Emissions Restatements after the SEC's Request for Public Input on Climate-Related Disclosures: Evidence from Carbon Disclosure Project Filings*

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Abstract

This paper analyzes firms' restatements of their Scope 1 emission numbers after the Securities and Exchange Commission's request for public input on climate-related disclosure in March 2021. Using data from the Carbon Disclosure Project, we find a marked increase in the frequency and magnitude of restatements by U.S. public firms, both relative to their previous restatement levels and to those of private firms not subject to SEC oversight. Firms with independently assured emission data, board-level oversight of climate issues, high transition risk, and high institutional ownership restate less upwards but not downwards. Firms with upward revisions in response to the SEC's initiative increase investments in emission-reduction projects. The results are consistent with widespread weaknesses in firms' carbon reporting infrastructures and strategic motives to underreport. They have important implications for regulators, investors, and standard setters by highlighting the need for robust carbon reporting, and the critical role of assurance of sustainability disclosures.

Keywords: Climate disclosure and its real effects; greenhouse gas emissions; emissions restatements; regulatory scrutiny; SEC oversight; assurance services

JEL: M41, G38, Q56, K22, D82

1. INTRODUCTION

Over the past decade, companies in the United States have faced increasing demand from investors, governments, and regulators, for Environmental, Social, and Governance (ESG) information (e.g., Bloomberg, 2021; Cohen et al., 2023; Sustainalytics, 2023). In response, many firms have experimented with voluntarily disclosing information about their ESG practices. A specific focus has been on greenhouse gas (GHG) emissions data, particularly corporate disclosures of their own emissions (i.e., Scope 1 emissions), often reported through the Carbon Disclosure Project (CDP) (e.g., Cohen et al. 2023).[1] In fact, emission disclosures have become a widely used basis for measuring climate risk, routinely cited in investor presentations, policy documents, and academic studies (IPCC, 2018; UNEP FI, 2024). However, the accuracy of the reported measures has been debated. Studies have shown that firm-level GHG estimates are often imputed, based on outdated models, or lack methodological transparency (Aswani et al., 2024; Zhang, 2025). In this study, we focus on the importance of regulatory scrutiny and the risk of a disclosure mandate for firms to improve accuracy of their voluntary disclosures.

Specifically, we study whether and how firms revise their reported GHG emissions in response to potential regulatory scrutiny from the Securities and Exchange Commission (SEC). We exploit a pivotal inflection point in March 2021 that marked the beginning of a shift from the SEC's interpretive guidance toward potential mandatory climate reporting (Kirkland and Ellis, 2021; Carter et al., 2025). In March 2021, the SEC—under then-Acting Chair Commissioner Allison Lee—issued a formal public call for input on climate-related disclosures. The consultation process invited extensive feedback from investors, preparers, and policy experts, signaling the

[1] The Carbon Disclosure Project (CDP) compiles firm-level responses into a publicly accessible database. This dataset has been central to the information architecture of ESG investing, widely used by asset managers, ESG raters and data providers, civil society, and regulators alike (Cohen et al., 2023). For more than a decade, CDP has served as the de-facto global repository for corporate carbon disclosures (Carbon Market Institute, 2024).

SEC's serious intent to reshape the disclosure landscape (SEC, 2021). Reinforcing this intent, the SEC also created a Climate and ESG Task Force within the Division of Enforcement. Importantly, companies subject to SEC oversight were aware of these initiatives, with some of them subsequently adjusting their supply chains to minimize their Scope 3 emissions (Carter et al., 2025). In March 2022, the SEC's initiative eventually resulted in a proposal titled "The Enhancement and Standardization of Climate-Related Disclosures for Investors," aiming to mandate Scope 1 and 2 emission disclosures for certain registrants in the future.

By using the March 2021 initiative as the starting point for a potential increase in regulatory scrutiny and future ligation risk, we examine whether and how firms revise previously reported GHG emissions in their CDP disclosures—a behavior that may reveal latent uncertainty or fragility in existing climate reporting practices. On the one hand, prior studies in the context of financial accounting find evidence with regulatory scrutiny, particularly from the SEC, having positive effects on financial reporting quality and even real effects on companies' decisions (e.g., Kedia and Rajgopal, 2011; Bens et al., 2016; Kubick et al., 2016; DeFond and Lennox, 2017; Aobdia, 2018; Shroff, 2020; Aobdia et al., 2021). In addition, some studies show that companies make changes as soon as regulation is proposed, before waiting for implementation of final rules (e.g., Hendricks et al., 2023). Thus, the prospect for increased SEC scrutiny may make companies re-evaluate and improve their GHG reporting protocols and internal controls. Doing so likely increases the likelihood of detecting prior issues, resulting in increased restatement rates.

On the other hand, it is not completely clear that companies would make changes to their protocols in reaction to the SEC initiative. Given the strong demand for accurate voluntary disclosures on GHG emissions, companies may have already improved their GHG reporting protocols even before the SEC initiative. This is particularly the case when firms had more robust

reporting processes in place, for example by obtaining some assurance on their emission numbers, by having a board-level oversight of their GHG reporting, or by facing greater external pressure from their investors or from regulators. In addition, given the major changes proposed by the SEC and the significant resulting uncertainty about the regulatory landscape, companies may have waited for more clarity before undertaking any changes.

Using a panel of CDP responses from United States (U.S.) public firms, we examine the frequency and magnitude of Scope 1 emission restatements following the SEC's climate disclosure initiatives. We focus on Scope 1 emissions because they are directly under the firm's control and less subject to estimation uncertainty or external data dependencies inherent to Scope 2 emissions, which rely on utility providers and regional grid factors that firms have limited control over. This makes Scope 1 an advantageous setting to assess intentional revisions and reporting integrity, particularly in the face of anticipated regulatory scrutiny. By isolating Scope 1 emissions, we reduce confounding factors from technical recalculations and instead capture restatements that more plausibly reflect firms' internal processes, governance, and exposure to enforcement risk.

We define a restatement as a revision—upward or downward—of at least five percent of a firm's previously reported emissions,[2] and during our sample period between 2011 and 2023, find that the restatement rate is non-trivial: firms announce restatements in 5.2% of all firm-years.[3] Importantly, we find a sharp increase in restatement rates among public firms in 2022 and 2023, which exceeds the underlying trend and diverges markedly from the trend during the pre-period. Our univariate test suggests that public firms' average rate during the pre-period was 2.6%. After

[2] We apply this threshold to focus on economically meaningful restatements. A 5% threshold is consistent with the quantitative materiality benchmarks commonly employed in financial statement auditing. While auditors may deviate from this threshold based on context, it remains a key reference point in materiality assessments (Choudhary et al, 2023). Importantly, our findings are robust to alternative cutoffs. In untabulated analyses, we find similar results when using thresholds of 1% or 10%, indicating that our conclusions do not depend on the specific choice of threshold.

[3] Also, restatement amounts are non-trivial: conditional upon a firm restating its emissions, median relative upward and downward restatement amounts are about 22% and 12%, respectively.

the 2021 initiative, their average restatement rate jumped to 12.2%. To assess the robustness of this pattern, we implement a series of regression analyses that control for firm fundamentals, emissions, and firm fixed effect, and find that public firms are 6.4 percentage points more likely to restate emissions in the post-initiative period—a large effect relative to the base rate in the pre-period. We also find that the average restatement magnitude nearly doubled in the post-period. These results are statistically significant for both upward and downward revisions, suggesting widespread recalibration of emissions disclosures.

To strengthen our identification, we exploit the fact that large private firms—while voluntarily disclosing emissions to CDP—are not subject to SEC oversight and face lower public litigation risk (Erickson, 2025). This allows us to use private firms as a control group using a difference-in-differences (DiD) framework. In these DiD regressions, we compare public and private firms before and after 2021. Across both unmatched and entropy-balanced samples, we find consistent evidence that public firms responded disproportionately to the SEC initiative: they were 6.1 percentage points more likely to restate emissions than private firms during the post period. This estimate is economically meaningful and closely aligns with the univariate comparison. The results are generally robust across multiple specifications, including signed and unsigned measures of restatement likelihood and magnitude, and support the identification assumption through the absence of significant pre-trend differentials between groups.

To understand whether heterogeneity exists in firms' response to regulatory scrutiny, we examine cross-sectional variation in restatement behavior. We begin with the role of third-party assurance. CDP data allow us to identify both public and private firms that obtained independent verification of emissions data before the SEC's intervention. We find that firms that obtained assurance are less likely to make upward restatements to their GHG emissions reporting, although

there is no difference for downward revisions. This asymmetric pattern suggests that assurance plays a meaningful role in limiting opportunistic reporting and enhancing the preparation and overall accuracy of climate disclosures.

Next, we examine the role of internal governance, specifically whether board-level oversight of climate-related issues is associated with better emissions reporting. Firms where such issues were overseen by their boards of directors prior to 2021 restate their emissions less upon the SEC's initiative, particularly for upward revisions. These findings suggest that internal governance mechanisms facilitate more accurate and reliable carbon disclosures, even in the absence of formal enforcement. Taken together, our evidence points to systematic underreporting by many public firms prior to the SEC's request for input, consistent with both greenwashing and weaknesses in estimation capacity. However, the presence of robust internal controls—such as board oversight and assurance—can meaningfully mitigate these vulnerabilities.

We also examine the role of transition risk and institutional investors, i.e., external governance. We classify firms in the top decile of Scope 1 emissions (or, alternatively, with regulatory climate risk exposure) as having high transition risk. Such firms may already be subject to scrutiny by investors and regulatory agencies and should thus be incentivized to report more accurately even in the absence of formal regulation. A similar reasoning should apply to firms with high institutional ownership. Consistently, we find that firms with high transition risk and institutional ownership are less likely to restate emissions upwards following the SEC's initiative. This result suggests that the emissions numbers of firms subject to higher external scrutiny were more credible ex-ante—perhaps due to greater reputational concerns or superior internal systems.

Taken together, our findings suggest that the prospect of regulatory scrutiny triggers significant corrections in emissions reporting, revealing latent weaknesses in voluntary regimes

for emerging types of disclosures. At the same time, voluntary assurance and governance mechanisms (both internal and external) appear to meaningfully reduce the likelihood of misreporting. These patterns reinforce the growing call for a robust carbon accounting infrastructure that is both verifiable and enforceable, aligning with recent proposals in the academic and policy spheres. We believe that our findings offer timely insights into the credibility of corporate emissions data and the mechanisms that can enhance its reliability. They also carry important implications for regulators designing climate disclosure standards (e.g., the SEC and International Sustainability Standards Board (ISSB)), for information intermediaries who aggregate and rate emissions performance, and for investors who rely on these figures to price climate risk and inform capital allocation.

Finally, we provide evidence on the real effects of the SEC's March 2021 request for input on climate-related disclosures. Using CDP data on firms' individual decarbonization initiatives (following Achilles et al., 2024, and Fuchs et al., 2024), we document that firms which revised their emissions upwards upon the SEC's request, invest more in Scope 1 emission-reduction initiatives. In contrast, we find no response for firms that revised their emissions downwards.

This study contributes to three key literatures and offers practical implications for regulatory bodies, investors, and standard setters engaged in the development of climate disclosure frameworks. First, our findings contribute to the literature on restatements of voluntary disclosures. While most prior work has focused on financial restatements and narrative corrections (Kinney and McDaniel, 1989; Dechow et al., 1996; Palmrose et al., 2004; Amel-Zadeh and Zhang, 2015), little is known about the reliability of key emerging non-financial quantitative disclosures such as carbon emissions. However, focusing on such disclosures is important given that such disclosures are new and the internal systems employed by companies to prepare such disclosures are clearly

not as established as financial reporting disclosures. A recent working paper by Cohen et al. (2025) provides early evidence that large U.S. firms occasionally revise reported carbon data, highlighting the fluid nature of such disclosures. In addition, Pinnuck et al. (2021) find that corporate social responsibility reports of Global Fortune 250 companies are frequently restated. We contribute to this literature by examining how restatements cluster around periods of heightened regulatory attention—such as the SEC's request for input on climate disclosure—and by documenting that revisions often involve direct emissions from sources owned or controlled by a company, long viewed as the most "objective" and "trusted" components of GHG reporting. Our findings suggest that potential regulatory scrutiny and litigation risk meaningfully influence carbon disclosure behavior, and echo broader calls by Kaplan and Ramanna (2021) and Reichelstein (2024) for a robust, verifiable, and standardized carbon accounting infrastructure. By documenting a significant increase of decarbonization activities upon the SEC's 2021 initiative for firms that previously understated their emissions, we also contribute to an emerging literature on the real effects of environmental disclosures (e.g., Fiechter et al. 2022; Tomar 2023), and particularly firm responses to the SEC's climate initiative (Carter et al., 2025).

Second, our findings contribute to the ongoing debate surrounding the decision-usefulness of corporate carbon disclosures. A number of influential studies—such as Bolton and Kacperczyk (2021) and In et al. (2019)—find that reported emissions help predict stock returns and firm-level risk, suggesting that carbon data are priced by investors. More recent work, however, including Aswani et al. (2024) and Zhang (2025), raises concerns about the reliability of these data, citing issues such as estimation error, imputation, and reporting lags. Our study directly contributes to this literature. We show that Scope 1 emissions—the very data used in much of this literature—are frequently restated, often materially so, and particularly when regulatory scrutiny increases.

This calls into question the empirical foundation of market-pricing tests based on emissions data and underscores the importance of improving the credibility, consistency, and assurance of climate-related disclosures before drawing strong conclusions about their informational content.

Third, we contribute to the literature on ESG assurance by introducing restatement behavior as a new lens through which to evaluate the effectiveness of assurance. Prior research has primarily focused on indirect outcomes—showing that assurance enhances the credibility of ESG disclosures (Simnett et al., 2009), improves reported quality (Gipper et al., 2025), and signals strong internal controls (Aobdia and Yoon, 2025). We particularly contribute to recent work on GHG emissions assurance, which paints an unclear picture. While Gipper et al. (2024) document that first-time assurance (based on ESG report and CDP data) is associated with lower abnormal emissions, Berg et al., (2025) find that firms obtaining first-time assurance (from Clarity AI) report significantly greater emissions. We extend this literature by examining whether assurance helps preserve the *integrity* of carbon disclosures over time, a direct outcome of the assurance process.[4] Using the SEC's March 2021 climate consultation and the following SEC initiatives on climate-related disclosures as a shock to public firms' perceived enforcement risk, we show that assured firms are significantly less likely to restate previously disclosed Scope 1 emission, and when they do, the revisions are smaller. These findings suggest that assurance plays a meaningful role, safeguarding the integrity of sustainability disclosures when they face heightened scrutiny.

[4] This discussion echoes the debate in the auditing literature on accurate proxies for audit quality. While indirect proxies for audit quality exist (e.g., discretionary accruals and investor perception), restatements provide a more direct measure of audit quality, that also predicts practitioner assessments of poor audit quality (DeFond and Zhang, 2014; Aobdia, 2019). Similarly, our setting focuses on restatements of previous GHG disclosures, which represents a direct measure of the accuracy of the initial disclosure and a direct measure of the quality of the assurance process.

2. INSTITUTIONAL SETTING

2.1. The SEC's Evolving Approach to Climate Disclosure

Over the past decade, the SEC has gradually shifted its stance on climate-related disclosure from passive interpretation to proactive regulation. One of its first actions in this arena dates back to 2010 with the issuance of interpretive guidance clarifying that material climate risks could fall under existing financial disclosure obligations (SEC, 2010). While this was indeed foundational, it neither imposed new rules nor spurred further regulatory action for nearly a decade (Lee, 2020). During this period, climate information remained largely governed by voluntary frameworks like the Task Force on Climate-related Financial Disclosures (TCFD), adopted unevenly across industries (Bloomberg, 2022). By the late 2010s, however, investor demand for reliable ESG data was intensifying, prompting a broader reassessment of disclosure adequacy within the SEC. This reassessment gained momentum in 2020, when internal advisory committees and external stakeholders began calling for updated reporting standards (Lee, 2020; Wall Street Journal, 2020).

U.S. regulatory posture shifted decisively in March 2021, when then-Acting Chair Allison Lee issued a statement initiating a formal consultation on climate-related disclosures (SEC, 2021). The SEC solicited input on how to better capture climate risk, referencing both the inadequacy of current voluntary disclosures and the potential role of third-party frameworks like TCFD and the Sustainability Accounting Standards Board. This move marked the clearest signal to date that climate risk warranted standalone disclosure regulation, not merely reinterpretation of existing rules. In tandem, the SEC established a Climate and ESG Task Force within the Division of Enforcement, aimed at proactively identifying ESG-related misconduct. Although the task force was later dissolved, its creation emphasized the SEC's growing commitment to both rulemaking and enforcement in the ESG domain. The March 2021 initiative thus served as both a rhetorical and institutional pivot, heightening firms' awareness of rising regulatory scrutiny.

Importantly, these initiatives can be viewed within the broader context of a shifting federal regulatory landscape following President Biden's inauguration in January 2021. Executive Order 14008, the appointments of Gina McCarthy as National Climate Advisor and Gary Gensler as SEC Chair nominee, and the broader prioritization of ESG risks by federal agencies all reflected an enhanced national focus on climate-related financial risks and disclosures. These developments—along with the SEC's March statement—support our designation of 2021 as a pivotal year for regulatory expectations surrounding climate reporting. Consistent with the idea that firms subject to SEC oversight were aware of and reacted to this initiative, Carter et al. (2025) find that following the March 2021 statement, larger publicly traded companies reduced their reliance on imports, arguably to reduce their Scope 3 emissions.

The SEC formalized this pivot with its March 21, 2022 proposal: "The Enhancement and Standardization of Climate-Related Disclosures for Investors" (SEC, 2022). This proposed rule would require all public companies to disclose Scope 1 and 2 emissions in standardized formats, with large and accelerated filers subject to limited assurance requirements. In some cases, Scope 3 disclosures were also included, although with longer implementation timelines and materiality thresholds. Beyond emissions data, firms would be required to describe governance processes, management oversight, and the anticipated financial impacts of climate-related risks (Bloomberg Law, 2022). These requirements aimed to improve comparability and reduce investor uncertainty about firms' exposure to—and preparedness for—climate-related transition and physical risks. Importantly, the proposal introduced phased implementation by filer status, increasing litigation exposure for large firms reporting inaccurate or misleading emissions data.

Despite strong support from investors and climate risk experts, the SEC's climate disclosure proposal faced significant political and legal resistance. Critics questioned the agency's

statutory authority, the compliance burden for registrants, and the feasibility of Scope 3 emission disclosures, particularly for firms with complex value chains (Politico, 2023). Following over two years of debate, the SEC adopted a scaled-back version of the rule on March 6, 2024, eliminating the Scope 3 requirement while mandating Scope 1 and 2 disclosures for large accelerated and accelerated filers, contingent on materiality (SEC, 2024). The rule also introduced phased assurance requirements and narrative disclosures concerning climate-related risks, governance, and risk management processes. However, it was immediately met with legal challenges from industry groups and state attorneys general, prompting the SEC to voluntarily stay its implementation in April 2024 to allow for judicial review (Reuters, 2024).

On March 27, 2025, the SEC voted to cease defending the climate disclosure rule in court (SEC, 2025). Acting SEC Chair Mark Uyeda characterized the rule as "costly and unnecessarily intrusive," and stated that discontinuing its defense would best serve the Commission's resources (DLA Piper, 2025). Although the rule technically remains on the books, its enforcement effectively halted without additional regulatory or legislative action. This outcome underscores the deep political and legal volatility surrounding climate-related financial regulation in the United States.

Taken together, the SEC's shifting climate-disclosure agenda intensified regulatory attention around corporate GHG reporting. By elevating emissions disclosure from a reputational concern to a compliance and litigation issue, these initiatives likely introduced a new set of incentives for firms to accurately prepare and report their GHG disclosures, and correct prior misstatements. Overall, this changing landscape provides a valuable setting for evaluating whether and how companies revisited previously reported climate data under the prospect of formal oversight. The next section turns to the CDP, a leading voluntary reporting platform, to examine how this evolving regulatory pressure was reflected in firm-level emissions disclosures.

2.2. The Carbon Disclosure Project

The CDP plays a central role in the ecosystem of voluntary corporate climate disclosures and serves as the backbone of our empirical setting. Founded in 2000 as a nonprofit initiative, CDP's mission is to facilitate environmental transparency by collecting standardized information on corporate GHG emissions and climate-related risks. Since its first climate disclosure campaign in 2003, issued on behalf of 35 institutional investors to FTSE 500 firms, CDP has grown into the world's largest repository of environmental data. As of 2023, more than 24,000 companies—representing over two-thirds of the global market capitalization—respond to its annual climate questionnaires. The platform is widely viewed as a cornerstone of the voluntary carbon disclosure ecosystem, used extensively by investors, data vendors, and policymakers (CDP, 2024).

Each year, CDP distributes a detailed questionnaire aligned with frameworks such as the GHG Protocol and the TCFD. The survey requests information across a range of categories including emissions targets, governance of climate risks, scenario planning, and quantitative emissions data for Scopes 1, 2, and 3. It is typically distributed in January, with submissions due by July and results published in October. Firms may designate their responses as "Public" or "Private," with the latter accessible only to CDP's network of investor signatories. While participation is voluntary, firms that respond gain visibility to institutional investors representing over $140 trillion in assets and may benefit from reputational and scoring advantages (CDP, 2024).

CDP disclosures are well-suited for empirical analysis due to their consistency, scope, and longevity. Many firms have participated annually for over a decade, generating panel data that support reliable within-firm comparisons over time. The standardized questionnaire and reporting format minimize definitional drift, making CDP uniquely valuable for detecting substantive changes in emissions reporting. Cohen et al. (2023), for example, use CDP data to identify

systematic misreporting and the influence of institutional investor scrutiny. Similarly, Bonetti et al. (2024) analyze supply chain disclosures to show how customer demand for climate transparency drives supplier decarbonization. Together, these studies show that CDP serves not only as a disclosure platform but also as a quasi-regulatory mechanism for evaluating climate reporting credibility and its economic effects.

Despite these strengths, CDP data also reflect the broader challenges of voluntary disclosure. The technical complexity of the questionnaire and the scale of required data make participation resource-intensive, particularly for first-time respondents. Firms must interpret over 100 pages of guidance, coordinate cross-departmentally, and estimate emissions under evolving methodological standards. CDP does not mandate third-party verification of reported data, and assurance practices vary widely across respondents. These features introduce heterogeneity in data quality and create vulnerabilities to errors, estimation drift, or strategic misreporting (CDP, 2024).

The voluntary and non-binding nature of CDP disclosures also highlight their evolving interface with emerging regulatory expectations. Although firms are not legally obligated to ensure accuracy unless CDP responses are incorporated into official filings, the rise of climate-focused regulation—such as the SEC's proposed disclosure rules—has blurred the line between voluntary and de facto mandatory reporting. As the regulatory environment intensifies, voluntary disclosures like those collected by CDP increasingly serve as testing grounds for firms navigating the rising costs of misreporting, reputational fallout, and litigation risk (CDP, 2024).

3. DATA AND DESCRIPTIVE STATISTICS

3.1 Data

We obtain information about GHG emissions and the restatements thereof from the CDP. Specifically, we use information that firms provide in response to several CDP questions.[5] To identify the years for which firms report emissions, we use question C0.2_C1 (C0.2_C2) *"State the start and end date of the year for which you are reporting data and indicate whether you will be providing emissions data for past reporting years. - Start date (End date)."* We retrieve information on Scope 1 emissions from question C6.1_C1 *"What were your organization's gross global Scope 1 emissions in metric tons carbon dioxide equivalent (CO2e)? - Gross global Scope 1 emissions (metric tons CO2e)."*[6] We identify emissions restatements by comparing responses to this question in different questionnaires over time. The information on whether firms' emissions are independently assured comes from question C10.1_C1 *"Indicate the verification/assurance status that applies to your reported emissions. - Verification/assurance status."* Information on whether firms' climate-related issues are overseen by the board comes from question C1.1 *"Is there board-level oversight of climate-related issues within your organization?"*

We use the above information to build our sample of public and private U.S. firms reporting Scope 1 emissions between 2010 and 2023 (with years referring to CDP questionnaire years). To ensure firms can restate emissions, we require them to have reported Scope 1 emissions in the prior year. Thus, our sample effectively starts in 2011. To be included in the sample, we also require that at least six years of firms' CDP emissions data is available. Since CDP coverage rarely discontinues once firms begin reporting, this requirement ensures that we at least observe

[5] The numbers and exact wording of the questions refer to the 2023 CDP questionnaire.
[6] Answers to this question often also contain information on the fiscal year for which the emissions are reported so that we do not generally have to rely on questions C0.2_C1 and C0.2_C2.

emissions and restatements for our sample firms during the post period (2021-2023) as well as the three preceding years (2018-2020).[7] Our final sample contains 3,930 (715) firm-year observations by 439 (108) U.S. public (private) firms over the CDP questionnaire years 2011 to 2023. Table A1 presents our sample selection process.

For the public firms in our sample, we complement the CDP data with firm fundamentals and Standard Industry Classification (SIC) codes from Compustat. To match this data to CDP, we use the reporting fiscal year that firms name in the CDP questionnaire. Further, to identify firms, we bridge ISINs/CUSIPs provided by CDP by using historical GVKEYs. Our final sample with available fundamental data includes 3,436 firm-year observations by 396 public firms.

3.2 Descriptive Statistics

In this section, we provide descriptive statistics for the variables used in our study, along with variable definitions (which are shown in Table A2). Table 1 presents the descriptive statistics for both the public and private firms in our sample. We use several dependent variables to capture firms' restatements of Scope 1 emissions. Again, we consider restatements of at least five percent of a firm's reported emissions to focus on economically meaningful changes. The indicator variable *Restatement* equals one if, in a given year, a company makes at least one (up- or downward) restatement of its previously reported Scope 1 emissions (and zero otherwise). For the public firms in our sample, the unconditional likelihood of such restatements is 5.2%, while it is 2.2% for private firms. Public firms are slightly more likely to revise previously reported emissions upward than downward, as indicated by the mean values of the indicator variables *Upward*

[7] Our results are qualitatively the same if we do not impose the six-year screen and expand the sample, or when we impose a tighter screen to require firms to exist longer in the data (e.g., for nine years).

Restatement and *Downward Restatement*, which are 3.0% and 2.4%, respectively.[8] The opposite pattern emerges for private firms (i.e., 0.8% versus 1.5%).

We also consider restatement magnitudes using *ln(Restatement Amount)*, which is the logarithm of one plus the absolute restated amount of Scope 1 emissions.[9] If, in a given year, a firm restates emissions for several previous years, we use the sum of the absolute values of restated emissions amounts. We winsorize absolute restatement amounts at the 99th percentile to account for outliers. The average public firms' restatement amount is 11,679 metric tons of CO2e, with upward restatements being considerably larger than downward restatements (i.e., 8,430 vs 5,928), as indicated by the mean non-logarithmic values of the variables *Upward Restatement Amount* and *Downward Restatement Amount*. Private firms' average restatement amounts are much smaller (i.e., 66 metric tons). However, these firms also report significantly smaller Scope 1 emissions of 91,631 metric tons, as compared to 3,345,237 metric tons for public firms.[10]

Lastly, the public firms in our sample have a median firm size (i.e., total assets) of $17.4 billion, a median leverage (i.e., total liabilities to total assets) of 30%, and a median firm age (i.e., years in Compustat) of 42 years. We winsorize accounting variables at the 1st and 99th percentiles.

[8] The total number of firms with upward (3.0%) and downward (2.4%) restatements slightly exceeds the overall percentage of firms with restatements (5.2%), because some firms reported both types of revisions for different fiscal years during the same reporting cycle.
[9] We also apply the 5% threshold to quantify *Restatement Amount*. In an untabulated analysis, we find that our results are not sensitive to this choice and remains robust even when the construct is measured without applying any cutoff.
[10] In our difference-in-differences estimations, we account for the significant difference in Scope 1 emissions between public and private firms via entropy balancing.

4. RESEARCH DESIGN AND RESULTS

4.1. Scope 1 Emissions Restatements Around the SEC's 2021 Initiative

4.1.1. Univariate Analysis

Figure 1 illustrates public and private firms' restatement behavior over time by plotting their annual average restatement likelihood. For both public and private firms, restatement rates generally increase over time. However, while restatement rates for both firm types fluctuate around a similar trend until 2021, the rate for public firms increases considerably in 2022 and 2023. In contrast, between 2021 and 2023, the restatement rate for private firms roughly follows the previous trend and does not meaningfully increase during these years.

The above pattern is consistent with the average restatement rates before and after the SEC's 2021 initiative on climate-related disclosure for public versus private firms reported in Panel C of Table 1. In particular, during the years leading up to the SEC's initiative, the restatement rates of public and private firms were statistically indistinguishable, averaging 2.6% and 1.7%, respectively. However, for the years 2021 to 2023, restatement rates averaged 12.2% for public firms but only 4.1% for private firms, with the difference in restatement rates between the early and later years being at best marginally significant for private firms. We also find that the increase in restatement rates of public firms upon the SEC's initiative was driven by firms from the following Fama-French 12 industries: Business Equipment, Chemicals, Manufacturing, and Non-Durables. Overall, the univariate evidence suggests that while restatements of Scope 1 emissions have generally become more frequent over time, the SEC's initiatives on climate-related disclosure starting in 2021 significantly impacted the public firms.

4.1.2. Multivariate Analysis

We test whether the univariate evidence in the previous subsection is robust using multivariate regression analyses that control for firm-specific characteristics. We staexamine

public firms' Scope 1 restatements relative to their previous restatement levels in a simple pre-post analysis around the 2021 initiative. Specifically, we compare public firms' restatements in the years 2021-2023 to their restatements in previous years by using the following model:

$$y_{i,t} = Post + ln(Scope\ 1)_{i,t} + ln(Assets)_{i,t} + Leverage_{i,t} + ln(Firm\ Age)_{i,t} + Firm\ FE \qquad (1)$$

where $y_{i,t}$ stands for the dependent variables measuring firms' restatement likelihoods and magnitudes (i.e., *Restatement* and *ln(Restatement Amount)*), as well as versions of these two variables that measure upward and downward restatements. Our variable of interest is *Post*, which is an indicator that equals one for the years 2021, 2022, and 2023 (and zero otherwise). The coefficient on this variable captures the difference in public firms' restatement behavior compared to the years before the SEC's initiative on climate-related disclosure.

In all regressions, we control for the natural logarithm of firms' Scope 1 emissions, because firms with more emissions may be more likely to restate and such restatements may have larger magnitudes. We also include firm fixed effects (FE) in all regressions to account for time-invariant unobserved firm heterogeneity, thereby lowering concerns of omitted variable bias. We conduct regressions with and without controls for firm fundamentals (i.e., firm age, leverage, and size), which leads to variation in the number of observations. Lastly, we cluster standard errors at the firm level to account for serial correlation in firms' emissions and restatement behavior.

Table 2 reports the results explaining *Restatement* and *ln(Restatement Amount)* as the dependent variables. The coefficient on the variable *Post* is significant at the 1% level in all four columns, independent of whether we control for firm fundamentals in columns (2) and (4). Hence, compared to the pre-period, public firms are significantly more likely to restate Scope 1 emissions and they make significantly larger restatements after the SEC's initiative on climate-related disclosure. The coefficient estimate on *Post* in column (2), where *Restatement* is used as the

dependent variable, is 0.0637 (t-stat = 4.788). This indicates that public firms are 6.4 percentage points more likely to make emissions restatements in the post period. We note that this effect is economically meaningful given that the unconditional likelihood of restatements in the pre-period is 2.6 percent (see Table 1, Panel C).

We find equally compelling results when looking at the restatement amount. The coefficient estimate on *Post* in column (4), where *ln(Restatement Amount)* is used as the dependent variable, is 0.6415 (t-stat = 4.557). This result indicates that public firms restated their reported Scope 1 emissions by approximately 90% (= *exp(0.6415)-1*) more after the SEC's climate disclosure initiative compared to before. This effect is economically meaningful given that the average restatement amount nearly doubled in the post-period, even after accounting for firm-level covariates as well as fixed effects. This suggests a substantial regulatory effect—firms may have reacted in anticipation of future enforcement or mandatory disclosure standards.

Table 3 investigates how firms adjusted their reported emissions by separating restatements into upward and downward revisions. Columns (1) and (2) use *Upward Restatement* and *Downward Restatement*, which captures the likelihood of making an upward or downward restatement, respectively. Columns (3) and (4) use *ln(Upward Restatement)* and *ln(Downward Restatement)*, which captures the revision magnitude. Across all specifications, we find that the coefficient on *Post* is positive and statistically significant at the 1% level, indicating that both the frequency and magnitude of restatements increased after the SEC's climate disclosure initiative. In column (1), the coefficient on *Post* is 0.0363 (t-stat = 3.491), suggesting that public firms were 3.6 percentage points more likely to report upward restatements in the post-period. In column (3), the coefficient of 0.3711 (t-stat = 3.398) indicates that the magnitude of upward restatements increased by approximately 44.9% (= *exp(0.3711)–1*) after the SEC's announcement.

We observe similar patterns for downward restatements. Column (2) shows a 3.2 percentage point increase in the likelihood of downward revisions (*Post* = 0.0315; t = 3.377), and column (4) indicates a 36.6% increase in their magnitude (*Post* = 0.3116; t = 3.142). While the point estimates are somewhat larger for upward restatements, we note that the differences between upward and downward revisions are not statistically significant. Taken together, these results show that firms became significantly more likely to revise their previously reported Scope 1 emissions—both upward and downward—after the SEC signaled a move toward mandatory climate-related disclosures. The increase in both the incidence and scale of revisions points to a broader shift in reporting behavior, consistent with firms reassessing the credibility and accuracy of their voluntary disclosures under anticipated regulatory scrutiny.[11,12]

4.2. Difference-in-differences Estimates

While the previous analysis suggests that public firms make significantly more and larger restatements after the SEC's initiative on climate-related disclosure, it may be subject to endogeneity concerns because we simply compare public firms to themselves over time. To improve identification, we now exploit the fact that large private firms that report carbon emissions to the CDP are excluded from SEC regulation and oversight, and can thus serve as a counterfactual. This allows us to conduct DiD regressions comparing public to private firms around the SEC's March 2021 initiative.[13] To this end, we conduct the following DiD regression:

[11] In untabulated regressions similar to those shown in Tables 2 and 3, we examine firms' restatement behavior for their Scope 2 emissions. We find that both the incidence and magnitude of restatements is significantly larger after the SEC's 2021 first initiative on climate-related disclosure, similar to the Scope 1 emissions.

[12] In further untabulated regressions, we find our results to be robust to additionally controlling for firms' Scope 3 emissions. Carter et al. (2025) provide evidence that following the March 2021 SEC statement, public companies reduced imports to lower Scope 3 emissions, and such changes could also prompt Scope 1 restatements. Controlling for Scope 3 emissions helps absorb this channel, thereby mitigating concerns that our results may be solely driven by contemporaneous shifts in firms' supply chains.

[13] One may argue that the SEC's initiative (unintentionally) also caused investors, NGOs, and other stakeholders to pay closer attention to large private firms' reported CO_2 emissions, incentivizing these firms to improve their emissions estimation procedures and disclosure. However, this would run against us finding results.

$$y_{i,t} = Post \times Public + ln(Scope\ 1)_{i,t} + Firm\ FE + Year\ FE \qquad (2)$$

where $y_{i,t}$ stands for our set of dependent variables measuring firms' restatement likelihoods and magnitudes and the indicator variable *Post* equals one for the years 2021, 2022, and 2023 (and zero otherwise) as in Equation (1). *Public* is an indicator variable that equals one for the public firms in our sample (and zero for private firms). Our variable of interest is the interaction term *Post* × *Public*, which captures the treatment effect for public firms. All regressions control for firms' Scope 1 emissions as well as for both firm and year fixed effects. These fixed effects subsume the individual coefficients on *Post* and *Public*. We note that we cannot control for other control variables used in Equation (1) because we are comparing both public and private firms and accounting data are not publicly available for private firms in the U.S. We cluster standard errors at the firm level, i.e., the unit of treatment.

Table 4 presents the results from our DiD analysis. Panel A reports estimates using the unmatched sample. The results reveal a consistent empirical pattern: public firms exhibit a marked increase in both the likelihood and magnitude of restating Scope 1 emissions relative to their private-sector counterparts after the SEC's March 2021 climate disclosure initiative. Across five of the six specifications, the coefficient on the DiD estimator (*Post* × *Public*) is positive and statistically significant at the 1% level. The lone exception is in column (3), where the effect on downward restatement incidence is positive but not statistically significant, potentially reflecting more conservative adjustments or fewer incentives to downwardly revise.

To illustrate the magnitude of these effects, the coefficient in column (1) implies that public firms became 6.1 percentage points more likely to issue a restatement following the SEC's request for input—an economically meaningful shift that slightly falls short, but remains consistent with the 8 percentage point increase observed in the univariate DiD comparison reported in Table 1,

Panel C. Further, the estimate in column (4) suggests that the average restatement amount increased by roughly 106.2% (= *exp(0.7237)–1*) for public firms relative to private firms in the post-period, highlighting the scale of these corrections and underscoring the materiality of what had previously been disclosed. This general pattern holds when disaggregating the restatements into upward and downward revisions. Columns (2), (5), and (6) show statistically significant effects on both the frequency and magnitude of these revisions, reinforcing the conclusion that the post-SEC reporting behavior among public firms reflects not isolated adjustments but a systematic recalibration of previously reported emissions.

The validity of the DiD design hinges on parallel trends—that absent regulatory exposure, public and private firms would have followed comparable trajectories in their restatement behavior. While we cannot test this, we can still determine whether the pre-trends are parallel. We do so in Panel B where we include the *Pre* × *Public* interaction term to Equation (2). The indicator variable *Pre* equals one for the years 2018, 2019, and 2020 (and zero otherwise). Across all columns, these coefficients are economically modest and statistically insignificant, lending confidence that no differential trends were present in the pre-period. This bolsters the internal validity of our identification strategy and supports the interpretation that the observed divergence in reporting behavior is plausibly attributable to the SEC's climate disclosure initiative.

Panels C and D present the results from our entropy-balanced DiD analysis, which complements Panels A and B by addressing potential imbalances between public and private firms. We apply entropy balancing based on firms' Scope 1 emissions, following Hainmueller (2012), to ensure that both groups are comparable along this key operational dimension. This adjustment is especially salient in our setting, given the limited availability of standardized financial statement data for private firms and the well-documented empirical link between emission volumes and firm

size, complexity, and industrial activity (e.g., Aswani et al., 2024). By reweighting private firms to match the emissions distribution of public firms, we obtain a more tightly aligned counterfactual group without sacrificing sample size or requiring parametric assumptions.

The results in Panel C mirror and reinforce the baseline findings in Panel A. Across all six specifications, the *Post* × *Public* coefficients are positive and statistically significant, indicating that public firms were significantly more likely to revise their Scope 1 emissions disclosures—both in frequency and magnitude—relative to comparable private firms following the SEC's climate initiative. For example, public firms were 7.6 percentage points more likely to restate (column (1)), and the average restatement amount increased by approximately 109.2% (column (4)). This pattern holds across both upward and downward revisions (columns (2)–(3) and (5)–(6)), though we find no statistically significant differences by direction. As in Panel B, the *Pre* × *Public* terms included in Panel D remain small and insignificant, supporting the parallel trends assumption. Taken together, the entropy-balanced results confirm that our findings are not driven by sample composition or covariate imbalance: public firms revised their carbon disclosures more frequently and substantially than their private-sector counterparts following the SEC's initiative.

One potential issue with our DiD and pre-post estimates is that both might be driven (or at least blurred) by public firms' heightened merger and acquisition (M&A) activities, which could make Scope 1 emission restatements technically necessary according to the Greenhouse Gas Protocol.[14] To address this issue, we re-estimate our main regressions in Tables 2, 3 and 4 excluding observations of restatements that firms attribute to M&As. We use comments in the CDP data where firms briefly explain why the restate their emissions though they are only

[14] See p35 of https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

available for a subset of firms. Our results remain qualitatively similar (see Table A3 Panels A and B), indicating that M&A-initiated restatements are unlikely to significantly affect our findings.

4.3. Cross-sectional Tests

4.3.1. Third-party Verification

This section explores cross-sectional heterogeneity in restatement behavior by examining which types of firms were more or less likely to revise their Scope 1 emissions—and why. We begin by focusing on the role of third-party verification in shaping firms' emissions restatement behavior following the SEC's climate disclosure initiative. External assurance is a voluntary governance mechanism that may indicate greater internal discipline, stakeholder accountability, or methodological rigor. We hypothesize that firms with pre-initiative emission verification would have less to correct after the SEC's regulatory signal, either because they already disclosed more accurately or because external assurance deterred strategic underreporting.

Importantly, the verification variable is observed for both public and private firms, as CDP collects this information consistently across all reporting entities. This allows us to perform both quasi-DiD[15] (for public firms only) and DiD (for public vs private) analyses. We construct a binary indicator, *Verification*, equal to one if a firm reported having its Scope 1 emissions verified by a third party in 2020, i.e., prior to the SEC's initiative. Panel A of Table 5 presents a quasi-difference-in-differences analysis restricted to public firms, where we add the interaction term *Post* × *Verification* to Equation (1) to test whether verified public firms exhibited different restatement behavior in the post-initiative period.

The results reveal a strikingly consistent pattern: firms with verified emissions were significantly less likely to revise their reported emissions and made materially smaller upward

[15] Armstrong et al. (2022) show that cross-sectional settings are a generalization of DiD and can provide confidence vis-à-vis the direction of causality. We refer to such specifications as quasi-DiD in the remainder of the paper.

corrections. The coefficient on *Post* × *Verification* is negative and statistically significant in columns (1), (2), (4), and (5). Verified firms were 6.4 percentage points less likely to restate (column (1)) compared to the baseline effect of a 10.4 percentage point increase (coefficient on *Post*), and restated by approximately 44.4% less in magnitude (column (4); *exp(–0.5878)–1*). These effects are concentrated in upward restatements, suggesting that external assurance may have constrained pre-initiative overstatement rather than conservative reporting.[16]

To further validate these findings, Panel B leverages the full public–private sample to estimate a triple-difference specification. This model includes the interaction *Post* × *Public* × *Verification* and the related double interaction terms to Equation (2) and is based on an entropy-balanced sample that balances Scope 1 emissions between public and private firms.[17] This specification tests whether the effect of verification is stronger among public firms—those directly affected by the SEC's request for input. Once again, the pattern holds for upward revisions: the coefficients on *Post* × *Public* × *Verification* are negative and statistically significant in columns (2) and (5), confirming that public firms with third-party verified emissions restated less frequently upwards and by smaller amounts than either unverified public firms or verified private firms. For example, verified public firms were 7.4 percentage points less likely to restate upwards (column (1)) and restated by approximately 49% less in magnitude (column (4); *exp(–0.6724)–1*).

Together, the results underscore the disciplinary role and value of third-party verification: it not only enhances the credibility of voluntary disclosures but also meaningfully reduces the need for corrective reporting under regulatory pressure. Importantly, verification reflects a deliberate

[16] Our results are not sensitive to including year fixed effects which subsume the term *Post*. This holds not just for Table 5 Panel A but also for Tables 6, 7, and 8.
[17] We find qualitatively similar results in unreported analyses using the unmatched sample.

firm choice and its effects are strongest where it matters most: among public firms facing the prospect of climate-related enforcement.

4.3.2. Board-level Oversight of Climate-related Issues

We next investigate the role of governance structures—specifically board-level oversight of climate-related issues—in moderating firms' emissions restatement behavior. The restatement patterns documented earlier suggest systematic underreporting, which may reflect not only greenwashing but also deficiencies in internal emissions estimation systems. Firms that assign formal oversight of climate issues to their boards may signal stronger organizational commitment, internal controls, and reporting discipline, particularly with respect to CO_2 emissions.[18] If so, we would expect these firms to report more reliable emissions estimates and, consequently, to exhibit lower incidence and magnitude of restatements in response to heightened regulatory scrutiny.

We leverage CDP data to construct an indicator variable, *Board Oversight*, equal to one if a firm reported in 2020 that climate-related issues were overseen by its board of directors. Notably, because this variable is available for both public and private firms, we can implement both a quasi-DiD specification (restricted to public firms) and a full DiD design (comparing public and private firms), analogous to our approach in Table 5.

Panel A of Table 6 presents the quasi-DiD results. We interact *Post* × *Board Oversight* to test whether restatement behavior differs across public firms with and without board-level climate governance. The findings show that the coefficient on this interaction term is negative and statistically significant in columns (2) and (5), indicating that firms with board oversight are both less likely to revise emissions upward and, when they do, they revise by smaller amounts. Firms

[18] For example, Cunningham et al. (2025) find interview evidence that some Board members, especially in the audit committee, are more aware about the risks posed by ESG reporting. For example, one of their Board Member interviewees, p206, mentions that *"I'm 100 percent convinced that the next crisis we're going to be dealing with in a reporting sense is errors and restatements of ESG disclosures."*

with board oversight are 13.4 percentage points less likely to make an upward restatement (column (2)) relative to firms without such oversight. This mitigates most of the baseline increase of 15.7 percentage points observed among firms lacking board involvement (see coefficient on *Post*). In addition, firms with board oversight report significantly smaller upward revision magnitudes (column (5)). There is no significant difference in downward restatements, suggesting that board oversight primarily constrains initial overstatements rather than influencing all forms of correction.

To further validate this pattern, Panel B implements a triple-difference specification across public and private firms, interacting *Post, Public,* and *Board Oversight* based on an entropy-balanced sample that balances Scope 1 emissions between public and private firms. The results mirror those from Panel A. The coefficient on the triple interaction term *Post* × *Public* × *Board Oversight* is negative and statistically significant in columns (2) and (5), at the 5% level, respectively. These estimates confirm that public firms with board-level climate governance restate their emissions upwards less frequently and by smaller amounts, relative to both public firms without board oversight and private firms with board oversight.[19]

Taken together, the results in Table 6 point to a governance-based explanation for variation in reporting quality: firms with board-level engagement on climate issues appear better equipped to produce more conservative and defensible carbon disclosures, and are less likely to require upward retrospective corrections when regulatory expectations change. These findings underscore

[19] We also find in Panel B of Table 6 weak evidence of increase in downward restatements when Board oversight is present, consistent with the Board being initially more aware of ESG misreporting risks and adopting a more conservative stance in presence of weak reporting systems. Subsequent to the SEC initiative, these Boards seem to have helped create stronger infrastructure and more accurate GHG reporting. Consistent with this idea, Cunningham et al. (2025, p. 206) interviewed a Board member between September 2021 and March 2022 who mentions that *"I was reviewing the [Company Name's] 10-K, and I asked some questions: "So where does this number come from?…Talk to me about this statement here." It was a throwaway statement that someone in our ESG team had put in about a particular topic in the social arena. I said, "Time out. Where does this come from? Did this come from our systems and processes? Or did this come from someone quoting someone else saying something, and now it's in our audited financial statements?" Sorry to get on my soapbox on this, but this is, by far, the thing I am most worried about right now—getting this right."*

the importance of internal oversight mechanisms as a complementary force to external assurance and regulatory intervention in improving the credibility of sustainability reporting.

4.3.3. Transition Risk

We additionally focus on firms with elevated climate transition risk for whom climate-related disclosures may already have been under scrutiny from investors, the general public, and regulatory agencies even prior to the SEC's 2021 initiative. We approximate firms' transition risk via their CO_2 emissions, under the assumption that firms with higher emissions will face higher transition risk. This construct is also used by regulators, such as the European Central Bank (ECB) (ECB, 2021). On the one hand, high-risk firms may have had stronger incentives to report accurately—whether due to internal climate governance, better estimation systems, or heightened exposure to litigation and reputational risks. On the other hand, the absence of formal regulatory standards prior to 2021 may have left room for strategic underreporting or greenwashing. If that were the case, the SEC's move toward mandatory disclosures could have prompted these firms to restate their emissions more aggressively to preempt repercussions.

To empirically test these competing possibilities, we estimate both a quasi-DiD regression using public firms only and a DiD using public and private firms, analogous to Tables 5 and 6. We define the binary variable *High Transition Risk* as equal to 1 if a firm's Scope 1 emissions fall within the top sample decile in 2020—i.e., prior to the SEC's initiative. By interacting this indicator with *Post*, we identify whether firms with very high CO_2 levels prior to the SEC initiative adjusted their disclosures differently in response to anticipated regulation.

Panel A of Table 7 presents the results of the quasi-DiD. Across columns (1), (2), and (5), the coefficient on *Post* × *High Transition Risk* is negative and statistically significant, indicating that firms with the highest CO_2 levels were significantly less likely to restate their emissions upwards and made smaller revisions. This pattern is corroborated in Panel B, which presents the

triple-difference specification. There, the coefficient on *Post* × *Public* × *High Transition Risk* is again negative and statistically significant in columns (1), (2), (4), and (5), further supporting the interpretation that high-emitting public firms reported more credible emissions figures ex-ante.

We note that Scope 1 emissions represent an advantageous measure of firms' climate transition risk for our setting versus conference call-based measures proposed in the recent literature (e.g., Sautner et al., 2023), because it allows us to compare public and private firms. Nevertheless, for robustness purposes, we use the measure of regulatory climate risk exposure provided by Sautner et al. (2023) as an alternative proxy for firms' transition risk. Table A4 presents the results, which are limited to public firms by design. We conduct quasi-DiD regressions, using the indicator variable *High Regulatory Climate Risk Exposure*, which equals one if a firm's regulatory exposure to climate risk is in the top decile in 2020. The statistically significant coefficients on *Post* × *High Regulatory Climate Risk Exposure* in columns (2) and (5) indicate that firms with high regulatory climate risk are less likely to restate their emissions upwards and make smaller revisions. These results corroborate our findings in Table 7.

Collectively, the evidence suggests that firms with high climate transition risk, such as high-CO_2 emitters, may have already faced sufficient pressure from stakeholders to maintain more accurate carbon disclosures prior to the SEC's intervention, reducing the need for ex-post upward corrections. Alternatively, it may reflect superior internal systems or a more cautious disclosure posture among firms for whom climate exposure and thus transition risk is especially salient.

4.3.4. Institutional Ownership

In this subsection, we examine the role of institutional investors to complement our previous results in two important ways. First, we test whether investors may indeed scrutinize firms, such as those with high climate transition risk, as assumed above. Second, we complement

the evidence on board-related oversight of climate issues, an internal governance mechanism, by studying institutional investors as an external governance mechanism. Generally, we expect firms with high institutional ownership to be subject to heightened investor scrutiny regarding carbon emissions as many institutional investors pay significant attention to climate risks (e.g., Krueger, Sautner, and Starks, 2020). Firms may also depend on these investors to secure future financing. Therefore, firms may report their emissions more accurately, even in the absence of formal regulation, because of enhanced monitoring or reputational concerns. Accordingly, we expect firms with more institutional ownership to restate less.

To conduct our analyses, we rely on institutional ownership data is from Thomson Reuters' Institutional (13F) Holdings database. We define two indicator variables, which we use for quasi-DiD regressions similar to those in the previous subsection, yet limited to public firms. The first indicator is *High Institutional Ownership*, which equals one if the percentage of shares held by institutional investors is above the median in 2020 (i.e., during the pre-treatment). As an alternative measure, we use the indicator *High Institutional Ownership Concentration* that equals one if a firm's institutional ownership concentration (HHI) is above the median in 2020.

Table 8 shows the regression results. In Panel A, the coefficient on our variable of interest, *Post* × *High Institutional Ownership*, is negative throughout all six columns, and significantly so in columns (1), (2), (4) and (5). Hence, firms with high institutional ownership directly prior to 2021's initiative are significantly less likely to restate their Scope 1 emissions and also restate significantly less in response to the SEC's initiative. This effect is mainly driven by firms' lower likelihood and magnitude of upward revisions. The results in Panel B support this conclusion. Specifically, the coefficient on *Post* × *High Institutional Ownership Concentration* is significantly negative for the two measures of upward revisions in columns (2) and (5).

Overall, our cross-sectional evidence suggests firms with independently assured Scope 1 emission data, board-level oversight of climate-related issues, high transition risk, and high institutional ownership are less likely to make upward revisions and also revise less. We find no such evidence for firms' downward revisions. This empirical pattern is consistent with significant differences and weaknesses in firms' carbon reporting infrastructures as well as with potential strategic motives to underreport emissions, including incentives for greenwashing when no strict climate-related disclosure regulation is in place.

4.4. Real Effects of Firms' Decarbonization Efforts

While extant evidence suggests that mandated environmental disclosures yield real effects, including increased corporate sustainability activities and reduced GHG emissions (e.g., Fiechter et al. 2022; Tomar 2023), evidence on the real effects of the SEC's request for public input on climate-related disclosures is still rare. Recently, Carter et al. (2025) provide evidence that firms responded to the March 2021 request by reducing their imports, consistent with the SEC's initiative leading to an increased probability of required Scope 3 emission disclosure. However, although the SEC's focus has been on the disclosure of Scope 1 and 2 emissions, virtually nothing is known about firms' responses regarding the reduction of these emissions.[20] Understanding whether and which firms responded to the SEC's initiative is important to assess its potential effectiveness.

Against this background, we provide novel evidence on the real effects of the SEC's climate-related disclosure initiative by examining changes in treated public firms' decarbonization investments after 2021. We use project-level data on firms' investment projects targeting the

[20] The SEC's 2022 proposed rule ("Enhancement and Standardization of Climate-Related Disclosures for Investors") required the disclosure of Scope 1 and 2 emissions for all registrants, while disclosing Scope 3 emissions was only required if such emissions were material to a company or if the registrant had already set emissions targets including Scope 3. Besides, the disclosure of Scope 3 emissions was heavily debated early on.

reduction of their Scope 1 emissions initiated in a year. Particularly, following Achilles et al. (2024) and Fuchs et al. (2024), we exploit information on firms' disclosed decarbonization initiatives and their required investment amount in response to the following CDP question: *"Did you have emissions reduction initiatives that were implemented within the reporting year?"*[21]

We aggregate the number of Scope 1-reduction initiatives and their total investment to create the following firm-year variables: *ln(# Investments)*, which is the logarithm of a firms' total number of all investment projects targeting reductions in Scope 1 emissions, and *ln(Investment Amount)*, which is the logarithm of one plus total dollar amount invested in all projects in a year (since some projects do not require investments, for example reducing heating or lighting). The median (mean) number of and total amount of investment are 2 (2.6) and $ 554,137 ($ 25,436,944), respectively. The investment amount exhibits significant right skewness—with the 75th percentile at $4,329,879—so we transform this variable using its natural logarithm. Furthermore, since CDP only reports information on the emission scopes targeted by decarbonization initiatives starting in 2015, we begin our sample that year and conduct the following quasi-DiD regression:

$$y_{i,t+1} = Post + Post \times Restatement + Firm\ controls + Firm\ FE \qquad (3)$$

where the dependent variable $y_{i,t+1}$ is comprised of *ln(# Investments)* and *ln(Investment Amount)* in the following year, and the indicator variable *Post* equals one for the years 2021-2023. This indicator captures changes in firms' investments in Scope 1-reduction initiatives upon the SEC's climate-related disclosure initiative. *Restatement* is an indicator variable that equals one if a firm restated its previously reported Scope 1 emissions in 2021, i.e., in response to the SEC's request on public input. We additionally use the two indicator variables *Upward Restatement* and *Downward Restatement*, which capture upward and downward restatements in 2021, respectively.

[21] For a detailed description of the data, we refer the reader to Achilles et al. (2024).

Together, the *Post* indicator and interactions of this indicator with the three restatement indicators (i.e., *Post* × *Restatement*) allow us to test whether firms generally responded to the SEC's initiative or if firms only responded if they restated their prior emissions.[22]

Table 9 presents the regression results. We note that the number of observations in the regressions is smaller than in our previous analyses of public firms, because data on firms' decarbonization investments is only available for a subset of all firms. The dependent variable in Panel A is *ln(# Investments)*. Throughout all five columns, the coefficient on *Post* is statistically insignificant and economically small, indicating that firms do not generally respond to the SEC's initiative by initiating more decarbonization investments. However, the coefficient on *Post* × *Restatement* in column (2) and that on *Post* × *Restatement Upward* in columns (3) and (5) is significantly positive, suggesting that firms initiate more decarbonization projects in 2022 and 2023 if they revised their previously reported Scope 1 emissions upwards upon the SEC's 2021 request for public input. The estimates in columns (3) and (5) suggest that firms initiate about 70% (or 1-2) more projects. We find no such pattern for firms that revised their emissions downwards.

The results in Panel B, where we use the dependent variable *ln(Investment Amount)* reveal a similar pattern. Firms do not generally invest more to lower their Scope 1 emissions upon the SEC's climate-related disclosure initiative. However, firms that restated their previously reported Scope 1 emissions upwards—but not downwards—in 2021 subsequently show significantly higher investments in decarbonization projects. Collectively, these results suggest that firms that restated their emissions upwards upon the SEC's initiative invest more in decarbonization when climate-related disclosure becomes more likely. Thus, they imply a real effect of the SEC initiative in the

[22] We cannot conduct DiD regressions comparing public and private firms because there are too few private firms with coverage of the CDP question on decarbonization investments that restated their emissions.

form of more decarbonization investments for those firms that had to make upward restatements. This highlights the importance of emission data accuracy for climate-related decision-making.

5. CONCLUSION

This study provides empirical evidence on the credibility and reliability of corporate carbon disclosures in the face of rising regulatory scrutiny. Leveraging CDP filings by U.S. firms, we document a sharp rise in the incidence and magnitude of Scope 1 emissions restatements following the SEC's request for public input on climate-related disclosures and subsequent initiatives, particularly among public firms newly exposed to potential enforcement risk. The restatements—many of which are materially large—call into question the robustness of existing emissions reporting practices and reveal weaknesses in corporate climate disclosures infrastructure.

Our results suggest that emissions data, even when publicly reported through leading platforms such as CDP, may not reflect firms' true environmental footprints. The asymmetry in restatement patterns—where upward revisions significantly are less common among firms with emissions assurance, board-level oversight, high transition risk, and high institutional ownership prior to the SEC initiative—points to some underreporting prior to regulatory scrutiny. These findings echo growing concerns over greenwashing and underscore the structural fragility of the voluntary carbon reporting ecosystem.

Our results also suggest that firms which revised their Scope 1 emissions upwards (but not downwards) upon the SEC's request for public input on climate-related disclosures, expanded their investments in Scope 1 emission-reduction initiatives. This result suggests that the SEC's climate disclosure initiative effectively incentivized some firms to curb their emissions, thereby

contributing to an emerging literature on the real effects of the SEC's initiative and highlighting the importance of accurate disclosures for climate-related decision-making.

Beyond firm behavior, our findings speak directly to a foundational issue in the climate-finance interface: the urgent need for a rigorous, standardized, and verifiable carbon accounting system. As highlighted by Kaplan and Ramanna (2021), without credible carbon accounting rules, emissions disclosures risk becoming "the next Enron"—subject to manipulation, misinterpretation, and ultimately erosion of trust. Similarly, Reichelstein (2024) emphasizes that the current patchwork of carbon reporting practices is inadequate for the scale and urgency of climate decision-making. Our evidence aligns with these calls for reform by demonstrating how emissions restatements cluster around periods of regulatory exposure, suggesting that current practices are neither sufficiently robust nor reliably verifiable.

Taken together, our findings underscore the critical role of robust carbon accounting—not only for ensuring disclosure accuracy, but also for preserving the informational value of emissions data in regulatory, investment, and societal decision-making. As regulators such as the SEC and ISSB finalize climate reporting standards, they should prioritize mechanisms that enhance the integrity of emissions disclosures, including mandatory assurance, board accountability, and independent verification. Only through a credible carbon accounting infrastructure can sustainability reporting support the urgent global transition toward a net-zero economy.

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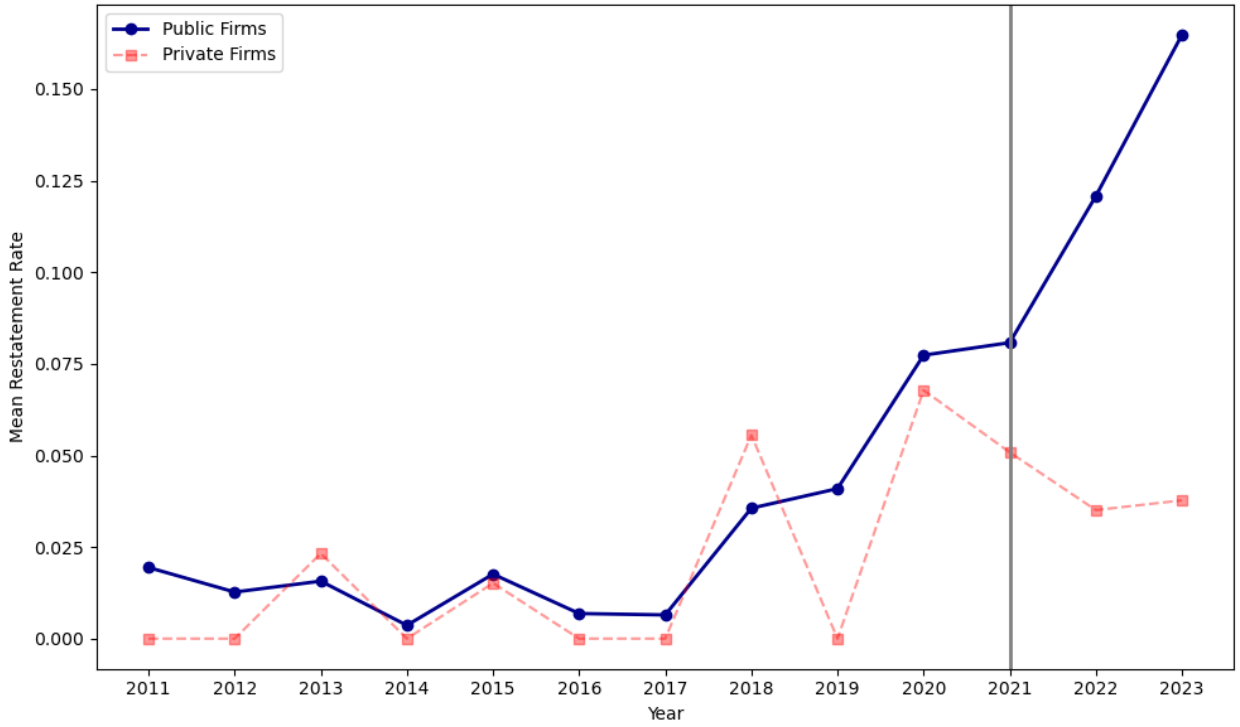
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Figure 1

Average Scope 1 Emissions Restatement Rate Over Time: Public vs Private U.S. Firms



Notes: The blue (orange) dots (squares) show the proportion of public (private) firms that filed a restatement in a given year. The gray line illustrates the SEC's request for input on climate-related disclosure, first announced in March 2021.

Table 1

Descriptive Statistics

Panel A: Public Firms

	Mean	P25	P50	P75	Std.
Dependent variables:					
Restatement	0.052	0	0	0	0.222
Upward Restatement	0.030	0	0	0	0.169
Downward Restatement	0.024	0	0	0	0.154
Restatement Amount	11,679.78	0	0	0	142,308.4
ln(Restatement Amount)	0.519	0	0	0	2.288
Upward Restatement Amount	8,429.56	0	0	0	203,434.5
ln(Upward Restatement Amount)	0.292	0	0	0	1.726
Downward Restatement Amount	5,928.04	0	0	0	102,873.6
ln(Downward Restatement Amount)	0.242	0	0	0	1.586
Independent variables:					
Scope 1	3,345,237	15,451.25	89,241.34	852,575.8	9,228,378
ln(Scope 1)	11.683	9.646	11.399	13.656	3.014
Assets (in millions)	80,018.07	7,048.631	17,380.91	51,612	239,975.2
ln(Assets)	9.922	8.861	9.763	10.852	1.511
Leverage	0.308	0.178	0.300	0.418	0.177
Firm Age (in years)	41.167	23	42	61	20.712
ln(Firm Age)	3.575	3.178	3.761	4.127	0.640
Verification	0.724	0	1	1	0.724
Board Oversight	0.951	1	1	1	0.951
High Transition Risk	0.176	0	0	0	0.176
High Institutional Ownership	0.398	0	0	1	0.490
High Institutional Ownership Concentration	0.390	0	0	1	0.488
High Regulatory Climate Risk Exposure	0.082	0	0	0	0.274

Panel B: Private Firms

	Mean	P25	P50	P75	Std.
Dependent variables:					
Restatement	0.022	0	0	0	0.148
Upward Restatement	0.008	0	0	0	0.091
Downward Restatement	0.015	0	0	0	0.123
Restatement Amount	65.617	0	0	0	807.754
ln(Restatement Amount)	0.147	0	0	0	1.025
Upward Restatement Amount	25.991	0	0	0	424.327
ln(Upward Restatement Amount)	0.060	0	0	0	0.664
Downward Restatement Amount	39.627	0	0	0	662.653
ln(Downward Restatement Amount)	0.097	0	0	0	0.829
Independent variables:					
Scope 1	91,630.71	221.3	1,599.43	13,031.23	663,682.9
ln(Scope 1)	7.362	5.404	7.378	9.475	3.068
Verification	0.292	0	0	1	0.455
Board Oversight	0.629	0	1	1	0.484
High Transition Risk	0.013	0	0	0	0.113

Notes: Panels A and B report descriptive statistics based on 3,930 (715) firm-year observations of public (private) U.S. firms. The control variables for public firms are based on 3,436 observations.

Panel C: Restatement Likelihood

	Restatement Likelihood		
Industry (Public Firms)	**pre 2021**	**2021-2023**	***p-value difference pre vs post***
BusEq	0.0223	0.1520	0.0000
Chems	0.0256	0.1636	0.0100
Durbl	0.0299	0.0714	0.4446
Enrgy	0.0000	0.0909	0.1621
Hlth	0.0588	0.1053	0.3034
Manuf	0.0344	0.1532	0.0006
Money	0.0231	0.1329	0.0001
NoDur	0.0096	0.1429	0.0026
Other	0.0262	0.0714	0.0881
Shops	0.0437	0.1579	0.0295
Telcm	0.0000	0.0769	0.3370
Utils	0.0154	0.0400	0.3162
Public Firms	**0.0256**	**0.1221**	***0.0000***
Private Firms	**0.0165**	**0.0414**	***0.0556***
p-value diff. pub. vs priv.	***0.1441***	***0.0019***	

Notes: Panel C reports the average restatement likelihood for the years before and after the SEC's initiative on climate-related disclosure for public and private firms. Industry figures are for public firms only. The average restatement likelihood is the average of the indicator variable *Restatement*. The p-value on sample differences refers to a t-test accounting for unequal variances between samples. When combined, the t-tests for differences between the pre and post period and between public and private firms show the univariate difference-in-differences estimates for public and private firms.

Table 2

Scope 1 Emissions Restatements After the SEC's Request for Input on Climate Disclosure: Pre-Post Estimates (Public U.S. Firms Only)

Dependent Variable:	Restatement	Restatement	ln(Restatement Amount)	ln(Restatement Amount)
	(1)	(2)	(3)	(4)
Post	**0.0802*** **	**0.0637*** **	**0.8009*** **	**0.6415*** **
	(7.025)	**(4.788)**	**(6.778)**	**(4.557)**
ln(Scope 1)	0.0214***	0.0171**	0.2536***	0.2089**
	(2.815)	(2.044)	(3.196)	(2.379)
ln(Assets)		0.0196		0.2533
		(0.9921)		(1.251)
Leverage		0.0230		0.3457
		(0.3664)		(0.5400)
ln(Firm Age)		0.0599*		0.4049
		(1.807)		(1.222)
Firm FE	Yes	Yes	Yes	Yes
Observations	3,930	3,436	3,930	3,436
Adjusted R^2	0.1495	0.1515	0.1361	0.1381

Notes: This table reports the results from OLS regressions of the dependent variables *Restatement* and *ln(Restatement Amount)* on *Post* along with firm-level controls and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Table 3

Scope 1 Emissions Restatements After the SEC's Request for Input on Climate Disclosure: Pre-Post Estimates of Upward and Downward Restatements (Public U.S. Firms Only)

Dependent Variable:	Upward Restatement	Downward Restatement	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)
Post	**0.0363*** **	**0.0315*** **	**0.3711*** **	**0.3116*** **
	(3.491)	**(3.377)**	**(3.398)**	**(3.142)**
ln(Scope 1)	0.0217***	-0.0030	0.2452***	-0.0276
	(3.001)	(-0.5689)	(3.128)	(-0.5355)
ln(Assets)	0.0128	0.0033	0.1628	0.0707
	(0.7212)	(0.3045)	(0.9466)	(0.5788)
Leverage	-0.0230	0.0384	-0.0914	0.3865
	(-0.5298)	(0.8687)	(-0.2148)	(0.8298)
ln(Firm Age)	0.0236	0.0434	0.0342	0.4094
	(0.9515)	(1.573)	(0.1476)	(1.398)
Firm FE	Yes	Yes	Yes	Yes
Observations	3,436	3,436	3,436	3,436
Adjusted R^2	0.0924	0.0865	0.0876	0.0770

Notes: This table reports the results from OLS regressions of the dependent variables *Upward Restatement*, *Downward Restatement*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* along with firm-level controls and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Table 4

Difference-in-Differences Estimates for Public vs Private U.S. Firms

Panel A: Unmatched Sample

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Public	**0.0608*** **	**0.0490*** **	**0.0186**	**0.7237*** **	**0.4690*** **	**0.3132*** **
	(3.238)	**(4.194)**	**(1.153)**	**(4.882)**	**(4.280)**	**(2.689)**
ln(Scope 1)	0.0089	0.0141***	-0.0041	0.1403***	0.1609***	-0.0143
	(1.609)	(3.517)	(-1.018)	(2.682)	(3.679)	(-0.4433)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,645	4,645	4,645	4,645	4,645	4,645
Adjusted R^2	0.1558	0.0941	0.0934	0.1429	0.0862	0.0814

Notes: Panel A reports the results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post × Public* along with a firm-level control, firm and year fixed effects for the sample period 2011 to 2023. The sample contains both public and private U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e). The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Panel B: Unmatched Sample Accounting for Parallel Pre-Trends

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Public	**0.0648*** **	**0.0488*** **	**0.0202**	**0.7950*** **	**0.4838*** **	**0.3511*** **
	(3.447)	**(4.951)**	**(1.273)**	**(5.180)**	**(4.915)**	**(2.968)**
Pre × Public	0.0084	-0.0004	0.0033	0.1490	0.0309	0.0792
	(0.4889)	(-0.0271)	(0.2907)	(1.029)	(0.2681)	(0.7809)
ln(Scope 1)	0.0088	0.0141***	-0.0041	0.1394***	0.1607***	-0.0148
	(1.599)	(3.510)	(-1.022)	(2.663)	(3.668)	(-0.4583)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,645	4,645	4,645	4,645	4,645	4,645
Adjusted R^2	0.1556	0.0939	0.0932	0.1428	0.0860	0.0813

Notes: Panel B reports the results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post × Public* along with a firm-level control, firm and year fixed effects for the sample period 2011 to 2023. The sample contains both public and private U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. The indicator variable *Pre* equals one for 2018, 2019, and 2020. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e). The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Panel C: Entropy-balanced Sample

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Public	**0.0760*** **	**0.0382*** **	**0.0439*** **	**0.7463*** **	**0.3589*** **	**0.4411*** **
	(5.051)	**(3.525)**	**(3.261)**	**(5.204)**	**(3.536)**	**(3.624)**
ln(Scope 1)	0.0095	0.0177***	-0.0052	0.1482**	0.1982***	-0.0312
	(1.325)	(3.636)	(-0.8823)	(2.326)	(3.751)	(-0.7119)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,845	3,845	3,845	3,845	3,845	3,845
Adjusted R^2	0.1691	0.1143	0.0875	0.1543	0.1028	0.0793

Notes: Panel C reports the results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* × *Public* along with a firm-level control, firm and year fixed effects for the sample period 2011 to 2023. The sample is entropy-balanced (Hainmueller, 2012) and contains both public and private U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. The indicator variable *Pre* equals one for 2018, 2019, and 2020. The treatment variable for entropy balancing is *Public*, and the balanced covariate is *ln(Scope 1)*, which is defined as the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e). The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Panel D: Entropy-balanced Sample Accounting for Parallel Pre-Trends

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Public	**0.0787*** **	**0.0391*** **	**0.0429*** **	**0.8127*** **	**0.3878*** **	**0.4596*** **
	(5.347)	**(4.323)**	**(3.533)**	**(5.693)**	**(4.325)**	**(4.011)**
Pre × Public	0.0052	0.0017	-0.0018	0.1313	0.0571	0.0365
	(0.2392)	(0.1322)	(-0.0974)	(0.6456)	(0.5114)	(0.2097)
ln(Scope 1)	0.0095	0.0177***	-0.0052	0.1478**	0.1980***	-0.0314
	(1.323)	(3.627)	(-0.8828)	(2.319)	(3.739)	(-0.7173)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,845	3,845	3,845	3,845	3,845	3,845
Adjusted R^2	0.1689	0.1141	0.0872	0.1542	0.1026	0.0790

Notes: Panel D reports the results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* × *Public* along with a firm-level control, firm and year fixed effects for the sample period 2011 to 2023. The sample is entropy-balanced (Hainmueller, 2012) and contains both public and private U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. The indicator variable *Pre* equals one for 2018, 2019, and 2020. The treatment variable for entropy balancing is *Public*, and the balanced covariate is *ln(Scope 1)*, which is defined as the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e). The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Table 5

Cross-sectional Difference-in-Differences Estimates for Public and Private Firms: Emissions Verification

Panel A: Public Firms Only

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post	**0.1036*** **	**0.0721*** **	**0.0482** **	**1.004*** **	**0.7271*** **	**0.4311** **
	(3.574)	**(3.157)**	**(2.524)**	**(3.588)**	**(3.051)**	**(2.312)**
Post × Verification	**-0.0642** **	**-0.0593** **	**-0.0221**	**-0.5878***	**-0.5859** **	**-0.1538**
	(-1.974)	**(-2.351)**	**(-0.9930)**	**(-1.842)**	**(-2.251)**	**(-0.6925)**
ln(Scope 1)	0.0204**	0.0242***	-0.0016	0.2425**	0.2688***	-0.0145
	(2.041)	(2.889)	(-0.2479)	(2.328)	(2.965)	(-0.2271)
ln(Assets)	0.0150	0.0105	-0.0005	0.2010	0.1437	0.0275
	(0.7113)	(0.5631)	(-0.0397)	(0.9414)	(0.8110)	(0.2037)
Leverage	0.0668	0.0106	0.0499	0.8124	0.2511	0.5241
	(1.001)	(0.2390)	(1.030)	(1.199)	(0.5750)	(1.044)
ln(Firm Age)	0.0690	0.0137	0.0615**	0.5233	-0.0414	0.6070*
	(1.514)	(0.4050)	(2.046)	(1.159)	(-0.1300)	(1.913)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,034	3,034	3,034	3,034	3,034	3,034
Adjusted R^2	0.1417	0.0927	0.0787	0.1342	0.0892	0.0725

Notes: Panel A reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* × *Verification* along with firm-level controls and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *Verification* is a binary variable that equals one if the firm states that its CO_2 emissions are verified by a third party in 2020. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Panel B: Public vs Private Firms

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Public × Verification	**-0.0492**	**-0.0735****	**0.0008**	**-0.4902**	**-0.6724****	**-0.0108**
	(-1.366)	**(-2.555)**	**(0.0286)**	**(-1.428)**	**(-2.460)**	**(-0.0395)**
Post × Public	0.1192***	0.0900***	0.0516**	1.155***	0.8352***	0.5092**
	(3.890)	(3.339)	(2.118)	(3.977)	(3.318)	(2.179)
Post × Verification	-0.0078	0.0183	-0.0175	-0.0294	0.1328	-0.1030
	(-0.3801)	(1.047)	(-0.8487)	(-0.1655)	(0.9496)	(-0.5891)
ln(Scope 1)	0.0094	0.0205***	-0.0076	0.1598**	0.2287***	-0.0467
	(1.155)	(3.663)	(-1.145)	(2.208)	(3.743)	(-0.9552)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,713	3,713	3,713	3,713	3,713	3,713
Adjusted R^2	0.1741	0.1191	0.0903	0.1576	0.1076	0.0810

Notes: Panel B reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* × *Public* × *Verification* along with firm-level controls, firm and year fixed effects for the sample period 2011 to 2023. The sample is entropy-balanced (Hainmueller, 2012) and contains both public and private U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *Verification* is a binary variable that equals one if the firm states that its CO_2 emissions are verified by a third party in 2020. The treatment variable for entropy balancing is *Public*, and the balanced covariate is *ln(Scope 1)*, which is defined as the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e). The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Table 6

Cross-sectional Difference-in-Differences Estimates for Public Firms: Board Oversight

Panel A: Public Firms Only

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post	**0.0986***	**0.1566*****	**-0.0311**	**0.9419**	**1.509*****	**-0.2782**
	(1.709)	**(2.705)**	**(-0.6906)**	**(1.597)**	**(2.702)**	**(-0.5742)**
Post × Board Oversight	**-0.0441**	**-0.1335****	**0.0656**	**-0.3877**	**-1.264****	**0.6197**
	(-0.7478)	**(-2.277)**	**(1.461)**	**(-0.6472)**	**(-2.238)**	**(1.284)**
ln(Scope 1)	0.0188**	0.0232***	-0.0022	0.2240**	0.2562***	-0.0200
	(1.984)	(2.928)	(-0.3565)	(2.261)	(2.987)	(-0.3327)
ln(Assets)	0.0171	0.0106	0.0018	0.2240	0.1479	0.0470
	(0.8140)	(0.6072)	(0.1428)	(1.049)	(0.8857)	(0.3489)
Leverage	0.0640	0.0194	0.0390	0.7806	0.3274	0.4279
	(0.9743)	(0.4882)	(0.7930)	(1.159)	(0.8317)	(0.8319)
ln(Firm Age)	0.0860*	0.0409	0.0551	0.6215	0.1480	0.5250
	(1.940)	(1.311)	(1.480)	(1.400)	(0.5086)	(1.333)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,042	3,042	3,042	3,042	3,042	3,042
Adjusted R^2	0.1383	0.0929	0.0790	0.1311	0.0883	0.0730

Notes: Panel A reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* × *Board Oversight* along with firm-level controls and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *Board Oversight* is an indicator variable that equals one if the firm states that there is board-level oversight of climate-related issues within the organization in 2020. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Panel B: Public vs Private Firms

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Public × Board Oversight	**-0.0080**	**-0.1145****	**0.0916***	**-0.0092**	**-1.009****	**0.8253***
	(-0.1346)	**(-2.222)**	**(1.959)**	**(-0.0168)**	**(-2.084)**	**(1.864)**
Post × Public	0.0892	0.1482***	-0.0381	0.8025	1.330***	-0.3034
	(1.569)	(2.967)	(-0.8561)	(1.520)	(2.829)	(-0.7166)
Post × Board Oversight	-0.0435	-0.0068	-0.0414	-0.3703	-0.0740	-0.3299
	(-1.444)	(-0.6615)	(-1.404)	(-1.618)	(-0.8841)	(-1.493)
ln(Scope 1)	0.0098	0.0184***	-0.0055	0.1506**	0.2041***	-0.0336
	(1.358)	(3.735)	(-0.9173)	(2.346)	(3.829)	(-0.7623)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,845	3,845	3,845	3,845	3,845	3,845
Adjusted R^2	0.1697	0.1176	0.0888	0.1545	0.1054	0.0802

Notes: Panel B reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post × Public × Board Oversight* along with a firm-level control, firm and year fixed effects for the sample period 2011 to 2023. The sample is entropy-balanced (Hainmueller, 2012) and contains both public and private U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *Board Oversight* is an indicator variable that equals one if the firm states that there is board-level oversight of climate-related issues within the organization in 2020. The treatment variable for entropy balancing is *Public*, and the balanced covariate is *ln(Scope 1)*, which is defined as the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e). The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Table 7

Cross-sectional Difference-in-Differences Estimates for Public Firms: Transition Risk

Panel A: Public Firms Only

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post	**0.0678*** **	**0.0376*** **	**0.0351*** **	**0.6612*** **	**0.3881*** **	**0.3256*** **
	(4.388)	**(3.137)**	**(3.117)**	**(4.382)**	**(3.237)**	**(2.918)**
Post × High Transition Risk	**-0.0582** **	**-0.0471*** **	**-0.0158**	**-0.4634**	**-0.4756** **	**-0.0409**
	(-2.051)	**(-2.616)**	**(-0.7211)**	**(-1.265)**	**(-2.095)**	**(-0.1487)**
ln(Scope 1)	0.0181*	0.0220***	-0.0019	0.2187**	0.2447***	-0.0160
	(1.875)	(2.730)	(-0.3049)	(2.172)	(2.821)	(-0.2628)
ln(Assets)	0.0146	0.0106	-0.0004	0.2035	0.1455	0.0315
	(0.6780)	(0.5471)	(-0.0362)	(0.9410)	(0.7993)	(0.2355)
Leverage	0.0611	0.0048	0.0481	0.7505	0.1900	0.5068
	(0.9094)	(0.1053)	(0.9901)	(1.098)	(0.4266)	(1.003)
ln(Firm Age)	0.0834*	0.0390	0.0541	0.6035	0.1291	0.5228
	(1.884)	(1.222)	(1.453)	(1.366)	(0.4330)	(1.328)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,036	3,036	3,036	3,036	3,036	3,036
Adjusted R^2	0.1390	0.0874	0.0783	0.1309	0.0829	0.0723

Notes: Panel A reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post × High Transition Risk* along with firm-level controls and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *High Transition Risk* is an indicator proxying for firms' significant climate transition risk that equals one if the firm's scope 1 emissions is in the top decile in 2020. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Panel B: Public vs Private Firms

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Public × High Transition Risk	**-0.0848*** **	**-0.0688*** **	**-0.0231**	**-0.8037** **	**-0.6886*** **	**-0.1840**
	(-2.932)	**(-3.843)**	**(-0.9999)**	**(-2.305)**	**(-3.243)**	**(-0.6899)**
Post × Public	0.0911***	0.0505***	0.0479***	0.8895***	0.4821***	0.4735***
	(5.149)	(4.028)	(3.018)	(5.527)	(4.216)	(3.389)
Post × High Transition Risk	0.0085	0.0161**	-0.0042	0.1267	0.1569**	-0.0075
	(0.6166)	(1.987)	(-0.3360)	(1.126)	(2.284)	(-0.0748)
ln(Scope 1)	0.0092	0.0177***	-0.0055	0.1465**	0.1983***	-0.0328
	(1.260)	(3.638)	(-0.9235)	(2.295)	(3.759)	(-0.7462)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,845	3,845	3,845	3,845	3,845	3,845
Adjusted R^2	0.1713	0.1164	0.0876	0.1560	0.1050	0.0790

Notes: Panel B reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post × Public × High Transition Risk* along with a firm-level control, firm and year fixed effects for the sample period 2011 to 2023. The sample is entropy-balanced (Hainmueller, 2012) and contains both public and private U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *High Transition Risk* is an indicator proxying for firms' significant transition risk that equals one if the firm's scope 1 emissions is in the top decile in 2020. The treatment variable for entropy balancing is *Public*, and the balanced covariate is *ln(Scope 1)*, which is defined as the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e). The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Table 8

Cross-sectional Difference-in-Differences Estimates for Public Firms: Institutional Ownership and Ownership Concentration

Panel A: Institutional Ownership (Public Firms Only)

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post	**0.0893*** **	**0.0561*** **	**0.0405*** **	**0.9349*** **	**0.5940*** **	**0.4072*** **
	(4.945)	**(3.978)**	**(3.098)**	**(4.714)**	**(3.950)**	**(2.810)**
Post × High Institutional Ownership	**-0.0554** **	**-0.0426** **	**-0.0200**	**-0.6169** **	**-0.4667** **	**-0.2079**
	(-2.298)	**(-2.237)**	**(-1.150)**	**(-2.495)**	**(-2.389)**	**(-1.154)**
ln(Scope 1)	0.0205**	0.0251***	-0.0025	0.2471**	0.2797***	-0.0217
	(2.269)	(3.161)	(-0.4410)	(2.580)	(3.248)	(-0.3912)
ln(Assets)	0.0163	0.0103	0.0019	0.2141	0.1331	0.0568
	(0.8044)	(0.5674)	(0.1641)	(1.031)	(0.7576)	(0.4511)
Leverage	0.0130	-0.0338	0.0373	0.2519	-0.1877	0.3751
	(0.2036)	(-0.7584)	(0.8419)	(0.3903)	(-0.4322)	(0.8105)
ln(Firm Age)	0.0700*	0.0387	0.0416	0.4955	0.1874	0.3673
	(1.799)	(1.328)	(1.390)	(1.294)	(0.6977)	(1.192)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,369	3,369	3,369	3,369	3,369	3,369
Adjusted R^2	0.1501	0.0999	0.0799	0.1334	0.0956	0.0649

Notes: Panel A reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* × *High Institutional Ownership* along with firm-level controls and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *High Institutional Ownership* is an indicator that equals one if the percentage of shares held by institutional investors is above the median in 2020. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Panel B: Institutional Ownership Concentration (Public Firms Only)

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post	**0.0770*** **	**0.0539*** **	**0.0283** **	**0.8219*** **	**0.5758*** **	**0.2917** **
	(4.096)	**(3.749)**	**(2.195)**	**(4.064)**	**(3.767)**	**(2.067)**
Post × High Institutional	**-0.0260**	**-0.0364***	**0.0078**	**-0.3451**	**-0.4114** **	**0.0569**
Ownership Concentration	**(-1.060)**	**(-1.915)**	**(0.4269)**	**(-1.369)**	**(-2.110)**	**(0.3023)**
ln(Scope 1)	0.0196**	0.0244***	-0.0029	0.2368**	0.2730***	-0.0263
	(2.156)	(3.113)	(-0.5190)	(2.476)	(3.206)	(-0.4733)
ln(Assets)	0.0160	0.0086	0.0033	0.2064	0.1136	0.0700
	(0.7775)	(0.4694)	(0.2884)	(0.9755)	(0.6399)	(0.5467)
Leverage	0.0204	-0.0286	0.0404	0.3325	-0.1312	0.4074
	(0.3143)	(-0.6367)	(0.9032)	(0.5070)	(-0.2995)	(0.8718)
ln(Firm Age)	0.0627*	0.0348	0.0371	0.4196	0.1461	0.3232
	(1.654)	(1.207)	(1.273)	(1.125)	(0.5487)	(1.075)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,369	3,369	3,369	3,369	3,369	3,369
Adjusted R^2	0.1478	0.0991	0.0792	0.1310	0.0948	0.0641

Notes: Panel A reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* × *High Institutional Ownership* along with firm-level controls and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *High Institutional Ownership Concentration* is an indicator that equals one if the firm's institutional ownership concentration (HHI) is above the median in 2020. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Table 9

Real Effects: Scope 1 Emission-Reduction Investments of Public Firms Following the SEC's Request for Input on Climate Disclosure

Panel A: Number of Scope 1 Emission-Reduction Investments

Dependent Variable:	ln(# Investments)				
	(1)	(2)	(3)	(4)	(5)
Post	-0.0201	-0.0485	-0.0396	-0.0299	-0.0503
	(-0.4050)	(-0.9363)	(-0.7939)	(-0.5806)	(-0.9745)
Post × Restatement		**0.4332***			
		(1.727)			
Post × Upward Restatement			**0.7070****		**0.7191****
			(2.357)		**(2.403)**
Post × Downward Restatement				**0.2578**	**0.2755**
				(0.7801)	**(0.8301)**
ln(Scope 1)	0.0288	0.0177	0.0120	0.0283	0.0112
	(0.3426)	(0.2172)	(0.1477)	(0.3373)	(0.1382)
ln(Assets)	0.1260	0.1361	0.1263	0.1319	0.1326
	(1.057)	(1.141)	(1.060)	(1.105)	(1.110)
Leverage	-0.6010*	-0.5965*	-0.5881*	-0.6030*	-0.5901*
	(-1.731)	(-1.742)	(-1.697)	(-1.746)	(-1.713)
ln(Firm Age)	-0.4736	-0.5087*	-0.4726	-0.4949*	-0.4953*
	(-1.636)	(-1.818)	(-1.632)	(-1.779)	(-1.784)
Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	1,453	1,453	1,453	1,453	1,453
Adjusted R^2	0.4261	0.4299	0.4298	0.4266	0.4305

Notes: Panel A reports the results from OLS regressions of the dependent variable *ln(# Investments)* on *Post* along with a firm-level control and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *Ln(# Investments)* is the logarithm of the number of Scope 1 emission-reduction projects initiated in the following year. *Restatement, Upward Restatement,* and *Downward Restatement* are indicator variables equal to one if a firm (upward or downward, respectively) restated its previously reported Scope 1 emissions in 2021. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Panel B: Investment Amount of Scope 1 Emission-Reduction Investments

Dependent Variable:	ln(Investment Amount)				
	(1)	(2)	(3)	(4)	(5)
Post	0.1439	-0.0532	0.0551	0.0418	-0.0524
	(0.3258)	(-0.1203)	(0.1231)	(0.0955)	(-0.1181)
Post × Restatement		**3.504***			
		(1.743)			
Post × Upward Restatement			**3.301****		**3.424****
			(2.385)		**(2.456)**
Post × Downward Restatement				**3.481**	**3.550**
				(1.152)	**(1.173)**
ln(Scope 1)	0.6746	0.6143	0.6164	0.6760	0.6158
	(1.019)	(0.9302)	(0.9338)	(1.021)	(0.9326)
ln(Assets)	-1.293	-1.217	-1.271	-1.241	-1.217
	(-1.469)	(-1.376)	(-1.441)	(-1.406)	(-1.376)
Leverage	-1.688	-1.595	-1.672	-1.613	-1.595
	(-0.6850)	(-0.6616)	(-0.6792)	(-0.6676)	(-0.6612)
ln(Firm Age)	-0.2589	-0.5379	-0.1999	-0.5983	-0.5439
	(-0.1243)	(-0.2522)	(-0.0959)	(-0.2763)	(-0.2512)
Firm FE	Yes	Yes	Yes	Yes	Yes
Observations	1,248	1,248	1,248	1,248	1,248
Adjusted R^2	0.4245	0.4276	0.4251	0.4263	0.4270

Notes: Panel B reports the results from OLS regressions of the dependent variable *ln(Investment Amount)* on *Post* along with a firm-level control and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023 *Ln(Investment Amount)* is the logarithm of one plus the dollar amount of capital invested in Scope 1 emission-reduction projects initiated in the following year. *Restatement, Upward Restatement,* and *Downward Restatement* are indicator variables equal to one if a firm (upward or downward, respectively) restated its previously reported Scope 1 emissions in 2021. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

APPENDICES

Table A1

Sample Selection

Selection	# Public U.S. Firms	# Public Firm-Years	# Private U.S. Firms	# Private Firm-Years
Full data (2011-2023) with at least one year of past reported Scope 1 emissions in CDP	697	4,472	600	1,514
At least six years of CDP data	439	3,930	108	715
Accounting data available (in Compustat)	396	3,436	-	-

Notes: This tables illustrates our sample selection procedure.

Table A2

Variable Definitions

Variables	Definition
Dependent variables	
Restatement	An indicator variable that equals one if, in a given year, a company makes at least one (up- or downward) restatement of its previously reported Scope 1 emissions
Upward Restatement	An indicator variable that equals one if, in a given year, a company makes at least one upward restatement of its previously reported Scope 1 emissions
Downward Restatement	An indicator variable that equals one if, in a given year, a company makes at least one downward restatement of its previously reported Scope 1 emissions
ln(Restatement Amount)	Logarithm of one plus the absolute restated amount of Scope 1 emissions (the sum of the absolute values of restated amounts of emissions in case of several restatements)
ln(Upward Restatement Amount)	Logarithm of one plus the absolute upward Scope 1 emissions restatement amount
ln(Downward Restatement Amount)	Logarithm of one plus the absolute downward Scope 1 emissions restatement amount
ln(# Investments)	Logarithm of the total number of Scope 1-reduction projects initiated by a firm in the following year.
ln(Investment Amount)	Logarithm of one plus the dollar amount of capital invested in all of a firm's Scope 1-reduction projects initiated in the following year.
Independent variables	
ln(Scope 1)	Logarithm of one plus gross global Scope 1 emissions (in metric tons of CO2e)
ln(Assets)	Logarithm of a firm's total assets
Leverage	Total liabilities divided by total assets
ln(Firm Age)	Logarithm of the firm's age based on the Compustat inclusion date
Board Oversight	An indicator variable that equals one if the firm reports to the CDP that there is board-level oversight of climate-related issues within the organization
High Transition Risk	An indicator variable that equals one if the firm's reported Scope 1 emissions are in the top decile in 2020
Institutional Ownership	Percentage of a firm's shares held by institutional investors
Regulatory Climate Risk Exposure	Regulatory exposure to climate risk (Sautner et al. 2021)
Verification	An indicator variable that equals one if a firm's reported Scope 1 emissions are verified by a third party

Notes: This tables provides definitions for the variables used in this paper.

Table A3

Baseline Pre-Post and Difference-in-Differences Estimates: Excluding M&A-related Restatements

Panel A: Public Firms Only

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post	**0.0492*** **	**0.0312*** **	**0.0221*** **	**0.4721*** **	**0.3072*** **	**0.2069*** **
	(4.224)	**(3.237)**	**(2.815)**	**(3.994)**	**(3.077)**	**(2.607)**
ln(Scope 1)	0.0131*	0.0156**	-0.0007	0.1544**	0.1677***	-0.0037
	(1.838)	(2.560)	(-0.1377)	(2.095)	(2.640)	(-0.0809)
ln(Assets)	0.0056	0.0017	0.0004	0.1019	0.0487	0.0342
	(0.2838)	(0.0972)	(0.0425)	(0.5237)	(0.2896)	(0.3210)
Leverage	-0.0328	-0.0524	0.0127	-0.3181	-0.4368	0.0733
	(-0.6312)	(-1.298)	(0.3352)	(-0.6179)	(-1.143)	(0.1891)
ln(Firm Age)	0.0689**	0.0323	0.0438*	0.5160	0.1319	0.4233
	(2.157)	(1.364)	(1.697)	(1.641)	(0.6142)	(1.538)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,371	3,371	3,371	3,371	3,371	3,371
Adjusted R^2	0.14580	0.10218	0.08116	0.13778	0.08815	0.08054

Notes: Panel A reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* along with firm-level controls and firm fixed effects for the sample period 2011 to 2023. The sample comprises public U.S. firms, excluding observations of restatements that firms attribute to M&As. The indicator variable *Post* equals one for 2021, 2022, and 2023. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Panel B: Public vs Private Firms

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Public	**0.0569*** **	**0.0303*** **	**0.0328*** **	**0.5405*** **	**0.2779*** **	**0.3177*** **
	(4.110)	**(2.925)**	**(2.597)**	**(4.246)**	**(2.923)**	**(2.903)**
ln(Scope 1)	0.0062	0.0133***	-0.0040	0.1082*	0.1449***	-0.0170
	(0.9429)	(3.266)	(-0.6709)	(1.936)	(3.324)	(-0.4009)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,776	3,776	3,776	3,776	3,776	3,776
Adjusted R^2	0.1729	0.1087	0.0934	0.1589	0.0937	0.0882

Notes: Panel B reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post* × *Public* along with firm-level controls, firm and year fixed effects for the sample period 2011 to 2023. The sample is entropy-balanced (Hainmueller, 2012) and contains both public and private U.S. firms, excluding observations of restatements that firms attribute to M&As. The indicator variable *Post* equals one for 2021, 2022, and 2023. The treatment variable for entropy balancing is *Public*, and the balanced covariate is *ln(Scope 1)*, which is defined as the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e). The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).

Table A4

Cross-sectional Difference-in-Differences Estimates for Public Firms: Regulatory Climate Risk Exposure

Dependent Variable:	Restatement	Upward Restatement	Downward Restatement	ln(Restatement Amount)	ln(Upward Restatement Amount)	ln(Downward Restatement Amount)
	(1)	(2)	(3)	(4)	(5)	(6)
Post	**0.0643*** **	**0.0412*** **	**0.0275** **	**0.6423*** **	**0.4300*** **	**0.2576** **
	(4.362)	**(3.606)**	**(2.535)**	**(4.184)**	**(3.632)**	**(2.245)**
Post × High Regulatory	**-0.0249**	**-0.0614** **	**0.0323**	**-0.1148**	**-0.6652***	**0.4993**
Climate Risk Exposure	**(-0.5232)**	**(-2.295)**	**(0.9007)**	**(-0.1827)**	**(-1.844)**	**(1.141)**
ln(Scope 1)	0.0190**	0.0227***	-0.0019	0.2328**	0.2548***	-0.0129
	(2.108)	(2.965)	(-0.3387)	(2.451)	(3.074)	(-0.2308)
ln(Assets)	0.0191	0.0135	0.0018	0.2453	0.1761	0.0479
	(0.9203)	(0.7249)	(0.1590)	(1.153)	(0.9691)	(0.3896)
Leverage	0.0174	-0.0314	0.0402	0.3499	-0.1512	0.4425
	(0.2675)	(-0.7029)	(0.9032)	(0.5234)	(-0.3414)	(0.9582)
ln(Firm Age)	0.0821**	0.0379	0.0537	0.5722	0.1222	0.5015
	(1.992)	(1.237)	(1.576)	(1.355)	(0.4208)	(1.405)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,352	3,352	3,352	3,352	3,352	3,352
Adjusted R^2	0.1344	0.0939	0.0707	0.1189	0.0908	0.0553

Notes: This table reports results from OLS regressions of the dependent variables *Restatement*, *Upward Restatement*, *Downward Restatement*, *ln(Restatement Amount)*, *ln(Upward Restatement Amount)*, and *ln(Downward Restatement Amount)* on *Post × High Regulatory Climate Risk Exposure* along with firm-level controls and firm fixed effects for the sample period 2011 to 2023. The sample contains public U.S. firms. The indicator variable *Post* equals one for 2021, 2022, and 2023. *High Regulatory Climate Risk Exposure* is an indicator that equals one if the firm's regulatory exposure to climate risk (as per Sautner et al., 2023) is in the top decile in 2020. *Ln(Scope 1)* is the logarithm of one plus gross global Scope 1 emissions (in metric tons of CO_2e), *ln(Assets)* is the logarithm of total assets, *Leverage* is total liabilities divided by total assets, and *ln(Firm Age)* is the logarithm of the firm's age. The t-statistics (shown below the coefficient estimates) are on the basis of standard errors clustered by firm. The following significance levels are indicated by asterisks: *** (1%), ** (5%), * (10%).