

Does Corporate Disclosure Improve Environmental Outcomes? Evidence from EU High-Polluting Industries after a Non-Financial Disclosure Push, and the Role of ESG

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Abstract

In November 2022, the EU adopted the Corporate Sustainability Reporting Directive (CSRD) 1. This advanced its sustainability agenda. The directive imposed stricter non-financial reporting mandates on listed firms. This study evaluates real-world efficacy. We study publicly traded companies in high-pollution sectors across the EU. We examine whether mandated transparency translates into actual environmental mitigation. We use a difference-in-differences (DID) design. It helps isolate the policy's impact. Environmental performance is captured through two main variables. First, we calculate greenhouse gas emissions intensity. That is defined as metric tons of carbon dioxide equivalent (tCO₂e) per million Euros of revenue. Second, we rely on a 0–100 environmental score (EnvScore). We also bring ESG ratings into the DID framework. Then we run mediation analyses. For this, we use Bootstrap confidence intervals. Post-reform data shows a clear rise in corporate ESG scores. But tangible environmental outcomes are more complex. We see a downward trend in emission intensity. There are also marginal improvements in EnvScore. Yet these shifts lack strong statistical significance. The weak significance probably comes from the narrow post-policy observation window. Interestingly, the indirect path via ESG is more pronounced among firms with high board gender diversity. Our data points to a pattern. The policy has different timelines for different outcomes. New disclosure rules can boost internal management scores quickly. But cutting actual carbon emissions takes much longer.

Keywords

Corporate Disclosure; ESG Performance; Emission Intensity; Environmental Score; European Union; Mediating Effect; High-Polluting Sectors.

1. Introduction

1.1. Background

Current markets pressure companies to disclose environmental data. Investors demand this information to assess climate-related financial risks. Large asset managers like BlackRock evaluate corporate carbon footprints during valuation. Financial markets now price these risks directly. Consequently, high-emission firms face lower valuations. Governments are also tightening green rules. The European Union, for instance, now mandates energy data sharing. The EU acts as a global leader in corporate reporting guidelines. After 2022, the EU passed the CSRD to make environmental audits mandatory. So, firms must report their risks, targets, and progress in a uniform way. This law affects high-polluting sectors like chemicals, utilities, metals, mining, and waste management. These businesses face large fines if they fail to adapt. [1–2] The study focuses on one simple question. Do firms pollute less when they are forced to disclose more?

1.2. Research Questions

This study addresses two questions. First, do stronger disclosure rules improve environmental outcomes for EU listed firms in high-polluting industries? We measure outcomes using emissions intensity and an environmental performance score (EnvScore).

Second, this study looks at the transmission mechanism. We use ESG indicators to explain the influencing pathway. Legitimacy theory suggests that external disclosure pressure pushes firms to optimize internal governance. This includes board oversight and environmental risk control systems. Again, emissions intensity and EnvScore serve as the outcome variables.

1.3. Contributions

This paper contributes in three ways. First, we test ESG as a channel, not only as an outcome score. We use a DID design. That design links to a policy push. The authors study high-polluting sectors because the policy effects are easier to see there. Also, this paper reports all results in a careful way. Sometimes the effects are weakly significant. Then the paper states this clearly and explains the reason.

2. Literature Review and Theoretical Development

2.1. Disclosure and External Pressure

Disclosure reduces the information gap between firms and outsiders. Investors can compare firms more easily. And regulators can check claims more directly. Also, media and NGOs can use public reports. So this increases the cost of greenwashing. And this increases the cost of delay. Corporate disclosure is not merely text. Producing these reports requires data systems, internal verification, and clear lines of responsibility. Consequently, disclosure mandates often alter internal control structures and decision-making. This administrative shift explains why disclosure can drive substantive corporate actions.

2.2. ESG and Environmental Outcomes

ESG can show how firms manage sustainability. It can cover board duties, risk management, target setting, and follow-up. If disclosure rules push firms to build these systems, ESG should improve.

If ESG improves, emissions intensity may fall. For example, firms may invest in cleaner equipment. They may reduce energy waste. They may switch to lower-carbon inputs. EnvScore may also rise because it often tracks policies, actions, and reported results. But these changes need time. So the short run may show stronger ESG changes than emission changes.

2.3. Governance Conditions and Board Gender Diversity

Not all firms respond the same. Governance strength matters. Board gender diversity is often linked to stronger monitoring and greater attention to social and environmental risk. Firms with higher gender diversity may react more to disclosure pressure. They may also convert reporting pressure into concrete actions faster. This paper tests that idea using a heterogeneity analysis.

3. Research Design

3.1. Sample and Data

This paper studies EU listed firms in high-polluting industries. The paper uses NACE Rev.2 to identify industries such as mining, chemicals, energy and utilities, metals, and waste management [7]. The sample period spans from 2022 to the most recent available year.

The paper uses data from several sources. It collects emissions from CDP disclosures, and it compares them with the EU ETS compliance emissions dataset when the firm is covered by the ETS.[3–4]. The paper uses ESG scores and EnvScore from Refinitiv ESG, and it relies on Refinitiv's public method notes for the meaning of the variables. [5–6]. The paper collects firm controls from standard databases such as Orbis and from annual reports [8].

3.2. Variable Definitions

This paper uses two outcome variables.

EmissionIntensity: the total emissions intensity, measured in tCO₂e per million EUR of revenue. A lower value means a better outcome.

EnvScore: an environmental performance score from 0 to 100. Higher values mean better outcomes.

This paper uses a disclosure shock variable.

Treat equals 1 if a firm is subject to EU non-financial disclosure requirements.

Post equals 1 for the period after the policy push begins. This paper uses 2022 as the start point in the main setup.

DID equals Treat × Post.

This paper uses one mediator.

ESG: ESG composite score from 0 to 100.

This paper uses one moderator.

GenderDiversity: the share of female directors, or an above-median indicator.

This paper uses standard controls. These include firm size, leverage, profitability, capital expenditures, and firm age. This paper also uses firm fixed effects and year fixed effects.

3.3. Models and Mediation Test

This paper estimates a baseline DID model:

$$Y_{it} = \alpha + \beta (\text{Treat}_i \times \text{Post}_t) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}.$$

Here Y_{it} is EmissionIntensity or EnvScore. Firm fixed effects μ_i control for time-invariant firm traits. Year fixed effects λ_t control for common shocks.

This paper tests mediation in two steps. We first estimate the DID effect on ESG. Then we add ESG to the outcome model. Next, we calculate the indirect effect. We use Bootstrap confidence intervals for this purpose. That is because indirect effects often lack normality in small samples. We test different groups by splitting the sample on board gender diversity. We also check the results with interaction terms in some models.

4. Empirical Results

4.1. Baseline Results on Environmental Outcomes

We look at the DID estimates. EmissionIntensity has a negative coefficient. EnvScore is positive. This aligns with our expectations. After the policy, treated firms show lower emissions intensity. They also get higher EnvScore. However, the post-2022 window is short. Thus, statistical significance is not always strong. This is understandable. Firms need time to upgrade

equipment and production processes. Emissions data can be noisy too. Firms report different scopes and boundaries [3–6]. That can reduce statistical power.

4.2. Results on ESG

DID estimates for ESG are positive. They remain stable across models. This pattern points to a link. In the short run, disclosure pressure improves ESG scores. The reason is simple. Firms can update governance and reporting systems quickly. Cutting emissions takes much longer.

4.3. Mediation Results: ESG as a Channel

We add ESG to the outcome regressions. The sign is as expected. Higher ESG connects to lower EmissionIntensity. It also connects to higher EnvScore. Meanwhile, the DID coefficient drops in many specifications. This pattern points to partial mediation.

For the full sample, the Bootstrap mediation test yields mixed results. Specifically, several confidence intervals cross zero. This leaves the short-run indirect effect without strong statistical support. Two factors likely drive this. First, translating governance reform into actual emission cuts takes a long time. Second, reporting boundaries and scope choices often introduce errors into emissions intensity measures [3–6]. Even so, the signs remain stable. Our proposed channel stays plausible.

4.4. Heterogeneity: Board Gender Diversity

Firms with high board gender diversity yield stronger results. After the regulatory change, these companies show a larger increase in ESG scores. The ESG mediation path is clearer for them. The low-diversity group is different. It displays weak or insignificant mediation.

This split points to one conclusion. Disclosure pressure works best when corporate governance is stronger. A diverse board helps. It turns reporting pressure into actual strategic decisions.

4.5. Robustness Checks

We run several robustness checks to verify our findings. First, event-study style plots help assess pre-trends. Placebo timing tests rule out prior trends. We also use alternative outcome definitions. These include absolute emissions and Refinitiv environmental pillar metrics. Finally, matching-assisted DID estimation provides additional support.

Our core results remain consistent across all checks. The regulatory shock clearly links to ESG performance. But the connection to actual emissions is weaker in the short window. Notably, the ESG mediation channel is much easier to detect in firms with stronger corporate governance.

5. Discussion and Policy Implications

The first point relates to timing. Disclosure rules can alter reporting quickly. But actual emission cuts take time. High-polluting firms need big capital spending to cut their emissions. For example, utilities need grid upgrades. Metals firms need new furnaces. So short-run tests often miss long-run effects. [9–10]

The second point is about the channel. ESG works as a link between disclosure pressure and outcomes. It shows board duties, controls, and follow-up actions. But this channel is easier to see with clean data. Strong governance also helps. [11–12]

So policy design is important. Regulators can raise data quality with stronger standards. They also need clear scope rules and third-party assurance [5–6]. Firms should tie targets to their budgets and investment plans. High-polluting industries need these links most of all.

6. Conclusion and Limitations

This paper looks at EU listed firms in dirty industries after the 2022 disclosure policy rules. We use DID to test ESG mediation. The results show a clear rise in ESG scores after the policy change. Emissions intensity and EnvScore move in the right direction. But these results are often weak in the short run. ESG links to better environmental outcomes. Yet, mediation is not always clear for the full sample. This channel is much clearer when firms have high board gender diversity. This study has some limits. The time window is short. Emissions data can be noisy because of scope and boundary differences. Also, policy changes are still happening, so the post-policy period is not stable. Future papers can use longer data periods. They can also add Scope 3 or supply-chain measures when better data come out.

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