency costs—drive a wedge between internal and external funds (Stein, 2003), leading firms to forgo valuable investments rather than bear the high cost of external capital, creating a preference for internal funding (Myers and Majluf, 1984). Investment–cash flow sensitivity (ICFS), formalized by Fazzari, Hubbard, and Petersen (1988), has emerged as the canonical measure of financial constraints that restrict corporate investment and growth.

In recent years, numerous studies have documented a "brown penalty" on polluters. Regulatory risks (e.g., carbon taxes), investor aversion to externalities, and transition uncertainty raise debt costs (Chava, 2014) and equity premia (Bolton and Kacperczyk, 2021; Hsu, Li, and Tsou, 2023; Chan and Wan, 2026). For high emitters, this creates a vicious cycle: elevated costs lock in dirty assets, blocking decarbonization via path-dependent R&D inertia (Aghion et al., 2016) and amplified financial constraints (Altavilla et al., 2024)—manifesting as higher ICFS which prevents the very transition that investors and regulators demand.

Green finance counters this, channeling capital via sustainable funds and instruments toward environmentally sustainable projects (Global Sustainable Investment Alliance, 2016). Socially responsible investing (SRI) assets surged 324% from 1995–2007 (Chava, 2014) and 23% post-Paris (Gallo and Park, 2025). Fueled by initiatives like Climate Action 100+ where large investors pressurize high-emission firms to decarbonize, firms with strong environmental profiles enjoy a green premium: lower debt costs (Fatica et al., 2021; Degryse et al., 2023; Chan and Liao, 2025), lower equity costs (Chan and Wan, 2026) and broader funding access (Bellucci et al., 2023).

We argue that this preferential treatment stems from a signaling mechanism. Conceptually, a firm's generation of green revenue—the share from environmentally beneficial activities— provides a credible, market-based signal of its transition capacity; this is supported by recent studies emphasizing the informational and financial implications of green business models (Klausmann, Krueger, and Matos, 2024; Bassen et al., 2023). This tangible, verifiable signal of a successful transition toward a sustainable business model reduces the information asymmetry and perceived transition risk that drive financing frictions. By lowering the cost and increasing the availability of external finance, green revenue should systematically reduce a firm's dependence on internal cash flows for investment.

H1: Firms with green revenue exhibit lower financial constraints.

Investors perceive climate risk as financially material and are integrating it into their decision-making, with a particular focus on regulatory transition risk (Krueger et al., 2020). Climate risk influences valuations through two channels. Physical risk captures direct threats to operations and assets, such as production halts or supply chain disruptions caused by extreme weather. Transition risk—central to our analysis—stems from the move to a low-carbon economy and includes regulatory tightening, technological disruption, and shifts in investor preferences. These risks are especially acute for high-pollution firms and translate into a measurable "brown premium": investors demand higher expected returns, reflected in higher borrowing costs (Chava, 2014) and higher realized equity returns for carbon-intensive firms (Hsu, Li, and Tsou, 2023).

We argue that the informational value of green revenue is shaped by a firm's exposure to transition risk. For high-pollution firms, generating green revenue is not a peripheral activity but a salient signal of a substantive strategic shift toward decarbonization. It credibly demonstrates alignment with net-zero and Paris-consistent objectives (e.g., SBTi, COP21), directly targeting the main source of their elevated financing costs. Recent evidence shows that high-emission firms that credibly commit to reducing future emissions obtain external funding on more favorable terms (Altavilla et al., 2024; Chan and Wan, 2026), indicating that markets disproportionately reward convincing transition signals from the most exposed entities. For these firms, green revenue should therefore be particularly effective in reducing information asymmetry, lowering the cost of capital across funding sources (banks, venture capital, and dedicated green investors), and, in turn, sharply diminishing reliance on internal cash flows to finance investment.

H2: The negative relationship between green revenue and financial constraints is stronger for high-pollution firms.

3. Data and Sample

3.1. Data

Firm-level data are obtained from Refinitiv (now part of the London Stock Exchange Group, LSEG). Our sample period begins in 2014, which marks the first year of consistent, global data coverage for the principal variables in our analysis: capital expenditures and operating cash flow. These variables are essential for estimating investment-cash flow sensitivity (ICFS). The final sample comprises 13,168 firms globally, spanning 71 countries from 2014 to 2024 across ten GICS sectors, as detailed in Appendix Table A1. The dataset includes detailed financial, environmental, and operational variables. For the instrumental-variable analysis, we complement this dataset with country-level climate sentiment data from the Yale Program on Climate Change Communication[3], which provides nationally representative measures of public beliefs regarding climate change. Moreover, following standard practice in corporate-finance research, all continuous variables are winsorized at the 1st and 99th percentiles to mitigate the impact of outliers, skewness, and kurtosis (e.g., Almeida and Campello, 2007; Whited and Wu, 2006). We exclude firm-year observations with implausible or inconsistent values, such as negative capital expenditures or total assets. The resulting unbalanced panel comprises 143,624 firm-year observations. All variable definitions and detailed construction formulas are reported in Appendix A2.

3.2.Measurement of Variables

3.2.1. Green Revenue

Our main independent variable, Green Revenue, measures the proportion of a firm's total revenue derived from environmentally sustainable activities. The data are sourced from Refinitiv, which classifies green revenue according to the *Refinitiv Environmental Product and Services Taxonomy*, aligned with the EU Green Taxonomy and the Climate Bonds Initiative framework. In the full descriptive sample, approximately 24% of firm-year observations report positive green revenue. The highest representation occurs in the United States, China, and Japan, with industrial and materials sectors exhibiting the largest green revenue shares, while communication services and healthcare show the lowest. This sectoral pattern—where green revenue is most prevalent among high-emission industries—supports our theoretical premise that transition efforts within carbon-intensive sectors play a disproportionate role in reducing financial frictions.

3.2.2. Financial Constraints

Our primary measure of financial constraints is Investment–Cash Flow Sensitivity (ICFS), which captures the extent to which corporate investment depends on internal liquidity.

[3] https://climatecommunication.yale.edu/visualizations-data/global-factsheets/

Following Fazzari, Hubbard, and Petersen (1988), high ICFS implies that firms rely more heavily on internal cash flows, reflecting limited access to external capital. Although the measure has faced conceptual critiques (Kaplan and Zingales, 1997; Cleary, 1999), subsequent studies—such as Almeida and Campello (2007), and Moyen (2004)—have demonstrated its empirical robustness and interpretability in distinguishing financially constrained firms. Consistent with this literature, ICFS remains the canonical empirical proxy for financing frictions and has been extensively employed in both firm-level and macro-finance contexts (e.g., Fazzari, Hubbard, & Petersen, 1988).

To validate the robustness of our findings, we complement ICFS with two widely used model-based indices of financial constraints: the Size–Age (SA) index of Hadlock and Pierce (2010) and the Whited–Wu (WW) index of Whited and Wu (2006). The SA index infers financial constraints based on firm size and age, whereas the WW index incorporates a broader set of firm characteristics, including cash flow, leverage, dividend payout, and sales growth. In addition, we employ a binary indicator equal to one if a firm pays dividends and zero otherwise, following the literature that interprets dividend-paying status as evidence of lower financing frictions. Employing these alternative measures ensures that our results are not driven by the functional form of ICFS and remain consistent across multiple, theoretically grounded specifications of financial constraints.

3.2.3. Control Variables

We include a comprehensive set of control variables that the literature identifies as influencing corporate investment behavior and financial constraints. Following standard ICFS specifications (Fazzari, Hubbard, and Petersen, 1988; Almeida and Campello, 2007; Whited and Wu, 2006), we control for firm characteristics that capture financial structure, profitability, and growth opportunities. *Firm Size* is measured as the natural logarithm of total revenue, capturing scale effects in financing and investment. *Tangibility* is defined as the ratio of property, plant, and equipment (PPE) to total assets, proxying for collateral value (Almeida and Campello, 2007). *Leverage* is total debt divided by total assets, reflecting capital structure and potential debt overhang. *Dividend Payout* is dividends over total assets, capturing financial flexibility and agency considerations. *Tobin's Q*, measured as the market value of equity plus total liabilities divided by total assets, represents investment opportunities. *Cash Holdings*, defined as cash and short-term investments over total assets, capture internal liquidity. Together, these controls reflect the core determinants of investment and financial frictions in the corporate-finance literature (Cleary, 1999; Moyen, 2004; Hennessy and Whited, 2007).

Given our focus on environmental transition, we additionally include firm-level environmental characteristics. *Green CapEx* is a binary indicator equal to one if the firm reports capital expenditures directed toward environmentally sustainable projects. *CO_2 Intensity* is measured as total carbon emissions scaled by total assets and captures firm-level carbon exposure. To examine heterogeneity across pollution intensity, we construct two alternative measures of *high-pollution* status. The first defines high-polluting firms as those whose CO_2 intensity exceeds the annual cross-sectional median. The second, more stringent definition classifies firms in the top quartile of industry-year-adjusted CO_2 intensity. Specifically, we normalize firm-level CO_2 intensity by the corresponding industry-year median and rank firms within each industry-year distribution, assigning High Pollution a value of one for firms in the top quartile and zero otherwise. Our primary specification adopts the industry-year–adjusted top-quartile definition, while the annual median-based definition serves as a robustness check. *Resource Use Efficiency* reflects the firm's environmental resource efficiency score from Refinitiv and captures the effectiveness with which firms manage energy, water, and material inputs.

Finally, we include governance-related controls to account for firm-level heterogeneity in managerial quality and sustainability orientation. *Governance Pillar Score* (GPS) reflects the robustness of a firm's corporate governance structure, while the *ESG Score* summarizes overall environmental, social, and governance performance. Both variables have been shown to influence access to finance and investors' perception of risk (Krueger, Sautner, and Starks, 2020). Together, these environmental and governance variables ensure that our estimates of green revenue effects are not confounded by firm-level differences in sustainability performance or institutional quality.

3.3.Empirical Models

To test our hypotheses, we employ an augmented investment model. The core of this model is the standard investment-cash flow sensitivity (ICFS) specification, which we extend by incorporating our variables of interest.

$$I_{it} = \beta_0 + \beta_1 CF_{it} + \beta_2 Green_{Revenue_{it}} + \beta_3 Green_{Revenue} * CF_{it} + Control_{Variables} + \delta_y + \delta_c + \delta_i + \epsilon_{it} \text{\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_} (1)$$

$$I_{it} = \beta_0 + \beta_1 CF_{it} + \beta_2 High_{pollution_{it}} + \beta_3 Green_{Revenue_{it}} + \beta_4 CF * High_{pollution_{it}} + \beta_5 CF * Green_{Revenue_{it}} + \beta_6 Green_{Revenue} * High\_pollution_{it} + \beta_7 Green_{Revenue} * CF * High\_pollution_{it} + Control_{Variables} + \delta_y + \delta_c + \delta_i + \epsilon_{it} \text{\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_} (2)$$

In these models, I_{it} denotes capital expenditures of firm *i* in year *t*, scaled by beginning-of-period total assets. CF_{it} represents operating cash flow scaled by beginning-of-period total assets, and the coefficient on cash flow captures baseline investment–cash flow sensitivity (ICFS), which serves as our proxy for financing frictions. For H1, the coefficient on *Green_Revenue×CF* measures whether engagement in environmentally sustainable activities attenuates investment–cash flow sensitivity. For H2, the triple interaction *Green_Revenue×CF×High_Pollution* captures whether this moderating effect differs among firms with relatively high pollution exposure. Equation 1 includes industry (δ_i), country (δ_c), and year (δ_t) fixed effects. In Equation (2), High_Pollution, defined above as firms in the top quartile of industry-year-adjusted CO_2 intensity, captures relative pollution exposure within comparable sectoral and temporal environments. In specifications involving High_Pollution and its interaction terms, we omit the continuous CO_2 Intensity variable to avoid mechanical dependence between the moderator and its underlying component. In both equations, standard errors are clustered at the firm level, and ε_{it} represents the error term.

To ensure the robustness of our results and address potential econometric concerns, Equations (1) and (2) are estimated using a range of empirical techniques. Our primary specifications employ both pooled ordinary least squares (OLS) and fixed-effects (FE) estimators. We begin with the pooled OLS as a baseline; however, to mitigate omitted variable bias and account for unobserved heterogeneity—such as firm-specific characteristics or corporate culture—we progressively include a comprehensive set of fixed effects, encompassing industry, country, and year. Standard errors are clustered at the firm level to address potential within-firm serial correlation and heteroskedasticity.

Moreover, recognizing that the relationship between green revenue and investment may not be uniform across all firms, we employ quantile regressions. This method allows us to test whether the moderating effect of green revenue on ICFS is consistent across the entire distribution of investment, or if it is particularly potent at the upper quantiles where firms are undertaking substantial capital expenditures. However, another central identification challenge might be the potential endogeneity of green revenue. It may be correlated with unobservable time-varying factors, or firm performance may simultaneously influence both investment and green revenue strategies. To address this, we implement a two-step approach. First, we use a two-stage least squares (2SLS) estimator with external instruments to isolate the exogenous variation in green revenue. Second, we employ the system Generalized Method of Moments (GMM) estimator (Blundell & Bond, 1998), which is designed for dynamic panel data models and uses internal instruments to control for endogeneity and firm-specific effects. Finally, to mitigate concerns that our results are driven by systematic differences between firms with and without green revenue, we re-estimate our models on a matched sample using both Propensity Score Matching (PSM) and Entropy Balancing. This ensures our treatment and control groups are statistically indistinguishable based on observable characteristics, strengthening the causal interpretation of our findings.

3.4.Summary Statistics

Appendix Table A3 reports descriptive statistics for the main variables. Panel A compares firms with and without green revenue. Green firms comprise about one-quarter of firm-year observations (24.5%). Compared to non-green firms, green firms are significantly larger, older, and more levered. They also have higher ESG and governance scores, but lower Tobin's Q and cash holdings. Despite operating in more emission-intensive sectors, green firms invest more in green capital expenditure and exhibit stronger resource-use efficiency, suggesting that transition efforts are concentrated among carbon-intensive firms. Panel B replicates the comparison using green capital expenditure to define green status. Results are qualitatively similar: firms with green capex are larger, have higher ESG scores, and operate in more emission-intensive sectors. Panel C presents pairwise correlations. Capital expenditure correlates positively with cash flow and tangibility, and negatively with leverage and cash holdings—consistent with standard corporate finance relationships. The summary statistics reveal substantial heterogeneity in firms' environmental orientation and financial characteristics, motivating the multivariate analyses that follow.

4. Main Empirical Results

This section presents the empirical findings and their interpretation. We begin by establishing the presence of investment–cash flow sensitivity (ICFS) as the baseline foundation for our analysis, documenting the extent to which corporate investment depends on internally generated cash flows. This step serves as the empirical basis for testing the study's two main hypotheses. We then test Hypothesis 1 (H1), which predicts that firms with stronger green engagement—measured through green revenue and green capital expenditure—experience lower ICFS, indicating that green activities alleviate financing frictions. Next, we test Hypothesis 2 (H2), which examines whether the mitigating effect of green activities on ICFS varies across firm characteristics such as ESG performance, firm size, and asset tangibility. We also perform robustness and endogeneity analyses to ensure that the results are not driven by reverse causality or omitted variables.

4.1.Determinants of Green Status

Before delving into the detailed discussion of investment–cash flow sensitivity (ICFS) and the moderating role of green revenue, it is important to first explore the determinants of firms' green status. This preliminary analysis helps clarify which firm-level characteristics are associated with greater engagement in green activities and provides an initial understanding of the factors that drive or hinder the transition toward sustainable operations. We analyze a range of firm-specific variables—including CO_2 intensity, ESG performance, resource use efficiency, green capital expenditure (CapEx), cash flow, leverage, and firm size—to assess their relationship with firms' likelihood of being classified as green. This analysis sheds light on whether environmental performance is primarily a result of internal firm characteristics, external regulatory pressure, or financial constraints.

Appendix A4 presents the results of the logistic regression estimations, where two alternative proxies—green revenue and green capital expenditure—are used to represent the dependent variable "green status." These models include relevant financial and environmental variables as predictors to identify the characteristics that increase or reduce a firm's likelihood of being green. The results reveal several notable patterns. First, firms with higher CO_2 intensity are positively and significantly associated with green status ($\beta = 0.001$, $p < 0.01$). This finding suggests that environmentally intensive firms are more likely to engage in green activities, possibly reflecting regulatory compliance pressures or stakeholder-driven initiatives. The pressure from investors, lenders, and policymakers may encourage these firms to align their operations with sustainability standards in order to maintain legitimacy and access to finance (Chava, 2014; Degryse et al., 2023).

Second, ESG performance is positively and significantly related to green status when measured by green revenue, indicating that firms with stronger sustainability performance tend to generate more green income streams. However, the relationship becomes statistically insignificant when green CapEx is used as the proxy, implying that high ESG ratings may not necessarily translate into immediate green investments. Third, the resource use score shows mixed effects—insignificant for green revenue but positive and significant for green CapEx—suggesting that efficient resource utilization supports the implementation of green investments but does not always yield immediate green revenues. The regression also shows that green revenue and green CapEx are positively related to each other, though the coefficients are statistically insignificant. This pattern may reflect timing differences between green investment decisions and the subsequent realization of green revenue streams.

Among conventional financial variables, cash flow, cash holdings, leverage, and dividend payout are negatively related to green status, with several coefficients being statistically significant. This implies that financially constrained firms may be less capable of allocating funds to green projects, supporting earlier findings that internal finance plays a key role in enabling sustainable investments (Fazzari et al., 1988). In contrast, firm size shows a consistently positive and highly significant association with green status, indicating that larger firms are more inclined toward green activities. Larger firms are typically better equipped to absorb the costs of green transitions and face greater scrutiny from investors and regulators. Overall, these results highlight that firm-level characteristics, financial flexibility, and environmental performance jointly determine green engagement. High-emission firms appear to invest in green activities primarily due to external pressures, while financially constrained or smaller firms lag behind. These insights provide a foundation for the subsequent sections, which analyze how green revenue moderates the sensitivity of investment to cash flow and how this interaction varies across different pollution and industry contexts.

4.2. Green Revenue and ICFS

We begin by establishing the presence of investment–cash flow sensitivity (ICFS) in our global sample. Consistent with the seminal framework of Fazzari, Hubbard, and Petersen (1988) and subsequent work by Almeida and Campello (2007) and Moyen (2004), firms facing capital-market frictions exhibit a stronger dependence of investment on internal cash flows due to information asymmetry and agency problems that distort external financing costs (Stein, 2003). Column (1) of Table 1, Panel A reports the baseline specification with year, industry, and country fixed effects. The coefficient on cash flow is positive and highly statistically significant, indicating that investment increases with internal cash flow. Column (2) reports the corresponding fixed-effects specification, in which the cash-flow coefficient remains positive and economically meaningful, confirming that ICFS persists after controlling for time-invariant firm heterogeneity. These results are in line with the established literature showing that higher ICFS reflects tighter financial constraints and a greater risk of underinvestment (Whited and Wu, 2006). This baseline evidence motivates our central hypothesis that firm characteristics related to green activities may attenuate ICFS by alleviating financing frictions.

Having established the baseline ICFS relationship, we next test Hypothesis 1 (H1), which posits that firms engaged in green economic activities—captured through green revenue and green capital expenditure—exhibit lower investment–cash flow sensitivity. A firm's green revenue share serves as a credible signal of its strategic commitment to the low-carbon transition, which, in turn, can reduce information asymmetry by clearly communicating its technological trajectory and long-term orientation to external capital providers. In the post-Paris Agreement environment, where transition risk and climate-policy uncertainty have become central to capital allocation, as evidenced by a carbon premium in stock returns (Bolton and Kacperczyk, 2021; Krueger, Sautner, and Starks, 2020), investors increasingly differentiate between high- and low-carbon business models. As a result, green revenue may function as a credible indicator of lower regulatory and transition risk, potentially easing firms' financing frictions.

As defined in Appendix A2, green revenue represents the share of a firm's total revenue generated from environmentally sustainable activities, while green capital expenditure (green capex) is a binary indicator capturing environmentally oriented investment. Both measures reflect a firm's strategic intention to transition toward a low-carbon business model and its commitment to climate-risk mitigation. Panel A of Table 1 reports the main interaction results. In Columns (3) and (4), the interaction between cash flow and green revenue is negative and statistically significant, ind0icating that firms with higher green revenue exhibit weaker investment–cash flow sensitivity. Columns (5) and (6) show similar results when green capital expenditure is used as an alternative proxy. The fixed-effects estimates imply economically meaningful effects: the interaction terms indicate that the sensitivity of investment to cash flow declines by approximately 0.029 when firms report positive green revenue and by about 0.026 when firms undertake green capital expenditures.

Panel B further reinforces this interpretation by re-estimating the baseline ICFS model separately for green and non-green firms. Although ICFS remains present in both groups, its magnitude is substantially lower among green firms. A plausible explanation is that green activities mitigate information asymmetry and reduce perceived transition risk, thereby improving access to external finance. This interpretation is consistent with recent evidence that investors require lower expected returns from firms actively engaged in green innovation, as such firms are perceived to be better hedged against transition risk (Leippold and Yu, 2025). Overall, the results indicate that green revenue acts as a financially meaningful signal that reduces capital-market frictions and provide clear empirical support for H1.

The control variables enter with signs largely consistent with the investment literature. Tangibility and Tobin's Q are positively associated with capital expenditure, consistent with collateral and growth-opportunity channels (Almeida and Campello, 2007; Hayashi, 1982). Dividends, cash holdings, and firm size are negatively related to investment, reflecting competing uses of internal funds and diminishing marginal investment opportunities. Among the environmental controls, ESG scores and green revenue are positively associated with capex, while CO_2 intensity is negatively related. Overall, these patterns provide reassurance on the validity of the empirical specification.

[Insert Table 1 about here]

4.3.High CO_2 Emissions, Green Revenue, and ICFS

Having established that green revenue significantly reduces investment–cash flow sensitivity (ICFS), we next test Hypothesis 2 (H2), which examines whether this mitigating effect varies across firms with different environmental risk profiles. Specifically, we investigate whether the financial benefits of green revenue are equally pronounced for firms with high CO_2 emissions. High-emission firms face heightened transition risk due to exposure to carbon pricing, regulatory tightening, and investor scrutiny, all of which can exacerbate financing frictions. Prior evidence shows that carbon-intensive firms experience higher transition risk, lower valuations, and more restrictive financing conditions (e.g., Ilhan, Sautner & Vilkov, 2021; Bolton & Kacperczyk, 2021). These mechanisms imply that high-emission firms may be more financially constrained, raising an open question: can green revenue offset these disadvantages, or are its effects weaker among firms most exposed to transition pressures?

To examine whether the ICFS-reducing effect of green revenue varies across environmental risk profiles, we distinguish firms using the two emission-based classifications defined in Section 3.2. The first classifies firms as high-emitting if their CO_2 intensity exceeds the annual cross-sectional median, capturing absolute transition risk within each year. The second—our primary specification—identifies high-emitting firms as those in the top quartile of industry-year–adjusted CO_2 intensity, thereby isolating firms with disproportionately high emissions relative to sectoral peers. Employing both measures allows us to assess whether the moderating effect of green revenue on ICFS is robust to alternative definitions of pollution exposure.

Table 2 reports the moderating effect of high CO_2-emitting firms on the relationship between green revenue and ICFS. Models (1) and (2) capture high emission using a simple measure: firms with CO_2 intensity above the annual median. Models (3) and (4) use an industry- and year-adjusted measure of CO_2 intensity, identifying firms in the top quartile of emissions relative to their industry peers. Both OLS and fixed-effects estimators are employed to ensure robust and unbiased estimates. Given that high emissions are defined based on CO_2 intensity, we exclude this variable from the set of controls and omit industry fixed effects to avoid multicollinearity and to obtain realistic coefficient estimates.

The results in Table 2 show a consistently negative and statistically significant interaction between green revenue and high CO_2 emission firms across all specifications. This indicates that the presence of high emissions strengthens the effect of green revenue in reducing ICFS. In other words, high-emission firms that actively generate green revenue are able to signal a credible commitment to low-carbon transition, thereby attracting external financing for their investments. Compared with low-emission firms, high-emission firms appear to benefit more from such signaling, likely because their green initiatives represent a more pronounced deviation from their baseline environmental footprint, enhancing investors' perception of transition risk mitigation. The consistently negative and significant triple interaction term across all models and pollution measures strongly supports H2. This indicates that capital markets disproportionately reward high-pollution firms for generating green revenue, as it represents a particularly credible signal of transition commitment from the entities most exposed to climate transition risk.

[Insert Table 2 about here]

5. Robustness Checks and Endogeneity Tests

5.1.Robustness Check

5.1.1. Alternative Specifications of Financial Constraints

In the primary analysis, financial constraints are proxied through investment–cash flow sensitivity (ICFS), following the seminal framework of Fazzari, Hubbard, and Petersen (1988) and subsequent applications by Almeida and Campello (2007) and Moyen (2004). ICFS remains one of the most widely adopted empirical measures of financing frictions, as it captures the extent to which firms rely on internal funds for investment. However, ICFS has faced criticism—most notably by Kaplan and Zingales (1997)—who argue that the relationship between cash flow and investment may not uniquely reflect financing constraints but could instead capture differences in investment opportunities or managerial preferences.

To address these concerns and ensure the robustness of our results, we re-estimate our main specification using three widely employed firm-level proxies for financial constraints: the Whited–Wu (WW) index (Whited & Wu, 2006), the Hadlock–Pierce (SA) index (Hadlock & Pierce, 2010), and dividend-paying status. The WW and SA indices are model-based measures constructed from firm-specific characteristics available in our dataset and provide complementary perspectives on financing frictions. The SA index, based on firm size and age, reflects the notion that smaller and younger firms are typically more financially constrained (Hadlock & Pierce, 2010). In contrast, the WW index incorporates a broader set of variables—including cash flow, leverage, sales growth, and firm size—to capture dynamic aspects of financing constraints and investment behavior (Whited & Wu, 2006). As an additional proxy, we use dividend-paying status, which is widely interpreted in the corporate finance literature as an indicator of greater financial maturity and flexibility, as dividend-paying firms tend to be more profitable and less reliant on external finance.

The results reported in Table 3 further support our baseline findings. Across all alternative proxies, green revenue is systematically associated with lower financing constraints. In Columns (1) and (2), the coefficients on green revenue are negative and highly statistically significant when using the WW and SA indices, indicating that firms with higher green revenue exhibit lower levels of model-implied financial constraints. In Column (3), green revenue is positively and significantly associated with the likelihood of paying dividends. Given that dividend-paying firms are typically viewed as financially less constrained and more capable of accessing external capital markets, this result provides complementary evidence that green revenue is linked to improved financial flexibility. Collectively, these results reinforce H1: the persistent negative association between green revenue and financial constraints indicates that green revenue serves as a cue of firms' transition capacity to capital markets, thereby alleviating financing frictions.

[Insert Table 3 about here]

5.1.2. Quantile Regression

The results in Table 4 strongly support both hypotheses. For H1, the interaction between green revenue and cash flow is negative and statistically significant at the 50th, 75th, and 90th quantiles of capital expenditure, but insignificant at the 25th quantile. This indicates that green revenue's constraint-alleviating effect is not uniform; it is strongest for firms with high investment levels. The economic impact is notably larger at the upper end of the investment distribution, with ICFS reduced by 8.6% at the 90th quantile compared to 3.2% at the median. This suggests that green revenue signals are most critical for firms undertaking substantial capital projects, especially when they rely heavily on external finance.

For H2, the moderating effect of pollution intensity is concentrated in the upper tail of the investment distribution. The triple interaction between green revenue, high-pollution status, and cash flow is statistically insignificant at the 25th quantile but becomes negative and significant from the median onward, with its magnitude increasing monotonically and reaching its strongest effect at the 90th percentile. This pattern indicates that for environmentally intensive firms, green revenue significantly weakens investment–cash flow sensitivity precisely when investment intensity is high. Overall, the evidence suggests that green revenue reduces reliance on internal liquidity among high-pollution firms undertaking large capital expenditures.

[Insert Table 4 about here]

5.1.3. Green Revenue and Access to Syndicated Loan Markets

To further validate our findings and examine whether green firms differ in their access to external finance, we analyze syndicated loan activity using DealScan data. Prior research indicates that environmental characteristics can shape firms' interactions with capital markets, as investors incorporate regulatory, reputational, and transition risks into market prices (Hsu, Li, & Tsou, 2023; Ilhan, Sautner, & Vilkov, 2021). In line with our hypotheses, we test whether green engagement—measured by green revenue—is associated with improved access to syndicated loan markets. We employ a two-part model. The first stage (extensive margin) estimates the likelihood that a firm obtains at least one syndicated loan in a given year, capturing access to credit markets. The second stage (intensive margin) examines the logarithm of loan amount conditional on obtaining a loan, reflecting the scale of external borrowing. This framework distinguishes between firms' ability to access credit and the magnitude of borrowing once access is granted, consistent with prior corporate finance research (Ivashina, 2009; Bharath, Dahiya, Saunders, & Srinivasan, 2011).

Table 5 presents the results. In the extensive margin (Column 1), green revenue is positively and statistically significantly associated with the probability of obtaining a loan. This finding suggests that green firms face fewer barriers to accessing syndicated loan markets. The result is consistent with the view that credible green engagement may enhance firms' standing with financial intermediaries and strengthen lending relationships, in line with theories of dynamic reputation in banking (Petersen & Rajan, 1994). In contrast, the intensive margin (Column 2) reveals a negative and statistically significant association between green revenue and loan size. Conditional on borrowing, green firms obtain smaller loan amounts. Interpreted alongside the descriptive evidence—showing that green firms are significantly larger and more leveraged—this pattern suggests that green firms are active participants in credit markets but structure borrowing through comparatively smaller facilities rather than large, episodic debt issuance. Thus, greater loan access does not translate into reliance on large external debt positions. Taken together, the two-part model indicates that green firms are more likely to access loan markets while borrowing smaller amounts per transaction. This supports the idea that firms with lower costs of raising external capital will make more gradual adjustments to their capital structure (e.g., Bazdresch, 2013; Faulkender et al., 2012).

To further examine the robustness of these findings, Panel B reports Poisson regressions using the number of loan deals and loan tranches per firm-year as alternative measures of external financing activity[4]. Our results indicate that green revenue is positively and significantly associated with both deal frequency and tranche count. Economically, this suggests that firms with greater green engagement access syndicated loan markets more frequently and structure borrowing through a larger number of facilities. These findings complement the two-part model results by showing that green revenue is not only associated with the likelihood of obtaining credit but also with the overall intensity of firms' participation in loan markets.

[Insert Table 5 about here]

5.2.Endogeneity Tests

While our empirical findings consistently show that green revenue mitigates financial constraints—and that highly polluting firms benefit more strongly from this effect once they begin generating green revenue—potential endogeneity concerns may still threaten the validity of these results. Specifically, issues such as reverse causality (where financially unconstrained firms are more capable of investing in green projects) and omitted variable bias (e.g., unobserved managerial quality, policy shocks, or local regulatory environments) could bias the estimated relationships. To strengthen the causal interpretation of our findings, we employ several complementary econometric approaches, including extended controls, two-stage least squares (2SLS), system generalized method of moments (system GMM), propensity score matching (PSM), and entropy balancing. Together, these methods allow us to address simultaneity,

[4] Because loan counts are highly skewed and include a substantial mass of zeros, we also estimate alternative count-data specifications, including linear fixed-effects and zero-inflated negative binomial (ZINB) models. The results are qualitatively similar to those reported and do not alter our conclusions.

dynamic endogeneity, and sample selection bias, providing a more rigorous assessment of the relationship between green activities and financial constraints.

5.2.1. Extended Specification with Governance and ESG Controls

To ensure that the observed relationship between firms' green activities and investment–cash flow sensitivity (ICFS) is not confounded by omitted firm-level characteristics, we augment our baseline specification with an extended set of governance and ESG-related control variables. Omitted variable bias is a common concern in investment regressions, particularly when unobserved governance quality, sustainability orientation, or strategic ESG commitments are correlated with both firms' financial flexibility and their engagement in green activities. While our baseline model includes the governance pillar score as a broad proxy for corporate governance, this aggregated measure may not fully capture firm-level heterogeneity in governance and sustainability practices that could influence investment behavior.

Accordingly, we estimate an extended specification that incorporates a richer set of governance and ESG controls, including board size, environmental controversies, CSR/sustainability committee presence, sustainability reporting, sustainability-linked executive incentives, and alignment with SDG 13 (Climate Action). Prior research shows that firms' sustainability disclosure and environmental governance are closely related to financing conditions and climate-related risk exposure. Voluntary CSR and sustainability reporting has been shown to reduce information asymmetry and lower firms' cost of equity capital (Dhaliwal et al., 2011). Board-level environmental governance mechanisms, such as the presence of sustainability or environmental committees, are associated with more extensive and higher-quality climate and greenhouse gas disclosure (Liao, Luo, and Tang, 2015). In addition, firms' carbon exposure affects investors' risk assessments and is priced in the cross-section of stock returns (Bolton and Kacperczyk, 2021). Incorporating these governance, disclosure, and carbon-exposure controls allows us to mitigate concerns that the estimated effect of green revenue reflects unobserved sustainability reporting practices, environmental oversight structures, or underlying climate risk rather than a direct easing of financial constraints.

Table 6 presents the results of this extended specification. The coefficients on the interaction between green revenue and cash flow remain negative and statistically significant across all model variants, confirming that firms with higher green revenue exhibit lower ICFS even after controlling for governance and ESG attributes. Economically, the magnitude of the coefficient slightly increases relative to the baseline (from −0.043 to approximately −0.050), implying that a one standard deviation increase in green revenue reduces ICFS by about 5–6% of its sample mean—a nontrivial effect in the context of corporate investment sensitivity. Similarly, the results for high-pollution firms (Panel B) remain consistent, indicating that the moderating effect of green activities on financing frictions persists even under stricter control conditions. Overall, the inclusion of granular governance and ESG variables does not attenuate the significance or direction of the main coefficients. Instead, the results become slightly stronger, suggesting that the relationship between green revenue and reduced financial constraints is not merely an artifact of unobserved governance or ESG quality. This reinforces the interpretation that green activities themselves, rather than general corporate responsibility or governance strength, play a distinct role in alleviating financing frictions.

[Insert Table 6 about here]

5.2.2. Instrumental Variables (2SLS)

To address potential endogeneity concerns—particularly reverse causality and omitted variable bias—in the relationship between firms' green revenue and financial constraints, we employ a two-stage least squares (2SLS) estimation strategy. The main econometric challenge lies in the possibility that financially unconstrained firms are inherently more capable of undertaking green investments, thereby biasing the estimated effect of green revenue on investment–cash flow sensitivity (ICFS). To mitigate this, we construct exogenous instruments based on regional climate perception data, exploiting spatial variation in environmental awareness that plausibly influences firms' environmental engagement but is orthogonal to their financing conditions. This approach follows recent advances in environmental finance that leverage social and regional sentiment shocks to identify causal effects in sustainability contexts (Goldsmith-Pinkham, Sorkin, & Swift, 2020).

We draw on the *Yale Program on Climate Change Communication* to construct two climate-related instrumental variables that capture regional heterogeneity in environmental concern. The first instrument reflects the proportion of respondents within a country who agree that *"climate change will harm future generations"*, while the second measures the proportion who believe that *"climate change is happening."* These measures represent exogenous variation in public climate beliefs that are plausibly correlated with firms' propensity to generate green revenue but unlikely to directly affect firm-level financing frictions. This logic is consistent with recent evidence showing that regional environmental sentiment shapes firms' voluntary sustainability actions, and that firm characteristics like pre-existing sustainable ownership predict engagement in green activities (Klausmann, Krueger, & Matos, 2024).

To strengthen instrument relevance and incorporate heterogeneity across industries, we interact these regional perception variables with the industry–year average of green revenue (*avg_greenrev_industry_year*). This captures the exogenous component of environmental sentiment intensity that varies jointly by region and industry. Additionally, we employ a Bartik-style specification (Goldsmith-Pinkham et al., 2020), ranking regional climate perceptions into quartiles and interacting these ranks with the industry–year average of green revenue to construct instruments that exploit large-scale exogenous shifts in climate awareness (e.g., *instr_bartik_futureharm*). This design leverages the differential propensity for firms in the same industry to generate green revenue based on the level of climate concern in their country of operation.

Table 7 reports the results of the 2SLS estimations. For Hypothesis 1 (H1), the coefficient on the interaction between green revenue and cash flow remains negative and statistically significant when using continuous climate perception instruments, providing causal evidence that green revenue alleviates financial constraints. This effect weakens under the Bartik-style specification, indicating some sensitivity to the underlying source of exogenous variation but maintaining the same direction. For Hypothesis 2 (H2), the triple interaction term between green revenue, cash flow, and pollution intensity is consistently negative and statistically significant across specifications. This finding supports the interpretation that the constraint-alleviating role of green activities is amplified among high-emission firms—consistent with the notion that credible green engagement helps such firms signal lower transition risk and improve access to capital.

Diagnostic tests support the validity of the instruments. The Cragg–Donald F-statistics exceed the conventional threshold of 10 (Stock & Yogo, 2005), and the Hansen J and Sargan tests indicate instrument exogeneity (p-values > 0.05). Collectively, the 2SLS results strengthen the causal interpretation that green revenue mitigates financial constraints, particularly for firms exposed to high transition risk. In unreported robustness tests, we also implement the heteroskedasticity-based identification approach proposed by Lewbel (2012), which constructs internal instruments from model residuals when valid external instruments are scarce. The results from this approach are qualitatively similar, confirming that our findings are not driven by the choice of identification strategy.

[Insert Table 7 about here]

5.2.3. System GMM

While the 2SLS estimations provide strong causal evidence that green revenue alleviates financial constraints—particularly among high-emission firms—this approach does not explicitly account for potential dynamic endogeneity arising from the persistence of investment and financing behaviors over time. To further strengthen the causal interpretation and ensure robustness against unobserved heterogeneity and simultaneity bias, we complement the instrumental-variable approach with a dynamic panel estimation using the System Generalized Method of Moments (System GMM). The System GMM estimator (Blundell & Bond, 1998), which builds on the framework of Arellano & Bover (1995), is particularly suitable for corporate finance applications where lagged dependent variables may correlate with firm-specific effects or contemporaneous shocks, leading to endogeneity in standard fixed-effects estimations. By jointly estimating equations in first differences and levels, System GMM addresses issues of reverse causality, measurement error, and omitted variable bias, thereby yielding consistent and efficient estimates in the presence of endogenous regressors (Roodman, 2009).

We estimate the System GMM specification for both hypotheses, with results reported in Table 8[5]. Model (1), corresponding to Hypothesis 1 (H1), indicates that the coefficient on the

[5] Industry and country fixed effects are not included because the system GMM estimator eliminates time-invariant firm-level heterogeneity through first-differencing and internal instrumentation (Arellano and Bover, 1995; Blundell and Bond, 1998).

interaction between cash flow and green revenue remains negative and statistically significant, confirming that firms with greater green revenue exhibit lower investment–cash flow sensitivity. This finding corroborates the interpretation that green activities reduce financial constraints by lowering information asymmetry and improving perceived creditworthiness. Model (2), testing Hypothesis 2 (H2), includes the interaction between green revenue and CO_2 emissions intensity. Consistent with earlier findings, the results show that the mitigating impact of green revenue on financial constraints is more pronounced for highly polluting firms, supporting the argument that credible green signaling enhances the financial flexibility of transition-exposed entities.

The diagnostic tests further validate the robustness of the GMM estimations. The Arellano–Bond tests for first-order autocorrelation (AR(1)) are significant ($p < 0.01$), while the tests for second-order autocorrelation (AR(2)) are insignificant ($p = 0.255$ and 0.596), confirming that no higher-order serial correlation exists. The Hansen test of overidentifying restrictions ($p = 0.784$ and 0.752) supports instrument validity, and the difference-in-Hansen tests ($p = 0.403$ and 0.628) confirm the exogeneity of the instrument subsets. Together, these results indicate that the model specification and instruments are both statistically sound and econometrically well-behaved. Overall, the System GMM estimates reinforce the conclusions drawn from the 2SLS analysis, providing additional evidence that the observed relationship between green revenue and reduced financial constraints is not driven by endogeneity or dynamic bias. The consistency of these findings across distinct estimation frameworks underscores the robustness of our results and contributes to the growing evidence that firms' credible engagement in environmental transition activities can materially improve their access to external finance (e.g., Degryse et al. (2023).

[Insert Table 8 about here]

5.2.4. Propensity Score Matching (PSM) and Entropy Balancing

To further strengthen the robustness of our results and mitigate concerns related to sample selection and confounding bias, we complement the instrumental variable and dynamic panel estimations with Propensity Score Matching (PSM) and Entropy Balancing (EB) techniques. While 2SLS primarily addresses reverse causality and omitted variable bias, and System GMM mitigates concerns of unobserved heterogeneity and dynamic endogeneity, both methods rely on model-based identification assumptions. In contrast, PSM and EB adopt a design-based approach that directly improves the comparability between treatment and control groups, thus providing a more transparent assessment of the relationship between green revenue and financial constraints (Rosenbaum & Rubin, 1983; Hainmueller, 2012).

In the PSM procedure, we define the treatment group as firms reporting non-zero green revenue and the control group as firms without any green revenue exposure. To estimate the probability of treatment, we employ a probit model where the dependent variable is an indicator for green revenue generation (*has_greenrev*), and the explanatory variables include firm-specific characteristics that may simultaneously affect both environmental engagement and financing behavior. These covariates comprise firm size, leverage, asset tangibility, age, dividend policy, cash holdings, Tobin's Q, CO_2 intensity, ESG performance, and resource efficiency. Using the predicted propensity scores (*pscore*), we perform nearest-neighbor matching with a caliper of 0.05 and without replacement, ensuring that each treated firm is matched with its closest untreated counterpart within the common support region. The matched sample consists of 8,553 treated firms (with green revenue) and an equal number of 8,553 control firms (without green revenue), resulting in a total of 17,106 firm-year observations that are statistically comparable across observable characteristics. This balanced matching framework significantly enhances the internal validity of the analysis by reducing selection bias and isolating the causal impact of green revenue generation on firms' financial constraints.

The post-matching diagnostics confirm substantial improvement in covariate balance. Specifically, the mean bias decreases from 17.5% to 0.9%, and the median bias from 15.4% to 0.9%, while the pseudo R^2 falls from 0.047 to 0.000 and the LR χ^2 statistic becomes insignificant ($p = 0.778$). The variance ratio ($R = 1.01$) lies comfortably within the acceptable range [0.5, 2], and the bias ratio ($B = 4.1\%$) is well below the 25% threshold recommended by Caliendo and Kopeinig (2008). These diagnostics collectively confirm that the matching successfully achieves statistical comparability across observable firm characteristics.

Recognizing that PSM reduces the effective sample size and may discard informative observations, we further apply Entropy Balancing (Hainmueller, 2012), a reweighting technique that preserves all firm-year observations while ensuring exact covariate balance across the first three moments (mean, variance, and skewness). As shown in the diagnostic tables, after applying entropy balancing, the treatment and control groups exhibit nearly identical distributions across all covariates. For instance, mean differences in leverage, firm size, ESG scores, and CO_2 intensity effectively disappear, and variance ratios converge closely around unity—indicating high-quality balance without information loss.

The empirical results reported in Table 9 are highly consistent across both methodologies. Models (1) and (2), based on PSM, show a negative and statistically significant relationship between green revenue and investment–cash flow sensitivity, supporting H1. Similarly, the interaction between green revenue and pollution intensity remains negative and significant, providing strong evidence in favor of H2. Models (3) and (4), estimated using entropy balancing weights, yield qualitatively similar results: the coefficient for the main effect of green revenue remains negative and significant, while the interaction term for high-pollution firms, though negative, is statistically weaker. The convergence of findings across both methods reinforces the stability and reliability of the main results. Taken together, the PSM and entropy balancing analyses provide compelling complementary evidence that the observed effects are not artifacts of sample composition or selection bias. The results substantiate that green revenue generation causally reduces financial constraints, particularly among high-emission firms—consistent with the view that credible environmental transition strategies enhance firms' access to external capital by mitigating information asymmetry and improving stakeholder trust (Degryse et al., 2023).

[Insert Table 9 about here]

6. Heterogeneity Analysis

The preceding analyses establish that green revenue alleviates financial constraints, with the effect being particularly pronounced for high-emission firms. This section examines why this relationship arises. Our central premise is that green revenue affects investment–cash flow sensitivity by altering how investors and lenders assess firms' transition prospects and future risk. If this mechanism is correct, the impact of green revenue should vary systematically with firm characteristics that shape the credibility, visibility, and economic relevance of transition-related signals. We therefore conduct a heterogeneity analysis along three dimensions—ESG performance, firm size, and asset tangibility. This analysis is not intended to document moderation per se, but to probe the underlying mechanism linking green revenue to ICFS. Evidence that green revenue reduces ICFS more strongly in settings where transition signals are more credible, more observable, or more consequential would support a signaling-based explanation, while the absence of such patterns would weaken it.

6.1.Role of ESG

ESG performance plays an important role in shaping how capital providers interpret firms' green revenue. For firms with strong ESG governance, green revenue is more likely to be perceived as a credible and strategically embedded signal of long-term transition, reducing concerns about greenwashing and lowering financing frictions. Consistent with this view, a large literature documents that firms with superior ESG performance face lower costs of capital and fewer financial constraints (e.g., El Ghoul et al., 2011; Banerjee et al., 2020). To examine whether the effect of green revenue on ICFS depends on ESG performance, we split the sample into high- and low-ESG firms based on the median ESG score and re-estimate our main specifications within each subgroup. The results reported in Table 10 show that green revenue reduces investment–cash flow sensitivity in both subsamples, but the effect is more pronounced and statistically robust among high-ESG firms. This finding supports the signaling interpretation underlying our first hypothesis: when sustainability governance is strong, green revenue is more readily interpreted by investors and lenders as a credible indicator of transition commitment.

Importantly, a different pattern emerges when we focus on high-pollution firms, which relates directly to our second hypothesis. Among environmentally intensive firms, the reduction in ICFS associated with green revenue is stronger for low-ESG firms. This suggests that, in carbon-intensive settings, green revenue conveys information about transition urgency rather than sustainability reputation. For firms starting from a weak ESG baseline, observable green revenue may signal meaningful adjustment in response to regulatory and economic pressures, leading capital providers to reassess financing risk. Taken together, the ESG-based heterogeneity indicates that green revenue reduces financial constraints through distinct but complementary signaling channels, depending on firms' sustainability context.

[Insert Table 10 about here]

6.2.Role of Firm Size

Firm size shapes the information environment in which firms' green activities are observed and evaluated by capital providers. Large firms typically operate under greater public scrutiny, benefit from broader analyst coverage, attract institutional investors, and face more stringent disclosure requirements. As a result, information about their revenue composition—particularly the emergence of green revenue—is more visible, more frequently monitored, and more readily incorporated into financing decisions. If green revenue alleviates financial constraints by signaling credible transition prospects, its impact on investment–cash flow sensitivity should therefore be stronger among large firms, where such signals are more effectively processed. In contrast, smaller firms—especially SMEs—tend to face higher information asymmetry, limited analyst following, and weaker access to capital markets (Beck, Demirgüç-Kunt, & Maksimovic, 2008; Hadlock & Pierce, 2010). In these settings, green revenue may exist but fail to materially alter investors' or lenders' beliefs, limiting its ability to reduce reliance on internal cash flow.

To examine whether the effect of green revenue on financial constraints varies with firm size, we partition the sample into large and small firms based on the median value of firm size and re-estimate our main specifications within each subsample. Table 11 reports the results. The reduction in investment–cash flow sensitivity associated with green revenue is concentrated among large firms, while the effect is weak or insignificant among small firms. This pattern is consistent with a signaling-based mechanism: green revenue reduces ICFS when it is sufficiently visible and credible to external capital providers. Importantly, this size-based heterogeneity is particularly pronounced among high-pollution firms. Large, environmentally intensive firms that generate green revenue experience a substantially greater decline in ICFS than their smaller counterparts. This finding supports our second hypothesis by indicating that green revenue is most effective in easing financial constraints when transition signals are both economically relevant and observable. Overall, the firm-size heterogeneity reinforces the interpretation that green revenue alleviates financial constraints by shaping capital providers' beliefs about firms' transition prospects, rather than by mechanically increasing investment capacity.

[Insert Table 11 about here]

6.3.Role of Tangibility

Asset tangibility plays an important role in shaping firms' financing conditions by affecting both borrowing capacity and the credibility of investment signals. Tangible assets such as property, plant, and equipment can be pledged as collateral, reducing agency problems and information asymmetry between firms and external financiers (Almeida & Campello, 2007; Chaney, Sraer, & Thesmar, 2012). As a result, firms with higher asset tangibility typically face lower baseline financing frictions and lower investment–cash flow sensitivity. Beyond this mechanical effect, asset tangibility may also influence how capital providers interpret green revenue as a signal of transition. Firms with high tangibility are often locked into capital-intensive and carbon-intensive production structures, facing substantial sunk costs and limited flexibility in reallocating assets. For such firms, generating green revenue requires adjustments that are difficult to reverse and costly to imitate, making green revenue a more informative indicator of genuine transition intent. If green revenue alleviates financial constraints by shaping investors' beliefs about future cash flows and regulatory risk, its effect should therefore be stronger among firms with higher asset tangibility.

To examine this mechanism, we partition the sample into high- and low-tangibility firms based on the median ratio of property, plant, and equipment to total assets and re-estimate our main specifications within each subsample. Table 12 reports the results. The negative association between green revenue and investment–cash flow sensitivity is concentrated among high-tangibility firms, while the effect is weak or insignificant among low-tangibility firms. Moreover, the triple interaction with high pollution is economically meaningful only for firms with high tangibility.

These patterns are consistent with a signaling-based interpretation rather than a purely collateral-driven explanation. While high tangibility lowers financing frictions on average, the incremental reduction in ICFS associated with green revenue arises primarily when green activities signal meaningful reorientation within rigid, asset-intensive production structures—particularly in environmentally intensive sectors. For firms with low tangibility, where business models are more flexible and green activities may require less structural adjustment, green revenue appears less informative for capital providers and therefore has a weaker impact on financing constraints. Overall, the tangibility-based heterogeneity supports the view that green revenue alleviates financial constraints when it conveys credible information about firms' transition prospects, rather than simply reflecting balance-sheet strength.

[Insert Table 12 about here]

7. Conclusion and Policy Implications

This study demonstrates that green revenue—the share of total revenue from environmentally beneficial products and services—significantly reduces firms' financial constraints, as measured by investment–cash flow sensitivity (ICFS). Analyzing a global panel of 13,168 firms from 2014–2024, we find robust evidence that green revenue lowers ICFS, with an especially pronounced effect among high-pollution firms. This supports our hypotheses: green activities ease financing frictions, and financial markets especially value credible transition signals from high transition risk entities.

Our baseline analysis employs OLS estimations with fixed effects. It is extended via multiple robustness and endogeneity tests. Alternative financial constraint measures, including the Whited–Wu (WW) and Size–Age (SA) indices, yield consistent results. Quantile regressions confirm the effect strengthens at the upper tail of the investment distribution, where financing frictions are most binding. A Two-Part Model of loan issuance reveals a screening-and-reward dynamic, showing that high-emission firms reporting green revenue receive more favorable credit terms after initial screening. Moreover, endogeneity is tackled via instrumental variables, System GMM, and matching procedures. Heterogeneity tests show amplified benefits for larger firms with higher asset tangibility and stronger ESG profiles—attributes that enhance the credibility of transition signals and facilitate external financing.

Overall, our findings suggest that green revenue functions as a credible market signal of transition capacity. By embedding low-carbon activities within revenue-generating operations, firms reduce information asymmetry and perceived transition risk, improving their financing conditions. This evidence extends the logic of signaling theory to the domain of sustainable finance, indicating that financial markets interpret verifiable green revenue as a costly and credible signal of commitment to decarbonization. Importantly, even highly polluting firms—

traditionally penalized by investors—benefit from this signaling channel, transforming the "brown penalty" into a "green advantage."

These findings carry clear implications for policy and practice. Policymakers should reward credible transition efforts—rather than excluding high emitters—since measurable green revenue generation demonstrably relaxes financing frictions, aligning with GFANZ (2022) calls to finance committed transition entities over firms that are purely green already. Financial institutions should consider integrating green revenue metrics into credit assessment and risk-pricing models, as these provide forward-looking indicators of transition capacity and resilience. For corporate managers, generating verifiable green revenue not only advances environmental goals but also builds investor trust, cutting capital costs. At the same time, small and financially constrained firms remain disadvantaged in accessing transition finance, suggesting that targeted policy instruments—such as transition-linked guarantees, blended finance, and disclosure harmonization—are essential to broaden participation in the low-carbon economy.

Despite these contributions, the study is not without limitations. The analysis spans eleven years, and future research could extend this period to capture the long-term evolution of transition finance as climate policies mature. Moreover, while global in scope, future work might zoom into carbon-intensive sectors (e.g., steel, cement) or regions for granular insights. Additional studies could unpack green revenue's interplay with innovation and valuation, illuminating how transition signals drive broader financial outcomes.

References

Aghion, P., Dechezleprêtre, A., Hemous, D., Martin, R., & Van Reenen, J. (2016). Carbon taxes, path dependency, and directed technical change: Evidence from the auto industry. *Journal of Political Economy*, *124*(1), 1-51.

Aghion, P., Bergeaud, A., De Ridder, M., & Van Reenen, J. (2024). Lost in transition: Financial barriers to green growth.

Almeida, H., & Campello, M. (2007). Financial constraints, asset tangibility, and corporate investment. *The Review of Financial Studies, 20*(5), 1429–1460.

Altavilla, C., Boucinha, M., Pagano, M., & Polo, A. (2024). Climate risk, bank lending and monetary policy.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29–51.

Banerjee, R., Gupta, K., & Mudalige, P. (2020). Do environmentally sustainable practices lead to financially less constrained firms? International evidence. *International Review of Financial Analysis*, *68*, 101337.

Bartram, S. M., Hou, K., & Kim, S. (2022). Real effects of climate policy: Financial constraints and spillovers. *Journal of Financial Economics*, 143(2), 668-696.

Bassen, A., Shu, H., and Tan, W. (2023). Green revenues and stock returns: Cross-market evidence. Finance Research Letters, 52:103550.

Bazdresch, S. (2013). The role of non-convex costs in firms' investment and financial dynamics. *Journal of Economic Dynamics and Control*, *37*(5), 929-950.

Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2008). Financing patterns around the world: Are small firms different? *Journal of financial economics*, *89*(3), 467-487.

Bellucci, A., Fatica, S., Georgakaki, A., Gucciardi, G., Letout, S. and Pasimeni, F., 2023. Venture capital financing and green patenting. *Industry and Innovation*, *7*(30), 947-983.

Bharath, S. T., Dahiya, S., Saunders, A., & Srinivasan, A. (2011). Lending relationships and loan contract terms. *Review of Financial Studies, 24(4), 1141–1203.*

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*(1), 115–143.

Boeckx, J., Struyfs, K., & Torsin, W. (2025). Green pressure, lean measures: Unveiling corporate downsizing within the European Union Emissions Trading System. *Journal of Financial and Quantitative Analysis*, 1-61.

Bolton, P., & Kacperczyk, M. (2021). Do investors care about carbon risk? *Journal of Financial Economics, 142*(2), 517–549.

Breuer, Matthias. "Bartik instruments: An applied introduction." Journal of Financial Reporting 7.1 (2022): 49-67.

Brown, J. R., Martinsson, G., & Thomann, C. (2022). Can environmental policy encourage technical change? Emissions taxes and R&D investment in polluting firms. *The Review of financial studies*, *35*(10), 4518-4560.

Caliendo, M., & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys, 22*(1), 31-72.

Chan, K.J.D., & Liao, V.Y. (2025). Sustainability Commitment, Environmental Achievement, and Green Bond Premium. *Journal of Environmental Management*, 392, 126875.

Chan, K.J.D., & Wan, W.T.S. (2026). The Double-edged Sword of Corporate Net Zero Commitment on the Carbon Risk Premium. *Journal of Corporate Finance*, 97, 102920.

Chaney, T., Sraer, D., & Thesmar, D. (2012). The collateral channel: How real estate shocks affect corporate investment. *American Economic Review*, 102, 2381–2409.

Chava, S. (2014). Environmental externalities and cost of capital. *Management Science, 60*(9), 2223–2247.

Cleary, S. (1999). The relationship between firm investment and financial status. *The journal of finance*, *54*(2), 673-692.

Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *The Accounting Review*, *86*(1), 59-100.

Degryse, H., Goncharenko, R., Theunisz, C., and T. Vadasz, 2023. When Green Meets Green. *Journal of Corporate Finance* 78, 102355.

El Ghoul, S., Guedhami, O., Kwok, C.C. and Mishra, D.R., 2011. Does corporate social responsibility affect the cost of capital? *Journal of banking & finance*, 35(9), pp.2388-2406.

Fatica, S., Panzica, R., & Rancan, M. (2021). The pricing of green bonds: are financial institutions special?. *Journal of Financial Stability*, *54*, 100873.

Fazzari, S. M., Hubbard, R. G., & Petersen, B. C. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity, 1988*(1), 141–206.

Faulkender, M., Flannery, M. J., Hankins, K. W., & Smith, J. M. (2012). Cash flows and leverage adjustments. *Journal of Financial economics*, *103*(3), 632-646.

Flammer, C. (2021). Corporate green bonds. *Journal of financial economics*, *142*(2), 499-516.

Gallo, A., & Park, M. (2025). Financing green transition: The role of bank-nonbank partnerships (*SSRN Working Paper 4585722). Social Science Research Network*.

Glasgow Financial Alliance for Net Zero (2022). Glasgow financial alliance for net zero: Financial institution net-zero transition plans. https://assets.bbhub.io/company/sites/63/2022/10/Financial-Institutions-Net-zero-Transition-Plan-Executive-Summary.pdf

Global Sustainable Investment Alliance. (2016). Global sustainable investment review 2016. http://www.gsi-alliance.org/wp-content/uploads/2017/03/GSIR_Review2016.F.pdf

Goldsmith-Pinkham, P., Sorkin, I., & Swift, H. (2020). Bartik instruments: What, when, why, and how. *American Economic Review, 110*(8), 2586–2624.

Hadlock, C. J., & Pierce, J. R. (2010). New evidence on measuring financial constraints: Moving beyond the KZ index. *The Review of Financial Studies, 23*(5), 1909–1940.

Hainmueller, J. (2012). Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. *Political Analysis, 20*(1), 25–46.

Hayashi, F. (1982). Tobin's marginal q and average q: A neoclassical interpretation. *Econometrica: Journal of the Econometric Society*, 213-224.

Hennessy, C. A., & Whited, T. M. (2007). How costly is external financing? Evidence from a structural estimation. *The Journal of Finance*, *62*(4), 1705-1745.

Hong, H., Kubik, J. D., & Scheinkman, J. A. (2012). *Financial constraints on corporate goodness* (No. w18476). National Bureau of Economic Research.

Hsu, Po-Hsuan, Kai Li, and Chi-Yang Tsou, 2023, The Pollution Premium, The Journal of Finance 78, 1343–1392.

Ilhan, E., Sautner, Z., & Vilkov, G. (2021). Carbon tail risk. *Review of Financial Studies*, 34, 1540–1571.

International Monetary Fund. (2022). *Global Financial Stability Report: Navigating the High-Inflation Environment*. International Monetary Fund.

https://www.imf.org/en/publications/gfsr/issues/2022/10/04/global-financial-stability-report-october-2022-navigating-the-high-inflation-environment-523390

Ivanov, I. T., Kruttli, M. S., & Watugala, S. W. (2024). Banking on carbon: Corporate lending and cap-and-trade policy. *The Review of Financial Studies*, *37*(5), 1640-1684.

Ivashina, V. (2009). Asymmetric information effects on loan spreads. *Journal of Financial Economics, 92(2), 300–319.*

Kaplan, S. N., & Zingales, L. (1997). Do investment–cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics,* 112(1), 169–215.

Klausmann, J., Krueger, P., & Matos, P. (2024). The green transition: Evidence from corporate green revenues

Krueger, P., Z. Sautner, and L. T. Starks, 2020. The importance of Climate Risks for Institutional Investors. *Review of Financial Studies* 33 (3): 1067–1111.

Leippold, M., & Yu, T. (2025). Firm-level green innovation beyond patents. *Review of Finance*, rfaf058.

Leland, H. E., & Pyle, D. H. (1977). Informational asymmetries, financial structure, and financial intermediation. *Journal of Finance*, 32(2), 371–387.

Lewbel, A. (2012). Using heteroscedasticity to identify and estimate mismeasured and endogenous regressor models. Journal of business & economic statistics, 30(1), 67-80.

Liao, L., Luo, L., & Tang, Q. (2015). Gender diversity, board independence, environmental committee and greenhouse gas disclosure. *The British Accounting Review*, *47*(4), 409-424.

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review, 48*(3), 261–297.

Moyen, N. (2004). Investment–cash flow sensitivities: Constrained versus unconstrained firms. *Journal of Finance*, 59, 2061–2092.

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics, 13*(2), 187–221.

Opler, T., Pinkowitz, L., Stulz, R., & Williamson, R. (1999). The determinants and implications of corporate cash holdings. *Journal of financial economics*, *52*(1), 3-46.

Petersen, M. A., & Rajan, R. G. (1994). The benefits of lending relationships: Evidence from small business data. *The Journal of Finance*, *49*(1), 3-37.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9(1), 86–136.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70*(1), 41–55.

Spence, M. (1973). Job Market Signaling. *The Quarterly Journal of Economics*, 87(3), 355–374.

Stein, J. C. (2003). Agency, information and corporate investment. In G. M. Constantinides, M. Harris, & R. M. Stulz (Eds.), *Handbook of the Economics of Finance* (Vol. 1, pp. 111–165). Elsevier.

Stock, J. H., & Yogo, M. (2002). Testing for weak instruments in linear IV regression.

Whited, T. M., & Wu, G. (2006). Financial constraints risk. *The Review of Financial Studies, 19*(2), 531–559.

Xu, Q., & Kim, T. (2022). Financial constraints and corporate environmental policies. *The Review of Financial Studies, 35*(2), 576-635. https://doi.org/10.1093/rfs/hhab056

Appendix Table A1

Sample Composition by Country of Headquarters

Country of Headquarters	Freq.	Percent	Cum.
Argentina	297	0.21	0.21
Australia	3,578	2.49	2.70
Austria	319	0.22	2.92
Azerbaijan	11	0.01	2.93
Bahamas	11	0.01	2.94
Belgium	561	0.39	3.33
Bermuda	281	0.20	3.52
Brazil	1,889	1.32	4.84
Cambodia	11	0.01	4.84
Canada	3,140	2.19	7.03
Cayman Islands	164	0.11	7.15
Chile	401	0.28	7.42
China	28,377	19.76	27.18
Colombia	22	0.02	27.20
Costa Rica	11	0.01	27.21
Cyprus	44	0.03	27.24
Denmark	421	0.29	27.53
Egypt	319	0.22	27.75
Faroe Islands	11	0.01	27.76
Finland	510	0.36	28.11
France	1,666	1.16	29.27
Germany	1,957	1.36	30.64
Gibraltar	22	0.02	30.65
Greece	428	0.30	30.95
Guernsey	130	0.09	31.04
Hong Kong	3,320	2.31	33.35
India	7,037	4.90	38.25
Indonesia	1,452	1.01	39.26
Ireland	531	0.37	39.63
Isle of Man	77	0.05	39.69
Israel	1,639	1.14	40.83
Italy	910	0.63	41.46
Japan	15,279	10.64	52.10
Jersey	100	0.07	52.17
Korea; Republic (S. Korea)	7,559	5.26	57.43
Kuwait	329	0.23	57.66
Lithuania	11	0.01	57.67
Luxembourg	319	0.22	57.89
Macau	55	0.04	57.93
Malaysia	1,485	1.03	58.96
Malta	11	0.01	58.97
Mexico	583	0.41	59.38
Monaco	55	0.04	59.41
Mongolia	11	0.01	59.42
Netherlands	658	0.46	59.88
New Zealand	484	0.34	60.22
Norway	757	0.53	60.74
Pakistan	328	0.23	60.97
Panama	11	0.01	60.98
Philippines	607	0.42	61.40
Poland	527	0.37	61.77

Portugal	147	0.10	61.87
Qatar	220	0.15	62.03
Romania	132	0.09	62.12
Russia	451	0.31	62.43
Saudi Arabia	1,198	0.83	63.27
Singapore	1,445	1.01	64.27
South Africa	1,024	0.71	64.98
Spain	701	0.49	65.47
Sweden	1,646	1.15	66.62
Switzerland	1,359	0.95	67.56
Taiwan	6,689	4.66	72.22
Thailand	1,781	1.24	73.46
Turkey	1,759	1.22	74.69
Ukraine	22	0.02	74.70
United Arab Emirates	472	0.33	75.03
United Kingdom	6,147	4.28	79.31
United States of America	29,629	20.63	99.94
Uruguay	22	0.02	99.96
Vietnam	11	0.01	99.96
Virgin Islands; British	53	0.04	100.00
Total	**143,624**	**100.00**	

Appendix Table A2

Measurement of Variables and Data Sources

Variable Name	Definition	Measurement	Source
Green_Revenue	Revenue from environmentally sustainable activities	1 if grevpercent > 0%, 0 otherwise	Refinitiv
CO_2 Intensity	Emissions relative to firm size (assets-based)	CO_2 emissions / total assets	Refinitiv
Green CapEx	Indicates whether the firm allocates capital toward climate opportunities	1 if gcapex = "TRUE", 0 otherwise	Refinitiv
CapEx	Spending on long-term assets	Capex / lagged assets	Refinitiv
Cash Flow	Cash flow from operations	Cash flow / lagged assets	Refinitiv
Leverage	Proportion of firm assets financed by debt	Total liabilities / total assets	Refinitiv
Asset Tangibility	Share of physical assets in total assets	PPE (property, plant, equipment) / assets	Refinitiv
Dividend Payout	Firm's distribution of earnings to shareholders	Dividends / assets	Refinitiv
Tobin Q	Market valuation relative to asset replacement cost	(Market cap + assets - equity) / assets	Refinitiv
Cash Holdings	Share of assets held as cash or cash equivalents	Cash / assets	Refinitiv
Firm Size	Scale of firm operations, proxied by total revenue	Natural log of revenue (ln(rev + 1))	Refinitiv
Firm Age	Number of years since firm founding	Year of Observation-Founding year	Refinitiv
High_Pollution	Indicator for firms with relatively high emissions within industry-year	1 if firm is in the top quartile of CO_2 intensity within industry-year (CO_2 intensity scaled by industry-year median), 0 otherwise	Refinitiv (constructed)

Variable Name	Definition	Measurement	Source
SA_Index	Proxy for financial constraints based on firm size and age	$-0.737*size + 0.043*size^2 - 0.040*firmage$	Refinitiv (constructed)
Whited–Wu Index	Composite index for financial constraints	-0.091 × Cash Flow/Total_Assets - 0.062 × Dividend_Payer + 0.021 × Long-term Debt/Total_Assets - 0.044 × Log Assets + 0.102 × Industry Sales Growth - 0.035 × Sales Growth	Refinitiv (constructed)
Div_payer	Proxy for financial constraints based on whether the firm pays dividends	1 if Dividend Payout > 0%, 0 otherwise	Refinitiv
Governance Pillar Score	Assessment of firm's governance practices	Governance performance score	Refinitiv
ESG Score	ESG composite score	Overall ESG performance score	Refinitiv
Resource Use Score	Efficiency in managing materials, energy, and water	Refinitiv score reflecting performance on environmental resource efficiency	Refinitiv

Appendix A3. Descriptive Statistics

Panel A. Based on Green Revenue

Panel A reports descriptive statistics split by green revenue status (has_greenrev = 1 if green revenue percentage > 0; 0 otherwise). Diff reports differences in means (Green − Non-Green). p-values are from two-sample t-tests allowing for unequal variances. Variable definitions are provided in Table A2.

Variable	Non-Green Firms						Green Firms						Difference	p-value
	N	Mean	SD	P25	Median	P75	N	Mean	SD	P25	Median	P75	Diff	
CapEx	81,630	0.053	0.063	0.015	0.034	0.066	28,223	0.049	0.048	0.019	0.038	0.061	-0.004	<0.001
Cash Flow	57,443	0.075	0.139	0.033	0.082	0.140	23,009	0.079	0.080	0.039	0.075	0.118	0.004	<0.001
Dividends	65,489	0.029	0.034	0.009	0.019	0.034	24,877	0.022	0.024	0.009	0.016	0.028	-0.006	<0.001
Firm Size	88,717	6.191	1.923	5.077	6.238	7.451	29,338	7.376	1.703	6.316	7.394	8.556	1.186	<0.001
Tobin's Q	89,601	2.538	3.236	1.055	1.516	2.562	29,123	1.795	2.024	0.987	1.247	1.794	-0.742	<0.001
Tangibility	88,832	0.267	0.225	0.080	0.212	0.402	29,124	0.286	0.204	0.121	0.254	0.398	0.019	<0.001
Leverage	90,263	0.475	0.243	0.296	0.461	0.629	29,334	0.532	0.196	0.406	0.540	0.653	0.058	<0.001
Cash Holdings	90,000	0.154	0.161	0.045	0.104	0.205	29,284	0.108	0.101	0.039	0.083	0.145	-0.046	<0.001
Firm Age	89,543	54.0	224.1	14.0	22.0	37.0	29,188	73.3	257.7	18.0	29.0	62.0	19.3	<0.001
Governance	39,059	48.44	22.39	30.26	48.79	66.49	18,389	54.62	21.84	37.71	56.42	72.54	6.18	<0.001
ESG Score	39,059	42.32	19.42	26.81	41.44	56.90	18,389	51.67	18.84	38.31	53.25	66.35	9.35	<0.001
Resource Use	39,048	38.85	32.70	3.59	36.29	67.52	18,383	54.14	30.71	29.48	58.40	81.09	15.29	<0.001
Green Capex	34,824	0.031	0.172	0.000	0.000	0.000	16,954	0.055	0.228	0.000	0.000	0.000	0.025	<0.001
CO_2 Intensity	21,767	161.7	417.7	6.54	24.66	106.98	14,212	232.3	468.9	12.36	43.96	198.19	70.60	<0.001

Notes: Green firms are defined as firm-year observations with strictly positive green revenue (has_greenrev = 1). Among observations with non-missing green revenue data, 29,452 firm-year observations (24.5%) report positive green revenue.

Panel B. Based on Green Capex

Panel B reports descriptive statistics split by green capex status (gcapex_numeric = 1 if green capex > 0; 0 otherwise). Diff reports differences in means (Green − Non-Green). p-values are from two-sample t-tests allowing for unequal variances. Variable definitions are provided in Table A2.

Variable	Non-Green Firms						Green Firms						Difference	p-value
	N	Mean	SD	P25	Median	P75	N	Mean	SD	P25	Median	P75	Diff	
CapEx	48,758	0.050	0.053	0.017	0.036	0.062	1,989	0.050	0.038	0.024	0.043	0.064	-0.000	0.876
Cash Flow	43,649	0.082	0.125	0.040	0.084	0.137	1,801	0.095	0.068	0.051	0.086	0.136	0.014	<0.001
Dividends	37,938	0.029	0.032	0.010	0.020	0.034	1,860	0.026	0.027	0.010	0.020	0.033	-0.003	<0.001
Firm Size	49,955	7.379	1.800	6.307	7.500	8.623	2,001	8.165	1.490	7.072	8.202	9.397	0.785	<0.001
Tobin's Q	50,271	2.234	2.580	1.056	1.450	2.285	1,998	1.996	2.400	0.982	1.266	1.888	-0.238	<0.001
Tangibility	49,921	0.276	0.225	0.091	0.225	0.406	1,995	0.313	0.190	0.161	0.315	0.431	0.037	<0.001
Leverage	50,533	0.526	0.228	0.371	0.529	0.655	1,999	0.512	0.189	0.380	0.523	0.653	-0.014	0.009
Cash Holdings	50,399	0.125	0.137	0.038	0.083	0.159	1,995	0.099	0.087	0.040	0.083	0.127	-0.025	<0.001
Firm Age	49,878	67.9	260.6	19.0	28.0	48.0	2,002	93.2	310.4	24.0	35.0	69.0	25.4	<0.001
Governance	50,750	50.52	22.43	32.56	51.38	68.77	2,002	56.64	21.20	40.05	58.91	74.20	6.12	<0.001
ESG Score	50,750	45.52	19.65	29.96	45.61	60.71	2,002	58.55	15.51	47.23	59.55	70.78	13.03	<0.001
Resource Use	50,733	44.17	32.68	12.04	44.27	73.29	2,002	67.06	24.87	50.00	72.29	88.20	22.89	<0.001
CO_2 Intensity	32,249	184.5	431.6	7.96	30.08	132.72	1,889	286.2	589.9	13.29	48.66	249.24	101.7	<0.001

Panel C. Correlation Matrix

This table presents pairwise Pearson correlations for the primary variables used in the regressions. All continuous variables are winsorized at the 1st and 99th percentiles. Variable definitions are provided in Table A2.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(1) CapEx	1.000														
(2) Cash Flow	0.160	1.000													
(3) Leverage	-0.021	0.000	1.000												
(4) Tangibility	0.354	0.174	0.097	1.000											
(5) Dividends	0.023	0.411	-0.156	-0.025	1.000										
(6) Tobin's Q	0.126	0.102	-0.091	-0.104	0.252	1.000									
(7) Cash Holdings	-0.048	-0.195	-0.248	-0.304	0.155	0.230	1.000								
(8) Firm Size	-0.094	0.302	0.284	0.115	-0.102	-0.229	-0.309	1.000							
(9) Firm Age	-0.014	0.017	0.025	-0.010	-0.010	-0.033	-0.048	0.043	1.000						
(10) Governance	-0.018	0.131	0.096	0.045	-0.002	-0.066	-0.147	0.281	0.022	1.000					
(11) Green Revenue	-0.030	0.013	0.106	0.037	-0.089	-0.106	-0.133	0.264	0.036	0.129	1.000				
(12) CO_2 Intensity	0.095	0.038	0.005	0.336	-0.017	-0.084	-0.091	0.089	-0.023	0.008	0.078	1.000			
(13) ESG	-0.057	0.147	0.142	0.000	-0.011	-0.093	-0.184	0.423	0.091	-0.058	0.221	-0.058	1.000		
(14) Resource Efficiency	-0.045	0.175	0.144	0.041	-0.021	-0.116	-0.202	0.476	0.090	-0.055	0.217	-0.055	0.813	1.000	
(15)Green Capex	-0.001	0.022	-0.011	0.031	-0.017	-0.018	-0.036	0.084	0.019	0.052	0.060	0.053	0.127	0.134	1.0

Table A4. Logistic Regression

This table presents logistic regression estimates examining the determinants of green firm status. Columns (1)–(3) model the likelihood that a firm reports any green revenue (*Green Revenue Dummy*), while columns (4)–(5) model the likelihood that a firm undertakes green capital expenditures (*Green CapEx Dummy*). All specifications include year and country fixed effects. Industry fixed effects are also included where noted. Standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

Dependent			**has_greenrev**		**Green_Capex**
	(1)	(2)	(3)	(4)	(5)
	Logit	Logit	Logit	Logit	Logit
CO_2 Intensity	-0.000	0.001***		0.000***	0.000***
	(-1.574)	(6.292)		(3.356)	(4.492)
ESG Score	0.014***	0.014***	0.014***	0.006	0.007
	(4.478)	(5.111)	(5.446)	(1.416)	(1.644)
Resource Efficiency	-0.000	-0.001	0.000	0.007***	0.007***
	(-0.086)	(-0.460)	(0.292)	(3.163)	(3.064)
Green CapEx	0.026	0.065			
	(0.286)	(0.820)			
Green Revenue				0.099	0.127
				(1.050)	(1.502)
CapEx	1.444**	1.029	-0.093	-0.272	-0.293
	(2.120)	(1.621)	(-0.183)	(-0.237)	(-0.254)
Cash Flow	-2.440***	-3.705***	-3.197***	-0.617	-0.787
	(-5.998)	(-9.594)	(-10.029)	(-1.011)	(-1.277)
Leverage	-0.370*	0.062	-0.084	-0.925***	-0.953***
	(-1.795)	(0.336)	(-0.536)	(-3.263)	(-3.533)
Tangibility	-0.926***	-0.411**	0.238*	0.601**	0.651**
	(-4.423)	(-2.400)	(1.660)	(2.134)	(2.480)
Dividend Payout	-1.803	-2.268**	-3.365***	-1.493	-1.193
	(-1.494)	(-2.045)	(-3.456)	(-0.954)	(-0.773)
Tobin's Q	-0.025	-0.045**	-0.036**	0.030	0.024
	(-1.245)	(-2.073)	(-2.126)	(1.291)	(1.018)
Cash Holdings	-1.901***	-1.799***	-1.671***	-0.247	-0.528
	(-4.402)	(-4.714)	(-5.203)	(-0.469)	(-0.997)
Firm Size	0.322***	0.203***	0.228***	0.286***	0.275***
	(9.544)	(7.379)	(9.241)	(7.288)	(7.115)
Firm Age	0.000	0.000	0.000	-0.000	-0.000
	(1.229)	(1.348)	(1.454)	(-0.335)	(-0.406)
Governance Pillar Score	-0.002	-0.003*	-0.002	0.001	0.001

	(-1.299)	(-1.787)	(-1.219)	(0.584)	(0.387)
_cons	-4.273***	-2.036**	-2.658***	-5.741***	-5.326***
	(-4.893)	(-2.519)	(-3.684)	(-13.981)	(-15.065)
r2					
N	25439	25439	36872	20601	20601
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	No	No	Yes	No
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 1. Green Firms and Investment–Cash Flow Sensitivity

Panel A. Green Firm Status and ICFS

This table presents OLS and fixed effects (FE) regressions examining whether green firms exhibit lower investment–cash flow sensitivity (ICFS). Columns 1-2 show the baseline ICFS. Columns 3-4 examine green revenue as the green measure, and columns 5-6 examine green capex. The dependent variable is capital expenditures (CAPEX) scaled by lagged total assets. All specifications include year, industry, and country fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

		Baseline	Green_Revenue_Percentage			Green_Capex
	OLS	**FE**	**OLS**	**FE**	**OLS**	**FE**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	CapEx	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Cash Flow	0.163***	0.090***	0.176***	0.099***	0.166***	0.091***
	(20.050)	(12.225)	(18.389)	(11.023)	(19.916)	(12.272)
Green Revenue# Cash Flow			-0.043***	-0.029**		
			(-3.553)	(-2.373)		
Green CapEx# Cash Flow					-0.053***	-0.026*
					(-2.997)	(-1.938)
Green Revenue	0.002**	-0.001	0.006***	0.002	0.002**	-0.001
	(2.260)	(-0.442)	(4.450)	(1.363)	(2.237)	(-0.488)
Green CapEx	0.001	-0.000	0.001	-0.000	0.006**	0.002
	(0.442)	(-0.380)	(0.436)	(-0.353)	(2.538)	(1.301)
Dividend Payout	-0.143***	0.057***	-0.145***	0.056***	-0.143***	0.057***
	(-9.200)	(3.230)	(-9.274)	(3.186)	(-9.227)	(3.236)
Firm Size	-0.004***	0.007***	-0.004***	0.007***	-0.004***	0.007***
	(-10.017)	(5.402)	(-9.784)	(5.338)	(-9.982)	(5.434)
Tobin's Q	0.001***	0.002***	0.001***	0.002***	0.001***	0.002***
	(4.070)	(5.250)	(3.954)	(5.183)	(4.067)	(5.264)
Asset Tangibility	0.085***	0.075***	0.085***	0.075***	0.085***	0.075***
	(24.697)	(9.159)	(24.668)	(9.209)	(24.695)	(9.168)
Leverage	-0.002	0.008	-0.003	0.008	-0.002	0.008
	(-0.884)	(1.526)	(-1.206)	(1.475)	(-0.906)	(1.520)
Cash Holdings	-0.036***	-0.045***	-0.036***	-0.045***	-0.036***	-0.045***
	(-7.463)	(-6.574)	(-7.517)	(-6.554)	(-7.468)	(-6.552)
Firm Age	0.000	-0.001***	0.000	-0.001***	0.000	-0.001***
	(0.156)	(-5.130)	(0.153)	(-5.125)	(0.176)	(-5.103)
Governance Pillar Score	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-1.199)	(-0.804)	(-1.068)	(-0.764)	(-1.127)	(-0.792)
ESG Score	0.000***	-0.000	0.000***	-0.000	0.000***	-0.000
	(2.937)	(-0.028)	(2.756)	(-0.054)	(2.848)	(-0.086)

Resource Efficiency	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
	(-2.064)	(-2.029)	(-1.985)	(-2.023)	(-2.005)	(-2.007)
CO_2 Intensity	-0.000***	-0.000***	-0.000**	-0.000***	-0.000***	-0.000***
	(-2.675)	(-5.267)	(-2.551)	(-5.308)	(-2.719)	(-5.266)
_cons	0.054***	0.030*	0.052***	0.030*	0.053***	0.030*
	(4.759)	(1.944)	(4.687)	(1.931)	(4.731)	(1.902)
r2	0.315		0.316		0.315	
Within r2		0.083		0.083		0.083
N	25098	25098	25098	25098	25098	25098
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes	No	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Panel B. Split-Sample Analysis by Green Status

This panel presents split-sample OLS regressions comparing investment–cash flow sensitivity (ICFS) between green and non-green firms. Columns (1) and (2) report results for firms classified as green based on positive green revenue (*Green Revenue > 0%*) or reported green capital expenditures (*Green CapEx = 1*). Columns (3) and (4) report results for firms with zero green revenue or no green CapEx. The dependent variable is capital expenditures (CapEx) scaled by lagged total assets.All regressions include a full set of firm-level controls: Leverage, Dividend Payout, Firm Size, Asset Tangibility, Tobin's Q, Cash Holdings, Firm Age, Governance Score, ESG Score, Resource Efficiency, and Green CapEx (or Green Revenue, where not used as a split criterion), as well as year, industry, and country fixed effects. Standard errors are clustered at the firm level.

		Green_Firms		**Non_Green_Firms**
	Green_Revenue_%>0	**Green_Capex=1**	**Green_Revenue_%=0**	**Green_Capex=0**
	(1)	**(2)**	**(3)**	**(4)**
	CapEx	**CapEx**	**CapEx**	**CapEx**
Cash Flow	**0.135*****	**0.082*****	**0.174*****	**0.166*****
	(11.042)	**(4.215)**	**(17.045)**	**(19.619)**
Controls	Yes	Yes	Yes	Yes
r2	0.298	0.324	0.336	0.316
N	10947	1587	14151	23854
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 2. The Moderating Effect of High Pollution on Green Revenue and ICFS

This table presents OLS and fixed effects (FE) regressions examining how high pollution status moderates the relationship between green revenue and investment–cash flow sensitivity (ICFS). The dependent variable is capital expenditures (CAPEX) scaled by lagged total assets. Columns (1) and (2) define high-pollution firms as those with CO_2 intensity above the yearly median. Columns (3) and (4) use a stricter definition: firms in the top quartile of industry- and year-adjusted CO_2 intensity. All regressions include a full set of firm-level controls: Leverage, Dividend Payout, Firm Size, Asset Tangibility, Tobin's Q, Cash Holdings, Firm Age, Governance Score, ESG Score, Resource Efficiency, and Green CapEx, as well as year, industry, and country fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

High-pollution	**CO_2 > Yearly Median**		**Top Quartile of Industry/Year-Adjusted CO_2**	
	OLS	**FE**	**OLS**	**FE**
	(1)	**(2)**	**(3)**	**(4)**
Dependent	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Green Revenue# High Pollution# Cash Flow	**-0.087*** **	**-0.072*** **	**-0.074** **	**-0.064*** **
	(-3.552)	**(-3.204)**	**(-2.501)**	**(-2.601)**
Green Revenue #High Pollution	0.010***	0.014***	0.009***	0.011***
	(3.844)	(5.913)	(2.609)	(3.677)
Green Revenue # Cash Flow	-0.005	0.006	-0.028**	-0.013
	(-0.302)	(0.365)	(-2.077)	(-0.954)
High Pollution # Cash Flow	0.090***	0.052***	0.056***	0.050***
	(5.516)	(3.484)	(2.926)	(2.593)
Green Revenue	0.002	-0.004**	0.004***	-0.000
	(0.976)	(-2.425)	(2.978)	(-0.292)
High Pollution	-0.004**	-0.013***	-0.003	-0.013***
	(-2.122)	(-6.713)	(-1.524)	(-4.822)
Cash Flow	0.131***	0.074***	0.162***	0.086***
	(11.772)	(7.131)	(15.635)	(9.245)
Controls	Yes	Yes	Yes	Yes
r2	0.323		0.318	
Within r2		0.085		0.083
N	25098	25098	25098	25098
Year Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Robustness Check

Table 3. Alternative Measures of Financial Constraints

This table reports regressions using alternative proxies for financial constraints as dependent variables. Column (1) uses the Whited–Wu (WW) index and column (2) uses the Size–Age (SA) index. Column (3) uses a binary indicator equal to one if the firm pays dividends in a given year. Columns (1) and (2) are estimated using OLS, and column (3) is estimated using a logistic regression model. All specifications include the Green Revenue indicator and a consistent set of firm-level control variables. Controls that mechanically enter the construction of the dependent variable are excluded where applicable. The full set of controls across specifications includes Capital Expenditures, Tobin's Q, Asset Tangibility, Cash Holdings, Firm Age, Governance Score, ESG Score, Resource Efficiency Score, CO_2 Intensity, Leverage, Cash Flow, Firm Size, and Green CapEx. Year, industry, and country fixed effects are included in all models. Standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

	(1)	**(2)**	**(1)**
Dependent	**WW_Index**	**SA_Index**	**Div_payer**
Model	OLS	OLS	Logistic Regression
Green Revenue	-0.014***	-0.155***	0.284***
	(-9.663)	(-5.102)	(3.514)
Controls	Yes	Yes	Yes
r2	0.369	0.319	
N	31215	31253	29483
Year Fixed Effect	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 4. Quantile Regression Results: Green Revenue and ICFS Across the Investment Distribution

This table presents quantile regression estimates for conditional quantiles of capital expenditures (CAPEX) scaled by lagged total assets. Columns (1)–(4) examine the effect of green revenue on investment–cash flow sensitivity (ICFS) at the 25th, 50th, 75th, and 90th percentiles of the investment distribution. Columns (5)–(8) examine the triple interaction between green revenue, cash flow, and high-pollution status across the same quantiles. All regressions include a full set of firm-level controls: Leverage, Dividend Payout, Firm Size, Asset Tangibility, Tobin's Q, Cash Holdings, Firm Age, Governance Score, ESG Score, Resource Efficiency, and Green CapEx. Standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

	Green Firms and ICFS				Moderation effect of Polluted Companies			
	Q(.25)	**Q(.50)**	**Q(.75)**	**Q(.90)**	**Q(.25)**	**Q(.50)**	**Q(.75)**	**Q(.90)**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	CapEx	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Green Revenue# Cash Flow	-0.003	-0.032***	-0.068***	-0.086***	-0.009	-0.027***	-0.052***	-0.069***
	(-0.611)	(-5.897)	(-8.696)	(-5.668)	(-1.576)	(-4.375)	(-5.592)	(-4.110)
Green Revenue# High Pollution# Cash Flow					-0.011	-0.039***	-0.068***	-0.093***
					(-1.060)	(-3.195)	(-3.743)	(-2.793)
Green Revenue # High Pollution					0.003**	0.005***	0.006***	0.008**
					(2.440)	(3.087)	(2.782)	(2.022)
High Pollution # Cash Flow					0.038***	0.029***	0.057***	0.099***
					(6.360)	(4.235)	(5.558)	(5.342)
Green Revenue	0.003***	0.004***	0.006***	0.007***	0.002***	0.003***	0.005***	0.005***
	(4.136)	(6.317)	(6.250)	(3.682)	(3.188)	(4.555)	(4.023)	(2.691)
Cash Flow	0.086***	0.112***	0.159***	0.211***	0.078***	0.106***	0.148***	0.195***
	(27.264)	(31.952)	(31.476)	(21.518)	(22.732)	(27.719)	(25.581)	(18.536)
High Pollution					0.001	0.001	-0.002	-0.005**
					(0.985)	(1.464)	(-1.113)	(-1.963)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo r2	0.196	0.219	0.256	0.278	0.202	0.220	0.254	0.299
N	25983	25983	25983	25983	26597	26597	26597	26597
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 5. Green Revenue and Access to Syndicated Loan Markets

Panel A. Two Part Model

This table reports estimates from a two-part model examining the association between green revenue and firms' access to syndicated loan financing. Column (1) presents results from a logistic regression in which the dependent variable is Loan Issuance (Dummy), an indicator equal to one if the firm obtains at least one loan in a given year (extensive margin). Column (2) reports results from an OLS regression where the dependent variable is the logarithm of loan amount among firm-years with at least one loan (intensive margin). All regressions include a comprehensive set of firm-level controls: Leverage, Dividend Payout, Firm Size, Asset Tangibility, Tobin's Q, Cash Holdings, Firm Age, Governance Score, ESG Score, Resource Efficiency, Green CapEx, Cash Flow, and CO_2 Intensity. Year and industry fixed effects are included in all specifications. Standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

	Extensive Margin Logistic Regression (1) Loan Issuance (Dummy)	**Intensive Margin OLS (2) Loan Amount**
Green Revenue	0.109**	-0.222***
	(2.094)	(-3.394)
Controls	Yes	Yes
r2		0.273
N	16947	4175
Year Fixed Effect	Yes	Yes
Industry Fixed Effect	Yes	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Panel B. Green Revenue and Loan Deal Frequency

This table reports Poisson regression estimates examining the association between green revenue and firms' access to external loan financing. The dependent variable in Column (1) is the number of loan deals per firm-year (deal_count), and in Column (2) is the number of loan tranches per firm-year (tranche_count). Both models include the Green Revenue indicator and a comprehensive set of firm-level controls. Year, industry, and country fixed effects are included in all specifications. Standard errors are clustered at the firm level. Pseudo R^2 is reported for each model.

	(1)	**(2)**
Dependent	**Deal_Count**	**Tranche_Count**
Model	**Poisson**	**Poisson**
Green Revenue	0.191**	0.218**
	(2.218)	(2.162)
Controls	Yes	Yes
Pseudo r2	0.181	0.221
N	12913	12913
Year Fixed Effect	Yes	Yes
Industry Fixed Effect	Yes	Yes
Country Fixed Effect	Yes	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Endogeneity Tests

Table 6. Extended Controls: Green Firms and Investment–Cash Flow Sensitivity

Panel A. Green Firm Status and ICFS

This table presents OLS and fixed effects regressions testing whether the investment–cash flow sensitivity (ICFS) of green firms remains robust to the inclusion of sustainability controls. The dependent variable is capital expenditures (CapEx) scaled by lagged total assets. Reported coefficients are limited to the newly added variables: Board Size, Environmental Controversies, CSR Sustainability Committee, CSR Reporting, Sustainability-Incentives, and SDG13 Disclosure. All regressions include the full baseline controls (Firm Size, Cash Flow, Tobin's Q, Asset Tangibility, Cash Holdings, Leverage, Dividend Payout, Firm Age, Governance Score, ESG Score, Resource Efficiency, and CO_2 Intensity), as well as year, industry, and country fixed effects. Baseline controls are included in the models but omitted from the table for brevity. Standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

Green_Firm	**Green_Revenue_Percentage**			**Green_Capex**
	OLS	**FE**	**OLS**	**FE**
	(1)	**(2)**	**(3)**	**(4)**
Dependent	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Green Firm#Cash Flow	-0.050***	-0.034***	-0.043***	-0.021
	(-4.025)	(-2.703)	(-2.679)	(-1.616)
Green Firm	0.007***	0.002	0.004**	0.002
	(5.212)	(1.183)	(2.226)	(1.205)
Cash Flow	0.176***	0.094***	0.163***	0.084***
	(17.260)	(9.610)	(18.392)	(10.789)
Board Size	-0.000**	-0.000**	-0.000**	-0.000**
	(-2.393)	(-2.332)	(-2.389)	(-2.367)
Environmental Controversies	-0.001	0.001	-0.001	0.001
	(-0.568)	(1.508)	(-0.980)	(1.412)
CSR Sustainability Committee	0.002**	-0.002**	0.002**	-0.002**
	(2.058)	(-2.210)	(2.111)	(-2.250)
CSR Sustainability Reporting	-0.000	0.002	0.000	0.002
	(-0.021)	(1.438)	(0.029)	(1.436)
Sustainability Incentives	-0.000	0.000	-0.000	0.000
	(-0.105)	(0.131)	(-0.078)	(0.174)
SDG13	-0.001	-0.000	-0.000	-0.000
	(-0.632)	(-0.006)	(-0.559)	(-0.012)
Controls	Yes	Yes	Yes	Yes
r2	0.326		0.324	
Within r2		0.082		0.081
N	20627	20627	20627	20627
Year Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Panel B. Split-Sample Analysis by Green Status

This panel presents split-sample OLS regressions comparing investment–cash flow sensitivity (ICFS) between green and non-green firms. Columns (1) and (2) report results for firms classified as green based on positive green revenue (>0%) or reported green capital expenditures (Green CapEx = 1). Columns (3) and (4) report results for firms with zero green revenue or no green CapEx. The dependent variable is capital expenditures (CapEx) scaled by lagged total assets. Reported coefficients are limited to the newly added variables: Board Size, Environmental Controversies, CSR Sustainability Committee, CSR Reporting, Sustainability-Incentives, and SDG13 Disclosure. All regressions include the full baseline controls (Firm Size, Cash Flow, Tobin's Q, Asset Tangibility, Cash Holdings, Leverage, Dividend Payout, Firm Age, Governance Score, ESG Score, Resource Efficiency, and CO_2 Intensity), as well as year, industry, and country fixed effects. Baseline controls are included in the models but omitted from the table for brevity. Standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

		Green_Firms		Non_Green_Firms
	Green_Revenue_%>0	**Green_Capex=1**	**Green_Revenue_%=0**	**Green_Capex=0**
	(1)	**(2)**	**(3)**	**(4)**
Dependent	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Cash Flow	0.125***	0.089***	0.174***	0.162***
	(10.004)	(4.693)	(15.994)	(18.039)
Board Size	-0.000*	-0.001**	-0.000	-0.000**
	(-1.649)	(-2.287)	(-1.539)	(-2.095)
Environmental Controversies	0.002	0.005	-0.005**	-0.002
	(1.147)	(1.411)	(-2.033)	(-1.145)
CSR Sustainability Committee	0.003**	0.006	0.002	0.002**
	(2.054)	(1.533)	(1.003)	(2.041)
CSR Sustainability Reporting	0.002	-0.003	-0.001	0.000
	(0.652)	(-0.374)	(-0.293)	(0.227)
Sustainability Incentives	-0.000	0.002	0.000	-0.000
	(-0.492)	(0.969)	(0.117)	(-0.306)
SDG13	-0.002*	0.001	0.001	-0.001
	(-1.798)	(0.303)	(0.578)	(-0.655)
Controls	Yes	Yes	Yes	Yes
r2	0.310	0.341	0.345	0.325
N	9137	1541	11490	19238
Year Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 7. Instrumental Variables (2SLS)

This table presents two-stage least squares (2SLS) estimates addressing endogeneity in the relationship between green revenue and investment–cash flow sensitivity (ICFS). Columns (1)–(4) instrument green revenue using survey-based beliefs about whether climate change will harm future generations, while columns (5)–(8) use beliefs that climate change is happening. Bartik-style shift-share instruments are applied in columns (3)–(4) and (7)–(8). Even-numbered columns introduce a triple interaction with high-pollution exposure. The dependent variable is capital expenditure (CapEx) scaled by lagged total assets. All models include the full set of firm-level controls (Firm Size, Cash Flow, Tobin's Q, Asset Tangibility, Cash Holdings, Leverage, Dividend Payout, Firm Age, Governance Score, ESG Score, Resource Efficiency, and Green CapEx), as well as year and regional fixed effects. Robust standard errors are clustered at the firm level. Variable definitions and instrument construction details are provided in Appendix A2.

	Climate Change will Harm Future Generations				**Climate Change(CC) is Happening**			
Approaches of IV	**Future_ Harm**	**Future_ Harm & Pollution**	**Bartik Future_ Harm**	**Bartik Future_ Harm & Pollution**	**CC_Happen**	**CC_Happen × Pollution**	**Bartik _CC _Happen**	**Bartik _CC_ Happen& Pollution**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Dependent	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Model	**2SLS_IV**	**2SLS_IV**	**2SLS_IV**	**2SLS_IV**	**2SLS_IV**	**2SLS_IV**	**2SLS_IV**	**2SLS_IV**
Green Revenue# Cash Flow	-0.077*	-0.029	-0.061	-0.022	-0.092**	-0.045	-0.077	-0.036
	(-1.839)	(-0.656)	(-1.238)	(-0.407)	(-2.258)	(-1.041)	(-1.474)	(-0.674)
Green Revenue# High Pollution# Cash Flow		-0.233**		-0.213*		-0.231**		-0.263*
		(-2.222)		(-1.674)		(-2.308)		(-1.742)
Green Revenue# High Pollution		0.010		0.016		0.010		0.018
		(1.045)		(1.319)		(1.134)		(1.475)
High Pollution		0.001		-0.003		0.002		-0.002
		(0.217)		(-0.569)		(0.369)		(-0.448)
High Pollution#Cash Flow		0.088**		0.089**		0.087**		0.101**
		(2.407)		(2.108)		(2.437)		(2.125)
Green Revenue	0.000	-0.001	-0.001	-0.003	0.002	0.001	0.001	-0.001
	(0.110)	(-0.248)	(-0.183)	(-0.685)	(0.453)	(0.245)	(0.115)	(-0.139)
Cash Flow	0.196***	0.178***	0.191***	0.174***	0.201***	0.184***	0.196***	0.180***
	(11.917)	(10.155)	(10.486)	(8.917)	(12.299)	(10.583)	(10.327)	(9.096)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2	0.284	0.274	0.286	0.282	0.283	0.274	0.284	0.277
N	22330	22330	22330	22330	22330	22330	22330	22330
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Instrument Weakness								
Cragg-Donald F-test	727.834	297.664	534.288	232.408	755.739	269.341	503.475	141.342
Instrument Endogeneity								
Hansen J/Sargan	0.766	0.751	3.586	3.466	1.176	0.617	3.365	2.876
	(p=0.3814)	(p=0.3860)	(p=0.0583)	(p=0.0626)	(p=0.2782)	(p=0.4322)	(p=0.0666)	(p=0.0899)
Exclusion Restriction								
C statistic	0.766	0.751	3.586	3.466	1.176	0.617	3.365	2.876
	(p=0.3814)	(p=0.3860)	(p=0.0583)	(p=0.0626)	(p=0.2782)	(p=0.4322)	(p=0.0666)	(p=0.0899)

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 8. System GMM

This table presents System Generalized Method of Moments (GMM) estimates to account for dynamic endogeneity and firm-specific unobserved heterogeneity. The dependent variable is capital expenditures (CAPEX) scaled by lagged total assets. Column (1) includes the interaction between green revenue and cash flow (*has_greenrev_cff*). Column (2) adds the triple interaction between green revenue, cash flow, and high-pollution status (*triple_green_hi_poll_yr*) and the interaction between green revenue and high-pollution status (*has_greenrev_high_pollution*). All models include the full set of firm-level controls (Firm Size, Cash Flow, Tobin's Q, Asset Tangibility, Cash Holdings, Leverage, Dividend Payout, Firm Age, Governance Score, ESG Score, Resource Efficiency, and Green CapEx), as well as year fixed effects. The Arellano-Bond test for AR(2) and Hansen overidentification test support the validity of the instruments (reported separately). Robust standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

Dependent **Model**	**(1)** **CapEx** **System GMM**	**(2)** **CapEx** **System Gmm**
Green Revenue# Cash Flow	-0.072*	0.043
	(-1.924)	(0.742)
Green Revenue# High Pollution# Cash Flow		-0.258*
		(-1.815)
Green Revenue# High Pollution		0.028**
		(1.964)
High Pollution# Cash Flow		0.126***
		(2.794)
High Pollution		-0.012**
		(-2.324)
Cash Flow	0.085***	0.021
	(6.369)	(0.772)
Green Revenue	0.011***	-0.001
	(2.895)	(-0.239)
Controls	Yes	Yes
N	29837	29837
AR1 (P-Value)	0.000	0.000
AR2 (P-Value)	0.255	0.596
Hansen test (P-Value)	0.784	0.752
Diff-in-Hansen test (P-Value)	0.403	0.628
Year Fixed Effect	Yes	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 9. Matching Estimates: Propensity Score Matching (PSM) and Entropy Balancing

This table presents estimates from matching methods designed to address selection bias and improve covariate balance between green and non-green firms. Columns (1) and (2) report results using Propensity Score Matching (PSM), while columns (3) and (4) report results using Entropy Balancing. The dependent variable is capital expenditures (CAPEX) scaled by lagged total assets. Even-numbered columns include the triple interaction between green revenue, cash flow, and high-pollution status. All regressions include firm-level controls: CO_2 Intensity, ESG Score, Resource Efficiency, CapEx, Cash Flow, Leverage, Asset Tangibility, Dividend Payout, Tobin's Q, Cash Holdings, Firm Size, Firm Age, and Governance Score, as well as fixed effects. Variable definitions are provided in Appendix A2.

Model		**PSM**		**Entropy Balancing**
	(1)	**(2)**	**(3)**	**(4)**
Dependent	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Green Revenue# Cash Flow	**-0.032****	**-0.015**	**-0.053*****	**-0.043*****
	(-2.125)	**(-0.968)**	**(-4.473)**	**(-3.362)**
Green Revenue#High Pollution#Cash Flow		**-0.078***		**-0.049***
		(-1.944)		**(-1.703)**
High Pollution#Cash Flow		0.045		0.032*
		(1.618)		(1.745)
Green Revenue#High Pollution		0.010**		0.008**
		(2.151)		(2.413)
High Pollution		-0.001		0.001
		(-0.234)		(0.411)
Cash Flow	0.168***	0.157***	0.183***	0.173***
	(13.421)	(12.388)	(19.787)	(17.439)
Green Revenue	0.005***	0.003*	0.007***	0.006***
	(3.221)	(1.808)	(5.838)	(4.265)
Controls	Yes	Yes	Yes	Yes
r2	0.304	0.306	0.323	0.327
N	13200	13200	25098	25098
Year Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Heterogenous Effect

Table 10. Role of ESG

This table presents OLS and fixed effects (FE) regressions examining how the relationship between green revenue and investment–cash flow sensitivity (ICFS) varies by ESG performance. Columns (1)–(4) present results for high-ESG firms (above median ESG score), while columns (5)–(8) present results for low-ESG firms (below median). The dependent variable is capital expenditures (CAPEX) scaled by lagged total assets. Even-numbered columns include the triple interaction between green revenue, cash flow, and high-pollution status. All specifications include the full set of control variables, year fixed effects, industry fixed effects, and country fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

				High_ESG				Low_ESG
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Model	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**
Green Revenue# Cash Flow	**-0.046*** **	**-0.033** **	**-0.035** **	**-0.020**	**-0.045* **	**-0.040**	**-0.018**	**-0.013**
	(-3.517)	**(-2.505)**	**(-2.426)**	**(-1.413)**	**(-1.739)**	**(-1.271)**	**(-0.657)**	**(-0.339)**
Green Revenue#High Pollution#Cash Flow			**-0.056* **	**-0.051* **			**-0.120* **	**-0.114* **
			(-1.732)	**(-1.911)**			**(-1.919)**	**(-1.905)**
High Pollution#Cash Flow			0.054**	0.049**			0.064**	0.076
			(2.357)	(2.300)			(1.980)	(1.638)
Green Revenue#High Pollution			0.007*	0.010***			0.013*	0.017**
			(1.753)	(2.995)			(1.888)	(2.283)
High Pollution			-0.002	-0.014***			-0.005	-0.015***
			(-0.703)	(-4.682)			(-1.420)	(-2.785)
Cash Flow	0.173***	0.095***	0.159***	0.082***	0.178***	0.135***	0.163***	0.117***
	(15.967)	(9.106)	(13.908)	(7.697)	(10.978)	(6.819)	(9.128)	(5.521)
Green Revenue	0.006***	0.003*	0.004***	0.001	0.006**	0.001	0.001	-0.003
	(4.380)	(1.957)	(2.770)	(0.357)	(2.121)	(0.145)	(0.513)	(-0.531)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2	0.319		0.321		0.338		0.339	
Within r2		0.089		0.090		0.093		0.094
N	18751	18751	18751	18751	6607	6607	6607	6607
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes	No	Yes	No	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 11. Role of Firm Size

This table presents OLS and fixed effects (FE) regressions examining how the relationship between green revenue and investment–cash flow sensitivity (ICFS) varies by firm size. Columns (1)–(4) present results for large firms (above median total assets), while columns (5)–(8) present results for small firms (below median total assets). The dependent variable is capital expenditures (CAPEX) scaled by lagged total assets. Even-numbered columns include the triple interaction between green revenue, cash flow, and high-pollution status. All specifications include the full set of control variables, year fixed effects, industry fixed effects, and country fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

				Large Firms				**Small Firms**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Dependent	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Model	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**
Green Revenue# Cash Flow	**-0.054***	**-0.035***	**-0.037***	**-0.019**	**-0.046**	**-0.013**	**-0.036**	**-0.009**
	(-4.309)	**(-2.677)**	**(-2.601)**	**(-1.312)**	**(-1.080)**	**(-0.272)**	**(-1.032)**	**(-0.181)**
Green Revenue#High Pollution#Cash Flow			**-0.076***	**-0.057****			**-0.053**	**-0.062**
			(-2.686)	**(-2.200)**			**(-0.312)**	**(-0.524)**
High Pollution#Cash Flow			0.054***	0.044**			0.037	0.082*
			(2.735)	(2.040)			(0.773)	(1.667)
Green Revenue#High Pollution			0.008**	0.010***			0.016	-0.002
			(2.516)	(3.057)			(1.082)	(-0.136)
High Pollution			-0.003	-0.011***			-0.010*	-0.022***
			(-1.334)	(-3.851)			(-1.703)	(-2.758)
Cash Flow	0.172***	0.106***	0.156***	0.093***	0.149***	0.113***	0.143***	0.104***
	(16.919)	(10.828)	(14.340)	(9.621)	(7.263)	(5.082)	(6.666)	(4.343)
Green Revenue	0.007***	0.005***	0.005***	0.002	-0.000	-0.014**	-0.003	-0.013**
	(5.051)	(3.192)	(3.504)	(1.461)	(-0.084)	(-2.465)	(-0.881)	(-2.403)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2	0.348		0.349		0.263		0.264	
Within r2		0.084		0.084		0.091		0.093
N	21914	21914	21914	21914	3446	3446	3446	3446
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes	No	Yes	No	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 12. Role of Asset Tangibility

This table presents OLS and fixed effects (FE) regressions examining how the relationship between green revenue and investment–cash flow sensitivity (ICFS) varies by asset tangibility. Columns (1)–(4) present results for high-tangibility firms (above median property, plant, and equipment scaled by total assets), while columns (5)–(8) present results for low-tangibility firms (below median). The dependent variable is capital expenditures (CAPEX) scaled by lagged total assets. Even-numbered columns include the triple interaction between green revenue, cash flow, and high-pollution status. All specifications include the full set of control variables, year fixed effects, industry fixed effects, and country fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are provided in Appendix A2.

	High_Tangibility				**Low_Tangibility**			
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Dependent	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**	**CapEx**
Model	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**
Green Revenue# Cash Flow	**-0.074*** **	**-0.044*** **	**-0.065*** **	**-0.030* **	**-0.004**	**-0.013**	**-0.009**	**-0.005**
	(-4.963)	**(-3.106)**	**(-3.950)**	**(-1.870)**	**(-0.201)**	**(-0.522)**	**(-0.388)**	**(-0.171)**
Green Revenue#High Pollution#Cash Flow			**-0.046**	**-0.046* **			**0.035**	**-0.087**
			(-1.356)	**(-1.683)**			**(0.531)**	**(-1.622)**
High Pollution#Cash Flow			0.017	0.034			0.041	0.035
			(0.789)	(1.549)			(0.929)	(1.004)
Green Revenue#High Pollution			0.004	0.009**			0.002	0.010
			(1.015)	(2.691)			(0.251)	(1.399)
High Pollution			0.010***	-0.010***			0.001	-0.013**
			(4.254)	(-3.466)			(0.249)	(-2.310)
Cash Flow	0.258***	0.119***	0.245***	0.109***	0.108***	0.060***	0.101***	0.057***
	(21.898)	(10.865)	(18.828)	(9.435)	(6.903)	(4.210)	(6.224)	(3.905)
Green Revenue	0.008***	0.006***	0.007***	0.003*	-0.002	-0.007**	-0.002	-0.008**
	(4.711)	(3.475)	(4.048)	(1.848)	(-0.730)	(-2.041)	(-0.777)	(-2.319)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2	0.254		0.269		0.191		0.193	
Within r2		0.084		0.084		0.046		0.049
N	20822	20822	20822	20822	4536	4536	4536	4536
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effect	No	Yes	No	Yes	No	Yes	No	Yes

*t-statistics in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*